GEOTECHNICAL BASE LINE REPORT

I-77 Widening Design Build Preparation On-Call
Richland County, South Carolina
Contract No. 1654, Project ID. P027002
S&ME Project No. 1461-14-046

Prepared For:

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Prepared By:

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May 19, 2015

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Charleston, South Carolina 29405-8580

Attention: David A. Kinard, PE, AVP
Program Manager

Reference: **GEOTECHNICAL BASE LINE REPORT (GBLR)**
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S&ME Project No. 1461-14-046

Dear Mr. Kinard:

The purpose of this report is to provide preliminary geotechnical information to the South Carolina Department of Transportation for a Design/Build package. Our services were performed in general accordance with the Subconsultant Agreement between HDR and S&ME, Inc. dated July 24, 2014.

The enclosed report includes (1) a description of observed site conditions, (2) methods and results of field tests and sampling, (3) laboratory tests of recovered samples, and (4) design and construction considerations for informational purposes only.

We appreciate working with HDR, Inc. on this project and look forward to continuing our association in subsequent phases of this project. Please do not hesitate to contact us if you have questions or if we may be of any further assistance.

Very Truly Yours,
S&ME, Inc.

Robert C. Bruorton, PE
Senior Geotechnical Engineer

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION S&ME, INC. No. C00473

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1.0 INTRODUCTION

The project includes widening of Interstate 77 from Percival Road to Killian Road in Richland County, South Carolina. A site location map is included as Figure 1.

Improvements will include adding a lane in the existing grassed median of both northbound and southbound lanes of Interstate 77. Ten structures (five crossings total, northbound and southbound) will also be modified to include an additional lane.

Our services were performed in general conformance with Chapter 21.2.2 of the "2010 SCDOT Geotechnical Design Manual" (GDM) as modified by Bridge Design Memorandum 0510 dated October 22, 2010, and S&ME approved scope dated July 24, 2014. The objective of this exploration was to explore subsurface conditions along the alignment of Interstate 77 as they pertain to the proposed roadway and bridge structure improvements, and in conjunction with field and laboratory testing, to provide geotechnical baseline data to be utilized for preliminary design and estimating as part of a future design-build letting process.

This geotechnical base line report provides general information about subsurface conditions at the current bridge locations and along the proposed roadway approaches. We also attempt to compare as-built or as-let drawings provided by the SCDOT to our boring data to the extent feasible by the wide spacing of the borings.

This report presents a general discussion of preliminary design and construction issues anticipated for the proposed construction. While this report presents our field and laboratory testing data as well some design considerations, as requested by the SCDOT, we do not provide a level of exploration nor do we provide recommendations in sufficient detail to support final design recommendations.

2.0 PROJECT INFORMATION

Project information presented herein is based upon our site visits and our review of the existing site and bridge design drawings provided by the SCDOT. The South Carolina Department of Transportation proposes to widen I-77 from near mile marker (MM) 15 (Percival Road) on the southern terminus to approximately MM 22 (Killian Road) on the northern terminus.

The project includes adding a travel lane in each direction, improving various exit ramps, and widening ten mainline bridges. The bridges include:

- Four bridges over I-20 and I-20 exit ramps near MM 16;
- Two bridges over Windsor Lake Boulevard (S-1196) near MM 16.3;
- Two bridges over Windsor Lake near MM 16.6; and
- Two bridges over Edgewater Drive (S-1722) and Jackson Creek near MM 18.

It is assumed that the project limits and construction impacts will fall within the existing right-of-way for all improvements.

3.0 SITE CONDITIONS AND EXPLORATION PROCEDURES

S&ME's assessment of the geotechnical conditions began with a reconnaissance of the topography and physical features of the site. To the extent feasible, we consulted available existing bridge plans, topographic and geologic maps, soil maps, or South Carolina Geologic Survey (SCGS) boring data for relevant information.

This segment of I-77 is located in the northeastern part of the Columbia, South Carolina metropolitan area. The alignment traverses the "fall line" dividing the coastal plain and Piedmont regions of the state, and topographic relief in the local area reflects this transition. The alignment is moderately hilly with generally widely spaced secondary drainages running generally northeast to southwest. Ground slopes are generally gently sloping to moderately sloping, becoming steep in some limited areas adjacent to creeks. Maximum elevation change is approximately 200 feet along the alignment. The alignment was brought to its present grade in about 1982. Site grading plans indicate fills as high as 30 feet in some areas.

The alignment is located in a portion of Columbia that is transitional between the upper and oldest portions of the South Carolina Coastal Plain and underlying formations of the South Carolina Piedmont. Coastal Plain sediments and residual Piedmont soils are overlain by thin recent Quaternary alluvium in some minor areas adjacent to the banks of major creeks. Most adjacent areas consist of residential or commercially developed lands comprising suburban Columbia.

3.1 Site Reconnaissance

Messrs. Josh Quattlebaum and Bill Jones of S&ME, Inc. initially viewed proposed boring locations in June, 2014. During the initial visits to the site, they observed boring locations for accessibility to the drilling equipment scheduled for the project and, where necessary, adjusted locations in the field to facilitate the work. Surface conditions which could influence design and construction were also noted. These included presence of existing overhead or underground utilities in construction areas, conditions of surface soils, type of ground cover and general topography. Boring locations were adjusted when surface features implied significant variations in subsurface conditions.

The alignment is a relatively highly developed area just north of the downtown part of Columbia. Areas adjacent to the alignment consist of parking lots or residential streets with landscaped lawns and border plantings. Low density commercial and residential development extends right up to the alignment along substantial portions of the project.

3.2 Configuration and Layout of Borings

Prior to release, S&ME was provided scaled half-sized drawings depicting the alignment. Boring locations were proposed by S&ME and approved by HDR and SCDOT. After receiving notice to proceed, we notified the Palmetto Utility Protection Service (PUPS) of our intent to drill at designated locations along the alignment. Boring locations were laid out in the field by measuring from the existing bridge as marked on the site plan.

As requested, representatives of S&ME, Inc. were present at the above referenced site between September 2, 2014 and September 18, 2014, to conduct thirty-seven standard penetration test

(SPT) borings (B-01 through B-02, B-04 through B-18, and R-01 through R-20). The method of drilling, and the method and depths of sampling at the bridge location generally followed those outlined in the GDM. This scope of work formed the basis of the exploration plan.

Borings and testing were generally conducted at or near the proposed locations submitted to and approved by HDR and SCDOT prior to the field exploration. Additionally, MASW/MAM shear wave velocity testing was conducted on September 23, October 6, and October 8, 2014, at the bridge structure locations. The purpose of the MASW/MAM testing was to determine seismic site class for bridges using site classification procedures in the GDM.

Boring B-03 was not conducted due to on-going paving operations by Zachary Construction on Interstate 20 at the time of our exploration. While it was initially intended that his boring be performed at a later date, the boring was later eliminated based on consistency of the materials encountered by the three other borings at that bridge, and the high cost of a single mobilization to that location. Fourteen additional borings originally scoped for noise barrier walls pending results of a noise study have also been eliminated.

3.3 Boring and Sampling Procedures

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"* using 3.25-inch hollow stem auger drilling methods as described in Appendix II. Bridge borings were extended to refusal of the drilling tools. Rock coring was then conducted in general accordance with ASTM D2113, *"Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation"* as described in Appendix II, for a minimum of 20 feet below auger drilling refusal depths. Borings were drilled within the median except B-11, B-12 and B-15, which were drilled through bridge deck. The borings were backfilled with cuttings and patched with asphalt cold patch at the conclusion of each soil test boring. Split spoon samples were obtained continuously to a depth of 10 feet, then every 5 feet below that depth.

The boring locations were initially established in the field by a handheld GPS unit. Boring locations as drilled in the field were surveyed by CHE Surveying. Elevations were referenced from the provided survey information. Approximate boring locations are shown on the Boring Location Plans included as Figures 2 through 10 in Appendix I. A summary of soil test boring locations, boring depths and boring elevations are presented in Table 1. Surveyed coordinates are tabulated in decimal degrees latitude and longitude coordinates.

The borings were extended to depths ranging from 20 to 122 feet below the existing ground, roadway, or bridge deck surface. All borings were backfilled after obtaining 24-hour ground water measurements. Borings in high traffic areas were backfilled at the time of drilling for safety reasons. Bulk samples were obtained from 21 locations, with laboratory testing conducted on 11 of the collected samples. A total of 16 undisturbed samples were attempted with a total of 12 samples obtained and subjected to laboratory testing.

SPT hammer energy measurements were previously performed with a Pile Driving Analyzer (PDA) on the three drill rigs used to perform the borings on this project. The N-values indicated on the logs are field values and were not corrected for overburden stress, rod length, borehole diameter or hammer efficiency. Hammer energy ratios are provided on the individual soil test boring records.

3.4 Surface Wave Geophysics

Shear wave velocities were measured using MASW/MAM methods (Multi-Channel Analysis of Surface Waves) and Microtremor Array Method (MAM). MASW/MAM is a seismic method for near-surface characterization of shear-wave velocity (Vs). It utilizes the Rayleigh-type surface waves ("ground roll") recorded by multiple receivers (geophones) deployed on an even spacing and connected to a common recording seismograph.

The testing was conducted using a 16-channel GeoMetrics ES-3000 seismograph and the test data reduced using the OYO Corporation SeisImager software. Surface waves recorded as they propagate along the receiver line are analyzed through powerful and diverse multichannel processing techniques similar to a pattern-recognition approach. A combination of active and passive sources are used to develop the wave frequencies required to obtain velocities to a depth of 100 feet. The results of the active and passive sources were combined to produce a single shear wave velocity profile.

Five MASW/MAM arrays (5 using active sources and 5 using passive sources) were performed at locations indicated in Table 7. The results from the active MASW arrays were combined with the passive MAM arrays to develop shear wave velocity profiles SW-1 through SW-5.

3.5 Laboratory Examination and Testing of Samples

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally followed those given in ASTM D 4220, "*Standard Practice for Preserving and Transporting Soil Samples.*" Recovered soil samples were classified in general accordance with ASTM D 2488, "*Standard Practice for Description and Identification of Soils (Visual-Manual Method).*" Rock core descriptions follow those described in the GDM.

Interpreted subsurface conditions encountered by the SPT borings are shown on the records in the Appendix. These records represent our interpretation of the subsurface conditions based on the test data. Stratification lines on the boring records represent approximate boundaries between soil types; however, the actual transition may be gradual and the thicknesses of the strata will vary across the site. The soil and rock samples will be retained at our laboratory until SCDOT requests them or until completion of the new roadway and bridges.

Index property testing consisting of Atterberg limits, particle-size distribution, and natural moisture content tests were performed on soil samples to assist in classifying the soils. The samples were classified in accordance with the Unified Soil Classification System (USCS) and AASHTO. Index property test results are provided on the *Summary of Laboratory Test Results – Split Spoons* table along with the individual test data sheets in Appendix III-A. Index property and physical tests performed on bulk samples and undisturbed samples are provided on the *Summary of Laboratory Test Results – Bulk & UD Samples* table along with the individual test data sheets in Appendix III-B.

Laboratory physical testing including triaxial shear, moisture-density, resistivity, pH, sulfate content, chloride content, and organic content testing was performed on five bulk soil samples at the bridge structure locations. Triaxial shear, direct shear, and one-dimensional consolidation testing was also performed on relatively undisturbed Shelby tube samples

obtained at the bridge structure locations. Unconfined compressive strength testing was performed on intact rock core samples obtained from the bridge structure locations. Moisture-density and California Bearing Ratio testing was performed on six bulk soil samples along the proposed roadway widening alignment. Testing was performed in general accordance with ASTM or AASHTO test procedures.

The lab data summary tables are also provided directly following this letter as Tables 2 through 6. Unconfined compressive strength testing results are provided in Appendix III-C.

3.6 Local Physiographic Conditions and Geology

The site lies in close proximity to the "fall line" dividing the outcrop of Cretaceous-age Coastal Plain sediments of the Black Mingo and Middendorf formations, from outcropping residual soils derived from the much older crystalline bedrock of the Carolina Piedmont. The Coastal Plain sediments represent soils eroded from a range of mountains in the northwest portion of the state approximately 65,000,000 years ago and laid down as fan or playa deposits, where they have subsequently weathered in place. Piedmont residuum has weathered in place from the parent crystalline bedrock material and the soil fabric often retains the relict rock structure.

Over most of the Columbia metropolitan area the Coastal Plain sediments rest unconformably on top of the underlying Piedmont rocks. More elevated areas are underlain by Coastal Plain derived soils to at least some depth. The underlying Piedmont residuum or bedrock may be exposed on the slopes of stream drainages or other low lying areas. The "fall line" thus meanders erratically depending on local topography.

Subsequent geologic processes may mask the contact between the Piedmont and Coastal Plain over localized areas. Over geologic time, localized erosion of the Coastal Plain sediments has occurred from the higher elevations, with the eroded materials as sheet washed sands or gravels on top of the Piedmont strata at lower elevations. These materials tended to accumulate in low-lying swales or terraces well below the outcrop of the Coastal Plain sediments. Large areas of downtown Columbia and West Columbia are underlain by one or more Tertiary-age river terrace deposits consisting of highly oxidized clayey sands and gravels, which lie on top of and mask underlying Coastal Plain and Piedmont soils and rock. Coastal Plain sediments in elevated areas to the northeast and southwest of the downtown area are covered by wind-deposited dune sands up to 50 feet thick.

3.7 Interpreted Stratification of Soils and Rock on Site

S&ME's borings encountered up to five general strata or horizons based on interpreted physical properties, visual appearance, and apparent geologic origin. General descriptions of the samples recovered from each strata are included below at each bridge location.

3.7.1 I-77 NB and SB Bridges over I-20 (Bridge 1)

Borings B-01, B-02 and B-04 were performed in the median at abutments and near interior bents of these structures. Borings B-01 and B-04 were performed on top of the abutments and B-02 was performed at the I-20 grade below the bridges. Boring B-03 was not performed due to access restrictions. Grading plans provided by the SCDOT depict this area as being mostly in cut but with 5 to 15 feet of fill present in the upper portion of each abutment slope.

Borings penetrated soils interpreted as part of the Middendorf Formation of the Coastal Plain to approximately elevation 220 feet. Sediments appeared to be comprised of thickly interlayered strata consisting of silty or clayey sands interlayered with seams or lenses of hard, low plasticity to high plasticity clays. Most samples were evaluated as kaolinitic to some degree. Soil consistency as gauged by SPT penetration data was either medium dense or hard to about elevation 275 feet, and mostly dense to very dense or hard to very hard below. SPT N-values obtained in sand layers typically ranged from 10 to 20 bpf above elevation 275 feet and from 40 to over 100 bpf below that level.

Below elevation 220 feet, borings B-02 and B-04 penetrated partially weathered rock representing Piedmont residuum, which extended to termination of drilling at about elevation 210 feet. SPT N-values obtained in the Piedmont all exceeded 100 bpf.

Ground water was measured in Boring B-01 at a depth of about 12 feet, within the embankment perched on top of Coastal Plain sediments at the base of the fill. Ground water was also measured at approximately elevation 300 feet in Boring B-04, within a confined sand layer within the Middendorf Formation. Hard, plastic clays occurring within the Middendorf Formation appear impervious and likely form barriers to vertical movement of water between sand layers.

3.7.2 I-77 NB and SB Bridges over I-20 Exit Ramp (Bridge 2)

Borings B-05 through B-07 were performed in the median at abutments and near interior bents of these structures. Borings B-05 and B-07 were performed on top of the abutments and B-06 was performed at the I-20 ramp grade below the bridges. Grading plans provided by the SCDOT depict this area as being mostly in fill but with 5 to 15 feet of cut made near the bottom of each abutment slope.

Borings penetrated soils interpreted as part of the Middendorf Formation of the Coastal Plain to approximately elevation 230 feet. Sediments appeared to be comprised of thickly interlayered strata consisting of silty or clayey sands interlayered with a few seams or lenses of hard, low plasticity to high plasticity clays. Most samples were evaluated as kaolinitic. Soil consistency as gauged by SPT penetration data was either loose or medium dense to about elevation 275 to 285 feet, and mostly dense to very dense below. SPT N-values obtained in sand layers typically ranged from 8 to 10 bpf above elevation 275 feet and from 60 to over 100 bpf below that level.

Below elevation 220 feet borings B-05 and B-06 penetrated partially weathered rock representing Piedmont residuum, which extended to termination of drilling at about elevation 210 feet. SPT N-values obtained in the Piedmont all exceeded 100 bpf.

Ground water was measured in Boring B-05 at a depth of about 42 feet, within sands of the Middendorf and below a stiff clay cap at that location. Ground water was inferred at approximately elevation 260 feet by a wet spoon in Boring B-06, also within in a confined sand layer within the Middendorf Formation. Ground water within the Middendorf Formation likely occurs as separate perched layers.

3.7.3 I-77 NB and SB Bridges over Windsor Lake Boulevard (S-1196) (Bridge 3)

Borings B-08 and B-09 were performed in the I-77 median at abutments of these structures. Grading plans provided by the SCDOT depict this area as being filled with 2H:1V embankments with heights exceeding 30 feet. Fills consisted of loose to medium dense sands or stiff sandy clays.

Below the fill, borings penetrated soils interpreted as part of the Middendorf Formation of the Coastal Plain to approximately elevation 190 feet. Sediments appeared to be comprised of thickly interlayered strata consisting of silty or clayey sands interlayered with a few seams or lenses of hard, low plasticity to high plasticity clays. Most samples were evaluated as kaolinitic. Soil consistency as gauged by SPT penetration data was either loose or medium dense for about five feet, but became dense to very dense below about elevation 240 feet. SPT N-values obtained in sand layers below that elevation typically ranged from 35 to over 100 bpf.

Below elevation 190 feet, Boring B-09 penetrated partially weathered rock representing Piedmont residuum, which extended to refusal to drilling at about elevation 172 feet. SPT N-values obtained in the Piedmont all exceeded 100 bpf. Diamond coring carried out below refusal level penetrated coarse grained gneiss. Rock quality based on recovery, Deere's RQD values, and Rock Mass Rating (RMR) values ranged from fair to excellent. Unconfined compressive strength of selected cores obtained from each run ranged from about 3000 psi in Core Run #1 just below refusal level of the auger drilling to 16,000 to 20,000 psi at 5 to 10 feet of penetration below refusal. RMR ranking of the recovered cores were determined by inspection to range from 36 to 50.

Ground water was measured in Boring B-08 at a depth of about 20 feet, approximately elevation 260 feet, possibly representing a perched water layer on top of original grade. Ground water was measured at approximately elevation 225 feet in Boring B-09, within in a confined sand layer within the Middendorf Formation. Ground water within the Middendorf Formation likely occurs as separate perched layers. Difference in apparent ground water elevation between the two borings may reflect the original sloping ground present in this area prior to construction of I-77.

3.7.4 I-77 NB and SB Bridges over Windsor Lake at MM 16.6 (Bridge 4)

Borings B-10 through B-13 were performed in the I-77 median at the abutments of these structures or through the bridge structure into Windsor Lake. Grading plans provided by the SCDOT depict this area as being filled with 2H:1V embankments with heights exceeding 20 feet. Fills consisted of loose to medium dense sands or stiff sandy clays.

Below the fill, Boring B-10 penetrated soils interpreted as alluvium to approximately elevation 215 feet. Borings B-11 and B-12, extending through the bridge deck, also penetrated muck or alluvium to about elevation 205 feet below the open water of Windsor Lake. Alluvium represents geologically recent (Holocene or Quaternary) deposits are present within the pond at the bridge location, masked by overlying fill soils at the south abutment. Recovered samples consist mostly of very loose to loose sands, clayey sands, silty sands and soft sandy lean clays. These soils were typically dark brown to grayish brown in color. SPT N-values range from generally 2 to 4 bpf. Alluvium did not appear present in Boring B-13 on the northern abutment.

Coastal Plain sediments of the Middendorf Formation extended to approximately elevation 185 feet. Sediments appeared to be comprised of thickly interlayered strata consisting of generally cohesive, very stiff silts and clays interlayered with a few seams or lenses of loose sands. Most samples were evaluated as kaolinitic. Soil consistency as gauged by SPT penetration data was either stiff to very stiff for about 20 feet, but became hard approaching the contact with the underlying Piedmont soils. Coastal Plain soils appeared substantially harder on the south abutment in Boring B-10, with SPT values between about 20 and 40 bpf.

Below elevation 185 feet, the borings penetrated Piedmont residuum consisting of either dense silty sands or hard sandy silts, which increased to partially weathered rock within a few feet.

Diamond coring carried out below auger drilling refusal level penetrated coarse grained gneiss, in some locations mixed with highly weathered "claystone" seams, but graded to schist at the north abutment. "Rock" as opposed to PWR, was defined for purpose of this exploration as material which could not be penetrated by the rotary bit used to advance the soil borings. Refusal to drilling occurred at approximately elevations 155 to 160 feet at the south abutment and below Windsor Lake. Refusal occurred somewhat deeper in Boring B-13 on the north abutment, approximately elevation 147 feet, with the overlying partially weathered rock correspondingly thicker.

Data suggests substantial variations in rock mass properties in different locations along the bridges. Assumptions and rating criteria for application of the RMR rating system followed those described in the GDM. Recovered core samples in boring B-10 and B-11 were typically fair to excellent quality gneiss and exhibited RQD values between 70 and 100 percent. The RMR was estimated to be between 40 and 69, falling within the "fair" to "good" range as defined by Table 6-27 in the GDM. Unconfined compressive strength of representative cores ranged from 5,000 psi to as high as 22,000 psi.

Borings B-12 and B-13 penetrated schists or interlayered gneiss and claystone substantially softer in character than borings to the south. Rock quality based on recovery, Deere's RQD values, and RMR values in the remaining borings ranged from poor to fair. Unconfined compressive strength of selected cores obtained from each run in Boring B-12 ranged from less than 1000 psi at refusal level of the auger drilling to 1,000 to 2,000 psi at 15 to 20 feet of penetration below refusal. Unconfined compressive strength of schists penetrated in Boring B-13 ranged from 5000 to 7000 psi. RMR ranking of the recovered cores were determined by inspection to range from 31 to 40.

Ground water was measured at about elevation 222 feet in Boring B-13 when re-measured 24 hours after drilling. Remaining borings performed using mud rotary methods did not reveal ground water levels. Ground water level in Boring B-13 generally corresponds to water level of Windsor Lake.

3.7.5 I-77 NB and SB Bridges over Edgewater Drive (S-1722) and Jackson Creek near MM 18 (Bridge 5)

Borings B-14 through B-18 were performed in the I-77 median at the abutments of these structures or below the bridge structure in the Jackson Creek floodplain. A single boring, B-15, was performed through the bridge deck to the mudline below the NB bridge. Grading plans provided by the SCDOT depict this area as being filled with 2H:1V embankments with heights exceeding 20 feet. Fills consisted of loose to medium dense sands or stiff sandy clays.

Below the fill, Boring B-14 penetrated very loose soils interpreted as alluvium to approximately elevation 220 feet. Boring B-15 extending through the bridge deck also penetrated muck or alluvium to about elevation 220 feet below the open water of Jackson Creek, and borings B-16 and B-17 penetrated alluvium to similar elevations below approximately 5 feet of surface fill and rip rap. Alluvium appeared to be absent below the north abutment in Boring B-18. Recovered samples consist mostly of very loose to loose sands, clayey sands, silty sands and soft sandy lean clays. These soils were typically dark brown to grayish brown in color. SPT N-values range from generally WOH to 4 bpf.

Coastal Plain sediments of the Middendorf Formation extended to approximately elevations 200 to 210 feet. Sediments appeared to be comprised of thickly interlayered strata consisting of generally cohesive, hard silts and clays interlayered with a few seams or lenses of medium dense clean sands. Soil consistency was either stiff to very stiff for about 5 feet, but became hard below that depth. SPT values range between about 20 and 30 bpf.

Below elevation 185 feet, borings penetrated Piedmont residuum consisting of either dense silty sands or hard sandy silts, which increased in consistency to partially weathered rock within a few feet. Four of five borings at this bridge penetrated very thick zones of partially weathered rock, extending to termination of drilling at depths of up to 120 feet. Partially weathered rock was in some cases 60 feet or more in thickness.

Refusal was encountered only in Boring B-14. Diamond coring carried out below refusal level penetrated fine grained schist which extended to termination of coring. Refusal to drilling occurred at approximately elevation 160 feet. Rock mass properties were rated using the RMR rating system described in the "Geotechnical Design Manual". Recovered core samples in boring B-14 and were fair quality schists which exhibited RQD values between 40 and 60 percent after more than a few feet of penetration below refusal level of auger drilling. The RMR was estimated to be between 40 and 50, falling within the "fair" range as defined by Table 6-27 in the GDM. Unconfined compressive strength of representative cores ranged from 5,000 psi to as high as 8,000 psi.

Ground water was measured at about elevation 231 feet, generally corresponding to water level of Jackson Creek.

4.0 EARTHQUAKE DESIGN ISSUES

Seismic induced ground shaking at the foundation is the effect taken into account by "2008 SCDOT Seismic Design Specifications for Highway Bridges." Other effects, including landslides or soil liquefaction, are not addressed in the specifications but must also be considered for certain performance category structures.

Bridge structures on the state highway system have been classified as Operational I, II, or III structures as defined in the Seismic Design Specifications. The bridges for this project are Operational Classification I structures as defined by Section 3.2 of the SCDOT – Seismic Design Specifications. Operational Classification I structures require an evaluation for the Safety Evaluation Earthquake (SEE) and Functional Evaluation Earthquake (FEE). The Roadway Operational Classification is also I within 150 feet of the bridge abutment and will be ROC IV beyond 150 feet.

4.1 Ground Motion

The "2008 SCDOT Seismic Design Specifications for Highway Bridges" use two different earthquake motions. The Functional Evaluation Earthquake (FEE) is defined as an earthquake with a 15 percent probability of exceedance in 75 years. The Safety Evaluation Earthquake (SEE) is an earthquake with a 3 percent probability of exceedance in 75 years.

S&ME was provided the Acceleration Design Response Spectrum (ADRS) for each bridge by the SCDOT Geotechnical Design Section for coordinates corresponding to the bridge locations. Final design response spectrum (SEE and FEE) sheets provided by SCDOT are included in Appendix II. Performances required subsequent to each earthquake are tabulated in terms of service levels and damage levels in Section 3.2.3 of the SCDOT – Seismic Design Specifications.

4.2 Site Class Effects

We classified each bridge site as one of the Site Classes defined in Section 12.4.1 (Table 12-22) of the GDM.

Site conditions were initially compared to the three conditions described for Site Class E. These are soft soils vulnerable to large strains under seismic motion. Borings did not include at least 10 feet having 1) plasticity index greater than 20, 2) moisture content greater than 40 percent, and 3) undrained shear strength less than 500 psf.

The next step in site class definition is a check for the four conditions described for Site Class F, which would require a site specific evaluation to determine site coefficients F_A and F_V. The three conditions, 1) peats and highly organic clays; 2) very high plasticity clays; and 3) very thick soft/medium stiff clays, were not evident in the borings performed.

The GDM requires classification of a site using shear wave velocity values. Shear wave velocities were obtained in the five different soil profiles. Our MASW/MAM arrays were conducted to a depth of approximately 125 to 160 feet, beyond which no shear wave velocity signal could be detected. This is typical for geologies where a hard rock profile is encountered.

Five MASW/MAM arrays (5 using active sources and 5 using passive sources) were performed at locations indicated in Table 7. The results from the active MASW arrays were combined with the passive MAM arrays to develop shear wave velocity profiles SW-1 through SW-5.

Review of Vs computations assume transfer of the seismic forces to the structure to occur at the base of the end walls or at a depth of 15 feet. The 100-foot interval thus considered is 15 feet to 115 feet below the road level. Since the geophysical data was sufficiently detailed to permit the geophysicist to develop picks well below 115 feet, computation of the average shear wave velocity over a 100 foot profile below this depth was possible. All five geophysical profiles of shear wave velocity indicated in Table 7 (Vs_{100}) exceed 1200 ft./sec. While profiles were determined only at end bents, probability is considered high that Site Class C applies to all interior bents.

4.3 Design Spectral Values

The Seismic Design Category (SDC) of each structure was determined at the same time by the SCDOT Seismic Design Specifications considering the bridges to be Operational Classification II structures. Values of S_{DS}, S_{D1}, and PGA are included in the preliminary Acceleration Design Response Spectrum (ADRS) printout provided by SCDOT for the FEE and SEE earthquake and the printout is included in Appendix II. Table 8 lists values provided by the SCDOT specifically for each bridge for the "geologically realistic" profile.

4.4 Liquefaction Potential

Sediments penetrated by the borings are nearly all Cretaceous age Middendorf Formation. Probability of deep liquefaction appears very minimal. However, there are some limited areas of thin alluvial soils adjacent to Windsor Lake or Jackson Creek that will need to be assessed for liquefaction triggering, and these areas conceivably could affect widening of abutments.

The potential for liquefaction of sands below embankments and within the creekbeds at Windsor Lake and Jackson Creek was qualitatively assessed based on the estimated relative density and fines content of the soils lying below the water table. The liquefiable zone in Quaternary Alluvium appears to be relatively thin, about 10 feet, and may extend below both abutments at each location. Penetration resistances within the alluvial soils were mostly less than 5 blows per foot and liquefaction triggering of these sediments would be considered likely.

Liquefaction susceptibility of the alluvial sediments would be dependent on the long term elevation of the water table. At the time of our exploration, alluvial soils at Windsor Lake were entirely submerged below the impoundment and ground water levels in the abutments were at approximately the elevation of the base of the fills. At Jackson Creek, alluvial soils lie below fill at the surface, but ground water levels presently are within the fills and alluvial soils are entirely submerged.

5.0 DESIGN AND CONSTRUCTION CONSIDERATIONS

As defined in Section 21 of the GDM (as modified in Bridge Design Memorandum 0510 dated October 22, 2010) the scope of geotechnical interpretation and discussion to be included in a GBLR is limited to "very preliminary engineering recommendations." Very preliminary engineering recommendations are interpreted as conceptual stage recommendations regarding general foundation approach. Issues specifically called out in Section 21.2.2 of the GDM are general recommendations concerning foundations and/or ground improvement requirements.

5.1 I-77 NB and SB Bridges over I-20 (Bridge 1)

Current separate northbound and southbound bridges are 3-span continuous steel plate girder with cast-in-place deck, with outer spans consisting of simple steel beams. Both bridges are supported by 3-column concrete bents with a rough span arrangement of 55-91-82-84-57. The southbound bridge is 47 feet wide with three traffic lanes, the northbound bridge is 41 feet wide with two traffic lanes and a wide shoulder. Substructure units are on an approximate 13 degree skew.

"As-let" bridge plans from 1982 indicate existing foundation type is HP 10x42 steel piles at end bents of both bridges. Interior bents on the southbound bridge are indicated as 10 ft. - 6 inch square shallow foundations bearing at elevations 299 ft. to 304 feet. Interior bents on the northbound bridge were designed to be supported by 10 ft. - 6 inch square shallow foundations at Bent 2 and footings supported by creosoted timber piles at interior bents 3, 4, and 5. Creosoted timber piles originally called for in the drawings appear to have been replaced by steel piling during construction based on tabulated quantities on the as-built drawings.

Maximum design bearing for the controlling load combination is tabulated as 4,640 psf on shallow footings. Total bridge length is roughly 350 feet. Bearing pressure is the "average bearing pressure" tabulated in the block "Maximum Footing Reactions" on the drawing depicting interior footings of Bent 2, due to transverse and longitudinal loads. The value shown is actually 2.32 T/sq. ft. This value represents dead load on superstructure and bent, plus live load on superstructure, plus backfill loading, and an allowance for centrifugal force. The preceding statement references a design drawing prepared by RKK and dated 5-76, rather than a new calculation, and is interpreted to be an allowable (factored) rather than nominal value.

Existing bridges are unlikely to conform to current requirements for lateral support, so the widened sections of each bridge are anticipated to be designed and constructed as essentially stand-alone structures. End bent and column structures would be expected to conform to the existing span arrangement. Since additional lanes will be to the inside of the existing lanes, rework of embankments at the abutments will be minimal.

A profile of the borings conducted at this structure looking from the west appears in figures 11A and 11B. While shallow foundations appear to have been successful at several of the interior bents on the original structures, they do not appear feasible on the widened sections. Conditions described in Section 15.1 of the GDM (presence of fill) that preclude use of shallow foundations appear to be present. While End Bent 6 would likely penetrate fills at the north abutment and bear in Coastal Plain residual soils, SPT blow counts at this location are less than 10 bpf and differential settlements could exceed tolerable limits. End Bent 1 likely bears in 10 to 12 feet of fill.

Interior bents likely bear in relatively incompressible, very stiff Coastal Plain soils but the span arrangement will likely result in heavy column loads, requiring relatively large footing dimensions and bearing depth. The size of the footings required to provide general bearing, lateral or uplift resistance would likely require a large excavation in the I-20 right of way. New shallow foundations bearing to existing footings could result in some additional settlement of the existing bridge structure. Differential settlement between "old" and "new" bridge units would also be a concern and may be difficult to quantify. Use of shallow footings adjacent to the existing footings may require underpinning of the existing footings.

Acceptable pile types include steel H-piles, steel pipe piles, prestressed concrete piles, or composite piles of shapes and dimensions typically used by the SCDOT and listed in table 16-2 of the GDM. All of these pile types appear technically feasible for use at either end bents or interior bents, although there would be substantial risk of excessively high driving stresses or short refusal of prestressed concrete piles due to high blow counts encountered at shallow depths. Since all of these types would bear in hard to very hard sediments of the

Middendorf Formation, group settlements would be very small. Downdrag is not anticipated as an issue.

H-piles bearing in sands and clays of the Middendorf Formation in the Columbia area have had a tendency to drive through apparent dense or cemented zones at various locations, even where blow counts exceed 100 bpf, and require relatively long embedment lengths to resist axial loads possible for a given steel cross section. Pipe piles driven close-ended develop very high axial resistance, but may require 7-10 days of set up. Precast concrete piles may require a stinger if driven below about elevation 260 feet. Drilled piles described in section 16.5 of the GDM do not appear necessary at this location.

Continuous Flight Auger (CFA) Piles appear feasible for support of non-bridge structures near Bridge 1. 18 to 30-inch diameter continuous flight auger piles appear feasible below non-bridge structures such as retaining walls, noise barriers or signs. Use of CFA piles is permitted under section 16.6 of the GDM for non-bridge structures if approved by the SCDOT during preliminary design.

Drilled shafts may be preferable for support of interior bents since their use would preclude requirement for excavation of a pile cap. Rock strata is very deep (>120 feet) so drilled shafts would derive axial resistance primarily as side friction in very stiff to hard Coastal Plain materials or intermediate geomaterials below elevation 260 feet. SCDOT requires construction casing on all drilled shafts unless otherwise approved by the SCDOT.

5.2 I-77 NB and SB Bridges over I-20 Exit Ramp (Bridge 2)

Current separate northbound and southbound bridges are 3-span simply supported steel girder with cast-in-place deck. Bridge structures curve slightly and are super-elevated to the west. Both bridges are supported by 3-column concrete bents with a rough span arrangement of 67-82-47. Structures are each about 44 feet wide with two traffic lanes and a wide shoulder. Substructure units have a slight (8 degree) skew.

"As-built" plans from 1983 indicate end bents EB 1 and EB 4 on both bridges to be supported by 11 HP10x42 steel piles per end bent. Interior bents 2 and 3 columns are each supported by 8 HP 10x42 steel piles embedded in concrete footings bearing at approximately elevation 283 to 285 feet. Average pile bearing is noted as 30 tons per pile. Tabulated pile quantities suggest pay lengths at end bents to vary from 27 to 53 feet. Tabulated pay lengths for interior bents range from 10 to 15 feet.

Total bridge length is roughly 180 feet. A flyover ramp from I-77 NB to I-20 WB crosses over both bridges on hammerhead piers. Clearance of this ramp over the I-77 structures ranges from about 15 to 20 feet.

End bent and column structures would be expected to conform to the existing span arrangement. Since additional lanes will be to the inside of the existing lanes, rework of embankments at the abutments will be minimal.

A profile of the borings conducted at this structure looking from the west appears in figures 12A and 12B. Shallow foundations do not appear feasible. SPT blow counts at all borings suggest relatively compressible soils to be present to approximately elevation 275 feet, which would be 40 feet below the abutments and 15 feet below interior bents. The 80 foot span

arrangement will likely result in heavy column loads, requiring relatively large footing dimensions and bearing depth at the interior bents. The size of the footings required to provide general bearing, lateral or uplift resistance would likely preclude their use adjacent to the I-20 Exit Ramp. Further, use of shallow footings adjacent to existing footings could require underpinning of the existing footings.

Overhead considerations below the I-77 NB to I-20 WB exit ramp may influence selection of acceptable foundation type. Micropiles may be considered at this location due to overhead restrictions below the flyover ramp. Acceptable pile types include steel H-piles, steel pipe piles, prestressed concrete piles, or composite piles of shapes and dimensions typically used by the SCDOT and listed in table 16-2 of the GDM. All of these pile types appear technically feasible for use at either end bents or interior bents. Since all of these types would bear in hard to very hard sediments of the Middendorf Formation, group settlements would be very small. Downdrag is not anticipated as an issue.

H-piles bearing in very dense sands and very hard clays of the Middendorf Formation below about elevation 260-275 feet would begin to develop substantial capacity in end bearing. Pipe piles driven either open- or close-ended will develop very high axial resistance at similar elevation. Precast concrete piles may develop excessively high driving stresses or encounter shallow refusal if driven below elevation 260 feet. PCC piles may require a driving shoe or stinger if driven below about elevation 275 feet. Drilled piles described in section 16.5 of the GDM do not appear necessary at this location.

Drilled shafts may be preferable for support of interior bents since their use would preclude requirement for excavation of a pile cap. Rock strata is very deep (>120 feet) so drilled shafts would derive axial resistance primarily as side friction in very stiff to hard Coastal Plain materials or Piedmont partially weathered rock below elevation 260 feet. SCDOT requires construction casing on all drilled shafts unless otherwise approved by the SCDOT.

5.3 I-77 NB & SB Bridges over Windsor Lake Boulevard (S-1196) (Bridge 3)

"As-let" plans dated 1983 depict current separate northbound and southbound bridges to be 3-span simply supported steel girder with cast-in-place deck. The northbound bridge is supported by 3-column concrete bents and the southbound bridge is supported by 4-column bents. Both bridges have a rough span arrangement of 46-88-35. The northbound structure is appreciably wider than the southbound structure as designed, with two traffic lanes and one acceleration ramp lane, and a total width of about 54 feet. The southbound structure is two traffic lanes only and is depicted to be about 41 feet wide. The bridges are about 75 feet apart. Substructure units have a 12 degree skew. Existing foundation type is creosoted timber piles for both end and interior bents on both bridges. Total bridge length is roughly 165 feet.

End bent and column structures would be expected to conform to the existing span arrangement. Since additional lanes will be to the inside of the existing lanes, rework of embankments at the abutments will be minimal.

A profile of the borings conducted at this structure looking from the south appears in figures 13A and 13B. Boring data suggests substantial thickness of fill to be present below the current grade of Windsor Lake Boulevard and ground water to be present within the lower portion of the fill. Due to presence of ground water at shallow depth, shallow foundations do

not appear feasible. SPT blow counts in both borings suggest relatively compressible soils to be present to approximately elevation 250 feet, which would be 30 feet below the abutments and 12 to 15 feet below interior bents. The long central span arrangement of the piers will likely result in heavy column loads, requiring relatively large footing dimensions and bearing depth at the interior bents. The size of the footings required to provide general bearing, lateral or uplift resistance would likely preclude their use adjacent to Windsor Lake Boulevard or adjacent to existing pier footings, if present.

Acceptable pile types include steel H-piles, steel pipe piles, prestressed concrete piles, or composite piles of shapes and dimensions typically used by the SCDOT and listed in table 16-2 of the GDM. All of these pile types appear technically feasible for use at either end bents or interior bents. Since all of these types would bear in hard to very hard sediments of the Middendorf Formation, group settlements would be very small. Downdrag is not anticipated as an issue.

H-piles bearing in very dense sands and very hard clays of the Middendorf Formation below about elevation 220 feet would begin to develop substantial capacity in end bearing. Pipe piles driven either open or close-ended will develop very high axial resistance at similar elevation. Precast concrete piles may require a driving shoe or stinger if driven below about elevation 220 feet. Drilled piles described in section 16.5 of the GDM do not appear necessary at this location.

Drilled shafts may be preferable for support of interior bents since their use would preclude requirement for excavation of a pile cap. Rock strata is very deep (~100 feet) and was encountered only on the west end of the span. Rock was not encountered on the eastern side of the bridge to termination of drilling at 120 feet. Drilled shafts would derive axial resistance primarily as side friction in very stiff to hard Coastal Plain materials or Piedmont partially weathered rock below elevation 240 feet. SCDOT requires construction casing on all drilled shafts unless otherwise approved by the SCDOT.

5.4 I-77 NB and SB Bridges over Windsor Lake at MM 16.6 (Bridge 4)

"As-let" bridge plans from 1983 depict current separate northbound and southbound bridges each consisting of five 2-span continuous concrete slab sections with two single-span precast concrete slab sections. There appears to have been substantial earlier development of access ramps for I-77 prior to 1983 in this area. Windsor Lake was partially filled to accommodate the bridge structures and the west end of the bridge is underlain by a rip rap dyke containing structural soil fill which underlies the west abutment.

Bridge deck slabs are supported by cast in place concrete pile caps and 16-inch square PCC piles on interior bents and HP 12x53 steel piles at end bents. As-let plans depict both bridges to be 41 feet in width. Northbound and southbound bridges are about 75 feet apart. Substructure units do not have an appreciable degree of skew. Pile lengths for pay purposes vary by bent and range from 25 to 40 feet. Note on plans indicates PCC piles to be driven to a capacity of 32 tons and HP 12x53 piles to be driven to a capacity of 37 tons. Total bridge length is roughly 360 feet.

A profile of the borings conducted at this structure looking from the south appears in figures 14A and 14B. Boring data suggests substantial thickness of fill and alluvium to be present below Windsor Lake and the east abutment. Fill thickness was substantially less and no

alluvium was encountered below the west abutment. Ground water depth in the borings closely corresponds to the water level in Windsor Lake.

Deep foundations will be required at this bridge. Acceptable pile types include steel H-piles, steel pipe piles, prestressed concrete piles, or composite piles of shapes and dimensions typically used by the SCDOT and listed in table 16-2 of the GDM. All of these pile types appear technically feasible for use at either end bents. Interior bents would be limited to concrete piles or drilled shafts. Since deep foundations would bear in very dense Piedmont residuum, partially weathered rock, or rock, group settlements would be very small. Downdrag is not anticipated as an issue.

Precast concrete piles may require a driving shoe or stinger if driven below about elevation 180 feet. Drilled piles described in section 16.5 of the GDM do not appear necessary at this location.

Drilled shafts may be preferable for support of interior bents if longer spans are used for the widened sections. Shafts would be socketed into rock strata at depths of about 70 feet below the level of the lake. Boring B-12 suggests poor quality rock materials may be present over some portion of the bridge lengths, and rock quality may vary substantially from pier to pier. Permanent casing will be required for all shafts. Drilling slurry will be required for the full length until the shaft casing is sealed into the rock. Construction casing will be required for all drilled shafts.

Previous grading plans at this location suggests that the present alignment of I-77 required considerable demolition and rework of previous embankments or bridge structures over Windsor Lake. There may be obstructions or rip rap present in the bottom of the lake. Predrilling may be required to penetrate rip rap or obstructions.

5.5 I-77 NB and SB Bridges over Edgewater Drive (S-1722) and Jackson Creek near MM 18 (Bridge 5)

Current separate northbound and southbound bridges are 13-span structures crossing Jackson Creek and adjacent flood plain, including Edgewater Drive. Portions of the bridges crossing Jackson Creek and the flood plain include 10 spans consisting of precast concrete flat slabs supported by precast concrete pile bents and PCC piles. "As-let" bridge plans dated 8/30/1976 depict foundations at end bents EB-1 and EB-13, and interior bents 2-10, to consist of pile bents with five 18-inch square PCC piles with the outer two piles in each bent battered outward. PCC piles are shown with 8-1/2 foot long HP 10x57 or 8-inch diameter by 7/16-inch wall thickness pipe reinforced points embedded 6 feet into the pile tip. Pile pay length tabulated per bent appears to range from 38 to 40 feet on the southbound structure and 37 to 45 feet on the northbound structure. Plans show piles to be driven to a capacity of 54 tons at end bents and 84 tons at interior bents.

A single steel girder section about 75 feet in length spans Edgewater Drive. The steel girder section of the bridge is supported by 3-column bents at either end (interior bents 11 and 12) with precast concrete caps. Foundation types at these locations are indicated to be spread footings with plan dimensions ranging from 10 ft. – 3 inch square to 10 ft. x 11 ft. Tabulated bearing pressure required per footing is 3800 psf for the controlling load combination. Bearing elevation suggested by the profile drawings is 223 feet at Bent 11 and 226 feet at Bent 12.

Both northbound and southbound structures are approximately 48 feet width and support two traffic lanes. The bridges are about 75 feet apart. Substructure units an appreciable degree of skew, approximately 20 degrees. The bridges are located in a horizontal curve and the bridges are super-elevated to the north approximately one foot. Total bridge length is roughly 400 feet.

A profile of the borings conducted at this structure looking from the south appears in figures 15A and 15B. Boring data suggests portions of the Jackson Creek floodplain have been filled and alluvium is masked by surface materials. Loose alluvial deposits are present to about elevation 220 feet but do not appear to be present below the west abutment. Ground water depth in the borings closely corresponds to the water level in Jackson Creek.

Deep foundations will be required at this bridge. Acceptable pile types include steel H-piles, steel pipe piles, prestressed concrete piles, or composite piles of shapes and dimensions typically used by the SCDOT and listed in table 16-2 of the GDM. All of these pile types appear technically feasible for use at either end bents or interior bents. Since deep foundations would bear in very dense Piedmont residuum or partially weathered rock, group settlements would be very small. Downdrag is not anticipated as an issue.

Precast concrete piles may require a driving shoe or stinger if driven below about elevation 210 feet. Drilled piles described in section 16.5 of the GDM do not appear necessary at this location.

Drilled shafts may be preferable for support of interior bents if longer spans are used for the widened sections. However, rock considered accepted for rock socket supported shafts was not encountered in four of the five borings carried out at this bridge. Rather, borings penetrated very hard Piedmont residuum and partially weathered rock to termination of drilling at depths of up to 120 feet. Shafts resistance would be essentially through side friction with relatively limited contribution by end bearing. SCDOT requires construction casing on all drilled shafts unless otherwise approved by the SCDOT.

5.6 Corrosivity

In general, resistivity, pH, chemical composition including the presence of organics, porosity, and groundwater level are the factors that most affect the corrosiveness of the underground environment. Generally, ground conditions are considered aggressive if one or more of the following conditions apply:

- pH < 5 or pH > 10
- Resistivity <= 3,000 Ω–cm
- Chlorides >= 100 ppm,
- Sulfates >= 200 ppm, and,
- Organic content >= 1%

5.6.1 Electrical Resistivity

Although a number of other factors are important, apparent resistivity is considered a reliable indicator of corrosivity in soil. The soil resistivity for a sample obtained at Bridge 2 was 2,600 ohm-cm. A sample obtained at Bridge 5 indicated a resistivity of 5,400 ohm-cm. Therefore, the near-surface soils at the site appear to have some potential for aggressive corrosive characteristics based on resistivity test results at these two locations. The remaining three locations tested had resistivity values ranging from 21,000 to 41,000 ohm-cm, which would be relatively less corrosive to non-corrosive.

5.6.2 Soil pH

Based on AASHTO, soils with pH greater than 5 are typically considered to have negligible to slight degree of aggressiveness with regard to corrosion potential to concrete and steel. Soils with pH lower than 5 are considered to have aggressive corrosion potential. pH tests were conducted on bulk samples obtained in the upper 15 feet of borings B-001, B-05, B-09, B-13 and B-18. The pH test results typically fall in the corrosive range at all locations tested except B-01 and B-05.

5.6.3 Sulfate Ion Content

AASHTO specifications indicate that up to 200 parts per million sulfate by weight in soil is permitted as far as corrosion potential to concrete. The measured sulfate content in the soils ranged from 50 to 150 parts per million, below the level of detection of the test would be considered susceptible for corrosion potential.

In general, ACI recommends that a minimum concrete protective covering for reinforcement should be 3 inches for concrete deposited against the ground. According to ACI 201, soils with sulfates of less than 200 ppm only have the potential for “mild” attack and do not require special cements or admixtures. Also, ACI indicates reducing the allowable water/cement ratio of concrete mixes will reduce corrosion potential to concrete.

5.6.4 Chloride Ion Content

Chloride ion contents of five representative samples of fill soils along the alignment are listed in Table 3. The chloride content obtained from the laboratory analyses on the soils tested typically ranged from 6 to 17 mg/kg. These values are below the 100 ppm value permitted by AASHTO.

5.7 Vibration Monitoring

There are private homes within 300 feet of the east abutment of Bridge 5. No other private residences or similar structures appear present in aerial photographs at other bridge locations.

Construction activities such as demolition, clearing, grading, compaction, and pile driving generate vibrations. Our experience indicates the perception of neighboring property owners can be more significant than the actual potential for damage. Vibrations, when coupled with noise from activities such as pile driving, are readily perceptible by people. The human perception threshold is actually much smaller than the threshold for damage to structures. When neighbors perceive vibrations, which may be well below damaging magnitudes, they

can become more attuned to potential property damage, often noticing old problems such as cracks in walls and driveways previously overlooked.

SCDOT should require contractors to perform pre- and post-construction surveys on all structures within at least 300 feet of the site boundaries to document their condition before and after vibration generating construction activities. This survey should include video and photographic records and the installation of crack monitors throughout the area. Vibration monitoring should be performed during initial construction activity such as driving of sheet piles or light blasting. Depending on the levels recorded, vibration monitoring might also be continued throughout major construction activities to maintain a record of vibrations and to confirm that established thresholds are not exceeded.

5.8 Pavement Support

Borings R-1 through R-20 were performed along the roadway median and, coupled with abutment borings performed at bridges, represent a spacing of about one boring per 1500-1600 feet of alignment. Classification of samples in the laboratory and visual classification of recovered samples was performed using AASHTO M-145 terminology and soil types accumulated by thickness boring-by-boring to determine a weighted average of available subgrade soil classifications along the alignment. Based upon the classification and physical tests performed on representative samples, only about 65 percent of materials in the upper five feet of the subgrade consist of soils better than A-3. 26 percent of soils along the alignment are A-6 or poorer.

Bearing ratio tests carried out on bulk samples recovered in roadway borings are summarized in Table 4. Of six tests performed at 95 percent of Standard Proctor maximum dry density, three tests exhibited CBR values of 2 percent or less. Two samples from soils classified as A-1-b soils exhibited CBR values of 8 percent or better. One sample of soils classified as A-2-6 exhibited a CBR of 4.0 percent. Final grade of the roadway alignment, including bridge surface elevation, has not been determined.

6.0 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 in this report are based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The nature and extent of variations between the borings will not become evident until construction. If variations appear evident, then we will need to re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by the submitting engineers.

Summary of Test Locations

I-77 Widening Design/Build Preparation On-Call
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 1 – Test Locations

BORING ID	DEPTH (FT)	STATION*	OFFSET* (FT)	ELEVATION (FT)	SURVEYED COORDINATES	
					LATITUDE	LONGITUDE
B-01	120	1215+74.4	9.2 L	337.9	34.067120	-80.922152
B-02	100	1217+31.7	13.4 R	305.2	34.067554	-80.922215
B-03	Not Performed					
B-04	120	1219+72.6	5.4 R	332.4	34.068175	-80.922499
B-05	120	1223+71.6	2.4 L	323.3	34.069156	-80.923086
B-06	100	1224+97.0	3.3 R	291.4	34.069461	-80.923281
B-07	120	1225+85.2	0.6 L	315.3	34.069659	-80.923449
B-08	120	1236+51.9	1.2 L	278.4	34.071745	-80.925895
B-09	121.6	1238+66.5	16.6 L	271.3	34.072035	-80.926513
B-10	95.5	1246+85.0	2.7 R	246.0	34.073307	-80.928743
B-11	76.9	1248+28.9	43.6 R	243.3	34.073620	-80.929062
B-12	69.5	1249+39.6	42.6 L	243.1	34.073599	-80.929525
B-13	122	1250+72.6	1.4 L	242.0	34.073906	-80.929802
B-14	110.6	1327+75.0	6.6 R	252.6	34.087938	-80.948901
B-15	98.1	1328+67.5	44.6 R	253.7	34.088185	-80.949044
B-16	100	1329+83.3	9.6 L	234.4	34.088290	-80.949446
B-17	100	1330+65.9	6.6 L	234.6	34.088452	-80.949638
B-18	120	1332+01.8	4.9 R	255.6	34.088735	-80.949934
R-01	30	1170+76.0	0.7 R	256.3	34.054808	-80.922794
R-02	20	1188+76.2	8.1 R	276.8	34.059740	-80.922321
R-03	20	1206+75.7	0.4 L	332.6	34.064673	-80.921900
R-04	40	1231+20.0	6.5 R	294.7	34.070814	-80.924541
R-05	20	1258+36.5	4.8 L	245.1	34.075241	-80.931749
R-06	40	1273+68.2	C/L	254.0	34.078223	-80.935320
R-07	20	1289+02.1	2.3 R	264.9	34.081071	-80.939128
R-08	30	1304+38.4	C/L	276.1	34.083785	-80.943015
R-09	25	1319+95.0	6.9 L	260.1	34.086525	-80.946964
R-10	30	1339+56.5	4.7 L	261.8	34.090241	-80.951646
R-11	25	1355+02.4	5.1 R	278.8	34.093756	-80.954501

* Proposed Centerline

Summary of Test Locations

I-77 Widening Design/Build Preparation On-Call
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 1 – Test Locations

BORING ID	DEPTH (FT)	STATION*	OFFSET* (FT)	ELEVATION (FT)	SURVEYED COORDINATES	
					LATITUDE	LONGITUDE
R-12	20	1370+40.3	0.1 R	299.0	34.097467	-80.956851
R-13	20	1385+88.6	9.6 R	321.7	34.101253	-80.959187
R-14	40	1401+32.0	3.8 L	312.2	34.105098	-80.961320
R-15	40	1416+77.7	0.6 L	307.8	34.109274	-80.962179
R-16	20	1432+27.0	6.4 R	317.9	34.113532	-80.962215
R-17	20	1447+56.5	1.0 R	326.8	34.117735	-80.962285
R-18	40	1468+27.4	8.5 R	291.5	34.123427	-80.962329
R-19	20	1478+36.8	6.7 R	295.0	34.126200	-80.962399
R-20	20	1493+77.3	6.3 R	322.6	34.130424	-80.962765

* Proposed Centerline

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-1	18.5-20	SS-7				16.5	A-2	SM
B-1	28.5-30	SS-9	21.5	54	29		A-7-5	CH
B-1	38.5-40	SS-11				25.5	A-2	SM
B-1	48.5-50	SS-13				13.8	A-2	SM
B-1	58.5-60	SS-15	16.2	51	29		A-7-5	CH
B-2	2-4	SS-2	12.6	40	22		A-6	CL
B-2	6-8	SS-4	19.9	47	27		A-7-5	CL
B-2	13.5-15	SS-6				13.1	A-2	SM
B-2	18.5-20	SS-7				15.5	A-2	SM
B-2	38.5-40	SS-11	19.5	27	14	17.2	A-2-6	SC
B-2	58.5-60	SS-15	18.5	52	28		A-7-5	CH
B-4	4-6	SS-3	23.6	55	30		A-7-5	CH
B-4	13.5-15	SS-6				41.3	A-7	SC
B-4	18.5-20	SS-7	17.6	53	30		A-7-5	CH
B-4	33.5-35	SS-10				6.1	A-3	SP-SM
B-4	48.5-50	SS-13	15.8	45	26		A-7-5	CL
B-4	58.5-60	SS-15				26.1	A-2	SC
B-5	13.5-15	SS-6				38.3	A-7	SC
B-5	28.5-30	SS-9	23.6	36	18		A-6	CL
B-5	33.5-35	SS-10	18.0	48	26		A-7-5	CL
B-5	43.5-45	SS-12				11.4	A-2	SW-SM
B-5	48.5-50	SS-13				28.1	A-2	SC
B-6	6-8	SS-4				11.2	A-2	SP-SM
B-6	18.5-20	SS-7				46.5	A-6	SC
B-6	23.5-25	SS-8	10.2	34	19	49.1	A-6	SC
B-6	43.5-45	SS-12				28.1	A-2	SM

Summary of Laboratory Test Data
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Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-7	4-6	SS-3				26.6	A-2	SC
B-7	8-10	SS-5				25.0	A-2	SC
B-7	33.5-35	SS-10	26.2	63	34		A-7-6	CH
B-7	58.5-60	SS-15				49.2	A-6	SC
B-8	8-10	SS-5				51.7	A-6	CL
B-8	23.5-25	SS-8	18.2	39	18		A-6	CL
B-8	33.5-35	SS-10	16.2	45	24		A-7-6	CL
B-8	48.5-50	SS-13				14.7	A-2-6	SC
B-8	53.5-55	SS-14	17.7	47	23		A-7-6	CL
B-9	8-10	SS-5	18.0	44	23		A-7-6	CL
B-9	13.5-15	SS-6				41.9	A-6	SC
B-9	33.5-35	SS-10A	11.3	35	20		A-6	CL
B-9	43.5-45	SS-12				26.2	A-2	SC
B-10	23.5-25	SS-8				44.2	A-4	SM
B-10	33.5-35	SS-10				4.2	A-1-b	SW
B-10	43.5-45	SS-12	25.4	49	20	70.6	A-7-6	ML
B-10	48.5-50	SS-13	25.1	50	23		A-7-6	CH
B-11	33-35	SS-3				3.7	A-3	SP
B-11	48.8-50.3	SS-7	34.5	70	34		A-7-5	MH
B-11	53.8-55.3	SS-8	32.8	82	58		A-7-6	CH
B-11	58.8-60.3	SS-9				72.1	A-7-6	CH
B-12	35-37	SS-2				16.9	A-2	SC
B-12	39-41	SS-4	27.5	62	38	51.9	A-7-6	CH
B-12	41-43	SS-5	22.8	52	26		A-7-6	CH
B-12	51.5-53	SS-7				81.0	A-6	ML
B-13	19.5-20	SS-7B	19.6	29	13		A-6	CL
B-13	48.5-50	SS-13	31.0	71	41	98.3	A-7-5	CH
B-13	53.5-55	SS-14	38.4	97	67	91.0	A-7-5	CH

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Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-14	6-8	SS-4	12.6	33	18	66.5	A-6	CL
B-14	18.5-20	SS-7				21.9	A-2	SM
B-14	33.5-35	SS-10	17.1	46	21		A-7-6	CL
B-15	27.6-29.6	SS-2				22.6	A-2	SC
B-15	31.6-33.6	SS-4				38.1	A-7	SC
B-15	33.6-35.6	SS-5				34.6	A-2	SC
B-15	48.7-50.2	SS-8	19.4	48	22		A-7-6	CL
B-16	6-8	SS-4				39.4	A-6	SC
B-16	23.5-25	SS-8	36.4	49	20	65.1	A-7-6	ML
B-17	8-10	SS-5	59.1	47	21	52.1	A-7-6	CL
B-17	13.5-15	SS-6				16.1	A-2	SC
B-17	18.5-20	SS-7				2.7	A-1	SP
B-17	23.5-25	SS-8	27.8	56	31	71.3	A-7-6	CH
B-18	6-7.5	SS-3				25.6	A-2	SM
B-18	18.5-20	SS-6				28.6	A-2	SC
B-18	28.5-30	SS-8				45.5	A-6	SC
B-18	38.5-40	SS-10	32.4	60	27		A-7-5	MH
B-18	48.5-50	SS-12	26.3	36	13	76.4	A-6	CL

Summary of Laboratory Test Data
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Table 2 – Split Spoon Samples

Boring No.	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
R-1	0-2	SS-1	7.8	NP	NP	58.0	A-4	ML
R-1	2-4	SS-2	7.7	NP	NP	12.5	A-2-4	SM
R-2	0-2	SS-1	20.7	54	30	63.2	A-7-6	CH
R-2	2-4	SS-2	10.6	NP	NP	29.0	A-2-4	SM
R-3	0-2	SS-1	8.1	NP	NP	27.6	A-2-4	SM
R-3	2-4	SS-2	27.1	70	36	95.7	A-7-5	MH
R-4	0-2	SS-1	10.4	27	11	39.0	A-6	SC
R-4	2-4	SS-2	11.1	25	9	33.6	A-2-4	SC
R-5	0-2	SS-1	9.6	NP	NP	24.5	A-1-b	SM
R-5	2-4	SS-2	11.0	NP	NP	20.8	A-2-4	SM
R-6	0-2	SS-1	13.1	25	9	37.4	A-4	SC
R-6	2-4	SS-2	19.0	40	17	68.3	A-6	CL
R-7	0-2	SS-1	14.6	37	13	67.9	A-6	CL
R-7	2-4	SS-2	7.0	34	16	68.8	A-6	CL
R-8	0-2	SS-1	8.5	22	8	24.2	A-2-4	SC
R-8	2-4	SS-2	10.7	26	11	38.9	A-6	SC
R-9	0-2	SS-1	15.3	40	20	45.6	A-6	SC
R-9	2-4	SS-2	12.5	NP	NP	32.9	A-2-4	SM
R-10	0-2	SS-1	11.6	31	15	46.9	A-6	SC
R-10	2-4	SS-2	10.3	NP	NP	32.0	A-2-4	SM
R-11	0-2	SS-1	11.2	NP	NP	41.9	A-4	SM
R-11	2-4	SS-2	7.7	NP	NP	27.0	A-2-4	SM
R-12	0-2	SS-1	9.5	NP	NP	33.8	A-2-4	SM
R-12	2-4	SS-2	12.6	NP	NP	30.6	A-2-4	SM
R-13	0-2	SS-1	9.2	NP	NP	34.3	A-2-4	SM
R-13	2-4	SS-2	13.7	NP	NP	32.1	A-2-4	SM
R-14	0-2	SS-1	6.5	NP	NP	22.3	A-2-4	SM
R-14	2-4	SS-2	10.3	NP	NP	27.5	A-2-4	SM
R-15	0-2	SS-1	9.8	NP	NP	35.4	A-2-4	SM
R-15	2-4	SS-2	11.4	NP	NP	23.2	A-2-4	SM

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Table 2 – Split Spoon Samples

Boring No.	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
R-16	0-2	SS-1	10.5	NP	NP	21.5	A-1-b	SM
R-16	2-4	SS-2	15.4	NP	NP	15.8	A-1-b	SM
R-17	0-2	SS-1	11.2	NP	NP	23.6	A-1-b	SM
R-17	2-4	SS-2	12.4	NP	NP	14.2	A-1-b	SM
R-18	0-2	SS-1	6.6	NP	NP	24.0	A-2-4	SM
R-18	2-4	SS-2	11.4	NP	NP	38.3	A-4	SM
R-19	0-2	SS-1	17.7	43	11	94.6	A-7-5	ML
R-19	2-4	SS-2	13.1	49	15	98.5	A-7-5	ML
R-20	0-2	SS-1	8.3	NP	NP	26.2	A-2-4	SM
R-20	2-4	SS-2	8.4	NP	NP	65.7	A-4	ML

Summary of Laboratory Test Data

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Table 3: Bulk Samples – Bridge Abutments

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		Triaxial Shear (CU)		Max. Dry Density (pcf)	pH	Resistivity (ohm-cm)	Chloride (mg/kg)	Sulfate (mg/kg)	Organic Content (%)
					LL	PI	AASHTO	USCS	c′ (ksf)	ϕ′ (deg)						
B-1	0-15	Bulk	7.7	19	21	6	A-2-4	SC-SM	0.17	32.5	122.5	5.1	41,000	6.25	50.4	0.8
B-5	0-15	Bulk	13.8	42.5	33	16	A-6	SC	0.21	15.7	116.7	7.2	2,600	7.89	149	1.8
B-9	0-15	Bulk	15.4	56.2	38	21	A-6	CL	0.13	25.5	115.5	4.2	34,000	6.6	89.9	1.5
B-13	0-15	Bulk	15.7	52.3	41	22	A-7-6	CL	0.11	33.6	113.4	4.0	21,000	17.2	88.2	1.6
B-18	0-15	Bulk	11.2	28.6	25	11	A-2-6	SC	0.18	22.2	123.7	4.5	5,400	6.53	82.6	2.3

Table 4: Bulk Samples – Roadway

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		Max. Dry Density (pcf)	Specimen 1		Specimen 2		Specimen 3	
					LL	PI	AASHTO	USCS		% compaction	CBR	% compaction	CBR	% compaction	CBR
R-1	0-5	Bulk	14.7	14.6	NP	NP	A-1-b	SM	122.6	90.9	5.0	95.8	14.9	100.1	22.8
R-4	0-5	Bulk	11.3	33.3	29	13	A-2-6	SC	120.8	91.8	1.8	97.4	4.0	101.3	6.3
R-9	0-5	Bulk	8.7	28.6	26	10	A-2-4	SC	121.2	88.7	0.5	93.7	1.6	99.5	6.4
R-13	0-5	Bulk	12.3	33.5	28	12	A-2-6	SC	119.8	89.6	0.3	95.5	1.2	101.0	3.1
R-17	0-5	Bulk	11.6	21.5	25	8	A-1-b	SC	124.8	91.7	3.3	96.6	7.9	98.8	16.2
R-19	0-5	Bulk	15.6	75.5	40	11	A-6	ML	108.6	92.0	0.2	96.4	0.2	96.9	0.2

Summary of Laboratory Test Data

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Table 5: Undisturbed Samples – Shear Strength Testing

Sample Location	Sample Depth (feet)	Sample No.	Percent Finer #200	Atterberg Limits		Soil Classification		Triaxial Shear (CU)		Direct Shear	
				LL	PI	AASHTO	USCS	c′ (ksf)	ϕ′ (deg)	c (ksf)	ϕ (deg)
B-4	8-10	UD-1	80.1	49	27	A-7-6	CL	0.06	30.3		
B-7	18-20	UD-1	18.6	18	6	A-2-4	SC-SM			0	42.6
B-9	4-6	UD-1	61.9	33	16	A-6	CL			0	56.0
B-9	28-30	UD-2	36.4	30	15	A-6	SC			0	36.8
B-10	13-15	UD-1	46.7	37	20	A-6	SC			0.34	27.1
B-13	6-8	UD-1	57.0	36	19	A-6	CL			0.11	37.6
B-13	18.9-19.4	UD-2	54.7	34	15	A-6	CL	0.3	26.6		
B-13	38.8-40	UD-3	93.0	85	49	A-7-5	CH	1.10	6.6		
B-14	23-25	UD-1	27.5	30	14	A-2-6	SC	0.08	38.4		
B-14	28-30	UD-2	49.5	31	10	A-4	SC	0	41.0		
B-16	11-13	UD-1	54.7	76	34	A-7-5	MH	0.03	42.5		
B-17	6-8	UD-1	20.6	NP	NP	A-2-4	SM	0.07	18.5		

Table 6: Undisturbed Samples – Consolidation Testing

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		In-Situ Moist Unit Weight (pcf)	In-Situ Void Ratio (e_0)	Compression Index C_C
					LL	PI	AASHTO	USCS			
B-14	23-25	UD-1	12.0	27.5	30	14	A-2-6	SC	127.9	0.472	0.09
B-14	28-30	UD-2	55.6	49.5	31	10	A-4	SC	87.8	2.150	0.76
B-16	11-13	UD-1	13.3	54.7	76	34	A-7-5	MH	126.8	0.480	0.10

Summary of Laboratory Test Data

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Table 7: Surface Wave Geophysics

Test Number	Location	Approx. Begin Station	Vs.100	Notes
SW-1	Bridge 1 SB South Abutment	1215+75	1598 ft./sec.	Adjacent boring is B-01 Max. definition depth is 160 ft.
SW-2	Bridge 2 NB North Abutment	1225+00	1492 ft./sec.	Adjacent boring is B-07 Max. definition depth is 130 ft.
SW-3	Bridge 3 SB South Abutment	1236+50	1552 ft./sec.	Adjacent boring is B-08 Max. definition depth is 160 ft.
SW-4	Bridge 4 NB North Abutment	1250+00	1292 ft./sec.	Adjacent boring is B-13 Max. definition depth is 135 ft.
SW-5	Bridge 5 NB North Abutment	1331+00	1542 ft./sec.	Adjacent boring is B-18 Max. definition depth is 140 ft.

Summary of Laboratory Test Data

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Table 8: Seismic Parameters by Bridge

Bridge No.	Site Class	Hazard	pga	S_{DS}	S_{D1}	Mw	R	Geologic Condition
Bridge 1	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.29	117 km	
Bridge 2	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.29	117 km	
Bridge 3	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.26	117 km	
Bridge 4	C	FEE	0.13g	0.25g	0.11g	7.3	114.6 km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.26	117.2 km	
Bridge 5	C	FEE	0.14g	0.25g	0.10g	7.3	115.8 km	Geologically Realistic
		SEE	0.34g	0.65g	0.28g	7.26	118.2 km	

Summary of Laboratory Test Data

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Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
B-9	99.3	RC-1	99.6-101.6	83%	40%	Moderately hard to hard Soft to hard	Fairly continuous	Poor	Severe to slight	1	100.5	2,925
		RC-2	101.6-106.6	90%	44%	Soft to hard	Continuous	Poor	Severe to moderate	1	104	---
		RC-3	106.6-111.6	82%	38%	Soft to very hard	Fairly continuous	Poor	Severe to slight	1	107.9	20,773
		RC-4	111.6-116.6	59%	30%	Moderately hard to very hard	Competent	Poor	Moderately severe to very slight	N/A	N/A	---
		RC-5	116.6-121.6	98%	70%	Hard to very hard	Continuous	Fair	Slight to very slight	1	117.1	16,435
B-10	94	RC-1	94-94.5	100%	75%	Hard to very hard	Continuous	Fair	Very slight to fresh	N/A	N/A	---
		RC-2	94.5-99.5	97%	81%	Moderately soft to moderately hard	Continuous	Good	Slight to fresh	1	97.1	446
		RC-3	99.5-104.5	94%	43%	Moderately hard to hard	Continuous	Poor	Moderately severe to fresh	1	103.4	4,232
		RC-4	104.5-109	95%	68%	Moderately hard to hard	Continuous	Fair	Moderate to fresh	2	104.9, 105.4	6,551/ 18,872
		RC-5	109-114	92%	60%	Hard to very hard	Continuous	Fair	Slight to fresh	N/A	N/A	---
B-11	56.9	RC-1	86-91.2	100%	100%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	2	87.6, 88.8	23,445/ 21,801
		RC-2	91.2-96.4	98%	88%	Moderately hard to very hard	Continuous	Good	Slight to fresh	1	92.7	22,478
		RC-3	96.4-101.5	100%	100%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	1	98.7	11,952
		RC-4	101.5-105.9	98%	74%	Moderately hard to hard	Continuous	Fair	Slight to fresh	N/A	N/A	---
B-12	82.5	RC-1	80.5-82.5	73%	26%	Moderately soft to moderately hard	Fairly continuous	Poor	Severe to very slight	1	81.4	---

Summary of Laboratory Test Data
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Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
		RC-2	82.5-87.5	100%	87%	Moderately hard to moderately soft	Continuous	Good	Moderate to very slight	2	83.6, 86.5	3,038/ 1,150
		RC-3	87.5-92.5	94%	53%	Soft to moderately hard	Continuous	Fair	Moderately severe to slight	1	88.3	1,030
		RC-4	92.5-97.5	98%	84%	Moderately hard to hard	Continuous	Good	Slight to fresh	1	96.1	1,798
		RC-5	97.5-102.5	99%	83%	Moderately hard	Continuous	Good	Slight to fresh	N/A	N/A	---
B-13	94.7	RC-1	94.7-96.5	89%	73%	Hard	Fairly continuous	Fair	Very slight to fresh	1	95.1	---
		RC-2	96.5-101.5	90%	60%	Moderately hard to hard	Continuous	Fair	Severe to fresh	1	99	4,803
		RC-3	101.5-105.7	78%	45%	Soft to hard	Fairly continuous	Poor	Moderate to very slight	1	103.4	7,323
		RC-4	105.7-107	106%	78%	Moderately hard to very hard	Continuous	Good	Slight to very slight	N/A	N/A	---
		RC-5	107-112	98%	92%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	2	107.2, 110.6	5,918/ 5,788
		RC-6	112-117	80%	41%	Moderately hard to hard	Fairly continuous	Poor	Moderately severe to very slight	N/A	N/A	---
		RC-7	117-120.5	29%	0%	Moderately hard to hard	Incompetent	Very poor	Severe to very slight	N/A	N/A	---
		RC-8	120.5-122	100%	75%	Moderately hard to hard	Continuous	Good	Moderate to very slight	N/A	N/A	---
B-14	89.7	RC-1	89.7-91.4	90%	0%	Moderately hard	Continuous	Very poor	Severe to moderate	N/A	N/A	---
		RC-2	91.4-96.4	90%	27%	Moderately soft to moderately hard	Continuous	Poor	Moderately severe to slight	1	95.8	7,030
		RC-3	96.4-101.4	93%	64%	Moderately soft to moderately hard	Continuous	Fair	Severe to fresh	2	97.6, 99.6	5,112/ 8,086

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Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
		RC-3	89.7-91.4	90%	0%	Moderately hard	Continuous	Fair	Severe to fresh	2	97.6, 99.6	5,112/ 8,086
		RC-4	101-4-106.4	92%	76%	Soft to moderately hard	Continuous	Good	Severe to very slight	1	102.1	5,197
		RC-5	106.4-110.6	90%	48%	Moderately soft to moderately hard	Continuous	Poor	Severe to very slight	1	109.3	5,710

APPENDIX I

Appendix I - Figures
Site Location Plan – Figure 1
Boring Location Plan – Figures 2 -10
Profiles at Bridges – Figures 11-15
SCDOT ADRS Data by Bridge

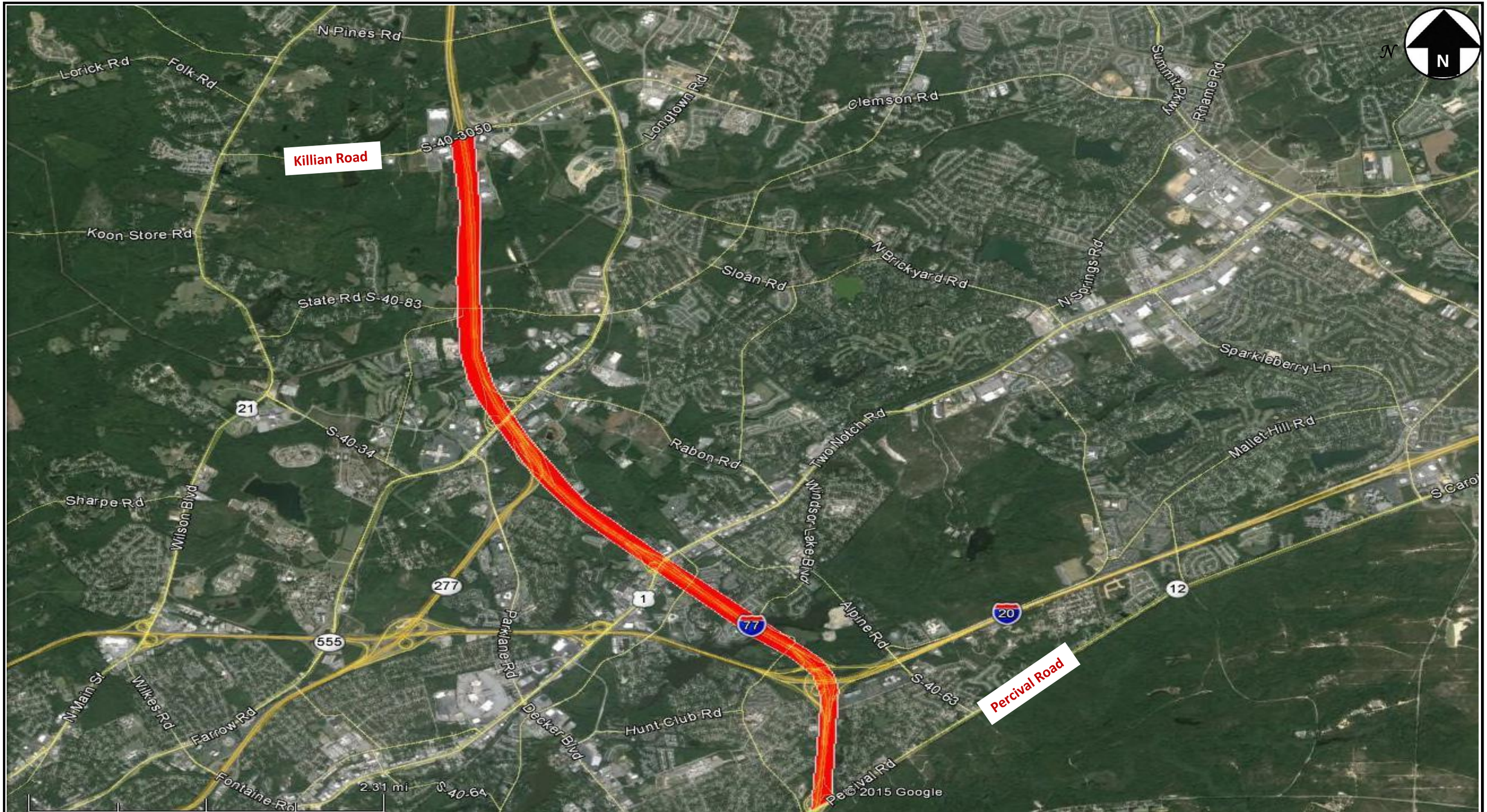


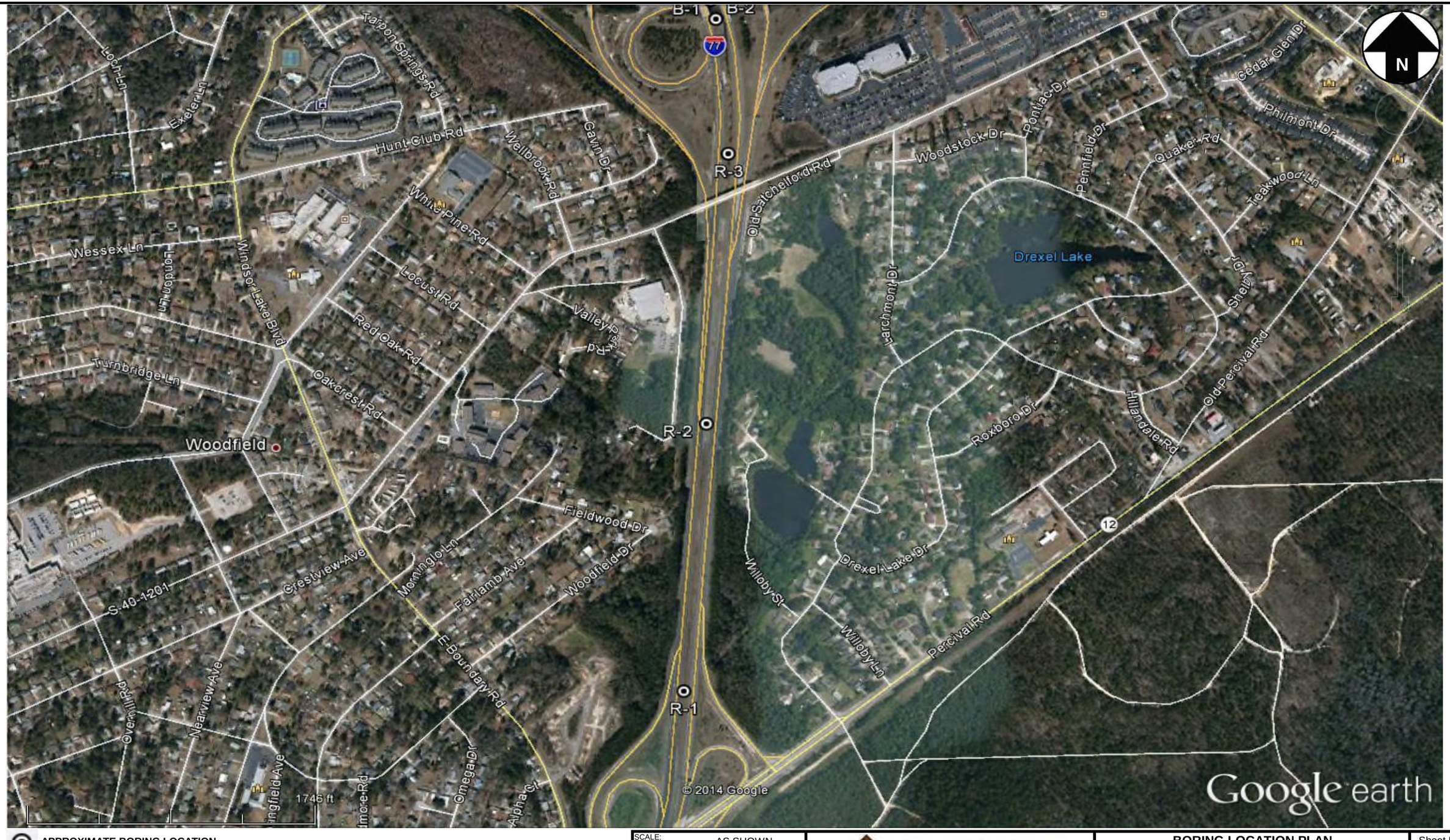
IMAGE SOURCE Google Earth
Project Limits

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	SJ
DATE:	2/4/2015

S&ME

SITE LOCATION PLAN
I-77 Widening Design/Build Preparation
Richland County, South Carolina
1461-14-046

Sheet No. 1



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

S&ME

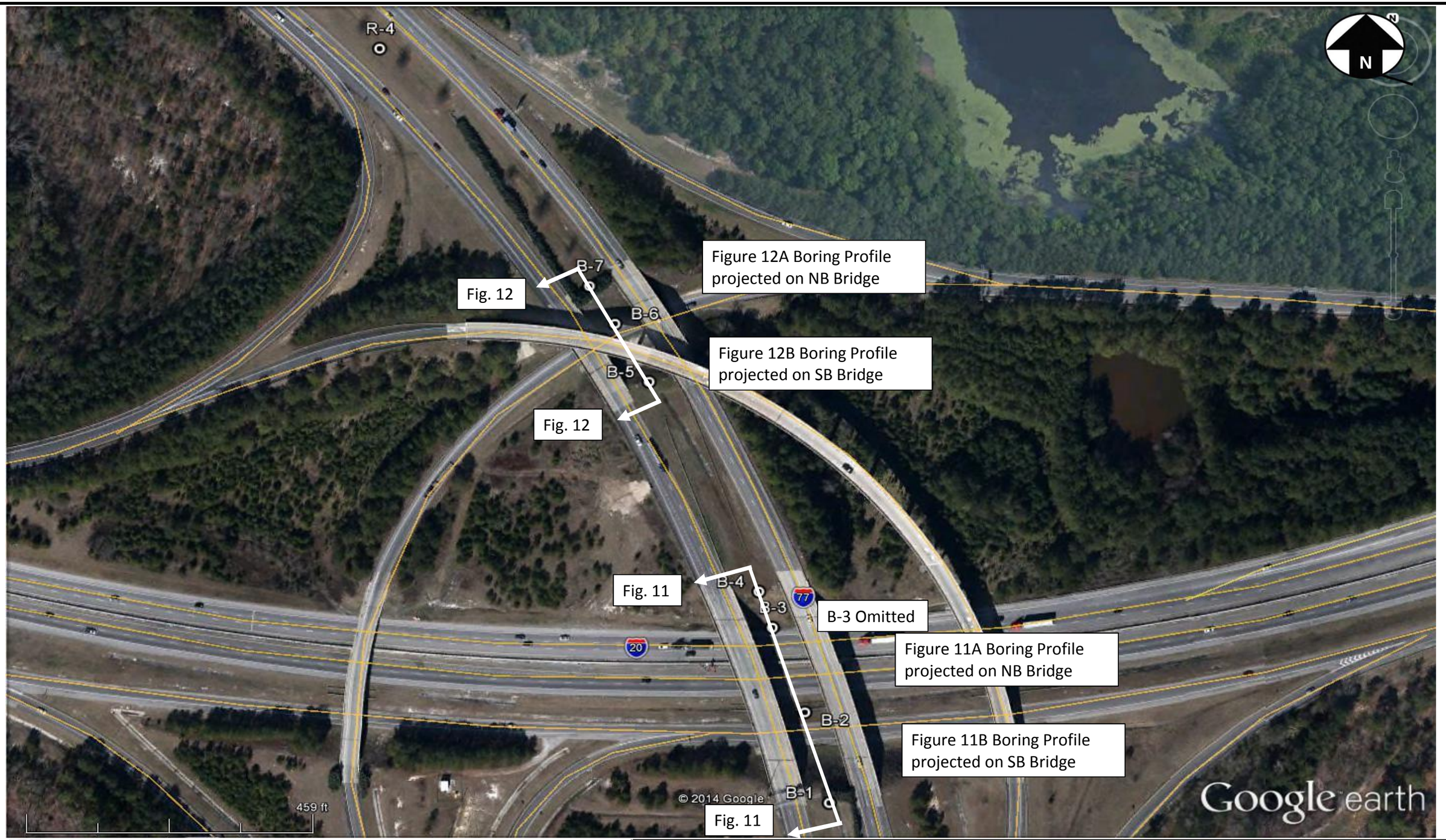
BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 2



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	JCL
DRAWN BY:	JCJ
DATE:	8/14/2014

S&ME

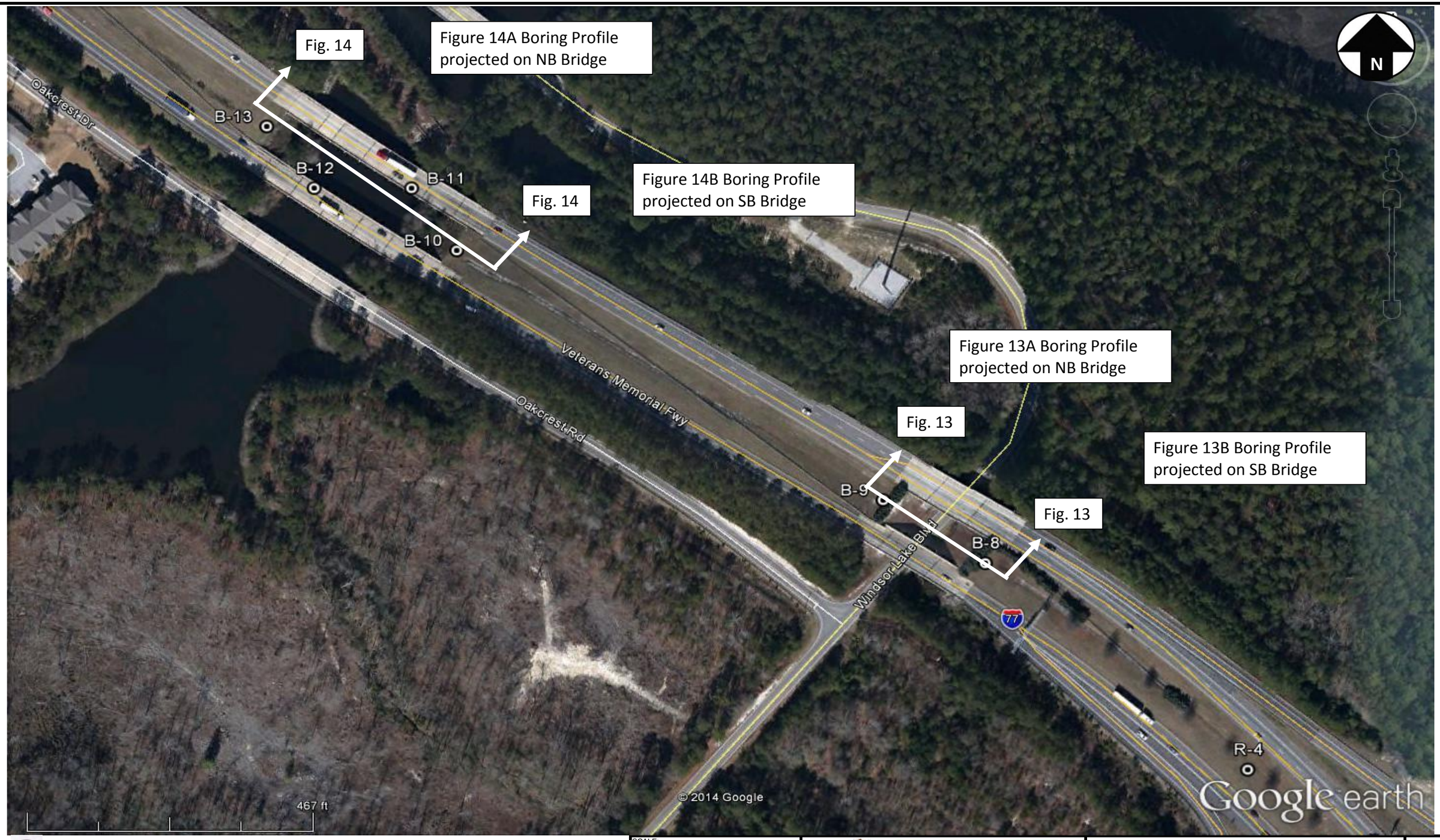
BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 3



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	JCL
DRAWN BY:	JCJ
DATE:	8/14/2014

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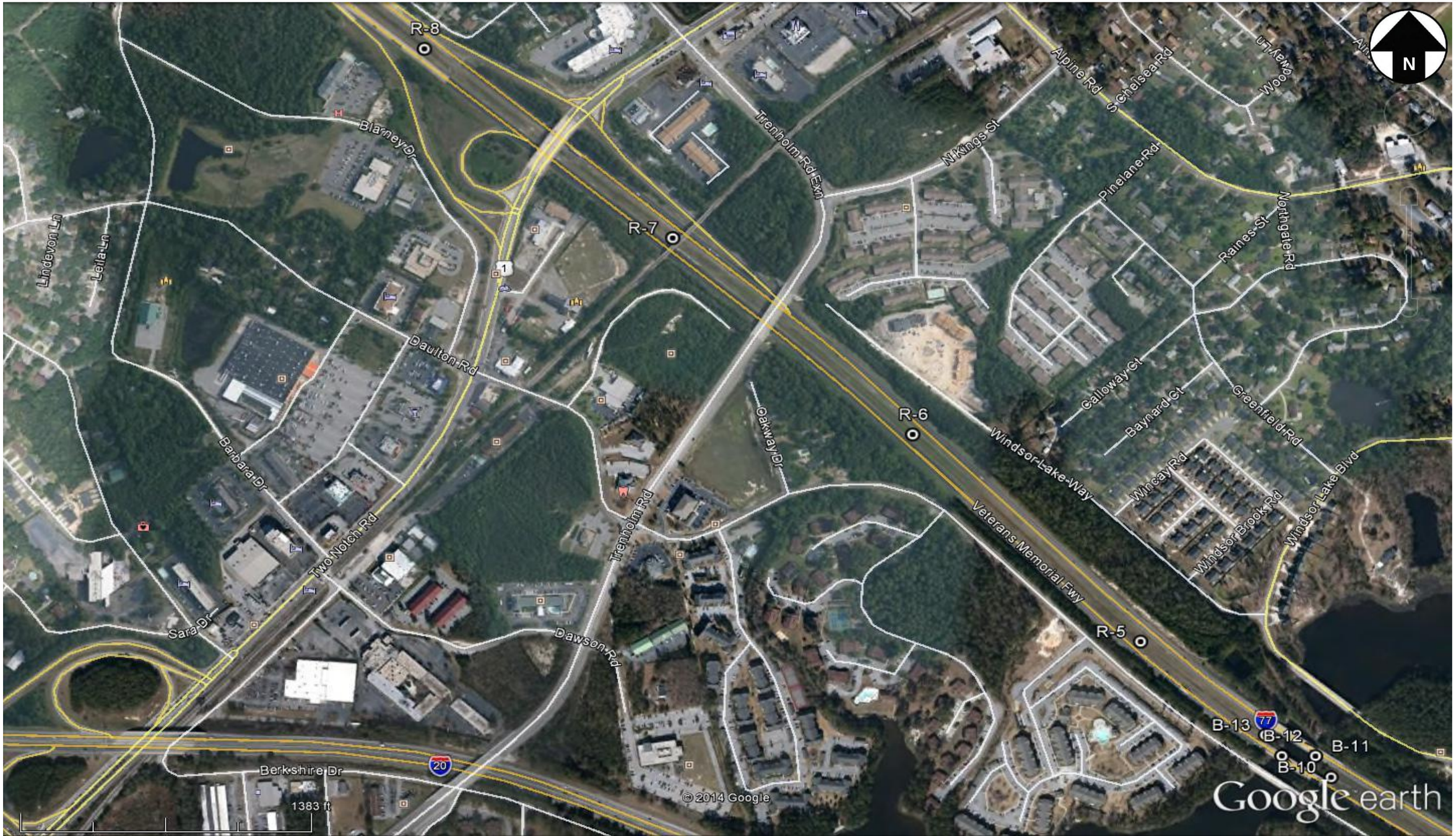
BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 4



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

S&ME

BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 5

APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	JCL
DRAWN BY:	JCJ
DATE:	8/14/2014

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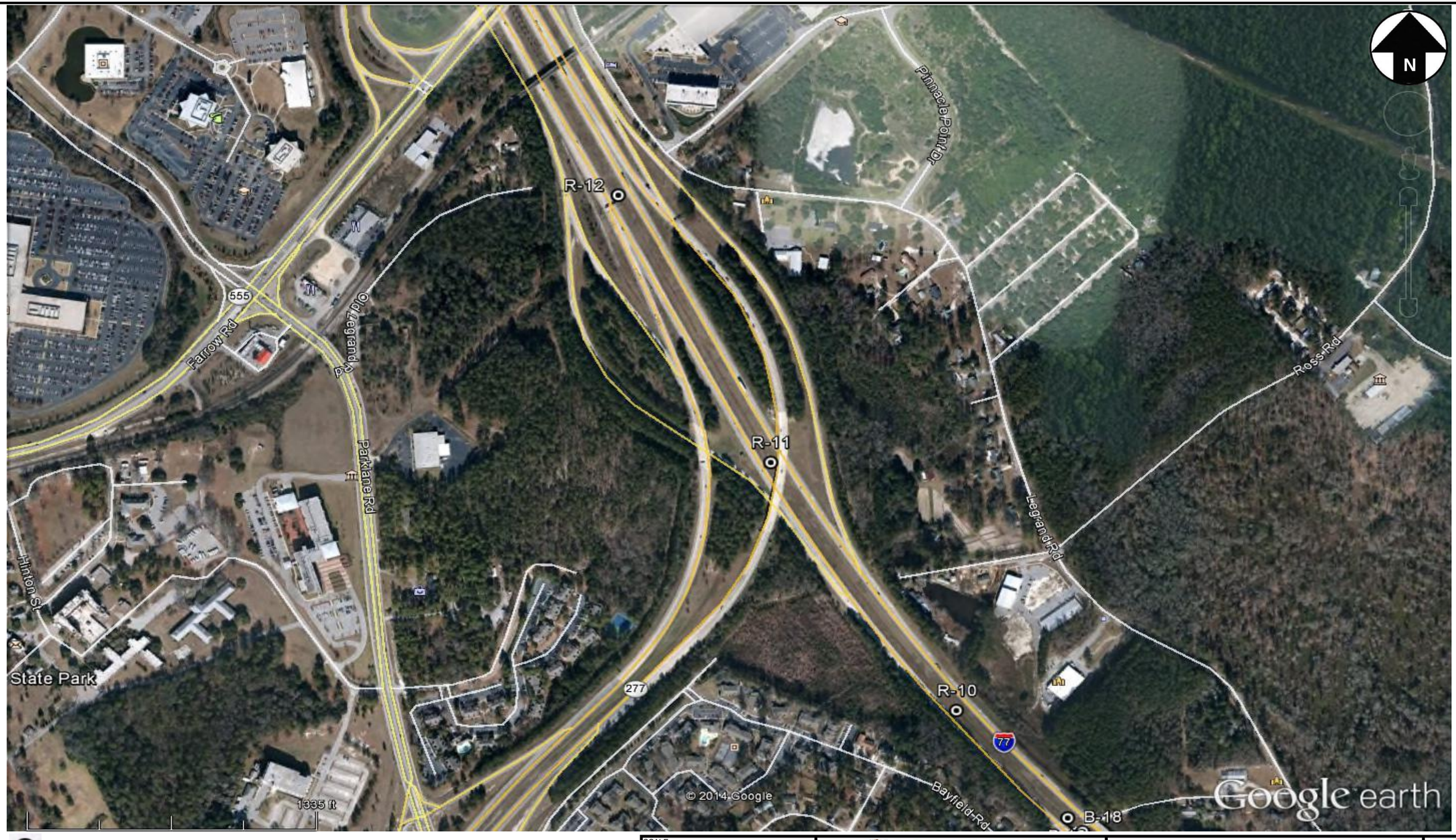
BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 6



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

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BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 7

APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

S&ME

BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 8

APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

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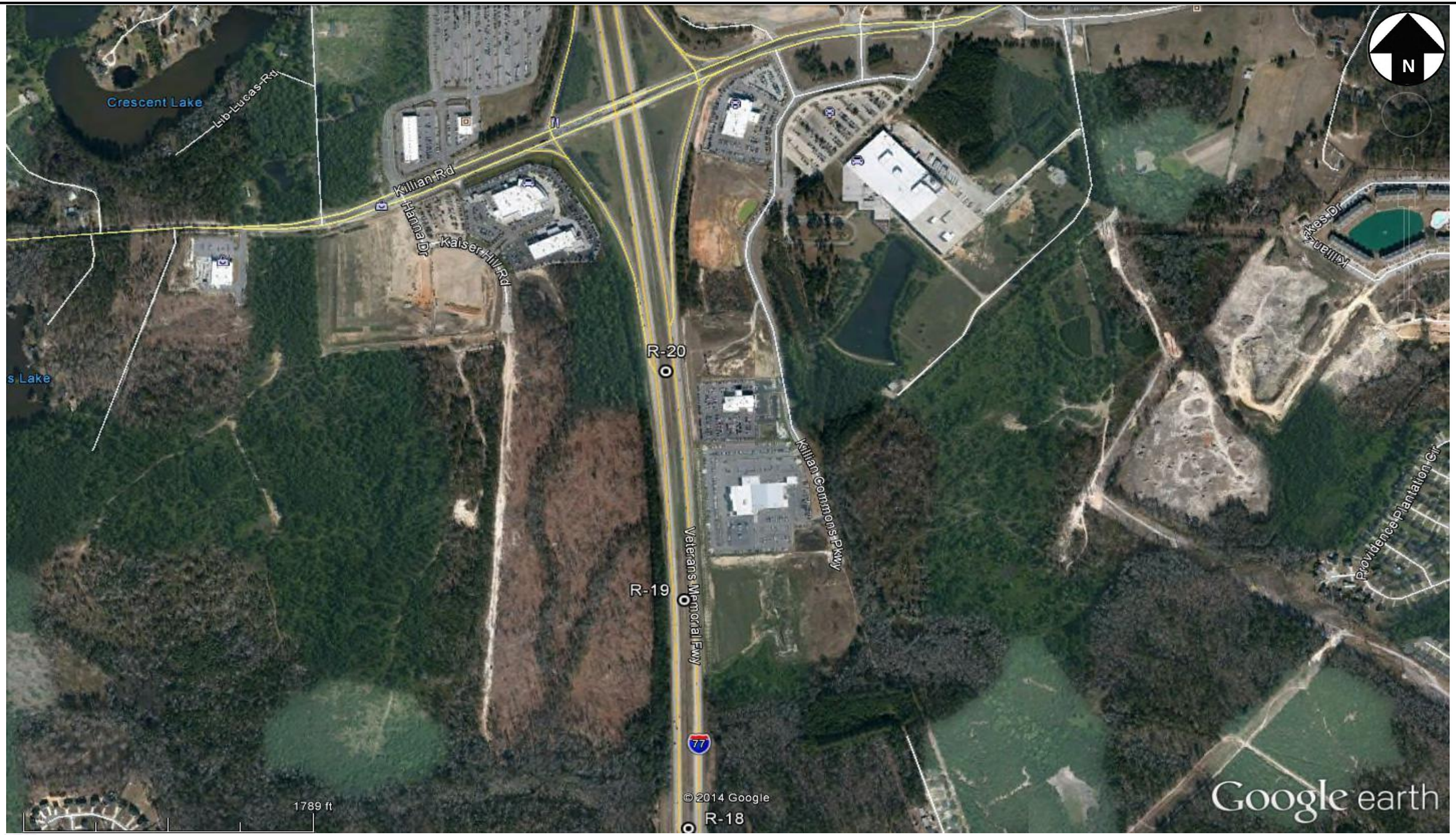
BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 9



APPROXIMATE BORING LOCATION

SOURCE: Google Earth

SCALE:	AS SHOWN
CHECKED BY:	TH
DRAWN BY:	JQ
DATE:	8/14/2014

S&ME

BORING LOCATION PLAN

I-77 Widening Design/Build Preparation

Richland County, South Carolina

1461-14-046

Sheet No. 10

BRIDGE 1-NORTHBOUND

TO CHARLESTON

TO CHARLOTTE

BENT 1

BENT 2

BENT 3

BENT 4

BENT 5

BENT 6

END BENT
CUT OFF
336.0

FILL

BENT
CUT OFF
299.0

BENT
CUT OFF
300.0

END BENT
CUT OFF
292.0

FILL

MEDIUM DENSE/VERY STIFF
COASTAL PLAIN
DEPOSITS

MEDIUM DENSE/VERY
STIFF COASTAL PLAIN
DEPOSITS

DENSE OR HARD
COASTAL PLAIN
DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

PIEDMONT PARTIALLY WEATHERED ROCK

BOTTOM OF
FOUNDATION

HP10X42
RANGE OF
TIP ELEVATION

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

ELEVATION (feet-MSL)

ELEVATION (feet-MSL)

340 330 320 310 300 290 280 270 260 250 240 230 220 210 200

0 50 100 150 200 250 300 350 400

B-01
9/5/2014
ELEV.337.9

Depth	
0	6-13-15
5	11-13-16
	7-11-14
	6-16-18
10	13-16-17
15	11-25-30
20	10-10-8
25	5-6-10
30	9-13-20
35	10-16-28
40	4-7-10
45	4-7-8
50	4-3-7
55	18-29-49
60	16-29-50
65	15-22-17
70	9-19-25
75	10-15-15
80	18-35-50/4"
85	10-14-25
90	12-16-19
95	9-16-21
100	15-32-50/1"
105	15-30-32
110	18-22-28
115	27-43-50/5"
120	10-8-13

BT @ 120

B-02
9/10/2014
ELEV.305.2

Depth	
0	2-4-5
5	13-18-26
	25-28-34
	4-8-8
10	15-21-20
15	2-3-4
20	6-5-4
25	20-40-50/5"
30	21-29-35
35	8-9-10
40	12-19-21
45	16-35-40
50	14-20-26
55	12-18-29
60	17-30-35
65	18-21-23
70	12-16-23
75	18-19-18
80	13-26-36
85	15-50/1"-
90	13-50/3"-
95	50/4"--
100	22-50/5"-

BT @ 100

B-04
9/12/2014
ELEV.332.4

Depth	
0	3-3-3
	3-3-3
5	2-2-2
	5-4-4
10	3-3-3
15	4-8-9
20	11-19-32
25	10-16-20
30	13-16-18
35	9-12-10
40	10-12-15
45	13-36-50/4"
50	10-11-22
55	20-36-44
60	8-10-12
65	9-11-14
70	18-32-38
75	10-13-15
80	9-12-16
85	19-35-47
90	29-34-50/4"
95	13-23-35
100	18-33-50/5"
105	20-32-50/4"
110	22-47-50/1"
115	50/2"--
120	50/3"--

BT @ 120

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)

Direct Push Sample

1265
Downhole Shear Wave Velocity

Water Level Inferred
from Pore Pressures

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

Water Level
Measured Downhole

BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)

Constrained Modulus M (ksf)

Water Level
Inferred from
Pore Pressure

BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

Water Level
at Time of Boring

Water Level
after 24 Hours

Hole Caved

Water Loss/Inflow

11-16-10 Standard Penetration Test
(blows per foot).

12in Undisturbed Sample
Recovery in Inches

NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation

BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- CH, High Plasticity Clay
- SC, Clayey Sand
- CL, Low Plasticity Clay
- SM, Silty Sand
- ML, Low Plasticity Silt
- SP/SM, Poorly-graded Sand with Silt

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgment. The actual subsurface conditions will vary between boring locations.

SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 11A

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 1-SOUTHBOUND

TO CHARLESTON

TO CHARLOTTE

BENT 1

BENT 2

BENT 3

BENT 4

BENT 5

BENT 6

FILL

END BENT CUT OFF 331.0

BENT CUT OFF 298.5

BENT CUT OFF 299.0

END BENT CUT OFF 328.0

FILL

MEDIUM DENSE/VERY STIFF COASTAL PLAIN DEPOSITS

MEDIUM DENSE/VERY STIFF COASTAL PLAIN DEPOSITS

DENSE OR HARD COASTAL PLAIN DEPOSITS

DENSE OR HARD COASTAL PLAIN DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

PIEDMONT PARTIALLY WEATHERED ROCK

BOTTOM OF FOUNDATION

HP10X42 RANGE OF TIP ELEVATION

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

ELEVATION (feet-MSL)

ELEVATION (feet-MSL)

340 330 320 310 300 290 280 270 260 250 240 230 220 210 200

0 50 100 150 200 250 300 350 400

B-01

9/5/2014

ELEV.337.9

Depth	
0	6-13-15
5	11-13-16
	7-11-14
	6-16-18
10	13-16-17
15	11-25-30
20	10-10-8
25	5-6-10
30	9-13-20
35	10-16-28
40	4-7-10
45	4-7-8
50	4-3-7
55	18-29-49
60	16-29-50
65	15-22-17
70	9-19-25
75	10-15-15
80	18-35-50/4"
85	10-14-25
90	12-16-19
95	9-16-21
100	15-32-50/1"
105	15-30-32
110	18-22-28
115	27-43-50/5"
120	10-8-13

BT @ 120

B-02

9/10/2014

ELEV.305.2

Depth	
0	2-4-5
5	13-18-26
	25-28-34
	4-8-8
10	15-21-20
15	2-3-4
20	6-5-4
25	20-40-50/5"
30	21-29-35
35	8-9-10
40	12-19-21
45	16-35-40
50	14-20-26
55	12-18-29
60	17-30-35
65	18-21-23
70	12-16-23
75	18-19-18
80	13-26-36
85	15-50/1"-
90	13-50/3"-
95	50/4"--
100	22-50/5"-

BT @ 100

B-04

9/12/2014

ELEV.332.4

Depth	
0	3-3-3
	3-3-3
5	2-2-2
	5-4-4
10	3-3-3
15	4-8-9
20	11-19-32
25	10-16-20
30	13-16-18
35	9-12-10
40	10-12-1
45	13-36-50/4"
50	10-11-22
55	20-36-44
60	8-10-12
65	9-11-14
70	18-32-38
75	10-13-15
80	9-12-16
85	19-35-47
90	29-34-50/4"
95	13-23-35
100	18-33-50/5"
105	20-32-50/4"
110	22-47-50/1"
115	50/2"--
120	50/3"--

BT @ 120

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number

123.0 Elevation at GS

CPT Sleeve Friction (tsf)

Direct Push Sample

1265 Downhole Shear Wave Velocity

Water Level Inferred from Pore Pressures

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

Water Level Measured Downhole

BT CPT Termination Depth

XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number

123.0 Elevation at GS

Undrained Strength (psf) | Constrained Modulus M (ksf)

125 ---125
725 ---225
5 ----90
---1245
550 ---675
---880
650 10 ---135
Water Level Inferred from Pore Pressure ---125
450 ---225
15 ---190
---2678
770 ---375
---556
20 ---1135

Water Level at Time of Boring

Water Level after 24 Hours

Hole Caved

Water Loss/Inflow

BT DMT Termination Depth

XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number

123.0 Elevation at GS

11-16-10 Standard Penetration Test (blows per foot).

12in Undisturbed Sample Recovery in Inches

NX Core Barrel Size

REC 80% Recovery in Percent

RQD 56% Rock Quality Designation

BT Boring Termination Depth

XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- CH, High Plasticity Clay
- SC, Clayey Sand
- CL, Low Plasticity Clay
- SM, Silty Sand
- ML, Low Plasticity Silt
- SP/SM, Poorly-graded Sand with Silt

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 11B

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME

ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 2-NORTHBOUND

TO CHARLESTON

TO CHARLOTTE

ELEVATION (feet-MSL)

B-05
9/17/2014
ELEV.323.3

BENT 1

END BENT CUT OFF 320.0

2-3-5
3-4-4
13-8-8
6-4-7
10-9-8
3-3-3
4-8-12
3-4-5
7-4-9
3-3-3
16-11-11
7-6-6
4-4-5
3-1-2
25-29-35
13-23-24
15-25-41
16-21-24
19-23-23
17-19-29
30-38-39
25-38-28
45-50/4"-
42-50/2"-
50/2"--
50/1"--
50/3"--

BT @ 120

FILL

MEDIUM DENSE/STIFF COASTAL PLAIN DEPOSITS

BENT 2

BEND CUT OFF 284.0

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

B-06
9/11/2014
ELEV.291.4

I-20 EXIT RAMP

4-8-10
4-4-6
2-1-1
1-1-2
2-1-2
2-3-4
2-6-8
16-27-50
16-27-33
12-25-34
15-36-50/6"
13-24-28
19-42-50/5"
22-30-50
19-30-32
36-50/3"-
38-48-50/5"
50/5"--
50/5"--
33-50/4"-
50/5"--
50/4"--
25-50/2"-

BT @ 100

BENT 3

BEND CUT OFF 287.5

FILL

MEDIUM DENSE/STIFF COASTAL PLAIN DEPOSITS

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

B-07
9/3/2014
ELEV.315.3

BENT 4

END BENT CUT OFF 313.5

5-5
6-6-9
4-4-4
2-2-4
2-4-4
6-4-4
3-3-3
6-10-10
21-32-37
14-28-36
19-25-50/5"
21-40-50/4"
31-50/4"-
19-35-50/5"
26-35-44
23-39-50/5"
28-37-50/5"
26-50/5"-
28-38-50
28-50/3"-
35-50/3"-
35-50/4"-
38-50/3"-
50/5"--
50/4"--
50/4"--
28-50/3"-

BT @ 120

HP10X42 RANGE OF TIP ELEVATION

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

0 20 40 60 80 100 120 140 160 180 200 220

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)

Direct Push Sample

1265
Downhole Shear Wave Velocity

Water Level Inferred from Pore Pressures

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

Water Level Measured Downhole

BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)

Constrained Modulus M (ksf)

---125
---225
---90
---1245
---675
---880
---135
---125
---225
---190
---2678
---375
---556
---1135

Water Level at Time of Boring

Water Level after 24 Hours

Hole Caved

Water Level Inferred from Pore Pressure

Water Loss/Inflow

BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

11-16-10 Standard Penetration Test (blows per foot).

12in Undisturbed Sample Recovery in Inches

NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation

BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- CL, Low Plasticity Clay
- SW/SM, Well-graded Sand with Silt
- SC, Clayey Sand
- Partially Weathered Rock
- SP/SM, Poorly-graded Sand with Silt
- SM, Silty Sand
- CH, High Plasticity Clay

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgment. The actual subsurface conditions will vary between boring locations.

SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 12A

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 2-SOUTHBOUND

TO CHARLESTON

TO CHARLOTTE

ELEVATION (feet-MSL)

B-05
9/17/2014
ELEV.323.3

BENT 1

END BENT CUT OFF 315.0

2-3-5
3-4-4
13-8-8
6-4-7
10-9-8
3-3-3
4-8-12
3-4-5
7-4-9
3-3-3
16-11-11
7-6-6
4-4-5
3-1-2
25-29-35
13-23-24
15-25-41
16-21-24
19-23-23
17-19-29
30-38-39
25-38-28
45-50/4"-
42-50/2"-
50/2"--
50/1"--
50/3"--

BT @ 120

FILL

MEDIUM DENSE/STIFF COASTAL PLAIN DEPOSITS

BENT 2

BEND CUT OFF 286.5

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

B-06
9/11/2014
ELEV.291.4

I-20 EXIT RAMP

4-8-10
4-4-6
2-1-1
1-1-2
2-1-2
2-3-4
2-6-8
16-27-50
16-27-33
12-25-34
15-36-50/6"
13-24-28
19-42-50/5"
22-30-50
19-30-32
36-50/3"-
38-48-50/5"
50/5"--
50/5"--
33-50/4"-
50/5"--
50/4"--
25-50/2"-

BT @ 100

BENT 3

BEND CUT OFF 289.5

FILL

MEDIUM DENSE/STIFF COASTAL PLAIN DEPOSITS

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

PIEDMONT PARTIALLY WEATHERED ROCK

B-07
9/3/2014
ELEV.315.3

BENT 4

END BENT CUT OFF 313.5

5-5
6-6-9
4-4-4
2-2-4
2-4-4
6-4-4
3-3-3
6-10-10
21-32-37
14-28-3
19-25-50/5"
21-40-50/4"
31-50/4"-
19-35-50/5"
26-35-44
23-39-50/5"
28-37-50/5"
26-50/5"-
28-38-50
28-50/3"-
35-50/3"-
35-50/4"-
38-50/3"-
50/5"--
50/4"--
50/4"--
28-50/3"-

BT @ 120

HP10X42 RANGE OF TIP ELEVATION

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

0 20 40 60 80 100 120 140 160 180 200 220

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)

Direct Push Sample

1265
Downhole Shear Wave Velocity

Water Level Inferred from Pore Pressures

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

Water Level Measured Downhole

BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)

Constrained Modulus M (ksf)

---125
---225
---90
---1245
---675
---880
---135
---125
---225
---190
---2678
---375
---556
---1135

Water Level Inferred from Pore Pressure

BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

Water Level at Time of Boring

Water Level after 24 Hours

Hole Caved

Water Loss/Inflow

11-16-10 Standard Penetration Test (blows per foot).

12in Undisturbed Sample Recovery in Inches

NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation

BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- CL, Low Plasticity Clay
- SW/SM, Well-graded Sand with Silt
- SC, Clayey Sand
- Partially Weathered Rock
- SP/SM, Poorly-graded Sand with Silt
- SM, Silty Sand
- CH, High Plasticity Clay

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 12B

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 3: NORTHBOUND

TO CHARLOTTE

TO CHARLESTON

WINDSOR LAKE BLVD

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

ELEVATION (feet-MSL)

B-09
9/5/2014
ELEV.271.3

BENT 4
END BENT CUT OFF 270.0

BENT 3
FILL
BENT CUT OFF 247.0

LOOSE TO MEDIUM DENSE COASTAL PLAIN DEPOSITS

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

PARTIALLY WEATHERED ROCK

PIEDMONT RESIDUUM

GNEISS

BT @121.6

Depth	
0	10-10-9
5	9-10-10
10	4-2-4
15	3-3-7
20	4-7-8
25	3-4-7
30	6-7-8
35	9-8-14
40	3-3-4
45	6-15-29
50	6-8-9
55	4-2-1
60	11-14-28
65	15-15-17
70	14-20-25
75	19-23-39
80	14-24-31
85	-9-11
90	15-10-9
95	47-50/5"-
100	6-9-10
105	15-20-25
110	50/4"--
115	--
120	--

B-08
9/4/2014
ELEV.278.4

BENT 2
BENT CUT OFF 248.0

BENT 1
END BENT CUT OFF 276.0

FILL

VERY DENSE/VERY HARD COASTAL PLAIN DEPOSITS

BT @ 120

Depth	
0	9-14-13
5	6-9-9
10	6-6-7
15	3-2-4
20	3-3-4
25	5-9-9
30	3-5-9
35	6-8-10
40	12-16-32
45	14-17-28
50	10-25-36
55	15-17-19
60	6-9-11
65	19-26-31
70	18-39-50/3"
75	14-21-40
80	15-17-28
85	25-50/4"-
90	32-36-50
95	11-11-21
100	15-20-22
105	50/3"--
110	19-50/4"-
115	50/3"--
120	5-7-9
	4-5-6
	4-6-7

HP 10X42 RANGE OF TIP ELEVATION

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)
Direct Push Sample
1265
Downhole Shear Wave Velocity
Water Level Inferred from Pore Pressures
CPT Tip Resistance (tsf)
CPT Pore Pressure (tsf)
Water Level Measured Downhole
BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)
Constrained Modulus M (ksf)
Water Level Inferred from Pore Pressure
Water Level at Time of Boring
Water Level after 24 Hours
Hole Caved
Water Loss/Inflow
BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

11-16-10 Standard Penetration Test (blows per foot).
12in Undisturbed Sample Recovery in Inches
NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation
BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- SC, Clayey Sand
- CL, Low Plasticity Clay
- Topsoil
- ML, Low Plasticity Silt
- Bedrock
- SM, Silty Sand
- CH, High Plasticity Clay
- SP/SM, Poorly-graded Sand with Silt
- Partially Weathered Rock

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 13A

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 3: SOUTHBOUND

TO CHARLOTTE

BENT 4

END BENT
CUT OFF
268.0

B-09
9/5/2014
ELEV.271.3

10-10-9
9-10-10
4-2-4
3-3-7
4-7-8
3-4-7
6-7-8
9-8-14
3-3-4
6-15-29
6-8-9
4-2-1
11-14-28
15-15-17
14-20-25
19-23-39
14-24-31
-9-11
15-10-9
47-50/5"-
6-9-10
15-20-25
50/1"--
--
--
--
--

BT @121.6

FILL

BENT 3

BENT
CUT OFF
248.0

LOOSE TO MEDIUM DENSE
COASTAL PLAIN
DEPOSITS

VERY DENSE/VERY HARD
COASTAL PLAIN
DEPOSITS

PARTIALLY WEATHERED ROCK

PIEDMONT
RESIDUUM

GNEISS

WINDSOR
LAKE BLVD

BENT 2

BENT
CUT OFF
247.5

VERY DENSE/VERY HARD
COASTAL PLAIN
DEPOSITS

B-08
9/4/2014
ELEV.278.4

9-14-13
6-9-9
6-6-7
3-2-4
3-3-4
5-9-9
3-5-9
6-8-10
12-16-32
14-17-28
10-25-36
15-17-19
6-9-11
19-26-31
18-39-50/3"
14-21-40
15-17-28
25-50/4"-
32-36-50
11-11-21
15-20-22
50/3"--
19-50/4"-
50/3"--
5-7-9
4-5-6
4-6-7

BT @ 120

FILL

BENT 1 TO CHARLESTON

END BENT
CUT OFF
273.0

HP 10X42
RANGE OF
TIP ELEVATION

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

ELEVATION (feet-MSL)

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)

1265
Downhole Shear Wave Velocity

Water Level Inferred
from Pore Pressures

Water Level
Measured Downhole

Direct Push Sample

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)

Constrained Modulus M (ksf)

125 ---125
725 ---225
5 ----90
---1245
550 ---675
---880
650 10 ---135
---125
450 ---225
15 ---190
---2678
770 ---375
---556
20 ---1135

Water Level
Inferred from
Pore Pressure

Water Level
at Time of Boring

Water Level
after 24 Hours

Hole Caved

Water Loss/Inflow

BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

11-16-10 Standard Penetration Test
(blows per foot).

12in Undisturbed Sample
Recovery in Inches

NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation

BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- SC, Clayey Sand
- CL, Low Plasticity Clay
- Topsoil
- ML, Low Plasticity Silt
- Bedrock
- SM, Silty Sand
- CH, High Plasticity Clay
- SP/SM, Poorly-graded Sand with Silt
- Partially Weathered Rock

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 13B

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 4: NORTHBOUND

TO CHARLOTTE

TO CHARLESTON

ELEVATION (feet-MSL)

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

B-13
9/9/2014
ELEV.242

BENT 12
BENT CUT OFF 236.2
FILL
COASTAL PLAIN DEPOSITS
6-9-9
6-7-7
3-3-3
2-3-5
3-5-6
4-6-7
7-3-4
12-14-22
5-7-6
6-16-15
1-WOH-1
15-13-16
3-5-9
4-6-7
11-11-15
8-13-16
PIEDMONT RESIDUAL SOILS
24-40-50/5"
27-40-50/3"
50--
PARTIALLY WEATHERED ROCK
50/5"--
40-41-50/4"
50/1"--
GRANITE
BT @ 122

BENT 11
236.2

BENT 10
239.9

BENT 9
240.1

B-12
9/15/2014

BENT 8
240.3
ELEV.243.1

BENT 7
240.5

WINDSOR LAKE
WATER
ALLUVIUM
2-WOH-1
5-4-3
3-4-3
2-3-4
4-11-12
COASTAL PLAIN DEPOSITS
5-8-9
4-8-8
5-8-13
50/3"--
PARTIALLY WEATHERED ROCK
24-40-45
50/5"--
50/3"--
BT @ 102.5

BENT 6
240.8

B-11
9/15/2014
ELEV.243.3

BENT 5
241.1

WATER
ALLUVIUM
WOH-WOH-WOH
WOH-WOH-WOH
WOH-1-1
WOH-WOH-2
1-1-1
19-10-19
13-7-9
3-5-8
5-7-9
9-11-14
10-13-15
50/3"--
50/2"--
50/1"--
GRANITE AND GNIESS
BT @ 105.9

BENT 4
241.5

BENT 3
242.0

B-10
9/18/2014
ELEV.246

BENT 2
242.6

BENT 1
BENT CUT OFF 243.2

WATER
FILL
6-7-4
5-7-7
5-4-5
6-4-4
4-6-5
4-2-3
6-6-6
2-2-2
4-8-9
5-4-4
6-8-6
9-19-29
10-16-23
6-12-14
9-9-17
8-11-11
COASTAL PLAIN DEPOSITS
PIEDMONT RESIDUAL SOILS
12-13-16
16-23-26
18-25-36
50/5"--
50/5"--
50/1"--
PARTIALLY WEATHERED ROCK
SCHIST
BT @ 114

16 INCH PRECAST CONCRETE
BENT CUT OFF WITH ELEVATION
HP 12X53 TIP ELEVATION

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS
CPT Sleeve Friction (tsf)
1265 Downhole Shear Wave Velocity
Water Level Inferred from Pore Pressures
Water Level Measured Downhole
Direct Push Sample
CPT Tip Resistance (tsf)
CPT Pore Pressure (tsf)
BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS
Undrained Strength (psf)
Constrained Modulus M (ksf)
Water Level Inferred from Pore Pressure
Water Loss/Inflow
BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS
Water Level at Time of Boring
Water Level after 24 Hours
Hole Caved
11-16-10 Standard Penetration Test (blows per foot).
12in Undisturbed Sample Recovery in Inches
NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation
BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- SM, Silty Sand
- Partially Weathered Rock
- SC, Clayey Sand
- SP/SM, Poorly-graded Sand with Silt
- Bedrock
- MH, High Plasticity Silt
- SW, Well-graded Sand
- Concrete
- CH, High Plasticity Clay
- ML, Low Plasticity Silt
- Muck/Peat

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 14A

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 4: SOUTHBOUND

TO CHARLOTTE

TO CHARLESTON

ELEVATION (feet-MSL)

HORIZONTAL LOCATIONS OF BENTS ARE NOT TO SCALE

B-13
9/9/2014
ELEV.242

BENT 13
BENT CUT OFF 243.5
FILL
COASTAL PLAIN DEPOSITS
PIEDMONT RESIDUAL SOILS
PARTIALLY WEATHERED ROCK
GRANITE
BT @ 122

BENT 12 243.1
BENT 11 236.2
BENT 10 242.1
BENT 9 242.0

B-12
9/15/2014
ELEV.243.1

BENT 8 242.5
BENT 7 241.0
WINDSOR LAKE
WATER
ALLUVIUM
COASTAL PLAIN DEPOSITS
PARTIALLY WEATHERED ROCK
BT @ 102.5

B-11
9/15/2014
ELEV.243.3

BENT 6 243.8
BENT 5 243.1
WATER
ALLUVIUM
PIEDMONT RESIDUAL SOILS
PARTIALLY WEATHERED ROCK
GRANITE AND GNIESS
BT @ 105.9

BENT 4 244.5
BENT 3 244.0

B-10
9/18/2014
ELEV.246

BENT 2 245.0
BENT 1
BENT CUT OFF 245.6
FILL
WATER
ALLUVIUM
COASTAL PLAIN DEPOSITS
PIEDMONT RESIDUAL SOILS
PARTIALLY WEATHERED ROCK
SCHIST
BT @ 114

16 INCH PRECAST CONCRETE
BENT CUT OFF WITH ELEVATION
HP 12X53 TIP ELEVATION

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS
CPT Sleeve Friction (tsf)
1265 Downhole Shear Wave Velocity
Water Level Inferred from Pore Pressures
Water Level Measured Downhole
Direct Push Sample
CPT Tip Resistance (tsf)
CPT Pore Pressure (tsf)
BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS
Undrained Strength (psf)
Constrained Modulus M (ksf)
Water Level Inferred from Pore Pressure
Water Level at Time of Boring
Water Level after 24 Hours
Hole Caved
Water Loss/Inflow
BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS
11-16-10 Standard Penetration Test (blows per foot).
12in Undisturbed Sample Recovery in Inches
NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation
BT Boring Termination Depth
XXX Boring Refusal

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Topsoil
- SM, Silty Sand
- Partially Weathered Rock
- SC, Clayey Sand
- SP/SM, Poorly-graded Sand with Silt
- Bedrock
- MH, High Plasticity Silt
- SW, Well-graded Sand
- Concrete
- CH, High Plasticity Clay
- ML, Low Plasticity Silt
- Muck/Peat

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 14B

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/24/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 5: NORTHBOUND

TO CHARLOTTE

TO CHARLESTON

ELEVATION (feet-MSL)

BENT 13 — END BENT CUT OFF 254.5

BENT 12 247.5

BENT 11 246.5

BENT 10 253.0

BENT 9 253.0

BENT 8 253.0

BENT 7 252.5

BENT 6 252.5

BENT 5 252.5

BENT 4 252.5

BENT 3 252.5

BENT 2 252.5

BENT 1 — END BENT CUT OFF 252.5

EDGEWATER DRIVE

JACKSON CREEK

FILL

ALLUVIUM

COASTAL PLAIN DEPOSITS

PIEDMONT RESIDUAL SOILS

PARTIALLY WEATHERED ROCK

ROCK

BENT CUT OFF WITH ELEVATION

BOTTOM OF 10X10 SHALLOW FOUNDATION

18X18 PRECAST PILE WITH HP 10X57 PILE POINT TIP ELEVATION

B-18
9/15/2014
ELEV.255.6

Depth	
0	13-14-15
5	6-6-6
10	1-1-2
15	1-2-2
20	5-6-6
25	5-5-6
30	4-8-19
35	6-5-7
40	8-13-19
45	6-10-17
50	11-25-44
55	7-8-15
60	6-10-15
65	8-11-20
70	10-16-27
75	14-21-34
80	17-29-38
85	50/3"--
90	50/2"--
95	50/2"--
100	50/1"--
105	50/1"--
110	50/2"--
115	50/1"--
120	50/1"--
	50/2"--

BT @ 120

B-17
9/18/2014
ELEV.234.6

Depth	
0	5-6-9
5	6-8-8
10	7-7-10
15	3-4-2
20	1-1-1
25	2-1-3
30	9-5-5
35	5-6-10
40	7-12-19
45	11-13-17
50	12-13-13
55	21-33-50/6"
60	50/5"--
65	50/6"--
70	50/1"--
75	50/1"--
80	50/1"--
85	50/1"--
90	50/1"--
95	50/2"--
100	50/1"--

BT @ 100

B-16
9/17/2014
ELEV.234.4

Depth	
0	4-4-4
5	3-4-4
10	7-8-10
15	6-5-3
20	2-1-1
25	2-3-4
30	10-13-14
35	4-11-20
40	11-22-36
45	50/3"
50	50/2"--
55	50/2"--
60	50/1"--
65	50/1"--
70	50/5"--
75	50/1"--
80	50/1"--
85	50/3"--
90	50/2"--
95	44-41-50/3"
100	50/2"--

BT @ 100

B-15
9/17/2014
ELEV.253.7

Depth	
0	18-7-4
5	WOR-WOR-WOR
10	WOR-WOR-WOR
15	WOR-WOR-WOR
20	WOH-WOH-1
25	7-10-15
30	--
35	9-11-13
40	17-25-40
45	30-49-50/3"
50	45-50/5"--
55	50/4"--
60	50/1"--
65	50/1"--
70	50/1"--
75	50/1"--
80	50/1"--
85	50/1"--
90	50/1"--
95	50/1"--
	50/1"--

BT @ 125.0

B-14
9/11/2014
ELEV.252.6

Depth	
0	6-6-5
5	5-4-4
10	4-3-4
15	1-2-6
20	4-6-6
25	4-5-5
30	5-2-1
35	3-5-2
40	1-1-WOH
45	8-14-21
50	8-12-16
55	12-14-20
60	9-11-14
65	12-14-22
70	16-20-26
75	50/6"--
80	15-20-27
85	50/1"--
90	50/1"--
95	50/0"--
100	50/1"--
105	
110	

BT @ 110.6

0 50 100 150 200 250 300 350 400 450

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)

1265 Downhole Shear Wave Velocity

Water Level Inferred from Pore Pressures

Water Level Measured Downhole

Direct Push Sample

CPT Tip Resistance (tsf)

CPT Pore Pressure (tsf)

BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)

Constrained Modulus M (ksf)

Water Level Inferred from Pore Pressure

BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

Water Level at Time of Boring

Water Level after 24 Hours

Hole Caved

Water Loss/Inflow

11-16-10 Standard Penetration Test (blows per foot).

12in Undisturbed Sample Recovery in Inches

NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation

BT Boring Termination Depth
XXX Boring Refusal

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Partially Weathered Rock
- Bedrock
- Topsoil
- CH, High Plasticity Clay
- Concrete
- SC, Clayey Sand
- ML, Low Plasticity Silt
- SP, Poorly-graded Sand
- CL, Low Plasticity Clay
- SP/SM, Poorly-graded Sand with Silt
- SM, Silty Sand
- MH, High Plasticity Silt

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SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 15A

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/23/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

BRIDGE 5: SOUTHBOUND

TO CHARLOTTE

TO CHARLESTON

ELEVATION (feet-MSL)

BENT 13 — END BENT CUT OFF 254.5

BENT 12 247.5

BENT 11 246.5

BENT 10 253.0

BENT 9 253.0

BENT 8 253.0

BENT 7 252.5

BENT 6 252.5

BENT 5 252.5

BENT 4 252.5

BENT 3 252.5

BENT 2 252.5

BENT 1 — END BENT CUT OFF 252.5

EDGEWATER DRIVE

JACKSON CREEK

FILL

ALLUVIUM

COASTAL PLAIN DEPOSITS

PIEDMONT RESIDUAL SOILS

PARTIALLY WEATHERED ROCK

ROCK

BENT CUT OFF WITH ELEVATION

BOTTOM OF 10X10 SHALLOW FOUNDATION

18X18 PRECAST PILE WITH HP 10X57 PILE POINT TIP ELEVATION

B-18
9/15/2014
ELEV.255.6

13-14-15
6-6-6
1-1-2
1-2-2
5-6-6
5-5-6
4-8-19
6-5-7
8-13-19
6-10-17
11-25-44
7-8-15
6-10-15
8-11-20
10-16-27
14-21-34
17-29-38
50/3"--
50/2"--
50/2"--
50/2"--
50/1"--
50/1"--
50/2"--
50/1"--
BT @ 120

B-17
9/18/2014
ELEV.234.6

5-6-9
6-8-8
7-7-10
3-4-2
1-1-1
2-1-3
9-5-5
5-6-10
7-12-19
11-13-17
12-13-13
21-33-50/6"
50/5"--
50/6"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
50/2"--
50/1"--
BT @ 100

B-16
9/17/2014
ELEV.234.4

4-4-4
3-4-10
7-8-10
6-5-3
2-1-1
2-3-
10-13-14
4-11-20
11-22-36
50/3"
50/2"--
50/2"--
50/1"--
50/1"--
50/5"--
50/1"--
50/1"--
50/3"--
50/2"--
-44-41-50/3"
50/2"--
BT @ 100

B-15
9/17/2014
ELEV.253.7

18-7-4
WOR-WOR-WOR
WOR-WOR-WOR
WOR-WOR-WOR
WOH-WOH-1
7-10-15
--
9-11-13
17-25-40
30-49-50/3"
45-50/5"--
50/4"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
50/1"--
BT @ 125.0

B-14
9/11/2014
ELEV.252.6

6-6-5
5-4-4
4-3-4
1-2-6
4-6-6
4-5-5
5-2-1
3-5-2
1-1-WOH
8-14-21
8-12-16
12-14-20
9-11-14
12-14-22
16-20-26
50/6"--
15-20-27
50/1"--
50/1"--
50/0"--
50/1"--
BT @ 110.6

0 50 100 150 200 250 300 350 400 450

ELECTRONIC CONE PENETROMETER SOUNDINGS

C-3 Sounding Number
123.0 Elevation at GS

CPT Sleeve Friction (tsf)
Direct Push Sample
1265
Downhole Shear Wave Velocity
Water Level Inferred from Pore Pressures
CPT Tip Resistance (tsf)
CPT Pore Pressure (tsf)
Water Level Measured Downhole
BT CPT Termination Depth
XXX CPT Refusal

MARCHETTI DILATOMETER SOUNDINGS

DMT-3 Sounding Number
123.0 Elevation at GS

Undrained Strength (psf)
Constrained Modulus M (ksf)
Water Level Inferred from Pore Pressure
BT DMT Termination Depth
XXX DMT Refusal

SOIL TEST BORINGS

B-3 Boring Number
123.0 Elevation at GS

Water Level at Time of Boring
Water Level after 24 Hours
Hole Caved
Water Loss/Inflow
11-16-10 Standard Penetration Test (blows per foot).
12in Undisturbed Sample Recovery in Inches
NX Core Barrel Size
REC 80% Recovery in Percent
RQD 56% Rock Quality Designation
BT Boring Termination Depth
XXX Boring Refusal

CPT/DMT MATERIAL GRAPHICS

- Sensitive Fine Grained Soils
- Organic Soils, Peats
- Clay to Silty Clay
- Clayey Silt to Silty Clay
- Silty Sand to Sandy Silt
- Clean Sand to Silty Sand
- Gravelly Sand to Sand
- OC Sand to Clayey Sand
- OC Fine Grained Soils

LEGEND OF MATERIAL GRAPHICS for SOIL TEST BORINGS

- Partially Weathered Rock
- Bedrock
- Topsoil
- CH, High Plasticity Clay
- Concrete
- SC, Clayey Sand
- ML, Low Plasticity Silt
- SP, Poorly-graded Sand
- CL, Low Plasticity Clay
- SP/SM, Poorly-graded Sand with Silt
- SM, Silty Sand
- MH, High Plasticity Silt

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgment. The actual subsurface conditions will vary between boring locations.

SUBSURFACE PROFILE

PROJECT: I-77 Widening Design/Build Preparation

FIGURE 15B

LOCATION: Richland County, SC

JOB NO: 1461-14-046

DATE: 2/23/15

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

Consultant Geotechnical Seismic Response

To:	John Lessley
Consultant:	S&ME, Inc.
Date Requested:	02/23/2015

PROJECT INFORMATION

File No. N/A	**Project No. (PIN):** P027002
County: Richland	**Route:** Interstate 77
Description: I-77 Design/Build - I-77 Bridges over I-20 Ramp	
Latitude (4 decimals): 34.0691	**Longitude (4 decimals):** -80.9231

Bridge Category / Seismic OC:	**I**
Type of Seismic Information Requested:	**Preliminary Seismic Design Information**
Seismic Site Class:	**C**

Pseudo-Spectral Acceleration (PSA)

The SCDOT Geotechnical Design Section has generated the required Design Earthquake the pseudo-spectral acceleration (PSA) oscillator response for frequencies 0.5, 1.0, 2.0, 3.3, 5.0, 6.7 and 13 Hz, for 5% critical damping and peak horizontal ground acceleration (PGA) at the **B-C Boundary.**

SEE – 3% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
8.24931	18.52125	33.01419	45.10939	53.70380	54.01530	56.66651	29.77292

Thickness of sediments: 339.0 meters

FEE – 15% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
2.33885	6.34119	12.10452	17.05394	20.59252	20.31622	20.95290	10.99708

Thickness of sediments: 339.0 meters

Time Series

Unscaled and Scaled time series were generated for the **B-C Boundary** in Shake91 data format. The Scaled time series are based on the earthquake magnitude (Mw) and Epicentral distance requested.

The Time Series Files are Attached:	**Yes** ☐	**No** ☒

Design Response Spectrum

The SCDOT Seismic Design Specifications for Highway Bridges, latest edition, is used to develop the Design Response Spectrum.

The Design Response Spectrum is Attached:	**Yes** ☒	**No** ☐

Geotechnical Designer:		**RPG[1]:**	Design-Build
Date:	03/23/15	**Phone Number:**	(803) 737-0766
Geotechnical Review:		**RPG[1,2]:**	Design-Build

[1]**RPG – Region Production Group**

Lowcountry - Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper

Pee Dee – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg

Midlands – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York

Upstate – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg

[2]**RPG – PreConstruction Support – Geotechnical Design Section (PCS/GDS)**

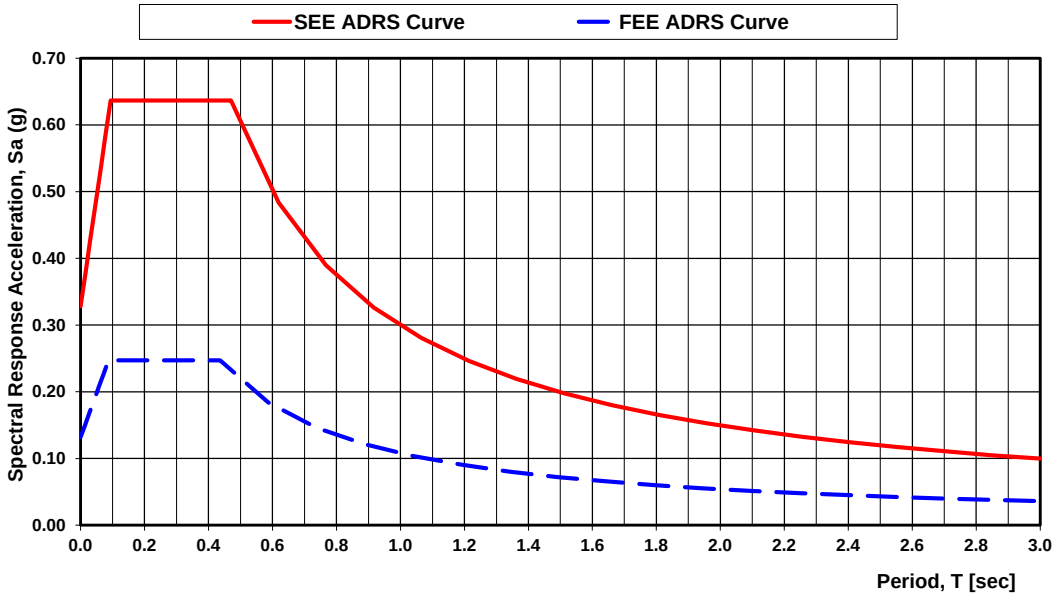
SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	**P027002**	**File No:**	**N/A**	**Latitude:**	**34.0691**
Route:	**I-77**	**County:**	**Richland**	**Longitude:**	**80.9231**
Project:	**I-77 Design/Build - I-77 Bridges over I-20 Ramp**				

Designer:	**T. Harris - Design Build**
Date:	**2/26/2015**

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.13	0.25	0.11	7.3	114.3	Geologically Realistic (Q = 100)	C	5%
SEE	0.33	0.64	0.30	7.29	117	Geologically Realistic (Q = 100)	C	

SC Seismic Hazard Map Three-Point ADRS Curve From Ground Surface



FEE ADRS Curve Three-Point Method

	T	S_a
	0.00	0.13
	0.01	0.15
	0.03	0.17
	0.04	0.19
	0.06	0.21
	0.07	0.23
To	0.09	0.25
	0.12	0.25
	0.15	0.25
	0.17	0.25
	0.20	0.25
	0.23	0.25
	0.26	0.25
	0.29	0.25
	0.32	0.25
	0.35	0.25
	0.38	0.25
	0.41	0.25
Ts	0.44	0.25
	0.59	0.18
	0.74	0.15
	0.89	0.12
	1.04	0.10
	1.19	0.09
	1.34	0.08
	1.49	0.07
	1.64	0.07
	1.79	0.06
	1.94	0.06
	2.10	0.05
	2.25	0.05
	2.40	0.04
	2.55	0.04
	2.70	0.04
	2.85	0.04
	3.00	0.04

SEE ADRS Curve Three-Point Method

	T	Sa
	0.00	0.33
	0.02	0.38
	0.03	0.43
	0.05	0.48
	0.06	0.53
	0.08	0.59
To	0.09	0.64
	0.13	0.64
	0.16	0.64
	0.19	0.64
	0.22	0.64
	0.25	0.64
	0.28	0.64
	0.31	0.64
	0.34	0.64
	0.38	0.64
	0.41	0.64
	0.44	0.64
Ts	0.47	0.64
	0.62	0.48
	0.77	0.39
	0.92	0.33
	1.07	0.28
	1.21	0.25
	1.36	0.22
	1.51	0.20
	1.66	0.18
	1.81	0.17
	1.96	0.15
	2.11	0.14
	2.26	0.13
	2.40	0.12
	2.55	0.12
	2.70	0.11
	2.85	0.10
	3.00	0.10

Consultant Geotechnical Seismic Response

To:	John Lessley
Consultant:	S&ME, Inc.
Date Requested:	02/23/2015

PROJECT INFORMATION

File No. N/A	**Project No. (PIN):** P027002
County: Richland	**Route:** Interstate 77
Description: I-77 Design/Build - I-77 Bridges over Jackson Creek	
Latitude (4 decimals): 34.0883	**Longitude (4 decimals):** -80.9494

Bridge Category / Seismic OC:	**I**
Type of Seismic Information Requested:	**Preliminary Seismic Design Information**
Seismic Site Class:	**C**

Pseudo-Spectral Acceleration (PSA)

The SCDOT Geotechnical Design Section has generated the required Design Earthquake the pseudo-spectral acceleration (PSA) oscillator response for frequencies 0.5, 1.0, 2.0, 3.3, 5.0, 6.7 and 13 Hz, for 5% critical damping and peak horizontal ground acceleration (PGA) at the **B-C Boundary.**

SEE – 3% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
6.92559	17.03244	33.26176	45.63147	54.67992	55.31333	59.46191	31.84654

Thickness of sediments: 264.2 meters

FEE – 15% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
1.97718	5.86712	12.27358	17.34463	21.03437	20.87236	22.05648	11.78237

Thickness of sediments: 264.2 meters

Time Series

Unscaled and Scaled time series were generated for the **B-C Boundary** in Shake91 data format. The Scaled time series are based on the earthquake magnitude (Mw) and Epicentral distance requested.

The Time Series Files are Attached:	**Yes** ☐	**No** ☒

Design Response Spectrum

The SCDOT Seismic Design Specifications for Highway Bridges, latest edition, is used to develop the Design Response Spectrum.

The Design Response Spectrum is Attached:	**Yes** ☒	**No** ☐

Geotechnical Designer:		**RPG[1]:**	Design-Build
Date:	03/23/15	**Phone Number:**	(803) 737-0766
Geotechnical Review:		**RPG[1,2]:**	Design-Build

[1]**RPG – Region Production Group**

Lowcountry - Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper

Pee Dee – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg

Midlands – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York

Upstate – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg

[2]**RPG – PreConstruction Support – Geotechnical Design Section (PCS/GDS)**

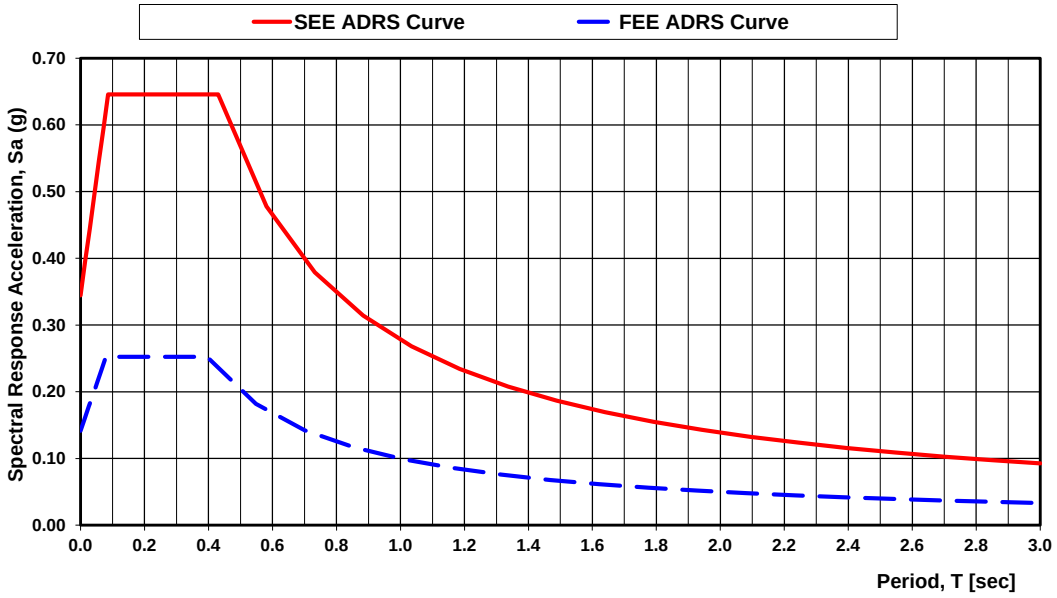
SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	**P027002**	**File No:**	**N/A**	**Latitude:**	**34.0883**
Route:	**I-77**	**County:**	**Richland**	**Longitude:**	**80.9494**
Project:	**I-77 Design/Build - I-77 Bridges over Jackson Creek**				

			Designer:	**T. Harris - Design Build**
			Date:	**2/26/2015**

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.14	0.25	0.10	7.3	115.8	Geologically Realistic (Q = 100)	C	5%
SEE	0.34	0.65	0.28	7.26	118.2	Geologically Realistic (Q = 100)	C	

SC Seismic Hazard Map Three-Point ADRS Curve From Ground Surface



FEE ADRS Curve Three-Point Method

	T	S_a
	0.00	0.14
	0.01	0.16
	0.03	0.18
	0.04	0.20
	0.05	0.22
	0.07	0.23
To	0.08	0.25
	0.11	0.25
	0.13	0.25
	0.16	0.25
	0.18	0.25
	0.21	0.25
	0.24	0.25
	0.26	0.25
	0.29	0.25
	0.32	0.25
	0.34	0.25
	0.37	0.25
Ts	0.40	0.25
	0.55	0.18
	0.70	0.14
	0.85	0.12
	1.01	0.10
	1.16	0.09
	1.31	0.08
	1.47	0.07
	1.62	0.06
	1.77	0.06
	1.93	0.05
	2.08	0.05
	2.23	0.04
	2.39	0.04
	2.54	0.04
	2.69	0.04
	2.85	0.04
	3.00	0.03

SEE ADRS Curve Three-Point Method

	T	Sa
	0.00	0.34
	0.01	0.39
	0.03	0.44
	0.04	0.50
	0.06	0.55
	0.07	0.60
To	0.09	0.65
	0.11	0.65
	0.14	0.65
	0.17	0.65
	0.20	0.65
	0.23	0.65
	0.26	0.65
	0.29	0.65
	0.32	0.65
	0.34	0.65
	0.37	0.65
	0.40	0.65
Ts	0.43	0.65
	0.58	0.48
	0.73	0.38
	0.88	0.31
	1.03	0.27
	1.19	0.23
	1.34	0.21
	1.49	0.19
	1.64	0.17
	1.79	0.16
	1.94	0.14
	2.09	0.13
	2.24	0.12
	2.40	0.12
	2.55	0.11
	2.70	0.10
	2.85	0.10
	3.00	0.09

Consultant Geotechnical Seismic Response

To:	John Lessley
Consultant:	S&ME, Inc.
Date Requested:	02/23/2015

PROJECT INFORMATION

File No. N/A	**Project No. (PIN):** P027002
County: Richland	**Route:** Interstate 77
Description: I-77 Design/Build - I-77 Bridges over Windsor Lake Boulevard	
Latitude (4 decimals): 34.0714	**Longitude (4 decimals):** -80.9259

Bridge Category / Seismic OC:	**I**
Type of Seismic Information Requested:	**Preliminary Seismic Design Information**
Seismic Site Class:	**C**

Pseudo-Spectral Acceleration (PSA)

The SCDOT Geotechnical Design Section has generated the required Design Earthquake the pseudo-spectral acceleration (PSA) oscillator response for frequencies 0.5, 1.0, 2.0, 3.3, 5.0, 6.7 and 13 Hz, for 5% critical damping and peak horizontal ground acceleration (PGA) at the **B-C Boundary.**

SEE – 3% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
8.11739	18.39511	33.07573	45.21257	53.87099	54.22204	57.06884	30.04665

Thickness of sediments: 331.9 meters

FEE – 15% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
2.30319	6.30237	12.13606	17.10377	20.66381	20.40107	21.10862	11.10000

Thickness of sediments: 331.9 meters

Time Series

Unscaled and Scaled time series were generated for the **B-C Boundary** in Shake91 data format. The Scaled time series are based on the earthquake magnitude (Mw) and Epicentral distance requested.

The Time Series Files are Attached:	**Yes** ☐	**No** ☒

Design Response Spectrum

The SCDOT Seismic Design Specifications for Highway Bridges, latest edition, is used to develop the Design Response Spectrum.

The Design Response Spectrum is Attached:	**Yes** ☒	**No** ☐

Geotechnical Designer:		**RPG[1]:**	Design-Build
Date:	03/23/15	**Phone Number:**	(803) 737-0766
Geotechnical Review:		**RPG[1,2]:**	Design-Build

[1]**RPG – Region Production Group**

Lowcountry - Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper

Pee Dee – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg

Midlands – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York

Upstate – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg

[2]**RPG – PreConstruction Support – Geotechnical Design Section (PCS/GDS)**

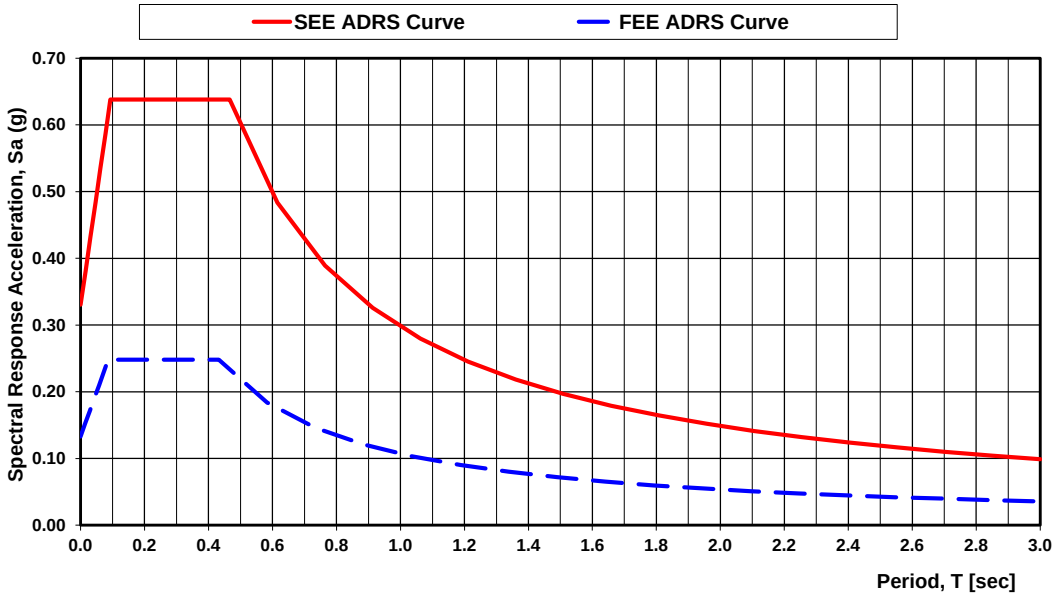
SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	**P027002**	**File No:**	**N/A**	**Latitude:**	**34.0714**
Route:	**I-77**	**County:**	**Richland**	**Longitude:**	**80.9259**
Project:	**I-77 Design/Build - I-77 Bridges over Windsor Lake Boulevard**				

Designer:	**T. Harris - Design Build**
Date:	**2/26/2015**

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.13	0.25	0.11	7.3	114.5	Geologically Realistic (Q = 100)	C	5%
SEE	0.33	0.64	0.30	7.28	117.1	Geologically Realistic (Q = 100)	C	

SC Seismic Hazard Map Three-Point ADRS Curve From Ground Surface



FEE ADRS Curve Three-Point Method

	T	S_a
	0.00	0.13
	0.01	0.15
	0.03	0.17
	0.04	0.19
	0.06	0.21
	0.07	0.23
To	0.09	0.25
	0.12	0.25
	0.14	0.25
	0.17	0.25
	0.20	0.25
	0.23	0.25
	0.26	0.25
	0.29	0.25
	0.32	0.25
	0.35	0.25
	0.37	0.25
	0.40	0.25
Ts	0.43	0.25
	0.58	0.18
	0.73	0.15
	0.89	0.12
	1.04	0.10
	1.19	0.09
	1.34	0.08
	1.49	0.07
	1.64	0.07
	1.79	0.06
	1.94	0.06
	2.09	0.05
	2.24	0.05
	2.40	0.04
	2.55	0.04
	2.70	0.04
	2.85	0.04
	3.00	0.04

SEE ADRS Curve Three-Point Method

	T	Sa
	0.00	0.33
	0.02	0.38
	0.03	0.43
	0.05	0.48
	0.06	0.54
	0.08	0.59
To	0.09	0.64
	0.12	0.64
	0.16	0.64
	0.19	0.64
	0.22	0.64
	0.25	0.64
	0.28	0.64
	0.31	0.64
	0.34	0.64
	0.37	0.64
	0.40	0.64
	0.43	0.64
Ts	0.47	0.64
	0.61	0.48
	0.76	0.39
	0.91	0.33
	1.06	0.28
	1.21	0.25
	1.36	0.22
	1.51	0.20
	1.66	0.18
	1.81	0.16
	1.96	0.15
	2.11	0.14
	2.25	0.13
	2.40	0.12
	2.55	0.12
	2.70	0.11
	2.85	0.10
	3.00	0.10

Consultant Geotechnical Seismic Response

To:	John Lessley
Consultant:	S&ME, Inc.
Date Requested:	02/23/2015

PROJECT INFORMATION

File No. N/A	**Project No. (PIN):** P027002
County: Richland	**Route:** Interstate 77
Description: I-77 Design/Build - I-77 Bridges over Windsor Lake	
Latitude (4 decimals): 34.0733	**Longitude (4 decimals):** -80.9295

Bridge Category / Seismic OC:	**I**
Type of Seismic Information Requested:	**Preliminary Seismic Design Information**
Seismic Site Class:	**C**

Pseudo-Spectral Acceleration (PSA)

The SCDOT Geotechnical Design Section has generated the required Design Earthquake the pseudo-spectral acceleration (PSA) oscillator response for frequencies 0.5, 1.0, 2.0, 3.3, 5.0, 6.7 and 13 Hz, for 5% critical damping and peak horizontal ground acceleration (PGA) at the **B-C Boundary.**

SEE – 3% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
7.95552	18.24320	33.13307	45.31481	54.04174	54.43711	57.50252	30.36911

Thickness of sediments: 323.0 meters

FEE – 15% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
2.25895	6.25486	12.16692	17.15448	20.73767	20.49082	21.27783	11.22123

Thickness of sediments: 323.0 meters

Time Series

Unscaled and Scaled time series were generated for the **B-C Boundary** in Shake91 data format. The Scaled time series are based on the earthquake magnitude (Mw) and Epicentral distance requested.

The Time Series Files are Attached:	**Yes** ☐	**No** ☒

Design Response Spectrum

The SCDOT Seismic Design Specifications for Highway Bridges, latest edition, is used to develop the Design Response Spectrum.

The Design Response Spectrum is Attached:	**Yes** ☒	**No** ☐

Geotechnical Designer:		**RPG[1]:**	Design-Build
Date:	03/23/15	**Phone Number:**	(803) 737-0766
Geotechnical Review:		**RPG[1,2]:**	Design-Build

[1]**RPG – Region Production Group**

Lowcountry - Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper

Pee Dee – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg

Midlands – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York

Upstate – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg

[2]**RPG – PreConstruction Support – Geotechnical Design Section (PCS/GDS)**

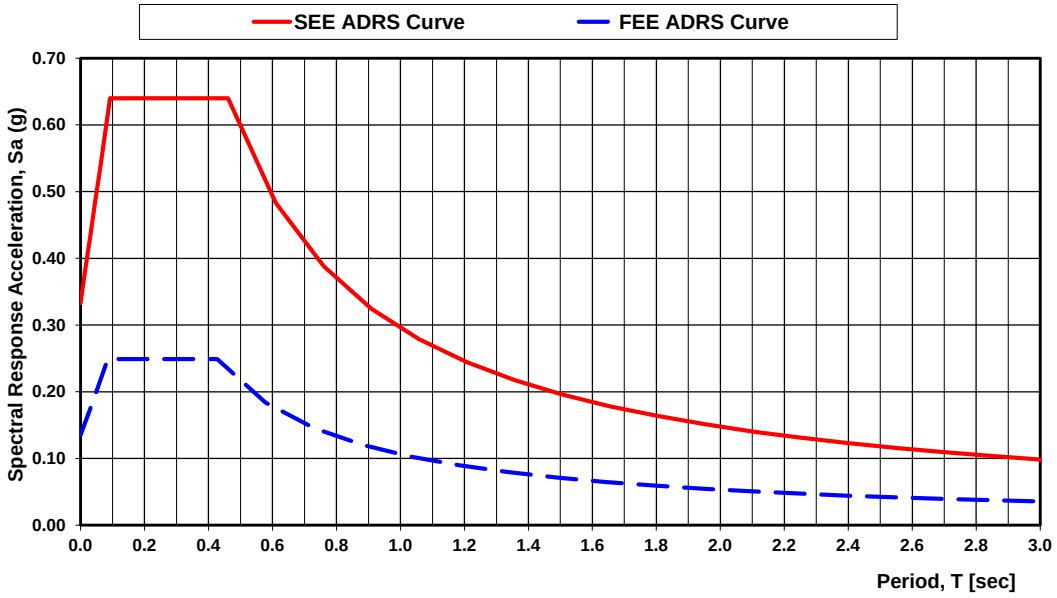
SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	**P027002**	**File No:**	**N/A**	**Latitude:**	**34.0733**
Route:	**I-77**	**County:**	**Richland**	**Longitude:**	**80.9295**
Project:	**I-77 Design/Build - I-77 Bridges over Windsor Lake**				

Designer:	**T. Harris - Design Build**
Date:	**2/26/2015**

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.13	0.25	0.11	7.3	114.6	Geologically Realistic (Q = 100)	C	5%
SEE	0.33	0.64	0.30	7.28	117.2	Geologically Realistic (Q = 100)	C	

SC Seismic Hazard Map Three-Point ADRS Curve From Ground Surface



FEE ADRS Curve
Three-Point Method

	T	S_a
	0.00	0.13
	0.01	0.15
	0.03	0.17
	0.04	0.19
	0.06	0.21
	0.07	0.23
To	0.09	0.25
	0.11	0.25
	0.14	0.25
	0.17	0.25
	0.20	0.25
	0.23	0.25
	0.26	0.25
	0.28	0.25
	0.31	0.25
	0.34	0.25
	0.37	0.25
	0.40	0.25
Ts	0.43	0.25
	0.58	0.18
	0.73	0.15
	0.88	0.12
	1.03	0.10
	1.18	0.09
	1.34	0.08
	1.49	0.07
	1.64	0.06
	1.79	0.06
	1.94	0.05
	2.09	0.05
	2.24	0.05
	2.39	0.04
	2.55	0.04
	2.70	0.04
	2.85	0.04
	3.00	0.04

SEE ADRS Curve
Three-Point Method

	T	Sa
	0.00	0.33
	0.02	0.38
	0.03	0.44
	0.05	0.49
	0.06	0.54
	0.08	0.59
To	0.09	0.64
	0.12	0.64
	0.15	0.64
	0.18	0.64
	0.22	0.64
	0.25	0.64
	0.28	0.64
	0.31	0.64
	0.34	0.64
	0.37	0.64
	0.40	0.64
	0.43	0.64
Ts	0.46	0.64
	0.61	0.48
	0.76	0.39
	0.91	0.32
	1.06	0.28
	1.21	0.24
	1.36	0.22
	1.51	0.20
	1.66	0.18
	1.81	0.16
	1.95	0.15
	2.10	0.14
	2.25	0.13
	2.40	0.12
	2.55	0.12
	2.70	0.11
	2.85	0.10
	3.00	0.10

Consultant Geotechnical Seismic Response

To:	John Lessley
Consultant:	S&ME, Inc.
Date Requested:	02/23/2015

PROJECT INFORMATION

File No. N/A	**Project No. (PIN):** P027002
County: Richland	**Route:** Interstate 77
Description: I-77 Design/Build - I-77 Bridges over I-20	
Latitude (4 decimals): 34.0676	**Longitude (4 decimals):** -80.9222

Bridge Category / Seismic OC:	**I**
Type of Seismic Information Requested:	**Preliminary Seismic Design Information**
Seismic Site Class:	**C**

Pseudo-Spectral Acceleration (PSA)

The SCDOT Geotechnical Design Section has generated the required Design Earthquake the pseudo-spectral acceleration (PSA) oscillator response for frequencies 0.5, 1.0, 2.0, 3.3, 5.0, 6.7 and 13 Hz, for 5% critical damping and peak horizontal ground acceleration (PGA) at the **B-C Boundary.**

SEE – 3% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
8.29889	18.57259	32.98061	45.05687	53.62184	53.91643	56.48547	29.66223

Thickness of sediments: 341.6 meters

FEE – 15% Probability of Exceedance in 75 years Geologically Realistic

PSA and PGA as Percentage of g

0.5Hz	1.0Hz	2.0Hz	3.3Hz	5.0Hz	6.7Hz	13.0Hz	PGA
2.35196	6.35660	12.08813	17.02933	20.55818	20.27654	20.88359	10.95542

Thickness of sediments: 341.6 meters

Time Series

Unscaled and Scaled time series were generated for the **B-C Boundary** in Shake91 data format. The Scaled time series are based on the earthquake magnitude (Mw) and Epicentral distance requested.

The Time Series Files are Attached:	**Yes** ☐	**No** ☒

Design Response Spectrum

The SCDOT Seismic Design Specifications for Highway Bridges, latest edition, is used to develop the Design Response Spectrum.

The Design Response Spectrum is Attached:	**Yes** ☒	**No** ☐

Geotechnical Designer:		**RPG[1]:**	Design-Build
Date:	03/23/15	**Phone Number:**	(803) 737-0766
Geotechnical Review:		**RPG[1,2]:**	Design-Build

[1]**RPG – Region Production Group**

Lowcountry - Beaufort, Berkeley, Charleston, Colleton, Dorchester, Hampton, Jasper

Pee Dee – Chesterfield, Clarendon, Darlington, Dillon, Florence, Georgetown, Horry, Kershaw, Lee, Marion, Marlboro, Sumter, Williamsburg

Midlands – Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chester, Fairfield, Lancaster, Lexington, Newberry, Orangeburg, Richland, Union, York

Upstate – Abbeville, Anderson, Cherokee, Edgefield, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Saluda, Spartanburg

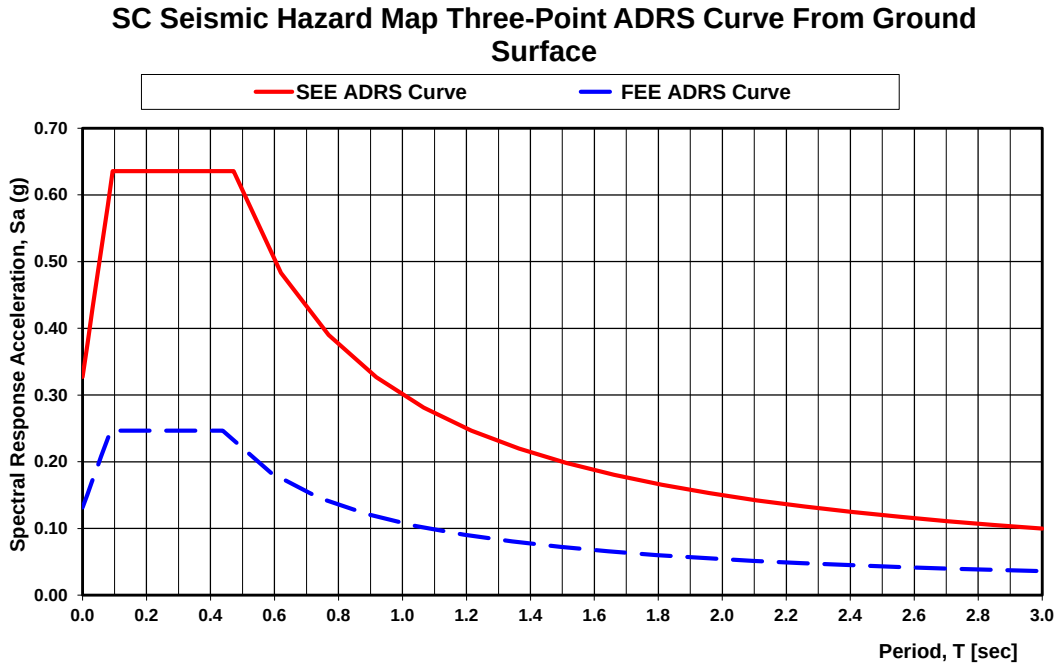
[2]**RPG – PreConstruction Support – Geotechnical Design Section (PCS/GDS)**

SC Seismic Hazard Map
Three-Point ADRS Curves

PIN No.	**P027002**	**File No:**	**N/A**	**Latitude:**	**34.0676**
Route:	**I-77**	**County:**	**Richland**	**Longitude:**	**80.9222**
Project:	**I-77 Design/Build - I-77 Bridges over I-20**				

Designer:	**T. Harris - Design Build**
Date:	**2/26/2015**

Design EQ	PGA	S_{DS}	S_{D1}	M_W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.13	0.25	0.11	7.3	114.3	Geologically Realistic (Q = 100)	C	5%
SEE	0.33	0.64	0.30	7.29	117	Geologically Realistic (Q = 100)	C	

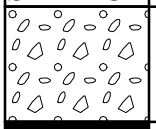
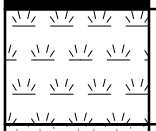
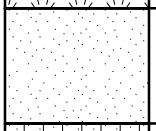
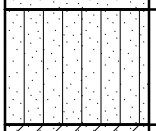
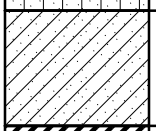
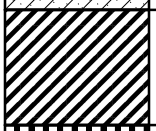
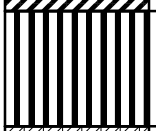
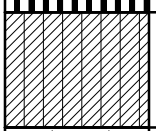
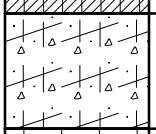
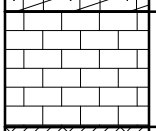
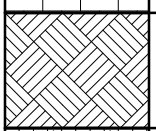
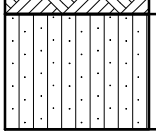


	FEE ADRS Curve Three-Point Method			SEE ADRS Curve Three-Point Method	
	T	S_a		T	Sa
	0.00	0.13		0.00	0.33
	0.01	0.15		0.02	0.38
	0.03	0.17		0.03	0.43
	0.04	0.19		0.05	0.48
	0.06	0.21		0.06	0.53
	0.07	0.23		0.08	0.58
To	0.09	0.25	To	0.09	0.64
	0.12	0.25		0.13	0.64
	0.15	0.25		0.16	0.64
	0.18	0.25		0.19	0.64
	0.20	0.25		0.22	0.64
	0.23	0.25		0.25	0.64
	0.26	0.25		0.28	0.64
	0.29	0.25		0.31	0.64
	0.32	0.25		0.35	0.64
	0.35	0.25		0.38	0.64
	0.38	0.25		0.41	0.64
	0.41	0.25		0.44	0.64
Ts	0.44	0.25	Ts	0.47	0.64
	0.59	0.18		0.62	0.48
	0.74	0.15		0.77	0.39
	0.89	0.12		0.92	0.33
	1.04	0.10		1.07	0.28
	1.19	0.09		1.22	0.25
	1.34	0.08		1.36	0.22
	1.49	0.07		1.51	0.20
	1.64	0.07		1.66	0.18
	1.79	0.06		1.81	0.17
	1.95	0.06		1.96	0.15
	2.10	0.05		2.11	0.14
	2.25	0.05		2.26	0.13
	2.40	0.05		2.41	0.12
	2.55	0.04		2.55	0.12
	2.70	0.04		2.70	0.11
	2.85	0.04		2.85	0.11
	3.00	0.04		3.00	0.10

APPENDIX II

Appendix II – Field Data
Soil Legend
Soil Test Boring Logs
MASW Shear Wave Velocity Data
MASW Shear Wave Velocity Locations
Field Test Procedures

SCDOT

SYMBOL	gINT CODE*	TYPICAL DESCRIPTION
	**SCCT**	*CONCRETE*
	**SCAT**	*ASPHALT*
	**SCTS**	*TOPSOIL/PEAT*
	**SCSAND**	*SAND*
	**SCSTSAND**	*SILTY SAND/SANDY SILT*
	**SCCLSAND**	*CLAYEY SAND/SANDY CLAY*
	**SCCLAY**	*CLAY*
	**SCSILT**	*SILT*
	**SCSTCLAY**	*SILTY CLAY/CLAYEY SILT*
	**SCSAP**	*SAPROLITE*
	**SCLS**	*LIMESTONE*
	**SCBR**	*GRANITE (BEDROCK)*
	**SCMARL**	*MARL*

**These codes are not the classification for the material. These are the Graphic codes to be used in the Lithology table.*

SC_DOT_LEGEND 1/98

gINT SOIL/ROCK SYMBOL LEGEND

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-01	**Boring Location:**	1215+74.4	**Offset:**	9.2' L	**Alignment:**	Mainline
Elev.:	337.9 ft	**Latitude:**	34.097467	**Longitude:**	80.956851	**Date Started:**	9/5/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	15 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.		0.0	SS-1	8	13	15	28	
	2.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** FILL, medium dense, dry, yellowish brown, mostly fine to medium sand, few non-plastic fines.		2.0	SS-2	11	13	16	29	
	4.0	**CLAYEY SAND (SC) -** FILL, medium dense, dry to moist, gray, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines.		4.0	SS-3	7	11	14	25	
332.9				6.0	SS-4	6	16	18	34	
	8.0	**SILTY SAND (SM) -** FILL, medium dense, dry to moist, yellowish brown, mostly fine to medium sand, little non-plastic fines. @ 6 feet, dense, little low plasticity fines, few low to medium plasticity nodules.		8.0	SS-5	13	16	17	33	
327.9		**CLAYEY SAND (SC) -** FILL, dense, dry to moist, gray, brown, yellowish brown, mostly fine to medium sand, some low plasticity fines.								
	12.0	**SILTY SAND (SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, brown, light brown, mostly fine to medium sand, little non-plastic fines.		13.5	SS-6	11	25	30	55	
322.9		▼								
		@18.5 feet, medium dense, moist to wet, light brown, little low plasticity fines. %200=16.5		18.5	SS-7	10	10	8	18	
317.9										
	22.0	**FAT CLAY (CH, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist, yellow, gray, white, mostly medium plasticity fines, trace fine sands.		23.5	SS-8	5	6	10	16	
312.9										

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-01	**Boring Location:**	1215+74.4	**Offset:**	9.2' L	**Alignment:**	Mainline
Elev.:	337.9 ft	**Latitude:**	34.097467	**Longitude:**	80.956851	**Date Started:**	9/5/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	15 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 28.5 feet, moist, hard, white. LL=54, PL=25, PI=29, NMC=21.5		28.5	SS-9	9	13	20	33	
307.9										
		@ 33.5 feet, white, yellow.		33.5	SS-10	10	16	28	44	
302.9										
	37.0	**SILTY SAND (SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, yellow, yellowish brown, gray, mostly fine sand with trace coarse sand, some low to medium plasticity fines. %200=25.5		38.5	SS-11	4	7	10	17	
297.9										
		@ 43.5 feet, wet, white, absent coarse sand, little low plasticity fines.		43.5	SS-12	4	7	8	15	
292.9										
		@ 48.5 feet, wet, loose, grayish white, some low plasticity fines. %200=13.8		48.5	SS-13	4	3	7	10	
287.9										
	52.0	**FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, grayish white, white, mostly medium plasticity fines, trace fine sand.		53.5						

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-01	**Boring Location:**	1215+74.4	**Offset:**	9.2' L	**Alignment:**	Mainline
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Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	15 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
282.9					SS-14	18	29	49	78	
	57.0	**SANDY FAT CLAY (CH, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry to moist, white, mostly medium plasticity fines, some fine sand. LL=51, PL=22, PI=29, NMC=16.2**		58.5	SS-15	16	29	50	79	
277.9										
	62.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist to wet, white, mostly fine to medium sand, some medium plasticity fines.		63.5	SS-16	15	22	17	39	
272.9										
		@ 68.5 feet, white, yellow, yellowish brown, decrease in fines content.		68.5	SS-17	9	19	25	44	
267.9										
		@ 73.5 feet, medium dense, white, increase in fines content.		73.5	SS-18	10	15	15	30	
262.9										
	77.0	**SANDY FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, grayish white, yellowish brown, mostly medium to high plasticity fines, some fine sand.		78.5	SS-19	18	35	50/4"	100	
257.9										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-01	**Boring Location:**	1215+74.4	**Offset:**	9.2' L	**Alignment:**	Mainline
Elev.:	337.9 ft	**Latitude:**	34.097467	**Longitude:**	80.956851	**Date Started:**	9/5/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	15 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0									
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, dense to very dense, wet, white, mostly fine to medium sand, some low to medium plasticity fines.		83.5	SS-20	10	14	25	39	●
252.9										
		@ 88.5 feet, wet to saturated, white, gray, some low plasticity fines, trace fine gravel.		88.5	SS-21	12	16	19	35	●
247.9										
		@ 93.5 feet, wet, white, gray, light brown, some medium to high plasticity fines, absent fine gravel.		93.5	SS-22	9	16	21	37	●
242.9										
		@ 98.5 feet, very dense, wet, white, gray, brown, some medium plasticity fines.		98.5	SS-23	15	32	50/1"	100	●
237.9										
		@ 103.5 feet, wet to saturated, white, gray, brown, yellow, some low plasticity fines.		103.5	SS-24	15	30	32	62	●
232.9										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-01	**Boring Location:**	1215+74.4	**Offset:**	9.2' L	**Alignment:**	Mainline
Elev.:	337.9 ft	**Latitude:**	34.097467	**Longitude:**	80.956851	**Date Started:**	9/5/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	15 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
				108.5					
					SS-25	18	22	28	50
227.9									
				113.5					
		@ 113.5 feet, white, gray, yellow, brown, mostly fine to medium sand with trace coarse sand.			SS-26	27	43	50/5"	100
222.9									
				118.5					
		@ 118.5 feet, medium dense, saturated, some medium plasticity fines, medium plasticity nodules.			SS-27	10	8	13	21
217.9	120.0								
		Boring Terminated at 120 feet.							
212.9									
207.9									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-02	**Boring Location:**	1217+31.7	**Offset:**	13.4' R	**Alignment:**	Mainline
Elev.:	305.2 ft	**Latitude:**	34.067554	**Longitude:**	80.922215	**Date Started:**	9/10/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL -** approximately 3 inches of topsoil.		0.0	SS-1	2	4	5	9
	2.0	**LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, stiff, dry, light gray, mostly low to medium plasticity fines, trace fine sand.		2.0	SS-2	13	18	26	44
	4.0	**SANDY LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, hard, dry, light gray, mostly low to medium plasticity fines, some fine sand. LL=40, PL=18, PI=22, NMC=12.6		4.0	SS-3	25	28	34	62
300.2	6.0	**LEAN CLAY WITH SAND (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry, light gray, dark gray, mostly low to medium plasticity fines, little fine sand.**		6.0	SS-4	4	8	8	16
	8.0			8.0	SS-5	15	21	20	41
295.2		**LEAN CLAY (CL, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist, light gray, dark gray, mostly low to medium plasticity fines, trace fine sand. LL=47, PL=20, PI=27, NMC=19.9							
	12.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, white, pale yellow, mostly fine to medium sand, some medium plasticity fines.		13.5	SS-6	2	3	4	7
290.2		**SILTY SAND (SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, wet, white, yellowish brown, yellow, mostly fine to medium sand, little low plasticity fines. %200=13.1							
		@ 18.5 feet, white, yellow, dark gray, mostly fine sand, some low plasticity fines. %200=15.5		18.5	SS-7	6	5	4	9
285.2	22.0								
		FAT CLAY WITH SAND (CH) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry to moist, white, mostly high plasticity fines, little fine sand.		23.5	SS-8	20	40	50/5"	100
280.2									
	27.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-02	**Boring Location:**	1217+31.7	**Offset:**	13.4' R	**Alignment:**	Mainline
Elev.:	305.2 ft	**Latitude:**	34.067554	**Longitude:**	80.922215	**Date Started:**	9/10/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		CLAYEY SAND (SC, A-2-6) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist to wet, white, yellow, mostly fine to medium sand, some medium to high plasticity fines.		28.5	SS-9	21	29	35	64
275.2									
		@ 33.5 feet, medium dense, white, pale yellow, some medium plasticity fines.		33.5	SS-10	8	9	10	19
270.2									
		@ 38.5 feet, dense, wet, white, gray, yellow, some low plasticity fines, nodules of medium plasticity fines. LL=27, PL=13, PI=14, NMC=19.5, %200=17.2		38.5	SS-11	12	19	21	40
265.2									
	42.0	**SANDY FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist to wet, gray, yellowish brown, mostly high plasticity fines, some fine to medium sand with trace coarse sand, trace fine gravel.		43.5	SS-12	16	35	40	75
260.2									
	47.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, grayish white, yellow, mostly fine to medium sand, some medium to high plasticity fines.		48.5	SS-13	14	20	26	46
255.2									
				53.5					

SPT N VALUE ●

PL ⨯ MC ○ LL ⨯

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-02	**Boring Location:**	1217+31.7	**Offset:**	13.4' R	**Alignment:**	Mainline
Elev.:	305.2 ft	**Latitude:**	34.067554	**Longitude:**	80.922215	**Date Started:**	9/10/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
250.2		@ 54 feet, wet, white, gray, dark gray, some low to medium plasticity fines, trace coarse sand, trace fine gravel.			SS-14	12	18	29	47	
	57.0	**FAT CLAY WITH SAND (CH, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, gray, brownish white, mostly high plasticity fines, little fine sand. LL=52, PL=24, PI=28, NMC=18.5**		58.5	SS-15	17	30	35	65	
245.2										
	62.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist to wet, white, pale yellow, yellowish brown, gray, mostly fine to medium sand, little low plasticity fines.		63.5	SS-16	18	21	23	44	
240.2										
		@ 68.5 feet, wet, white, yellowish white, trace coarse sand, some low plasticity fines, lense of medium to high plasticity fines.		68.5	SS-17	12	16	23	39	
235.2										
				73.5	SS-18	18	19	18	37	
230.2										
		@ 78.5 feet, very dense, absent coarse sands.		78.5	SS-19	13	26	36	62	
225.2										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-02	**Boring Location:**	1217+31.7	**Offset:**	13.4' R	**Alignment:**	Mainline
Elev.:	305.2 ft	**Latitude:**	34.067554	**Longitude:**	80.922215	**Date Started:**	9/10/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0							
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist to wet, yellowish brown, mostly fine to coarse sand, some low to medium plasticity fines.		83.5	SS-20	15 50/1"	100	
220.2								
		@ 88.5 feet, gray, trace fine gravel.		88.5	SS-21	13 50/5"	100	
215.2	90.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silt (ML), very hard, dry to moist, white, mostly low plasticity fines, trace fine sand.		93.5	SS-22	50/4"	100	
210.2								
		@ 98.5 feet, light red and white.		98.5	SS-23	22 50/5"	100	
205.2	100.0	Boring Terminated at 100 feet.						
200.2								

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-04	**Boring Location:**	1219+72.6	**Offset:**	5.4' R	**Alignment:**	Mainline
Elev.:	332.4 ft	**Latitude:**	34.068175	**Longitude:**	80.922499	**Date Started:**	9/12/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/12/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	32 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.5	**TOPSOIL -** approximately 6 inches of topsoil.		0.0	SS-1	3	3	3	6	
		CLAYEY SAND (SC) - FILL, loose, moist, yellowish brown, mostly fine to medium sand, little low plasticity fines.		2.0	SS-2	3	3	3	6	
	4.0	@ 2 feet, moist, gray, yellowish brown, some low to medium plasticity fines.		4.0	SS-3	2	2	2	4	
327.4		**FAT CLAY WITH SAND (CL, A-7-5) - FILL, soft, moist, grayish white, yellowish brown, mostly medium plasticity fines, little fine to medium sand. LL=55, PL=25, PI=30, NMC=23.6**		6.0	SS-4	5	4	4	8	
		@ 6 feet, firm, increase in medium plasticity fines.		8.0	SS-5	3	3	3	6	
		@ 8 feet, grayish white, dark gray, yellowish brown.								
322.4	12.0	**CLAYEY SAND (SC, A-7) -** FILL, medium dense, moist, yellowish brown, mostly fine to medium sand, some medium plasticity fines. %200=41.3		13.5	SS-6	4	8	9	17	
317.4	17.0	**FAT CLAY (CH, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry to moist, grayish white, mostly high plasticity fines, trace fine sand. LL=53, PL=23, PI=30, NMC=17.6		18.5	SS-7	11	19	32	51	
312.4	22.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, grayish white, mostly fine to medium sand, some medium plasticity fines.		23.5	SS-8	10	16	20	36	
307.4	27.0									

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-04	**Boring Location:**	1219+72.6	**Offset:**	5.4' R	**Alignment:**	Mainline
Elev.:	332.4 ft	**Latitude:**	34.068175	**Longitude:**	80.922499	**Date Started:**	9/12/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/12/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	32 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		POORLY GRADED SAND WITH SILT (SP-SM, A-3) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, white, yellow, mostly fine to medium sand, few non-plastic fines.		28.5	SS-9	13	16	18	34	
302.4		▼								
		@ 33.5 feet, medium dense, decrease in non-plastic fines. %200=6.1		33.5	SS-10	9	12	10	22	▲
297.4	37.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist to wet, yellowish brown, yellow, white, mostly fine to medium sand, little non-plastic fines.		38.5	SS-11	10	12	11	23	
292.4	42.0	**FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, grayish white, mostly high plasticity fines, trace fine sands.		43.5	SS-12	13	36	50/4"	100	
287.4	47.0	**LEAN CLAY WITH SAND (CL, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, moist, grayish white, gray, yellowish brown, mostly medium plasticity fines, little fine to medium sand. LL=45, PL=19, PI=26, NMC=15.8**		48.5	SS-13	10	11	22	33	○ ●
282.4	52.0	**SANDY LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, white, yellow, mostly medium plasticity fines, some fine to medium sand.		53.5						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-04	**Boring Location:**	1219+72.6	**Offset:**	5.4' R	**Alignment:**	Mainline
Elev.:	332.4 ft	**Latitude:**	34.068175	**Longitude:**	80.922499	**Date Started:**	9/12/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/12/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	32 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
277.4					SS-14	20	36	44	80	●
	57.0	**CLAYEY SAND (SC, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, yellow, mostly fine to medium sand, some medium plasticity fines. %200=26.1		58.5	SS-15	8	10	12	22	●▲
272.4										
		@ 63.5 feet, wet to saturated, some low to medium plasticity fines.		63.5	SS-16	9	11	14	25	●
267.4										
	67.0	**FAT CLAY WITH SAND (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, gray, yellowish brown, mostly high plasticity fines, little fine to medium sand.		68.5	SS-17	18	32	38	70	●
262.4										
	72.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, yellow, mostly fine to medium sand, some medium plasticity fines.		73.5	SS-18	10	13	15	28	●
257.4										
		@ 78.5 feet, wet, white, yellowish brown, trace coarse sand, little low plasticity fines.		78.5	SS-19	9	12	16	28	●
252.4										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-04	**Boring Location:**	1219+72.6	**Offset:**	5.4' R	**Alignment:**	Mainline
Elev.:	332.4 ft	**Latitude:**	34.068175	**Longitude:**	80.922499	**Date Started:**	9/12/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/12/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	32 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0									
		SANDY FAT CLAY (CH) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, white, mostly high plasticity fines, some fine to medium sand.		83.5	SS-20	19	35	47	82	●
247.4										
		@ 88.5 feet, moist to wet, mostly medium to high plasticity fines.		88.5	SS-21	29	34	50/4"	100	●
242.4										
	92.0									
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, wet to saturated, white, yellow, mostly fine to medium sand with trace course sand, some low to medium plasticity fines.		93.5	SS-22	13	23	35	58	●
237.4										
	97.0									
		SILTY SAND (SM) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, wet, white, yellowish brown, mostly fine to medium sand, some non-plastic to low plasticity fines.		98.5	SS-23	18	33	50/5"	100	●
232.4										
	102.0									
		FAT CLAY WITH SAND (CH) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry to moist, gray, dark gray, mostly high plasticity fines, little fine sand		103.5	SS-24	20	32	50/4"	100	●
227.4										
	107.0									
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense,								

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-04	**Boring Location:**	1219+72.6	**Offset:**	5.4' R	**Alignment:**	Mainline
Elev.:	332.4 ft	**Latitude:**	34.068175	**Longitude:**	80.922499	**Date Started:**	9/12/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/12/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	32 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		wet, yellow, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines.		108.5						
					SS-25	22	47	50/1"	100	
222.4										
	112.0	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Silt (ML), very hard, moist, yellowish brown, mostly low to medium plasticity fines, trace fine sand.		113.5						
					SS-26	50/2"			100	
217.4										
				118.5						
					SS-27	50/3"			100	
212.4	120.0	Boring Terminated at 120 feet.								
207.4										
202.4										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-05	**Boring Location:**	1223+71.6	**Offset:**	2.4' L	**Alignment:**	Mainline
Elev.:	323.3 ft	**Latitude:**	34.069156	**Longitude:**	80.923086	**Date Started:**	9/17/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	40 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.		0.0	SS-1	2	5	5	10
		CLAYEY SAND (SC, A-7) - FILL, loose, dry to moist, gray, yellowish brown, mostly fine to medium sand, little low plasticity fines, trace fine to coarse gravel.		2.0	SS-2	3	4	4	8
		@ 2 feet, moist, gray, white, yellowish brown, some low plasticity fines, absent gravel.		4.0	SS-3	13	8	8	16
318.3		@ 4 feet, no sample recovery.							
		@ 6 feet, medium dense, moist, brown, light brown, some low plasticity fines.		6.0	SS-4	6	4	7	11
		@ 8 feet, brown, light brown, gray, trace wood fragments.		8.0	SS-5	10	9	8	17
313.3									
				13.5					
		@ 13.5 feet, loose, brown, gray, some low to medium plasticity fines, absent wood fragments. %200=38.3			SS-6	3	3	3	6
308.3									
	17.0	**SILTY SAND (SM) -** FILL, medium dense, moist, pale yellowish brown, mostly fine sand, little non-plastic fines.		18.5	SS-7	4	8	12	20
303.3									
	22.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist to wet, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines.		23.5	SS-8	3	4	5	9
298.3									
	27.0								

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-05	**Boring Location:**	1223+71.6	**Offset:**	2.4' L	**Alignment:**	Mainline
Elev.:	323.3 ft	**Latitude:**	34.069156	**Longitude:**	80.923086	**Date Started:**	9/17/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	40 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
293.3		**LEAN CLAY WITH SAND (CL, A-6) - COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist to wet, white, grayish white, brown, mostly low to medium plasticity fines, little fine sand. LL=36, PL=18, PI=18, NMC=23.6**		28.5	SS-9	7	4	9	13	
	32.0	**LEAN CLAY WITH SAND (CL, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, firm, moist, grayish white, yellowish brown, mostly medium plasticity fines, little fine sand, lenses of clayey sand throughout sample. LL=48, PL=22, PI=26, NMC=18.0**		33.5	SS-10	3	3	3	6	
288.3										
	37.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist to wet, yellowish brown, brown, mostly fine to medium sand, little low to medium plasticity fines.		38.5	SS-11	16	11	11	22	
283.3		▼								
	42.0	**WELL GRADED SAND WITH SILT (SW-SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, grayish brown, mostly fine to coarse sand, few non-plastic fines. %200=11.4		43.5	SS-12	7	6	6	12	
278.3										
	47.0	**CLAYEY SAND (SC, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist to wet, yellowish brown, brown, mostly fine to medium sand, some low to medium plasticity fines. %200=28.1		48.5	SS-13	4	4	5	9	
273.3										
		@ 53.5 feet, very loose, wet, pale yellow,		53.5						

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-05	**Boring Location:**	1223+71.6	**Offset:**	2.4' L	**Alignment:**	Mainline
Elev.:	323.3 ft	**Latitude:**	34.069156	**Longitude:**	80.923086	**Date Started:**	9/17/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	40 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
268.3		some low plasticity fines, low sample recovery.			SS-14	3	1	2	3	●
				58.5						
		@ 58.5 feet, very hard, moist to wet, grayish white, some high plasticity fines, trace coarse sand.			SS-15	25	29	35	64	●
263.3										
	62.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist to wet, white, yellow, grayish white, mostly fine to medium sand, some non-plastic to low plasticity fines.		63.5	SS-16	13	23	24	47	●
258.3										
	67.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, yellowish brown, brown, mostly fine to medium sand, some high plasticity fines.		68.5	SS-17	15	25	41	66	●
253.3										
		@ 73.5 feet, dense, grayish white, pale yellow, some low to medium plasticity fines.		73.5	SS-18	16	21	24	45	●
248.3										
	77.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist to wet, yellow, brown, yellowish brown, mostly fine to medium sand, some non-plastic fines.		78.5	SS-19	19	23	23	46	●
243.3										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-05	**Boring Location:**	1223+71.6	**Offset:**	2.4' L	**Alignment:**	Mainline
Elev.:	323.3 ft	**Latitude:**	34.069156	**Longitude:**	80.923086	**Date Started:**	9/17/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	40 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				83.5	SS-20	17	19	29	48	
238.3		@ 83.5 feet, white, yellow, brownish yellow, reddish yellow, mostly fine to coarse sands, some low plasticity fines, trace fine gravel, medium plasticity nodules in sample.								
				88.5	SS-21	30	38	39	77	
233.3		@ 88.5 feet, very dense, white, yellow, mostly fine to medium sand, little low plasticity fines.								
	92.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, wet, brownish yellow, mostly fine to medium sand, some low plasticity fines.		93.5	SS-22	25	38	28	66	
228.3										
		@ 98.5 feet, brownish yellow, brown, gray, mostly fine to coarse sand, trace fine to coarse gravel.		98.5	SS-23	45	50/4"		100	
223.3										
	102.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silt (ML), very hard, moist, dark gray, brown, light brown, mostly low to medium plasticity fines, trace fine sand.		103.5	SS-24	42	50/2"		100	
218.3										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-05	**Boring Location:**	1223+71.6	**Offset:**	2.4' L	**Alignment:**	Mainline
Elev.:	323.3 ft	**Latitude:**	34.069156	**Longitude:**	80.923086	**Date Started:**	9/17/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	40 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				108.5				
					SS-25	50/2"	100	
213.3								
				113.5				
		@ 113.5 feet, dry to moist, dark gray, mostly low plasticity fines.			SS-26	50/1"	100	
208.3								
				118.5				
		@ 118.5 feet, light gray, dark gray.			SS-27	50/3"	100	
203.3	120.0	Boring Terminated at 120 feet.						
198.3								
193.3								

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-06	**Boring Location:**	1224+97.0	**Offset:**	3.3' R	**Alignment:**	Mainline
Elev.:	291.4 ft	**Latitude:**	34.069461	**Longitude:**	80.923281	**Date Started:**	9/11/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									0 10 20 30 40 50 60 70 80 90
	0.5	**TOPSOIL -** approximately 6 inches of topsoil.		0.0	SS-1	4	8	10	18	
		CLAYEY SAND (SC) - FILL, medium dense, moist, yellowish brown, mostly fine to medium sand, some low plasticity fines.		2.0	SS-2	4	4	6	10	
	4.0	@ 2 feet, loose, gray, yellowish brown, some low to medium plasticity fines.		4.0	SS-3	2	1	1	2	
286.4		**POORLY GRADED SAND WITH SILT (SP-SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, very loose, moist, brown, dark brown, mostly fine to medium sand, few non-plastic fines.		6.0	SS-4	1	1	2	3	
		@ 6 feet, yellowish brown. %200=11.2		8.0	SS-5	2	1	2	3	
281.4										
	12.0	**CLAYEY SAND (SC, A-6) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist, yellowish brown, mostly fine to medium sand, some low plasticity fines.		13.5	SS-6	2	3	4	7	
276.4										
		@ 18.5 feet, medium dense, grayish white, yellowish brown, some medium plasticity fines. %200=46.5		18.5	SS-7	2	6	8	14	
271.4										
		@ 23.5 feet, very dense, some medium to high plasticity fines. LL=34, PL=15, PI=19, NMC=10.2, %200=49.1		23.5	SS-8	16	27	50	77	
266.4										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-06	**Boring Location:**	1224+97.0	**Offset:**	3.3' R	**Alignment:**	Mainline
Elev.:	291.4 ft	**Latitude:**	34.069461	**Longitude:**	80.923281	**Date Started:**	9/11/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, grayish white, dark gray, gray, yellowish brown, some high plasticity fines.			SS-9	16	27	33	60	●
261.4										
				33.5						
		@ 33.5 feet, moist to wet, white, some low plasticity fines.			SS-10	12	25	34	59	●
256.4										
				38.5						
		@ 38.5 feet, moist, grayish white, white, some high plasticity fines, nodules of Fat Clay (CH).			SS-11	15	36	50/6"	100	●
251.4										
	42.0	**SILTY SAND (SM, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, pale yellow, mostly fine to medium sand, some low plasticity fines. %200=28.1		43.5						
					SS-12	13	24	28	52	▲ ●
246.4										
				48.5						
		@ 48.5 feet, moist to wet, white, pale yellow, brown, reddish yellow.			SS-13	19	42	50/5"	100	●
241.4										
				53.5						
		@ 53.5 feet, white, pale yellow, brown,								

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-06	**Boring Location:**	1224+97.0	**Offset:**	3.3' R	**Alignment:**	Mainline
Elev.:	291.4 ft	**Latitude:**	34.069461	**Longitude:**	80.923281	**Date Started:**	9/11/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		gray.			SS-14	22	30	50	80	
236.4				58.5						
		@ 58.5 feet, white, pale yellow, reddish yellow, brown.			SS-15	19	30	32	62	
231.4										
	62.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, gray, yellowish brown, red, yellow, mostly fine to medium sand, some medium to high plasticity fines.		63.5	SS-16	36	50/3"		100	
226.4										
	67.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, yellow, yellowish brown, gray, dark gray, mostly fine to medium sand with trace coarse sand, some low plasticity fines, trace fine gravel.		68.5	SS-17	38	48	50/5"	100	
221.4										
	72.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silt (ML), very hard, dry, gray, brown, yellow, mostly low plasticity fines, trace fine sand.		73.5	SS-18	50/5"			100	
216.4										
		@ 78.5 feet, moist, dark gray.		78.5	SS-19	50/5"			100	
211.4										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-06	**Boring Location:**	1224+97.0	**Offset:**	3.3' R	**Alignment:**	Mainline
Elev.:	291.4 ft	**Latitude:**	34.069461	**Longitude:**	80.923281	**Date Started:**	9/11/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				83.5				
		@ 83.5 feet, dark gray, gray.			SS-20	33 50/4"	100	
206.4								
				88.5				
					SS-21	50/5"	100	
201.4								
				93.5				
					SS-22	50/4"	100	
196.4								
				98.5				
					SS-23	25 50/2"	100	
191.4	100.0	Boring Terminated at 100 feet.						
186.4								

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-07	**Boring Location:**	1225+85.2	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	315.3 ft	**Latitude:**	34.069659	**Longitude:**	80.923449	**Date Started:**	9/3/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	55 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.		0.0	SS-1		5	5	10	
		CLAYEY SAND (SC, A-2) - FILL, loose, moist, light grayish brown, trace white, mostly fine to medium sand, little low plasticity fines.		2.0	SS-2	6	6	9	15	
		@ 3 feet, medium dense, light yellowish brown, trace white, trace coarse sand, some medium plasticity fines.		4.0	SS-3	4	4	4	8	
310.3		@ 4 feet, loose, little low to medium plasticity fines, slight decrease in fines content. %200=26.6		6.0	SS-4	2	2	4	6	
	7.0	@ 6 feet, increase in fines content, some medium plasticity fines.		8.0	SS-5	2	4	4	8	
	8.0	**SANDY FAT CLAY (CH) -** FILL, firm, moist, light yellowish brown, trace purple and yellow, mostly high plasticity fines, some fine to medium sand.								
305.3		**CLAYEY SAND (SC) -** FILL, loose, moist, white with pale yellow and light purple mottling, mostly fine to medium sand, some medium plasticity fines. %200=25.0		13.5	SS-6	6	4	4	8	
		@ 13.5 feet, very pale brown, trace of white, trace coarse sand, trace fine gravel, interbedded kaolinitic nodules and lenses.								
300.3				18.5	SS-7	3	3	3	6	
		@ 18.5 feet, white with very pale brown and trace reddish yellow mottling.								
295.3										
	22.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, dark grayish brown, traces sticks, large piece of wood, faint organic odor, mostly fine to medium sand, little non-plastic fines.		23.5	SS-8	6	10	10	20	
290.3										
	27.0									

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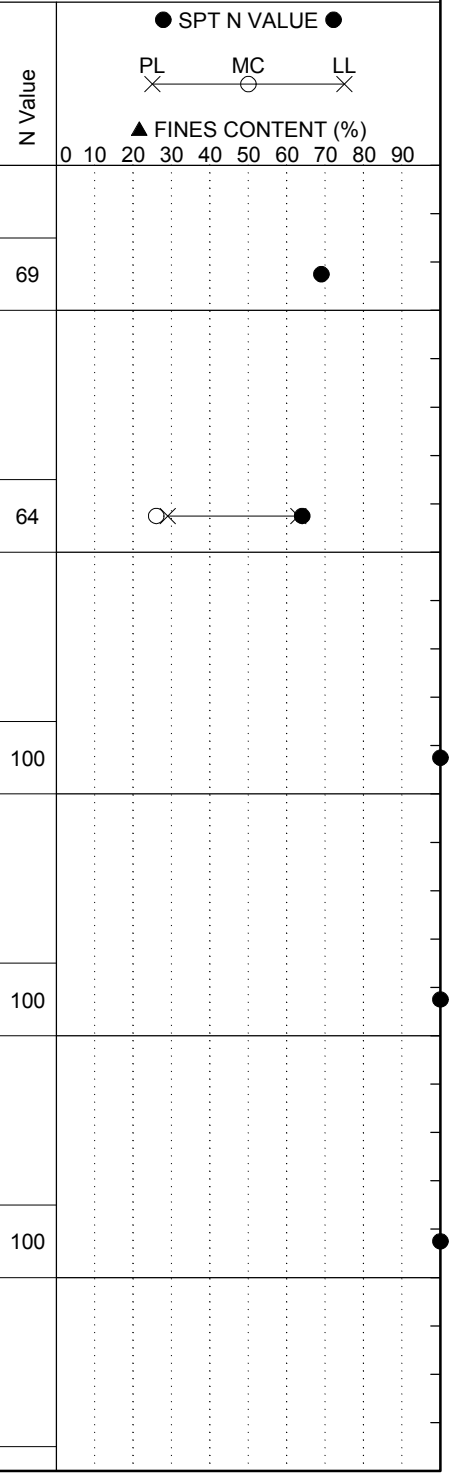
LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-07	**Boring Location:**	1225+85.2	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	315.3 ft	**Latitude:**	34.069659	**Longitude:**	80.923449	**Date Started:**	9/3/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	55 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, reddish yellow, mostly fine to medium sand with trace coarse sand, some low to medium plasticity fines.		28.5	SS-9	21	32	37	69
285.3	32.0								
		FAT CLAY (CH, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, white and light purple, mostly high plasticity fines, trace fine sand. LL=63, PL=29, PI=34, NMC=26.2		33.5	SS-10	14	28	36	64
280.3									
		@ 38.5 feet, white.		38.5	SS-11	19	25	50/5"	100
275.3	42.0								
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, mostly fine to medium sand, some high plasticity fines, lenses of Fat Clay (CH).		43.5	SS-12	21	40	50/4"	100
270.3									
		@ 48.5 feet, slight decrease in fines content, absent Fat Clay (CH) lenses.		48.5	SS-13	31	50/4"		100
265.3									
				53.5					



LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-07	**Boring Location:**	1225+85.2	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	315.3 ft	**Latitude:**	34.069659	**Longitude:**	80.923449	**Date Started:**	9/3/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	55 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
260.3		**FAT CLAY WITH SAND (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, red, yellow, light gray, mottled, mostly high plasticity fines, little fine sand.			SS-14	19	35	50/5"	100	
	57.0	**CLAYEY SAND (SC, A-6) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white to light gray with brownish yellow mottling, mostly fine to medium sand, some medium plasticity fines. %200=49.2		58.5	SS-15	26	35	44	79	
255.3										
		@ 63.5 feet, brownish yellow with trace brown and light gray mottling, some high plasticity fines.		63.5	SS-16	23	39	50/5"	100	
250.3										
		@ 68.5 feet, light gray to white with trace purple, mostly fine to coarse sand, trace fine gravel, some medium to high plasticity fines, slight decrease in fines content.		68.5	SS-17	28	37	50/5"	100	
245.3										
		@ 73.5 feet, moist to wet, pale yellow and white, slightly micaceous, mostly fine to medium sand with trace coarse sand, little low plasticity fines.		73.5	SS-18	26	50/5"		100	
240.3										
		@ 78.5 feet, moist, white with trace of purple, some high plasticity fines, increase in fines content, interbedded Fat Clay (CH) nodules.		78.5	SS-19	28	38	50	88	
235.3										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-07	**Boring Location:**	1225+85.2	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	315.3 ft	**Latitude:**	34.069659	**Longitude:**	80.923449	**Date Started:**	9/3/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	55 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 83.5 feet, pink, purple, white, micaceous, mostly fine to coarse sand, some medium plasticity fines, decrease in fines content.		83.5	SS-20	28 50/3"	100	
230.3	87.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist to wet, white with pale yellow, micaceous, mostly fine to medium sand, little low plasticity fines.		88.5	SS-21	35 50/3"	100	
225.3	89.5	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist to wet, white with trace purple, mostly fine to coarse sand, little low to medium plasticity fines, interbedded kaolinitic lenses.		93.5	SS-22	35 50/4"	100	
220.3	92.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONST RESIDUUM, sampled as Silty Sand (SM), very dense, moist to wet, pale yellow, reddish yellow, white, slightly micaceous, mostly fine to medium sand with few coarse sands, little to low plasticity fines.		98.5	SS-23	38 50/3"	100	
215.3		@ 98.5 feet, white and pale yellow, interbedded lenses of increased fines.						
210.3	102.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Clayey Sand (SC), very dense, moist, white and pale yellow, slightly micaceous, mostly fine to medium sand with trace coarse sand, trace fine gravel, little low to medium plasticity fines.		103.5	SS-24	50/5"	100	
	107.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-07	**Boring Location:**	1225+85.2	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	315.3 ft	**Latitude:**	34.069659	**Longitude:**	80.923449	**Date Started:**	9/3/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	55 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
		Silty Sand (SM), very dense, moist to wet, pale yellow and white, slightly micaceous, mostly fine to medium sand with trace coarse sand, little low plasticity fines.		108.5				0 10 20 30 40 50 60 70 80 90
205.3					SS-25	50/4"	100	
		@ 113.5 feet, wet, absent coarse sand.		113.5	SS-26	50/4"	100	
200.3								
	117.0	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Clayey Sand (SC), very dense, moist, white, slightly micaceous, mostly fine to medium sand, little low to medium plasticity fines.		118.5	SS-27	28 50/3"	100	
195.3	120.0	Boring Terminated at 120 feet.						
190.3								
185.3								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-08	**Boring Location:**	1236+51.9	**Offset:**	1.2' L	**Alignment:**	Mainline
Elev.:	278.4 ft	**Latitude:**	34.071745	**Longitude:**	80.925895	**Date Started:**	9/4/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0			0.0						
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.								
		CLAYEY SAND (SC) - FILL, medium dense, dry to moist, grayish brown with yellowish brown, slightly micaceous, mostly fine to medium sand, little low to medium plasticity fines.			SS-1	9	14	13	27	
	3.0			2.0						
	4.0	@ 2 feet, reddish yellow, some medium sand.			SS-2	6	9	9	18	
273.4				4.0						
		SILTY SAND (SM) - FILL, medium dense, moist, pale yellow, reddish yellow, white, micaceous, mostly fine to medium sand with trace coarse sand, little low plasticity fines.			SS-3	6	6	7	13	
				6.0						
					SS-4	3	2	4	6	
				8.0						
		SANDY LEAN CLAY (CL, A-6) - FILL, stiff, moist, reddish yellow with trace light gray, mostly low to medium plasticity fines, some fine to medium sand, interbedded Fat Clay (CH) seams.			SS-5	3	3	4	7	
268.4										
		@ 6 feet, firm, brownish yellow, red, light gray mottle, micaceous, mostly medium plasticity fines, interbedded Fat Clay (CH) seems.								
	12.0									
		@ 8 feet, brownish yellow, decrease in mica content, some low to medium plasticity fines, absent Fat Clay (CH) seams. %200=51.7		13.5						
					SS-6	5	9	9	18	
263.4										
		CLAYEY SAND (SC) - FILL, medium dense, moist, brownish yellow, yellowish red, slightly micaceous, mostly fine to medium sand, some low to medium plasticity fines.								
				18.5						
		@ 18.5 feet, light yellowish brown, ▼yellowish red, decrease in mica content, some medium plasticity fines, interbedded Fat Clay (CH) seams.			SS-7	3	5	9	14	
258.4										
	22.0									
		SANDY LEAN CLAY (CL, A-6) - FILL, very stiff, moist, white, mostly low to medium plasticity fines, some fine to medium sand. LL=39, PL=21, PI=18, NMC=18.2		23.5						
					SS-8	6	8	10	18	
253.4										
	27.0									

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-08	**Boring Location:**	1236+51.9	**Offset:**	1.2' L	**Alignment:**	Mainline
Elev.:	278.4 ft	**Latitude:**	34.071745	**Longitude:**	80.925895	**Date Started:**	9/4/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		CLAYEY SAND (SC) - FILL, dense, moist, brownish yellow, grayish brown, faint organic odor, mostly fine to medium sand, little low to medium plasticity fines.		28.5					
	29.5				SS-9	12	16	32	48
248.4		**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, black, faint organic odor, mostly fine to medium sand, little low plasticity fines.							
	32.0								
		LEAN CLAY WITH SAND (CL, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, moist, light gray, yellow, purple mottle, trace mica, mostly medium plasticity fines, little fine to medium sand. LL=45, PL=21, PI=24, NMC=16.2		33.5					
					SS-10	14	17	28	45
243.4									
	37.0								
		CLAYEY SAND (SC, A-2) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, light gray, purple mottle, slightly micaceous, mostly fine to medium sand, some medium plasticity fines.		38.5					
					SS-11	10	25	36	61
238.4									
				43.5					
		@ 43.5 feet, dense, trace coarse sand, increased in mica content, increase in fines content.			SS-12	15	17	19	36
233.4									
				48.5					
		@ 48.5 feet, medium dense, wet, white, decrease in mica content, little low plasticity fines, decrease in fines content. %200=14.7			SS-13	6	9	11	20
228.4									
	52.0								
		SANDY LEAN CLAY (CL, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, purple, light gray, pale yellow, very pale brown, mostly		53.5					

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-08	**Boring Location:**	1236+51.9	**Offset:**	1.2' L	**Alignment:**	Mainline
Elev.:	278.4 ft	**Latitude:**	34.071745	**Longitude:**	80.925895	**Date Started:**	9/4/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		medium plasticity fines, some fine to medium sand.			SS-14	19	26	31	57
223.4		@ 54.5 feet, pale yellow, very pale brown. LL=47, PL=24, PI=23, NMC=17.7							
	57.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white with light purple mottling, micaceous, mostly fine to medium sand, little low plasticity fines.		58.5	SS-15	18	39	50/3"	100
218.4									
		@ 63.5 feet, moist to wet, slightly decrease in fines content.		63.5	SS-16	14	21	40	61
213.4									
		@ 68.5 feet, dense, few coarse sands, trace fine gravel.		68.5	SS-17	15	17	28	45
208.4									
		@ 73.5 feet, very dense, moist, white and purple, micaceous, mostly fine to medium sand, little low plasticity fines, highly interbedded kaolinitic lenses and nodules.		73.5	SS-18	25	50/4"		100
203.4									
		@ 78.5 feet, wet, white with trace yellow, mostly fine to medium sand with trace coarse sand.		78.5	SS-19	32	36	50	86
198.4									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-08	**Boring Location:**	1236+51.9	**Offset:**	1.2' L	**Alignment:**	Mainline
Elev.:	278.4 ft	**Latitude:**	34.071745	**Longitude:**	80.925895	**Date Started:**	9/4/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0									
		SILTY SAND (SM) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, pale yellow, reddish yellow, micaceous, mostly fine to medium sand, little low plasticity fines, interbedded lenses of micaceous Silt (ML).		83.5	SS-20	11	11	21	32	●
193.4										
	87.0									
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet, pale yellow, mostly fine to medium sand with trace coarse sand, little low plasticity fines.		88.5	SS-21	15	20	22	42	●
188.4										
		@ 93.5 feet, very dense, pale yellow, reddish yellow, coarse quartz gravel.		93.5	SS-22	50/3"			100	●
183.4										
	97.0									
		SANDY SILT (ML) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, moist, light gray, white, micaceous, mostly medium plasticity fines, some fine to coarse sand.		98.5	SS-23	19	50/4"		100	●
178.4										
	102.0									
		SILTY SAND (SM) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, micaceous, mostly fine to coarse sand, some low to medium plasticity fines.		103.5	SS-24	50/3"			100	●
173.4										
	107.0									
		FAT CLAY (CH) - COASTAL PLAIN - MIDDENDORF FORMATION, very stiff to								

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-08	**Boring Location:**	1236+51.9	**Offset:**	1.2' L	**Alignment:**	Mainline
Elev.:	278.4 ft	**Latitude:**	34.071745	**Longitude:**	80.925895	**Date Started:**	9/4/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		stiff, moist to wet, dark red, light bluish green, mostly high plasticity fines, trace fine sand.		108.5						
					SS-25	5	7	9	16	●
168.4										
				113.5						
					SS-26	4	5	6	11	●
163.4										
				118.5						
					SS-27	4	6	7	13	●
158.4	120.0	Boring Terminated at 120 feet.								
153.4										
148.4										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-09	**Boring Location:**	1238+66.5	**Offset:**	16.6' L	**Alignment:**	Mainline
Elev.:	271.3 ft	**Latitude:**	34.072035	**Longitude:**	80.926513	**Date Started:**	9/5/2014
Total Depth:	121.6 ft	**Soil Depth:**	99.3 ft	**Core Depth:**	22.3 ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	42.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.		0.0	SS-1	10	10	9	19	
		CLAYEY SAND (SC) - FILL, loose, dry to moist, grayish brown with trace brownish yellow, mostly fine to medium sand, little low to medium plasticity fines, interbedded white Clay (CH) lenses.		2.0	SS-2	9	10	10	20	
	3.0									
	4.0			4.0	SS-3	4	2	4	6	
266.3		**SANDY FAT CLAY (CH) -** FILL, very stiff, moist, light gray and purple with pale yellow, mostly high plasticity fines, some fine to medium sand, interbedded Clayey Sand (SC) seams.		6.0	SS-4	3	3	7	10	
		CLAYEY SAND (SC) - FILL, loose, moist, grayish brown, pale yellow, white, mostly fine to medium sand, some low to medium plasticity fines, interbedded Clay (CH) seams.		8.0	SS-5	4	7	8	15	
	8.0									
261.3		@ 6 feet, reddish yellow, little low to medium plasticity fines, slight decrease in fines content.								
	12.0	**SANDY LEAN CLAY (CL) -** FILL, stiff, moist, white with pale yellow, mostly medium plasticity fines, some fine to medium sand. LL=44, PL=21, PI=23, NMC=18.0		13.5	SS-6	3	4	7	11	
256.3		**CLAYEY SAND (SC, A-6) -** FILL, medium dense, moist, light yellowish brown, grayish brown, trace white, mostly fine to medium sand, some medium plasticity fines, interbedded white Clay (CH) chunks. %200=41.9								
		@ 18.5 feet, pale yellow with trace pink and white.		18.5	SS-7	6	7	8	15	
251.3										
		@ 23.5 feet, light brown, yellow, trace white, little low plasticity fines, slight decrease in fines content, white Clay (CH) chunks.		23.5	SS-8	9	8	14	22	
246.3										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-09	**Boring Location:**	1238+66.5	**Offset:**	16.6' L	**Alignment:**	Mainline
Elev.:	271.3 ft	**Latitude:**	34.072035	**Longitude:**	80.926513	**Date Started:**	9/5/2014
Total Depth:	121.6 ft	**Soil Depth:**	99.3 ft	**Core Depth:**	22.3 ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	42.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 28.5 feet, loose, light grayish brown, mostly fine to medium sand with trace coarse sand, some medium plasticity fines, increase in fines content, absent Clay chunks.		28.5	SS-9	3	3	4	7	
241.3										
	32.0	**SANDY LEAN CLAY (CL, A-6) -** FILL, very stiff to hard, moist, light gray with trace yellow mottling, mostly low to medium plasticity fines, some fine to medium sand. LL=35, PL=15, PI=20, NMC=11.3		33.5	SS-10	6	15	29	44	
	34.5									
236.3		**CLAYEY SAND (SC, A-2) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, grayish brown, trace organics, faint organic odor, mostly fine to medium sand, little to some low to medium plasticity fines.		38.5	SS-11	6	8	9	17	
		@ 38.5 feet, medium dense, moist, light gray, reddish yellow, pale brown mottle, mostly fine to medium sand, little low to medium plasticity fines.								
231.3										
		@ 43.5 feet, very loose, wet, brownish yellow, trace coarse sand, little low plasticity fines. %200=26.2		43.5	SS-12	4	2	1	3	
226.3										
	47.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet, white, micaceous, mostly fine to medium sand, little to some low to medium plasticity fines.		48.5	SS-13	11	14	28	42	
221.3										
		@53.5 feet, little low plasticity fines.		53.5						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-09	**Boring Location:**	1238+66.5	**Offset:**	16.6' L	**Alignment:**	Mainline
Elev.:	271.3 ft	**Latitude:**	34.072035	**Longitude:**	80.926513	**Date Started:**	9/5/2014
Total Depth:	121.6 ft	**Soil Depth:**	99.3 ft	**Core Depth:**	22.3 ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	42.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
216.3					SS-14	15	15	17	32	
	57.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet, white, micaceous, mostly fine to medium sand with trace coarse sand, few low plasticity fines.		58.5	SS-15	14	20	25	45	
211.3	62.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, wet, white, micaceous, mostly fine to medium sand with trace coarse sand, little low plasticity fines.		63.5	SS-16	19	23	39	62	
206.3	67.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense to medium dense, wet, white, pale yellow, reddish yellow, mostly fine to medium sand with trace coarse sand, little low plasticity fines.		68.5	SS-17	14	24	31	55	
201.3		@ 72 feet, loss of drilling fluid circulation, driller noted hard drilling, possible gravel layer.		73.5	SS-18		9	11	20	
196.3										
191.3		@ 78.5 feet, medium dense, reddish yellow, light yellowish brown, trace gray, mostly fine to coarse sand, trace fine gravel.		78.5	SS-19	15	10	9	19	

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-09	**Boring Location:**	1238+66.5	**Offset:**	16.6' L	**Alignment:**	Mainline
Elev.:	271.3 ft	**Latitude:**	34.072035	**Longitude:**	80.926513	**Date Started:**	9/5/2014
Total Depth:	121.6 ft	**Soil Depth:**	99.3 ft	**Core Depth:**	22.3 ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	42.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0									
		PARTIALLY WEATHERED ROCK (PWR) - PIEDMONT, sampled as Sandy Lean Clay (CL), very hard, moist, reddish yellow, light bluish gray, trace mica, mostly medium plasticity fines, some fine to coarse sand.		83.5	SS-20	47	50/5"		100	
186.3										
	87.0	**SANDY FAT CLAY (CH) -** PIEDMONT, very stiff, moist, brown and bluish gray to bluish gray with white, mostly medium to high plasticity fines, some fine to medium sand.		88.5	SS-21	6	9	10	19	
181.3										
	92.0	**SILTY SAND (SM) -** PIEDMONT, dense, moist, grayish green, mostly fine to medium sand, some low to medium plasticity fines.		93.5	SS-22	15	20	25	45	
176.3										
		@ 98 feet, no sample recovery		98.5						
	99.3			99.3	SS-23	50/1"			100	
171.3		**GNEISS -** gray and brown, fine grained, highly to slightly weathered, weak to strong, no dip or discontinuities, 40% RQD, 83% REC, 50 RMR.			RC-1					UC=2,925 psi
	101.3			101.3						
		GNEISS - gray and brown, fine grained, highly to moderately weathered, weak to strong, no dip or discontinuities, 44% RQD, 90% REC, 36 RMR.			RC-2					
166.3										
	106.3			106.3						
		GNEISS - gray and brown, fine grained, highly to slightly weathered, weak to very strong, 45 deg. dip, shear, no infilling,								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-09	**Boring Location:**	1238+66.5	**Offset:**	16.6' L	**Alignment:**	Mainline
Elev.:	271.3 ft	**Latitude:**	34.072035	**Longitude:**	80.926513	**Date Started:**	9/5/2014
Total Depth:	121.6 ft	**Soil Depth:**	99.3 ft	**Core Depth:**	22.3 ft	**Date Completed:**	9/8/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	42.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		planar surface, smooth, 38% RQD, 82% REC, 60 RMR.			RC-3			UC=20,773 psi
161.3	111.3	**GNEISS -** gray and brown, fine grained, highly to slightly weathered, medium strong to very strong, 70 deg. dip, shear, tight discontinuity, no infilling, planar surface, close spacing, smooth, 30% RQD, 59% REC, 50 RMR.		111.3	RC-4			
156.3	116.3	**GNEISS -** gray and brown, fine grained, slightly weathered, strong to very strong, 45 deg. dip, shear, tight discontinuity, no infilling, planar surface, close spacing, smooth, 70% RQD, 98% REC, 65 RMR.		116.3	RC-5			UC=16,435 psi
151.3	121.3	Boring Terminated at 121.3 feet.						
146.3								
141.3								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-10	**Boring Location:**	1246+85.0	**Offset:**	2.7' R	**Alignment:**	Mainline
Elev.:	246.0 ft	**Latitude:**	34.073307	**Longitude:**	80.928743	**Date Started:**	9/18/2014
Total Depth:	95.5 ft	**Soil Depth:**	95.5 ft	**Core Depth:**	20 ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									0 10 20 30 40 50 60 70 80 90
	0.2	**TOPSOIL -** approximately 2 inches of topsoil.		0.0	SS-1	6	7	4	11	
		CLAYEY SAND (SC) - FILL, medium dense, moist, grayish brown to yellow, micaceous, mostly fine to medium sand, some medium plasticity fines.		2.0	SS-2	5	7	7	14	
		@ 2 feet, pale yellow with trace white, little low plasticity fines.		4.0						
241.0		@ 4 feet, loose, some medium plasticity fines, interbedded kaolinitc Clay chunks and lenses.			SS-3	5	4	5	9	
	7.0			6.0	SS-4	6	4	4	8	
	8.0	**SANDY ELASTIC SILT (MH) -** FILL, firm, moist, pale yellow, white, micaceous, mostly high plasticity fines, some fine to medium sand, Silty Sand (SM) seams.		8.0	SS-5	4	6	5	11	
236.0		**CLAYEY SAND (SC) -** FILL, medium dense, moist, pale yellow, white, micaceous, mostly fine to medium sand, little medium plasticity fines, interbedded kaolinitic Clay chunks.								
	12.0			13.5	SS-6	4	2	3	5	
		SANDY FAT CLAY (CH) - FILL, firm, moist, white with light grayish brown, mostly high plasticity fines, some fine to medium sand, interbedded Sand seams.								
231.0										
	17.0			18.5	SS-7	6	6	6	12	
		CLAYEY SAND (SC) - FILL, medium dense, moist, reddish yellow with trace white and pale yellow, micaceous, mostly fine to medium sand with trace coarse sand, some medium plasticity fines.								
226.0										
	22.0			23.5	SS-8	2	2	2	4	
		SILTY SAND (SM, A-4) - ALLUVIUM, very loose, moist, very pale brown, trace grayish brown, micaceous, mostly fine sand, some low plasticity fines. %200=44.2								
221.0										
	27.0									

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-10	**Boring Location:**	1246+85.0	**Offset:**	2.7' R	**Alignment:**	Mainline
Elev.:	246.0 ft	**Latitude:**	34.073307	**Longitude:**	80.928743	**Date Started:**	9/18/2014
Total Depth:	95.5 ft	**Soil Depth:**	95.5 ft	**Core Depth:**	20 ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		POORLY GRADED SAND WITH SILT (SP-SM) - ALLUVIUM, medium dense, wet, very pale brown, mostly fine to medium sand, few non-plastic fines.		28.5	SS-9	4	8	9	17	
216.0	32.0	**WELL GRADED SAND (SW, A-1-b) - ALLUVIUM, loose, wet, yellow, pale yellow, mostly fine to coarse sand, trace fine gravel, trace non-plastic fines. %200=4.2**		33.5	SS-10	5	4	4	8	
211.0	35.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, white to pale yellow, mostly fine to medium sand with trace coarse sand, trace fine gravel, little low to medium plasticity fines.		38.5	SS-11	6	8	6	14	
206.0	42.0	**SILT WITH SAND (ML, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, moist, yellow with pale yellow, trace mica, mostly medium plasticity fines, little fine sand. LL=49, PL=29, PI=20, NMC=25.4, %200=70.6**		43.5	SS-12	9	19	29	48	
201.0	47.0	**SANDY FAT CLAY (CH, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, moist, light purple with trace white, trace mica, mostly medium plasticity fines, little fine sand. LL=50, PL=27, PI=23, NMC=25.1**		48.5	SS-13	10	16	23	39	
196.0		@ 53.5 feet, very stiff, dry to moist, purple.		53.5						

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-10	**Boring Location:**	1246+85.0	**Offset:**	2.7' R	**Alignment:**	Mainline
Elev.:	246.0 ft	**Latitude:**	34.073307	**Longitude:**	80.928743	**Date Started:**	9/18/2014
Total Depth:	95.5 ft	**Soil Depth:**	95.5 ft	**Core Depth:**	20 ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		trace white, trace yellow, some fined sand.			SS-14	6	12	14	26
191.0	57.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, very stiff, moist, olive green and olive yellow, trace mica, mostly low plasticity fines, some fine sand.		58.5	SS-15	9	9	17	26
186.0		@ 63.5 feet, dark greenish gray, trace light red, medium sand to coarse gravel sized weathered rock fragments.		63.5	SS-16	8	11	11	22
181.0	67.0	**SILTY SAND (SM) -** PIEDMONT RESIDUUM, medium dense, moist, greenish gray, trace mica, mostly fine sand, some low plasticity fines.		68.5	SS-17	12	13	16	29
176.0		@ 73.5 feet, dense to very dense, dry to moist.		73.5	SS-18	16	23	26	49
171.0				78.5	SS-19	18	25	36	61
166.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-10	**Boring Location:**	1246+85.0	**Offset:**	2.7' R	**Alignment:**	Mainline
Elev.:	246.0 ft	**Latitude:**	34.073307	**Longitude:**	80.928743	**Date Started:**	9/18/2014
Total Depth:	95.5 ft	**Soil Depth:**	95.5 ft	**Core Depth:**	20 ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	82.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry to moist, greenish gray, mostly fine sand, some low plasticity fines.		83.5	SS-20	50/5"	100	
161.0				88.5	SS-21	50/5"	100	
156.0				93.5				
	94.0	@ 93.5 feet, no sample recovery.		94.0	SS-22	50/1"	100	
	94.5	**GRANITE -** gray, fine grained, slightly weathered to fresh rock, strong to very strong, no dip or discontinuities, 75% RQD, 100% REC, 45 RMR.		94.5	RC-1			
151.0		**GRANITE -** gray, fine grained, slightly weathered to fresh rock, very weak to medium strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, very close spacing, smooth, 81% RQD, 97% REC, 36 RMR.			RC-2			UC=446 psi
	99.5	**ANDESITE WITH CLAYSTONE SEAMS - gray, fine grained, highly weathered to fresh rock, medium strong to strong, 30 deg. dip, shear, tight discontinuity width, no infilling, planar surface, very close spacing, smooth, 43% RQD, 94% REC, 31 RMR.**		99.5	RC-3			UC=4,232 psi
146.0	104.5			104.5				
141.0		**ANDESITE WITH CLAYSTONE SEAMS - gray, fine grained, highly weathered to fresh rock, medium strong to very strong, no dip or discontinuities, 68% RQD, 95% REC, 40 RMR.**			RC-4			UC=6,551 psi & 18,872 psi

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-10	**Boring Location:**	1246+85.0	**Offset:**	2.7' R	**Alignment:**	Mainline
Elev.:	246.0 ft	**Latitude:**	34.073307	**Longitude:**	80.928743	**Date Started:**	9/18/2014
Total Depth:	95.5 ft	**Soil Depth:**	95.5 ft	**Core Depth:**	20 ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	109.0			109.0						
136.0		**ANDESITE -** gray, fine grained, slightly weathered to fresh rock, strong to very strong, 40 deg. dip, shear, tight discontinuity width, no infilling, planar surface, very close spacing, smooth, 60% RQD, 92% REC, 52 RMR.			RC-5					
	114.0	Boring Terminated at 114 feet.								
131.0										
126.0										
121.0										
116.0										

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-11	**Boring Location:**	1248+28.9	**Offset:**	43.6' R	**Alignment:**	Mainline
Elev.:	243.3 ft	**Latitude:**	34.07362	**Longitude:**	80.929062	**Date Started:**	9/15/2014
Total Depth:	76.9 ft	**Soil Depth:**	56.9 ft	**Core Depth:**	20 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0	**CONCRETE BRIDGE DECK**								
	1.0									
238.3										
233.3										
228.3		29 feet from Bridge Deck to Mudline								
223.3		▼								
218.3										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-11	**Boring Location:**	1248+28.9	**Offset:**	43.6' R	**Alignment:**	Mainline
Elev.:	243.3 ft	**Latitude:**	34.07362	**Longitude:**	80.929062	**Date Started:**	9/15/2014
Total Depth:	76.9 ft	**Soil Depth:**	56.9 ft	**Core Depth:**	20 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	29.0		29.0					
	29.2	**MUCK -** 2 inches of organic muck.						
213.3		**POORLY GRADED SAND (SP, A-3) - ALLUVIUM, very loose, wet, white, mostly fine to medium sand, trace non-plastic fines. %200=3.7**		SS-1	WOH	WOH	WOH	0
	31.0		31.0					
		SILTY SAND (SM) - ALLUVIUM, very loose, wet, dark brown, organically stained, mostly fine sand, little low plasticity fines.		SS-2	WOH	WOH	WOH	0
	33.0		33.0					
		POORLY GRADED SAND WITH SILT (SP-SM) - ALLUVIUM, very loose, wet, light gray, intermittent oraganics and lenses of organically stained brown silty sand, mostly fine to medium sands, few non-plastic fines.		SS-3	WOH	1	1	2
208.3			35.0					
				SS-4	WOH	WOH	2	2
	36.8		37.0					
		@ 35 feet, trace organics, trace fine quartz gravels.		SS-5	1	1	1	2
	38.0							
		CLAYEY SAND (SC) - ALLUVIUM, very loose, wet, light gray and white, mostly fine to medium sand, some low to medium plasticity fines.						
203.3								
		SILTY SAND (SM) - ALLUVIUM, very loose, moist, light grayish brown, micaceous, mostly fine sand, some low to medium plasticity fines.						
	42.0							
		SANDY SILT (ML) - COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist, light gray and yellow, mostly low plasticity fines, some fine to medium sand.	43.8	SS-6	19	10	19	29
198.3								
	47.0							
		SILT (MH, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist, light gray with trace dark brown and pale yellow, mostly high plasticity fines, few fine sands. LL=70, PL=36, PI=34, NMC=34.5	48.8	SS-7	13	7	9	16
193.3								
	52.0							
		FAT CLAY WITH SAND (CH, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist, purple and pale yellow, mostly high plasticity fines, little fine	53.8					

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-11	**Boring Location:**	1248+28.9	**Offset:**	43.6' R	**Alignment:**	Mainline
Elev.:	243.3 ft	**Latitude:**	34.07362	**Longitude:**	80.929062	**Date Started:**	9/15/2014
Total Depth:	76.9 ft	**Soil Depth:**	56.9 ft	**Core Depth:**	20 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
188.3		sand. LL=82, PL=24, PI=58, NMC=32.8			SS-8	3	5	8	13
				58.8					
183.3		@ 59 feet, light yellow, few fine sands. %200=72.1			SS-9	5	7	9	16
	62.0								
		SANDY SILT (ML) - PIEDMONT RESIDUUM, very stiff, moist, grayish green, mostly low to medium plasticity fines, some fine sand with little medium sand, weathered fragments.		63.8	SS-10	9	11	14	25
178.3									
				68.8					
					SS-11	10	13	15	28
173.3									
	72.0								
		PARTIALLY WEATHERED ROCK (PWR) - PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry to moist, grayish green with trace white, mostly fine to medium sand, some low to medium plasticity fines.		73.8	SS-12	50/3"			100
168.3									
				78.8					
		@ 79 feet, no sample recovery.			SS-13	50/2"			100
163.3									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-11	**Boring Location:**	1248+28.9	**Offset:**	43.6' R	**Alignment:**	Mainline
Elev.:	243.3 ft	**Latitude:**	34.07362	**Longitude:**	80.929062	**Date Started:**	9/15/2014
Total Depth:	76.9 ft	**Soil Depth:**	56.9 ft	**Core Depth:**	20 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				83.8				
158.3		@ 84 feet, no sample recovery.			SS-14	50/1"	100	●
	86.0	**GRANITE -** gray, fine grained, slightly weathered to fresh rock, strong to very strong, 5 deg. dip, vein, narrow discontinuity width, filled, quartz infilling, planar surface, extremely wide spacing, smooth, 100% RQD, 100% REC, 74 RMR.		86.0	RC-1			UC=23,445 psi & 21,801 psi
153.3								
	91.2	**GRANITE -** gray, fine grained, slightly weathered to fresh rock, strong to very strong, 5 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 88% RQD, 98% REC, 69 RMR.		91.2	RC-2			UC=22,478 psi
148.3								
	96.4	**GRANITE -** gray, fine grained, slightly weathered to fresh rock, strong, 60 deg. dip, vein, very narrow discontinuity width, filled, quartz infilling, planar surface, very close spacing, smooth, 100% RQD, 100% REC, 67 RMR.		96.4	RC-3			UC=11,952 psi
143.3								
	101.5	**GRANITE -** gray, fine grained, slightly weathered to fresh rock, strong, 60 deg. dip, vein, very narrow discontinuity width, filled, quartz infilling, planar surface, very close spacing, smooth, 74% RQD, 98% REC, 60 RMR.		101.5	RC-4			
138.3								
	105.9	Rock Coring Terminated at 105.9 feet. Boring Terminated at 105.9 feet.						

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-12	**Boring Location:**	1249+39.6	**Offset:**	42.6' L	**Alignment:**	Mainline
Elev.:	243.1 ft	**Latitude:**	34.073599	**Longitude:**	80.929525	**Date Started:**	9/15/2014
Total Depth:	69.5 ft	**Soil Depth:**	47.5 ft	**Core Depth:**	22 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	23.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0	**CONCRETE BRIDGE DECK**						
	1.6							
238.1								
233.1								
228.1		33 feet from Bridge Deck to Mudline						
223.1								
218.1								

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-12	**Boring Location:**	1249+39.6	**Offset:**	42.6' L	**Alignment:**	Mainline
Elev.:	243.1 ft	**Latitude:**	34.073599	**Longitude:**	80.929525	**Date Started:**	9/15/2014
Total Depth:	69.5 ft	**Soil Depth:**	47.5 ft	**Core Depth:**	22 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	23.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
213.1									
	33.0	**SILTY SAND (SM) -** ALLUVIUM, very loose, wet, dark gray, organically stained, mostly fine sands, some low plasticity fines.		33.0	SS-1	2	WOH	1	1
208.1	35.0	**CLAYEY SAND (SC, A-2)**COASTAL PLAIN - MIDDENDORF FORMATION, loose, wet, white, gray, mostly fine to medium sand, trace coarse sand, trace fine gravel, little non-plastic to low plasticity fines. %200=16.9		35.0	SS-2	5	4	3	7
		@ 37 feet, loose, wet, white, yellowish brown, yellow, mostly fine to medium sand, some low plasticity fines.		37.0	SS-3	3	4	3	7
203.1	39.0	**SANDY FAT CLAY (CH, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, firm, saturated, yellow, white, yellowish brown, mostly medium to high plasticity fines, some fine to medium sand, trace fine gravels. LL=62, PL=24, PI=38, NMC=27.5, %200=51.9**		39.0	SS-4	2	3	4	7
	41.0	**FAT CLAY WITH SAND (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist, grayish white, pale yellow, mostly medium plasticity fines, few fine sands. LL=52, PL=26, PI=26, NMC=22.8		41.0	SS-5	4	11	12	23
198.1	45.0	**SILT (ML, A-6) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist to wet, pale yellow, yellowish brown, gray, red, mostly low plasticity fines, few fine sands.		46.5	SS-6	5	8	9	17
193.1		@ 51.5 feet, gray, brown, yellowish brown. %200=80.4		51.5	SS-7	4	8	8	16

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-12	**Boring Location:**	1249+39.6	**Offset:**	42.6' L	**Alignment:**	Mainline
Elev.:	243.1 ft	**Latitude:**	34.073599	**Longitude:**	80.929525	**Date Started:**	9/15/2014
Total Depth:	69.5 ft	**Soil Depth:**	47.5 ft	**Core Depth:**	22 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	23.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
188.1	55.0	**SILT (ML) -** PIEDMONT RESIDUUM, very stiff, moist to wet, pale yellow, yellowish brown, gray, red, mostly low plasticity fines, few fine sands. @ 56.5 feet, yellowish brown, reddish yellow, brown.		56.5	SS-8	5	8	13	21
183.1	60.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Sandy Silt (ML), very hard, wet, brown, brownish white, yellowish brown, mostly low plasticity fines, some fine to medium sand, trace fine gravel.		61.5	SS-9	50/2"			100
178.1	65.0	**ELASTIC SILT (MH) -** PIEDMONT RESIDUUM, very hard, dry to moist, gray, dark gray, mostly low to medium plasticity fines, trace fine sand.		66.5	SS-10	24	40	45	85
173.1	70.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Elastic Silt (MH), very hard, dry to moist, gray, dark gray, mostly low to medium plasticity fines, trace fine sand.		71.5	SS-11	50/5"			100
168.1	75.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, moist, gray, dark gray, mostly fine to coarse sand, trace fine gravel, little low plasticity fines.		76.5	SS-12	50/3"			100
163.1	80.5	**GRANITE -** gray, fine grained, highly to		80.5					

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-12	**Boring Location:**	1249+39.6	**Offset:**	42.6' L	**Alignment:**	Mainline
Elev.:	243.1 ft	**Latitude:**	34.073599	**Longitude:**	80.929525	**Date Started:**	9/15/2014
Total Depth:	69.5 ft	**Soil Depth:**	47.5 ft	**Core Depth:**	22 ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-55	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	81%
Core Size:	2-inch (NQ-2)	**Driller:**	T. Miller	**Groundwater:**	**TOB** RW, N/A	**24HR**	23.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		slightly weathered, weak to medium strong, no dip or discontinuities, 26% RQD, 73% REC, 5 RMR.			RC-1			
	82.5			82.5				
		GRANITE - gray, fine grained, moderately to slightly weathered, weak to medium strong, 45 deg. dip, vein, very narrow to moderately wide discontinuity width, filled, quartz infilling, planar surface, very close spacing, smooth, 87% RQD, 100% REC, 48 RMR.			RC-2			UC=3,038 psi & 1,150 psi
158.1								
	87.5			87.5				
		CLAYSTONE - gray, fine grained, highly to slightly weathered, weak to medium strong, no dip or discontinuities, 53% RQD, 94% REC, 44 RMR.			RC-3			UC=1,030 psi
153.1								
	92.5			92.5				
		GNEISS - gray, white, medium to coarse grained, slightly weathered to fresh rock, weak to strong, 60 deg. dip, foliation, narrow discontinuity width, no infilling, wavy surface, close spacing, smooth, 84% RQD, 98% REC, 51 RMR.			RC-4			UC=1,798 psi
148.1								
	97.5			97.5				
		GNEISS - gray, white, medium to coarse grained, slightly weathered to fresh rock, weak to strong, 60 deg. dip, foliation, narrow discontinuity width, no infilling, wavy surface, close spacing, smooth, 83% RQD, 99% REC, 49 RMR.			RC-5			
143.1								
	102.5							
		Rock Coring Terminated at 102.5 feet.						
		Boring Terminated at 102.5 feet.						
138.1								

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-13	**Boring Location:**	1250+72.6	**Offset:**	1.4' L	**Alignment:**	Mainline
Elev.:	242.0 ft	**Latitude:**	34.073906	**Longitude:**	80.929802	**Date Started:**	9/9/2014
Total Depth:	122 ft	**Soil Depth:**	94.7 ft	**Core Depth:**	27.3 ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	**TOPSOIL -** approximately 1 inch of topsoil.		0.0	SS-1	6	9	9	18
		CLAYEY SAND (SC) - FILL, medium dense, dry to moist, grayish brown with yellow, mostly fine to medium sand with trace coarse sand, trace fine gravel, little low to medium plasticity fines.		2.0	SS-2	6	7	7	14
		@ 2 feet, moist, gray with brownish yellow and yellow, trace organics, with interbedded clay nodules and lenses.		4.0	SS-3	3	3	3	6
237.0	6.0	@ 4 feet, loose, brownish yellow and yellowish brown, trace white and red, mostly fine to medium sand, trace course sand, some medium plasticity fines.		6.0	SS-4	2	3	5	8
	8.0	**SANDY FAT CLAY (CH) -** FILL, firm, moist, mottled grayish brown, pale brown, brownish yellow, mostly high plasticity fines, some fine to medium sand.		8.0	SS-5	3	5	6	11
232.0		**SANDY FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist, mottled purple, yellow, and white, becoming light gray with depth, mostly high plasticity fines, some fine to medium sand.							
	12.0			13.5	SS-6	4	6	7	13
227.0		**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, mottled light gray with pink and trace pale brown, mostly fine to medium sand with few coarse sands, some low to medium plasticity fines.							
	17.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist to wet, light gray, mostly fine sand, little low plasticity fines.		18.5	SS-7	7	3	4	7
	19.5								
222.0		**SANDY LEAN CLAY (CL, A-6) - COASTAL PLAIN - MIDDENDORF FORMATION, firm, moist to wet, light gray, trace organics, mostly low to medium plasticity fines, some fine sand. LL=29, PL=16, PI=13, NMC=19.6**							
	22.0			23.5	SS-8	12	14	22	36
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet, white with brownish yellow, mostly fine to medium sand, trace coarse sand, little low plasticity fines, interbedded kaolinitic lenses.							
217.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-13	**Boring Location:**	1250+72.6	**Offset:**	1.4' L	**Alignment:**	Mainline
Elev.:	242.0 ft	**Latitude:**	34.073906	**Longitude:**	80.929802	**Date Started:**	9/9/2014
Total Depth:	122 ft	**Soil Depth:**	94.7 ft	**Core Depth:**	27.3 ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, medium dense, yellow and pale yellow, absent kaolinitic lenses.			SS-9	5	7	6	13	
212.0										
				33.5						
		@ 33.5 feet, dense, yellow with trace reddish yellow and white, mostly fine to coarse sand, trace fine gravel, little low to medium plasticity fines.			SS-10	6	16	15	31	
207.0										
	37.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, very loose, wet, reddish yellow with yellow, mostly fine to medium sand, little low plasticity fines, cemented lenses.		38.5						
					SS-11	1	WOH	1	1	
202.0										
	42.0	**SANDY LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, moist, pale yellow, trace yellow, mostly medium plasticity fines, some fine sand.		43.5						
					SS-12	15	13	16	29	
197.0										
	47.0	**FAT CLAY (CH, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist, purple with trace light gray, mostly medium to high plasticity fines, trace fine sands. LL=71, PL=30, PI=41, NMC=31.0, %200=98.3		48.5						
					SS-13	3	5	9	14	
192.0										
		@ 53.5 feet, light yellowish brown, brown,		53.5						

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-13	**Boring Location:**	1250+72.6	**Offset:**	1.4' L	**Alignment:**	Mainline
Elev.:	242.0 ft	**Latitude:**	34.073906	**Longitude:**	80.929802	**Date Started:**	9/9/2014
Total Depth:	122 ft	**Soil Depth:**	94.7 ft	**Core Depth:**	27.3 ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
187.0		mostly high plasticity fines, few fine sands. LL=97, PL=30, PI=67, NMC=38.4, %200=91.0			SS-14	4	6	7	13
	57.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, very stiff, moist, brown to greenish gray, mostly medium plasticity fines, some fine sand.		58.5	SS-15	11	11	15	26
182.0									
		@ 63.5 feet, hard, greenish gray with purple.		63.5	SS-16	8	13	18	31
177.0									
	67.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry to moist, dark greenish gray, mostly fine sand, some medium plasticity fines.		68.5	SS-17	24	40	50/5"	100
172.0									
				73.5	SS-18	27	40	50/3"	100
167.0		@ 75 feet, lense of fine gravel.							
		@ 78.5 feet, dry, greenish gray.		78.5	SS-19	50			100
162.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-13	**Boring Location:**	1250+72.6	**Offset:**	1.4' L	**Alignment:**	Mainline
Elev.:	242.0 ft	**Latitude:**	34.073906	**Longitude:**	80.929802	**Date Started:**	9/9/2014
Total Depth:	122 ft	**Soil Depth:**	94.7 ft	**Core Depth:**	27.3 ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 83.5 feet, dark greenish gray.		83.5	SS-20	50/5"			100	
157.0										
		@ 88.5 feet, dark greenish gray with trace of white.		88.5	SS-21	40	41	50/4"	100	
152.0										
		@ 93.5 feet, no sample recovery.		93.5	SS-22	50/1"			100	
	94.7			94.7						
147.0		**SCHIST -** gray, fine grained, slightly weathered to fresh rock, medium strong to strong, 45 deg. dip, shear, very narrow discontinuity width, partial clay infilling, planar surface, close spacing, smooth, 73% RQD, 89% REC, 49 RMR.			RC-1					UC=6,963 psi
	96.5			96.5						
		SCHIST - gray, fine grained, completely weathered to fresh rock, medium strong to strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 60% RQD, 90% REC, 49 RMR.			RC-2					UC=4,803 psi
142.0										
	101.5			101.5						
		SCHIST - gray, fine grained, moderately to slightly weathered, weak to strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 45% RQD, 80% REC, 44 RMR.			RC-3					UC=7,323 psi
137.0										
	105.7			105.7						
		SCHIST - gray, fine grained, slightly weathered, strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 78% RQD,			RC-4					
	107.0			107.0						

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-13	**Boring Location:**	1250+72.6	**Offset:**	1.4' L	**Alignment:**	Mainline
Elev.:	242.0 ft	**Latitude:**	34.073906	**Longitude:**	80.929802	**Date Started:**	9/9/2014
Total Depth:	122 ft	**Soil Depth:**	94.7 ft	**Core Depth:**	27.3 ft	**Date Completed:**	9/10/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	21.2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		100% REC, 53 RMR.						
132.0		**SCHIST -** gray, fine grained, slightly weathered to fresh rock, medium strong to strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 92% RQD, 98% REC, 66 RMR.			RC-5			UC=5,918 psi & 5,788 psi
	112.0			112.0				
		SCHIST - gray, fine grained, highly to slightly weathered, medium strong to strong, 45 deg. dip, shear, tight discontinuity width, filled, quartz infilling, planar surface, extremely wide spacing, smooth, 41% RQD, 80% REC, 44 RMR.			RC-6			
127.0								
	117.0			117.0				
		SCHIST - gray, fine grained, completely to slightly weathered, medium strong to strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 0% RQD, 29% REC, 39 RMR.			RC-7			
122.0								
	120.5			120.5				
		SCHIST - gray, fine grained, moderately to slightly weathered, medium strong to strong, 45 deg. dip, shear, tight discontinuity width, no infilling, planar surface, close spacing, smooth, 75% RQD, 100% REC, 49 RMR.			RC-8			
	122.0	Rock Coring Terminated at 122 feet.						
		Boring Terminated at 122 feet.						
117.0								
112.0								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-14	**Boring Location:**	1327+75.0	**Offset:**	6.6' R	**Alignment:**	Mainline
Elev.:	252.6 ft	**Latitude:**	34.087938	**Longitude:**	80.948901	**Date Started:**	9/11/2014
Total Depth:	110.6 ft	**Soil Depth:**	89.7 ft	**Core Depth:**	20.9 ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	17 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	**TOPSOIL -** approximately 1 inch of topsoil.		0.0	SS-1	6	6	5	11
		CLAYEY SAND (SC) - FILL, medium dense, dry to moist, yellowish brown, trace fine roots, some fine to medium sand with trace coarse sand, trace fine granite gravel, little low plasticity fines, intermittent Clay chunks.		2.0	SS-2	5	4	4	8
247.6		@ 2 feet, loose, moist, yellowish brown, trace reddish yellow, slightly micaceous, little low to medium plasticity fines.		4.0	SS-3	4	3	4	7
		@ 4 feet, trace fine granite gravel.		6.0	SS-4	1	2	6	8
	7.0	@ 6 feet, trace dark brown.		8.0	SS-5	4	6	6	12
	8.5	**SANDY LEAN CLAY (CL, A-6) -** FILL, firm, moist, light gray, trace purple and yellow, trace mica, mostly low to medium plasticity fines, some fine to medium sand. LL=33, PL=15, PI=18, NMC=12.6, %200=66.5							
242.6		**CLAYEY SAND (SC) -** FILL, medium dense, moist, white with trace pink and yellow, slightly micaceous, mostly fine to medium sand with trace coarse sand, trace fine quartz gravel, little medium plasticity fines.		13.5	SS-6	4	5	5	10
237.6		@ 13.5 feet, loose, pink and white with trace yellow.		18.5	SS-7	5	2	1	3
	19.0	**SILTY SAND (SM, A-2) -** ALLUVIUM, very loose, moist to wet, pale brown, mostly fine to medium sand, little low plasticity fines. %200=21.9							
232.6	22.0	**SANDY FAT CLAY (CH) -** ALLUVIUM, firm, moist, light gray with yellow becoming dark gray to black, large pieces of decaying wood, mostly medium plasticity fines, some fine to medium sand.		23.5	SS-8	3	5	2	7
227.6									
	27.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-14	**Boring Location:**	1327+75.0	**Offset:**	6.6' R	**Alignment:**	Mainline
Elev.:	252.6 ft	**Latitude:**	34.087938	**Longitude:**	80.948901	**Date Started:**	9/11/2014
Total Depth:	110.6 ft	**Soil Depth:**	89.7 ft	**Core Depth:**	20.9 ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	17 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		CLAYEY SAND (SC) - ALLUVIUM, very loose, wet, black, organics, mostly fine sand, some low plasticity fines.		28.5						
	29.0				SS-9	1	1	WOH	1	●
222.6		**CLAYEY SAND (SC) -** ALLUVIUM, very loose, wet, gray, mostly fine to medium sand, some low plasticity fines.								
	32.0			33.5						
		LEAN CLAY (CL, A-7-6) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, dry to moist, yellow, pale yellow, white, trace brown, micaceous, mostly low plasticity fines, few fine sands. LL=46, PL=25, PI=21, NMC=17.1			SS-10	8	14	21	35	○ × ● ×
217.6										
	37.0			38.5						
		SILT (ML) - PIEDMONT RESIDUUM, very stiff, moist, yellow and olive brown, slighly micaceous, mostly low to medium plasticity fines, few fine sands.			SS-11	8	12	16	28	●
212.6										
	42.0			43.5						
		@ 43.5 feet, hard, dry to moist, red with trace olive brown and yellowish brown, mostly low plasticity fines.			SS-12	12	14	20	34	●
207.6										
				48.5						
		@ 48.5 feet, very stiff, dark olive brown with trace dark bluish gray.			SS-13	9	11	14	25	●
202.6										
		SANDY SILT (ML) - PIEDMONT RESIDUUM, hard, moist, dark olive brown with trace dark bluish gray, slightly micaceous, mostly low to medium plasticity		53.5						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-14	**Boring Location:**	1327+75.0	**Offset:**	6.6' R	**Alignment:**	Mainline
Elev.:	252.6 ft	**Latitude:**	34.087938	**Longitude:**	80.948901	**Date Started:**	9/11/2014
Total Depth:	110.6 ft	**Soil Depth:**	89.7 ft	**Core Depth:**	20.9 ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	17 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		fines, some fine sand.			SS-14	12	14	22	36	
197.6				58.5						
					SS-15	16	20	26	46	
192.6										
	62.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Sandy Silt (ML), very hard, moist, dark olive brown with trace dark bluish gray, slightly micaceous, mostly low to medium plasticity fines, some fine sand.		63.5	SS-16	50/6"			100	
187.6										
	67.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, hard, moist, dark olive brown with trace dark bluish gray, slightly micaceous, mostly low to medium plasticity fines, some fine sand, trace quartz gravel.		68.5	SS-17	15	20	27	47	
182.6										
	72.0	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Silty Sand with Gravel (SM), very dense, dry, greenish gray, slightly micaceous, mostly fine to coarse sand, some fine gravel, some low plasticity fines.		73.5	SS-18	50/1"			100	
177.6										
		@ 78.5 feet, no sample recovery.		78.5	SS-19	50/1"			100	
172.6										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-14	**Boring Location:**	1327+75.0	**Offset:**	6.6' R	**Alignment:**	Mainline
Elev.:	252.6 ft	**Latitude:**	34.087938	**Longitude:**	80.948901	**Date Started:**	9/11/2014
Total Depth:	110.6 ft	**Soil Depth:**	89.7 ft	**Core Depth:**	20.9 ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	17 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 83.5 feet, no sample recovery.		83.5	SS-20	50/0"	100	
167.6				88.5	SS-21	50/1"	100	
	89.7	@ 88.5 feet, no sample recovery.		89.7	RC-1			
162.6		**SCHIST -** gray, fine grained, highly to moderately weathered, medium strong, 10 deg. dip, shear, tight discontinuity width, surface stain, planar surface, very close spacing, slightly rough, 0% RQD, 90% REC, 30 RMR.		91.4				
	91.4	**SCHIST -** gray, fine grained, highly to slightly weathered, weak to medium strong, 10 deg. dip, shear, tight discontinuity width, no infilling, planar surface, very close spacing, slightly rough, 27% RQD, 90% REC, 42 RMR.			RC-2			UC=7,030 psi
157.6				96.4				
	96.4	**SCHIST -** gray, fine grained, highly weathered to fresh rock, weak to strong, 45 deg. dip, shear, very narrow discontinuity width, no infilling, irregular surface, very close spacing, slightly rough, 64% RQD, 93% REC, 47 RMR.			RC-3			UC=5,122 psi & 8,086 psi
152.6				101.4				
	101.4	**SCHIST -** gray, fine grained, highly to slightly weathered, weak to medium strong, 60 deg. dip, shear, tight discontinuity width, no infilling, planar surface, very close spacing, smooth, 76% RQD, 92% REC, 51 RMR.			RC-4			UC=5,197 psi
147.6				106.4				
	106.4	**SCHIST -** gray, fine grained, highly to slightly weathered, medium strong, 60 deg. dip, shear, tight discontinuity width, no						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-14	**Boring Location:**	1327+75.0	**Offset:**	6.6' R	**Alignment:**	Mainline
Elev.:	252.6 ft	**Latitude:**	34.087938	**Longitude:**	80.948901	**Date Started:**	9/11/2014
Total Depth:	110.6 ft	**Soil Depth:**	89.7 ft	**Core Depth:**	20.9 ft	**Date Completed:**	9/11/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	2-inch (NQ-2)	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	17 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		infilling, planar surface, very close spacing, smooth, 48% RQD, 90% REC, 42 RMR.			RC-5			UC=5,710 psi
142.6	110.6	Rock Coring Terminated at 110.6 feet.						
		Boring Terminated at 110.6 feet.						
137.6								
132.6								
127.6								
122.6								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-15	**Boring Location:**	1328+67.5	**Offset:**	44.6' R	**Alignment:**	Mainline
Elev.:	253.7 ft	**Latitude:**	34.088185	**Longitude:**	80.949044	**Date Started:**	9/17/2014
Total Depth:	98.1 ft	**Soil Depth:**	98.1 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	28 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0	**CONCRETE BRIDGE DECK**								
	1.5									
248.7										
243.7										
		25.6 feet from Bridge Deck to Mudline								
238.7										
233.7										
228.7										
	25.6	**TOPSOIL & RIP RAP -** FILL, topsoil and fractured pieces of rip rap recovered in split		25.6	SS-1	18	7	4	11	●

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-15	**Boring Location:**	1328+67.5	**Offset:**	44.6' R	**Alignment:**	Mainline
Elev.:	253.7 ft	**Latitude:**	34.088185	**Longitude:**	80.949044	**Date Started:**	9/17/2014
Total Depth:	98.1 ft	**Soil Depth:**	98.1 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	28 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	27.6	spoon.		27.6					
	29.6	**SILTY SAND (SM, A-2) -** ALLUVIUM, very loose, wet, reddish yellow, mostly fine to medium sand, little low plasticity fines. %200=22.6		29.6	SS-2	WOR	WOR	WOR	0
223.7	31.6	**POORLY GRADED SAND (SP) - ALLUVIUM, very loose, wet, light yellowish brown, mostly fine to coarse sand, trace non-plastic fines.**		31.6	SS-3	WOR	WOR	WOR	0
		CLAYEY SAND (SC, A-7) - ALLUVIUM, very loose, wet, light gray to black, mostly fine to medium sand, some medium plasticity fines, some lenses of clean sand. %200=38.1			SS-4	WOR	WOR	WOR	0
218.7		@33.6 feet, (SC, A-2), lighty gray to brown, trace organics. %200=34.6		33.6	SS-5	WOH	WOH	1	1
	37.0	**POORLY GRADED SAND (SP) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, light gray, mostly fine to coarse sand, trace non-plastic fines.**		38.7	SS-6	7	10	15	25
213.7									
		@ 43.5 feet, driller missed sampling interval.		43.7	SS-7				
208.7									
	47.0	**LEAN CLAY (CL, A-7-6) -** PIEDMONT RESIDUUM, very stiff, moist, reddish brown, light greenish gray, trace purple, mostly medium plasticity fines, few fine sands. LL=48, PL=26, PI=22, NMC=19.4		48.7	SS-8	9	11	13	24
203.7									
	52.0	**SILT (ML) -** PIEDMONT RESIDUUM, very hard, moist, reddish brown, light greenish gray, trace purple, mostly low plasticity fines, some fine sand.		53.7					

SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-15	**Boring Location:**	1328+67.5	**Offset:**	44.6' R	**Alignment:**	Mainline
Elev.:	253.7 ft	**Latitude:**	34.088185	**Longitude:**	80.949044	**Date Started:**	9/17/2014
Total Depth:	98.1 ft	**Soil Depth:**	98.1 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	28 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / FINES CONTENT (%)
198.7					SS-9	17	25	40	65	
	57.0	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry to moist, reddish brown and greenish gray, mostly fine to coarse sand and weathered fragments, some low plasticity fines.		58.7	SS-10	30	43	50/3"	100	
193.7										
				63.7	SS-11	45	50/5"		100	
188.7										
		@ 69 feet, dark greenish gray.		68.7	SS-12	50/4"			100	
183.7										
		@ 74 feet, light greenish gray.		73.7	SS-13	50/1"			100	
178.7										
		@ 79 feet, light greenish gray with trace white.		78.7	SS-14	50/1"			100	
173.7										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-15	**Boring Location:**	1328+67.5	**Offset:**	44.6' R	**Alignment:**	Mainline
Elev.:	253.7 ft	**Latitude:**	34.088185	**Longitude:**	80.949044	**Date Started:**	9/17/2014
Total Depth:	98.1 ft	**Soil Depth:**	98.1 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	28 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
				83.7					
168.7		@ 84 feet, dark greenish gray.			SS-15	50/1"			100
				88.7					
163.7		@ 89 feet, no sample recovery.			SS-16	50/1"			100
				93.7					
158.7		@ 94 feet, no sample recovery.			SS-17	50/1"			100
				98.7					
153.7		@ 99 feet, no sample recovery.			SS-18	50/1"			100
				103.7					
148.7		@ 104 feet, light greenish gray.			SS-19	50/1"			100

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	JQuattlebaum
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-15	**Boring Location:**	1328+67.5	**Offset:**	44.6' R	**Alignment:**	Mainline
Elev.:	253.7 ft	**Latitude:**	34.088185	**Longitude:**	80.949044	**Date Started:**	9/17/2014
Total Depth:	98.1 ft	**Soil Depth:**	98.1 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	89%
Core Size:	N/A	**Driller:**	J. White	**Groundwater:**	**TOB** RW, N/A	**24HR**	28 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value
				108.7			
		@ 109 feet, no sample recovery.			SS-20	50/1"	100
143.7							
				113.7			
		@ 114 feet, no sample recovery.			SS-21	50/1"	100
138.7							
				118.7			
		@ 119 feet, no sample recovery.			SS-22	50/1"	100
133.7							
				123.7			
		@ 124 feet, no sample recovery.			SS-23	50/1"	100
128.7	125.2	Boring Terminated at 125.2 feet.					
123.7							

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-16	**Boring Location:**	1329+83.3	**Offset:**	9.6' L	**Alignment:**	Mainline
Elev.:	234.4 ft	**Latitude:**	34.08829	**Longitude:**	80.949446	**Date Started:**	9/17/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									0 10 20 30 40 50 60 70 80 90
	0.3	**TOPSOIL -** approximately 3 inches of topsoil.		0.0	SS-1	4	4	4	8	
		CLAYEY SAND (SC) - FILL, loose to medium dense, moist, tan, dark brown, mostly fine to medium sand, some low plasticity fines.		2.0	SS-2	3	4	10	14	
	4.0			4.0						
229.4	5.0	**SANDY LEAN CLAY (CL) -** FILL, very stiff, moist, gray, mostly low plasticity fines, some fine to medium sand.			SS-3	7	9	15	24	
	6.0	**CLAYEY SAND (SC) -** FILL, medium dense, moist, tan, gray, mostly fine to medium sands, mostly low plasticity fines.		6.0	SS-4	6	5	3	8	
		CLAYEY SAND (SC, A-6) - ALLUVIUM, loose to very loose, wet, tan, gray, organics and pieces of black wood, mostly fine to coarse sand, some low plasticity fines. %200=39.4		8.0	SS-5	2	1	1	2	
	9.0									
224.4		**FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, very soft to firm, wet, gray, mostly high plasticity fines, trace fine sand.		13.5	SS-6	2	3	3	6	
219.4										
	17.0	**POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, pale gray, mostly fine to coarse sand, few fine to medium subangular gravel, few low plasticity fines.		18.5	SS-7	10	13	14	27	
214.4										
	22.0	**SANDY SILT (ML, A-7-6) -** PIEDMONT RESIDUUM, hard, wet, green, gray, red, mostly medium plasticity fines, some fine sand, trace gravel. LL=49, PL=29, PI=20, NMC=36.4, %200=65.1		23.5	SS-8	4	11	20	31	
209.4										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-16	**Boring Location:**	1329+83.3	**Offset:**	9.6' L	**Alignment:**	Mainline
Elev.:	234.4 ft	**Latitude:**	34.08829	**Longitude:**	80.949446	**Date Started:**	9/17/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		@ 28.5 feet, very hard, moist, green, gray.		28.5						
					SS-9	11	22	36	58	●
204.4	30.5	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Sandy Silt (ML), very hard, moist, green, gray, mostly low plasticity fines, some fine sand, trace gravel.								
				33.5						
					SS-10	50/3"			100	●
199.4										
				38.5						
					SS-11	50/2"			100	●
194.4										
				43.5						
					SS-12	50/2"			100	●
189.4										
				48.5						
					SS-13	50/1"			100	●
184.4										
				53.5						

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-16	**Boring Location:**	1329+83.3	**Offset:**	9.6' L	**Alignment:**	Mainline
Elev.:	234.4 ft	**Latitude:**	34.08829	**Longitude:**	80.949446	**Date Started:**	9/17/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
179.4					SS-14	50/1"	100	
				58.5				
		@ 58.5 feet, no sample recovery.			SS-15	50/1"	100	
174.4								
				63.5				
		@ 63.5 feet, green, gray, white, some fine to medium sand.			SS-16	50/5"	100	
169.4								
				68.5				
		@ 68.5 feet, no sample recovery.			SS-17	50/1"	100	
164.4								
		@ 71 to 72 feet, quicker advancement of tri-cone roller during drilling.						
				73.5				
					SS-18	50/1"	100	
159.4								
				78.5				
		@ 78.5 feet, no sample recovery.			SS-19	50/1"	100	
154.4								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-16	**Boring Location:**	1329+83.3	**Offset:**	9.6' L	**Alignment:**	Mainline
Elev.:	234.4 ft	**Latitude:**	34.08829	**Longitude:**	80.949446	**Date Started:**	9/17/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/17/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	82.0								
		PARTIALLY WEATHERED ROCK (PWR) - PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, moist, green, gray, mostly fine to coarse sand, trace gravel, some low plasticity fines.		83.5	SS-20	50/3"			100
149.4									
				88.5	SS-21	50/2"			100
144.4									
				93.5	SS-22	44	41	50/3"	100
139.4									
		@ 98.5 feet, no sample recovery.		98.5	SS-23	50/2"			100
134.4	100.0	Boring Terminated at 100 feet.							
129.4									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-17	**Boring Location:**	1330+65.9	**Offset:**	6.6' L	**Alignment:**	Mainline
Elev.:	234.6 ft	**Latitude:**	34.088452	**Longitude:**	80.949638	**Date Started:**	9/18/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	**TOPSOIL -** approximately 3 inches of topsoil.		0.0	SS-1	5	6	9	15	
		CLAYEY SAND (SC) - FILL, medium dense, moist, tan, brown, orange, mostly fine to medium sand, some low plasticity fines.		2.0	SS-2	6	8	8	16	
		@3.5 feet, trace gravel, clean sand seam.		4.0	SS-3	7	7	10	17	
229.6	5.5									
	6.5	**SILTY SAND (SM) -** FILL, medium dense, moist, tan, gray, mostly fine coarse sands, some low plasticity fines.		6.0	SS-4	3	1	2	3	
		CLAYEY SAND (SC) - FILL, very loose, wet, dark gray, organics, mostly fine to medium sand, some low plasticity fines.		8.0	SS-5	1	1	1	2	
	8.5									
224.6		**SANDY LEAN CLAY (CL, A-7-6) - ALLUVIUM, very soft, wet, dark gray, organics, mostly low plasticity fines, some fine to medium sand. LL=47, PL=26, PI=21, NMC=59.1, %200=52.1**								
	12.0									
		CLAYEY SAND (SC, A-2) - ALLUVIUM, very loose, wet, dark gray, trace fine roots, mostly fine to coarse sand, some low plasticity fines.		13.5	SS-6	2	1	3	4	
219.6										
	16.0									
		POORLY GRADED SAND WITH GRAVEL (SP, A-1) - ALLUVIUM, medium dense, wet, pale tan, gray, mostly fine to coarse sand, some fine to medium subangular to subrounded gravel, trace fines. %200=2.7		18.5	SS-7	9	5	5	10	
	19.5									
214.6		**FAT CLAY WITH SAND (CH, A-7-6) - PIEDMONT RESIDUUM, stiff to hard, moist, greenish gray, mostly medium plasticity fines, little fine sand, trace gravel, lenses of PWR. LL=56, PL=25, PI=31, NMC=27.8, %200=71.3**		23.5	SS-8	5	6	10	16	
209.6										

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-17	**Boring Location:**	1330+65.9	**Offset:**	6.6' L	**Alignment:**	Mainline
Elev.:	234.6 ft	**Latitude:**	34.088452	**Longitude:**	80.949638	**Date Started:**	9/18/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5	SS-9	7	12	19	31	
204.6										
				33.5	SS-10	11	13	17	30	
199.6										
	37.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, very stiff, moist, greenish gray, mostly low to medium plasticity fines, some fine to medium sand.		38.5	SS-11	12	13	13	26	
194.6										
				43.5	SS-12	21	33	50/6"	100	
	44.5	**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Sandy Silty (ML), very hard, moist, green, gray, mostly low plasticity fines, little fine sand, trace gravel.								
189.6				48.5	SS-13	50/5"			100	
184.6										
				53.5						

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-17	**Boring Location:**	1330+65.9	**Offset:**	6.6' L	**Alignment:**	Mainline
Elev.:	234.6 ft	**Latitude:**	34.088452	**Longitude:**	80.949638	**Date Started:**	9/18/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
179.6					SS-14	50/6"	100	
				58.5				
		@ 58.5 feet, no sample recovery.			SS-15	50/1"	100	
174.6								
	62.0	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry, green, gray, mostly fine to coarse sand, some low plasticity fines.		63.5	SS-16	50/1"	100	
169.6		@ 65 to 65.25 feet, very hard drilling.						
		@ 68.5 feet, no sample recovery.		68.5	SS-17	50/1"	100	
164.6								
				73.5	SS-18	50/1"	100	
159.6								
		@ 78.5 feet, no sample recovery.		78.5	SS-19	50/1"	100	
154.6								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-17	**Boring Location:**	1330+65.9	**Offset:**	6.6' L	**Alignment:**	Mainline
Elev.:	234.6 ft	**Latitude:**	34.088452	**Longitude:**	80.949638	**Date Started:**	9/18/2014
Total Depth:	100 ft	**Soil Depth:**	100 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/18/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	2.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" / 2nd 6" / 3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				83.5	SS-20	50/1"	100	
149.6								
				88.5	SS-21	50/1"	100	
		@ 88.5 feet, no sample recovery.						
144.6								
				93.5	SS-22	50/2"	100	
139.6								
				98.5	SS-23	50/1"	100	
134.6	100.0	Boring Terminated at 100 feet.						
129.6								

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-18	**Boring Location:**	1332+01.8	**Offset:**	4.9' R	**Alignment:**	Mainline
Elev.:	255.6 ft	**Latitude:**	34.088735	**Longitude:**	80.949934	**Date Started:**	9/15/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	24.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.1	**TOPSOIL -** approximately 1.5 inches of topsoil.		1.0						
		SILTY SAND (SM) - FILL, medium dense, dry, tannish yellow, mostly fine to medium sand, little low plasticity fines.			SS-1	13	14	15	29	●
		@ 3.5 feet, moist, gray, dark brown, mostly fine to coarse sand.		3.5	SS-2	6	6	6	12	●
250.6	5.5	**CLAYEY SAND (SC, A-2) -** FILL, very loose, moist, tan, gray, mostly fine to coarse sand, some low plasticity fines. %200=25.6		6.0	SS-3	1	1	2	3	● ▲
				8.5	SS-4	1	2	2	4	●
245.6										
		@ 13.5 feet, medium dense, moist, pink, tan, gray, mostly fine to medium sand, some low plasticity fines, trace gravel.		13.5	SS-5	5	6	6	12	●
240.6										
		@ 18.5 feet, %200=28.6		18.5	SS-6	5	5	6	11	● ▲
235.6										
		▼		23.5	SS-7	4	8	19	27	●
230.6										
	27.0									

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-18	**Boring Location:**	1332+01.8	**Offset:**	4.9' R	**Alignment:**	Mainline
Elev.:	255.6 ft	**Latitude:**	34.088735	**Longitude:**	80.949934	**Date Started:**	9/15/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	24.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
		CLAYEY SAND (SC, A-6) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, gray, tan, brown, mostly fine sand, some low plasticity fines. %200=45.5		28.5	SS-8	6	5	7	12
225.6	32.0	**SILT (MH, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, hard to very stiff, moist, yellow, tan, mostly high plasticity fines, trace fine sand.		33.5	SS-9	8	13	19	32
220.6									
		@ 38.5 feet, LL=60, PL=33, PI=27, NMC=32.4		38.5	SS-10	6	10	17	27
215.6	42.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, very hard, moist, brown, mostly low plasticity fines, some fine sand.		43.5	SS-11	11	25	44	69
210.6									
	47.0	**LEAN CLAY WITH SAND (CL, A-6) - PIEDMONT RESIDUUM, very stiff, moist, green, gray, mostly low to medium plasticity fines, little fine sand. LL=36, PL=23, PI=13, NMC=26.3, %200=76.4**		48.5	SS-12	7	8	15	23
205.6									
	52.0	**SANDY SILT (ML) -** PIEDMONT RESIDUUM, very stiff to hard, moist, green, mostly low plasticity fines, mostly fine sand.		53.5					

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-18	**Boring Location:**	1332+01.8	**Offset:**	4.9' R	**Alignment:**	Mainline
Elev.:	255.6 ft	**Latitude:**	34.088735	**Longitude:**	80.949934	**Date Started:**	9/15/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	24.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
200.6				58.5	SS-13	6	10	15	25	
					SS-14	8	11	20	31	
195.6	60.0	**ELASTIC SILT (MH) -** PIEDMONT RESIDUUM, hard to very hard, moist, red, brown, gray, mostly high plasticity fines.		63.5	SS-15	10	16	27	43	
190.6				68.5	SS-16	14	21	34	55	
185.6				73.5	SS-17	17	29	38	67	
180.6	78.0									
175.6		**PARTIALLY WEATHERED ROCK (PWR) -** PIEDMONT RESIDUUM, sampled as Sandy Silty (ML), very hard, dry, green, gray, mostly low plasticity fines, some fine sand, trace gravel.		78.5	SS-18	50/3"			100	

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-18	**Boring Location:**	1332+01.8	**Offset:**	4.9' R	**Alignment:**	Mainline
Elev.:	255.6 ft	**Latitude:**	34.088735	**Longitude:**	80.949934	**Date Started:**	9/15/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	24.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				83.5	SS-19	50/2"	100	
170.6								
				88.5	SS-20	50/2"	100	
165.6								
				93.5	SS-21	50/1"	100	
160.6								
				98.5	SS-22	50/1"	100	
155.6								
				103.5	SS-23	50/2"	100	
150.6								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	M. Lucas
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	B-18	**Boring Location:**	1332+01.8	**Offset:**	4.9' R	**Alignment:**	Mainline
Elev.:	255.6 ft	**Latitude:**	34.088735	**Longitude:**	80.949934	**Date Started:**	9/15/2014
Total Depth:	120 ft	**Soil Depth:**	120 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/16/2014
Bore Hole Diameter (in):	4	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-550X	**Drill Method:**	Rotary Wash	**Hammer Type:**	Automatic	**Energy Ratio:**	83%
Core Size:	N/A	**Driller:**	R. Norwood	**Groundwater:**	**TOB** RW, N/A	**24HR**	24.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				108.5				
					SS-24	50/1"	100	●
145.6	110.0	**PARTIALLY WEATHERED ROCK (PWR)** - PIEDMONT RESIDUUM, sampled as Silty Sand (SM), very dense, dry, green, gray, mostly fine to coarse sand, some low plasticity fines, trace gravel.						
				113.5				
					SS-25	50/1"	100	●
140.6								
				118.5				
					SS-26	50/2"	100	●
135.6	120.0	Boring Terminated at 120 feet.						
130.6								
125.6								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-01	**Boring Location:**	1170+76.0	**Offset:**	0.7' R	**Alignment:**	Mainline
Elev.:	256.3 ft	**Latitude:**	34.054808	**Longitude:**	80.922794	**Date Started:**	9/9/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 28 ft	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.1	**TOPSOIL** - approximately 1 inch of topsoil.		0.0	SS-1	2	3	8	11	
	2.0	**SANDY SILT (ML, A-4) -** FILL, stiff, moist, yellowish brown, mostly medium plasticity fines, some fine to medium sand. LL=NP, PL=NP, PI=NP, NMC=7.8, %200=58.0		2.0	SS-2	12	16	20	36	
		SILTY SAND (SM, A-2-4) - FILL, dense, moist, brown, yellowish brown, mostly fine to medium sand, little non-plastic fines. (wet split spoon) LL=NP, PL=NP, PI=NP, NMC=7.7, %200=12.5		4.0	SS-3	3	10	5	15	
251.3	6.0	@ 4 feet, medium dense, wet to saturated, gray, brown, black, slight organic odor.		6.0	SS-4	11	11	11	22	
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist to wet, brown, yellowish brown, gray, mostly fine to medium sand, some medium to high plasticity fines.		8.0	SS-5	7	6	5	11	
246.3		@ 8 feet, gray, yellowish brown, brown, some medium plasticity fines.								
	12.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, brown, light brown, mostly fine to medium sand, few non-plastic fines.		13.5	SS-6	9	9	11	20	
241.3										
		@ 18.5 feet, wet to saturated, gray, dark gray.		18.5	SS-7	5	8	7	15	
236.3										
	22.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet to saturated, grayish white, mostly fine to medium sand, some low plasticity fines, nodules of medium plasticity fines.		23.5	SS-8	12	20	17	37	
231.3										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-01	**Boring Location:**	1170+76.0	**Offset:**	0.7' R	**Alignment:**	Mainline
Elev.:	256.3 ft	**Latitude:**	34.054808	**Longitude:**	80.922794	**Date Started:**	9/9/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 28 ft	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, saturated, yellow, brown, yellowish brown, mostly fine to medium sands, some low to medium plasticity fines.			SS-9	8	13	31	44	●
226.3	30.0	Boring Terminated at 30 feet.								
221.3										
216.3										
211.3										
206.3										

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-02	**Boring Location:**	1188+76.2	**Offset:**	8.1' R	**Alignment:**	Mainline
Elev.:	276.8 ft	**Latitude:**	34.05974	**Longitude:**	80.922321	**Date Started:**	9/9/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 14 ft	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL** - approximately 3 inches of topsoil.		0.0	SS-1	3	4	7	11
	2.0	**SANDY FAT CLAY (CH, A-7-6) -** FILL, stiff, dry to moist, gray, yellow, yellowish brown, mostly medium to high plasticity fines, little fine sand. LL=54, PL=24, PI=30, NMC=20.7, %200=63.2		2.0	SS-2	11	21	21	42
				4.0					
271.8	5.5	**SILTY SAND (SM, A-2-4) -** FILL, dense, dry to moist, grayish white, brown, yellowish brown, white, mostly fine to medium sand, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=10.6, %200=29.0			SS-3	7	14	21	35
		@ 4 feet, grayish white, pale yellow, brown, black, trace organics (6 in. seam), little low plasticity fines.		6.0	SS-4	21	30	31	61
	8.0			8.0	SS-5	8	12	12	24
266.8		**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, yellow, yellowish brown, mostly fine to medium sand, some low plasticity fines.							
		SILTY SAND (SM) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, yellow, mostly fine to medium sand, some low plasticity fines.		13.5	SS-6	5	5	7	12
		@ 13.5 feet, saturated, white, pale yellow, little low plasticity fines. (wet split spoon)							
261.8									
	17.0	**LEAN CLAY WITH SAND (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, saturated, white, yellow, grayish white, mostly medium plasticity fines, little fine to medium sand.**		18.5	SS-7	4	6	12	18
256.8	20.0	Boring Termintated at 20 feet.							
251.8									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-03	**Boring Location:**	1206+75.7	**Offset:**	0.4' L	**Alignment:**	Mainline
Elev.:	332.6 ft	**Latitude:**	34.064673	**Longitude:**	80.9219	**Date Started:**	9/2/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	Filled ATD

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	**TOPSOIL** - approximately 3 inches of topsoil.		1.0						
		SILTY SAND (SM, A-2-4) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, dry to moist, white, reddish yellow, yellowish brown, mostly fine to medium sand, little low plasticity fines, slighly micaceous. LL=NP, PL=NP, PI=NP, NMC=8.1, %200=27.6			SS-1	14	18	25	43	
	3.0			3.5						
327.6					SS-2	6	6	10	16	
	6.5	**ELASTIC SILT (MH, A-7-5) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, dry, white, red, yellowish brown, trace fine sands, mostly medium to high plasticity fines, micaceous. LL=70, PL=34, PI=36, NMC=27.1, %200=95.7		6.0	SS-3	8	10	14	24	
				8.5						
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, dry to moist, white, pale yellow, reddish brown, mostly fine to medium sand, some low to medium plasticity fines, trace mica.			SS-4	6	10	7	17	
322.6		@ 8.5 feet, moist to wet, reddish brown, yellowish brown, white, some low plasticity fines, Lean Clay (CL) lense at tip of split spoon.								
	13.5			13.5						
		LEAN CLAY (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry, white, gray, pale yellow, mostly medium to high plasticity fines, trace fine sand.			SS-5	12	23	38	61	
317.6										
		@ 18.5 feet, white, gray, yellowish brown.		18.5	SS-6	14	28	35	63	
312.6	20.0	Boring Terminated at 20 feet.								
307.6										

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-04	**Boring Location:**	1231+20.0	**Offset:**	6.5' R	**Alignment:**	Mainline
Elev.:	294.7 ft	**Latitude:**	34.070814	**Longitude:**	80.924541	**Date Started:**	9/2/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	30 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	**TOPSOIL** - approximately 4 inches of topsoil.		1.0						
		CLAYEY SAND (SC, A-6) - FILL, loose, dry to moist, yellowish brown, mostly fine to medium sand, little low plasticity fines. LL=27, PL=16, PI=11, NMC=10.4, %200=39.0			SS-1	4	4	6	10	
				3.5						
289.7		@ 3.5 feet, (SC, A-2-4), medium dense, moist, yellowish brown, white, gray, some low to medium plasticity fines. LL=25, PL=16, PI=9, NMC=11.1, %200=33.6			SS-2	4	6	6	12	
				6.0						
		@ 6 feet, yellow, reddish brown, white, little low plasticity fines.			SS-3	6	9	9	18	
				8.5						
		@ 8.5 feet, moist, brown, gray, white, trace orange, slight organic odor.			SS-4	3	5	7	12	
284.7										
	12.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, dry to moist, yellow, yellowish brown, mostly fine to medium sands, few non-plastic fines.		13.5	SS-5	3	5	5	10	
279.7										
				18.5						
		@ 18.5 feet, medium dense, increase in fines content.			SS-6	6	8	9	17	
274.7										
				23.5						
		@ 23.5 feet, white, yellow, yellowish brown, decrease in fines content.			SS-7	8	11	13	24	
269.7										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-04	**Boring Location:**	1231+20.0	**Offset:**	6.5' R	**Alignment:**	Mainline
Elev.:	294.7 ft	**Latitude:**	34.070814	**Longitude:**	80.924541	**Date Started:**	9/2/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	30 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
	29.5				SS-8	8	5	4	9	●
264.7		▼**LEAN CLAY WITH SAND (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, stiff, moist, gray, brown, mostly low plasticity fines, few fine sands.**								
	32.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet to saturated, white, yellow, pale yellow, mostly fine to medium sand, few non-plastic fines.		33.5						
					SS-9	4	9	7	16	●
259.7										
	37.0	**SANDY LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry, white, dark gray, purple, mostly medium to high plasticity fines, some fine sands.		38.5						
					SS-10	25	35	50/2"	100	●
254.7	40.0	Boring Terminated at 40 feet.								
249.7										
244.7										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-05	**Boring Location:**	1258+36.5	**Offset:**	4.8' L	**Alignment:**	Mainline
Elev.:	245.1 ft	**Latitude:**	34.075241	**Longitude:**	80.931749	**Date Started:**	9/2/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 16.8 ft	**24HR**	15.3 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL** - approximately 3 inches of topsoil.		1.0					
		SILTY SAND (SM, A-1-b) - COASTAL PLAIN - MIDDENDORF FORMATION, mostly dense, dry to moist, yellowish brown, mostly fine to medium sands, little medium plasticity fines. LL=NP, PL=NP, PI=NP, NMC=9.6, %200=24.5			SS-1	6	8	13	21
				3.5					
					SS-2	8	15	18	33
240.1	5.5	@ 3.5 feet, (SM, A-2-4) - dense, moist, yellowish brown, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=11.0, %200=20.8		6.0					
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, gray, mostly fine to medium sands, some medium plasticity fines.			SS-3	9	11	11	22
				8.5					
					SS-4	11	21	17	38
235.1		@ 7 feet, dense, white, some low plasticity fines, 6" lense of white SP sand.							
				13.5					
		@ 13.5 feet ,medium dense to very dense, wet, white, yellow, yellowish brown, little low plasticity fines.			SS-5	7	13	15	28
230.1									
				18.5					
					SS-6	15	17	41	58
225.1	20.0	Boring Terminated at 20 feet.							
220.1									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-06	**Boring Location:**	1273+68.2	**Offset:**	C/L	**Alignment:**	Mainline
Elev.:	254.0 ft	**Latitude:**	34.078223	**Longitude:**	80.93532	**Date Started:**	9/2/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 20 ft	**24HR**	14.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	**TOPSOIL** - approximately 4 inches of topsoil.		1.0						
		CLAYEY SAND (SC, A-4) - FILL, loose, dry to moist, gray, brown, mostly fine to medium sand, some low plasticity fines, trace organics, trace fine roots. LL=25, PL=16, PI=9, NMC=13.1, %200=37.4			SS-1	4	3	3	6	
	3.0			3.5						
		SANDY LEAN CLAY (CL, A-6) - FILL, firm, moist, yellowish brown, white, gray, mostly low to medium plasticity fines, some fine to medium sand. LL=40, PL=23, PI=17, NMC=19.0, %200=68.3			SS-2	3	3	4	7	
249.0										
	6.0			6.0						
		LEAN CLAY (CL) - FILL, firm, moist, white, gray, yellowish brown, mostly medium plasticity fines, trace fine sand, trace fine gravel.			SS-3	2	3	4	7	
	8.0			8.5						
		CLAYEY SAND (SC) - FILL, loose, dry to moist, gray, dark gray, white, mostly fine sand, some low to medium plasticity fines.			SS-4	2	3	2	5	
244.0										
	12.0									
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very loose, moist to wet, white, gray, pale yellow, mostly fine to medium sand, little low plasticity fines.		13.5	SS-5	1	1	1	2	
239.0										
		@ 18.5 feet, medium dense, saturated, yellowish brown, yellow, white. (wet split spoon)		18.5	SS-6	9	8	9	17	
234.0										
				23.5	SS-7	8	9	14	23	
229.0										

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-06	**Boring Location:**	1273+68.2	**Offset:**	C/L	**Alignment:**	Mainline
Elev.:	254.0 ft	**Latitude:**	34.078223	**Longitude:**	80.93532	**Date Started:**	9/2/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 20 ft	**24HR**	14.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, white, pale yellow, trace coarse sand.			SS-8	6	8	17	25	●
224.0										
				33.5						
		@ 33.5 feet, very dense to meduim dense, wet to saturated.			SS-9	10	36	50/2"	100	●
219.0										
				38.5						
					SS-10	2	3	10	13	●
214.0	40.0	Boring Terminated at 40 feet.								
209.0										
204.0										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-07	**Boring Location:**	1289+02.1	**Offset:**	2.3' R	**Alignment:**	Mainline
Elev.:	264.9 ft	**Latitude:**	34.081071	**Longitude:**	80.939128	**Date Started:**	9/2/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/2/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 19 ft	**24HR**	12.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL** - approximately 3 inches of topsoil.		1.0					
		SANDY LEAN CLAY (CL, A-6) - COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, dry, grayish white, pale yellow, mostly medium plasticity fines, some fine sand. LL=37, PL=24, PI=13, NMC=14.6, %200=67.9			SS-1	5	9	12	21
				3.5					
					SS-2	18	37	47	84
259.9		@ 3 feet, very hard, grayish white. LL=34, PL=18, PI=16, NMC=7.0, %200=68.8							
		@ 6 feet, grayish white, yellowish brown.		6.0					
					SS-3	12	21	30	51
	8.0								
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, dry to moist, white, gray, brown, mostly fine to medium sand, some medium plasticity fines.		8.5					
					SS-4	7	13	19	32
254.9									
		@ 13.5 feet, wet, white, pale yellow.		13.5					
					SS-5	7	10	12	22
249.9									
	17.0								
		SANDY LEAN CLAY (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, hard, dry to moist, white, gray, pale yellow, mostly medium plasticity fines, some fine sands.		18.5					
					SS-6	7	14	21	35
244.9	20.0	Boring Terminated at 20 feet.							
239.9									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-08	**Boring Location:**	1304+38.4	**Offset:**	C/L	**Alignment:**	Mainline
Elev.:	276.1 ft	**Latitude:**	34.083785	**Longitude:**	80.943015	**Date Started:**	9/3/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26 ft	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.2	**TOPSOIL** - approximately 2 inches of topsoil.		0.0	SS-1	2	4	6	10	
		CLAYEY SAND (SC, A-2-4) - FILL, loose, moist, yellowish brown, mostly fine to medium sands, little low plasticity fines. LL=22, PL=14, PI=8, NMC=8.5, %200=24.2		2.0	SS-2	5	4	4	8	
		@ 2 feet, white, gray, some low to medium plasticity fines. LL=26, PL=15, PI=11, NMC=10.7, %200=38.9		4.0	SS-3	3	3	1	4	
271.1		@ 4 feet, very loose, yellowish brown, gray, little low plasticity fines.		6.0	SS-4	1	3	4	7	
		@ 6 feet, loose, brown, gray, some low plasticity fines.		8.0	SS-5	7	5	6	11	
		@ 8 feet, medium dense, white, yellowish brown, gray, some medium to high plasticity fines.								
266.1	12.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist to wet, brownish gray, mostly fine to medium sands, some medium to high plasticity fines. (wet split spoon)		13.5	SS-6	3	5	5	10	
261.1	17.0	**FAT CLAY (CH) -** COASTAL PLAIN - MIDDENDORF FORMATION, hard to very stiff, moist, white, pale yellow, mostly medium to high plasticity fines, few fine fine to medium sands.		18.5	SS-7	13	18	19	37	
256.1		▼								
		@ 23.5 feet, white.		23.5	SS-8	8	11	15	26	
251.1		▽								
	27.0									

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-08	**Boring Location:**	1304+38.4	**Offset:**	C/L	**Alignment:**	Mainline
Elev.:	276.1 ft	**Latitude:**	34.083785	**Longitude:**	80.943015	**Date Started:**	9/3/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26 ft	**24HR**	21 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, dense, wet to saturated, white, yellow, reddish yellow, mostly fine sand, some low to medium plasticity fines. (wet split spoon)		28.5						
					SS-9	12	14	18	32	●
246.1	30.0	Boring Terminated at 30 feet.								
241.1										
236.1										
231.1										
226.1										

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-09	**Boring Location:**	1319+95.0	**Offset:**	6.9' L	**Alignment:**	Mainline
Elev.:	260.1 ft	**Latitude:**	34.086525	**Longitude:**	80.946964	**Date Started:**	9/3/2014
Total Depth:	25 ft	**Soil Depth:**	25 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 23 ft	**24HR**	13 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● / PL MC LL / ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.2	**TOPSOIL** - approximately 2 inches of topsoil.		0.0	SS-1	4	8	5	13	
	2.0	**CLAYEY SAND (SC, A-6) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines. LL=40, PL=20, PI=20, NMC=15.3, %200=45.6		2.0	SS-2	7	10	10	20	
				4.0						
255.1		**SILTY SAND (SM, A-2-4) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, dry to moist, yellowish brown, white, yellow, reddish yellow, mostly fine to medium sands, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=12.5, %200=32.8			SS-3	14	19	23	42	
				6.0						
					SS-4	20	23	22	45	
				8.0						
		@ 5 feet, dense, white, trace coarse sand, little low plasticity fines.			SS-5	8	14	16	30	
250.1		@ 6 feet, white, pale yellow, mostly fine to coarse sand.								
		@ 8 feet, moist, white, yellow, mostly fine to medium sand, little low plasticity fines with medium plasticity nodules.								
		▼		13.5						
		@ 13.5 feet, wet, white, yellow, yellowish brown, increase in low plasticity fines. (wet split spoon)			SS-6	12	18	31	49	
245.1										
				18.5						
		@ 18.5 feet, moist to wet, grayish white, yellow, yellowish brown, increase in fine sand, some low plasticity fines. (wet split spoon)			SS-7	8	14	26	40	
240.1										
	22.0									
		▽ **CLAYEY SAND (SC, A-6) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, saturated, white, pale yellow, mostly fine to coarse sands, some low to medium plasticity fines. (wet split spoon)		23.5	SS-8	10	12	11	23	
235.1	25.0									
		Boring Terminated at 25 feet.								

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-10	**Boring Location:**	1339+56.5	**Offset:**	4.7' L	**Alignment:**	Mainline
Elev.:	261.8 ft	**Latitude:**	34.090241	**Longitude:**	80.951646	**Date Started:**	9/3/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26 ft	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL** - approximately 4 inches of topsoil.		0.0	SS-1	3	4	5	9
	2.0	**CLAYEY SAND (SC, A-6) -** FILL, loose, dry to moist, yellowish brown, grayish white, mostly fine to medium sand, some low to medium plasticity fines. LL=31, PL=16, PI=15, NMC=11.6, %200=46.9		2.0	SS-2	3	5	9	14
256.8				4.0	SS-3	5	9	7	16
	6.0	**SILTY SAND (SM, A-2-4) -** FILL, medium dense, dry to moist, yellowish brown, gray, brown, mostly fine to medium sand, some low plasticity fines, trace fine gravel. LL=NP, PL=NP, PI=NP, NMC=10.3, %200=32.0		6.0	SS-4	10	12	12	24
	8.0	@ 4 feet, yellowish brown, brown, dark brown, trace fine gravel.		8.0	SS-5	8	5	4	9
251.8		**POORLY GRADED SAND WITH SILT (SP-SM) -** FILL, medium dense, dry to moist, light brown, dark brown, trace wood, trace fine roots, mostly fine to medium sand, few non-plastic fines, trace fine gravel.							
	12.0	**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, dry to moist, light brown, dark brown, mostly fine to medium sand, few non-plastic fines. (low sample recovery)		13.5	SS-6	2	3	3	6
246.8		**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, loose, moist, greenish white, yellowish brown, mostly fine to medium sand, some low plasticity fines. (wet split spoon)							
		@ 18.5 feet, medium dense, saturated. ▼		18.5	SS-7	6	7	8	15
241.8									
				23.5	SS-8	8	11	8	19
236.8		@ 23.5 feet, medium dense, wet to saturated, white, pale yellow, mostly fine to coarse sand, some low plasticity fines. (wet split spoon) ▽							
	27.0								

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

Continued Next Page

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-10	**Boring Location:**	1339+56.5	**Offset:**	4.7' L	**Alignment:**	Mainline
Elev.:	261.8 ft	**Latitude:**	34.090241	**Longitude:**	80.951646	**Date Started:**	9/3/2014
Total Depth:	30 ft	**Soil Depth:**	30 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/3/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 26 ft	**24HR**	19.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
		LEAN CLAY (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, very hard, dry, light gray, mostly medium plasticity fines, trace fine sands.		28.5						
					SS-9	33	50/1"		100	
231.8	30.0	Auger Refusal at 30 feet.								
		Boring Terminated at 30 feet.								
226.8										
221.8										
216.8										
211.8										

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-11	**Boring Location:**	1355+02.4	**Offset:**	5.1' R	**Alignment:**	Mainline
Elev.:	278.8 ft	**Latitude:**	34.093756	**Longitude:**	80.954501	**Date Started:**	9/4/2014
Total Depth:	25 ft	**Soil Depth:**	25 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 22 ft	**24HR**	10.9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									
	0.2	**TOPSOIL** - approximately 2 inches of topsoil.		0.0	SS-1	10	13	13	26	
		SILTY SAND (SM, A-4) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, yellowish brown, gray, mostly fine to medium sand, some low to medium plasticity fines. LL=NP, PL=NP, PI=NP, NMC=11.2, %200=41.9		2.0	SS-2	8	14	21	35	
	4.0			4.0						
273.8		@ 2 feet, (SM, A-2-4), dense, yellowish brown. LL=NP, PL=NP, PI=NP, NMC=7.7, %200=27.0			SS-3	10	14	15	29	
		FAT CLAY WITH SAND (CH) - COASTAL PLAIN - MIDDENDORF FORMATION, very stiff, dry to moist, gray, yellowish brown, mostly medium to high plasticity fines, few fine to medium sands.		6.0	SS-4	10	50/5"		100	
	8.0			8.0	SS-5	22	17	13	30	
		@ 6 feet, very hard, gray, little fine sand.								
268.8		**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, white, yellowish brown, yellow, mostly fine sand, some low plasticity fines.								
	12.0			13.5	SS-6	12	14	16	30	
263.8		**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet to saturated, white, mostly fine to medium sand, some low to medium plasticity fines. (wet split spoon)								
		@ 18.5 feet, saturated, white, yellow, yellowish brown. (low sample recovery, wet split spoon)		18.5	SS-7	10	12	15	27	
258.8										
				23.5	SS-8	6	8	2	10	
		@ 23.5 feet, loose, purple, gray, white, mostly fine to coarse sand, some low to medium plasticity fines.								
253.8	25.0									
		Boring Terminated at 25 feet.								

LEGEND

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

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SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-12	**Boring Location:**	1370+40.3	**Offset:**	0.1' R	**Alignment:**	Mainline
Elev.:	299.0 ft	**Latitude:**	34.097467	**Longitude:**	80.956851	**Date Started:**	9/4/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 14 ft	**24HR**	7.5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.2	**TOPSOIL** - approximately 2 inches of topsoil.		0.0	SS-1	6	11	10	21
		SILTY SAND (SM, A-2-4) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, dry to moist, yellowish brown, mostly fine to medium sand, little low to medium plasticity fines. (low sample recovery) LL=NP, PL=NP, PI=NP, NMC=9.5, %200=33.8		2.0	SS-2	6	8	11	19
294.0		@ 2 feet, gray, yellowish brown, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=12.6, %200=30.6		4.0	SS-3	18	16	15	31
		@ 4 feet, dense, moist, white, gray, yellow, yellowish brown, some low plasticity fines.		6.0	SS-4	8	10	21	31
	8.0	@ 6 feet, little low plasticity fines.		8.0	SS-5	8	10	13	23
289.0		**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, white, yellow, mostly fine to medium sand with trace coarse sand, some low to medium plasticity fines.		13.5	SS-6	9	10	12	22
		@ 13.5 feet, saturated, white, increase in medium sand. (wet split spoon)							
284.0				18.5	SS-7	12	14	16	30
		@ 18.5 feet, white, yellow, little low plasticity fines. (wet split spoon)							
279.0	20.0	Boring Terminated at 20 feet.							
274.0									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-13	**Boring Location:**	1385+88.6	**Offset:**	9.6' R	**Alignment:**	Mainline
Elev.:	321.7 ft	**Latitude:**	34.101253	**Longitude:**	80.959187	**Date Started:**	9/4/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 13 ft	**24HR**	5.9 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL** - approximately 4 inches of topsoil.		0.0	SS-1	8	11	14	25
		SILTY SAND (SM, A-2-4) - FILL, medium dense, dry, white, pale yellow, mostly fine to medium sand, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=9.2, %200=34.3		2.0	SS-2	16	21	21	42
		@ 2 feet, dense, moist. LL=NP, PL=NP, PI=NP, NMC=13.7, %200=32.1		4.0	SS-3	8	13	20	33
316.7	6.0	@ 4 feet, dense, dry to moist, white, mostly fine to medium sands, some low to medium plasticity fines, 4" lense of Silt (ML) within middle of spoon.		6.0	SS-4	24	24	18	42
		SANDY LEAN CLAY (CL) - COASTAL PLAIN - MIDDENDORF FORMATION, moist to wet, hard, white, mostly low to medium plasticity fines, some fine to medium sand.		8.0	SS-5	8	13	18	31
311.7	12.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, dense, moist, yellowish brown, yellow, gray, mostly fine to medium sand, some medium plasticity fines.		13.5	SS-6	9	11	30	41
306.7				18.5	SS-7	20	23	30	53
301.7	20.0	@ 19 feet, very dense, moist, white, gray, mostly fine to coarse sand, trace fine gravel, some medium to high plasticity fines.							
		Boring Terminated at 20 feet.							
296.7									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-14	**Boring Location:**	1401+32.0	**Offset:**	3.8' L	**Alignment:**	Mainline
Elev.:	312.2 ft	**Latitude:**	34.105098	**Longitude:**	80.96132	**Date Started:**	9/4/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 32.5 ft	**24HR**	19 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.7	**TOPSOIL** - approximately 8 inches of topsoil.		0.0	SS-1	2	4	5	9	
		SILTY SAND (SM, A-2-4) - FILL, loose, dry to moist, yellowish brown, mostly fine to medium sand, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=6.5, %200=22.3		2.0	SS-2	5	8	10	18	
		@ 2 feet, medium dense, pale yellow, yellowish brown. LL=NP, PL=NP, PI=NP, NMC=10.3, %200=27.5		4.0	SS-3	14	14	11	25	
307.2	5.5	@ 4 feet, yellowish brown, brown, gray, some low plasticity fines.		6.0	SS-4	8	9	10	19	
	6.5	**CLAYEY SAND (SC) -** FILL, medium dense, moist, orange with tan, mostly fine to medium sand, some low plasticity fines.		8.0	SS-5	10	11	13	24	
		SANDY LEAN CLAY (CL) - FILL, very stiff, dry to moist, grayish white, mostly low to medium plasticity fines, some fine sand.								
302.2		@ 8 feet, grayish white, gray, brown, interbedded thin sand seams.								
	12.0	**SANDY LEAN CLAY (CL) -** COASTAL PLAIN - MIDDENDORF FORMATION, firm, moist, grayish white, green, brown, reddish brown, trace fine roots, mostly low plasticity fines, some fine sand.		13.5	SS-6	2	3	3	6	
297.2										
	17.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist to wet, grayish white, white, yellow, mostly fine to medium sand, little low plasticity fines.		18.5	SS-7	7	10	10	20	
292.2										
		@ 23.5 feet, interbedded Silt (ML) lenses. (wet split spoon)		23.5	SS-8	8	8	11	19	
287.2										

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LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-14	**Boring Location:**	1401+32.0	**Offset:**	3.8' L	**Alignment:**	Mainline
Elev.:	312.2 ft	**Latitude:**	34.105098	**Longitude:**	80.96132	**Date Started:**	9/4/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 32.5 ft	**24HR**	19 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, loose, wet, little non-plastic fines.			SS-9	7	5	4	9	●
282.2										
	32.0	▽**SILT (ML) -** COASTAL PLAIN - MIDDENDORF FORMATION, very stiff to very hard, dry to moist, white, pale yellow, mostly low plasticity fines, few fine sands, trace fine gravel.		33.5	SS-10	8	12	15	27	●
277.2										
				38.5						
					SS-11	12	23	37	60	●
272.2	40.0	Boring Terminated at 40 feet.								
267.2										
262.2										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-15	**Boring Location:**	1416+77.7	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	307.8 ft	**Latitude:**	34.109274	**Longitude:**	80.962179	**Date Started:**	9/4/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 14 ft	**24HR**	7 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.6	**TOPSOIL** - approximately 7 inches of topsoil.		0.0	SS-1	2	8	7	15	
		SILTY SAND (SM, A-2-4) - medium dense, dry, brown, gray, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines. LL=NP, PL=NP, PI=NP, NMC=9.8, %200=35.4		2.0	SS-2	6	8	10	18	
	4.0	@ 2 feet, dry to moist, brown, yellowish brown, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=11.4, %200=23.2		4.0	SS-3	13	17	17	34	
302.8	5.5	**POORLY GRADED SAND WITH SILT (SP-SM) -** FILL, dense, dry to moist, brown, gray, black, trace organics, trace fine roots, trace wood fragments, mostly fine to medium sand, few non-plastic fines.		6.0	SS-4	9	9	7	16	
	7.0			8.0	SS-5	2	1	3	4	
297.8		**POORLY GRADED SAND WITH SILT (SP-SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, dry to moist, brown, gray, mostly fine to medium sand, few non-plastic fines.								
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet to saturated, grayish brown, brown, mostly fine to medium sand, some low to medium plasticity fines.		13.5	SS-6	3	6	7	13	
292.8		@ 8 feet, very loose, saturated, gray, mostly fine to coarse sand, trace fine gravel.								
		@ 13.5 feet, medium dense, wet, yellow, mostly fine to medium sand, little low to medium plasticity fines.		18.5	SS-7	7	11	9	20	
287.8		@ 18.5 feet, wet to saturated, white, gray, yellow, some low to medium plasticity fines. (wet split spoon)								
	22.0	**SILTY SAND (SM) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, saturated, yellow, mostly fine to medium sand, some low plasticity fines. (wet split spoon)		23.5	SS-8	5	9	9	18	
282.8										
	27.0									

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-15	**Boring Location:**	1416+77.7	**Offset:**	0.6' L	**Alignment:**	Mainline
Elev.:	307.8 ft	**Latitude:**	34.109274	**Longitude:**	80.962179	**Date Started:**	9/4/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 14 ft	**24HR**	7 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, grayish white, gray, yellow, mostly fine to coarse sand, some medium plasticity fines.		28.5	SS-9	19	29	43	72	
277.8	32.0	**SILT (ML) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, white, pale yellow, mostly low plasticity fines, trace fine sand.		33.5	SS-10	19	42	50/5"	100	
272.8				38.5	SS-11	12	39	50/2"	100	
267.8	40.0	Boring Terminated at 40 feet.								
262.8										
257.8										

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-16	**Boring Location:**	1432+27.0	**Offset:**	6.4' R	**Alignment:**	Mainline
Elev.:	317.9 ft	**Latitude:**	34.113532	**Longitude:**	80.962215	**Date Started:**	9/4/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/4/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 19 ft	**24HR**	5.1 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.3	**TOPSOIL -** approximately 3 inches of topsoil.		0.0	SS-1	3	5	8	13
		SILTY SAND (SM, A-1-b) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, yellow, brown, yellowish brown, mostly fine to medium sand, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=10.5, %200=21.5		2.0	SS-2	6	8	7	15
312.9		▼@ 2 feet, moist to wet, white, yellowish brown, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=15.4, %200=15.8		4.0	SS-3	6	6	9	15
		@ 5.5 feet, wet, white, pale yellow.		6.0	SS-4	3	6	8	14
		@ 6 feet, wet to saturated, white, yellowish brown, some non-plastic fines. (wet split spoon)		8.0	SS-5	9	13	15	28
		@ 8 feet, wet, white, yellowish brown, brown, little non-plastic fines.							
307.9									
	12.0	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, moist, brownish yellow, mostly fine to medium sand, some low to medium plasticity fines, 3 in. seam of Silt (ML).		13.5	SS-6	17	42	38	80
302.9									
		▽@ 18.5 feet, dense, moist to wet, yellowish brown, reddish brown, gray, mostly fine to medium sand with trace coarse sand, some medium plasticity fines, lense of Silt (ML) and Silty Sand (SM).		18.5	SS-7	9	17	29	46
297.9	20.0	Boring Terminated at 20 feet.							
292.9									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-17	**Boring Location:**	1447+56.5	**Offset:**	1.0' R	**Alignment:**	Mainline
Elev.:	326.8 ft	**Latitude:**	34.117735	**Longitude:**	80.962285	**Date Started:**	9/9/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** 15 ft	**24HR**	5 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE ● PL MC LL ▲ FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
	0.0									
	0.3	**TOPSOIL** - approximately 3 inches of topsoil.		0.0	SS-1	3	6	10	16	
		SILTY SAND (SM, A-1-b) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, yellow, white, gray, mostly fine to medium sand, some medium plasticity fines. LL=NP, PL=NP, PI=NP, NMC=11.2, %200=23.6		2.0	SS-2	10	9	9	18	
321.8		▼@ 2 feet, moist to wet, white, yellow, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=12.4, %200=14.2		4.0	SS-3	8	8	12	20	
	6.0	@ 4 feet, white, grayish white, little low plasticity fines.		6.0	SS-4	9	9	12	21	
		CLAYEY SAND (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, wet, yellow, pale yellow, mostly fine to medium sand, some low to medium plasticity fines. (water in split spoon)		8.0	SS-5	2	7	12	19	
316.8		@ 8 feet, yellow.								
		@ 13.5 feet, dense, saturated split spoon, some low plasticity fines.		13.5	SS-6	9	12	19	31	
311.8		▽								
		@ 18.5 feet, medium dense, wet to saturated, white, yellow.		18.5	SS-7	7	11	13	24	
306.8	20.0	Boring Terminated at 20 feet.								
301.8										

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-18	**Boring Location:**	1468+27.4	**Offset:**	8.5' R	**Alignment:**	Mainline
Elev.:	291.5 ft	**Latitude:**	34.123427	**Longitude:**	80.962329	**Date Started:**	9/9/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	10 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%)
	0.0									0 10 20 30 40 50 60 70 80 90
	0.4	**TOPSOIL -** approximately 5 inches of topsoil.		0.0	SS-1	3	8	11	19	
		SILTY SAND (SM, A-2-4) - FILL, medium dense, dry to moist, yellow, yellowish brown, gray, mostly fine to medium sand, some low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=6.6, %200=24.0		2.0	SS-2	8	6	6	12	
	4.0	@ 2 feet, gray, mostly fine sand, little low to medium plasticity fines. LL=NP, PL=NP, PI=NP, NMC=11.4, %200=38.3		4.0	SS-3	4	3	5	8	
286.5		**CLAYEY SAND (SC) -** FILL, loose, moist, brown, yellowish brown, gray, mostly fine to medium sand, some low to medium plasticity fines.		6.0	SS-4	13	13	12	25	
		@ 6 feet, medium dense, dry, brown, yellowish brown, mostly fine sand with trace coarse sand, some medium to high plasticity fines.		8.0	SS-5	13	15	14	29	
281.5		@ 8 feet, dry to moist, yellow, brown, yellowish brown, mostly fine to medium sand, some low to medium plasticity fines.		13.5	SS-6	4	7	9	16	
	14.5	**CLAYEY SAND (SC) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist, yellowish brown, brown, dark brown, gray, mostly fine to medium sand, trace fine gravel, some low to medium plasticity fines.								
276.5		@ 18.5 feet, moist, brown, dark brown, trace coarse sand, some medium plasticity fines.		18.5	SS-7	4	7	10	17	
271.5				23.5	SS-8	4	6	9	15	
		@ 23.5 feet, brown, yellowish brown, trace coarse sands, increase in medium plasticity fines.								
266.5										

LEGEND

Continued Next Page

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-18	**Boring Location:**	1468+27.4	**Offset:**	8.5' R	**Alignment:**	Mainline
Elev.:	291.5 ft	**Latitude:**	34.123427	**Longitude:**	80.962329	**Date Started:**	9/9/2014
Total Depth:	40 ft	**Soil Depth:**	40 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	10 ft

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	SPT N VALUE / PL MC LL / FINES CONTENT (%) 0 10 20 30 40 50 60 70 80 90
				28.5						
		@ 28.5 feet, loose, moist to wet, yellowish brown, brown, gray, trace coarse sands, trace fine gravel, some low to medium plasticity fines.			SS-9	3	2	3	5	●
261.5										
	32.0	**CLAYEY SAND WITH GRAVEL (SC) - COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, moist to wet, yellowish brown, mostly fine to coarse sand, some fine to coarse angular quartz gravel, some low to medium plasticity fines.**		33.5	SS-10	25	17	9	26	●
256.5										
	37.0	**SILT (ML) -** PIEDMONT RESIDUUM, very hard, dry, yellow, trace fine sands, trace gravel, mostly low plasticity fines.		38.5	SS-11	20	50/5"		100	●
251.5	40.0	Boring Terminated at 40 feet.								
246.5										
241.5										

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-19	**Boring Location:**	1478+36.8	**Offset:**	6.7' R	**Alignment:**	Mainline
Elev.:	295.0 ft	**Latitude:**	34.1262	**Longitude:**	80.962399	**Date Started:**	9/9/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	NE

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	**TOPSOIL** - approximately 1 inch of topsoil.		0.0	SS-1	2	4	6	10
		SILT (ML, A-7-5) - COASTAL PLAIN - MIDDENDORF FORMATION, stiff, dry, white, mostly low plasticity fines, trace fine sands. LL=43, PL=32, PI=11, NMC=17.7, %200=94.6		2.0	SS-2	10	17	19	36
290.0		@ 2 feet, hard to very hard. LL=49, PL=34, PI=15, NMC=13.1, %200=98.5		4.0	SS-3	8	18	20	38
		@ 4 feet, white, yellow.		6.0	SS-4	22	29	34	63
		@ 6 feet, white, yellow, grayish white.		8.0	SS-5	13	19	26	45
285.0									
				13.5	SS-6	22	31	44	75
		@ 13.5 feet, grayish white, pale yellow.							
280.0									
				18.5	SS-7	13	27	38	65
		@ 18.5 feet, white, grayish white.							
275.0	20.0	Boring Terminated at 20 feet.							
270.0									

SPT N VALUE

PL MC LL

FINES CONTENT (%)

0 10 20 30 40 50 60 70 80 90

LEGEND

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

SCDOT Soil Test Boring Log

File No.:		**Project No. (PIN):**	1461-14-046	**County:**	Richland	**Eng./Geo.:**	S. Jones
Site Description:	I-77 Widening Design/Build Preparation					**Route:**	I-77
Boring No.:	R-20	**Boring Location:**	1493+77.3	**Offset:**	6.3' R	**Alignment:**	Mainline
Elev.:	322.6 ft	**Latitude:**	34.130424	**Longitude:**	80.962765	**Date Started:**	9/9/2014
Total Depth:	20 ft	**Soil Depth:**	20 ft	**Core Depth:**	N/A ft	**Date Completed:**	9/9/2014
Bore Hole Diameter (in):	7.5	**Sampler Configuration**		**Liner Required:**	Y (N)	**Liner Used:**	Y (N)
Drill Machine:	CME-45	**Drill Method:**	3-1/4" HSA	**Hammer Type:**	Automatic	**Energy Ratio:**	87%
Core Size:	N/A	**Driller:**	T. Miller	**Groundwater:**	**TOB** NE	**24HR**	NE

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	0.0								
	0.1	**TOPSOIL -** approximately 1 inch of topsoil.		0.0	SS-1	4	8	9	17
	2.0	**SILTY SAND (SM, A-2-4) -** COASTAL PLAIN - MIDDENDORF FORMATION, medium dense, dry to moist, white, yellowish brown, brown, mostly fine to coarse sand, little low plasticity fines. LL=NP, PL=NP, PI=NP, NMC=8.3, %200=26.2		2.0	SS-2	38	50/3"		100
				4.0					
317.6		**SANDY SILT (ML, A-4) -** COASTAL PLAIN - MIDDENDORF FORMATION, very dense, dry, grayish white, white, yellowish brown, yellow, mostly non-plastic to low plasticity fines, some fine to coarse sand.			SS-3	17	25	23	48
				6.0					
	8.0	LL=NP, PL=NP, PI=NP, NMC=8.4, %200=65.7			SS-4	15	14	14	28
				8.0					
		@ 4 feet, dense, moist, grayish white, white, yellow, dark gray, trace fine gravel.			SS-5	14	12	15	27
312.6		@ 6 feet, medium dense, dry to moist, some fine to medium sand with trace coarse sand.							
		SILT (ML) - PIEDMONT RESIDUUM, very stiff, dry, grayish white, pale yellow, mostly low plasticity fines, trace fine sand.		13.5					
		@ 13.5 feet, very hard. (low sample recovery)			SS-6	16	22	33	55
307.6									
				18.5					
		@ 18.5 feet, trace coarse gravel.			SS-7	17	26	31	57
302.6	20.0	Boring Terminated at 20 feet.							
297.6									

● SPT N VALUE ●

PL MC LL

▲ FINES CONTENT (%)

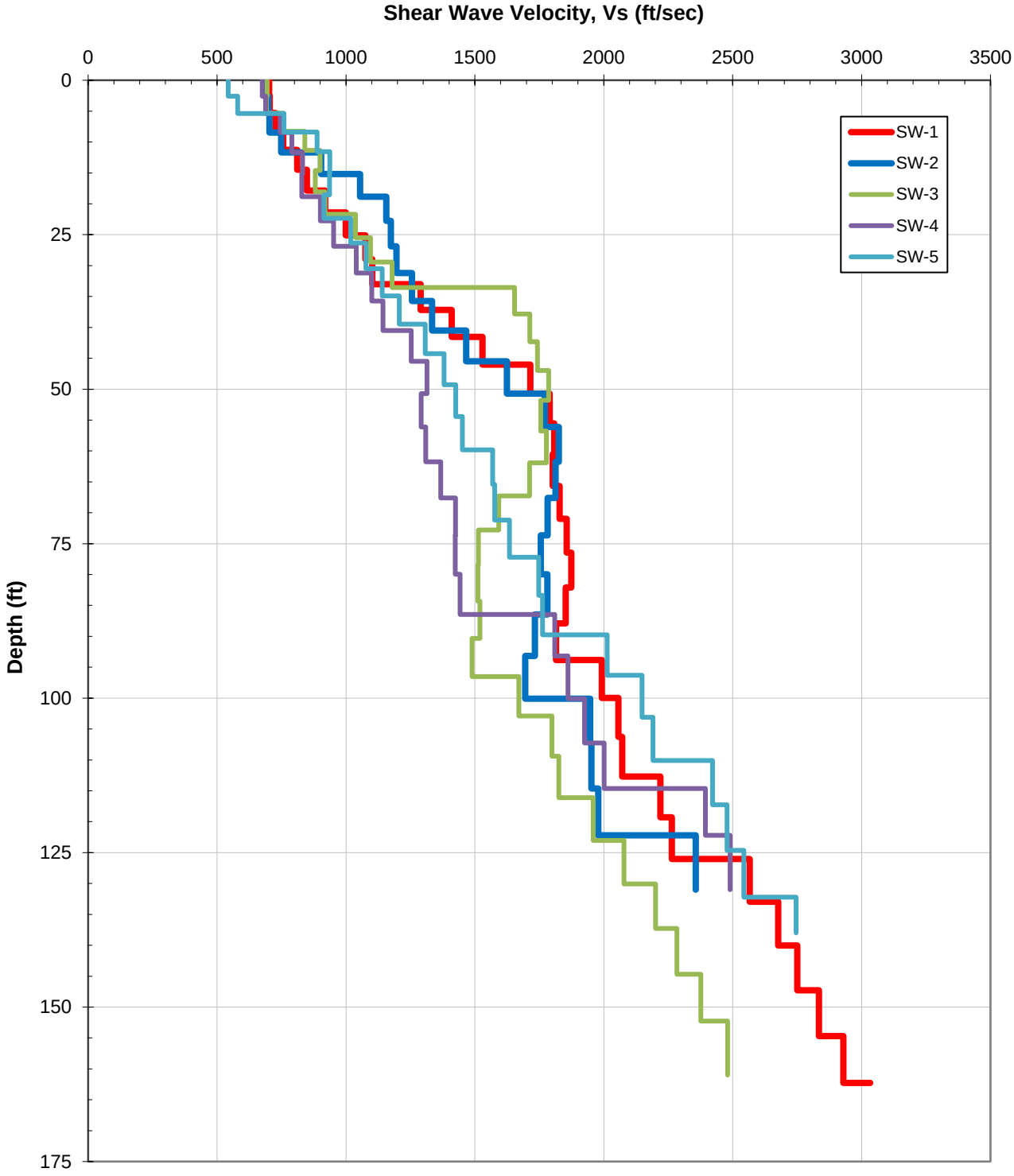
0 10 20 30 40 50 60 70 80 90

LEGEND

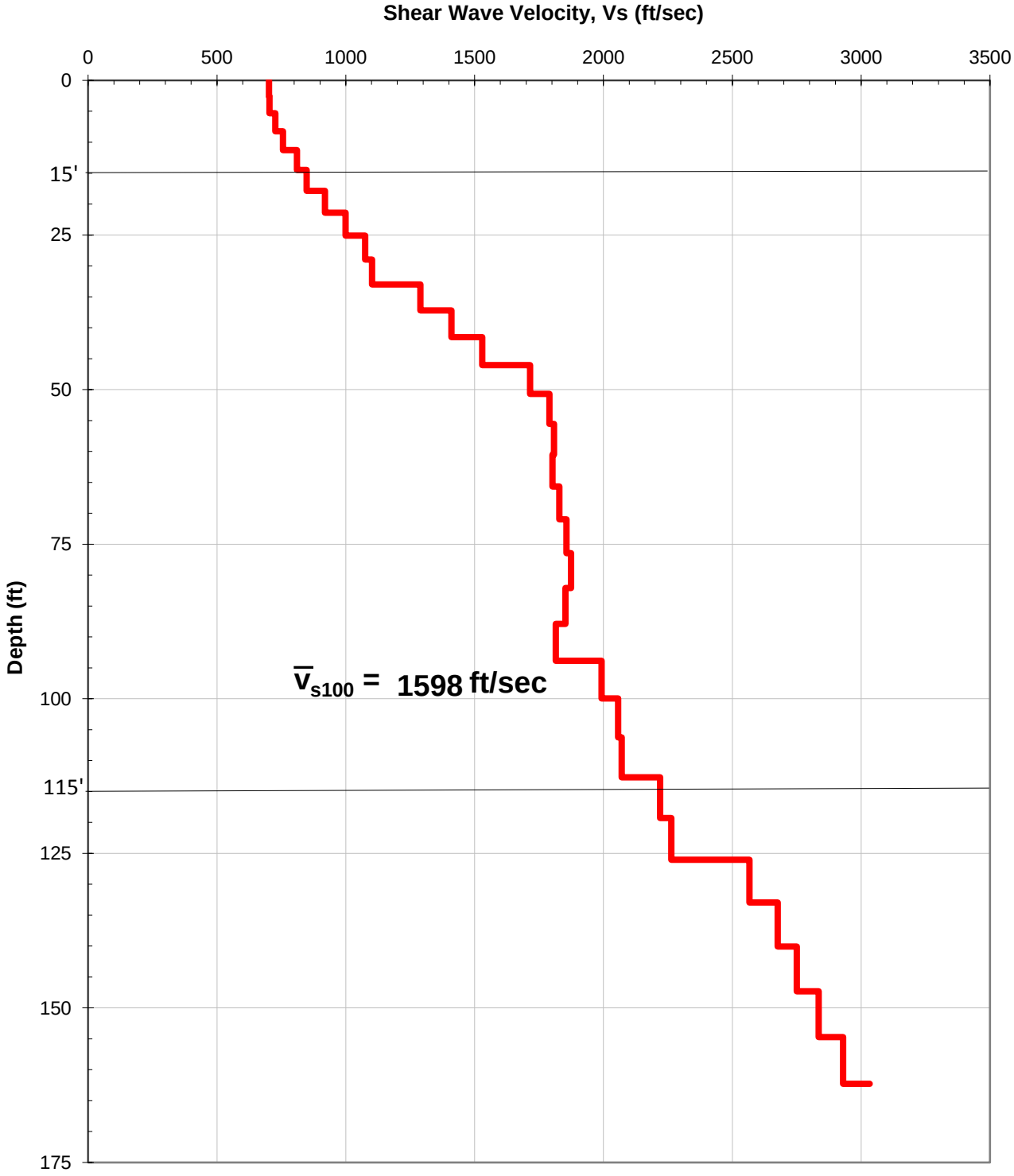
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SC_DOT 14-046 I-77 BORING LOGS.GPJ SC_DOT.GDT 5/19/15

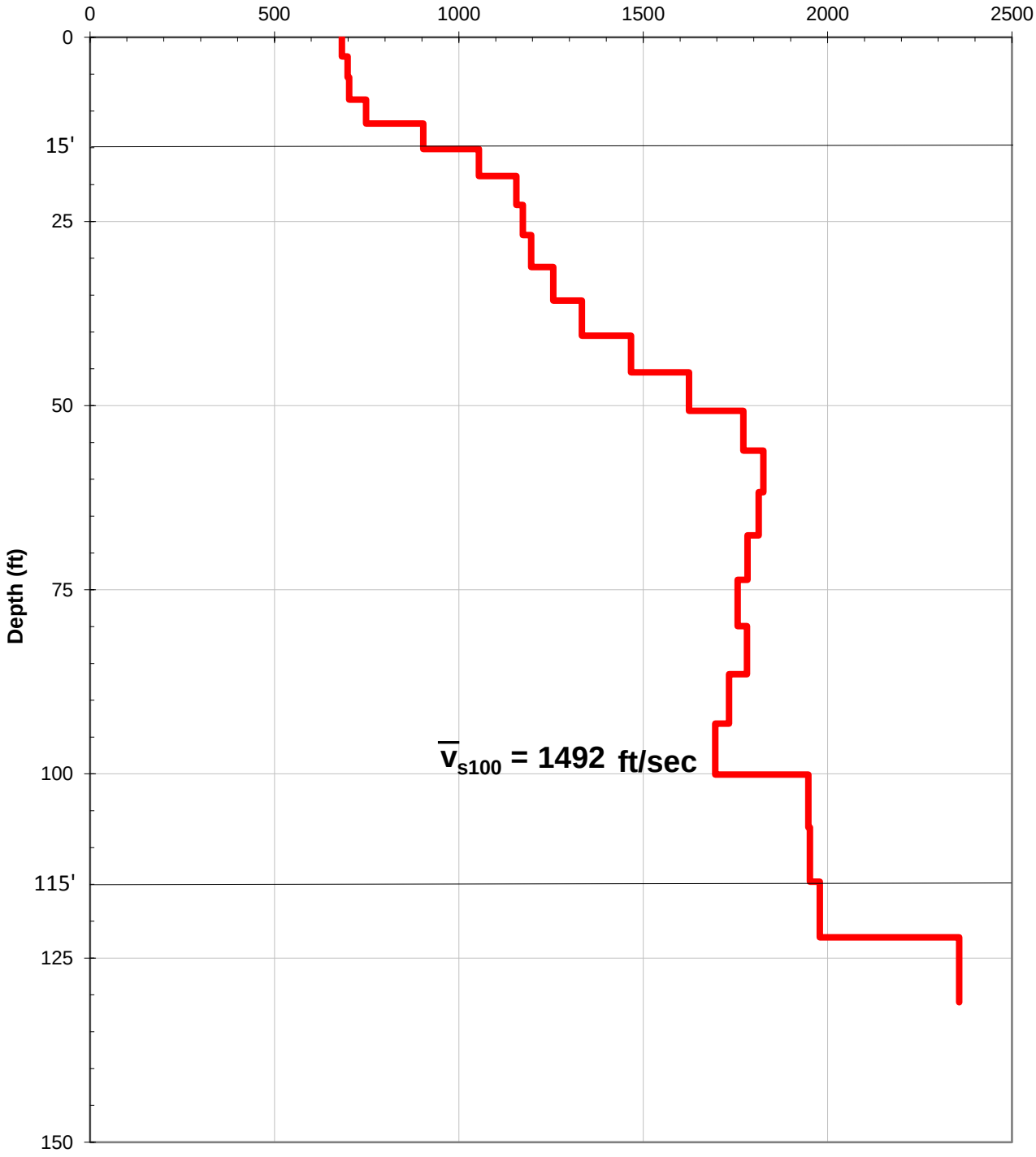
Shear Wave Velocity Profiles
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



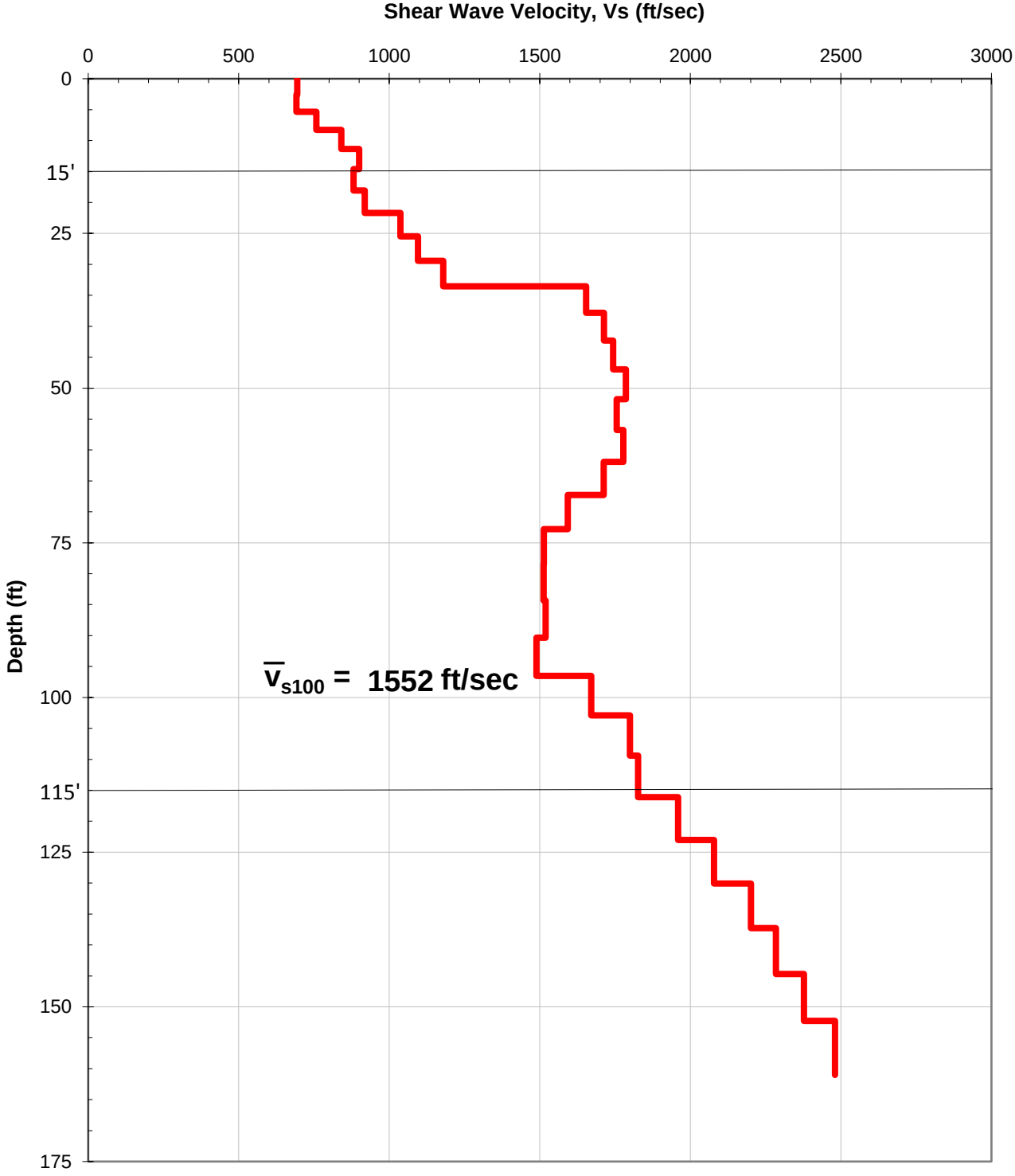
Shear Wave Velocity Profile SW-1
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



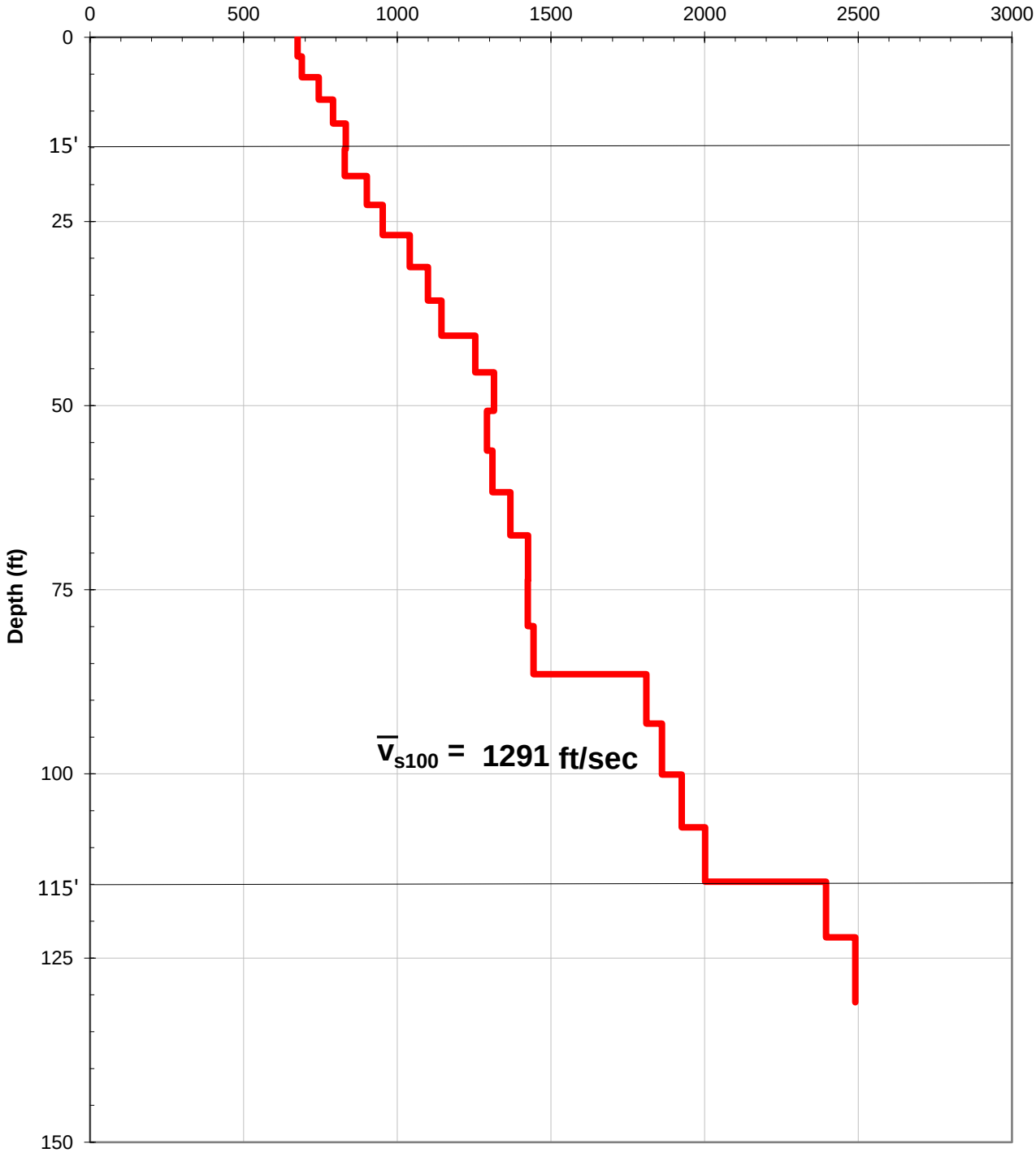
Shear Wave Velocity Profile SW-2
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



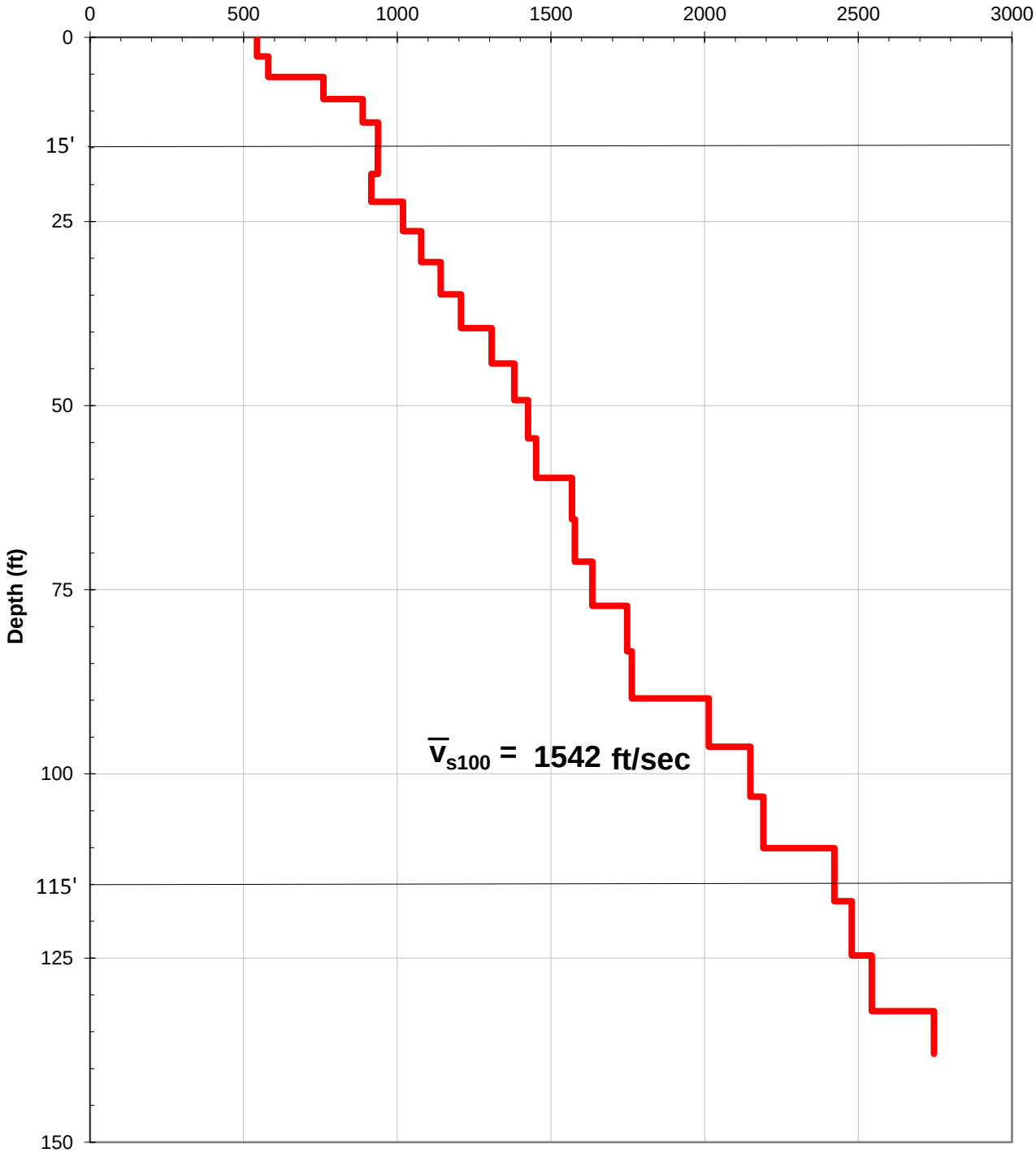
Shear Wave Velocity Profile SW-3
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



Shear Wave Velocity Profile SW-4
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



Shear Wave Velocity Profile SW-5
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046



SOIL BORING AND SAMPLING PROCEDURES

INTRODUCTION

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-98, "*Standard Guide to Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. 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

Where practical, we review available topographic maps, county soil surveys, reports of nearby investigations and aerial photographs when preparing the boring and sampling plan. Then 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.

PREPARATION OF EXPLORATION PLAN

The exploration plan or drilling assignment sheet consists of a set of written directions to the drillers or to other field exploration staff. The plan tabulates the minimum depth of borings, method of drilling and stabilizing the boring, sampling methods and depths, procedures for backfilling, and procedures to be followed if certain subsurface conditions were encountered.

The location, number and depth of the borings, the method of drilling, and the method and depths of sampling were discussed prior to commencement of the exploration and were outlined in our initial proposal. This scope of work formed the basis of the initial exploration plan attached in the appendices.

Utility Locator Service

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

Utility Checks with Owner

Where the site lies beyond junction boxes or meters these areas will not be checked by the utility location crews dispatched in response to our utility locate request. In these cases we check proposed sampling points for conflicts during the site walkover with a representative of the facility.

Federal, State and Local Regulatory Permitting

S&ME did not attempt to obtain federal or state permits for any part of its work unless specifically described in the accompanying report. S&ME also assumes that in circumstances where we are directed by the client to perform sampling or borings at specific locations - that these locations have been determined by the client to be in compliance with applicable regulatory statues.

Health and Safety Plan

A job-specific health and safety plan is not prepared for geotechnical explorations at sites with no known environmental contamination. Geotechnical explorations are conducted under the S&ME general health and safety plan.

Drilling Assumed to be Permitted at Designated Locations

S&ME assumes permission to perform borings or other exploratory work is conveyed either with notice to proceed by the client. Where S&ME personnel are denied access to proposed boring or sample locations upon or following arrival at the site, they are instructed to demobilize pending resolution of any dispute.

S&ME also assumes that contamination of the soils or ground water of the site has not occurred unless otherwise specifically indicated by the client in advance of our exploration. S&ME will not perform intrusive exploration in any area known to contain hazardous wastes except under a plan specifically prepared in advance. Where suspected hazardous materials are unexpectedly encountered, S&ME suspends all work and evacuates the area immediately until a determination can be made as to the nature of the material encountered.

Use of S&ME Data From Other Projects

Where previous S&ME boring or sounding data pertinent to the project is known to exist and can be readily retrieved, such data is incorporated into our evaluation process. Boring or sounding data, in-situ tests or laboratory data may be incorporated into the cross sections presented in the report. Boring and sounding records and laboratory records may also be included in the appendices or in summary tables embedded in the report.

Where boring or sounding records predate the computerized database record system now in use, records included in the report will be paper hard copies of the records in their original forms. In most cases S&ME will not re-enter the data into the database to produce a new record in the current format.

Use of Other Firms' Boring and Sounding Data

While S&ME may review this data as part of planning of our exploration, such data will not be incorporated into our evaluation unless the data is independently verified by S&ME using parallel borings or other appropriate means, except under some very limited circumstances which will be detailed in the text of the project report.

Other firms' boring or sounding records typically can not be read by the computerized database record system now in use by S&ME. Foreign boring or sounding records included in the report will be paper hard copies of the records in their original forms. In most cases S&ME will not re-enter foreign data into the S&ME database to produce a new record in the current format.

Use of Building Plans and Construction Data

Where S&ME is provided as-built building plans, pile driving records, PDA data or other construction data pertinent to the project, such data is incorporated into our evaluation process. However, S&ME can typically not independently verify the accuracy of as-built data.

S&ME

SOIL BORING AND SAMPLING PROCEDURES (continued)

FIELD LAYOUT AND SAMPLE POINT ELEVATIONS

The type of site plan provided to us determines largely how well the sampling locations can be depicted on the site. We normally locate sampling points using very rough field methods. The report will indicate the type of layout plan we use to locate each sampling point, how we approximate each sampling point elevation, and how we stake the sampling point location in the field.

Layout Plan

There are typically five alternative means available to depict sampling point locations. Which one is used depends on the type of drawing or map provided to us by the client or his designer.

(1) No Plan or Sketch Provided – Where the client provides no plan of the site, we will prepare a sketch using large scale aerial photographs, USGS topographic maps, or plain paper as a base. The sketch is not to scale. The "Boring Location Plan" will depict only very a general location of each sampling point relative to the proposed construction.

(2) Unscaled Sketch – Where the client provides only an unscaled sketch of the site indicating proposed structures, we attempt to reproduce that sketch as the "Boring Location Plan." We will plot the sampling points on the sketch. But we can not warrant that the sketch depicts the true positions of the sampling points relative to one another, to physical features on the site, or to the actual dimensions of the structure.

(3) Scaled Survey Property Plat – Where the client provides a scaled survey property plat that shows property corners and major site features, we attempt to reproduce the plat as the "Boring Location Plan." We will plot sample points at their approximately locations using reconnaissance methods described below. But plotted locations depicted on the plan are not warranted.

(4) Scaled Topographic Site Survey – Where a topographic site survey plan is provided, indicating the general orientation or outline of proposed structures, S&ME attempts to reproduce this drawing with sampling points indicated in their approximate positions subject to the limitations of the method used in staking the locations, using normal care and diligence in plotting the positions. We emphasize that the plotted positions are not exact.

(5) Scaled Building Layout Plan – Where we are provided a building layout plan indicating numbered column lines prior to commencement of field work, we attempt to reproduce the plan with sampling points approximately plotted relative to the column lines.

Sampling Point Elevations

S&ME does not directly measure ground surface elevation at the sample points, unless this is included in the contract, We estimate sample point elevations in several ways, which we describe below. The attached report states the method used.

(1) No Elevation Information Provided – Where a topographic site plan is not available, we do not show elevations. Boring data and strata are stated in terms of depth below ground on all boring records.

(2) Interpolation From Large Scale Topographical Maps – We may get a rough elevation for each boring from a large-scale topographic quadrangle map of the area. We use this method only on very rough sites, with large differences in elevation. We do this only to profile uneven ground. Elevations are "illustration only" and do not accurately show site contours.

(3) Interpolation From Topographic Site Plan – We interpolate the elevation of each boring from the plotted contours on topographic site plans. We use the care and judgment ordinarily exercised in similar work. We consider sample point elevations accurate only to the degree that the contours shown on the plans reflect actual site topography.

(4) Use of Spirit Level – S&ME may use a spirit level to measure ground surface elevations at sampling point locations. S&ME establishes a temporary benchmark on the site as a reference point for the survey. This is done only when specifically stated in our proposal as part of our scope of work for the project,

S&ME uses the degree of care normally exercised for rough layout work, but we do not attempt to tie survey loops back to the origin. Boring elevations must be considered approximate and not exact.

(5) Leveling Survey by Others - Top-of-ground elevations are surveyed by others at sampling point locations. They then provide the elevations to us for us to use to complete our report. We do not independently verify any of the surveyed elevations.

Staking of Sampling Points in the Field

Since S&ME does not provide surveying services, typically we provide only rough staking of sample point locations, unless specifically required in our contracted scope of services. The report will describe the means used to locate sampling points in the field.

(1) Reconnaissance Methods - Locations are stepped off from existing site features, turning rough right angles from existing features marked on the site plan. Locations are marked with small colored flags with the sampling point numbers inscribed.

(2) Rough Measurement - Sampling points are laid out by measuring distances from existing site features with a measuring wheel and by turning rough right angles from existing features. Locations were marked in the field with small colored flags.

(3) Handheld Global Positioning System – Sampling points are laid out using a hand-held Global Positioning System (GPS) device. The GPS measures from a base coordinate on the site provided to us before beginning field work. The device used is considered accurate within 1 meter of the true coordinate.

(4) Surveyed and Marked by Others Prior to Exploration – Sampling points are staked by others. Sampling point numbers shown on the attached "Boring Location Plan" match markings on the survey stakes at each boring location. Offsets from staked locations are indicated on the sampling point records.

(5) Surveyed and Marked by Others Subsequent to Exploration – Sampling point locations are surveyed by others after drilling and sampling was completed. Sampling point numbers shown on the attached "Boring Location Plan" match markings left on the survey stakes or flags at each sampling point location by our crew. Sampling point locations on the "Boring Location Plan" are accurate only to the degree of surveying accuracy used by the surveyor.

S&ME

SOIL BORING AND SAMPLING PROCEDURES (continued)

ACCESS TO SAMPLING LOCATIONS

We perform all borings at marked location stakes unless they are offset because of slopes, ditches, overhead power or other obstructions. Where we must offset from the stake, we indicate the offset distance and relative direction on the field boring record. The final Soil Test Boring Record and the attached "Boring Location Plan" in the Appendix indicates all offsets.

(1) ATV Access Over Sloping Ground - All-terrain-mounted drilling and sampling equipment allows movement to the sampling points over sloping ground. This requires careful alignment and positioning of the rig on the face of the slope during both ascent and descent. The crew moves only over a marked access route to each staked boring location. They attempt to move only on firm ground and they avoid rutting or disturbing the surface as much as possible. We do not attempt to repair any ruts or other disturbance unless required by our contract.

(2) Access Restricted by Stacked Construction Materials S&ME makes no attempt to pick up or move construction materials obstructing access to the borings. In these cases we offset the borings from the stakes to provide safe clearance between the drilling equipment and the material.

(3) Access Restricted by Soft, Marshy Ground - Truck-mounted drilling and sampling equipment can usually only access soft, marshy sites on existing roads or paths - dirt, gravel, pavement. Where they need to move on natural ground, the crew will move only over marked routes to the staked boring locations. They will attempt to move only on firm ground and will limit rutting or disturbance of the ground surface as much as they can. S&ME's field crew also will avoid cutting or taking apart any fences to reach any of the staked borings, except where the landowner specifically grants permission.

(4) Access Restricted by Locked Gates or Fences – Where access to sampling points is prevented by gates or fences, we defer performing these borings until the end of field work. In the meantime we attempt to obtain access through the land owner. S&ME will make no attempt to cut locks or disassemble any fencing to access boring locations.

(5) Access Restricted by Parked Vehicles – Where parked cars or trucks restrict our access to sampling points, we defer performing these borings until the parking locations are empty. At that time we place a traffic cone in the vacated spot until the boring can be performed. Where this can not be done, we offset the boring to the closest feasible location that does not block traffic.

(6) Access Restricted by Overhead Utilities - Access to one or more of the sampling points may be restricted by close clearances to energized utilities. In this case we make no attempt to perform the boring at the staked location. We offset the boring a sufficient distance to provide a minimum clearance or we abandon the boring.

(7) Access Along Highways – Where a sampling point lies close to heavy traffic, we perform lane or shoulder closures using the signage layout shown in state department of transportation work zone safety guidelines. Closures may be either two-lane or four-lane, and may include flagmen or police.

We may need to shift traffic to opposing lanes or establish one-way traffic during the lane closure period. Public notice of all work is made to the media before any operation which requires shifting lanes. Supplemental traffic control, including floggers, barriers and flashing signs are also required.

(8) Use of Temporary Work Barriers Required – We may place traffic cones, stanchions and rope, tape, or wooden barricades when drilling in public areas. This is to prevent people from approaching the rig. We then remove these barriers when the rig is moved. .

(9) Access by ATV, Vegetation Pushed Over - Where the site is lightly to moderately covered with small brush or saplings, flagged sampling points may be accessed by either a truck-mounted or all-terrain tractor mounted drill rig by pushing over underbrush or saplings as required. It is understood in our contract that no attempt will be made to restore the access route to its original condition. To the extent possible, the crew avoids pushing over man-made plantings such as crops, ornamental shrubs or fruit trees.

(10) Heavy Vegetation, Dozer Clearing - A crawler-mounted bulldozer is often needed to get to staked boring locations in heavy woods. The dozer follows flags or other marks that our personnel place along the access route. The operator attempts to clear small brush and saplings to the minimum extent possible to allow passage of the equipment.

We do not attempt to topple or fell large trees or snags, nor do we attempt to strip or grub the surface. Felled vegetation is pushed to the side of the path to allow equipment to pass but is not stacked or burned. Unless specifically stated as part of our contract, no attempt is made to restore the route to its original condition.

FIELD SAMPLING AND TESTING OF EARTH MATERIALS

In general, soil test borings, cone penetration or dilatometer soundings, or other sampling methods were advanced at the marked locations by methods as described more fully below.

All borings or soundings were advanced approximately at their assigned locations and to their assigned depths in the exploration plan, subject to the limitations in staking described above, except as specifically described in the text summary.

Numbering of Borings and Soundings

Soil test borings are usually denoted "B-" on the boring location plan except as specifically described in the report text. CPT soundings are denoted "C-", Marchetti dilatometer soundings "D-", hand auger borings "HA-", and machine excavated test pits or trenches "TP-". Temporary or permanent piezometers are denoted "P-."

Drilling and Direct Push Sounding Procedures

Procedures used to perform soil test borings, hand auger borings, test pits, CPT soundings, or other sampling are summarized on the attached pages. The report text explains necessary exceptions to standard procedures.

Field Records

The chief driller prepares field test boring records or sounding records recording subsurface conditions encountered during field work. Field records contain information about the drilling or push method, samples attempted and sample recovery, presence of coarse gravel, cobbles, etc, and indications of materials encountered between sample intervals. Field records are retained at our office.

Preservation and Handling of Recovered Samples

Handling of recovered samples is in general accordance with one or more of the procedures described by ASTM D 4220, section 4, or ASTM D 5079, section 7.5.1, as described below. Carbon copies of field boring records accompanied the samples. Recovered samples not expended in laboratory tests are commonly retained in our laboratory for 60 days following completion of drilling.

S&ME

SOIL BORING AND SAMPLING PROCEDURES (continued)

METHODS FOR AUGERING OR DRILLING

The Soil Test Boring Records enclosed with this report indicate methods used to advance the borings.

Measurement of Topsoil Layers

The thickness of the organic topsoil layers, including humus and underlying stained soils, was measured by taping at shovel cuts made near each boring or sounding.

Surface Coring of Concrete Pavement for Thickness Measurement or Boring Access

Coring of concrete slabs or concrete pavement is performed in general accordance with ASTM C 42, "*Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*." Samples were obtained for measuring approximate thickness only. Moisture conditioning and end surface preparation of recovered cores described in Section 7 of ASTM C 42 was not performed.

Surface Coring of Asphalt Pavement for Thickness Measurement or Boring Access

Asphalt pavement layers are sampled using diamond coring in general accordance with ASTM D 979, "*Standard Practice for Sampling Bituminous Paving Mixtures.*" Coring is performed to allow penetration of the pavement layers by soil drilling equipment, so random sampling and averaging of data points, described in paragraph 5.2.6 of the Practice, is not performed.

Auger Borings

Auger borings are advanced mechanically by a drill rig using a flight auger or hollow stem auger in general accordance with ASTM D 1452, "*Standard Practice for Soil Investigation and Sampling by Auger Borings*". The soils encountered are identified by examining the cuttings brought to the surface. Soil consistency is qualitatively estimated by the relative difficulty of advancing the augers.

Soil Test Boring with Flight Auger

Borings were made by mechanically twisting a continuous steel flight auger into the soil. The auger consists of a flighted solid drive tube having hex couplings at each end. The drive head consists of either a steel clay split or spade bit, or a carbide finger bit with tungsten carbide teeth.

Continuous flight augering is limited to stiff cohesive soils that are able to stand unsupported for the full length of the boring. Use of split barrel samplers requires withdrawal of the drill string from the boring and insertion of a separate sampling string. Grab samples can also be recovered by "dead stick withdrawal" in which the loaded augers are withdrawn from the boring without rotation.

Soil Test Boring with Hollow-Stem Auger

The hollow stem auger consists of a hollow cutting head for cutting soil, mounted on the terminal section of the lead auger. Following auger sections consist of hollow tube with continuous helical flights on the outside to lift cuttings to the surface. Inside diameter of the hollow stem ranges from 2-1/4 inches to 6-5/8 inches and outside diameters of the auger flights range from 5 to 18 inches.

Use of hollow stem augers to obtain soil samples for engineering purposes is described by ASTM D 6151-97(2000), "*Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling*." Hollow stem augering allows drilling and casing the boring simultaneously. Sampling or penetration testing is conducted through the hollow auger column below the lead auger assembly.

Heaving, blow-in or sanding-in, sand lock or wedging of cuttings into the lead auger assembly may occur in cohesionless soils. Water or drilling fluid added to the auger column to provide hydrostatic balance and limit entry of sands, or use of special pilot bit assemblies, are noted on the field boring logs.

Soil Test Boring with Rotary Wash

A rotary drill rig has three functions: rotating the drill string, hoisting the drill string, and circulating the drilling fluid. A bit is rotated against the formation while mud is pumped down the drill pipe, through ports in the bit, and back to the ground surface through the well bore hole. Rotary drilling is sometimes called mud rotary drilling.

The drilling apparatus consists of a rotating kelly with hollow drill rod and either a rotary roller bit or drag type bit with either a side discharge or bottom discharge orifice for the drilling fluid. Drill pipes or rods are joined to a bit to form the drill string. A separate sampling string consists of either split spoon samplers or Shelby tube samplers mounted on NX drill rod. Hole diameter is typically restricted to the minimum necessary for passage of the sampling device.

A heavy drilling fluid is circulated in the boreholes to stabilize the sides and flush the cuttings. Drilling fluid may consist of either water without additives or water with heavy bentonite slurry added to raise the specific gravity of the circulating fluid. Synthetic polymer drilling fluids such as Revert also may be used. The type of drilling fluid used and the portion(s) of each boring mudded are indicated on the boring records.

A short length of drill casing is installed to stabilize the upper few feet of the boring near the ground surface. A mud pump of suitable capacity is used to push the drilling fluid through drill rod and up to the surface. Drilling fluid is recirculated through a mud tub with baffles to allow separation of the drilling cuttings from the fluid. The mud tub also serves as an initial reservoir for mixing of the drilling fluid.

Field boring records indicate size and type of drilling bit, type of drilling fluid used, and note any loss or increase in the volume of the circulating fluid during drilling. At selected intervals, circulation of the mud is turned off, the drill string withdrawn from the hole, and the sampling string inserted into the open boring to obtain samples and perform penetration testing.

Hand Auger Borings

Borings are advanced by hand augering and the soils encountered identified by cuttings brought to the surface. Representative samples of the cuttings are placed in glass jars and transported to the laboratory. Soil consistency is estimated by the relative difficulty of advancing the augers.

Backhoe Test Pits

Test pits excavated with a backhoe or excavator provide a view of a relatively large section of the strata. During excavation, the bottom of the pit is kept relatively horizontal so that each lift represents a uniform horizon. Excavated material brought up is placed in separate stacks or piles adjacent to the pit to allow segregation of the material by depth. The excavated bucket is used to clean or chip a vertical band along the side of the pit to allow inspection and identification of the soil or rock layers.

A field engineer is present to examine the soil strata exposed in each pit, estimate the relative ease of excavation, the amount of subsurface water entering the pits, and the maximum depth the pits could be excavated. However, field staff do not enter the pit to inspect the sides after the pits were extended further than five feet below the surface.

S&ME

SOIL BORING AND SAMPLING PROCEDURES (continued)

SPLIT BARREL SAMPLER WITH STANDARD PENETRATION TEST

Soil sampling and penetration testing in the soil test borings were performed in general accordance with ASTM D1586, *"Standard Test Method for Penetration Test and Split Barrel Sampling of Soils."* At regular intervals, soil samples were obtained with a standard 1.4 inch I. D., two-inch O. D., split barrel sampler.

Standard Sample Intervals

Standard sample intervals used by S&ME are as follows unless otherwise described in the report text:

Sample No.	Depth Interval (ft)	
SS-1	1-2.5	
SS-2	3.5-5	subsequent samples
SS-3	6-7.5	are taken at five foot
SS-4	8.5-10	intervals
SS-5	13.5-15	
SS-6	18.5-20	.

SPT Hammer Arrangement

S&ME uses a conventional rope and cathead arrangement with a Saf-T hammer on most of its rigs. In this arrangement the 140-lb hammer telescopes over the sampling rods and is lifted by means of hemp rope wrapped around the rotating cathead. The hammer is rhythmically lifted and dropped through a 30-inch travel along the guide by the operator.

The cathead rope is is looped around the rotating drum or cathead with the rope coming off the bottom of the cathead, making 2-1/4 total turns around the drum. The cathead rotates at 100 rpm unless noted otherwise on the field boring log. Borings performed using a donut hammer are specifically described as such in the report text.

Use of SPT Autohammer

Sampling is performed using a trip, automatic or semi-automatic hammer drop system which lifts the 140-lb hammer and allows it to drop the required 30-in distance unimpeded. This method is allowed in Section 7.4 of ASTM D 1586.

Standard penetration test N-values obtained using one of the available autohammer systems often vary widely from those obtained using conventional rope and cathead arrangements. While corrections to the resulting N-value have been developed for certain specific applications, N-values presented on S&ME graphical boring records represent field blow counts which are not modified to account for hammer energy variations.

Split Barrel Sampler

The sampler is constructed to the dimensions indicated in Fig. 2 of ASTM D 1586. The driving shoe is of hardened steel with a 35mm inside diameter. The shoe is inspected for damage at the beginning of each production day. The split barrel sample has a minimum diameter of 38 mm. ASTM D 1586 allows use of a 16-gage thick liner within the sampler, but no liner is used unless otherwise noted on the boring log. ,

Use of Retainers or Sample Catchers

Saturated, clean cohesionless sands may tend to flow out when the sampler is withdrawn from the boring. Steel or plastic sample retainers may be required to keep samples of clean granular soils in the sampler barrel. Retainers or baskets are inserted between the shoe and the sampler barrel to help retain loose or flowing materials. The retainers permit the soil to enter the sampler during driving but upon withdrawal they close and thereby retain the sample. Use of sample baskets or retainers is noted in the boring records.

Description of Soil Consistency

The sampler is first seated six inches to penetrate 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 is 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.

Boring records will indicate partial increments in which sampling was terminated due to excessive driving (>50 blows/6 inch) or the length in which the sampler is advanced beyond the increment by a single blow. The records will note whether the static weight of the drill rods (WOR) or the static weight of the drill rods plus the hammer (W-O-H) was required to advance the sampler beyond the sample interval.

Sample descriptions in the soil test boring logs contain a descriptor of the relative density or consistency of each soil penetrated in the boring. Soil consistency is described using SPT N-values, using the terminology in the table.

SANDS		SILTS AND CLAYS	
Penetration Resistance (bpf)	Relative Density	Penetration Resistance (bpf)	Consistency
0-4	Very Loose	0- 2	Very Soft
5-9	Loose	3 - 4	Soft
10 - 29	Medium Dense	5 - 8	Firm
		9 - 16	Stiff
30 - 50	Dense	16 - 30	Very Stiff
>50	Very Dense	31 – 50	Hard
		>50	Very Hard

Interpreted Soil Consistency Using SPT Blow Count

Correction to SPT Blow Count

Corrections to the Standard Penetration test N-value in sands have been developed to account for variations in confining stress, hole diameter, rod length and other factors. These corrections are frequently made in interpreting the N-values obtained in certain geologic environments. Under certain circumstances the corrected N-values may allow a more realistic appraisal of the relative density of sandy soils penetrated by the borings. But N-values presented on S&ME graphical boring records represent field blow counts and not modified blow counts.

Dynamic Cone Penetrometer

The dynamic cone penetrometer is a handheld penetrometer used to qualitatively estimate soil relative density or consistency in hand auger borings or test pits. At selected intervals, the penetrometer is inserted into the open boring. The conical point of the penetrometer is first seated 1-3/4 inches to penetrate any loose cuttings in the boring, then driven two additional 1-3/4 inch increments by a 15 pound hammer falling 20 inches. The number of hammer blows required to achieve this penetration is recorded. When properly evaluated by qualified professional staff, the blow count is an index to the soil strength and ability to support foundations.

S&ME

SOIL BORING AND SAMPLING PROCEDURES (continued)

RECOVERY OF BULK AND UNDISTURBED SAMPLES

Bulk samples provide a sufficient quantity of material to allow laboratory evaluation of compaction or bearing ratio tests of laboratory-fabricated samples.

Split spoon or split barrel sampling provide samples suitable for visual examination and classification tests but not sufficiently intact for quantitative laboratory testing. To provide samples for quantitative tests, relatively undisturbed samples are obtained by use of either driven or pushed Shelby tubes or other techniques further described below.

Block samples often allow strength or compressibility tests of cohesive materials where it is desired to evaluate shear strength along predetermined failure planes or if other techniques are not feasible or do not provide sufficiently intact samples.

Bulk Samples

At selected locations and depths, representative bulk samples of the soils are obtained by randomly taking shovel loads from the cuttings or spoil brought to the surface by the hoe or by the auger scrolls used to advance soil test borings. Typically a minimum sample of 30 to 50 lbs is obtained. The bulk sample is placed in a cloth or plastic sack marked with appropriate descriptive information.

Recovered materials are typically treated as Group A samples as defined by ASTM D 4220, Section 4, except that in most cases a small quantity of soil may be placed in a sealed jar to allow a moisture content determination. Samples are protected from freezing at all times.

Stockpile Sampling

At selected locations and depths, representative bulk samples of stockpiled materials soils are obtained by randomly taking shovel loads from the surface of the pile. Typically a minimum sample of 50 lbs to 100 lbs is obtained, but a quantity sufficient to meet the requirements of section 7.2 of ASTM D 2487 is obtained if the Unified classification will be determined for the material.

The bulk sample was prepared by initially obtaining approximately three times the required quantity of material, then quartering the sample to the minimum size. The resulting sample is placed in a cloth or plastic sack marked with appropriate descriptive information.

Block Samples

Representative sections of cohesive soils are hand trimmed from large blocks of the excavated material recovered from test pits or excavations. The trimmed blocks are approximately 6 in. x 6 in. x 8 in. in length. Field trimmed block samples are treated as Group C samples as defined in ASTM 4220, section 4. Each block sample after field trimming is sealed in plastic wrap and encased by sand or other inert filler material in a suitable box or container. Samples are then immediately transported to our laboratory for further study. Unwrapped block samples are further trimmed to size suitable for shear strength or consolidation testing in the laboratory.

Shelby Tube Sampling

Undisturbed samples are obtained either in conjunction with conventional split spoon sampling and penetration tests, or in separate parallel borings advanced specifically for the purpose of obtaining samples in targeted horizons or seams. Where hollow-stem augers are used to advance the borings, open boring diameter is limited to 11.5 inches for a 3-inch diameter Shelby tube.

Undisturbed samples are obtained by pushing sections of three-inch O. D., 16 gauge, steel tubing (Shelby tube) into the soil at the desired sampling intervals. The procedures used generally follow those described in ASTM D 1587*, "Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils*." Tube lengths are standard 30-inches unless otherwise indicated. After advancing the tube, a short set period is allowed for pore pressure dissipation, then the tube slowly spun in place to shear and break off the end of the sample. The Shelby tube, together with the encased soil, is then carefully removed from the ground.

After withdrawal, the length of the recovered soil is measured and the sample preserved in accordance with the sampling plan. Recovered Shelby tube samples are typically treated as either Group B or Group C samples as defined by ASTM D 4220, Section 4, depending on the level of care to be exercised during transport. Locations and depths of undisturbed samples are recorded on each field test boring record.

UD Shelby Tube Insertion by Pushing - After cleaning out the boring, Shelby tubes are typically advanced 24 inches by pushing the tube relatively rapidly without rotating the sampling string as described in Section 7.3 of ASTM D 1587. Other push lengths, if deemed to be appropriate depending on soil conditions, are indicated on the boring records.

UD Shelby Tube Insertion by Driving - When the formation is too hard for push insertion, Shelby tubes are advanced by driving as described in Section 7.5 of ASTM D 1587. The weight and fall of the drive hammer used, the length of advance, and the penetration required are indicated on the boring records. Where drive methods of used, the sample is termed a "driven sample."

Piston Sampler

The piston sampler is a thin-wall tube with a piston, rod and a modified sampler head used for sampling soft soils where the sample recovery is difficult. The sampler is lowered to the bottom of the cleaned boring with the piston fully extended to the bottom of the tube. The piston is held fixed against the bottom of the hole and the thin walled tube is slowly advanced by hydraulic pressure or jacking.

The sampler is then carefully removed from the boring and the vacuum between the piston and the sample helps retain the sample in position. Recovered piston samples are typically treated as Group C samples as defined by ASTM D 4220, Section 4. Piston samplers are never driven. Locations and depths of undisturbed piston samples attempted are recorded on each field test boring record.

Double Tube, Pitcher Type Sampling

Samples of highly compacted, hard, stiff uncemented or slightly cemented materials are obtained using a double tube soil core barrel with liner. The double-tube core barrel is advanced by rotating the outer barrel, which cuts a circular groove and loosens the soil material to be displaced by the two barrels. Drilling fluid was forced downward through the drill stem. The inner barrel, which does not rotate, moves downward over the relatively undisturbed core of soil formed by rotation of the outer barrel. A liner is inserted into the inner barrel before the sampler was assembled.

After drilling the required length, the sampler is withdrawn and the liner removed, made airtight, and transported to the laboratory. Recovered samples are typically treated as Group B samples as defined by ASTM D 4220, Section 4. Locations and depths of undisturbed samples were recorded on each field test boring record.

S&ME

MEASUREMENT OF STATIC WATER LEVELS

Water level readings are made in the open boreholes immediately after completing drilling and withdrawal of the tools. Where feasible, measurements are repeated after an elapsed period of 24 hours to gauge the stabilized water level. Procedures for measurement of liquid levels in open boreholes are described in ASTM D 4750, "*Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well).*"

We note that ground water levels are influenced by precipitation, long term climatic variations, and nearby construction. Ground water measurements made a different times than our exploration may indicate ground water levels substantially different than indicated on the boring records in the Appendix.

Weighted Tape Method

A weighted measuring tape is slowly lowered into each borehole until the liquid surface is penetrated by the weighted end. The reading on the tape is recorded at a reference point on the surface and compared to the reading at the demarcation of the wetted and unwetted portions of the tape. The difference between the two readings is recorded as the depth of the liquid surface below the reference point. Measurements made by this method are then repeated until approximately consistent values are obtained.

Calibrated Electric Cable Method

A calibrated cable with electrical wire encased, equipped with a weighted sensing tip at one end and an electric meter at the other, is slowly lowered into each borehole until the liquid surface is penetrated by the weighted end. Contact with the water closes an electric circuit and is recorded by the meter. The depth reading on the cable is then recorded relative to a reference point on the surface. Measurements made by this method are then repeated until approximately consistent values are obtained.

Time of Boring Reading

The level of free water standing in the boring is noted immediately following completion of each boring, except where the boring is performed using rotary mud drilling and the presence of the drilling mud in the open boring precludes determining a free water level. Where the water table is believed to be shallow we may attempt to drill a shallow parallel open boring immediately adjacent to allow us to measure the free water level.

24-Hour Reading

Ground water in low permeability soils may require many hours to seep into the open borings. Where feasible, measurements are repeated after an elapsed period of at least 24 hours to gauge the stabilized water level. Notes on the boring records will indicate the actual elapsed time between completion of drilling and final recording of ground-water level. Both time of boring and 24-hour readings are indicated on the boring records where these readings are available.

Caving/Collapse of Boring

Collapse of the boring or caving of the sides and filling of the bottom of the boring may occur during the period subsequent to completion of the boring. While it is common for caving or callapse to occur within two or three feet of the static water level, accumulation of water on top of the collapsed material could result where infiltration from the surface occurs. In this case a misleading level could result. When obtaining water levels in a boring we attempt to measure the full depth of the boring to provide an indication as to whether caving or collapse may have occurred and a notation made on the boring record.

Loss/Gain of Drilling Fluid

Boring Records will indicate depths at which changes in volume of drilling fluid returning to the surface are noted. This implies that some fluid pumped down the drill pipe is entering the soil, or that fluid is entering the boring under pressure from the soil. Flow can occur through open-graded sand or gravel or open joints in rock, or could indicate open voids in the soil. Fluid loss can also occur when cuttings are not washed out and the borehole annulus becomes restricted, resulting in increased down-hole pressure.

Installation of Temporary PVC Casing (Observation Well)

Water level readings taken during boring operations do not provide information on long term fluctuations of the water table. In several of the borings, a temporary observation well was constructed by inserting PVC casing to the indicated depth. A slotted PVC well screen is attached to the bottom of the PVC pipe to allow subsurface water to enter the well. Soil is mounded around the observation wells at the ground surface to prevent surface runoff from entering the boreholes.

CPT Methods

CPT penetration pore pressures include the *in-situ equilibrium pore pressure*, controlled by the local ground water regime, and the *excess pore pressure*, generated by insertion of the probe. In clays and silts, penetration is essentially undrained and recorded pore pressures significantly exceed in-situ equilibrium pore pressures.

In sands and gravels, penetration is essentially drained and recorded pore pressures are essentially equal to the in-situ equilibrium pore pressure. The piezometric surface, defined as the point of zero equilibrium pore pressure, was obtained by plotting in-situ equilibrium pore pressure vs. depth using only pore pressure data from sand or gravel soils. Where possible, derived piezometric surface was verified by tape measurement through the sounding opening after removal of the CPT rod and before collapse of the soils.

Free Water Surface vs. Piezometric Surface

The ground-water characteristics of a soil profile consisting of alternating beds of pervious and relatively impervious soils is difficult to define by a single set of borings or wells. Borings or wells extending through relatively impervious soils into an aquifer may indicate a piezometric surface which can exist well above the top of the saturated, fully confined aquifer. In this case the measured water level in the boring or well indicates the piezometric surface – an imaginary surface that everywhere coincides with the static water level in an aquifer – not necessarily the free water surface in the surrounding soils.

Borings or wells may also reflect the presence of unconfined ground water separated from an underlying body of ground water by an unsaturated zone. A perched water table may exist over a limited area at an elevation above the normal free water elevation by an intervening impervious zone. Perched water from shallow depth entering the boring from the surface may accumulate at depth. Water entering the boring from multiple aquifers may provide a reading at some level independent of the static water level in any one layer.

SOIL BORING AND SAMPLING PROCEDURES (continued)

TERMINATION OF DRILLING AND SAMPLING

The boring records indicate the circumstances under which drilling or excavation was terminated. Borings or test pits advanced to their assigned depths and intentionally terminated are indicated as such on the boring or test pit records. Boreholes or test pits may also be prematurely terminated due to encountering dense strata or other obstructions which prevent further advance.

Refusal to Augers

The term "refusal" in the context of this report refers to the inability of the drill rig employed on the project to further advance the boring with the type of soil auger and bit in use. Practical refusal of the tools may take the form of binding or seizing of the bit, "walking off" of the drill string, or liftoff of the rig itself when the operator attempts to crowd the kelly. The term refusal is not used to describe zero penetration of the split spoon sampler in 50 blows.

In natural soils, refusal to the soil drilling methods used at a particular site may result from encountering hard cemented soil, soft weathered rock, coarse gravel, cobbles or boulders, thin rock seams, or the upper surface of sound continuous rock. In fill zones, refusal may also occur from encountering buried debris or objects within the fill mass.

The composition and density of materials below the refusal level of the borings can not be reliably estimated based on the boring data. Core drilling would be required to determine the character and continuity, strength, compressibility and bearing capacity of materials below refusal of the soil auger in natural soils. Exploration of debris laden fill would require use of machine excavated test pits at refusal locations.

Additional Probe Borings Performed at Refusal Locations

Where refusal is encountered at shallow depth (typically less than 15 feet) in a site with deep cuts anticipated, one or more additional auger borings may be performed at locations offset 10 to 20 feet from the original location. The purpose of these offset borings would be to attempt to gauge whether initial refusal occurred on a boulder or lens.

Where offset borings are performed, the strategy used to further define the profile of the obstruction(s) is discussed in the report text. Offset borings are designated with the original boring number with the suffix "A" , "B", or "C" added as appropriate.

Refusal to Augers in Fill Soils

Where fills are present, refusal to drilling may result from encountering buried debris, building materials, or objects. Where the operator judges the material to consist predominantly of rockfill or other debris, borings may also be discontinued to avoid twisting-off of the drill string. In each case, backhoe test pits would be required to expose and identify buried materials below refusal levels in filled areas.

Test Pit Refusal to Machine Excavation

Refusal to the excavator used at the test pits may have resulted from encountering hard cemented soil, soft weathered rock, coarse gravel, cobbles or boulders, thin rock seams, or the upper surface of sound continuous rock. Since a test pit represents a confined excavation, refusal to digging will vary depending on the size of the bucket. Core drilling is required to determine the character and continuity of materials below refusal of the excavator.

METHODS FOR CLOSING AND PROTECTION OF BOREHOLES

Depending on the level of protection required at the surface, different procedures for abandoning the borings may be used. State regulations may also mandate certain procedures under some circumstances. The report text will indicate which procedure was used to abandon the soil borings.

Boreholes Closed Immediately with Auger Cuttings

Boreholes in areas subject to foot traffic or farm animals are closed immediately after drilling. Boreholes are filled by slowly pouring auger cuttings into the open hole such that minimal "bridging" of the material occurs in the hole. Backfill in the upper two feet of each hole is tamped as heavily as possible with a shovel handle or other hand held equipment, and the backfill crowned to direct rainfall away on the surface. Where boreholes exceeds five feet in depth, a plastic hole plug is firmly tamped into place within the backfill at a depth of about two feet.

Boreholes Barricaded and Subsequently Filled with Cuttings

Boreholes in areas subject to foot traffic or farm animals are barricaded immediately after drilling using inverted traffic cones. After completing 24-hour water measurements, boreholes are filled by slowly pouring auger cuttings into the open hole such that minimal "bridging" of the material occurs in the hole. Backfill in the upper two feet of each hole is tamped as heavily as possible with a shovel handle or other hand held equipment, and the backfill crowned to direct rainfall away on the surface. Where boreholes exceed five feet in depth, a plastic hole plug is firmly tamped into place within the backfill at a depth of about two feet.

Borehole Closure with Grout

Boreholes are barricaded immediately after drilling using inverted traffic cones. After completing 24-hour water measurements, boreholes are filled using forced injection or tremie methods by a cement-bentonite or a neat cement grout up to the ground surface.

Closure of Test Pits and Trenches

After completion of excavation, test pits are backfilled with the spoil material; however, since the pits are narrow, deep excavations, very limited compactive effort can be applied to the backfill. Backfill is bucket-tamped during placement and surface rolled. The backfill is heaped up slightly above the level of the ground surface to reduce the possibility of future formation of a depression in the ground surface after the spoil has consolidated.

Patching of Asphalt Surfaces

Where specified in our scope fo work, penetrations of asphalt surfaces made during the drilling process are patched using compacted asphalt cold patch material. Cold patch asphalt is placed to provide a surface flush with existing pavement adjacent to the boring. Cold patch asphalt is compacted by tamping it into the boring with a shovel handle or similar hand held equipment.

Patching of Concrete Surfaces

Where specified in our scope of work, penetrations or cores through concrete surfaces in areas subject to foot traffic are patched using a high strength, quick setting concrete grout. Grout is placed to provide a surface flush with existing pavement adjacent to the boring. The borehole location is barricaded to prevent traffic in the area of the patch for a minimum of 4 hours.

S&ME

PRESERVATION AND HANDLING OF SOIL SAMPLES

PRESERVATION AND HANDLING OF SOIL SAMPLES

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally follow those given in ASTM D 4220, "*Standard Practice for Preserving and Transporting Soil Samples*" for one of four groups of samples described in section 4. Sample groups are designated A through D, each group representing progressively greater effort to control the integrity and moisture content of the sample.

Soil Samples without Moisture Control – ASTM Group A

Group A samples are those samples not suspected of being contaminated and for which only a general visual description will be performed. These samples include bulk or stockpile samples transported in open containers, or jar or bag samples that are not sealed.

No attempt is made to maintain samples at the field moisture content value. Representative samples of the cuttings or split spoon samples, or representative bulk samples, are placed in suitably identified, non-sealed containers and transported to the laboratory. Sample identification numbers on the containers correspond to sample numbers recorded on field boring records or test pit records.

Soil Samples with Control of Field Moisture – ASTM Group B

Group B samples are those samples not suspected of being contaminated and for which only water content and classification, Proctor, relative density, or profile logging will be performed. Group B samples also include portions of bulk samples intended to be remolded in the laboratory for compaction, swell pressure, percent swell, consolidation, permeability, CBR, or shear testing, which are segregated from the sample to preserve natural water content.

Representative samples of the cuttings or split spoon samples, or representative bulk samples, are placed in suitably identified, sealed glass jars or plastic containers and transported to the laboratory. Sample identification numbers on the containers correspond to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples are sealed at the ends with paraffin and capped with plastic end caps.

Intact Soil Samples – ASTM Group C

Group C samples are intact, naturally formed or field fabricated, samples for density determination, swell pressure, percent swell, permeability testing or shear testing with or without stress-strain plots or volume change measurement, including dynamic and cyclic testing. These samples must be obtained and handled in ways that will preserve the natural soil fabric and stratification with little disturbance.

Representative thin walled tube samples must be protected against vibration or shock, or extreme heat or cold, during transport to the laboratory. Sample identification numbers on the containers correspond to sample numbers recorded on field boring records or test pit records.

Thin-walled tube samples are sealed at the ends with paraffin and capped with plastic end caps. Samples are transported in the upright position in containers providing complete encasement in cushioning or insulation for individual samples.

Sensitive Soil Samples – ASTM Group D

Group D samples are intact, naturally formed or field fabricated, samples of high sensitivity or fragility which will be subjected to density determination, swell pressure, percent swell, permeability testing or shear testing with or without stress-strain plots or volume change measurement, including dynamic and cyclic testing.

Representative thin-walled tube samples are protected against vibration or shock, or extreme heat or cold, during transport to the laboratory in specially loaded metal or wood reusable containers. Sample identification numbers on the containers correspond to sample numbers recorded on field boring records or test pit records.

Thin-walled tube samples are sealed at the ends with paraffin and capped with plastic end caps. Samples are transported in the same position as the sampling orientation in sufficient packing material to provide complete encasement and cushioning or insulation for individual samples. Transport of the samples is supervised by a qualified person at all times.

SAMPLE IDENTIFICATION NUMBER

All samples are assigned a laboratory identification number upon arrival. In most cases the laboratory identification number corresponds to the boring and sample numbers assigned in the field and shown on field boring records. A list is prepared which matches the laboratory tests to the field or laboratory identification numbers. When requesting laboratory testing, both the field identification number and the laboratory identification number (if different) are used on the request form.

SAMPLE STORAGE

All soil samples that are Group B or higher are transported and stored to maintain moisture content as close as possible to natural conditions. Samples are not placed in direct sunlight. Undisturbed soil samples are stored in an upright position with the top side of the sample up.

As storage time increases, moisture will migrate within a tube or condense within a sample jar. Potential for disturbance and moisture migration increases with time. Excessive storage time can lead to sample disturbance that will affect strength and compressibility properties. Additionally, stress relaxation, temperature changes over time also affect sample performance. All samples are discarded after 60 days or are returned to the client. Where tests are carried out on samples more than 30 days old, a notation is made on the test report.

Long term storage may result in excessive adhesion of the soil to the Shelby tube. Resistance to extrusion may cause internal failures to occur in some soils during extrusion. Often these failures cannot be seen by the naked eye. If these samples are tested as "undisturbed" specimens, the results may be misleading. Where "old" Shelby tube samples are proposed for strength tests, S&ME may recommend x-ray radiography (ASTM D 4452) or oedometer tests assess the sample condition prior to using the strength test data.

Extrusion and Trimming of Groups B or C Samples

Undisturbed samples are stored in the vertical position in the laboratory. Samples are extruded from the thin-walled sampler, using a specially constructed extruder, in the same direction of travel as the sample entered the tube during sampling. In certain cases it may be necessary to cut the tube into short sections to facilitate removal of the soil without compressing or disturbing the sample.

Specimens are trimmed using a wire saw or steel straightedge. Where removal of pebbles or crumbling resulting from trimming causes voids on the surface of the specimens selected for quantitative laboratory testing, they are filled with remolded soil obtained from the trimmed portion of the sample.

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SCDOT ADRS Data by Bridge

APPENDIX III-A

Appendix III-A – Split Spoon Sample Classification Test
Summary of Laboratory Test Results – Split Spoon Samples
Laboratory Test Data Sheets – Split Spoon Samples
Laboratory Test Procedures

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-1	18.5-20	SS-7				16.5	A-2	SM
B-1	28.5-30	SS-9	21.5	54	29		A-7-5	CH
B-1	38.5-40	SS-11				25.5	A-2	SM
B-1	48.5-50	SS-13				13.8	A-2	SM
B-1	58.5-60	SS-15	16.2	51	29		A-7-5	CH
B-2	2-4	SS-2	12.6	40	22		A-6	CL
B-2	6-8	SS-4	19.9	47	27		A-7-5	CL
B-2	13.5-15	SS-6				13.1	A-2	SM
B-2	18.5-20	SS-7				15.5	A-2	SM
B-2	38.5-40	SS-11	19.5	27	14	17.2	A-2-6	SC
B-2	58.5-60	SS-15	18.5	52	28		A-7-5	CH
B-4	4-6	SS-3	23.6	55	30		A-7-5	CH
B-4	13.5-15	SS-6				41.3	A-7	SC
B-4	18.5-20	SS-7	17.6	53	30		A-7-5	CH
B-4	33.5-35	SS-10				6.1	A-3	SP-SM
B-4	48.5-50	SS-13	15.8	45	26		A-7-5	CL
B-4	58.5-60	SS-15				26.1	A-2	SC
B-5	13.5-15	SS-6				38.3	A-7	SC
B-5	28.5-30	SS-9	23.6	36	18		A-6	CL
B-5	33.5-35	SS-10	18.0	48	26		A-7-5	CL
B-5	43.5-45	SS-12				11.4	A-2	SW-SM
B-5	48.5-50	SS-13				28.1	A-2	SC
B-6	6-8	SS-4				11.2	A-2	SP-SM
B-6	18.5-20	SS-7				46.5	A-6	SC
B-6	23.5-25	SS-8	10.2	34	19	49.1	A-6	SC
B-6	43.5-45	SS-12				28.1	A-2	SM

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-7	4-6	SS-3				26.6	A-2	SC
B-7	8-10	SS-5				25.0	A-2	SC
B-7	33.5-35	SS-10	26.2	63	34		A-7-6	CH
B-7	58.5-60	SS-15				49.2	A-6	SC
B-8	8-10	SS-5				51.7	A-6	CL
B-8	23.5-25	SS-8	18.2	39	18		A-6	CL
B-8	33.5-35	SS-10	16.2	45	24		A-7-6	CL
B-8	48.5-50	SS-13				14.7	A-2-6	SC
B-8	53.5-55	SS-14	17.7	47	23		A-7-6	CL
B-9	8-10	SS-5	18.0	44	23		A-7-6	CL
B-9	13.5-15	SS-6				41.9	A-6	SC
B-9	33.5-35	SS-10A	11.3	35	20		A-6	CL
B-9	43.5-45	SS-12				26.2	A-2	SC
B-10	23.5-25	SS-8				44.2	A-4	SM
B-10	33.5-35	SS-10				4.2	A-1-b	SW
B-10	43.5-45	SS-12	25.4	49	20	70.6	A-7-6	ML
B-10	48.5-50	SS-13	25.1	50	23		A-7-6	CH
B-11	33-35	SS-3				3.7	A-3	SP
B-11	48.8-50.3	SS-7	34.5	70	34		A-7-5	MH
B-11	53.8-55.3	SS-8	32.8	82	58		A-7-6	CH
B-11	58.8-60.3	SS-9				72.1	A-7-6	CH
B-12	35-37	SS-2				16.9	A-2	SC
B-12	39-41	SS-4	27.5	62	38	51.9	A-7-6	CH
B-12	41-43	SS-5	22.8	52	26		A-7-6	CH
B-12	51.5-53	SS-7				81.0	A-6	ML
B-13	19.5-20	SS-7B	19.6	29	13		A-6	CL
B-13	48.5-50	SS-13	31.0	71	41	98.3	A-7-5	CH
B-13	53.5-55	SS-14	38.4	97	67	91.0	A-7-5	CH

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring Number	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
B-14	6-8	SS-4	12.6	33	18	66.5	A-6	CL
B-14	18.5-20	SS-7				21.9	A-2	SM
B-14	33.5-35	SS-10	17.1	46	21		A-7-6	CL
B-15	27.6-29.6	SS-2				22.6	A-2	SC
B-15	31.6-33.6	SS-4				38.1	A-7	SC
B-15	33.6-35.6	SS-5				34.6	A-2	SC
B-15	48.7-50.2	SS-8	19.4	48	22		A-7-6	CL
B-16	6-8	SS-4				39.4	A-6	SC
B-16	23.5-25	SS-8	36.4	49	20	65.1	A-7-6	ML
B-17	8-10	SS-5	59.1	47	21	52.1	A-7-6	CL
B-17	13.5-15	SS-6				16.1	A-2	SC
B-17	18.5-20	SS-7				2.7	A-1	SP
B-17	23.5-25	SS-8	27.8	56	31	71.3	A-7-6	CH
B-18	6-7.5	SS-3				25.6	A-2	SM
B-18	18.5-20	SS-6				28.6	A-2	SC
B-18	28.5-30	SS-8				45.5	A-6	SC
B-18	38.5-40	SS-10	32.4	60	27		A-7-5	MH
B-18	48.5-50	SS-12	26.3	36	13	76.4	A-6	CL

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring No.	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
R-1	0-2	SS-1	7.8	NP	NP	58.0	A-4	ML
R-1	2-4	SS-2	7.7	NP	NP	12.5	A-2-4	SM
R-2	0-2	SS-1	20.7	54	30	63.2	A-7-6	CH
R-2	2-4	SS-2	10.6	NP	NP	29.0	A-2-4	SM
R-3	0-2	SS-1	8.1	NP	NP	27.6	A-2-4	SM
R-3	2-4	SS-2	27.1	70	36	95.7	A-7-5	MH
R-4	0-2	SS-1	10.4	27	11	39.0	A-6	SC
R-4	2-4	SS-2	11.1	25	9	33.6	A-2-4	SC
R-5	0-2	SS-1	9.6	NP	NP	24.5	A-1-b	SM
R-5	2-4	SS-2	11.0	NP	NP	20.8	A-2-4	SM
R-6	0-2	SS-1	13.1	25	9	37.4	A-4	SC
R-6	2-4	SS-2	19.0	40	17	68.3	A-6	CL
R-7	0-2	SS-1	14.6	37	13	67.9	A-6	CL
R-7	2-4	SS-2	7.0	34	16	68.8	A-6	CL
R-8	0-2	SS-1	8.5	22	8	24.2	A-2-4	SC
R-8	2-4	SS-2	10.7	26	11	38.9	A-6	SC
R-9	0-2	SS-1	15.3	40	20	45.6	A-6	SC
R-9	2-4	SS-2	12.5	NP	NP	32.9	A-2-4	SM
R-10	0-2	SS-1	11.6	31	15	46.9	A-6	SC
R-10	2-4	SS-2	10.3	NP	NP	32.0	A-2-4	SM
R-11	0-2	SS-1	11.2	NP	NP	41.9	A-4	SM
R-11	2-4	SS-2	7.7	NP	NP	27.0	A-2-4	SM
R-12	0-2	SS-1	9.5	NP	NP	33.8	A-2-4	SM
R-12	2-4	SS-2	12.6	NP	NP	30.6	A-2-4	SM
R-13	0-2	SS-1	9.2	NP	NP	34.3	A-2-4	SM
R-13	2-4	SS-2	13.7	NP	NP	32.1	A-2-4	SM
R-14	0-2	SS-1	6.5	NP	NP	22.3	A-2-4	SM
R-14	2-4	SS-2	10.3	NP	NP	27.5	A-2-4	SM
R-15	0-2	SS-1	9.8	NP	NP	35.4	A-2-4	SM
R-15	2-4	SS-2	11.4	NP	NP	23.2	A-2-4	SM

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 2 – Split Spoon Samples

Boring No.	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Atterberg Limits		Percent Finer #200	Soil Classification	
				LL	PI		AASHTO	USCS
R-16	0-2	SS-1	10.5	NP	NP	21.5	A-1-b	SM
R-16	2-4	SS-2	15.4	NP	NP	15.8	A-1-b	SM
R-17	0-2	SS-1	11.2	NP	NP	23.6	A-1-b	SM
R-17	2-4	SS-2	12.4	NP	NP	14.2	A-1-b	SM
R-18	0-2	SS-1	6.6	NP	NP	24.0	A-2-4	SM
R-18	2-4	SS-2	11.4	NP	NP	38.3	A-4	SM
R-19	0-2	SS-1	17.7	43	11	94.6	A-7-5	ML
R-19	2-4	SS-2	13.1	49	15	98.5	A-7-5	ML
R-20	0-2	SS-1	8.3	NP	NP	26.2	A-2-4	SM
R-20	2-4	SS-2	8.4	NP	NP	65.7	A-4	ML

Form No: TR-D2216-T265-1
Revision No. 0
Revision Date: 02/22/08

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/20/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		

Sampling Method: Split Spoon — Log No.: 341

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***18435*** *Calibration Date:* ***3/17/14***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft		grams	grams	grams	grams	%	
B-1	9	28.5 - 30	AA-5	31.85	82.73	73.72	9.01	**21.5%**	
B-1	15	58.5 - 60	AA-27	31.84	78.29	71.81	6.48	**16.2%**	
B-2	2	2 - 4	AA-30	31.98	90.81	84.22	6.59	**12.6%**	
B-2	4	6 - 8	AA-8	31.86	91.51	81.59	9.92	**19.9%**	
B-2	11	38.5 - 40	AA-1	31.97	84.25	75.73	8.52	**19.5%**	
B-2	15	58.5 - 60	AA-11	32.12	78.10	70.91	7.19	**18.5%**	
B-4	3	4 - 6	AA-17	32.03	72.29	64.59	7.70	**23.6%**	
B-4	7	18.5 - 20	AA-31	31.62	91.22	82.29	8.93	**17.6%**	
B-4	13	48.5 - 50	AA-15	32.27	92.68	84.42	8.26	**15.8%**	
B-5	9	28.5 - 30	AA-9	32.03	96.38	84.09	12.29	**23.6%**	
B-5	10	33.5 - 35	AA-18	31.94	95.15	85.51	9.64	**18.0%**	

Notes / Deviations / References

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

Derek Baker — *Technician Name*

10/20/2014 — *Date*

N. Randy Rainwater, P.E. — *Technical Responsibility*

_____ — *Signature*

Project Engineer — *Position*

_____ — *Date*

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/22/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/22/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		

Sampling Method: Split Spoon Log No.: 341

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***18435*** *Calibration Date:* ***3/17/14***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft		grams	grams	grams	grams	%	
B-6	8	23.5 - 25	AA-18	31.95	97.78	91.67	6.11	**10.2%**	
B-7	10	33.5 - 35	AA-12	31.86	91.53	79.14	12.39	**26.2%**	
B-8	8	23.5-25	210	157.20	217.94	208.58	9.36	**18.2%**	
B-8	10	33.5 - 35	AA-5	31.85	97.53	88.35	9.18	**16.2%**	
B-8	14	53.5 - 55	AA-27	31.84	72.94	66.75	6.19	**17.7%**	
B-9	5	8 - 10	AA-1	31.96	75.78	69.08	6.70	**18.0%**	
B-9	10A	33.5 - 35	AA-7	32.27	71.29	67.32	3.97	**11.3%**	
B-10	12	43.5 - 45	AA-15	32.28	82.88	72.63	10.25	**25.4%**	
B-10	13	48.5 - 50	AA-30	31.98	80.49	70.77	9.72	**25.1%**	

Notes / Deviations / References

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

Derek Baker — *Technician Name* — 10/22/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility* —  *Signature* — Project Engineer — *Position* — 11/25/2014 — *Date*

Form No: TR-D2216-T265-1
Revision No. 0
Revision Date: 02/22/08

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/23/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		

Sampling Method: Split Spoon Log No.: 341

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***18435*** *Calibration Date:* ***3/17/14***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft		grams	grams	grams	grams	%	
B-11	7	48.8 - 50.3	AA-2	31.74	78.26	66.34	11.92	**34.5%**	
B-11	8	53.8 - 55.3	AA-29	31.75	72.73	62.62	10.11	**32.8%**	
B-12	4	39 - 41	AA-26	31.88	96.20	82.32	13.88	**27.5%**	
B-12	5	41 - 43	AA-18	31.94	90.83	79.89	10.94	**22.8%**	
B-13	7B	19.5 - 20	AA-31	31.62	80.51	72.49	8.02	**19.6%**	
B-13	13	48.5 - 50	AA-6	20.87	62.32	52.52	9.80	**31.0%**	
B-13	14	53.5 - 55	AA-14	31.94	69.72	59.23	10.49	**38.4%**	
B-14	4	6 - 8	AA-15	32.27	79.07	73.82	5.25	**12.6%**	
B-14	10	33.5 - 35	AA-17	32.02	77.30	70.68	6.62	**17.1%**	
B-15	8	48.7 - 50.2	AA-11	32.12	71.97	65.49	6.48	**19.4%**	
B-16	8	23.5 - 25	AA-8	31.86	76.16	64.34	11.82	**36.4%**	

Notes / Deviations / References

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

Derek Baker — *Technician Name* — 10/23/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility* — *Signature* — Project Engineer — *Position* — 11/25/2014 — *Date*

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/26/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		

Sampling Method: Split Spoon — Log No.: 341

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***18435*** *Calibration Date:* ***3/17/14***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		ft		grams	grams	grams	grams	%	
B-17	5	8 - 10	AA-8	31.86	77.88	60.79	17.09	**59.1%**	
B-17	8	23.5 - 25	AA-30	31.98	92.05	79.00	13.05	**27.8%**	
B-18	10	38.5 - 40	AA-5	31.85	68.14	59.26	8.88	**32.4%**	
B-18	12	48.5 - 50	AA-1	31.96	72.99	64.44	8.55	**26.3%**	

Notes / Deviations / References

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

Derek Baker — *Technician Name* — 10/24/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility* — *Signature* — Project Engineer — *Position* — 12/1/2014 — *Date*

Sieve Analysis of Soils

ASTM D422

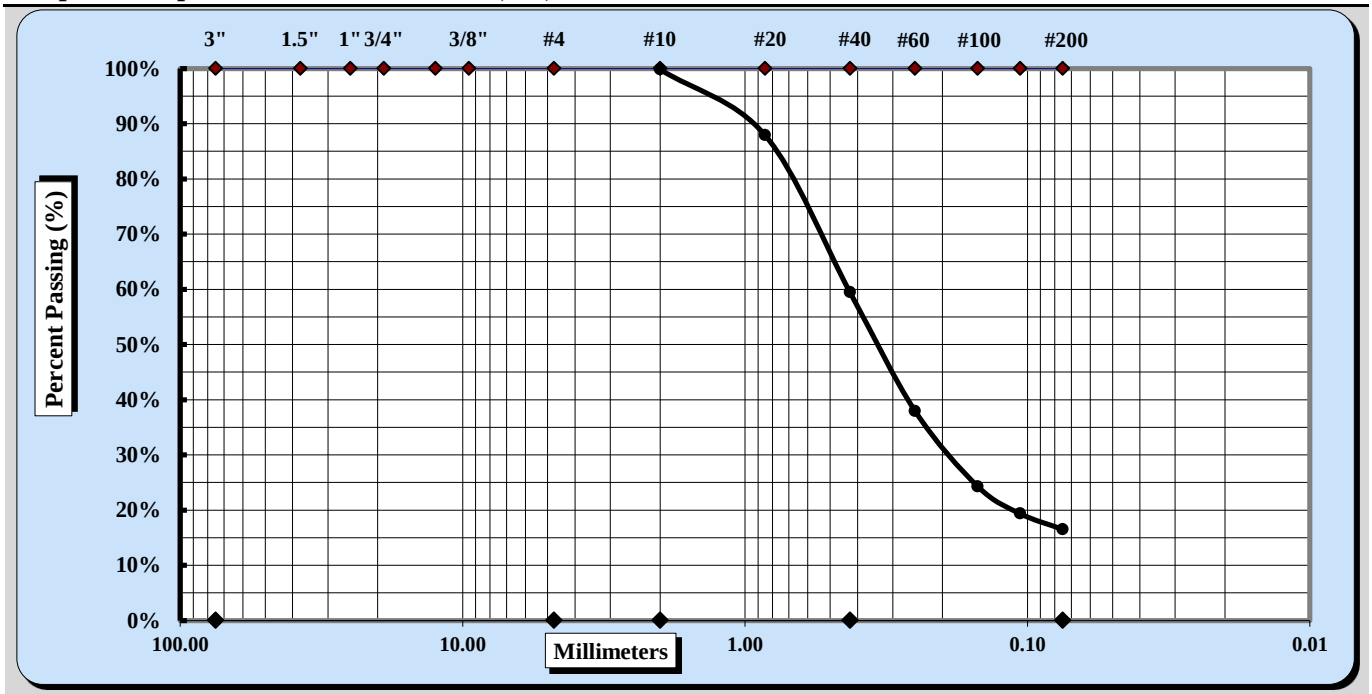
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Type: SS		
	Sample: 7	Depth:	18.5 - 20 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.2%	Fine Sand	42.9%
Gravel	0.0%	Medium Sand	40.4%	Silt & Clay	16.5%

Coarse Sand	0.2%	Medium Sand	40.4%	Fine Sand	42.9%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

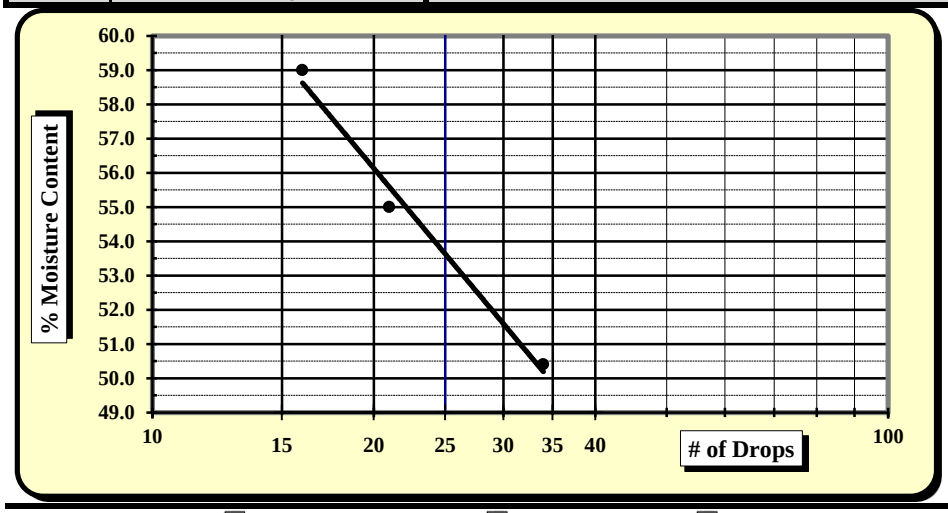
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/27/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Sample No: 9		
		Depth: 28.5 - 30 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	14	17	9				19	2	
A	Tare Weight	15.53	15.57	15.49				15.49	15.61	
B	Wet Soil Weight + A	28.71	29.12	30.51				24.55	24.65	
C	Dry Soil Weight + A	23.82	24.31	25.48				22.72	22.83	
D	Water Weight (B-C)	4.89	4.81	5.03				1.83	1.82	
E	Dry Soil Weight (C-A)	8.29	8.74	9.99				7.23	7.22	
F	% Moisture (D/E)*100	59.0%	55.0%	50.4%				25.3%	25.2%	
N	# OF DROPS	16	21	34				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**25.3%**		



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 **54**
Plastic Limit **25**
Plastic Index **29**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/27/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

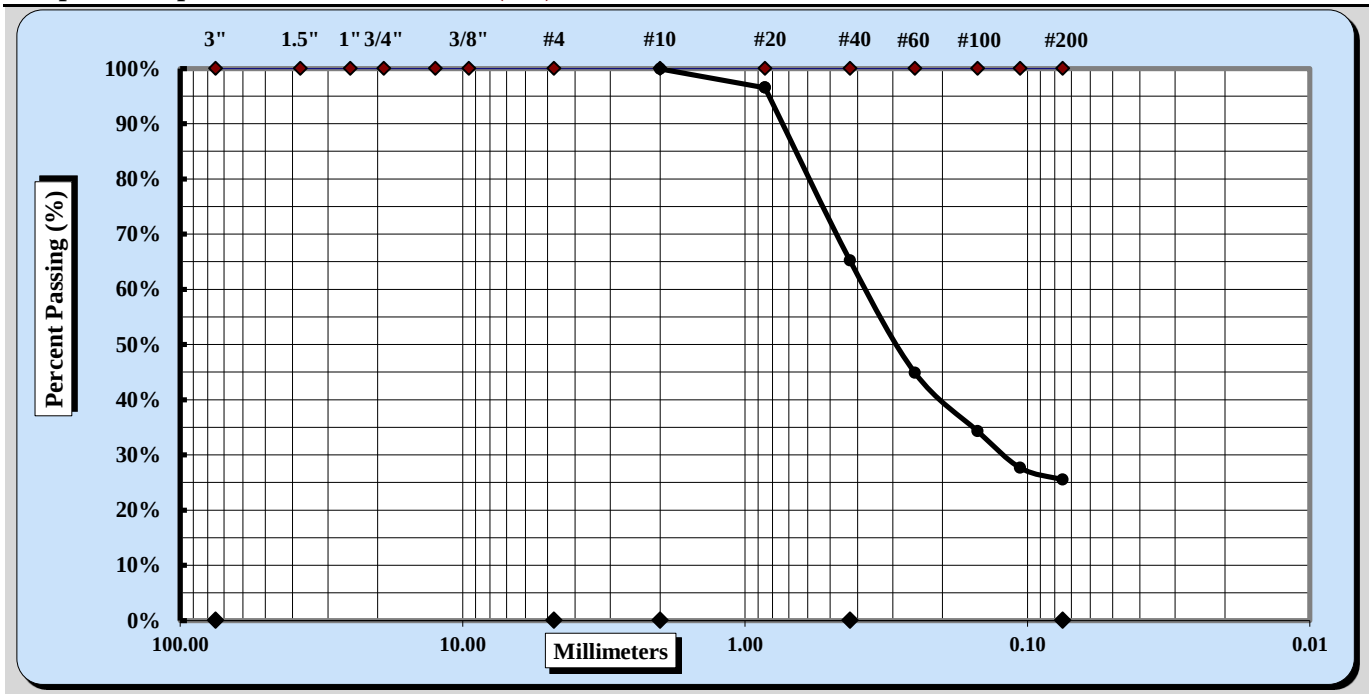
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Type: SS		
	Sample: 11	Depth:	38.5 - 40 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.0%	Fine Sand	39.7%
Gravel	0.1%	Medium Sand	34.7%	Silt & Clay	25.5%

Coarse Sand	0.0%	Medium Sand	34.7%	Fine Sand	39.7%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

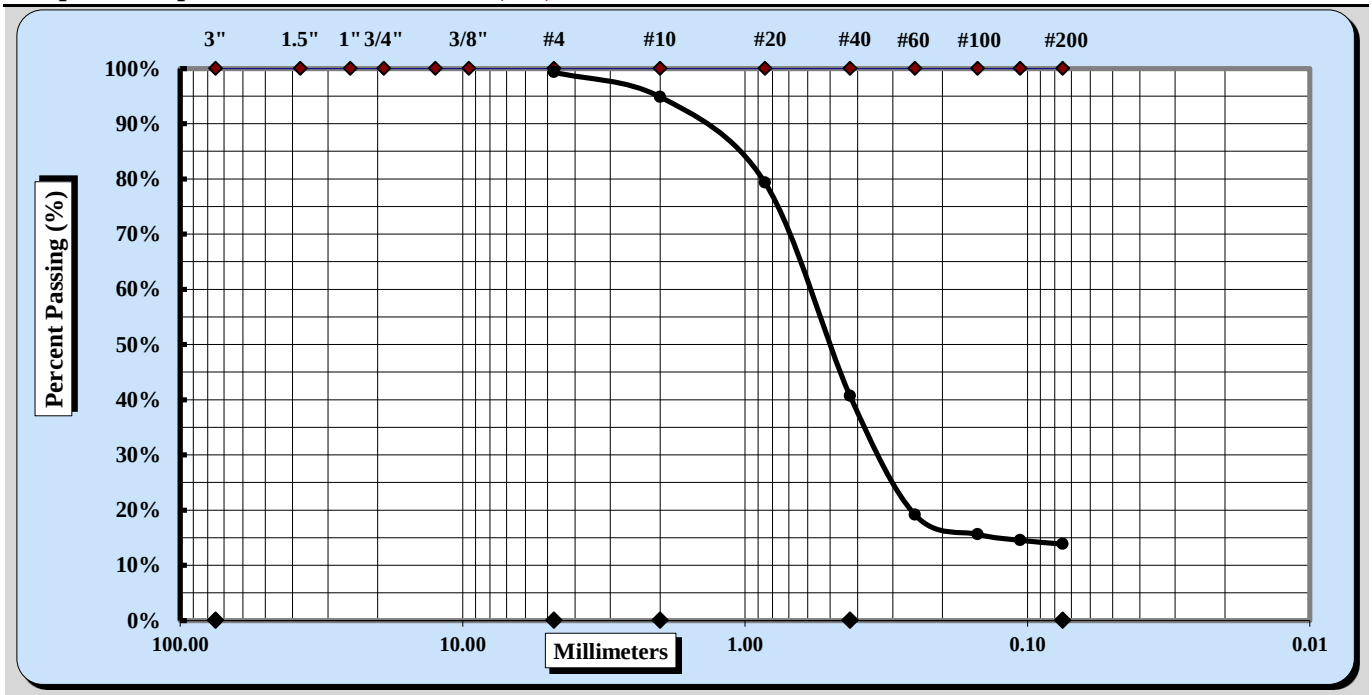
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Type: SS		
	Sample: 13	Depth:	48.5 - 50 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	4.5%	Fine Sand	26.8%
Gravel	0.7%	Medium Sand	54.2%	Silt & Clay	13.8%

Coarse Sand	4.5%	Medium Sand	54.2%	Fine Sand	26.8%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/20/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

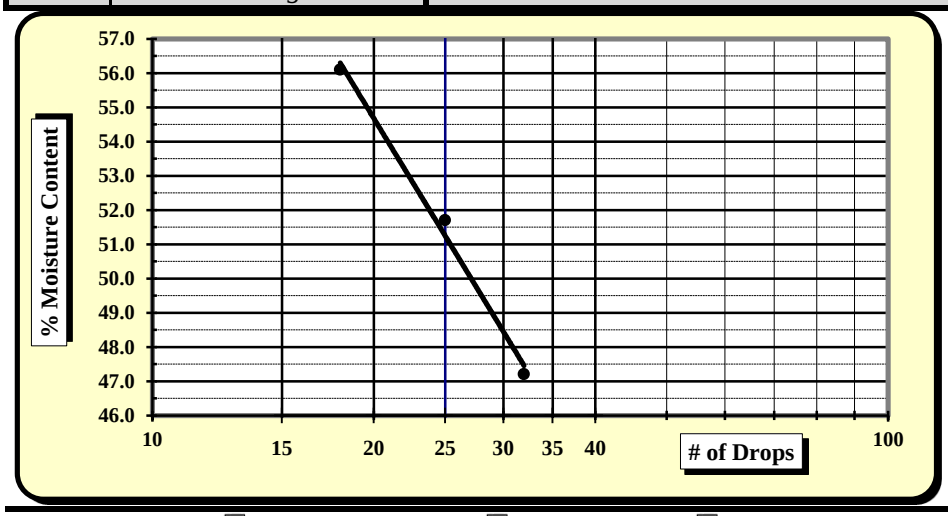
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/27/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Sample No: 15		
		Depth: 58.5 - 60 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	22	20	5				15	16	
A	Tare Weight	15.47	15.54	15.47				15.40	15.70	
B	Wet Soil Weight + A	28.18	29.36	30.50				24.37	24.23	
C	Dry Soil Weight + A	23.61	24.65	25.68				22.77	22.72	
D	Water Weight (B-C)	4.57	4.71	4.82				1.60	1.51	
E	Dry Soil Weight (C-A)	8.14	9.11	10.21				7.37	7.02	
F	% Moisture (D/E)*100	56.1%	51.7%	47.2%				21.7%	21.5%	
N	# OF DROPS	18	25	32				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.6%**		



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	**51**
Plastic Limit	**22**
Plastic Index	**29**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/27/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

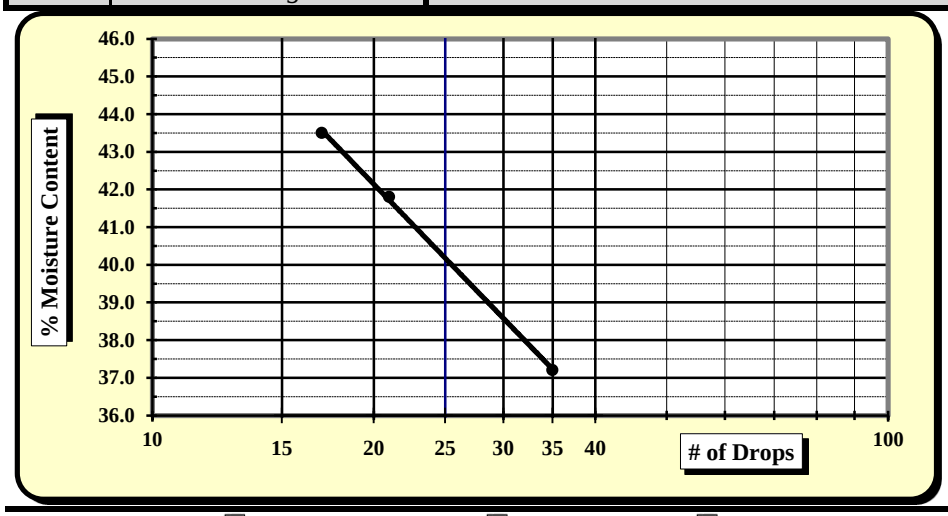
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/27/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Sample No: 2		
		Depth: 2 - 4 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	3	7	4				10	8	
A	Tare Weight	15.55	15.48	15.51				15.49	15.61	
B	Wet Soil Weight + A	29.47	30.16	31.10				23.91	24.88	
C	Dry Soil Weight + A	25.25	25.83	26.87				22.62	23.46	
D	Water Weight (B-C)	4.22	4.33	4.23				1.29	1.42	
E	Dry Soil Weight (C-A)	9.70	10.35	11.36				7.13	7.85	
F	% Moisture (D/E)*100	43.5%	41.8%	37.2%				18.1%	18.1%	
N	# OF DROPS	17	21	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**18.1%**		



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	**40**
Plastic Limit	**18**
Plastic Index	**22**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/27/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

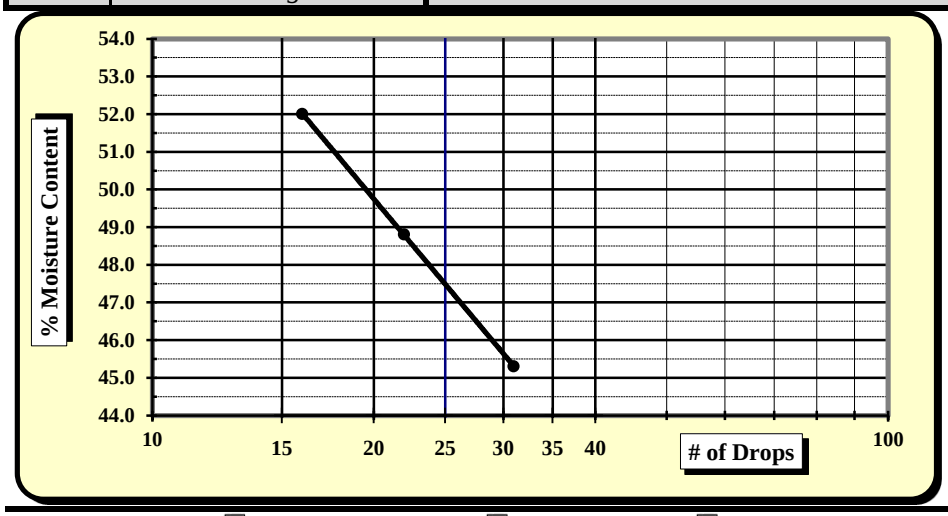
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/27/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Sample No: 4		
		Depth: 6 - 8 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	24	12				28	57	
A	Tare Weight	15.52	15.52	15.64				20.98	21.19	
B	Wet Soil Weight + A	27.15	28.08	29.53				30.12	29.44	
C	Dry Soil Weight + A	23.17	23.96	25.20				28.59	28.06	
D	Water Weight (B-C)	3.98	4.12	4.33				1.53	1.38	
E	Dry Soil Weight (C-A)	7.65	8.44	9.56				7.61	6.87	
F	% Moisture (D/E)*100	52.0%	48.8%	45.3%				20.1%	20.1%	
N	# OF DROPS	16	22	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**20.1%**		



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 **47**
Plastic Limit **20**
Plastic Index **27**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/27/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

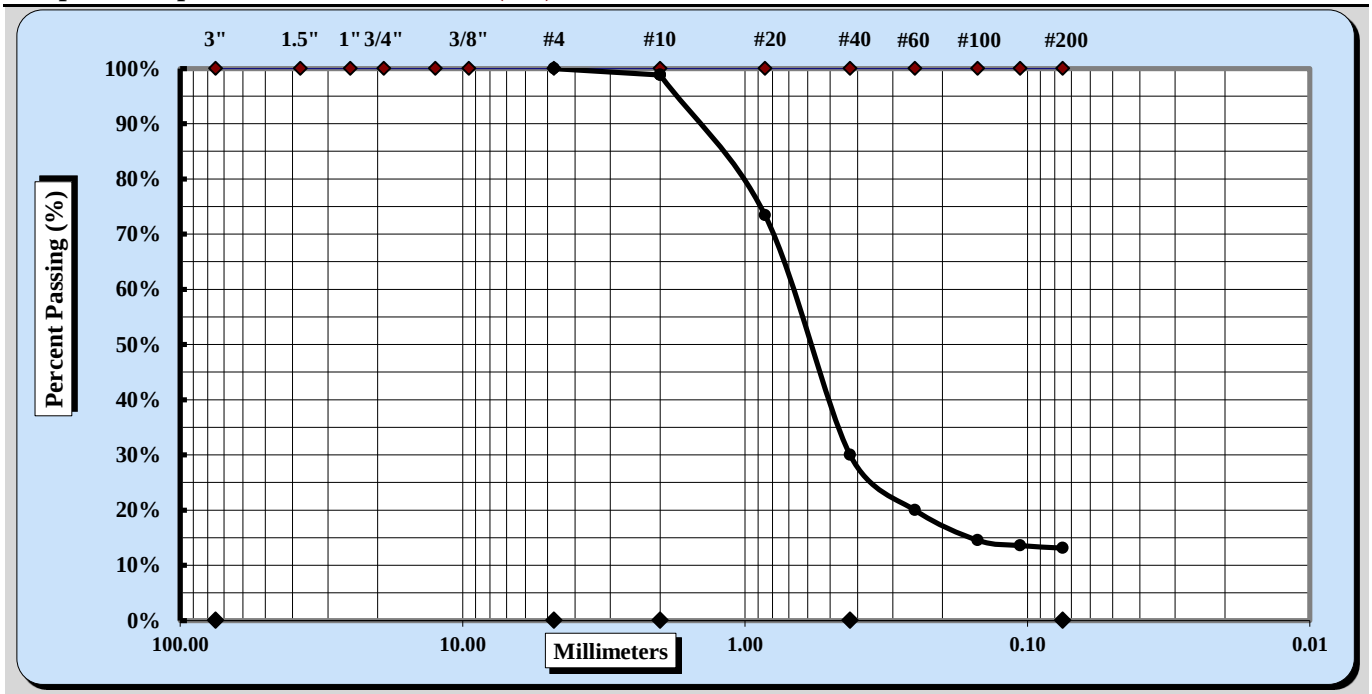
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Type: SS		
	Sample: 6	Depth:	13.5 - 15 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.2%	Fine Sand	16.9%
Gravel	0.0%	Medium Sand	68.8%	Silt & Clay	13.1%

Coarse Sand	1.2%	Medium Sand	68.8%	Fine Sand	16.9%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/20/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

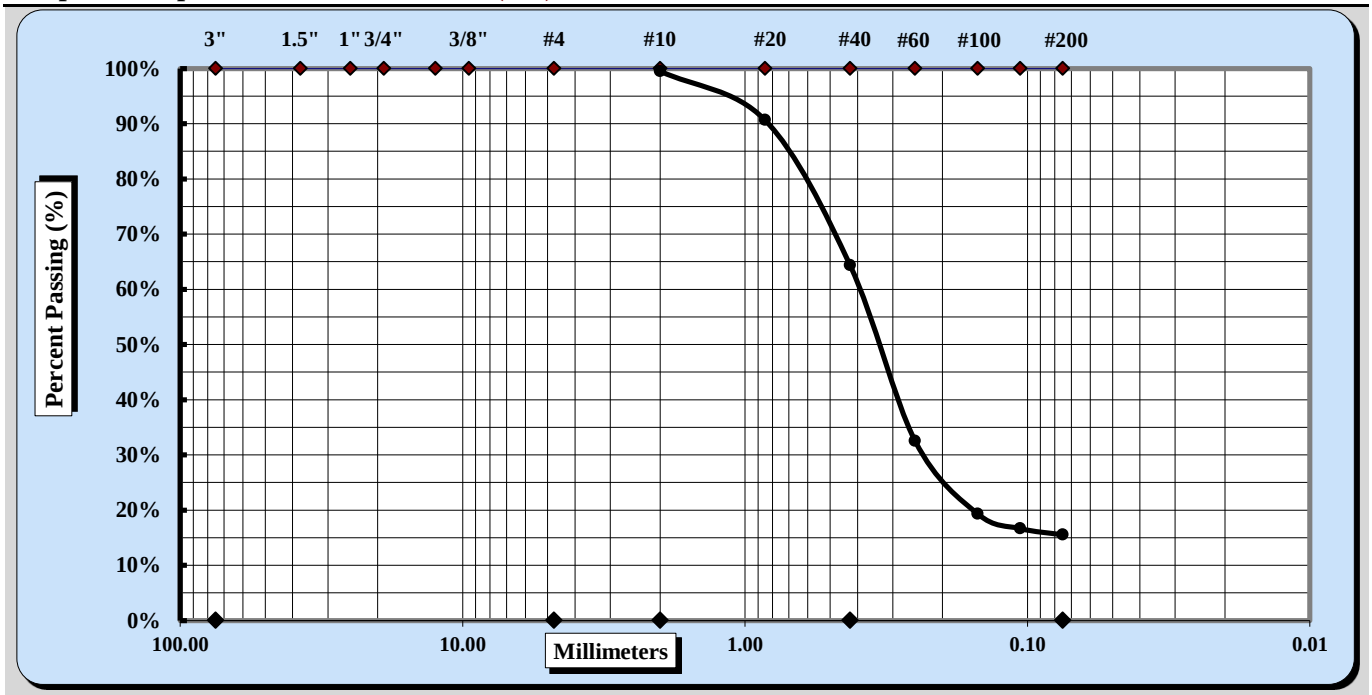
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Type: SS		
	Sample: 7	Depth:	18.5 - 20 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.5%	Fine Sand	48.8%
Gravel	0.0%	Medium Sand	35.2%	Silt & Clay	15.5%

Coarse Sand	0.5%	Medium Sand	35.2%	Fine Sand	48.8%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

17113

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

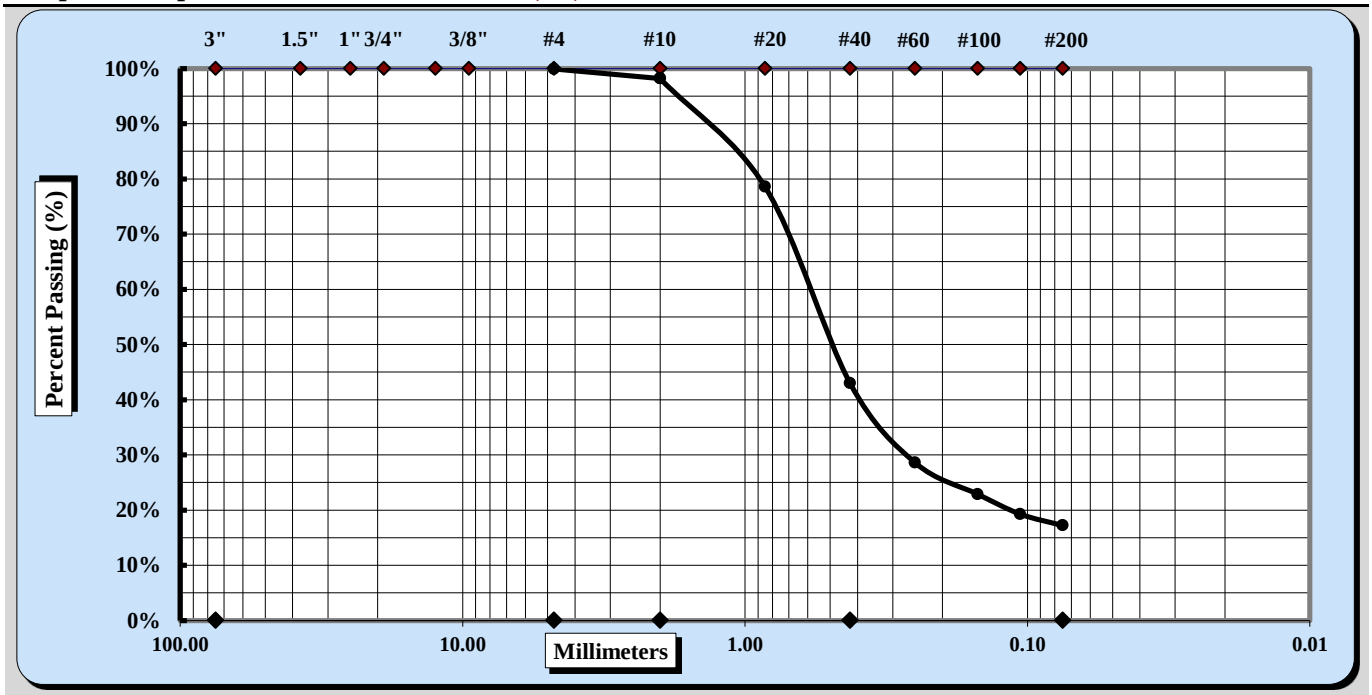
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Type: SS		
	Sample: 11	Depth:	38.5 - 40 ft

Sample Description: CLAYEY SAND (SC) **A-2-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.7%	Fine Sand	25.8%
Gravel	0.1%	Medium Sand	55.2%	Silt & Clay	17.2%
Liquid Limit	27	Plastic Limit	13	Plastic Index	14

Coarse Sand	1.7%	Medium Sand	55.2%	Fine Sand	25.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

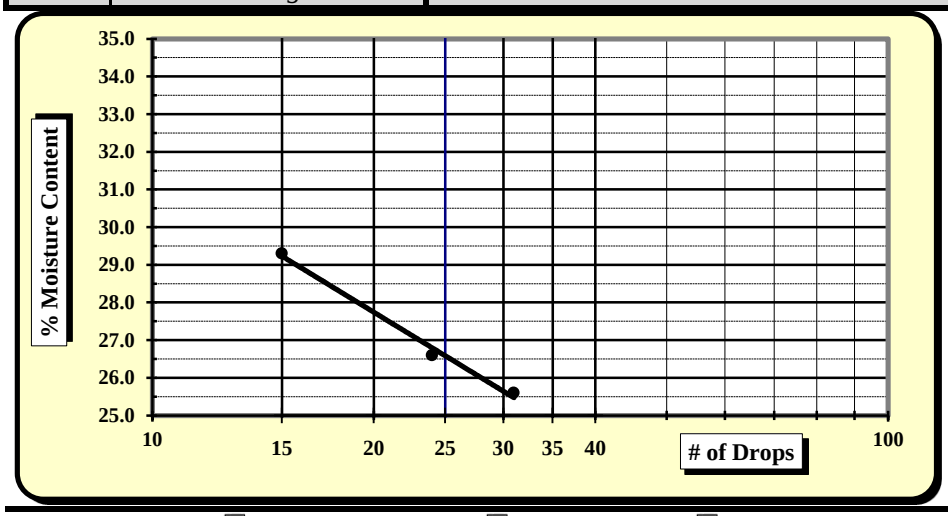
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Sample No: 11		
		Depth: 38.5 - 40 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	7	16	20				12	6	
A	Tare Weight	15.48	15.71	15.54				15.64	15.52	
B	Wet Soil Weight + A	31.32	32.10	33.33				24.91	24.25	
C	Dry Soil Weight + A	27.73	28.66	29.70				23.83	23.23	
D	Water Weight (B-C)	3.59	3.44	3.63				1.08	1.02	
E	Dry Soil Weight (C-A)	12.25	12.95	14.16				8.19	7.71	
F	% Moisture (D/E)*100	29.3%	26.6%	25.6%				13.2%	13.2%	
N	# OF DROPS	15	24	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**13.2%**		



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 **13**
Plastic Index **14**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-2-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/24/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

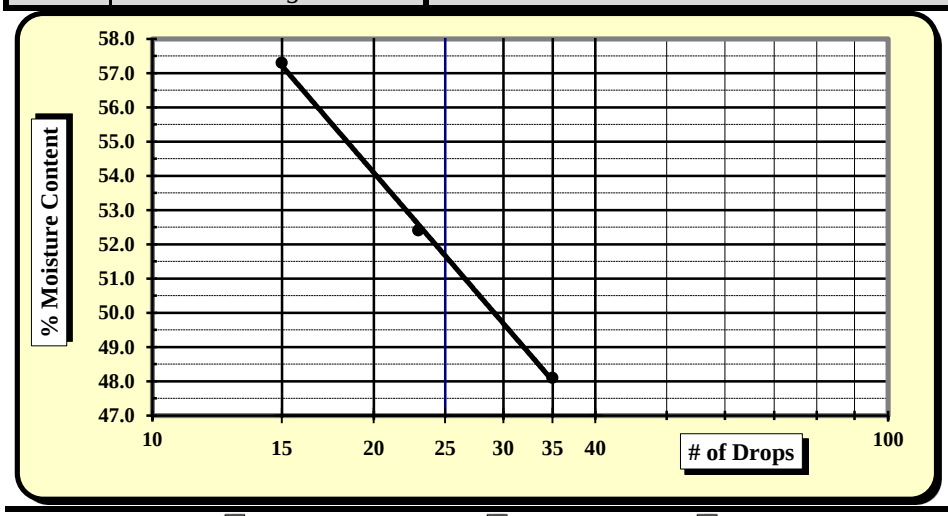
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-2	Sample No: 15		
		Depth: 58.5 - 60 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	2	14	17				22	23	
A	Tare Weight	15.60	15.54	15.57				15.47	15.50	
B	Wet Soil Weight + A	27.60	28.78	29.15				24.05	25.00	
C	Dry Soil Weight + A	23.23	24.23	24.74				22.39	23.17	
D	Water Weight (B-C)	4.37	4.55	4.41				1.66	1.83	
E	Dry Soil Weight (C-A)	7.63	8.69	9.17				6.92	7.67	
F	% Moisture (D/E)*100	57.3%	52.4%	48.1%				24.0%	23.9%	
N	# OF DROPS	15	23	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.0%**		



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 **52**
Plastic Limit **24**
Plastic Index **28**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/24/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

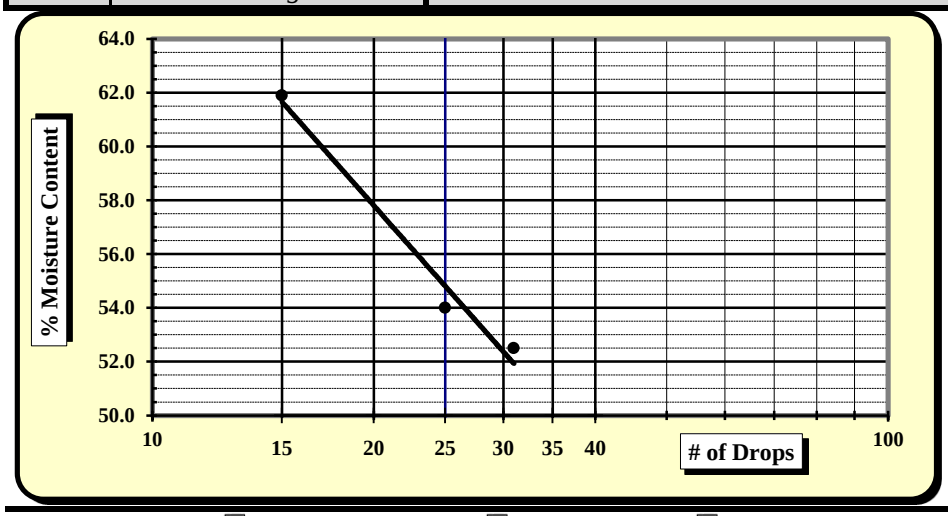
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/28/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Sample No: 3		
		Depth: 4 - 6 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	11	23	1				12	6	
A	Tare Weight	15.50	15.50	15.42				15.64	15.52	
B	Wet Soil Weight + A	26.72	27.97	28.79				24.62	24.03	
C	Dry Soil Weight + A	22.43	23.60	24.19				22.82	22.33	
D	Water Weight (B-C)	4.29	4.37	4.60				1.80	1.70	
E	Dry Soil Weight (C-A)	6.93	8.10	8.77				7.18	6.81	
F	% Moisture (D/E)*100	61.9%	54.0%	52.5%				25.1%	25.0%	
N	# OF DROPS	15	25	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**25.1%**		



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	**55**
Plastic Limit	**25**
Plastic Index	**30**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/28/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

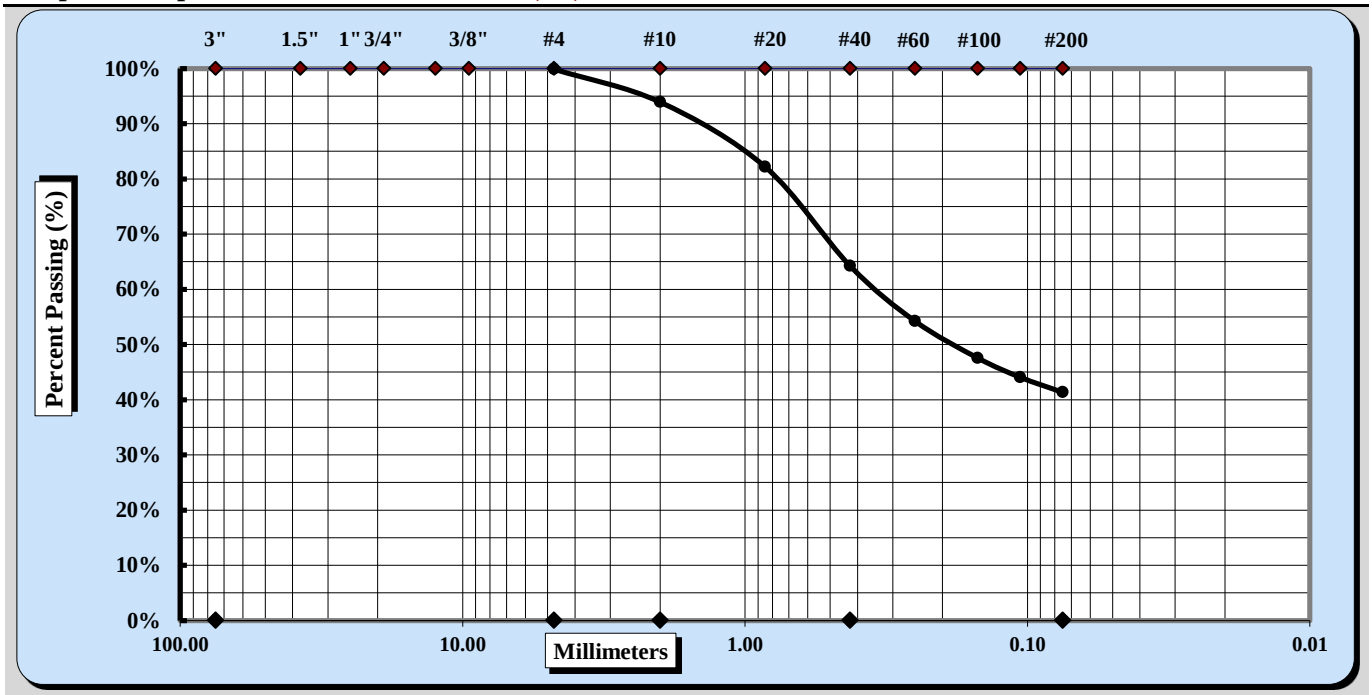
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/12/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Type: SS		
	Sample: 6	Depth:	13.5 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-7**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	6.0%	Fine Sand	22.9%
Gravel	0.1%	Medium Sand	29.7%	Silt & Clay	41.3%

Coarse Sand	6.0%	Medium Sand	29.7%	Fine Sand	22.9%
Description of Sand & Gravel Particles:		Rounded	☒	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

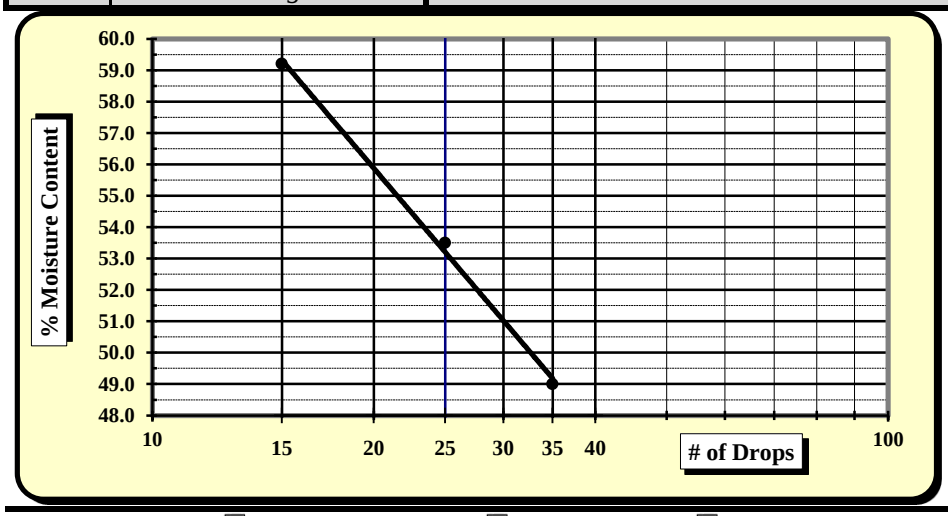
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/28/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Sample No: 7		
		Depth: 18.5 - 20 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	24	18	19				9	2	
A	Tare Weight	15.51	15.50	15.49				15.49	15.61	
B	Wet Soil Weight + A	30.84	31.79	32.64				24.92	24.16	
C	Dry Soil Weight + A	25.14	26.11	27.00				23.13	22.55	
D	Water Weight (B-C)	5.70	5.68	5.64				1.79	1.61	
E	Dry Soil Weight (C-A)	9.63	10.61	11.51				7.64	6.94	
F	% Moisture (D/E)*100	59.2%	53.5%	49.0%				23.4%	23.2%	
N	# OF DROPS	15	25	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**23.3%**		



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 **53**
Plastic Limit **23**
Plastic Index **30**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/28/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

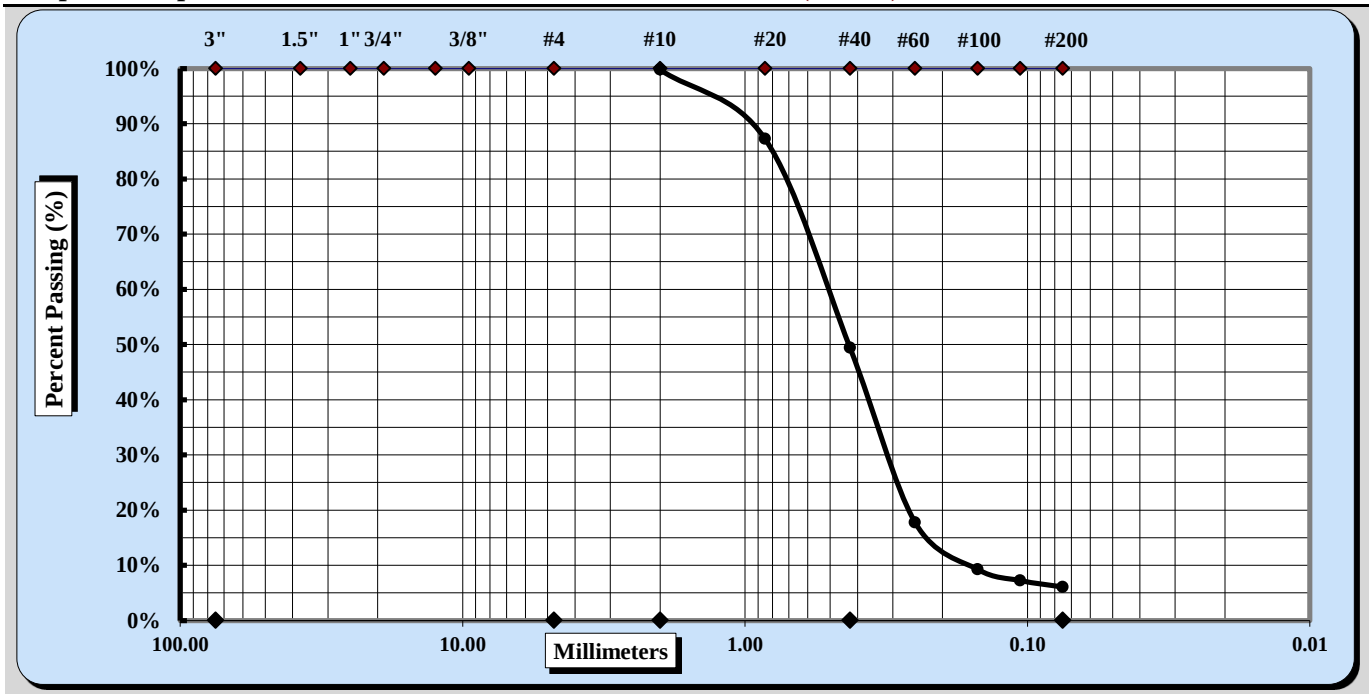
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/19/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/12/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Type: SS		
	Sample: 10	Depth:	33.5 - 35 ft

Sample Description: POORLY GRADED SAND WITH SILT (SP-SM) **A-3**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.2%	Fine Sand	43.3%
Gravel	0.0%	Medium Sand	50.4%	Silt & Clay	6.1%

Cc = 1 Cu = 3

Coarse Sand	0.2%	Medium Sand	50.4%	Fine Sand	43.3%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

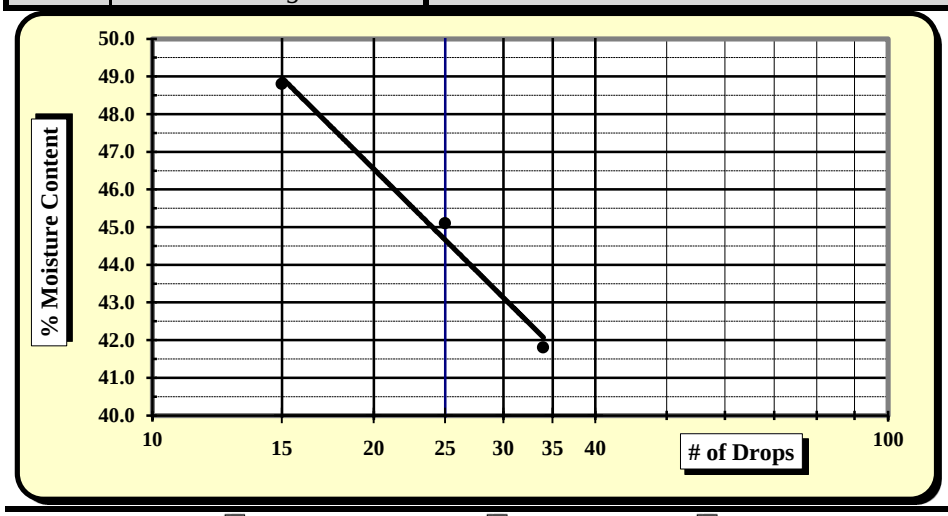
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Sample No: 13		
		Depth: 48.5 - 50 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	8	24				53	54	
A	Tare Weight	15.41	15.61	15.51				21.42	21.16	
B	Wet Soil Weight + A	31.50	32.76	33.53				29.41	31.14	
C	Dry Soil Weight + A	26.22	27.43	28.22				28.11	29.52	
D	Water Weight (B-C)	5.28	5.33	5.31				1.30	1.62	
E	Dry Soil Weight (C-A)	10.81	11.82	12.71				6.69	8.36	
F	% Moisture (D/E)*100	48.8%	45.1%	41.8%				19.4%	19.4%	
N	# OF DROPS	15	25	34				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**19.4%**		



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 **45**
Plastic Limit **19**
Plastic Index **26**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/24/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

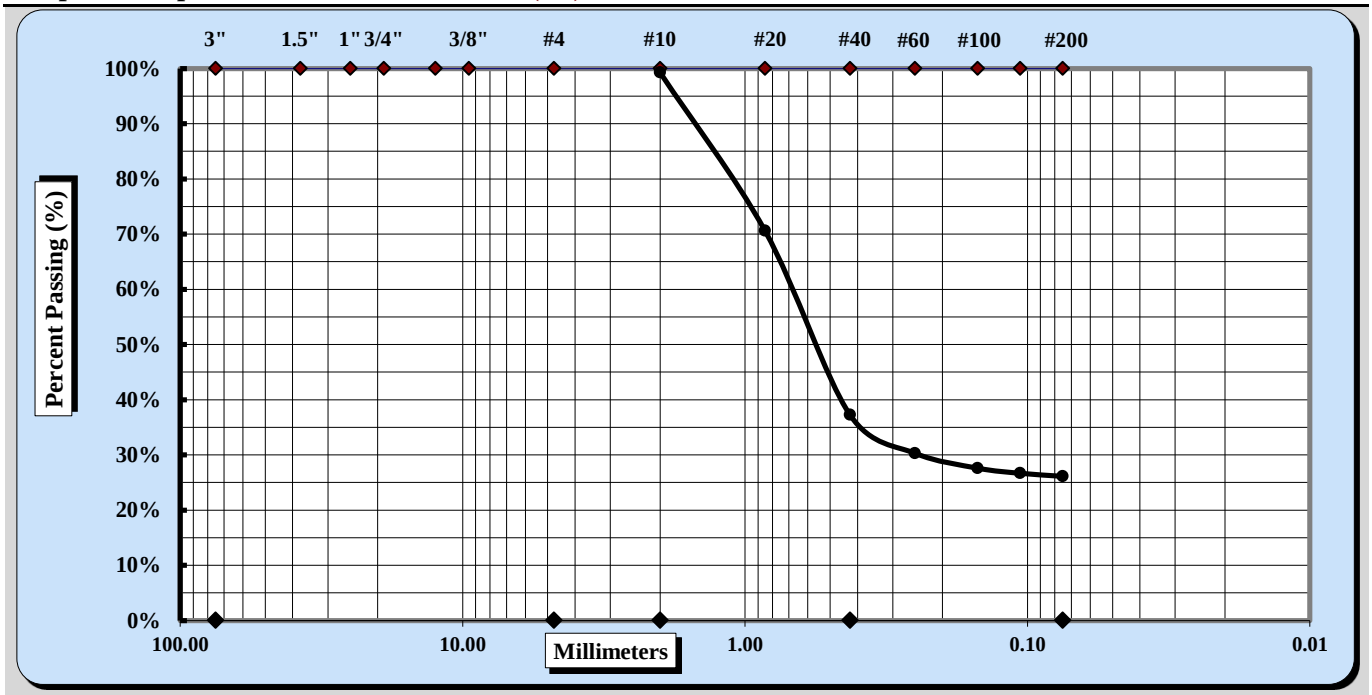
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/19/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/14/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Type: SS		
	Sample: 15	Depth:	58.5 - 60 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.7%	Fine Sand	11.1%
Gravel	0.0%	Medium Sand	62.0%	Silt & Clay	26.1%

Coarse Sand	0.7%	Medium Sand	62.0%	Fine Sand	11.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

ASTM D422

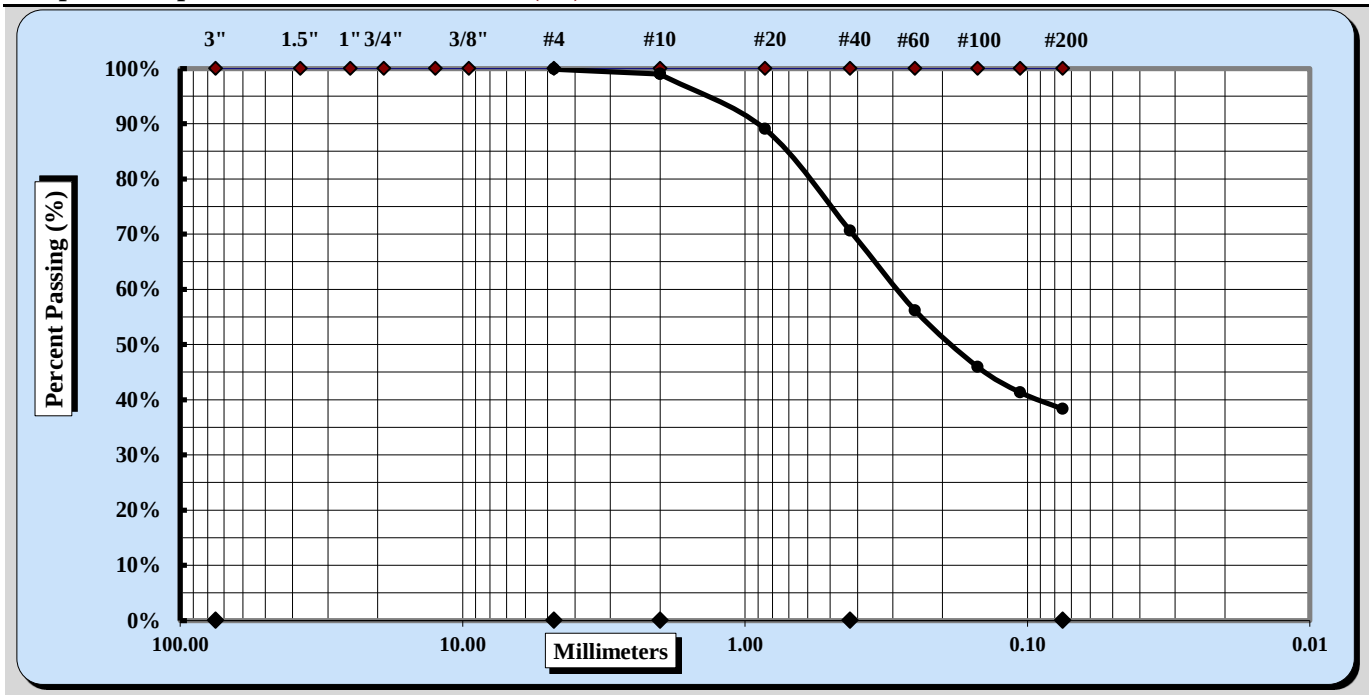
Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Sample Log No.:341

Project #:	**1461-14-046**	Report Date:	11/19/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/14/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Type: SS		
	Sample: 6	Depth:	13.5 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-7**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	0.9%	Fine Sand	32.3%
Gravel	0.1%	Medium Sand	28.4%	Silt & Clay	38.3%

Coarse Sand	0.9%	Medium Sand	28.4%	Fine Sand	32.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

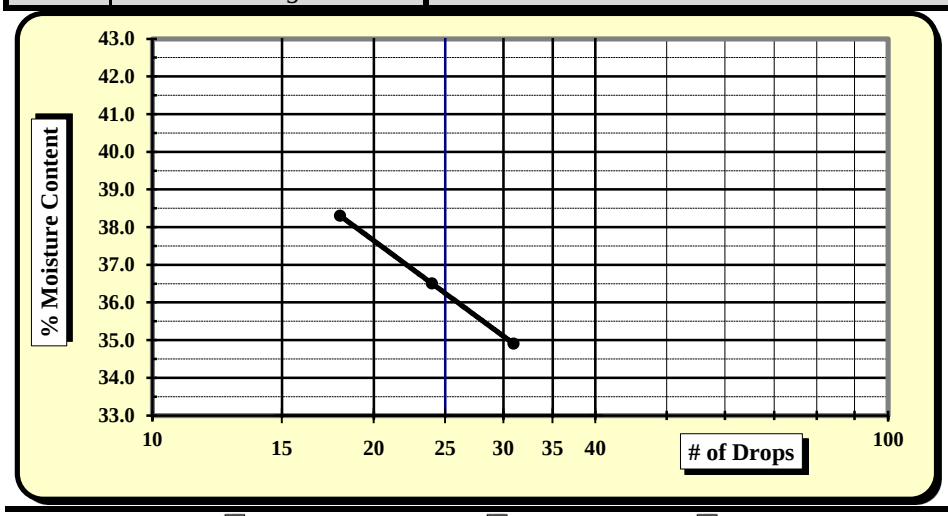
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Sample No: 9		
		Depth: 28.5 - 30 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	24	3	6				5	22	
A	Tare Weight	15.51	15.55	15.52				15.47	15.47	
B	Wet Soil Weight + A	27.64	28.91	29.72				24.57	24.02	
C	Dry Soil Weight + A	24.28	25.34	26.05				23.16	22.69	
D	Water Weight (B-C)	3.36	3.57	3.67				1.41	1.33	
E	Dry Soil Weight (C-A)	8.77	9.79	10.53				7.69	7.22	
F	% Moisture (D/E)*100	38.3%	36.5%	34.9%				18.3%	18.4%	
N	# OF DROPS	18	24	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**18.4%**		



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	**36**
Plastic Limit	**18**
Plastic Index	**18**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/25/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

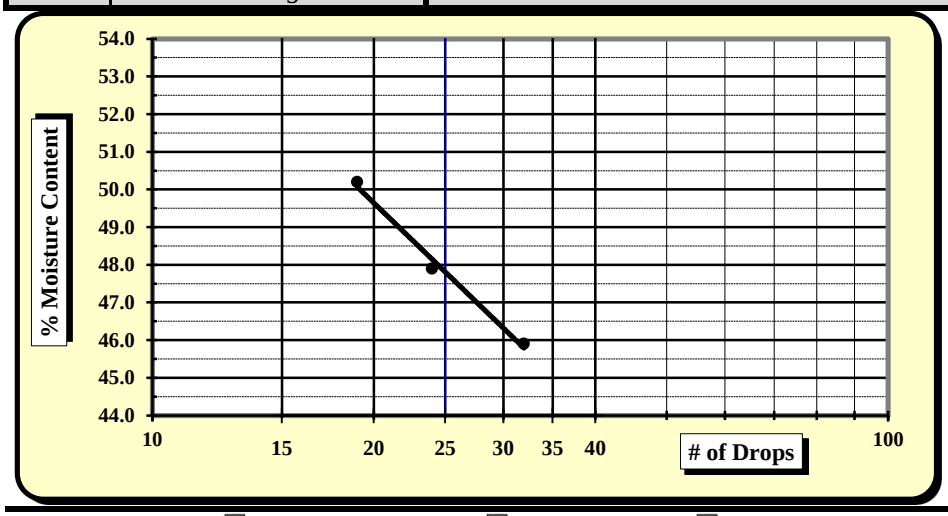
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/18/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Sample No: 10		
		Depth: 33.5 - 35 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	18	5	21				11	3	
A	Tare Weight	15.50	15.48	15.58				15.50	15.55	
B	Wet Soil Weight + A	31.66	32.21	33.52				23.64	24.81	
C	Dry Soil Weight + A	26.26	26.79	27.88				22.20	23.17	
D	Water Weight (B-C)	5.40	5.42	5.64				1.44	1.64	
E	Dry Soil Weight (C-A)	10.76	11.31	12.30				6.70	7.62	
F	% Moisture (D/E)*100	50.2%	47.9%	45.9%				21.5%	21.5%	
N	# OF DROPS	19	24	32				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.5%**		



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	**48**
Plastic Limit	**22**
Plastic Index	**26**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/24/2014	N. Randy Rainwater	11/20/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

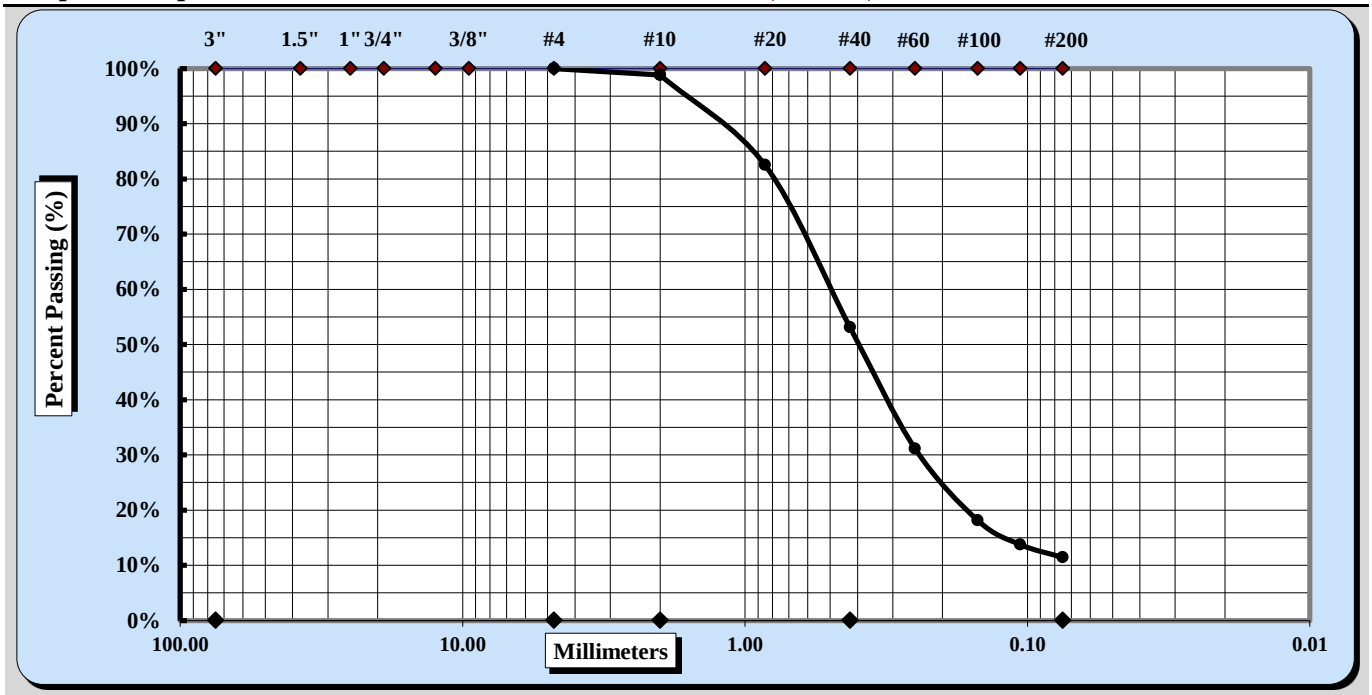
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/19/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/14/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Type: SS		
	Sample: 12	Depth:	43.5 - 45 ft

Sample Description: WELL GRADED SAND WITH SILT (SW-SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.2%	Fine Sand	41.7%
Gravel	0.0%	Medium Sand	45.7%	Silt & Clay	11.4%

Cc = 2 **Cu = 10**

Coarse Sand	1.2%	Medium Sand	45.7%	Fine Sand	41.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/20/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

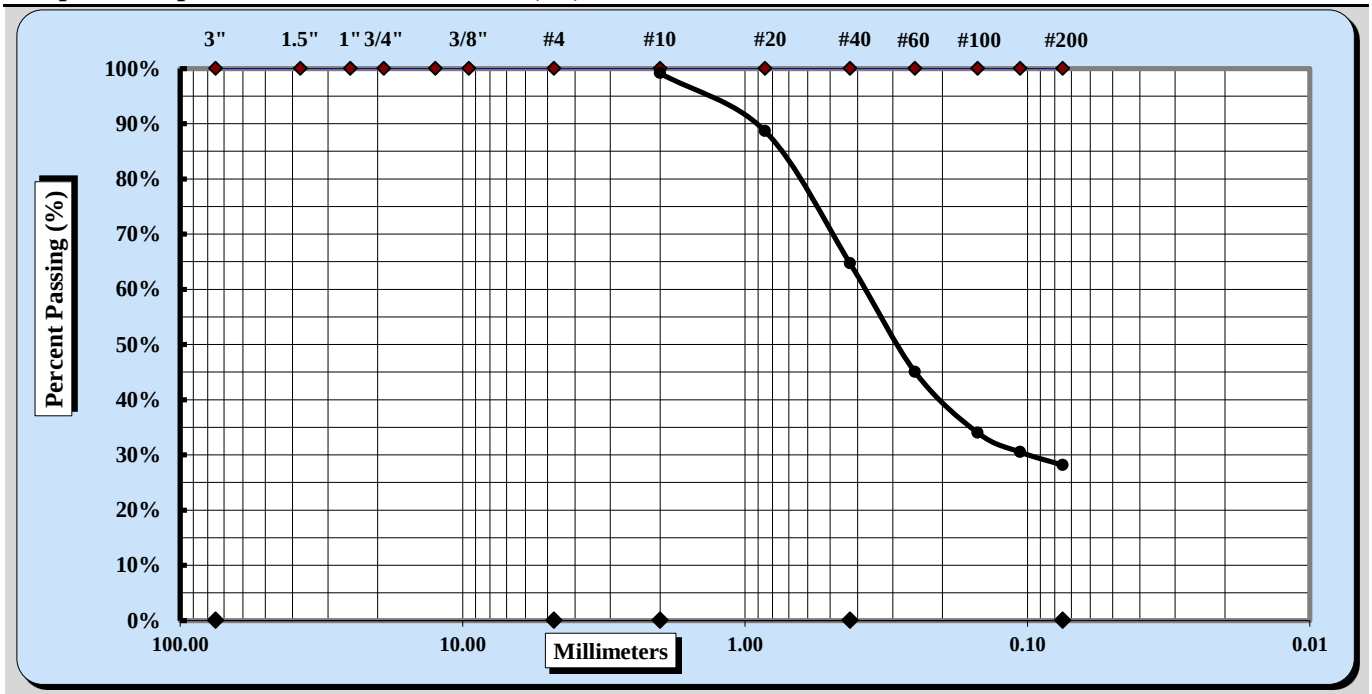
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/19/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/14/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Type: SS		
	Sample: 13	Depth:	48.5 - 50 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.9%	Fine Sand	36.5%
Gravel	0.0%	Medium Sand	34.4%	Silt & Clay	28.1%

Coarse Sand	0.9%	Medium Sand	34.4%	Fine Sand	36.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/20/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

ASTM D422

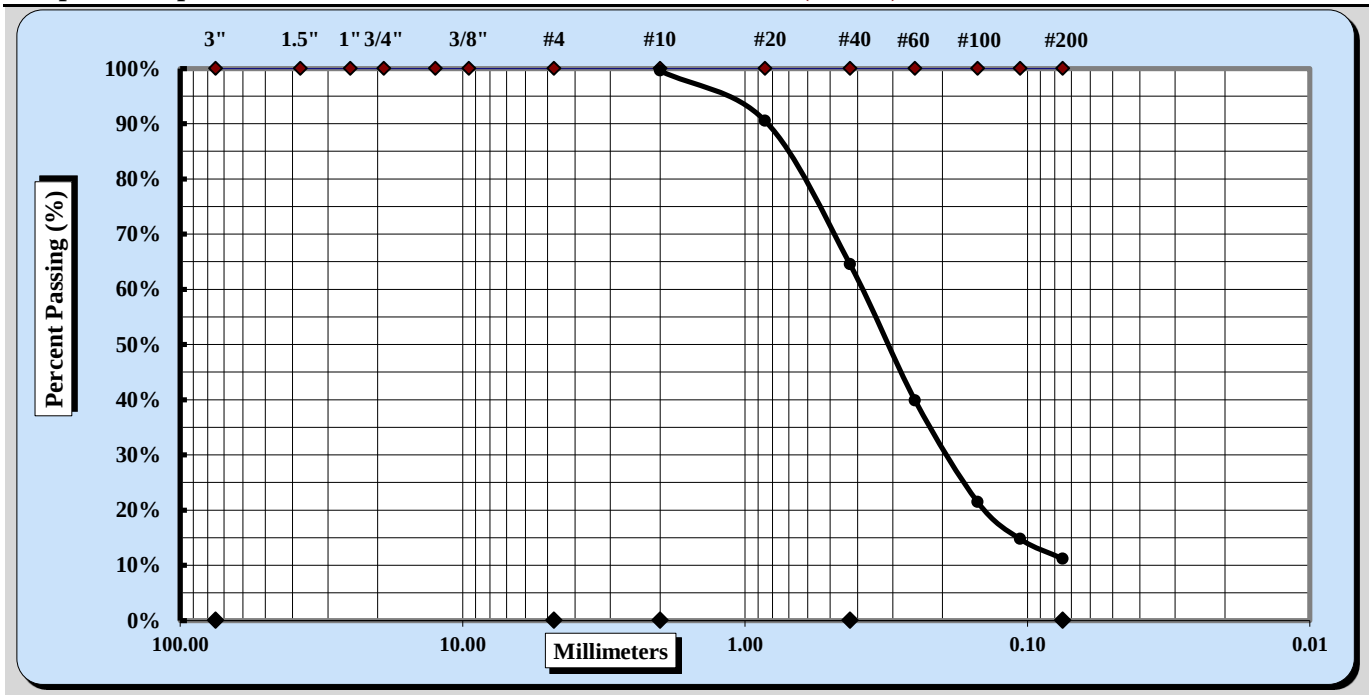
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-6	Type: SS		
	Sample: 4	Depth:	6 - 8 ft

Sample Description: POORLY GRADED SAND WITH SILT (SP-SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	53.3%
Gravel	0.0%	Medium Sand	35.1%	Silt & Clay	11.2%

Cc = 1 Cu = 5

Coarse Sand	0.4%	Medium Sand	35.1%	Fine Sand	53.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

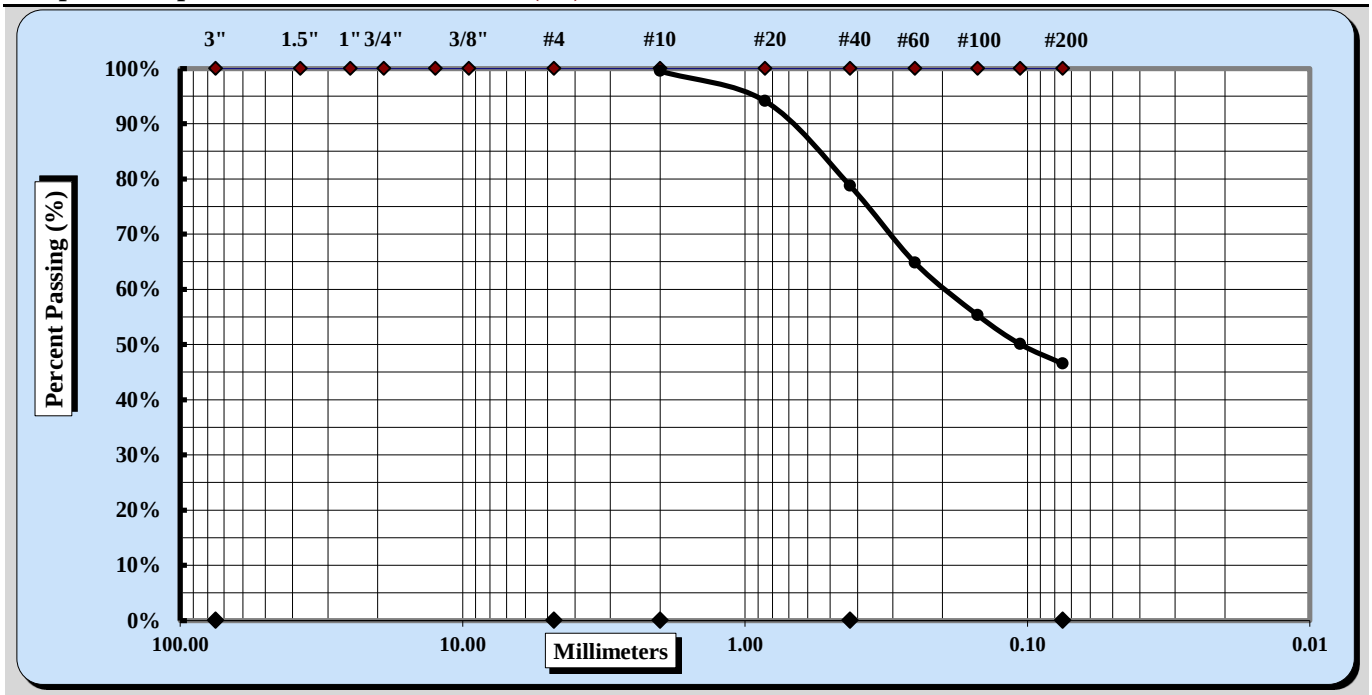
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-6	Type: SS		
	Sample: 7	Depth:	18.5 - 20 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	32.2%
Gravel	0.1%	Medium Sand	20.8%	Silt & Clay	46.5%

Coarse Sand	0.4%	Medium Sand	20.8%	Fine Sand	32.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

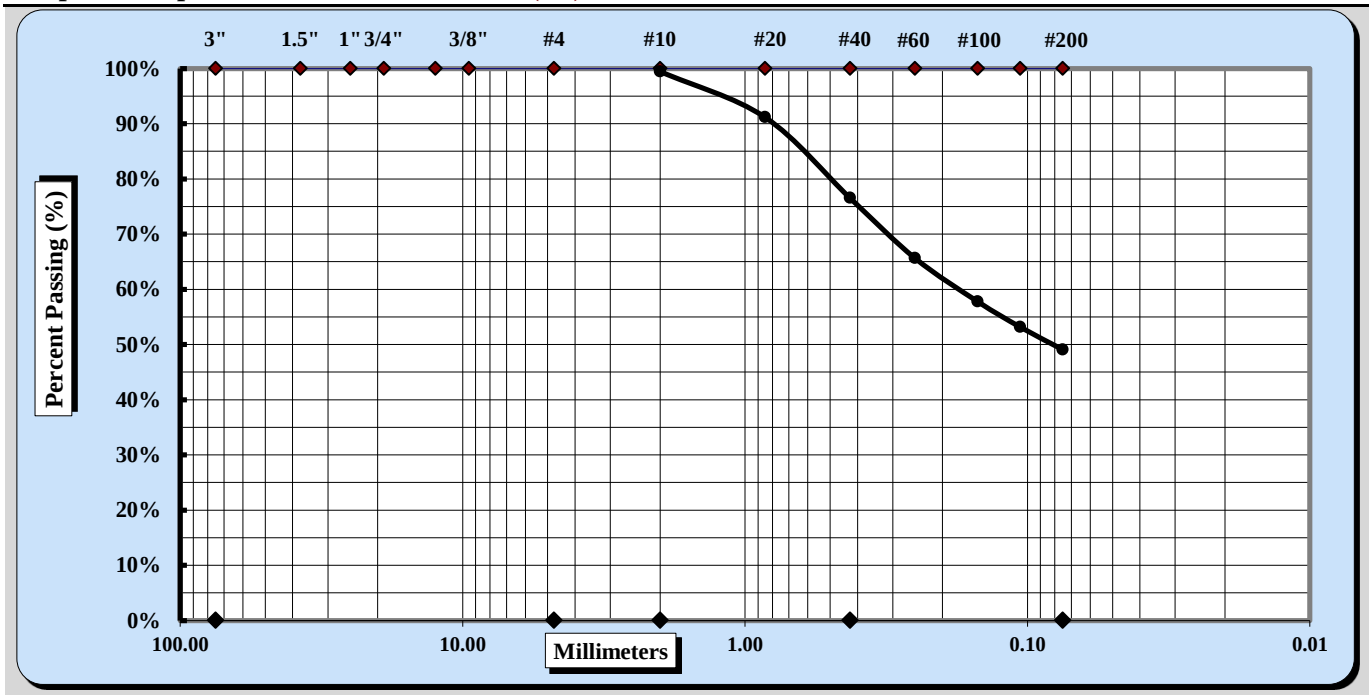
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/13/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-6	Type: SS		
	Sample: 8	Depth:	23.5 - 25 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.5%	Fine Sand	27.5%
Gravel	0.0%	Medium Sand	22.9%	Silt & Clay	49.1%
Liquid Limit	34	Plastic Limit	15	Plastic Index	19

Coarse Sand	0.5%	Medium Sand	22.9%	Fine Sand	27.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

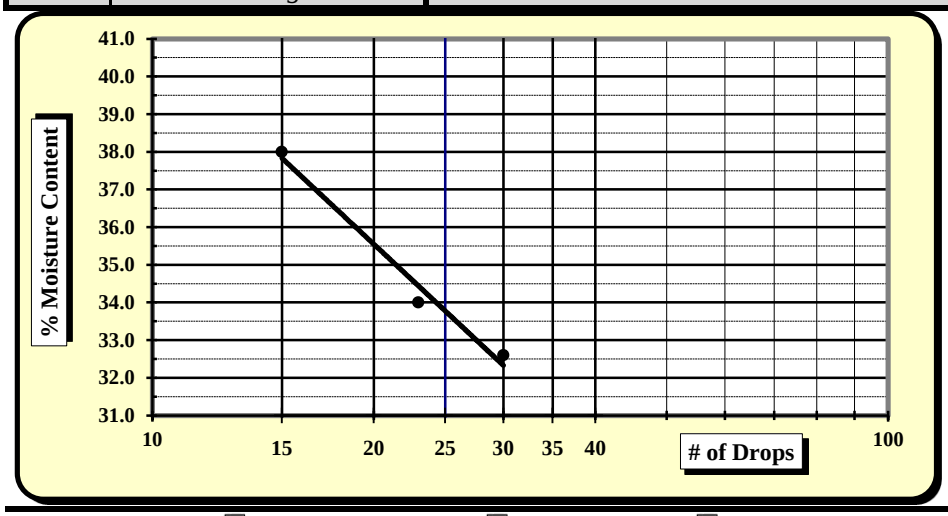
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/22/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/29/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-6	Sample No: 8		
		Depth: 23.5 - 25 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	21	3	8				11	24	
A	Tare Weight	15.58	15.55	15.61				15.50	15.51	
B	Wet Soil Weight + A	30.52	31.66	32.86				24.38	23.84	
C	Dry Soil Weight + A	26.41	27.57	28.62				23.18	22.74	
D	Water Weight (B-C)	4.11	4.09	4.24				1.20	1.10	
E	Dry Soil Weight (C-A)	10.83	12.02	13.01				7.68	7.23	
F	% Moisture (D/E)*100	38.0%	34.0%	32.6%				15.6%	15.2%	
N	# OF DROPS	15	23	30				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.4%**		



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 **34**
Plastic Limit **15**
Plastic Index **19**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/29/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

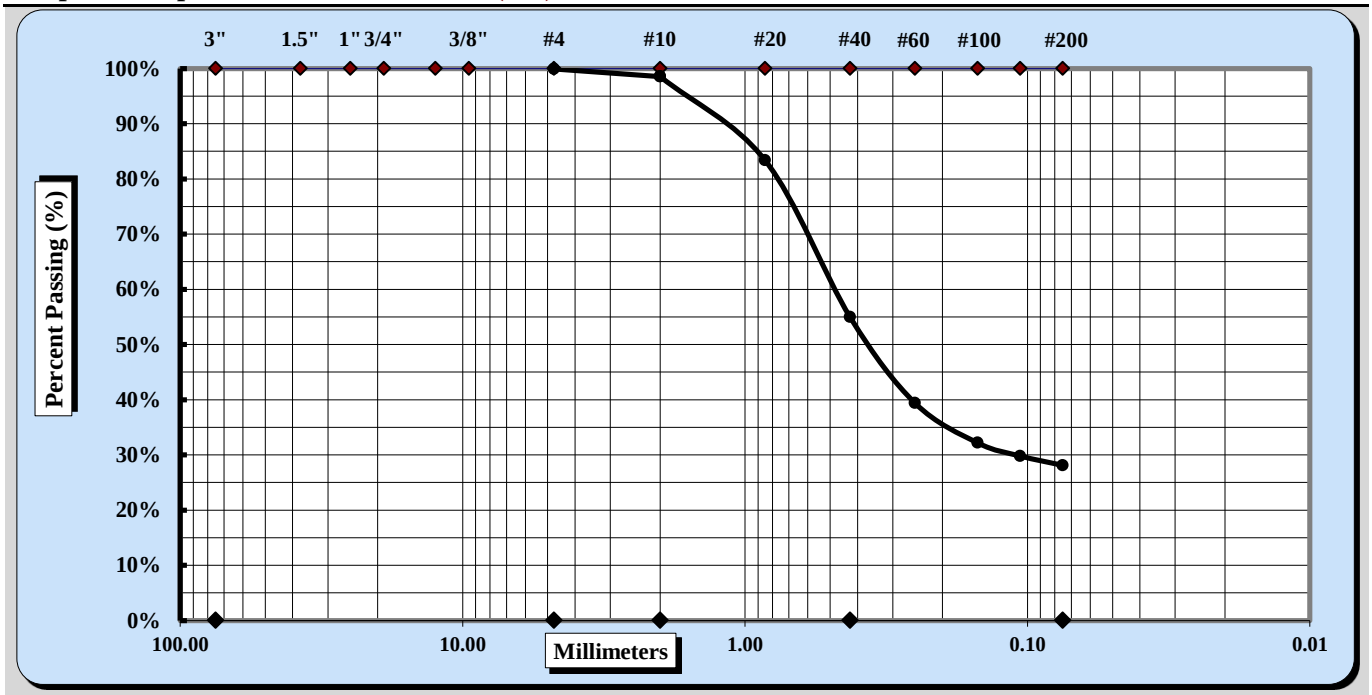
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-6	Type: SS		
	Sample: 12	Depth:	43.5 - 45 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.3%	Fine Sand	26.9%
Gravel	0.1%	Medium Sand	43.6%	Silt & Clay	28.1%

Coarse Sand	1.3%	Medium Sand	43.6%	Fine Sand	26.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

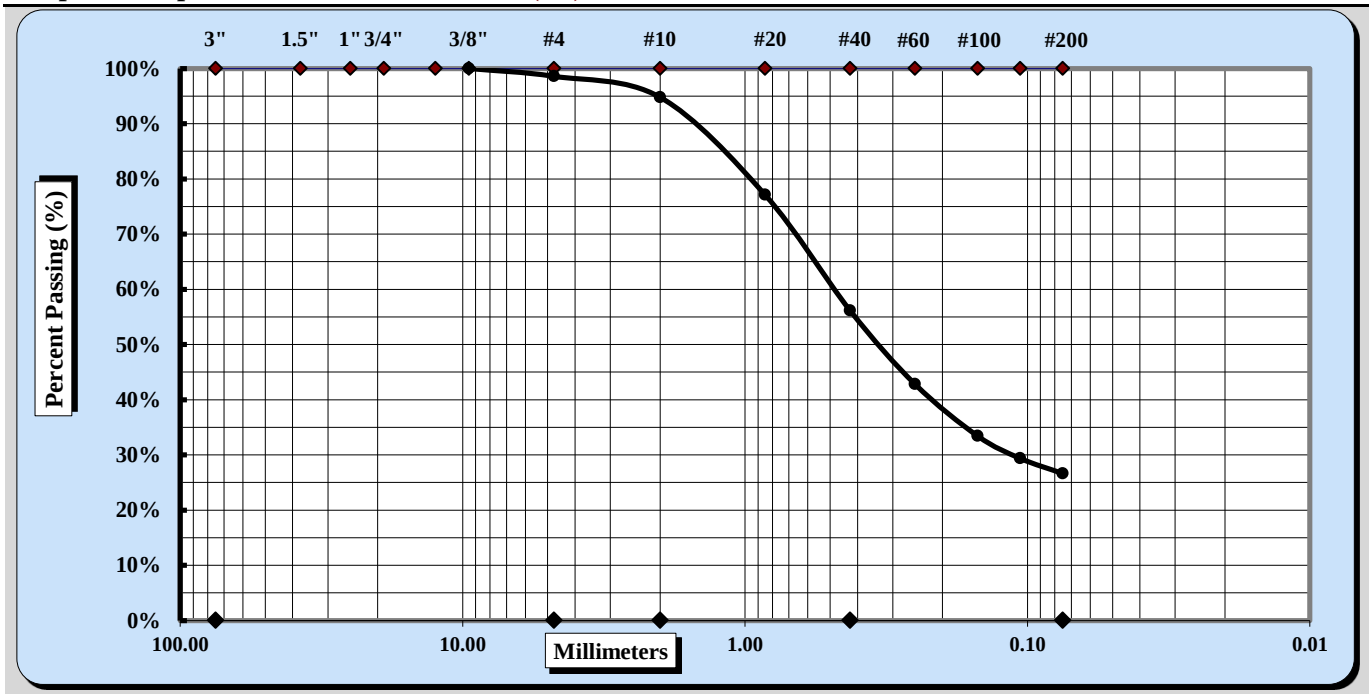
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Type: SS		
	Sample: 3	Depth:	4 - 6 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	3.8%	Fine Sand	29.5%
Gravel	1.4%	Medium Sand	38.6%	Silt & Clay	26.6%

Coarse Sand	3.8%	Medium Sand	38.6%	Fine Sand	29.5%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

ASTM D422

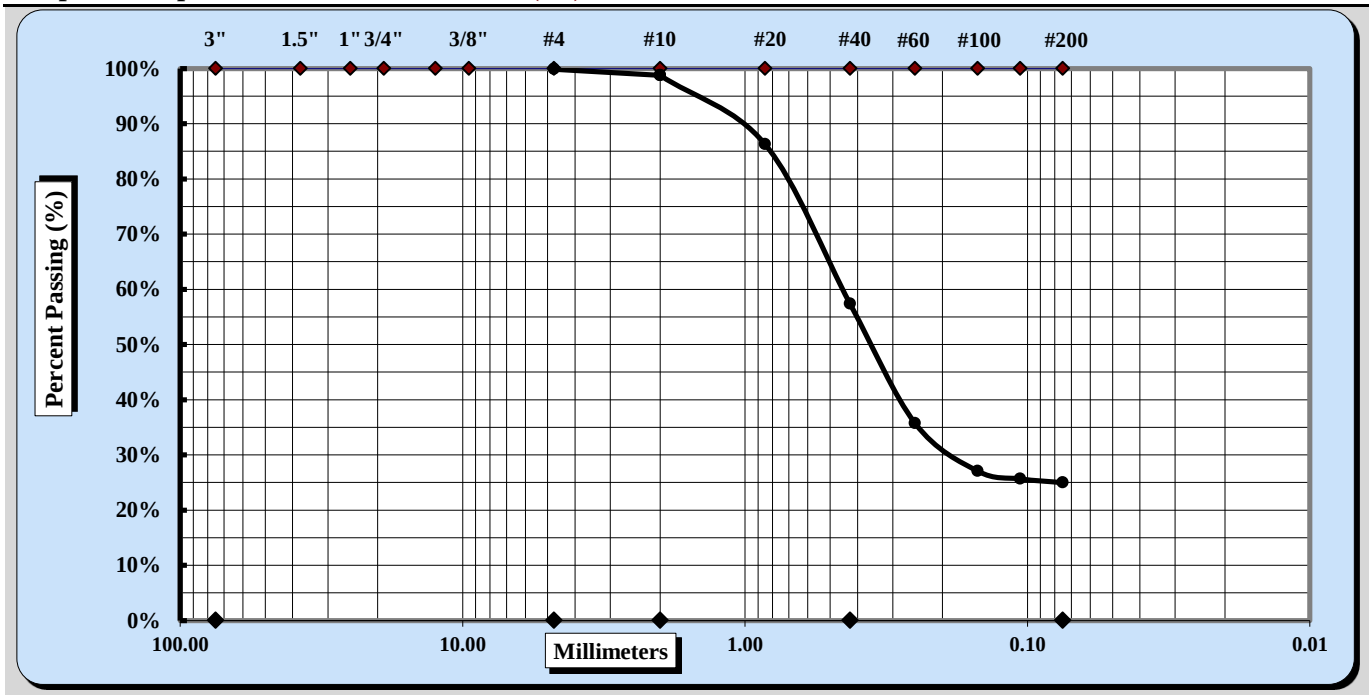
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Type: SS		
	Sample: 5	Depth:	8 - 10 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.1%	Fine Sand	32.4%
Gravel	0.1%	Medium Sand	41.4%	Silt & Clay	25.0%

Coarse Sand	1.1%	Medium Sand	41.4%	Fine Sand	32.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

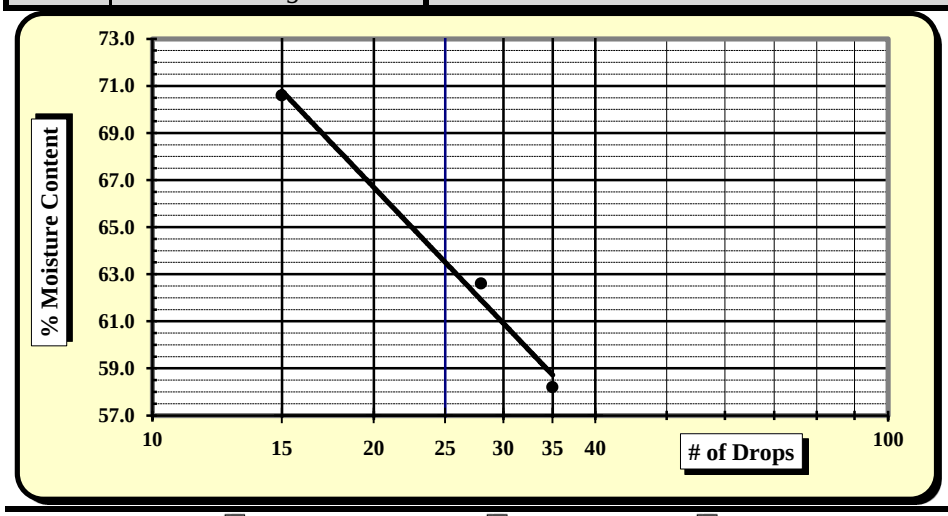
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/22/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/28/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Sample No: 10		
		Depth: 33.5 - 35 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	17	14	16				15	5	
A	Tare Weight	15.57	15.53	15.70				15.40	15.48	
B	Wet Soil Weight + A	27.46	28.46	29.75				24.06	23.74	
C	Dry Soil Weight + A	22.54	23.48	24.58				22.10	21.89	
D	Water Weight (B-C)	4.92	4.98	5.17				1.96	1.85	
E	Dry Soil Weight (C-A)	6.97	7.95	8.88				6.70	6.41	
F	% Moisture (D/E)*100	70.6%	62.6%	58.2%				29.3%	28.9%	
N	# OF DROPS	15	28	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**29.1%**		



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 **63**
Plastic Limit **29**
Plastic Index **34**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/28/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

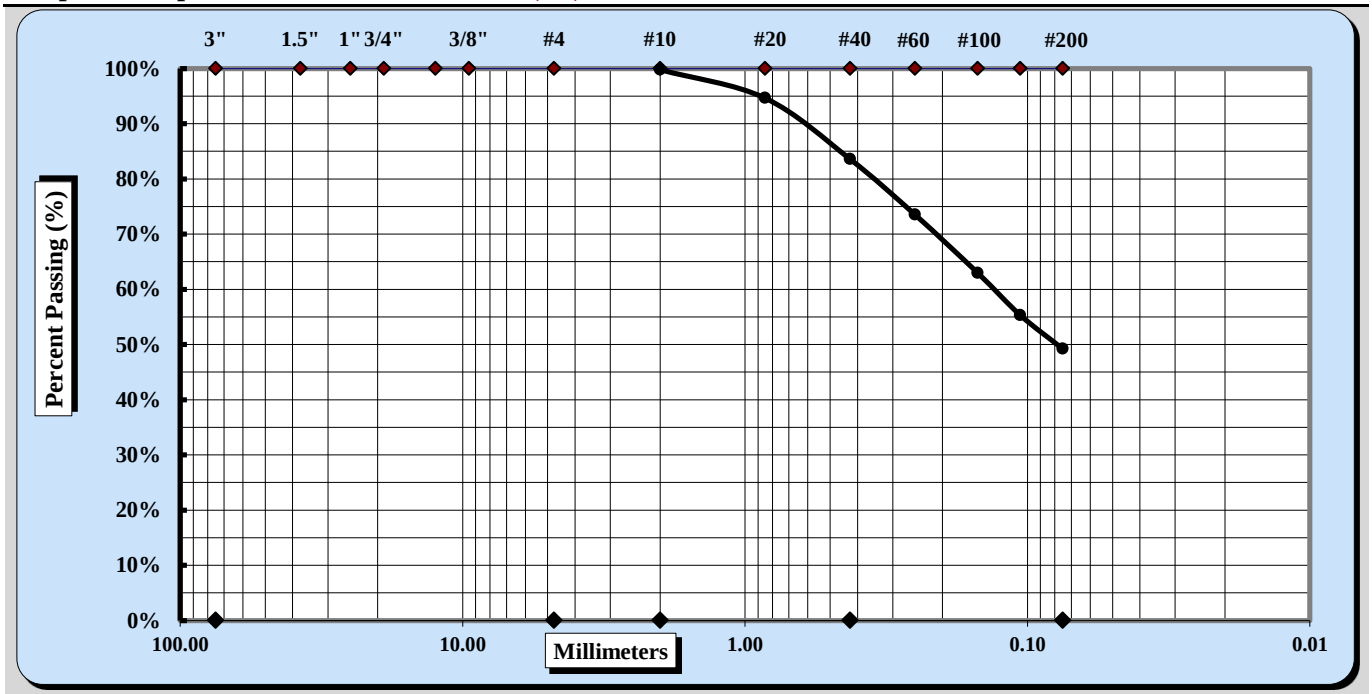
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Type: SS		
	Sample: 15	Depth:	58.5 - 60 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.2%	Fine Sand	34.4%
Gravel	0.0%	Medium Sand	16.2%	Silt & Clay	49.2%

Coarse Sand	0.2%	Medium Sand	16.2%	Fine Sand	34.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

17113

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

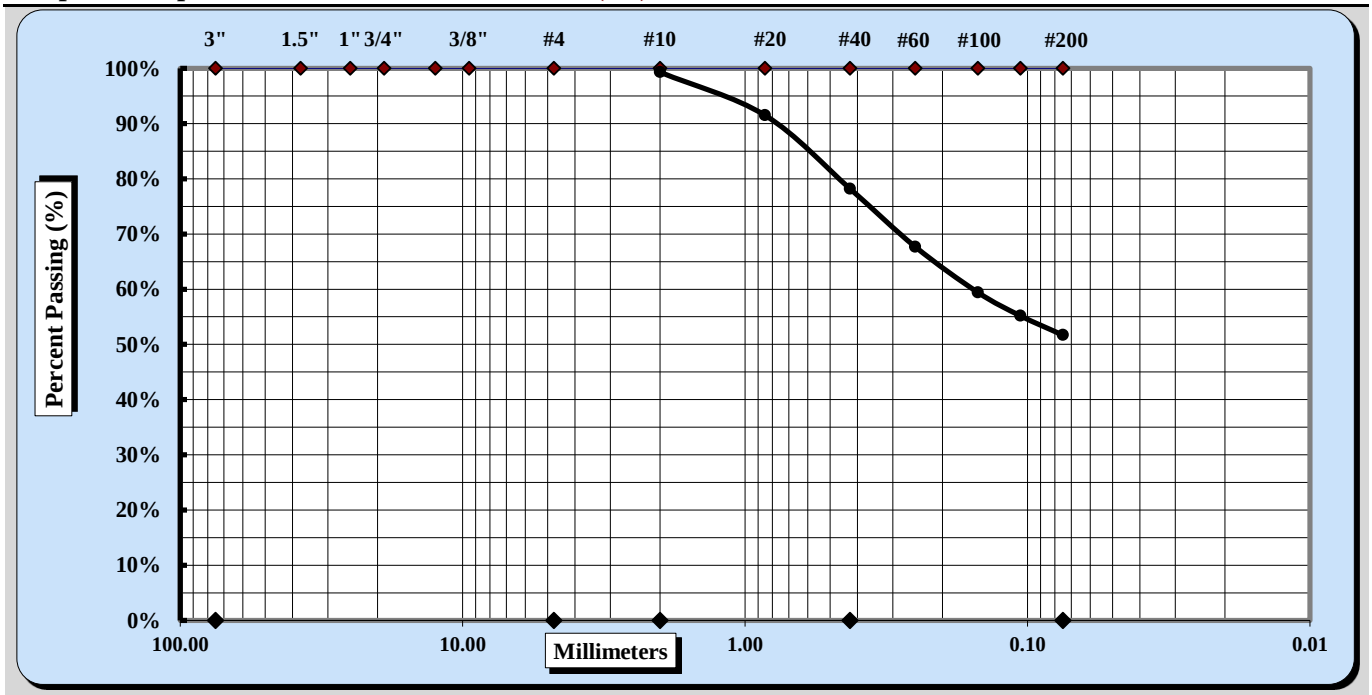
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-8	Type: SS		
	Sample: 5	Depth:	8 - 10 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.7%	Fine Sand	26.5%
Gravel	0.0%	Medium Sand	21.1%	Silt & Clay	51.7%

Coarse Sand	0.7%	Medium Sand	21.1%	Fine Sand	26.5%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

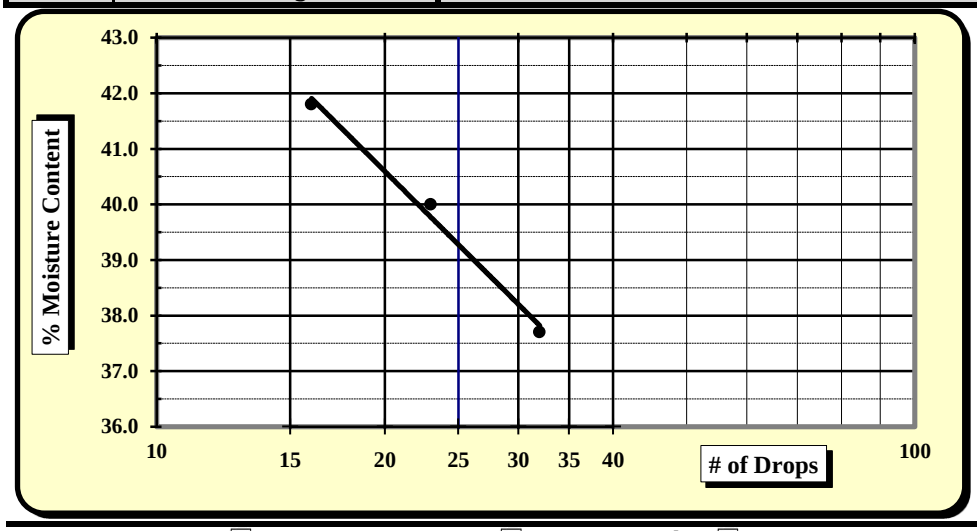
S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s)	11/5-11/7
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: B-8	Sample No: SS-8	Sample Date: Varies	
		Depth: 23.5-25 ft.	

Description: Lean Clay (CL)

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

		Liquid Limit						Plastic Limit		
Pan #	484									
	Tare #:	39	207	117				19	22	
A	Tare Weight	13.68	13.82	13.74				13.55	13.59	
B	Wet Soil Weight + A	24.12	23.55	24.73				20.14	21.31	
C	Dry Soil Weight + A	21.26	20.77	21.49				19.00	19.96	
D	Water Weight (B-C)	2.86	2.78	3.24				1.14	1.35	
E	Dry Soil Weight (C-A)	7.58	6.95	7.75				5.45	6.37	
F	% Moisture (D/E)*100	37.7%	40.0%	41.8%				20.9%	21.2%	
N	# OF DROPS	32	23	16				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.1%**		



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 **39**
Plastic Limit **21**
Plastic Index **18**
Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	11/7/2014	Matthew Wolfe	11/17/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

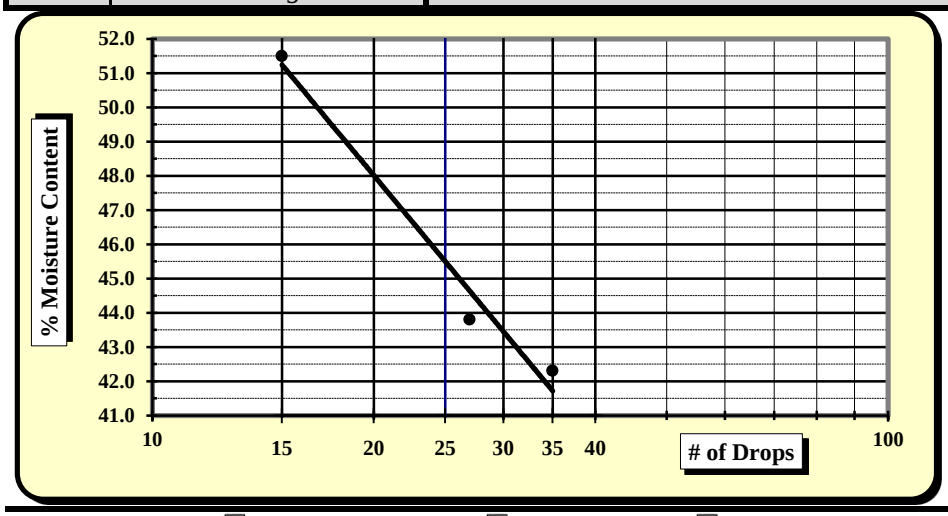
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/22/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/28/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-8	Sample No: 10		
		Depth: 33.5 - 35 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	22	20	10				4	7	
A	Tare Weight	15.46	15.53	15.48				15.51	15.47	
B	Wet Soil Weight + A	29.26	30.51	31.96				24.36	24.37	
C	Dry Soil Weight + A	24.57	25.95	27.06				22.81	22.83	
D	Water Weight (B-C)	4.69	4.56	4.90				1.55	1.54	
E	Dry Soil Weight (C-A)	9.11	10.42	11.58				7.30	7.36	
F	% Moisture (D/E)*100	51.5%	43.8%	42.3%				21.2%	20.9%	
N	# OF DROPS	15	27	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.1%**		



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	**45**
Plastic Limit	**21**
Plastic Index	**24**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/28/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

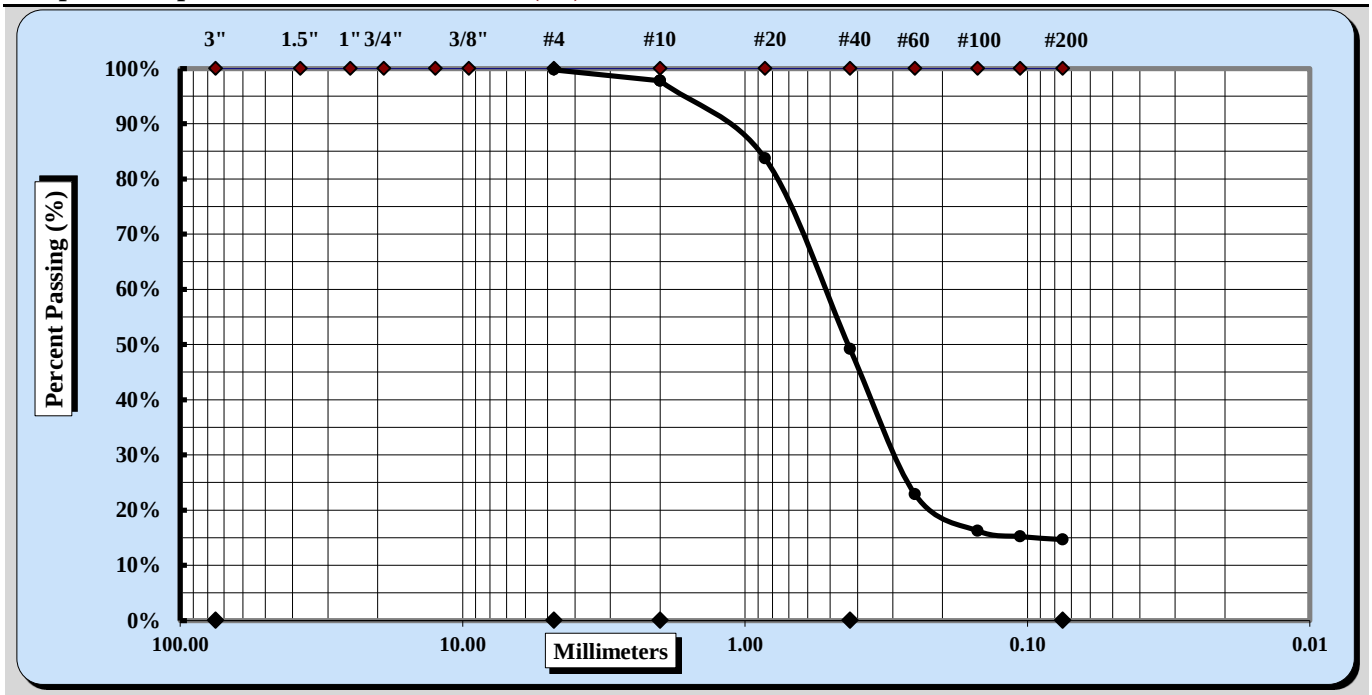
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-8	Type: SS		
	Sample: 13	Depth:	48.5 - 50 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.0%	Fine Sand	34.5%
Gravel	0.2%	Medium Sand	48.6%	Silt & Clay	14.7%

Coarse Sand	2.0%	Medium Sand	48.6%	Fine Sand	34.5%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

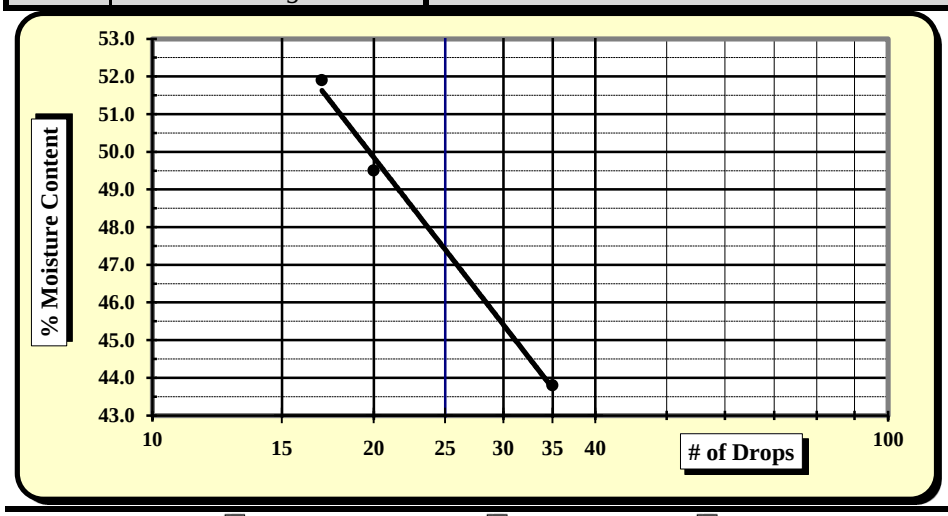
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/28/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-8	Sample No: 14		
		Depth: 53.5 - 55 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	8	3	21				53	36	
A	Tare Weight	15.61	15.55	15.57				21.41	21.04	
B	Wet Soil Weight + A	28.28	29.38	30.31				30.31	30.10	
C	Dry Soil Weight + A	23.95	24.80	25.82				28.58	28.35	
D	Water Weight (B-C)	4.33	4.58	4.49				1.73	1.75	
E	Dry Soil Weight (C-A)	8.34	9.25	10.25				7.17	7.31	
F	% Moisture (D/E)*100	51.9%	49.5%	43.8%				24.1%	23.9%	
N	# OF DROPS	17	20	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.0%**		



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	**47**
Plastic Limit	**24**
Plastic Index	**23**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/28/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

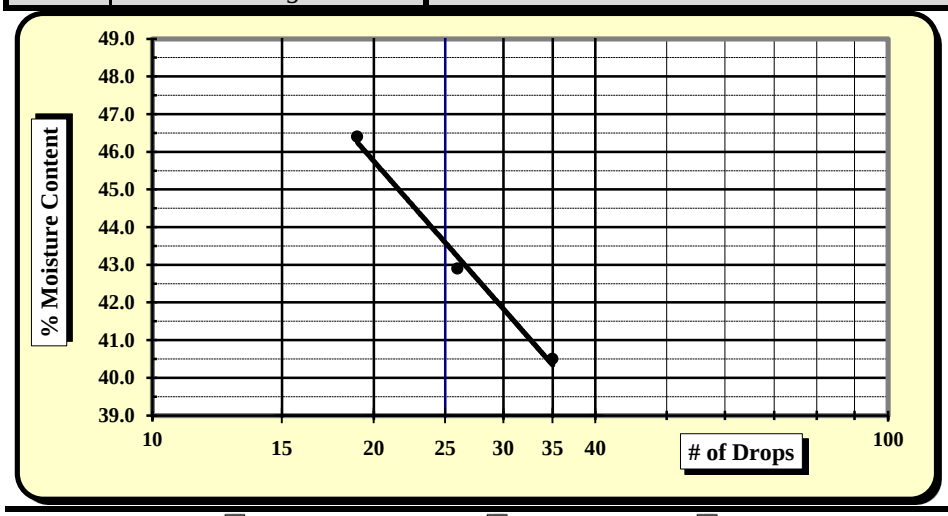
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: 5		
		Depth: 8 - 10 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	16	2	15				9	7	
A	Tare Weight	15.71	15.61	15.39				15.49	15.48	
B	Wet Soil Weight + A	29.90	30.34	31.21				24.83	23.44	
C	Dry Soil Weight + A	25.40	25.92	26.65				23.23	22.08	
D	Water Weight (B-C)	4.50	4.42	4.56				1.60	1.36	
E	Dry Soil Weight (C-A)	9.69	10.31	11.26				7.74	6.60	
F	% Moisture (D/E)*100	46.4%	42.9%	40.5%				20.7%	20.6%	
N	# OF DROPS	19	26	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**20.7%**		



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	**44**
Plastic Limit	**21**
Plastic Index	**23**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/25/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

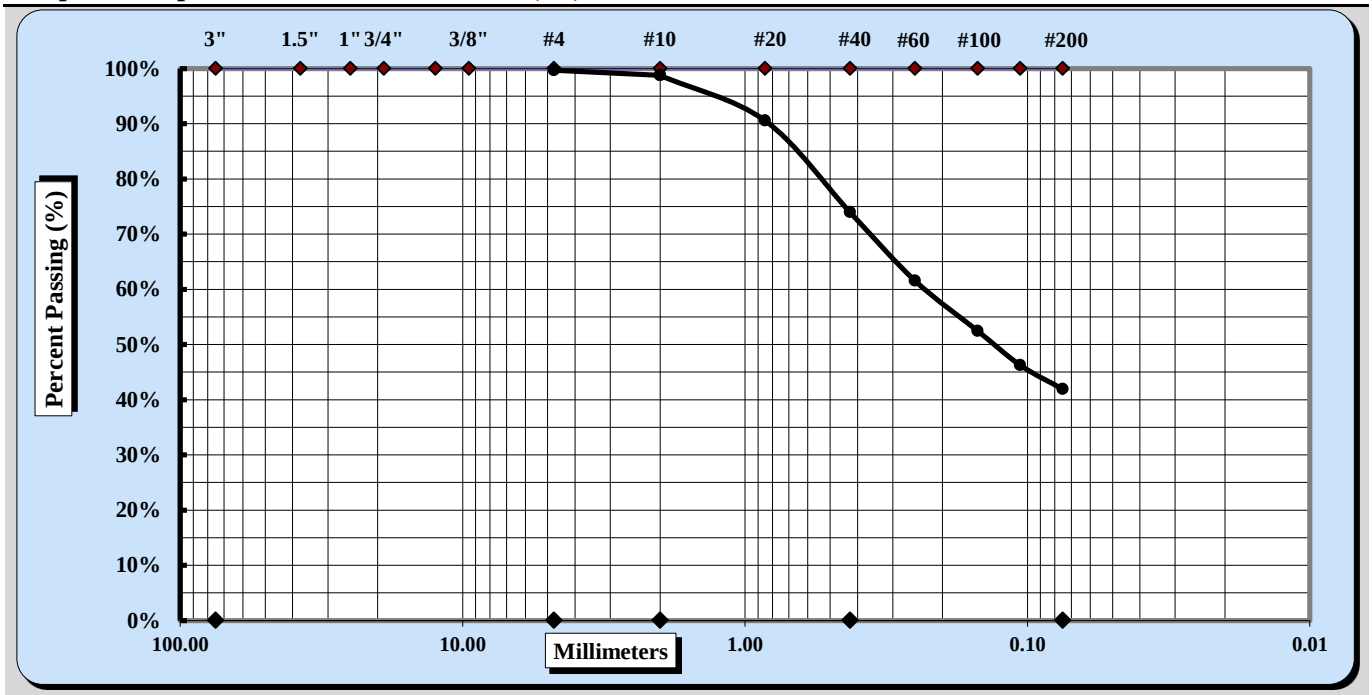
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Type: SS		
	Sample: 6	Depth:	13.5 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	0.9%	Fine Sand	32.0%
Gravel	0.3%	Medium Sand	24.8%	Silt & Clay	41.9%

Coarse Sand	0.9%	Medium Sand	24.8%	Fine Sand	32.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

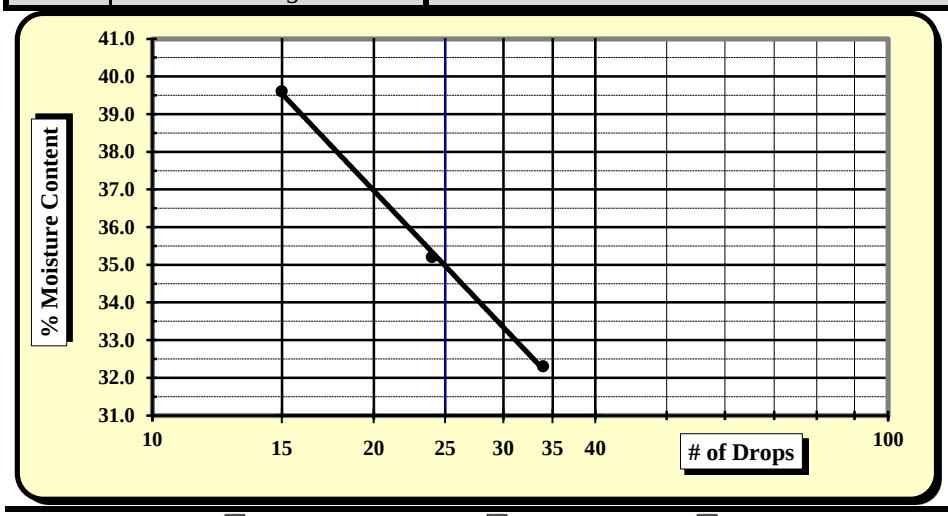
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: 10A		
		Depth: 33.5 - 35 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	12	8	10				20	19	
A	Tare Weight	15.64	15.60	15.49				15.54	15.49	
B	Wet Soil Weight + A	30.83	31.15	32.59				24.18	23.92	
C	Dry Soil Weight + A	26.52	27.10	28.42				23.02	22.80	
D	Water Weight (B-C)	4.31	4.05	4.17				1.16	1.12	
E	Dry Soil Weight (C-A)	10.88	11.50	12.93				7.48	7.31	
F	% Moisture (D/E)*100	39.6%	35.2%	32.3%				15.5%	15.3%	
N	# OF DROPS	15	24	34				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.4%**		



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	**35**
Plastic Limit	**15**
Plastic Index	**20**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/25/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

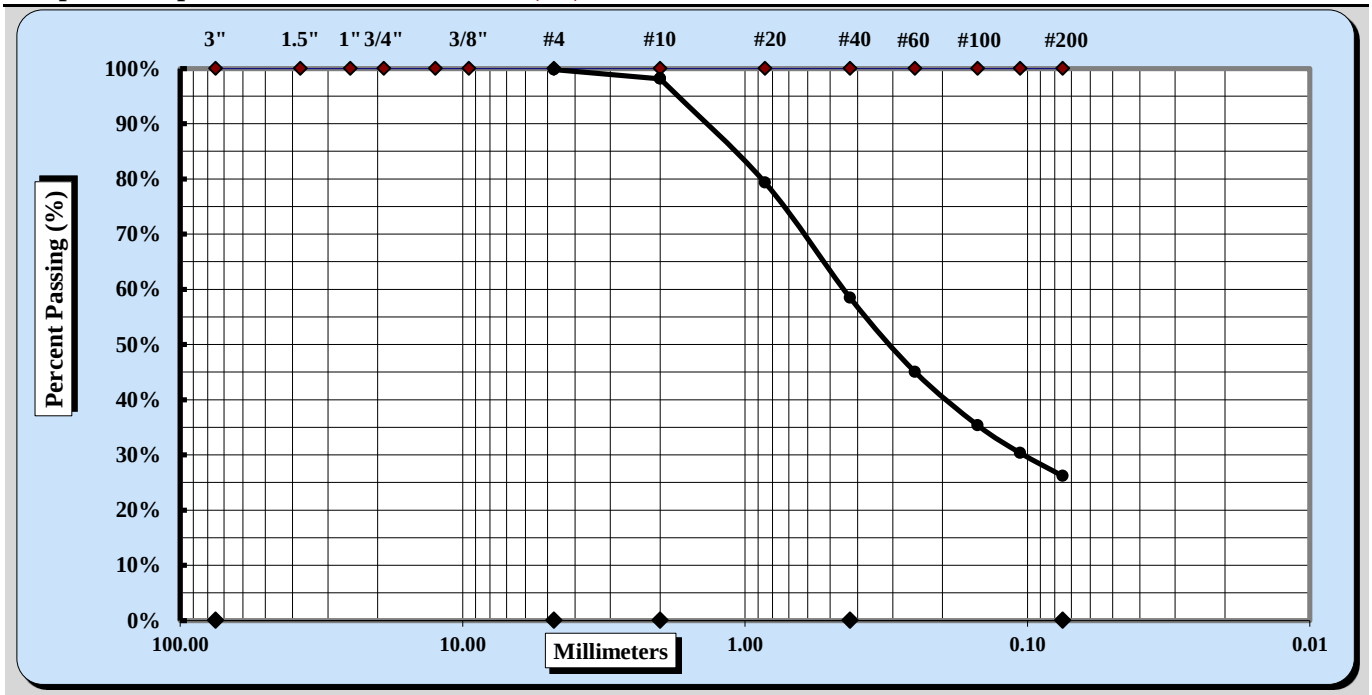
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Type: SS		
	Sample: 12	Depth:	43.5 - 45 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.6%	Fine Sand	32.3%
Gravel	0.2%	Medium Sand	39.7%	Silt & Clay	26.2%

Coarse Sand	1.6%	Medium Sand	39.7%	Fine Sand	32.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

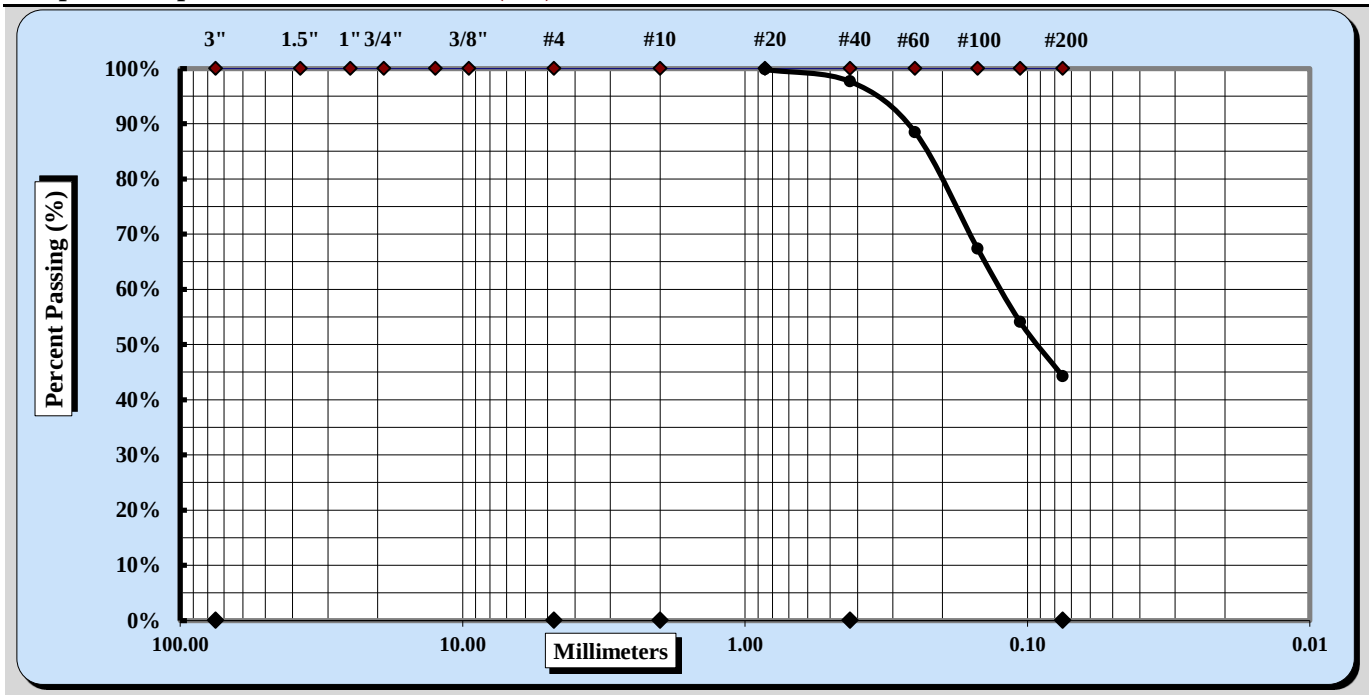
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Type: SS		
	Sample: 8	Depth:	23.5 - 25 ft

Sample Description: SILTY SAND (SM) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 20	Coarse Sand	0.0%	Fine Sand	53.4%
Gravel	0.0%	Medium Sand	2.4%	Silt & Clay	44.2%

Coarse Sand	0.0%	Medium Sand	2.4%	Fine Sand	53.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

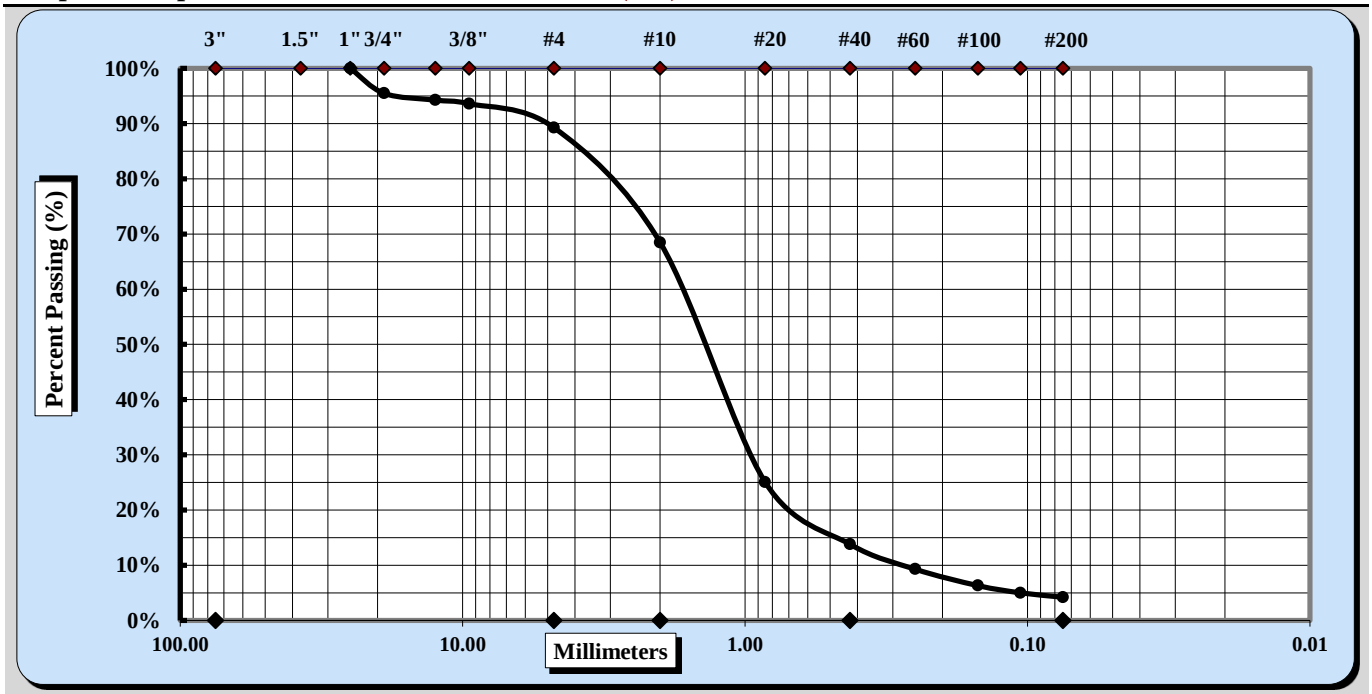
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Type: SS		
	Sample: 10	Depth:	33.5 - 35 ft

Sample Description: WELL GRADED SAND (SW) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1.0"	Coarse Sand	20.8%	Fine Sand	9.6%
Gravel	10.7%	Medium Sand	54.7%	Silt & Clay	4.2%

Cc = 2 Cu = 6

Coarse Sand	20.8%	Medium Sand	54.7%	Fine Sand	9.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/25/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

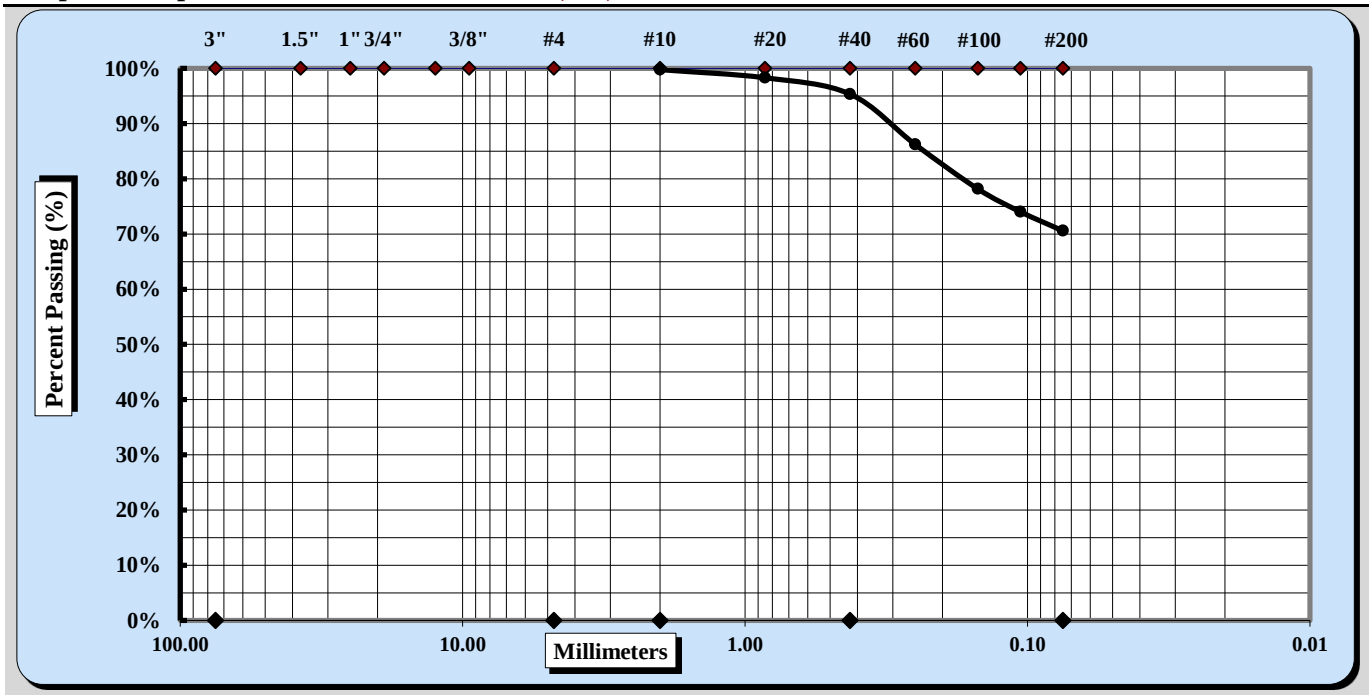
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Type: SS		
	Sample: 12	Depth:	43.5 - 45 ft

Sample Description: SILT WITH SAND (ML) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.1%	Fine Sand	24.8%
Gravel	0.1%	Medium Sand	4.4%	Silt & Clay	70.6%
Liquid Limit	49	Plastic Limit	29	Plastic Index	20

Coarse Sand	0.1%	Medium Sand	4.4%	Fine Sand	24.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

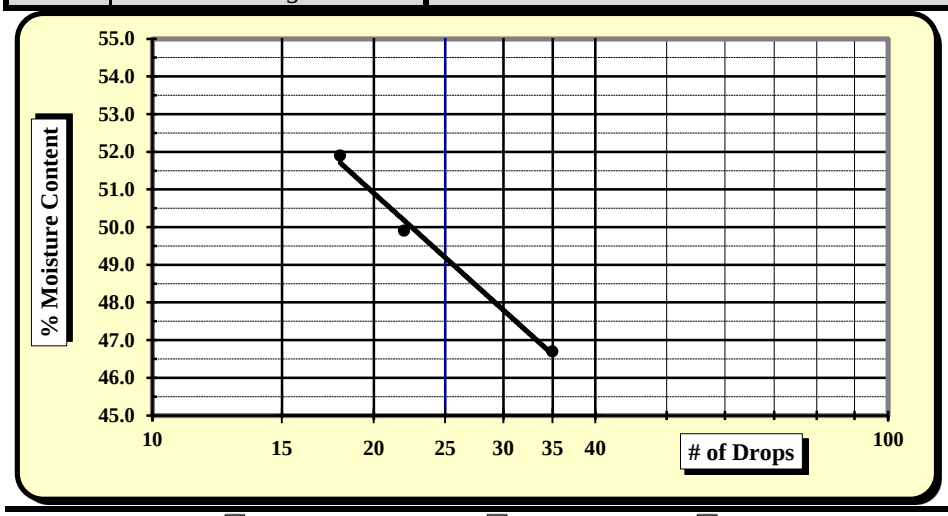
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Sample No: 12		
		Depth: 43.5 - 45 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	21	1	18				23	11	
A	Tare Weight	15.58	15.42	15.50				15.50	15.50	
B	Wet Soil Weight + A	27.75	28.69	29.22				23.51	24.45	
C	Dry Soil Weight + A	23.59	24.27	24.85				21.70	22.43	
D	Water Weight (B-C)	4.16	4.42	4.37				1.81	2.02	
E	Dry Soil Weight (C-A)	8.01	8.85	9.35				6.20	6.93	
F	% Moisture (D/E)*100	51.9%	49.9%	46.7%				29.2%	29.1%	
N	# OF DROPS	18	22	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**29.2%**		



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 **49**
Plastic Limit **29**
Plastic Index **20**
USCS Group Symbol **ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/25/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

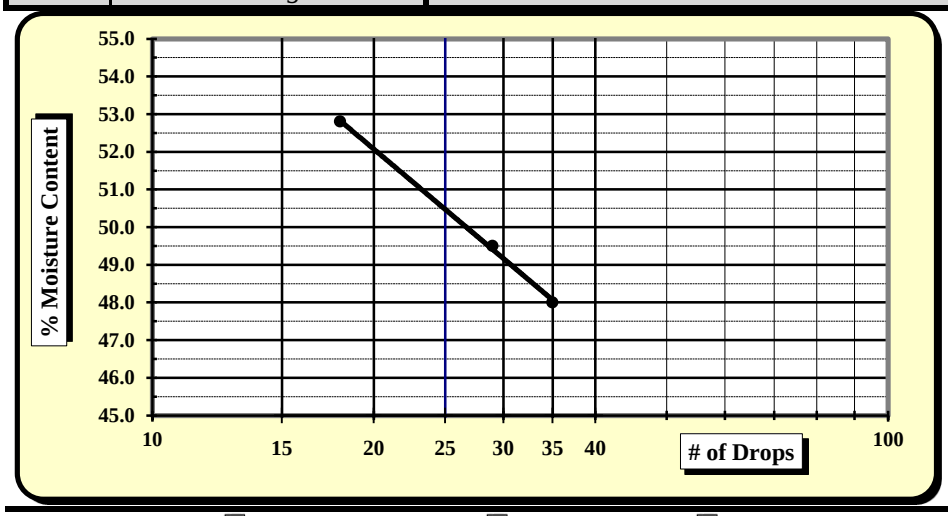
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Sample No: 13		
		Depth: 48.3 - 50 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	14	17	4				54	36	
A	Tare Weight	15.53	15.57	15.51				21.16	21.04	
B	Wet Soil Weight + A	27.02	28.73	29.61				29.24	28.62	
C	Dry Soil Weight + A	23.05	24.37	25.04				27.51	27.00	
D	Water Weight (B-C)	3.97	4.36	4.57				1.73	1.62	
E	Dry Soil Weight (C-A)	7.52	8.80	9.53				6.35	5.96	
F	% Moisture (D/E)*100	52.8%	49.5%	48.0%				27.2%	27.2%	
N	# OF DROPS	18	29	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**27.2%**		



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	**50**
Plastic Limit	**27**
Plastic Index	**23**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/25/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

Sample Log No.:341 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/17/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-11	Sample No.:	2
		Depth:	31 - 33 ft

Sample Description: POORLY GRADED SAND (SP)

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	B
t	Tare Weight	*grams*	19.45
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	47.80
c	Ash Weight + Tare Wt.	*grams*	46.67
C	Ash Weight	*c-t*	27.22
B	Mass of Oven Dry Specimen	*(b-t)*	28.35
D	***% Ash Content***	*(C/B)*100*	**96.0%**
	% Organic Matter	*100-D*	**4.0%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

(Description per ASTM D2488)

Derek Baker — *Technician Name*

11/17/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/25/2014 — *Date*

Sieve Analysis of Soils

ASTM D422

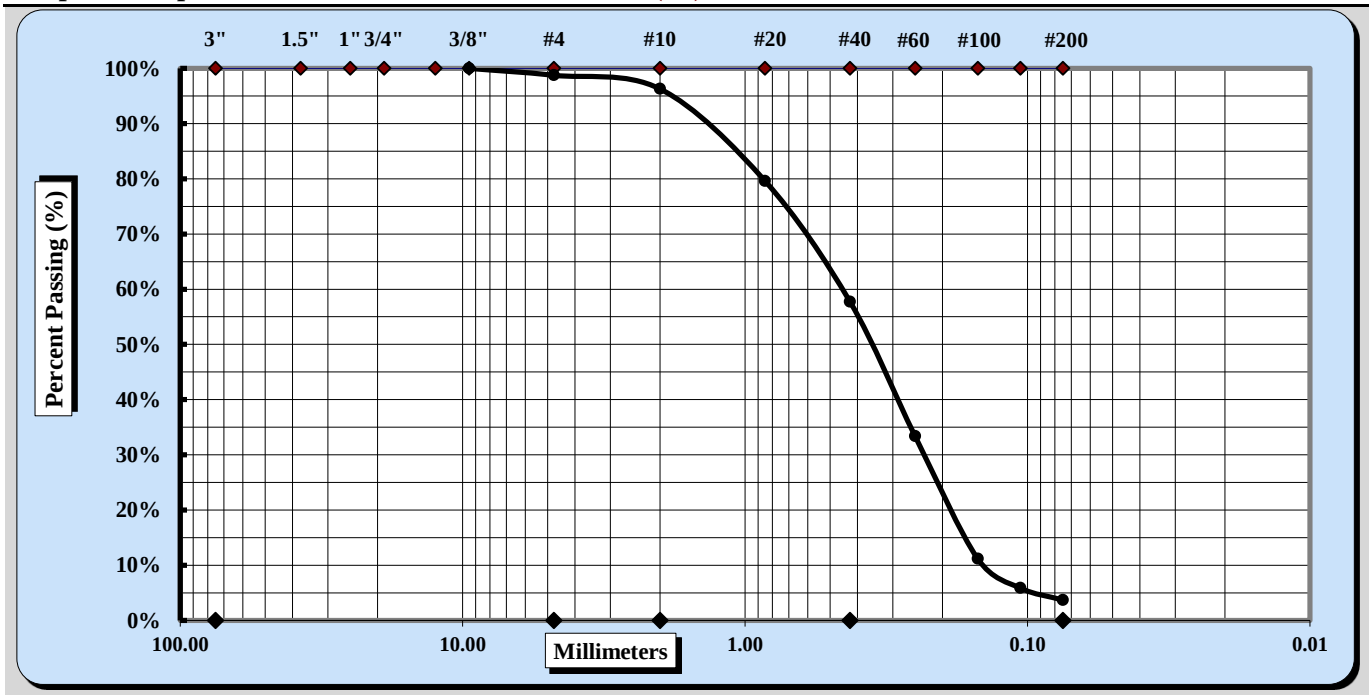
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-11	Type: SS		
	Sample: 3	Depth:	33 - 35 ft

Sample Description: POORLY GRADED SAND (SP) **A-3**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.5%	Fine Sand	54.0%
Gravel	1.3%	Medium Sand	38.6%	Silt & Clay	3.7%

Cc = 0.8 Cu = 3

Coarse Sand	2.5%	Medium Sand	38.6%	Fine Sand	54.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/25/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

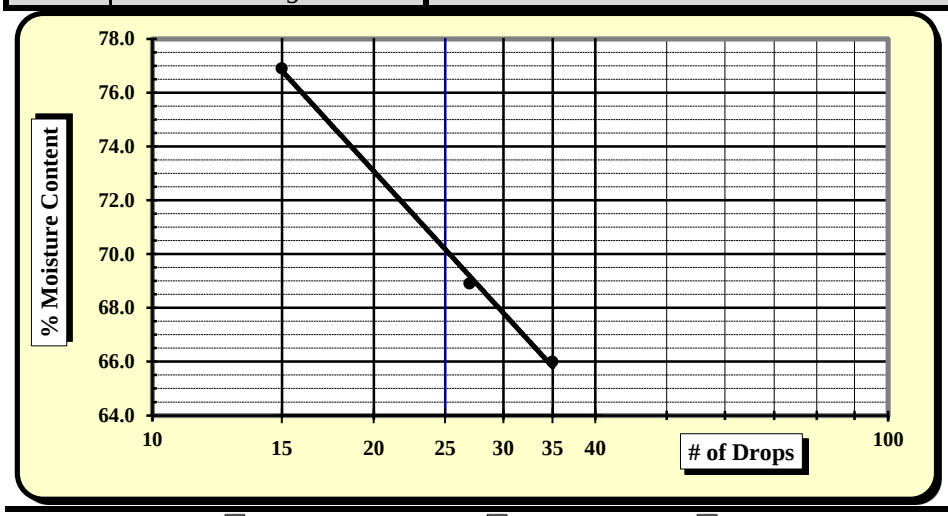
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/30/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-11	Sample No: 7		
		Depth: 48.8 - 50.3 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	22	15	9				16	17	
A	Tare Weight	15.47	15.40	15.50				15.70	15.57	
B	Wet Soil Weight + A	27.20	28.51	29.78				23.06	23.06	
C	Dry Soil Weight + A	22.10	23.16	24.10				21.11	21.09	
D	Water Weight (B-C)	5.10	5.35	5.68				1.95	1.97	
E	Dry Soil Weight (C-A)	6.63	7.76	8.60				5.41	5.52	
F	% Moisture (D/E)*100	76.9%	68.9%	66.0%				36.0%	35.7%	
N	# OF DROPS	15	27	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**35.9%**		



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 **70**
Plastic Limit **36**
Plastic Index **34**
USCS Group Symbol **MH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/30/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

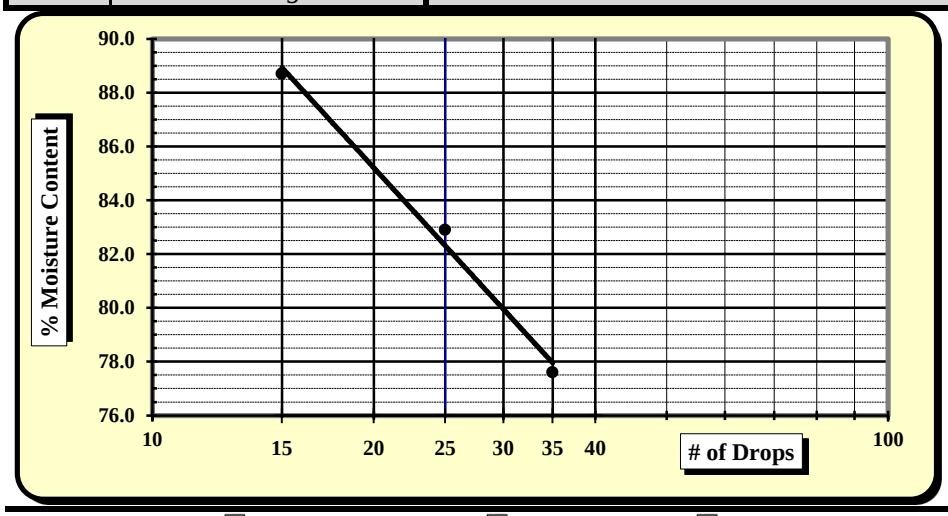
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/30/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-11	Sample No: 8		
		Depth: 53.8 - 55.3 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	19	2				10	14	
A	Tare Weight	15.41	15.49	15.61				15.49	15.54	
B	Wet Soil Weight + A	28.56	29.57	30.71				22.86	21.28	
C	Dry Soil Weight + A	22.38	23.19	24.11				21.43	20.17	
D	Water Weight (B-C)	6.18	6.38	6.60				1.43	1.11	
E	Dry Soil Weight (C-A)	6.97	7.70	8.50				5.94	4.63	
F	% Moisture (D/E)*100	88.7%	82.9%	77.6%				24.1%	24.0%	
N	# OF DROPS	15	25	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.1%**		



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 **82**
Plastic Limit **24**
Plastic Index **58**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/30/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

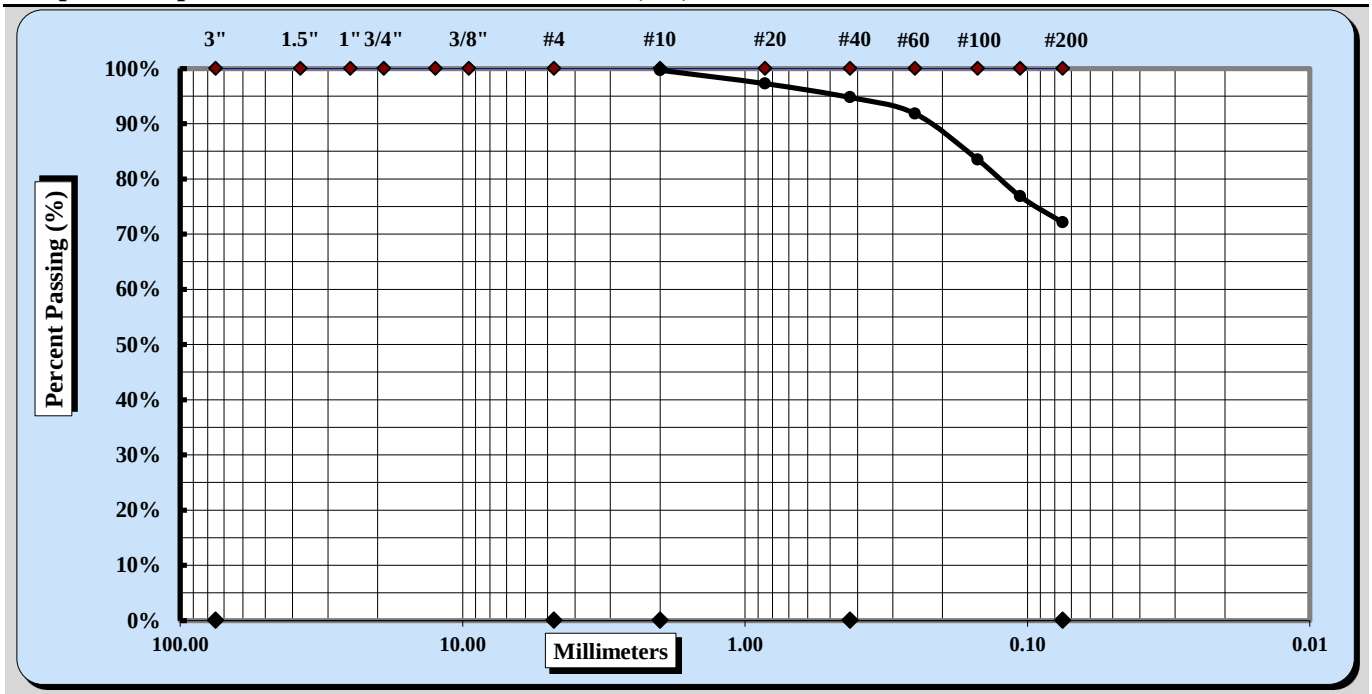
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-11	Type: SS		
	Sample: 9	Depth:	58.8 - 60.3 ft

Sample Description: FAT CLAY WITH SAND (CH) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.3%	Fine Sand	22.7%
Gravel	0.0%	Medium Sand	4.9%	Silt & Clay	72.1%

Coarse Sand	0.3%	Medium Sand	4.9%	Fine Sand	22.7%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

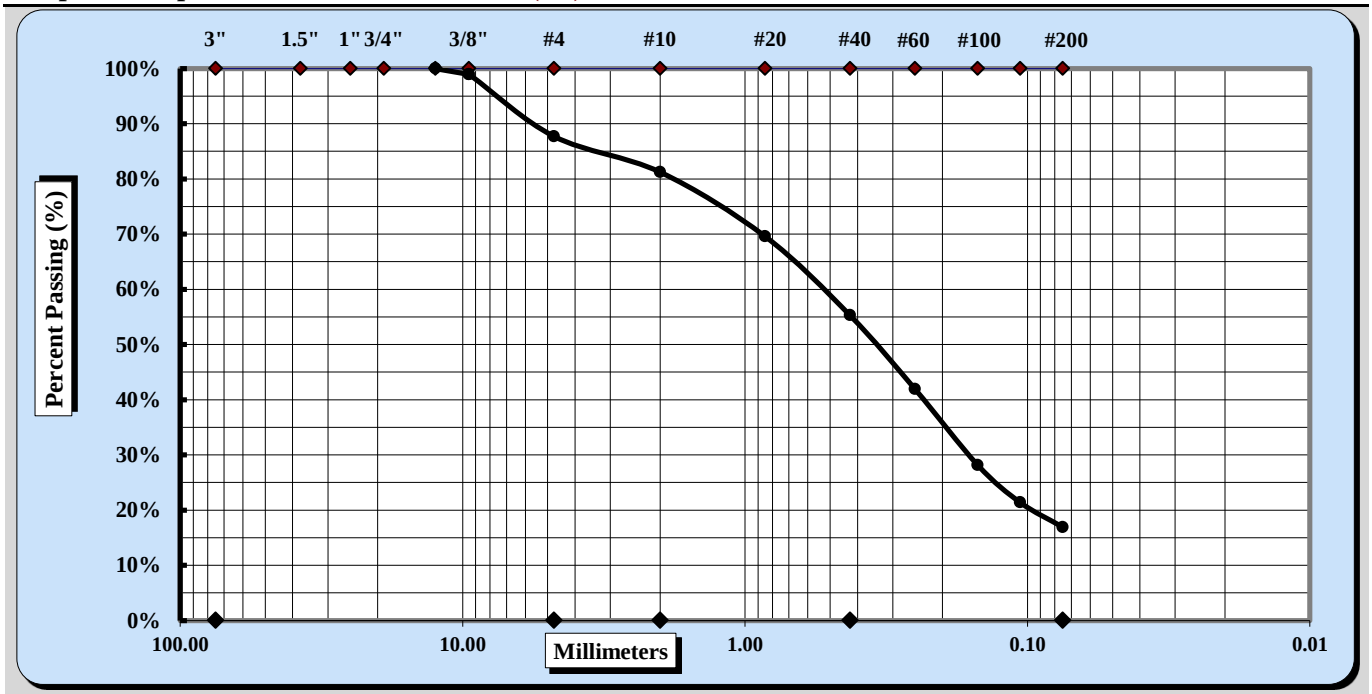
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/15/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-12	Type: SS		
	Sample: 2	Depth:	35 - 37 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1/2"	Coarse Sand	6.5%	Fine Sand	38.4%
Gravel	12.3%	Medium Sand	26.0%	Silt & Clay	16.9%

Coarse Sand	6.5%	Medium Sand	26.0%	Fine Sand	38.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

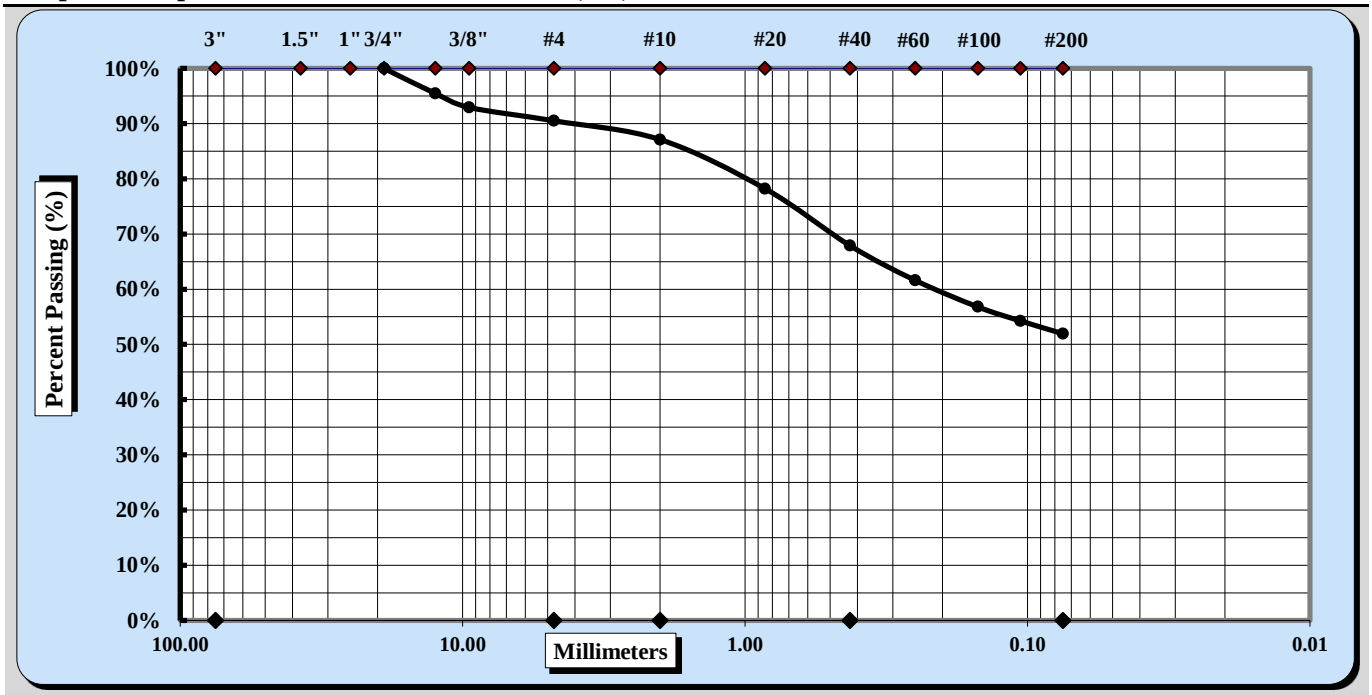
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/11/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-12	Type: SS		
	Sample: 4	Depth:	39 - 41 ft

Sample Description: SANDY FAT CLAY (CH) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	3.4%	Fine Sand	15.9%
Gravel	9.5%	Medium Sand	19.2%	Silt & Clay	51.9%
Liquid Limit:	62	Plastic Limit:	24	Plastic Index:	38

Coarse Sand	3.4%	Medium Sand	19.2%	Fine Sand	15.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

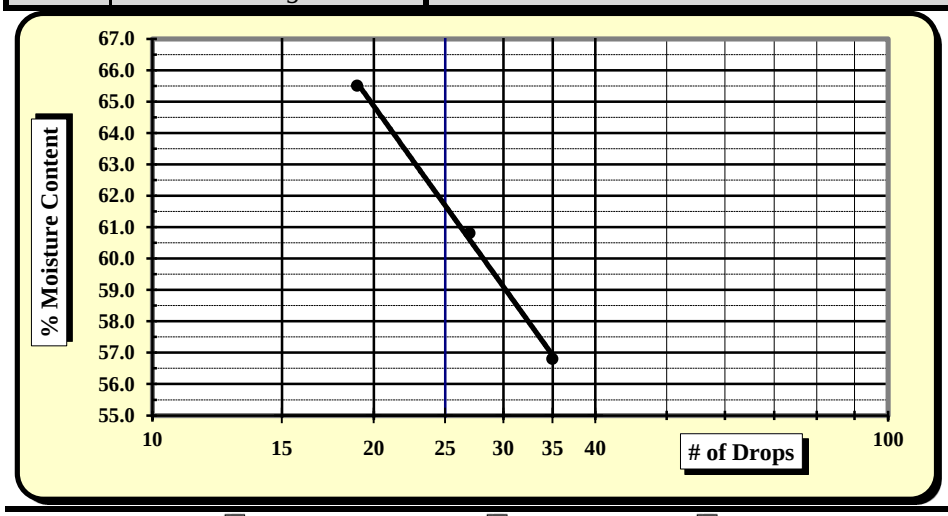
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/4/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-12	Sample No: 4		
		Depth: 39 - 41 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	21	15	12				6	16	
A	Tare Weight	15.58	15.40	15.64				15.52	15.70	
B	Wet Soil Weight + A	27.83	28.75	29.41				24.22	22.41	
C	Dry Soil Weight + A	22.98	23.70	24.42				22.54	21.13	
D	Water Weight (B-C)	4.85	5.05	4.99				1.68	1.28	
E	Dry Soil Weight (C-A)	7.40	8.30	8.78				7.02	5.43	
F	% Moisture (D/E)*100	65.5%	60.8%	56.8%				23.9%	23.6%	
N	# OF DROPS	19	27	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**23.8%**		



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	**62**
Plastic Limit	**24**
Plastic Index	**38**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/4/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

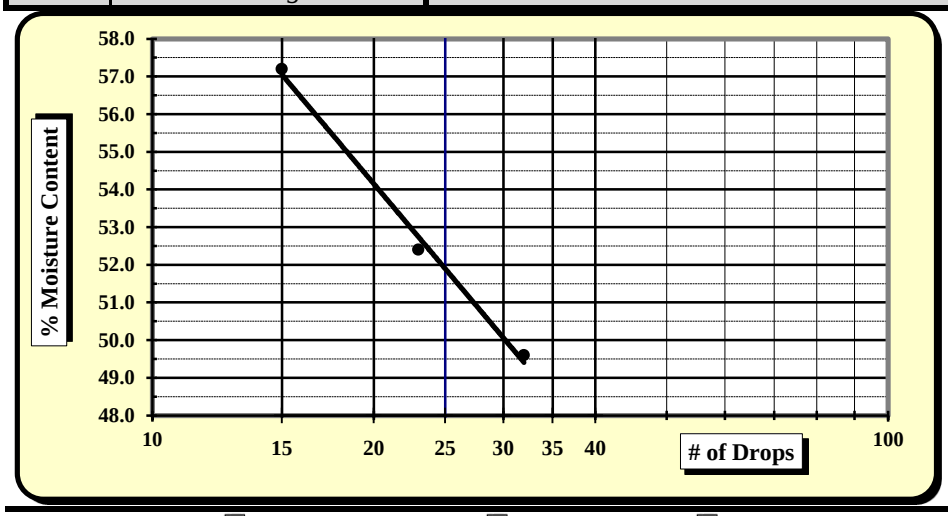
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/14/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/30/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-12	Sample No: 5		
		Depth: 41 - 43 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	12	5	11				4	7	
A	Tare Weight	15.64	15.48	15.50				15.51	15.48	
B	Wet Soil Weight + A	30.90	31.06	32.32				24.91	24.02	
C	Dry Soil Weight + A	25.35	25.70	26.74				22.95	22.24	
D	Water Weight (B-C)	5.55	5.36	5.58				1.96	1.78	
E	Dry Soil Weight (C-A)	9.71	10.22	11.24				7.44	6.76	
F	% Moisture (D/E)*100	57.2%	52.4%	49.6%				26.3%	26.3%	
N	# OF DROPS	15	23	32				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**26.3%**		



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	**52**
Plastic Limit	**26**
Plastic Index	**26**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/30/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

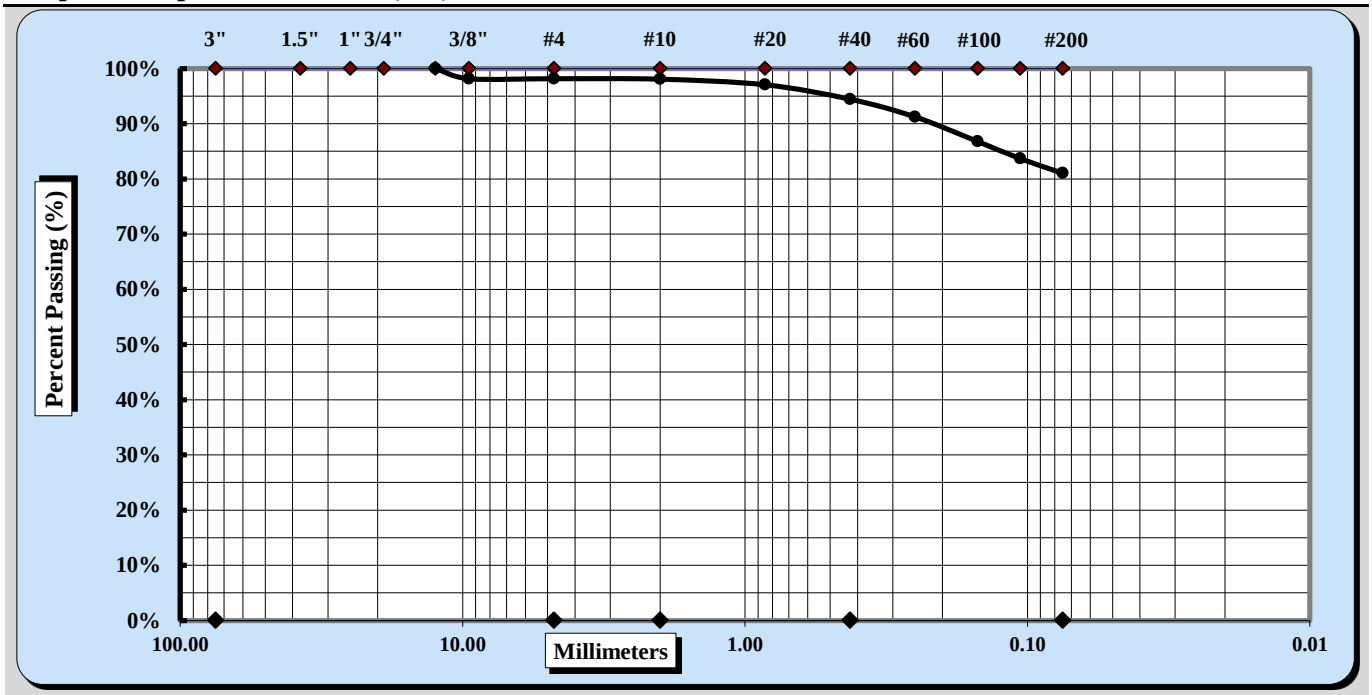
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-12	Type: SS		
	Sample: 7	Depth:	51.5 - 53 ft

Sample Description: SILT (ML) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1/2"	Coarse Sand	0.1%	Fine Sand	13.4%
Gravel	1.9%	Medium Sand	3.6%	Silt & Clay	81.0%

Coarse Sand	0.1%	Medium Sand	3.6%	Fine Sand	13.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

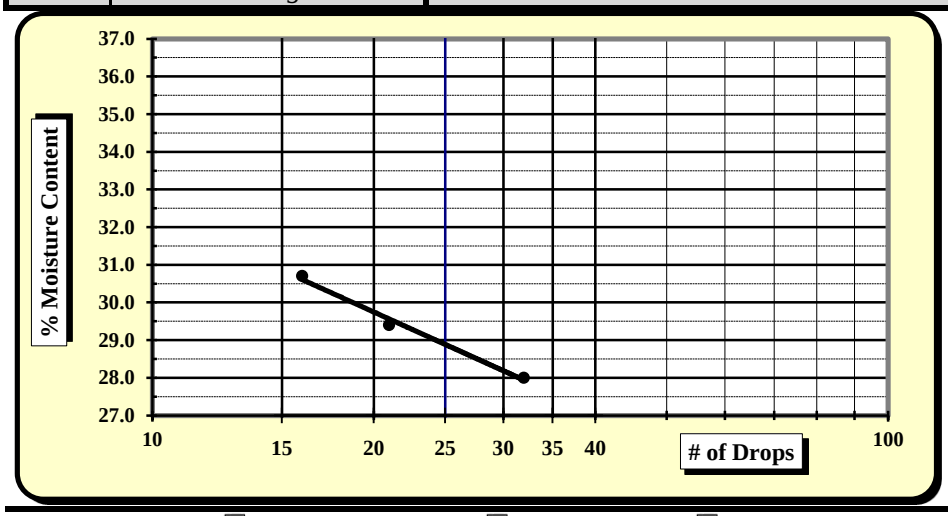
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/30/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: 7B		
		Depth: 19.5 - 20 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	21	18	6				24	20	
A	Tare Weight	15.58	15.50	15.52				15.51	15.54	
B	Wet Soil Weight + A	28.22	29.37	30.11				24.57	25.00	
C	Dry Soil Weight + A	25.25	26.22	26.92				23.31	23.69	
D	Water Weight (B-C)	2.97	3.15	3.19				1.26	1.31	
E	Dry Soil Weight (C-A)	9.67	10.72	11.40				7.80	8.15	
F	% Moisture (D/E)*100	30.7%	29.4%	28.0%				16.2%	16.1%	
N	# OF DROPS	16	21	32				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.2%**		



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	**29**
Plastic Limit	**16**
Plastic Index	**13**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/30/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

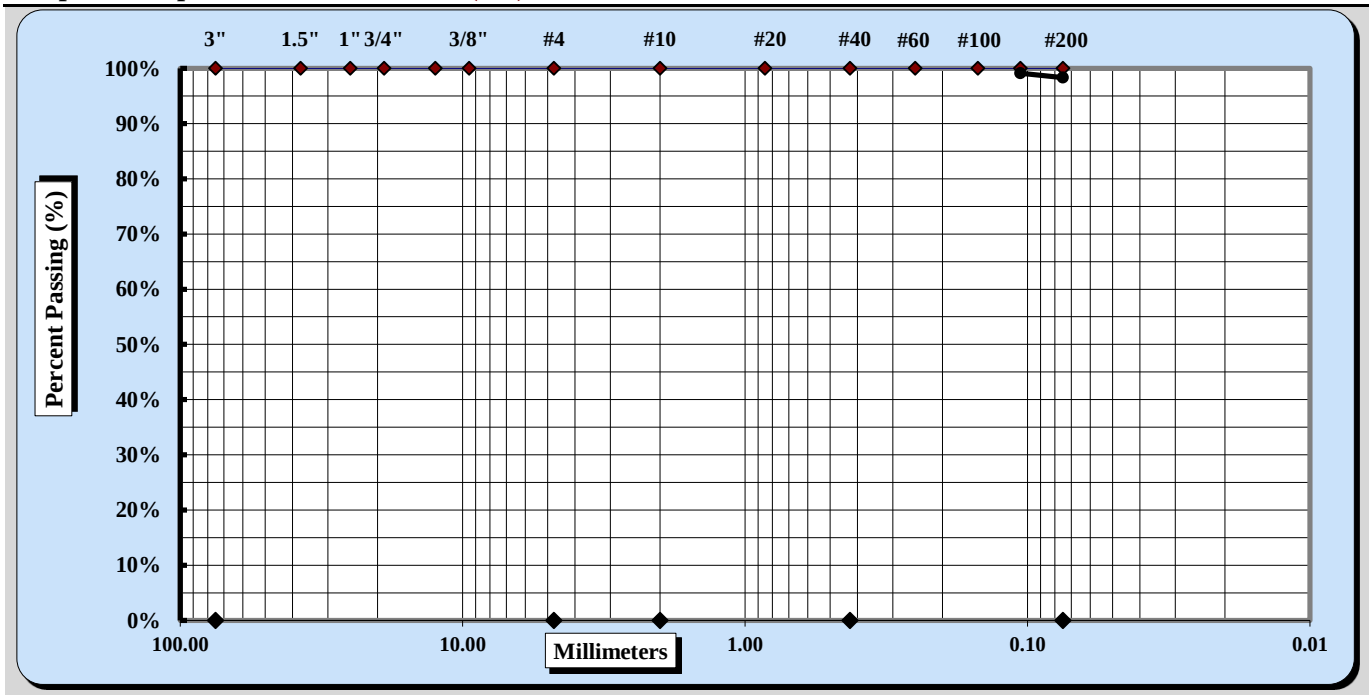
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Type: SS		
	Sample: 13	Depth:	48.5 - 50 ft

Sample Description: FAT CLAY (CH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 140	Coarse Sand	0.0%	Fine Sand	1.4%
Gravel	0.0%	Medium Sand	0.3%	Silt & Clay	98.3%
Liquid Limit:	71	Plastic Limit:	30	Plastic Index:	41

Coarse Sand	0.0%	Medium Sand	0.3%	Fine Sand	1.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

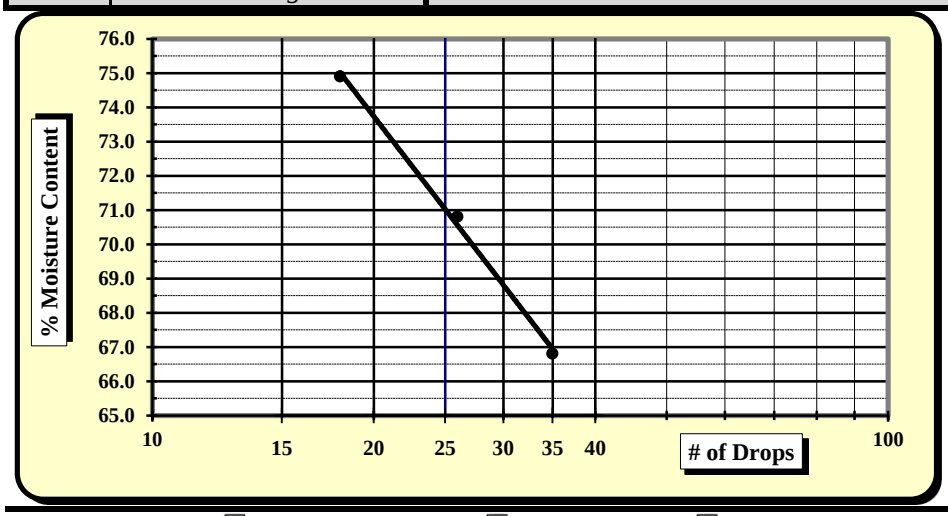
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: 13		
		Depth: 48.5 - 50 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	23	3	8				20	18	
A	Tare Weight	15.50	15.55	15.61				15.54	15.50	
B	Wet Soil Weight + A	27.69	28.62	29.87				22.70	22.31	
C	Dry Soil Weight + A	22.47	23.20	24.16				21.05	20.76	
D	Water Weight (B-C)	5.22	5.42	5.71				1.65	1.55	
E	Dry Soil Weight (C-A)	6.97	7.65	8.55				5.51	5.26	
F	% Moisture (D/E)*100	74.9%	70.8%	66.8%				29.9%	29.5%	
N	# OF DROPS	18	26	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**29.7%**		



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	**71**
Plastic Limit	**30**
Plastic Index	**41**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/1/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

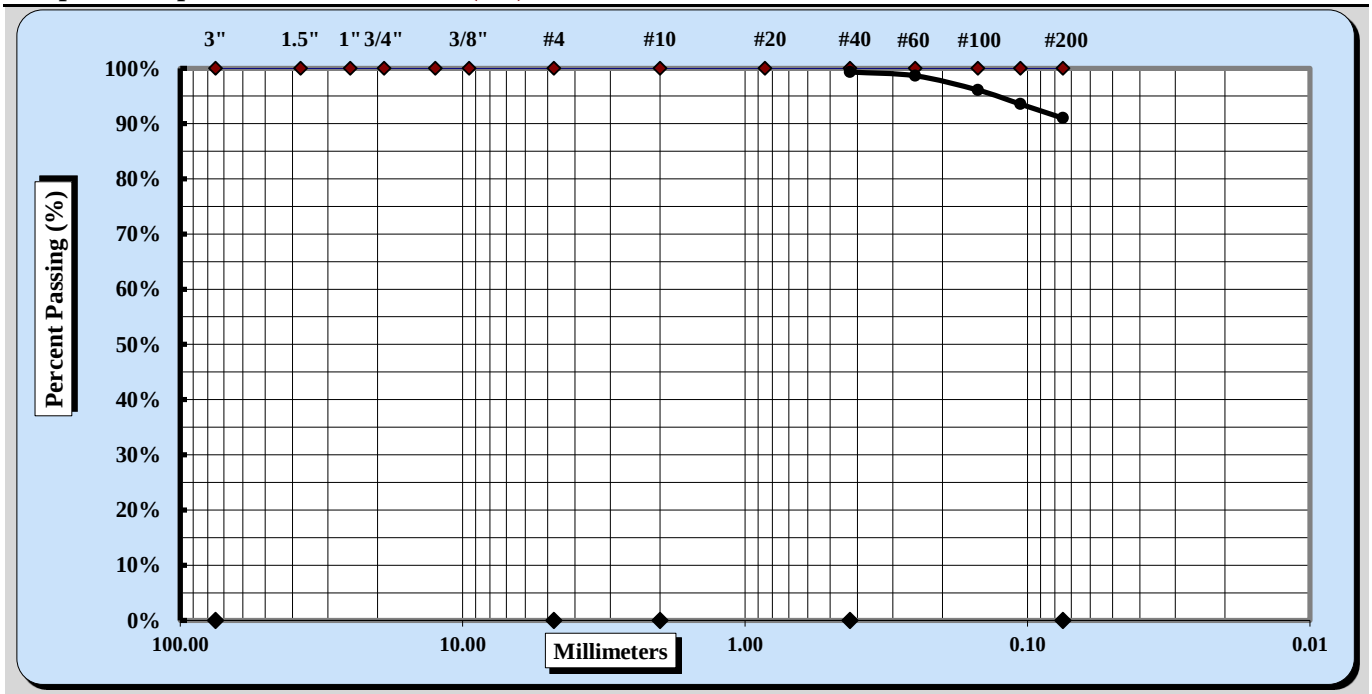
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Type: SS		
	Sample: 14	Depth:	53.5 - 55 ft

Sample Description: FAT CLAY (CH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 40	Coarse Sand	0.0%	Fine Sand	8.3%
Gravel	0.0%	Medium Sand	0.6%	Silt & Clay	91.0%
Liquid Limit:	97	Plastic Limit:	30	Plastic Index:	67

Coarse Sand	0.0%	Medium Sand	0.6%	Fine Sand	8.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

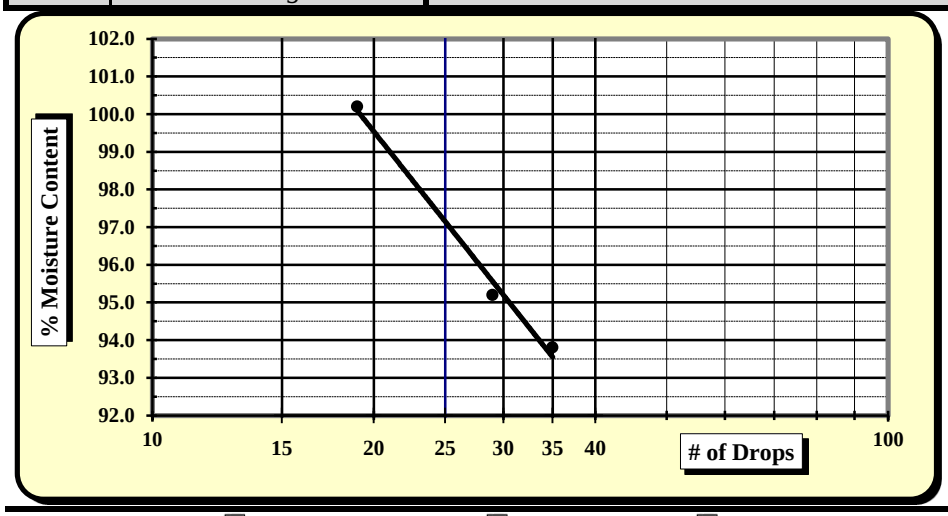
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: 14		
		Depth: 53.5 - 55 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	24	6	7				4	11	
A	Tare Weight	15.51	15.51	15.48				15.51	15.50	
B	Wet Soil Weight + A	28.34	29.68	30.85				20.52	21.22	
C	Dry Soil Weight + A	21.92	22.77	23.41				19.35	19.89	
D	Water Weight (B-C)	6.42	6.91	7.44				1.17	1.33	
E	Dry Soil Weight (C-A)	6.41	7.26	7.93				3.84	4.39	
F	% Moisture (D/E)*100	100.2%	95.2%	93.8%				30.5%	30.3%	
N	# OF DROPS	19	29	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**30.4%**		



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	**97**
Plastic Limit	**30**
Plastic Index	**67**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/1/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

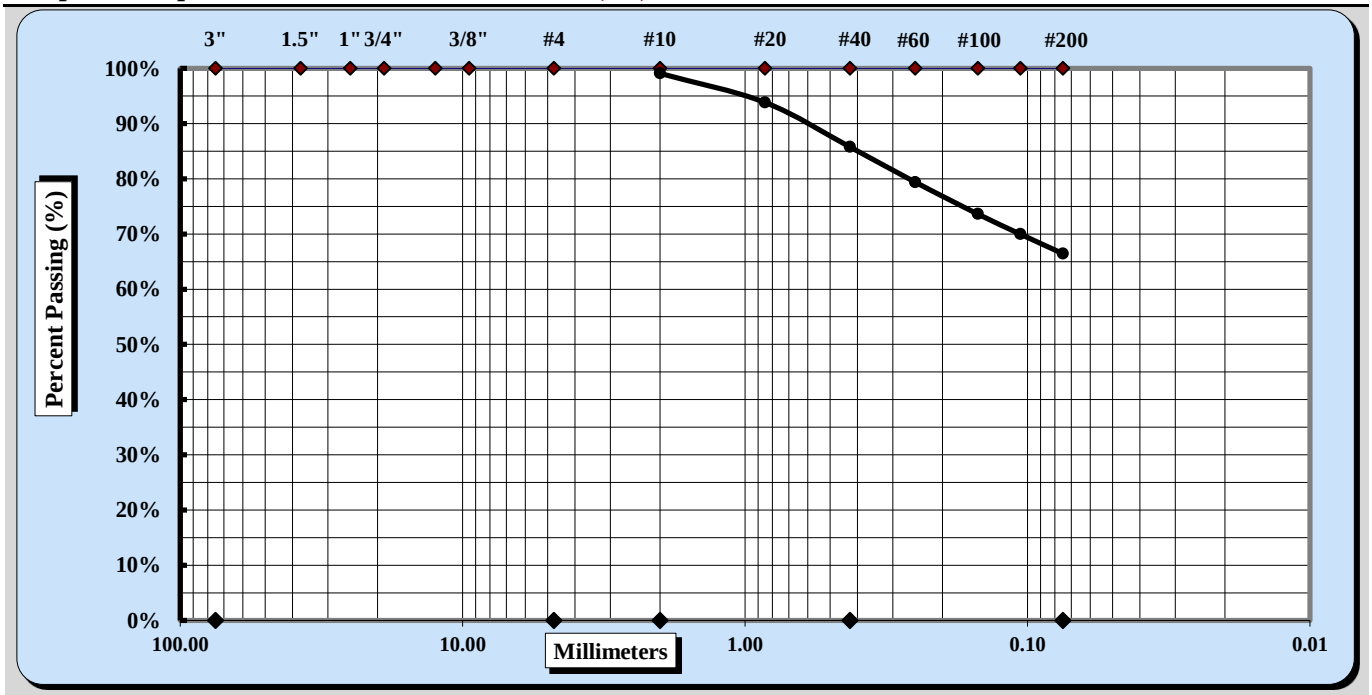
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: SS		
	Sample: 4	Depth:	6 - 8 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.9%	Fine Sand	19.3%
Gravel	0.0%	Medium Sand	13.3%	Silt & Clay	66.5%
Liquid Limit:	33	Plastic Limit:	15	Plastic Index:	18

Coarse Sand	0.9%	Medium Sand	13.3%	Fine Sand	19.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

11/25/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

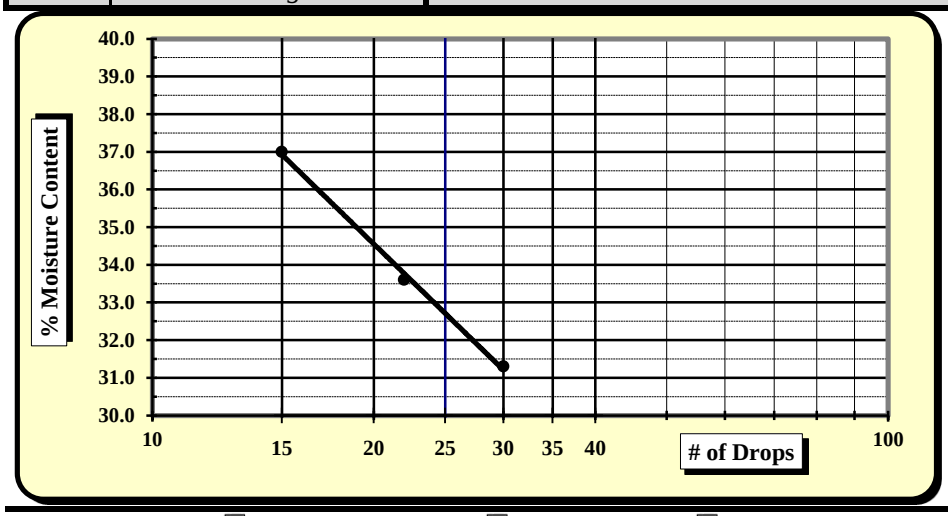
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: 4		
		Depth: 6 - 8 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	21	15	16				12	5	
A	Tare Weight	15.58	15.40	15.70				15.64	15.48	
B	Wet Soil Weight + A	31.68	32.05	33.87				24.21	23.74	
C	Dry Soil Weight + A	27.33	27.86	29.54				23.08	22.65	
D	Water Weight (B-C)	4.35	4.19	4.33				1.13	1.09	
E	Dry Soil Weight (C-A)	11.75	12.46	13.84				7.44	7.17	
F	% Moisture (D/E)*100	37.0%	33.6%	31.3%				15.2%	15.2%	
N	# OF DROPS	15	22	30				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.2%**		



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	**33**
Plastic Limit	**15**
Plastic Index	**18**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/1/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

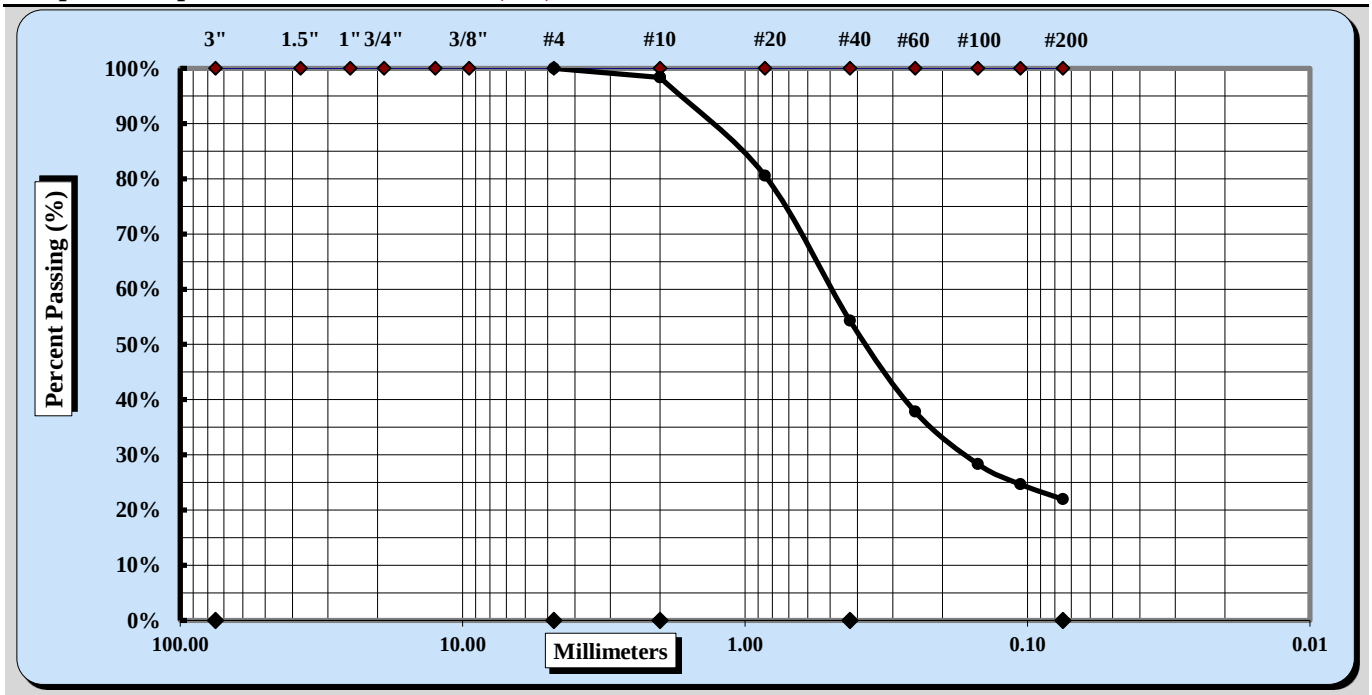
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: SS		
	Sample: 7	Depth:	18.5 - 20 ft

Sample Description: SILTY SAND (SM) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.6%	Fine Sand	32.3%
Gravel	0.0%	Medium Sand	44.1%	Silt & Clay	21.9%

Coarse Sand	1.6%	Medium Sand	44.1%	Fine Sand	32.3%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Moisture, Ash, and Organic Matter

Sample Log No.:341 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/17/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-14	Sample No.:	9A
		Depth:	28.5 - 29 ft
Sample Description:	SILTY CLAY (CL-ML)/LEAN CLAY (CL)		

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	A
t	Tare Weight	*grams*	18.95
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	50.75
c	Ash Weight + Tare Wt.	*grams*	49.98
C	Ash Weight	*c-t*	31.03
B	Mass of Oven Dry Specimen	*(b-t)*	31.80
D	***% Ash Content***	*(C/B)*100*	**97.6%**
	% Organic Matter	*100-D*	**2.4%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

(Description per ASTM D2488)

Derek Baker	11/17/2014		
Technician Name	*Date*		
N. Randy Rainwater	*Signature*	Project Engineer	11/25/2014
Technical Responsibility		*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

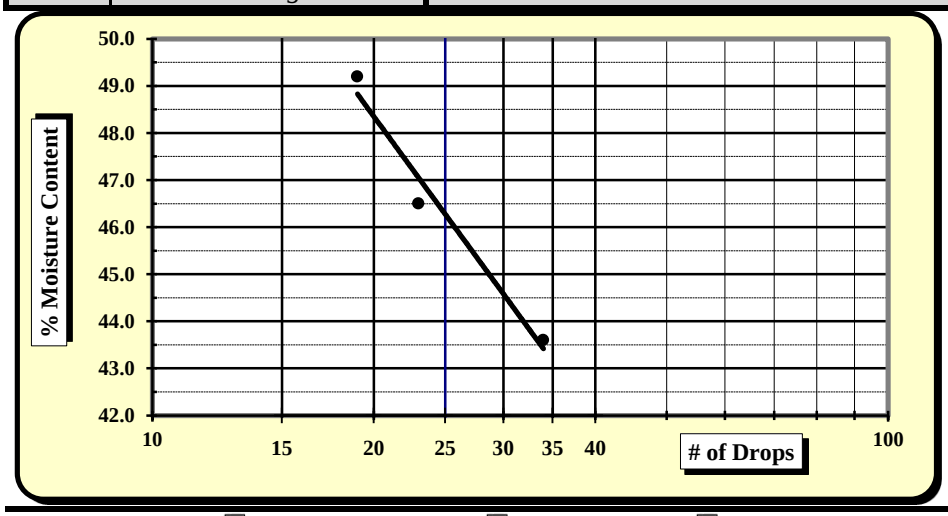
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: 10		
		Depth: 33.5 - 35 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	2	17	9				1	22	
A	Tare Weight	15.61	15.57	15.50				15.42	15.47	
B	Wet Soil Weight + A	28.28	29.78	30.89				22.96	24.63	
C	Dry Soil Weight + A	24.10	25.27	26.22				21.47	22.81	
D	Water Weight (B-C)	4.18	4.51	4.67				1.49	1.82	
E	Dry Soil Weight (C-A)	8.49	9.70	10.72				6.05	7.34	
F	% Moisture (D/E)*100	49.2%	46.5%	43.6%				24.6%	24.8%	
N	# OF DROPS	19	23	34				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.7%**		



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	**46**
Plastic Limit	**25**
Plastic Index	**21**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/1/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

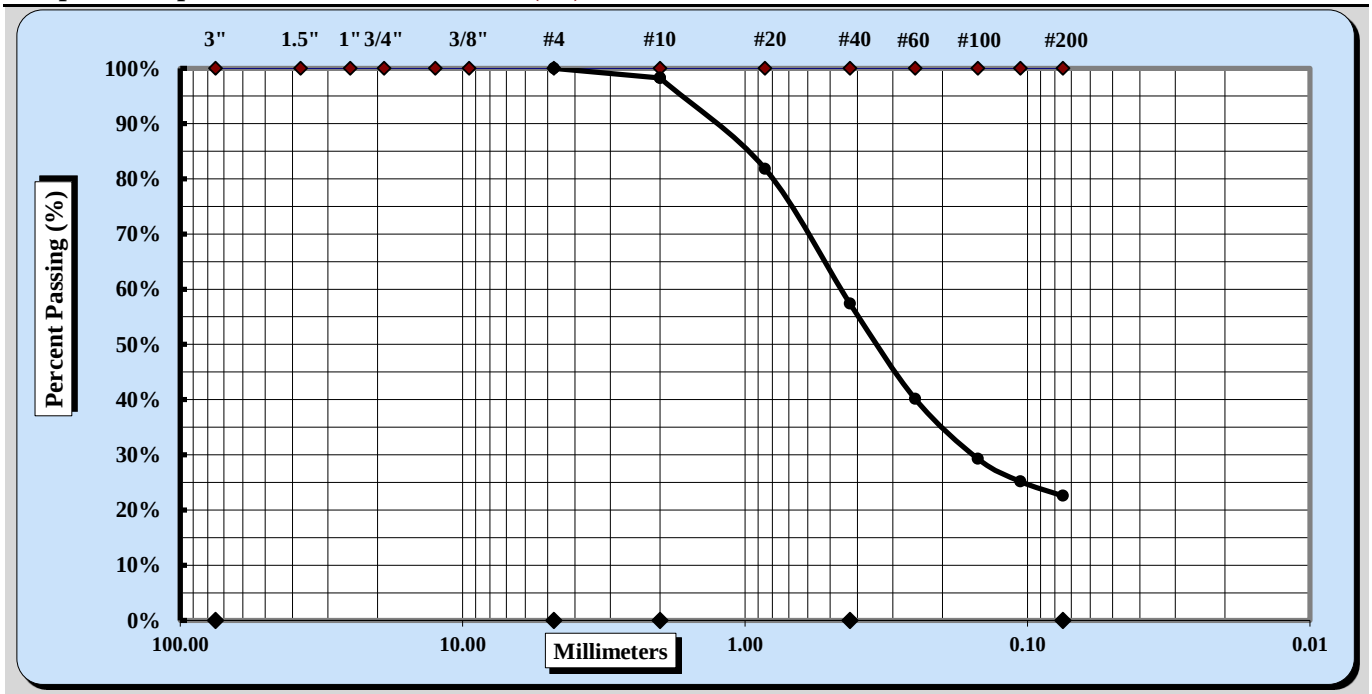
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-15	Type: SS		
	Sample: 2	Depth:	27.6 - 29.6 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.7%	Fine Sand	34.8%
Gravel	0.0%	Medium Sand	40.9%	Silt & Clay	22.6%

Coarse Sand	1.7%	Medium Sand	40.9%	Fine Sand	34.8%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

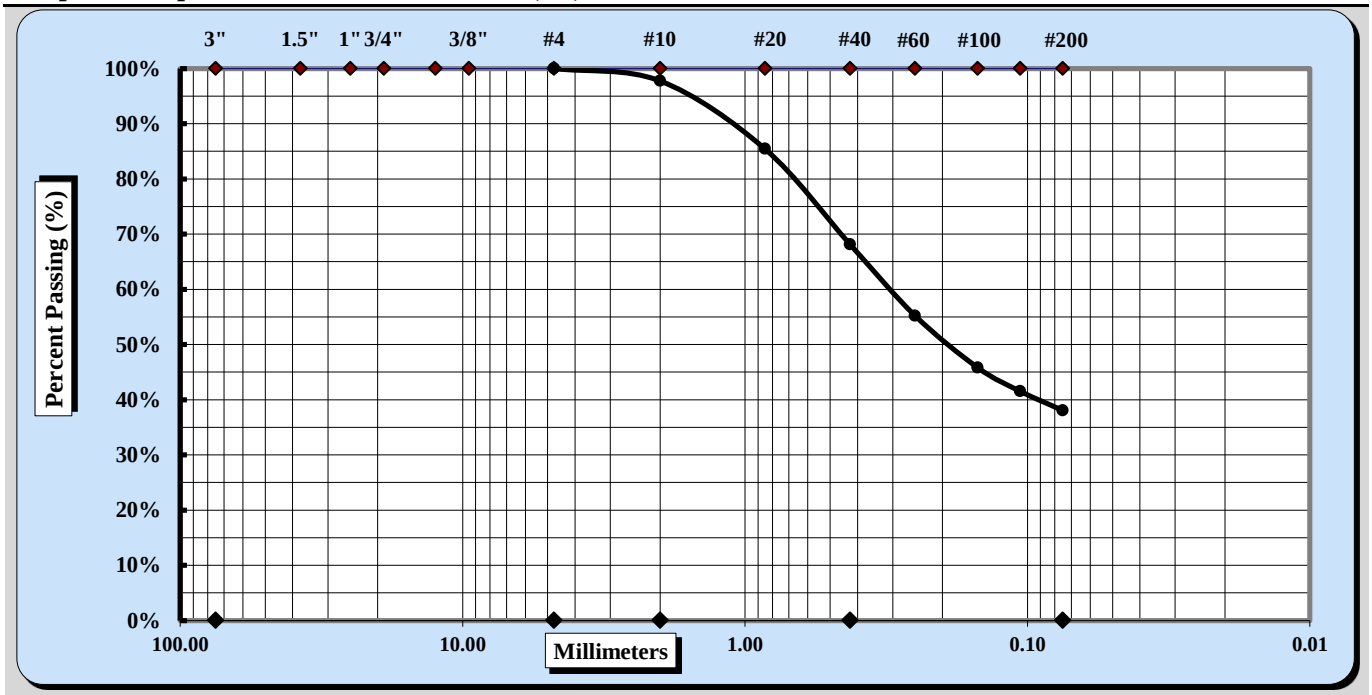
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-15	Type: SS		
	Sample: 4	Depth:	31.6 - 33.6 ft

Sample Description: CLAYEY SAND (SC) **A-7**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.3%	Fine Sand	30.1%
Gravel	0.0%	Medium Sand	29.6%	Silt & Clay	38.1%

Coarse Sand	2.3%	Medium Sand	29.6%	Fine Sand	30.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

ASTM D422

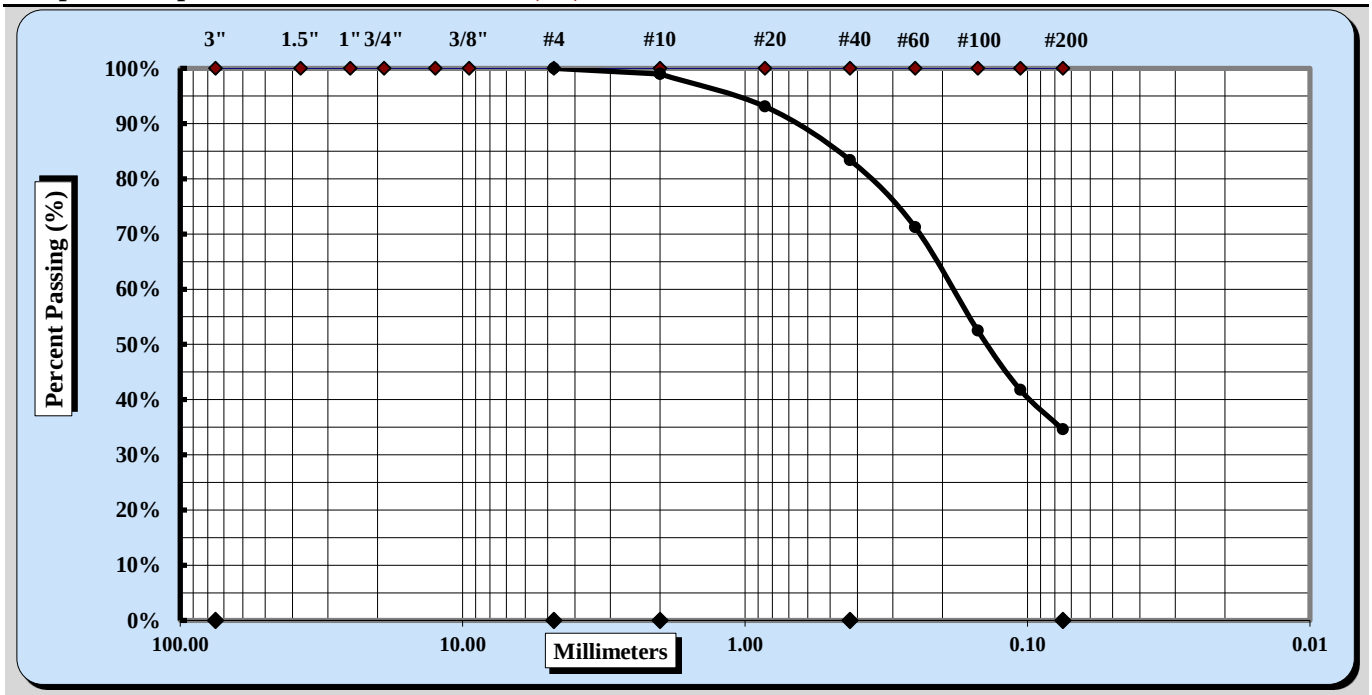
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-15	Type: SS		
	Sample: 5	Depth:	33.6 - 35.6 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.0%	Fine Sand	48.8%
Gravel	0.0%	Medium Sand	15.6%	Silt & Clay	34.6%

Coarse Sand	1.0%	Medium Sand	15.6%	Fine Sand	48.8%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

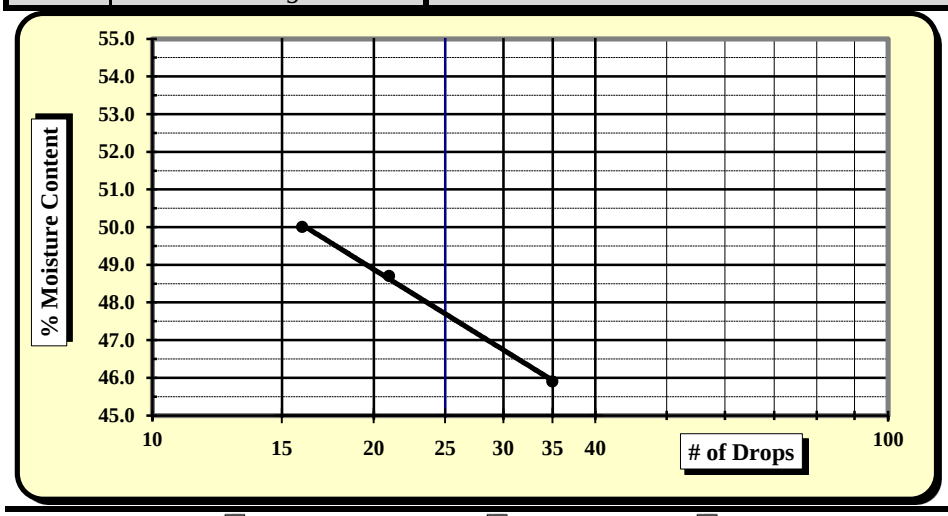
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-15	Sample No: 8		
		Depth: 48.7 - 50.2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	19	14	10				33	53	
A	Tare Weight	15.49	15.54	15.49				21.26	21.42	
B	Wet Soil Weight + A	31.19	32.18	33.41				29.49	30.16	
C	Dry Soil Weight + A	25.96	26.73	27.77				27.79	28.35	
D	Water Weight (B-C)	5.23	5.45	5.64				1.70	1.81	
E	Dry Soil Weight (C-A)	10.47	11.19	12.28				6.53	6.93	
F	% Moisture (D/E)*100	50.0%	48.7%	45.9%				26.0%	26.1%	
N	# OF DROPS	16	21	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**26.1%**		



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	**48**
Plastic Limit	**26**
Plastic Index	**22**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/1/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

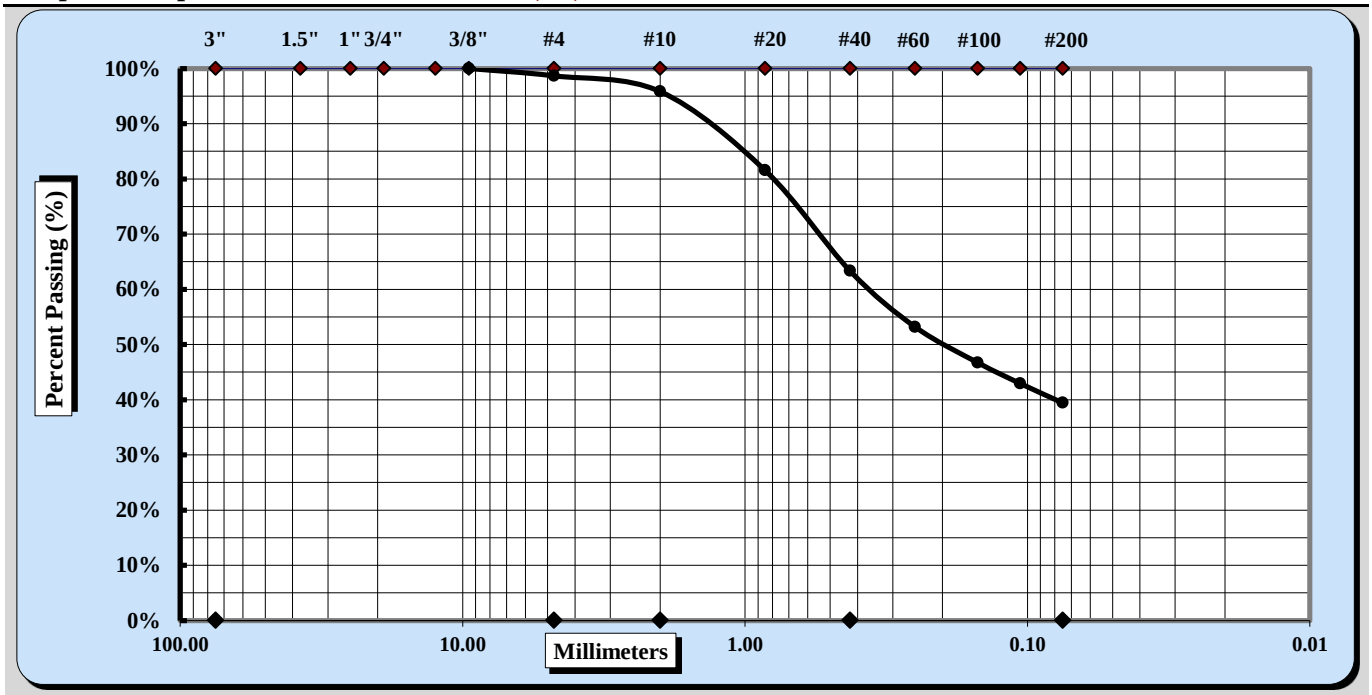
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Type: SS		
	Sample: 4	Depth:	6 - 8 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.8%	Fine Sand	23.9%
Gravel	1.3%	Medium Sand	32.5%	Silt & Clay	39.4%

Coarse Sand	2.8%	Medium Sand	32.5%	Fine Sand	23.9%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

Sample Log No.:341 | *AASHTO T 267* | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/17/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-16	Sample No.:	4
		Depth:	6 - 8 ft
Sample Description:	SILTY SAND (SM)		

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	C
t	Tare Weight	*grams*	19.18
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	56.81
c	Ash Weight + Tare Wt.	*grams*	56.23
C	Ash Weight	*c-t*	37.05
B	Mass of Oven Dry Specimen	*(b-t)*	37.63
D	***% Ash Content***	*(C/B)*100*	**98.5%**
	% Organic Matter	*100-D*	**1.5%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

(Description per ASTM D2487 and D2488)

Derek Baker	11/17/2014		
Technician Name	*Date*		
N. Randy Rainwater	*Signature*	Project Engineer	11/25/2014
Technical Responsibility		*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

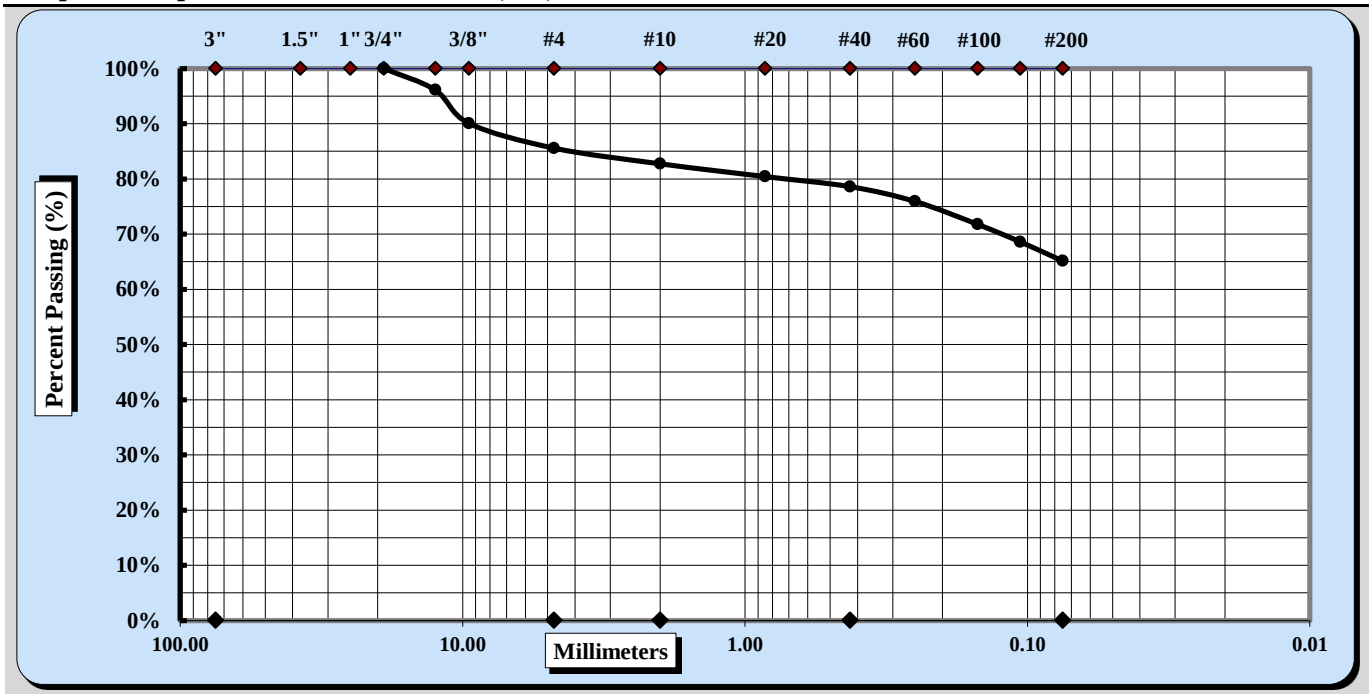
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/24/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/11/14 - 11/13/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Type: SS		
	Sample: 8	Depth:	23.5 - 25 ft

Sample Description: SANDY SILT (ML) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	2.8%	Fine Sand	13.5%
Gravel	14.4%	Medium Sand	4.1%	Silt & Clay	65.1%
Liquid Limit:	49	Plastic Limit:	29	Plastic Index:	20

Coarse Sand	2.8%	Medium Sand	4.1%	Fine Sand	13.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M 145

N. Randy Rainwater		Project Engineer	11/25/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

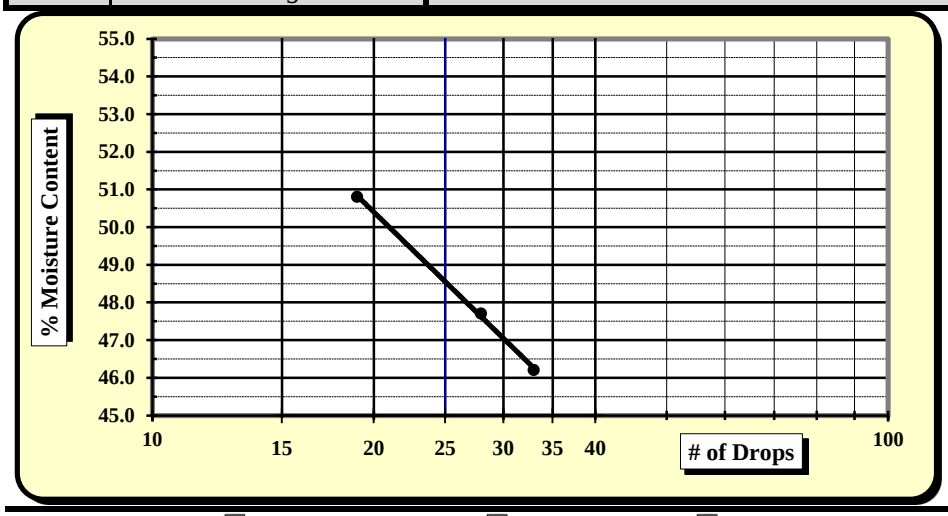
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/23/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/4/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Sample No: 8		
		Depth: 23.5 - 25 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	5	24	7				4	11	
A	Tare Weight	15.48	15.51	15.48				15.51	15.50	
B	Wet Soil Weight + A	26.40	27.71	28.73				24.31	23.79	
C	Dry Soil Weight + A	22.72	23.77	24.54				22.35	21.95	
D	Water Weight (B-C)	3.68	3.94	4.19				1.96	1.84	
E	Dry Soil Weight (C-A)	7.24	8.26	9.06				6.84	6.45	
F	% Moisture (D/E)*100	50.8%	47.7%	46.2%				28.7%	28.5%	
N	# OF DROPS	19	28	33				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**28.6%**		



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 **49**
Plastic Limit **29**
Plastic Index **20**
USCS Group Symbol **ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/4/2014	N. Randy Rainwater	11/25/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Moisture, Ash, and Organic Matter

Sample Log No.:341 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/17/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-17	Sample No.:	4
		Depth:	6 - 8 ft

Sample Description: POOLY GRADED SAND (SP)

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	6
t	Tare Weight	*grams*	16.60
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	52.43
c	Ash Weight + Tare Wt.	*grams*	51.41
C	Ash Weight	*c-t*	34.81
B	Mass of Oven Dry Specimen	*(b-t)*	35.83
D	***% Ash Content***	*(C/B)*100*	**97.2%**
	% Organic Matter	*100-D*	**2.8%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

(Description per ASTM D2488)

Derek Baker	11/17/2014		
Technician Name	*Date*		
N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

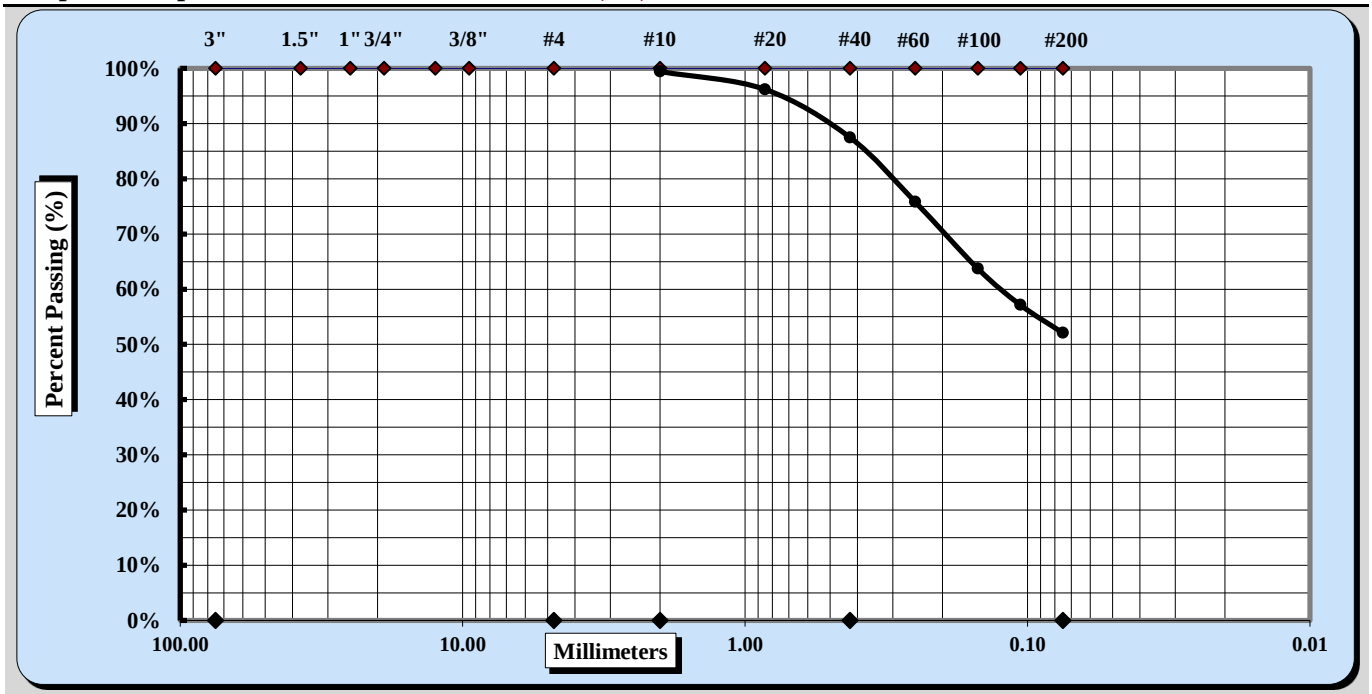
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Type: SS		
	Sample: 5	Depth:	8 - 10 ft

Sample Description: SANDY LEAN CLAY (CL) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.6%	Fine Sand	35.4%
Gravel	0.0%	Medium Sand	12.0%	Silt & Clay	52.1%
Liquid Limit:	47	Plastic Limit:	26	Plastic Index:	21

Coarse Sand	0.6%	Medium Sand	12.0%	Fine Sand	35.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D4318; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

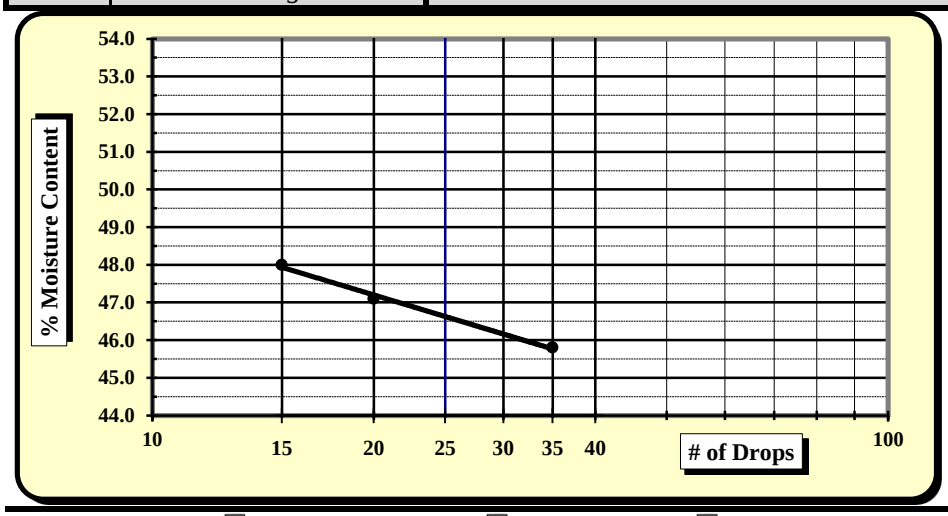
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/29/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Sample No: 5		
		Depth: 8 - 10 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	18	19				23	6	
A	Tare Weight	15.41	15.50	15.48				15.50	15.52	
B	Wet Soil Weight + A	28.79	29.67	30.77				24.41	23.96	
C	Dry Soil Weight + A	24.45	25.13	25.97				22.56	22.21	
D	Water Weight (B-C)	4.34	4.54	4.80				1.85	1.75	
E	Dry Soil Weight (C-A)	9.04	9.63	10.49				7.06	6.69	
F	% Moisture (D/E)*100	48.0%	47.1%	45.8%				26.2%	26.2%	
N	# OF DROPS	15	20	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**26.2%**		



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 **47**
Plastic Limit **26**
Plastic Index **21**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-2-7**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/29/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

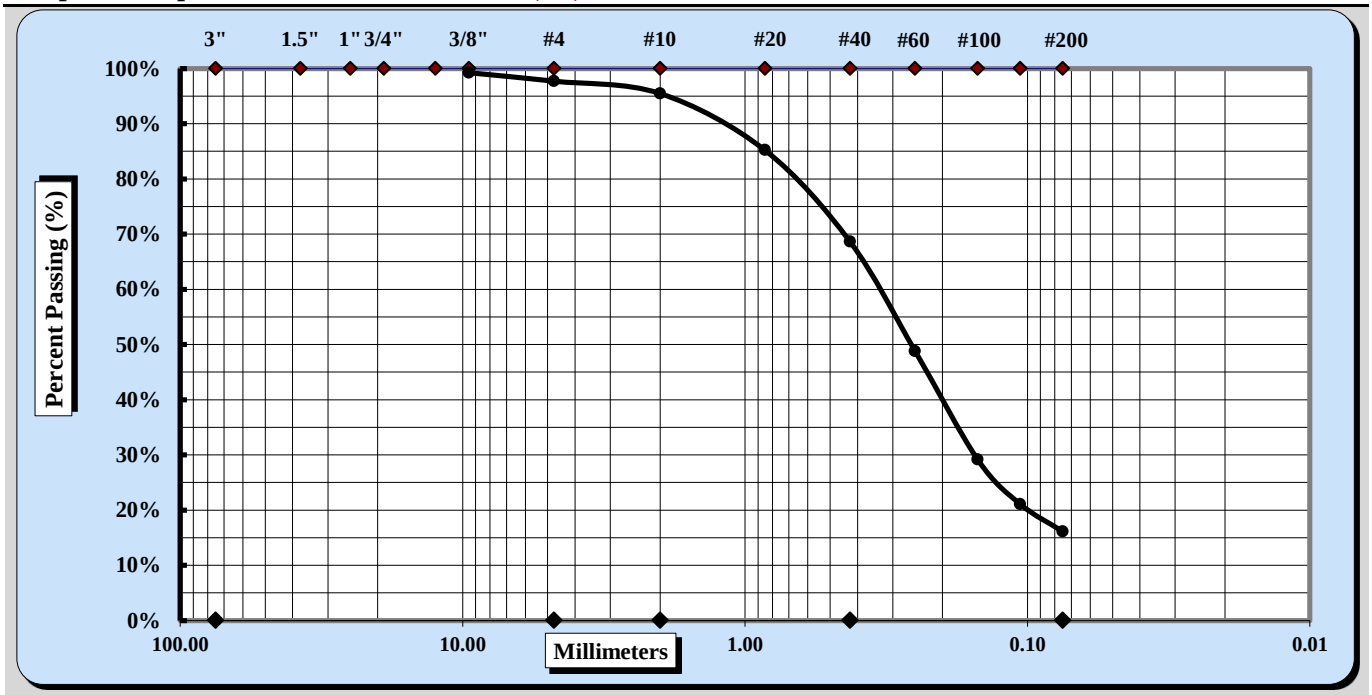
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/19/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Type: SS		
	Sample: 6	Depth:	13.5 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.2%	Fine Sand	52.5%
Gravel	2.3%	Medium Sand	26.8%	Silt & Clay	16.1%

Coarse Sand	2.2%	Medium Sand	26.8%	Fine Sand	52.5%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

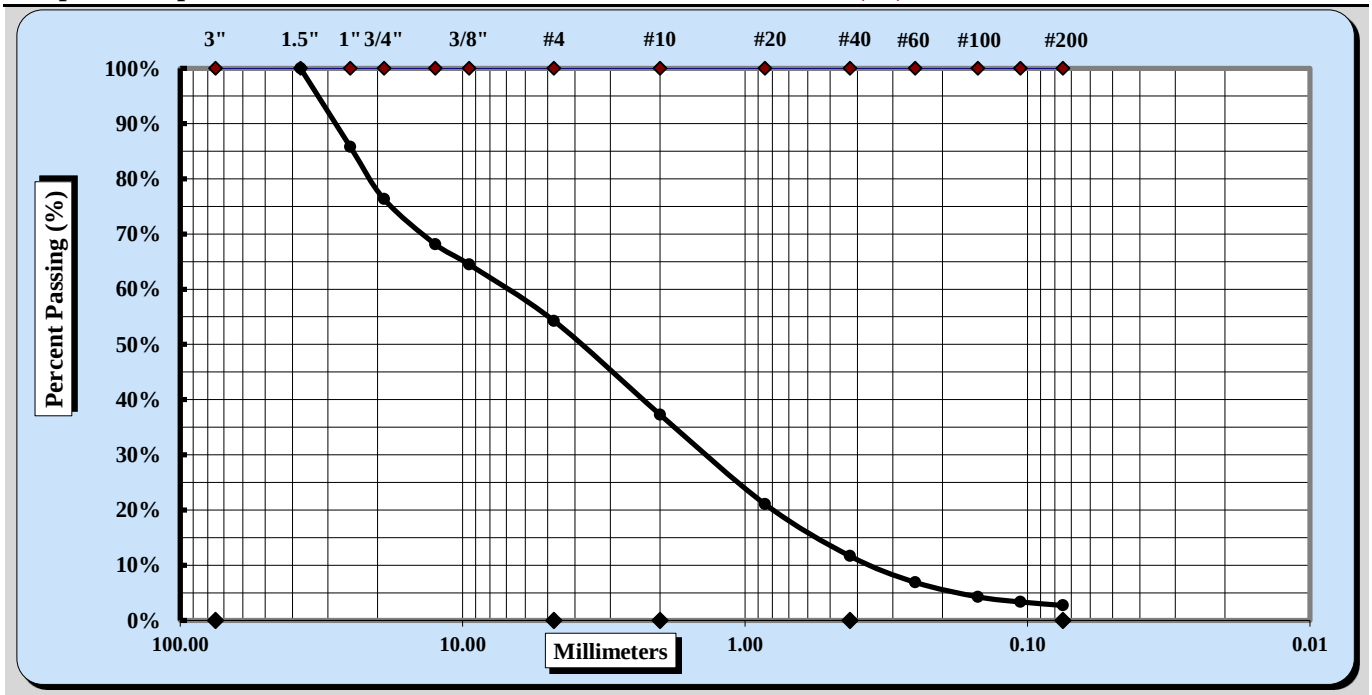
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/19/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Type: SS		
	Sample: 7	Depth:	18.5 - 20 ft

Sample Description: POORLY GRADED SAND WITH GRAVEL (SP) **A-1**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1.5"	Coarse Sand	17.0%	Fine Sand	8.9%
Gravel	45.7%	Medium Sand	25.6%	Silt & Clay	2.7%

Cc = 0.8 Cu = 19

Coarse Sand	17.0%	Medium Sand	25.6%	Fine Sand	8.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

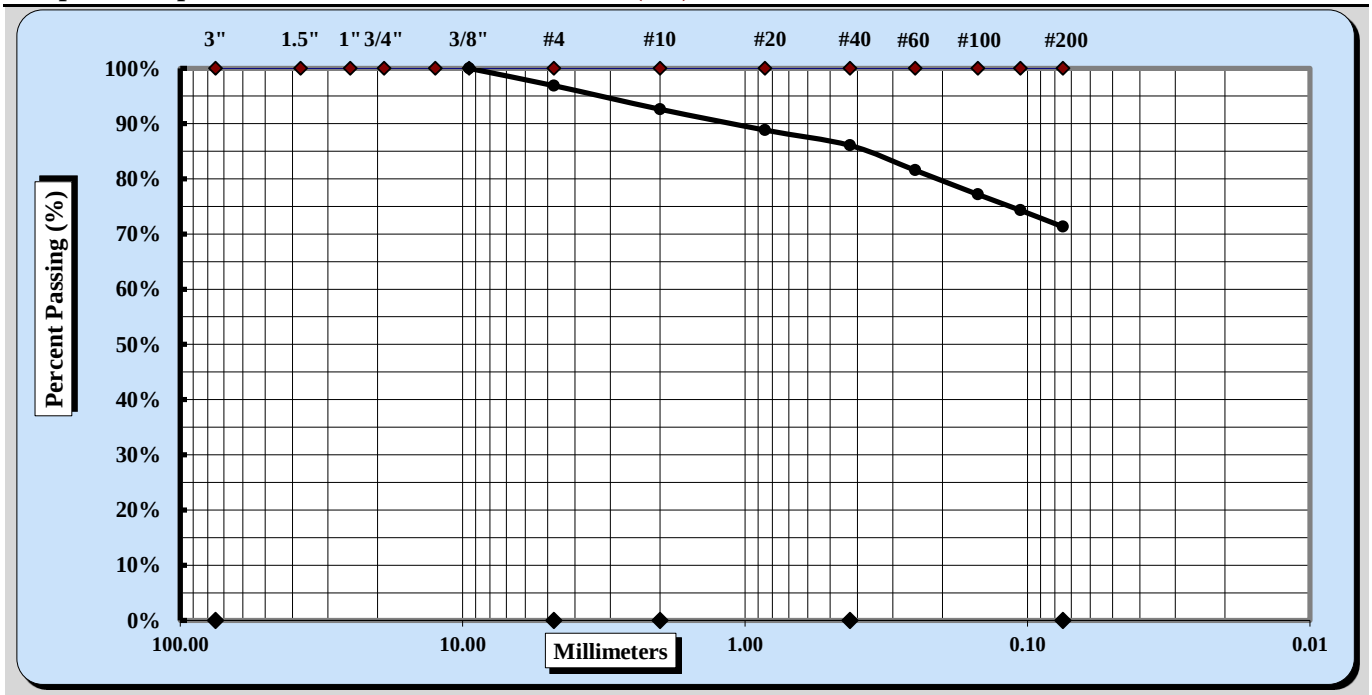
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Type: SS		
	Sample: 8	Depth:	23.5 - 25 ft

Sample Description: FAT CLAY WITH SAND (CH) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	4.3%	Fine Sand	14.7%
Gravel	3.1%	Medium Sand	6.6%	Silt & Clay	71.3%
Liquid Limit:	56	Plastic Limit:	25	Plastic Index:	31

Coarse Sand	4.3%	Medium Sand	6.6%	Fine Sand	14.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

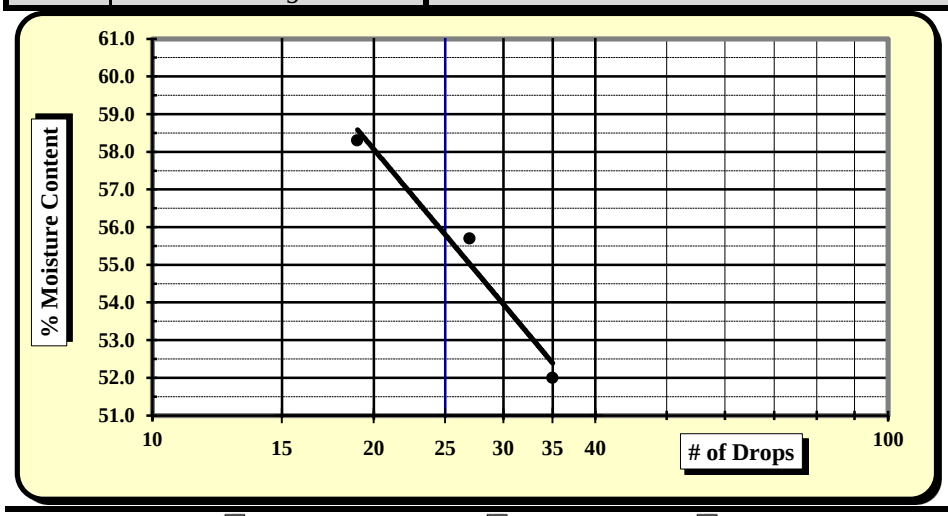
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/29/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Sample No: 8		
		Depth: 23.5 - 25 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	9	20	15				17	16	
A	Tare Weight	15.49	15.54	15.40				15.57	15.70	
B	Wet Soil Weight + A	27.49	28.88	29.46				23.97	23.47	
C	Dry Soil Weight + A	23.07	24.11	24.65				22.31	21.94	
D	Water Weight (B-C)	4.42	4.77	4.81				1.66	1.53	
E	Dry Soil Weight (C-A)	7.58	8.57	9.25				6.74	6.24	
F	% Moisture (D/E)*100	58.3%	55.7%	52.0%				24.6%	24.5%	
N	# OF DROPS	19	27	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.6%**		



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 **56**
Plastic Limit **25**
Plastic Index **31**
USCS Group Symbol **CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/29/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

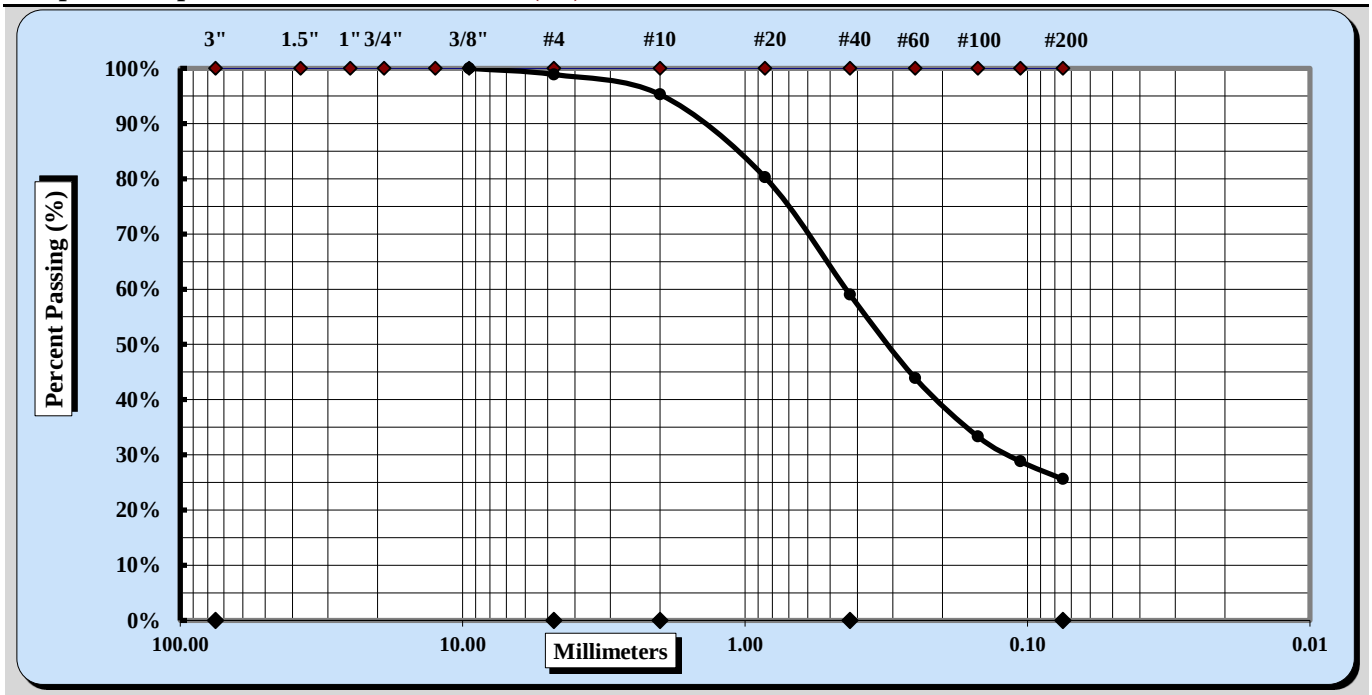
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Type: SS		
	Sample: 3	Depth:	6 - 7.5 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	3.6%	Fine Sand	33.4%
Gravel	1.1%	Medium Sand	36.3%	Silt & Clay	25.6%

Coarse Sand	3.6%	Medium Sand	36.3%	Fine Sand	33.4%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

ASTM D422

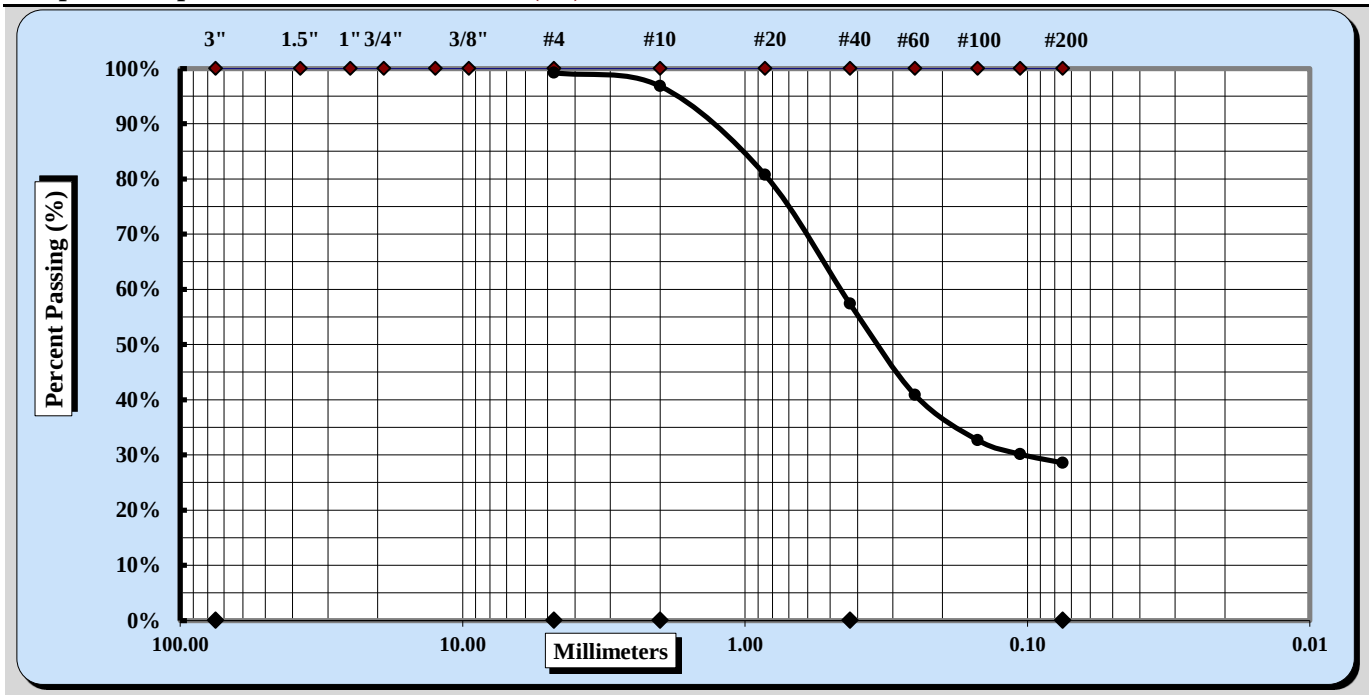
Quality Assurance

Sample Log No.:341

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/19/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Type: SS		
	Sample: 6	Depth:	18.5 - 20 ft

Sample Description: CLAYEY SAND (SC) **A-2**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.4%	Fine Sand	28.8%
Gravel	0.8%	Medium Sand	39.4%	Silt & Clay	28.6%

Coarse Sand	2.4%	Medium Sand	39.4%	Fine Sand	28.8%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

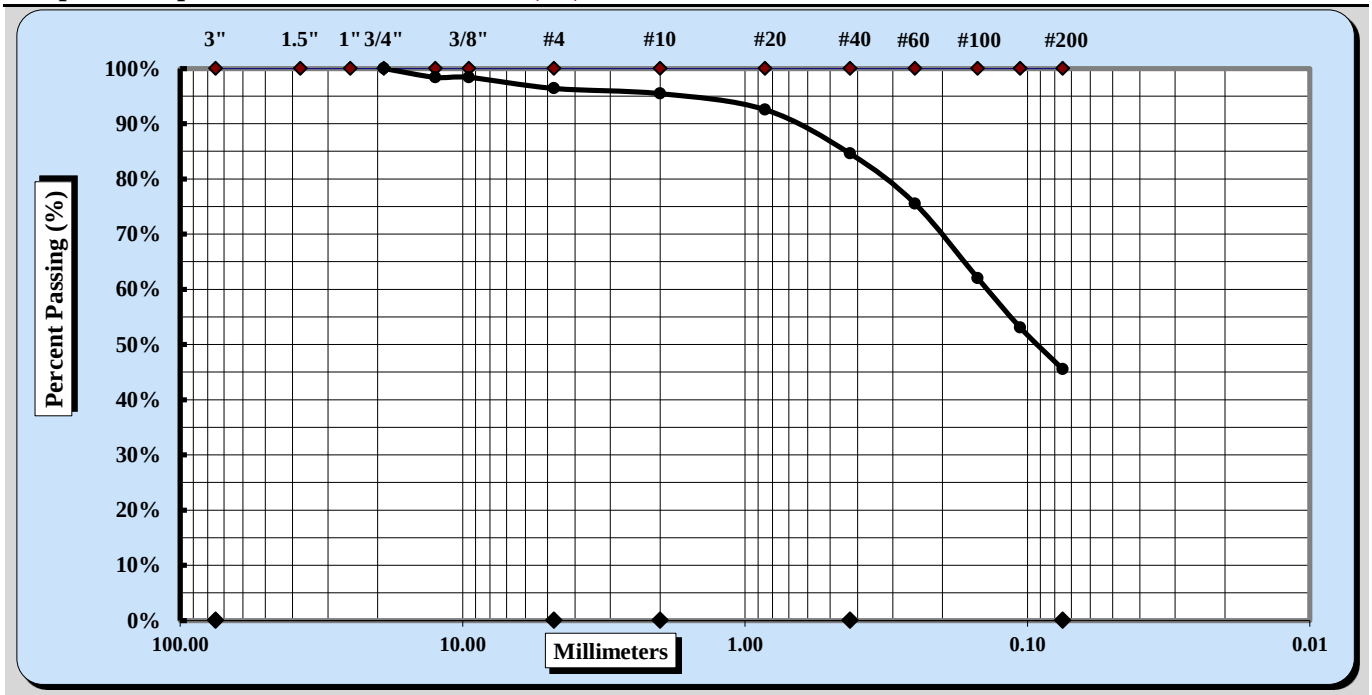
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/3/14 - 11/18/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Type: SS		
	Sample: 8	Depth:	28.5 - 30 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	0.9%	Fine Sand	39.1%
Gravel	3.6%	Medium Sand	10.9%	Silt & Clay	45.5%

Coarse Sand	0.9%	Medium Sand	10.9%	Fine Sand	39.1%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D422, D2487, D2488; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

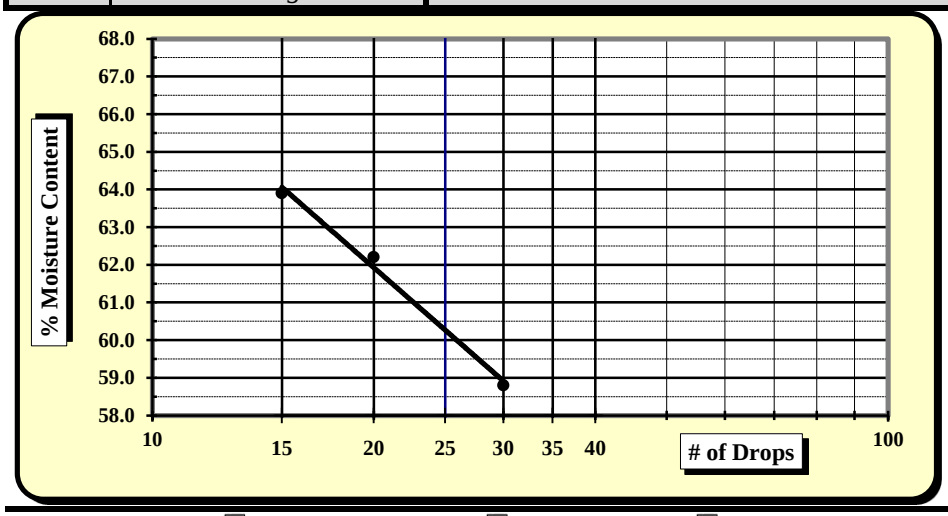
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/29/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Sample No: 10		
		Depth: 38.5 - 40 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	2	14	10				22	7	
A	Tare Weight	15.60	15.54	15.49				15.47	15.48	
B	Wet Soil Weight + A	26.14	27.64	28.08				23.37	23.79	
C	Dry Soil Weight + A	22.03	23.00	23.42				21.41	21.74	
D	Water Weight (B-C)	4.11	4.64	4.66				1.96	2.05	
E	Dry Soil Weight (C-A)	6.43	7.46	7.93				5.94	6.26	
F	% Moisture (D/E)*100	63.9%	62.2%	58.8%				33.0%	32.7%	
N	# OF DROPS	15	20	30				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**32.9%**		



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	**60**
Plastic Limit	**33**
Plastic Index	**27**
USCS Group Symbol	**MH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/29/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

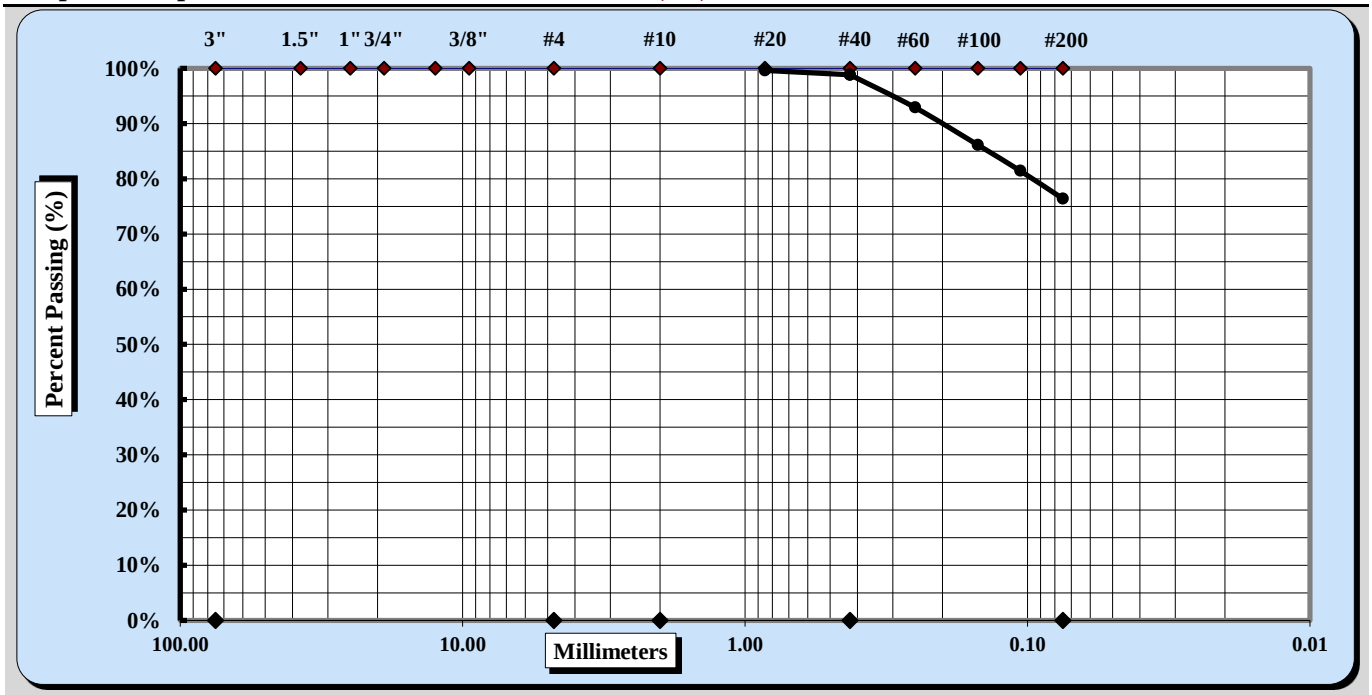
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Type: SS		
	Sample: 12	Depth:	48.5 - 50 ft

Sample Description: LEAN CLAY WITH SAND (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 20	Coarse Sand	0.0%	Fine Sand	22.4%
Gravel	0.0%	Medium Sand	1.1%	Silt & Clay	76.4%
Liquid Limit:	36	Plastic Limit:	23	Plastic Index:	13

Coarse Sand	0.0%	Medium Sand	1.1%	Fine Sand	22.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

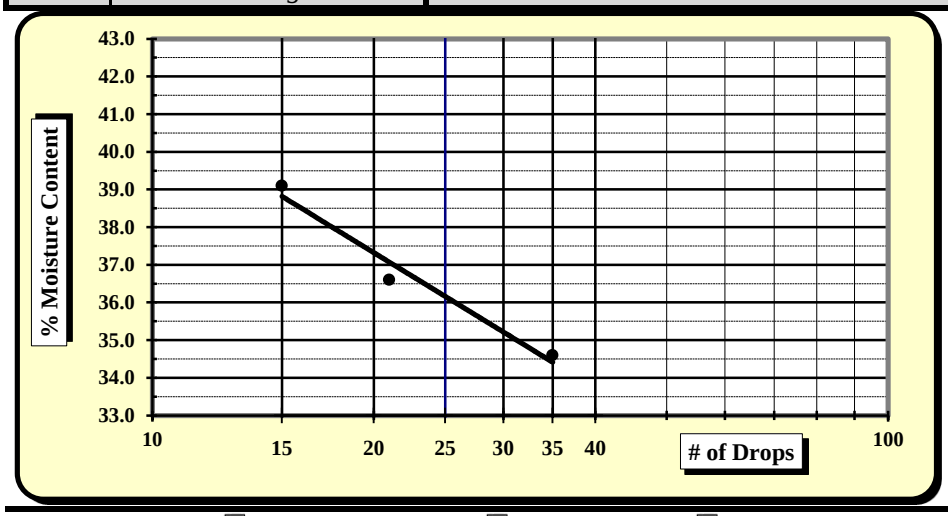
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	10/29/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Sample No: 12		
		Depth: 48.5 - 50 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	4	5	12				32	46	
A	Tare Weight	15.51	15.48	15.64				21.10	21.17	
B	Wet Soil Weight + A	29.31	30.76	31.79				30.26	30.06	
C	Dry Soil Weight + A	25.43	26.67	27.64				28.53	28.38	
D	Water Weight (B-C)	3.88	4.09	4.15				1.73	1.68	
E	Dry Soil Weight (C-A)	9.92	11.19	12.00				7.43	7.21	
F	% Moisture (D/E)*100	39.1%	36.6%	34.6%				23.3%	23.3%	
N	# OF DROPS	15	21	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**23.3%**		



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	**36**
Plastic Limit	**23**
Plastic Index	**13**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	10/29/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

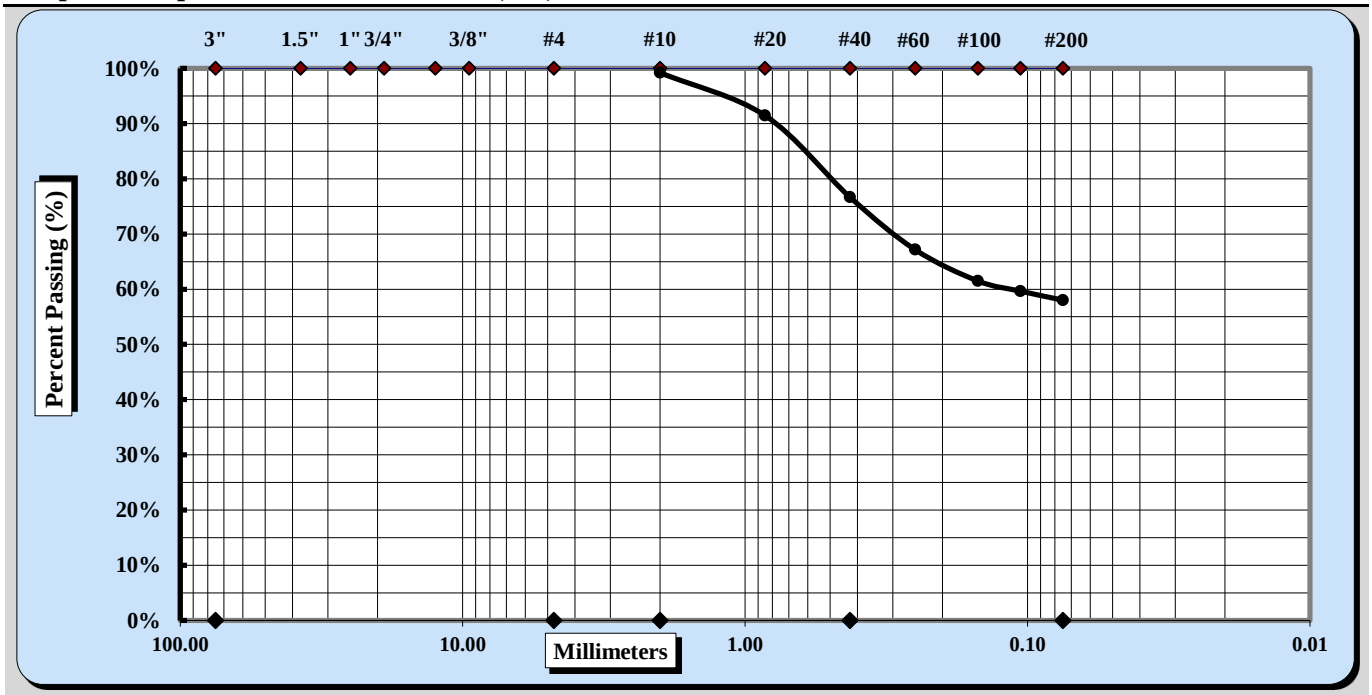
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-1	Type: SS	Depth:	0 - 2 ft

Sample Description: SANDY SILT (ML) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.8%	Fine Sand	18.6%
Gravel	0.0%	Medium Sand	22.6%	Silt & Clay	58.0%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.8%	Medium Sand	22.6%	Fine Sand	18.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

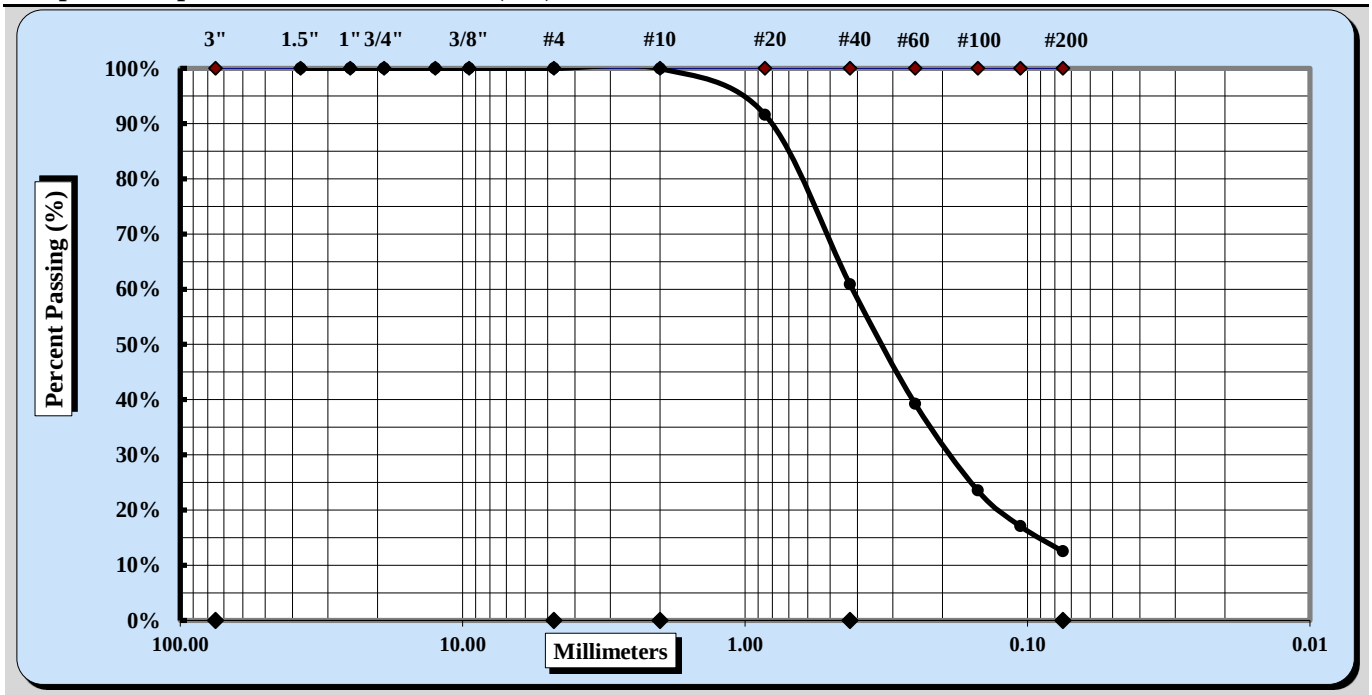
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-1	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.1%	Fine Sand	48.4%
Gravel	0.0%	Medium Sand	39.1%	Silt & Clay	12.5%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.1%	Medium Sand	39.1%	Fine Sand	48.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

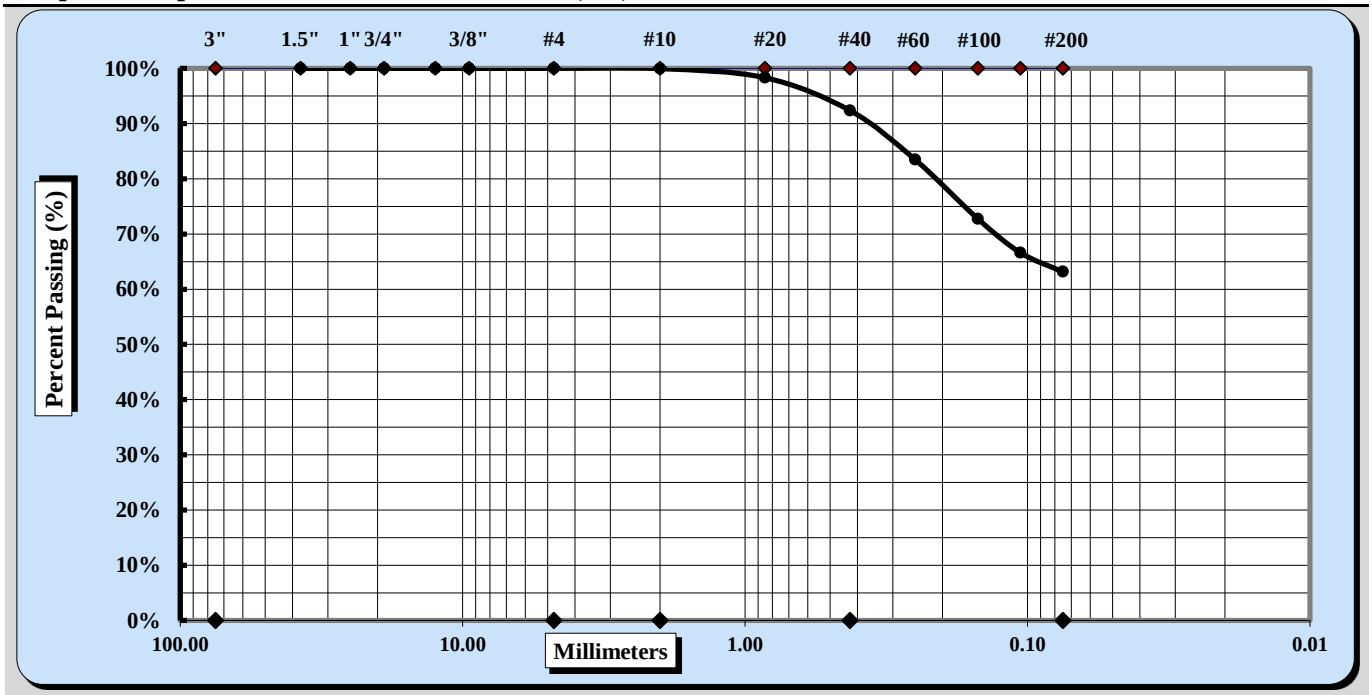
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-2	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SANDY FAT CLAY (CH) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.0%	Fine Sand	29.2%
Gravel	0.0%	Medium Sand	7.6%	Silt & Clay	63.2%
Liquid Limit	54	Plastic Limit	24	Plastic Index	30

Coarse Sand	0.0%	Medium Sand	7.6%	Fine Sand	29.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

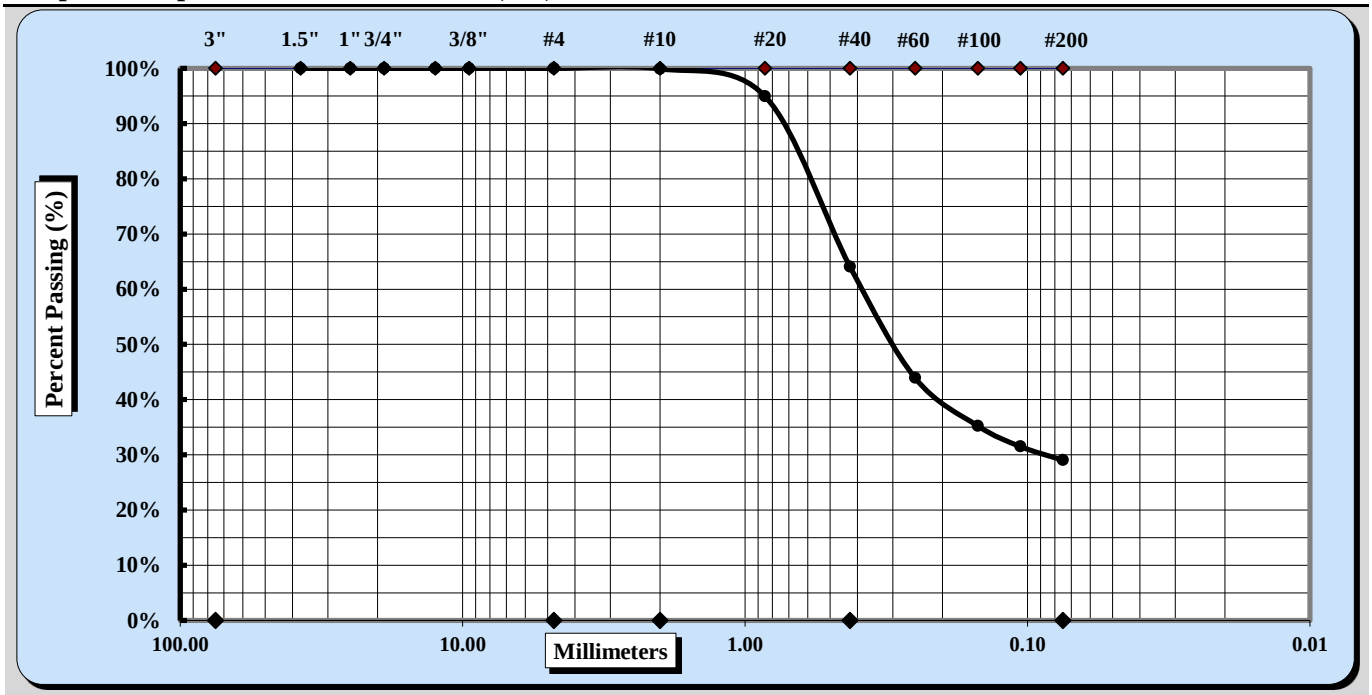
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-2	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.1%	Fine Sand	35.0%
Gravel	0.0%	Medium Sand	35.9%	Silt & Clay	29.0%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.1%	Medium Sand	35.9%	Fine Sand	35.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

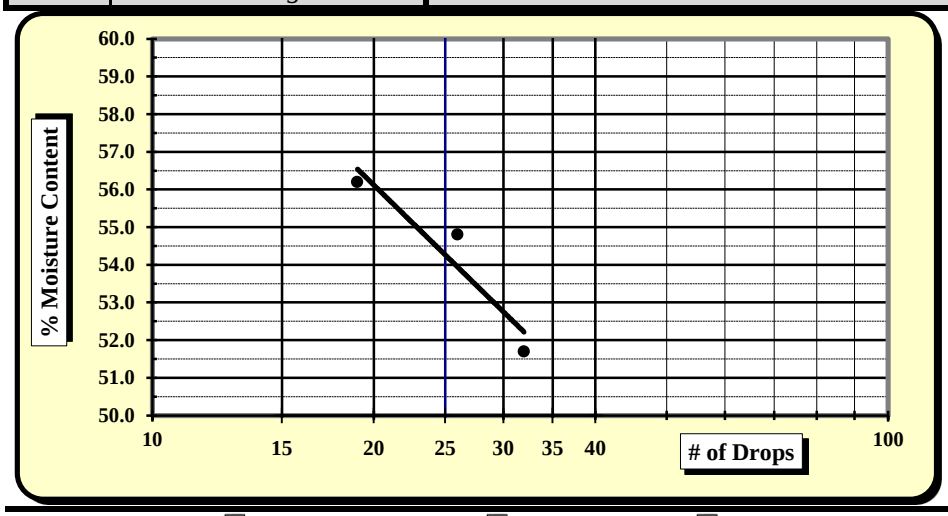
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/18/14 - 11/24/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-2	Sample No: 1		
		Depth: 0 - 2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	10.56	10.79	10.89				11.05	10.65	
B	Wet Soil Weight + A	18.98	18.59	17.95				19.58	20.64	
C	Dry Soil Weight + A	16.11	15.83	15.41				17.92	18.68	
D	Water Weight (B-C)	2.87	2.76	2.54				1.66	1.96	
E	Dry Soil Weight (C-A)	5.55	5.04	4.52				6.87	8.03	
F	% Moisture (D/E)*100	51.7%	54.8%	56.2%				24.2%	24.4%	
N	# OF DROPS	32	26	19				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.3%**		



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	**54**
Plastic Limit	**24**
Plastic Index	**30**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Jacob Folsom	11/18/14-11/24/14	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

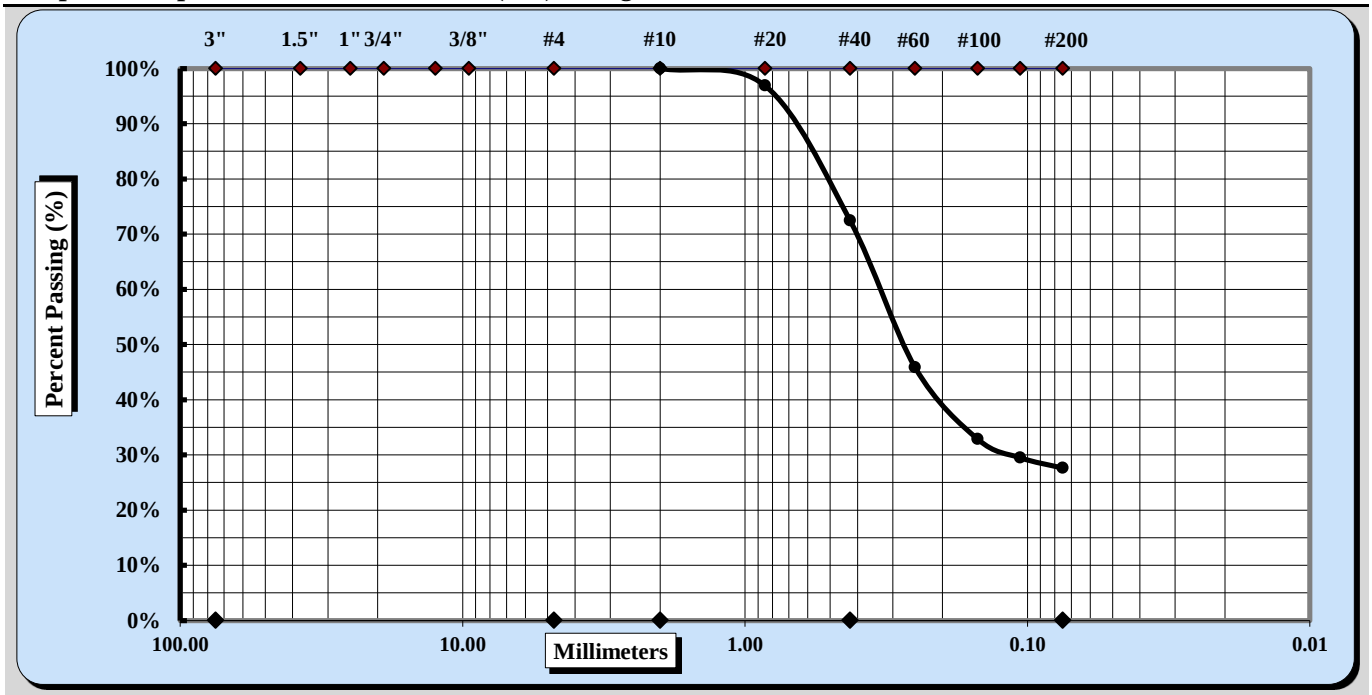
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-3	Type: SS		
		Depth:	1 - 2.5 ft

Sample Description: SILTY SAND (SM), orangish red **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.0%	Fine Sand	44.9%
Gravel	0.0%	Medium Sand	27.5%	Silt & Clay	27.6%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.0%	Medium Sand	27.5%	Fine Sand	44.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

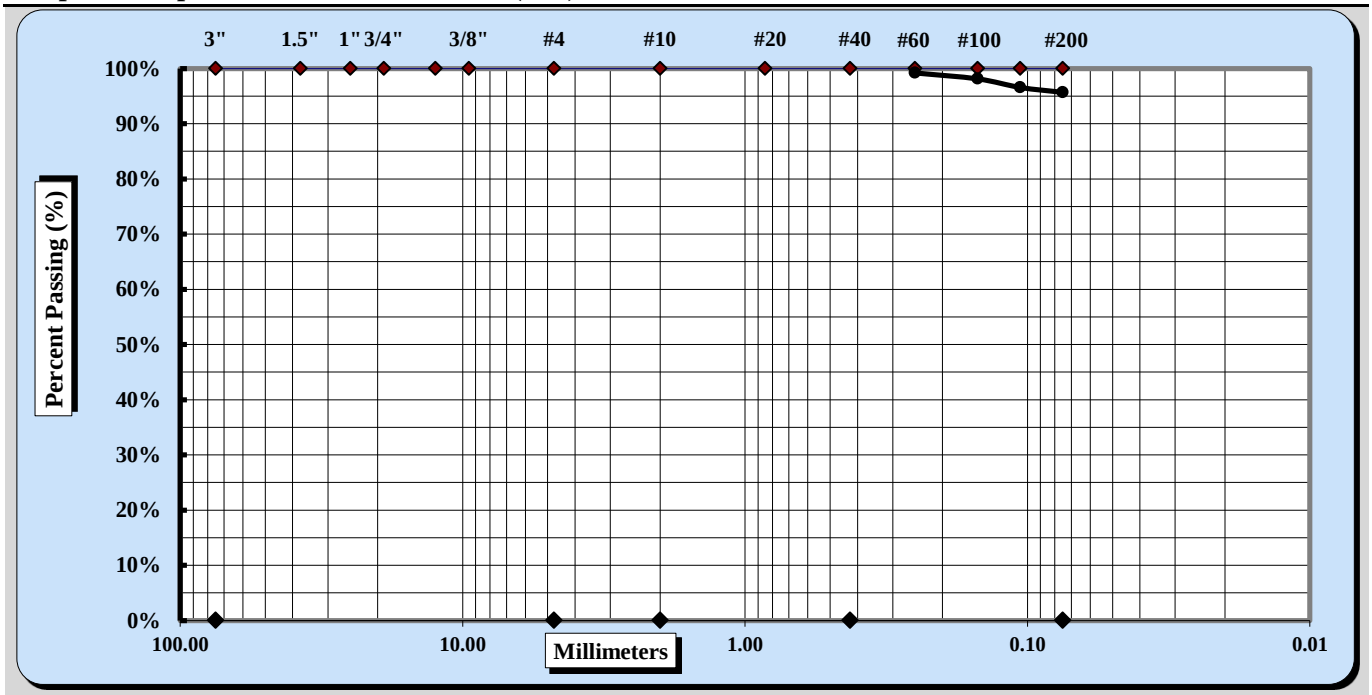
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-3	Type: SS		
		Depth:	3.5 - 5 ft

Sample Description: ELASTIC SILT (MH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 60	Coarse Sand	0.0%	Fine Sand	3.8%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	95.7%
Liquid Limit	70	Plastic Limit	34	Plastic Index	36

Coarse Sand	0.0%	Medium Sand	0.5%	Fine Sand	3.8%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

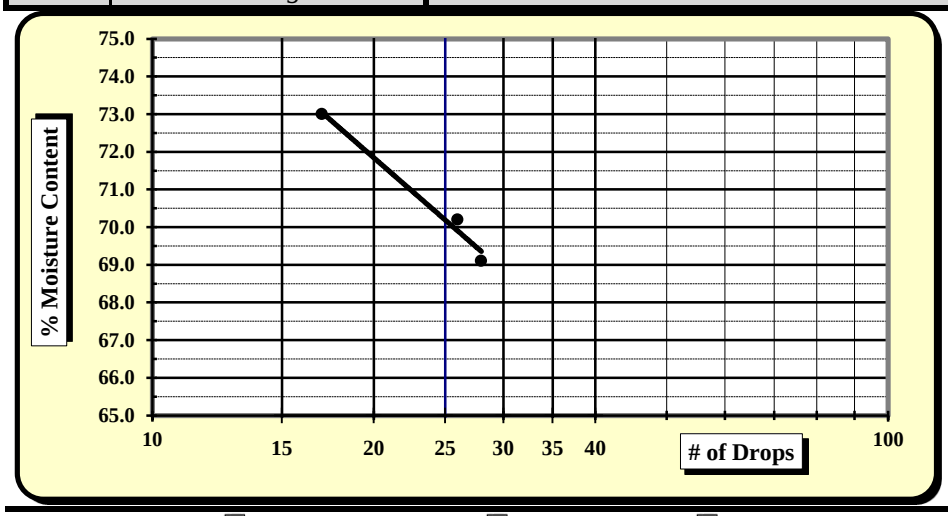
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-3	Sample No: 2		
		Depth: 3.5 - 5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	7	16	20				12	6	
A	Tare Weight	11.21	11.01	11.08				10.61	11.53	
B	Wet Soil Weight + A	18.04	17.97	18.57				17.31	22.42	
C	Dry Soil Weight + A	15.25	15.10	15.41				15.62	19.67	
D	Water Weight (B-C)	2.79	2.87	3.16				1.69	2.75	
E	Dry Soil Weight (C-A)	4.04	4.09	4.33				5.01	8.14	
F	% Moisture (D/E)*100	69.1%	70.2%	73.0%				33.7%	33.8%	
N	# OF DROPS	28	26	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**33.8%**		



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 **70**
Plastic Limit **34**
Plastic Index **36**
USCS Group Symbol **MH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

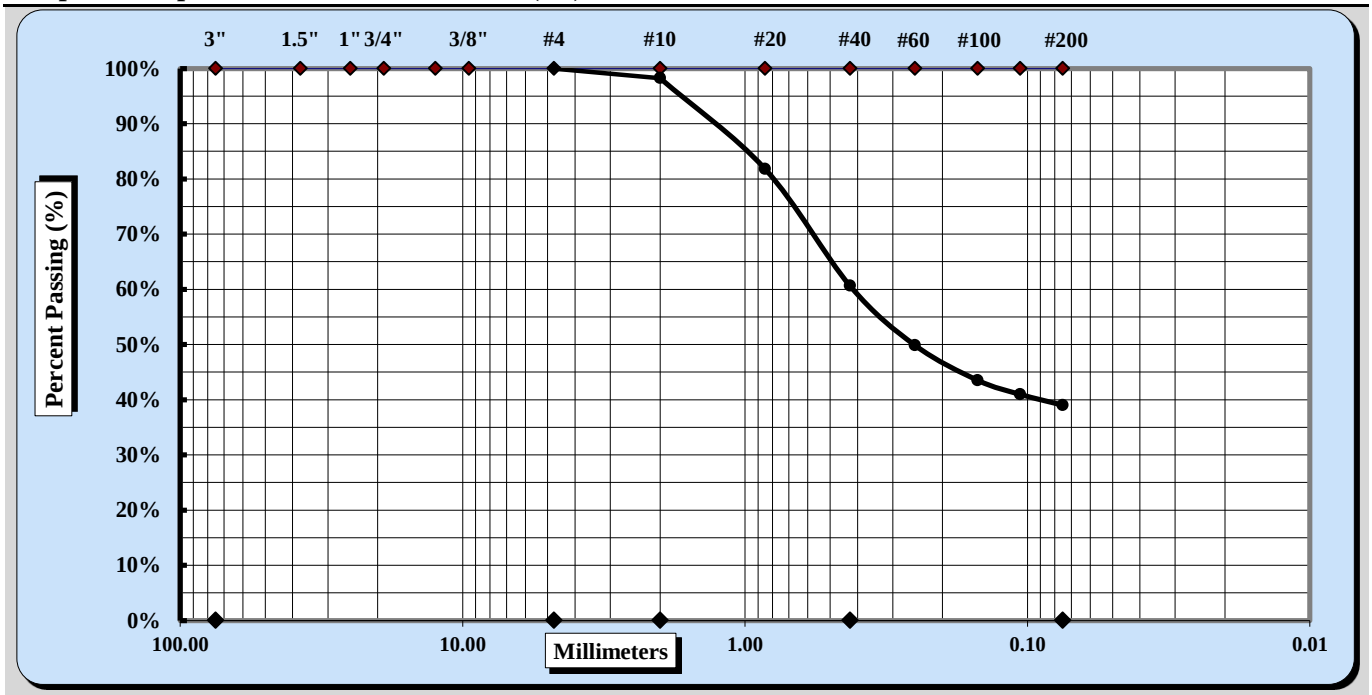
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-4	Type: SS		
		Depth:	1 - 2.5 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.8%	Fine Sand	21.6%
Gravel	0.0%	Medium Sand	37.6%	Silt & Clay	39.0%
Liquid Limit	27	Plastic Limit	16	Plastic Index	11

Coarse Sand	1.8%	Medium Sand	37.6%	Fine Sand	21.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

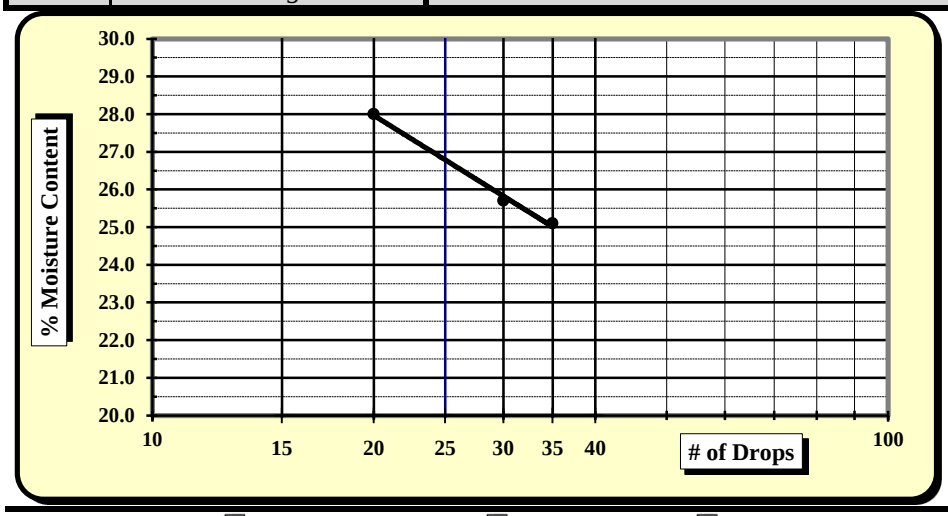
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-4	Sample No: 1		
		Depth: 1 - 2.5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	7	16	20				12	6	
A	Tare Weight	11.05	11.08	10.92				11.03	10.71	
B	Wet Soil Weight + A	19.58	21.26	20.30				19.96	22.09	
C	Dry Soil Weight + A	17.87	19.18	18.25				18.79	20.53	
D	Water Weight (B-C)	1.71	2.08	2.05				1.17	1.56	
E	Dry Soil Weight (C-A)	6.82	8.10	7.33				7.76	9.82	
F	% Moisture (D/E)*100	25.1%	25.7%	28.0%				15.1%	15.9%	
N	# OF DROPS	35	30	20				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.5%**		



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	**16**
Plastic Index	**11**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

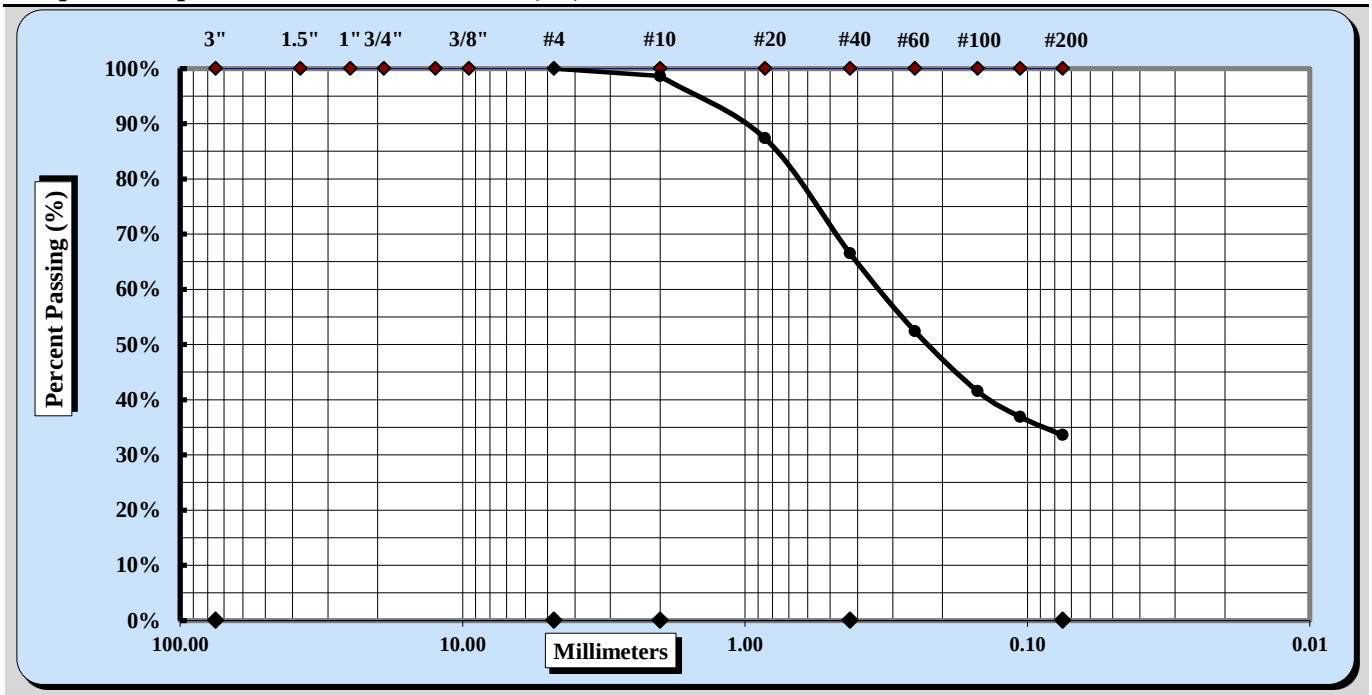
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-4	Type: SS		
		Depth:	3.5 - 5 ft

Sample Description: CLAYEY SAND (SC) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.4%	Fine Sand	32.9%
Gravel	0.0%	Medium Sand	32.1%	Silt & Clay	33.6%
Liquid Limit	25	Plastic Limit	16	Plastic Index	9

Coarse Sand	1.4%	Medium Sand	32.1%	Fine Sand	32.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

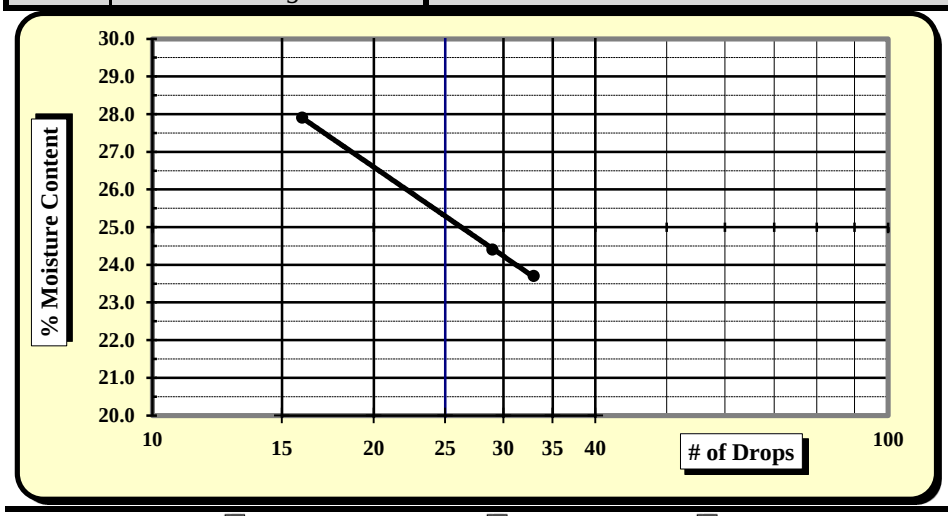
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-4	Sample No: 2		
		Depth: 3.5 - 5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:							12	6	
A	Tare Weight	10.85	10.64	10.79				11.15	10.64	
B	Wet Soil Weight + A	21.81	19.65	22.01				21.58	25.70	
C	Dry Soil Weight + A	19.71	17.88	19.56				20.13	23.60	
D	Water Weight (B-C)	2.10	1.77	2.45				1.45	2.10	
E	Dry Soil Weight (C-A)	8.86	7.24	8.77				8.98	12.96	
F	% Moisture (D/E)*100	23.7%	24.4%	27.9%				16.1%	16.2%	
N	# OF DROPS	33	29	16				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.2%**		



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 **25**
Plastic Limit **16**
Plastic Index **9**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-2-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

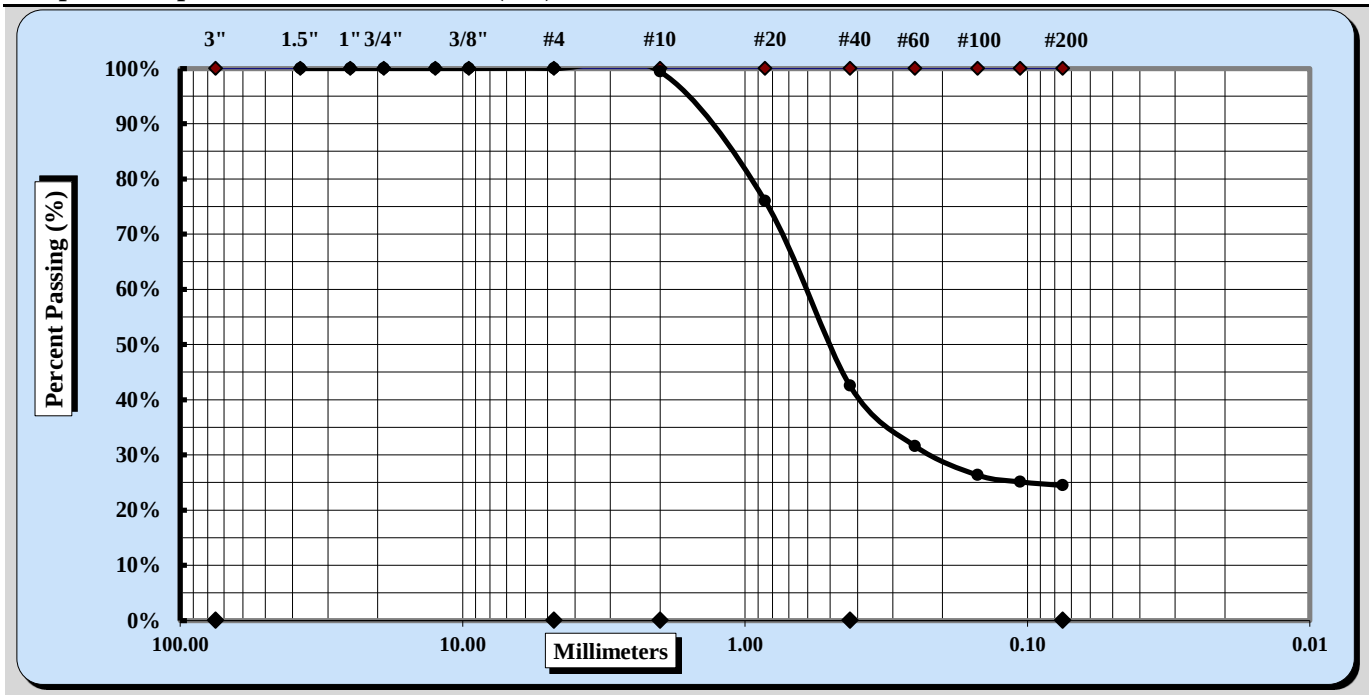
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-5	Type: SS		
		Depth:	1 - 2.5 ft

Sample Description: SILTY SAND (SM) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.6%	Fine Sand	18.1%
Gravel	0.0%	Medium Sand	56.9%	Silt & Clay	24.5%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.6%	Medium Sand	56.9%	Fine Sand	18.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

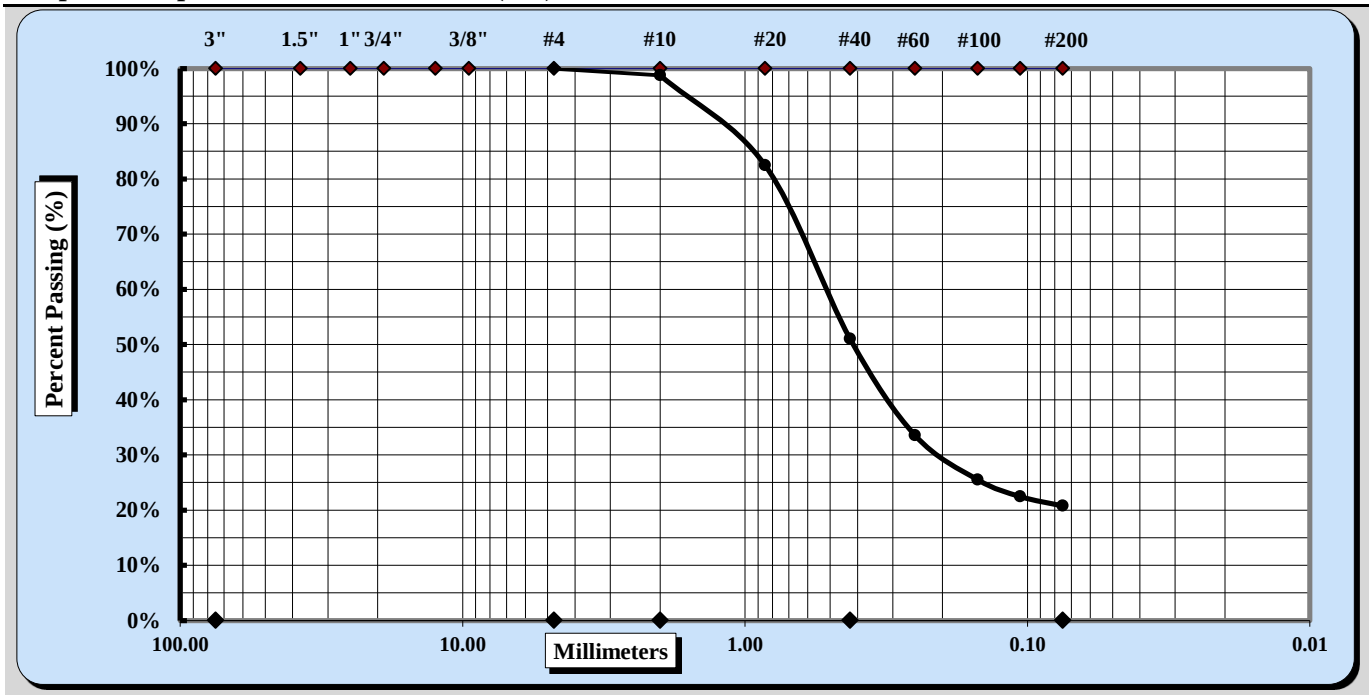
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-5	Type: SS		
		Depth:	3.5 - 5 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.2%	Fine Sand	30.3%
Gravel	0.0%	Medium Sand	47.7%	Silt & Clay	20.8%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.2%	Medium Sand	47.7%	Fine Sand	30.3%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

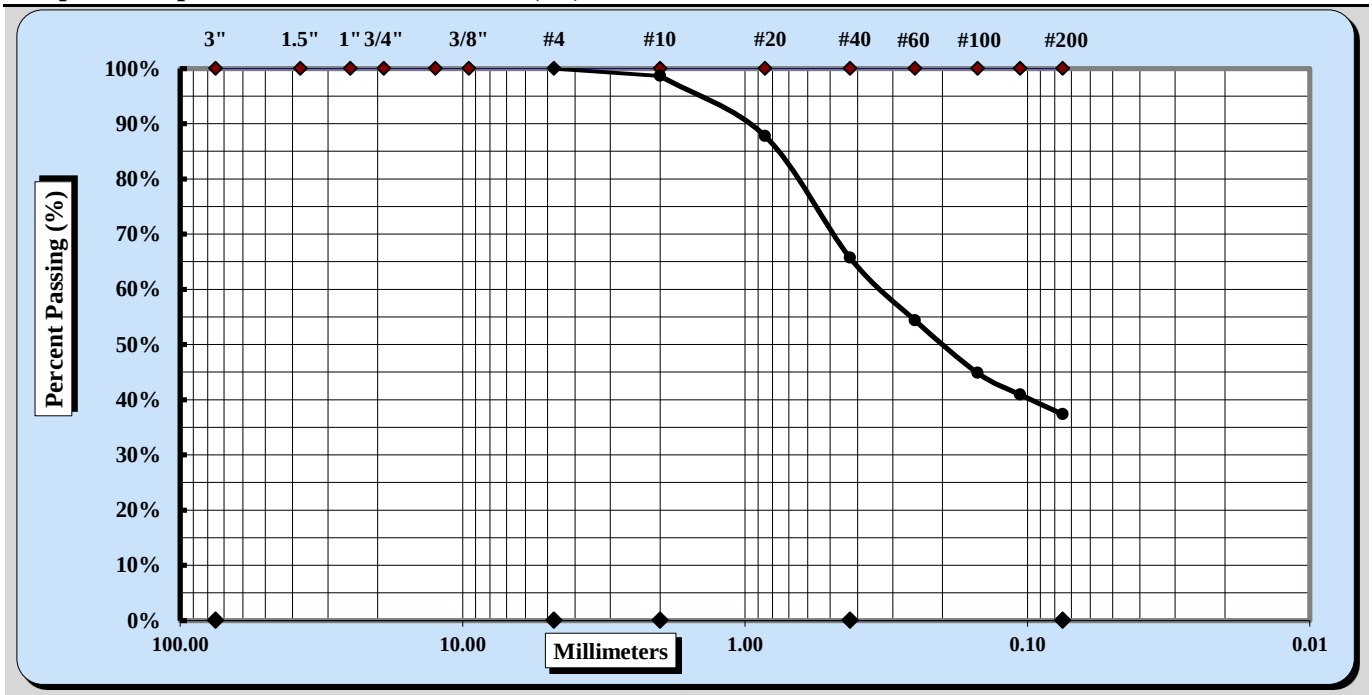
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-6	Type: SS		
		Depth:	1 - 2.5 ft

Sample Description: CLAYEY SAND (SC) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.3%	Fine Sand	28.3%
Gravel	0.0%	Medium Sand	33.0%	Silt & Clay	37.4%
Liquid Limit	25	Plastic Limit	16	Plastic Index	9

Coarse Sand	1.3%	Medium Sand	33.0%	Fine Sand	28.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

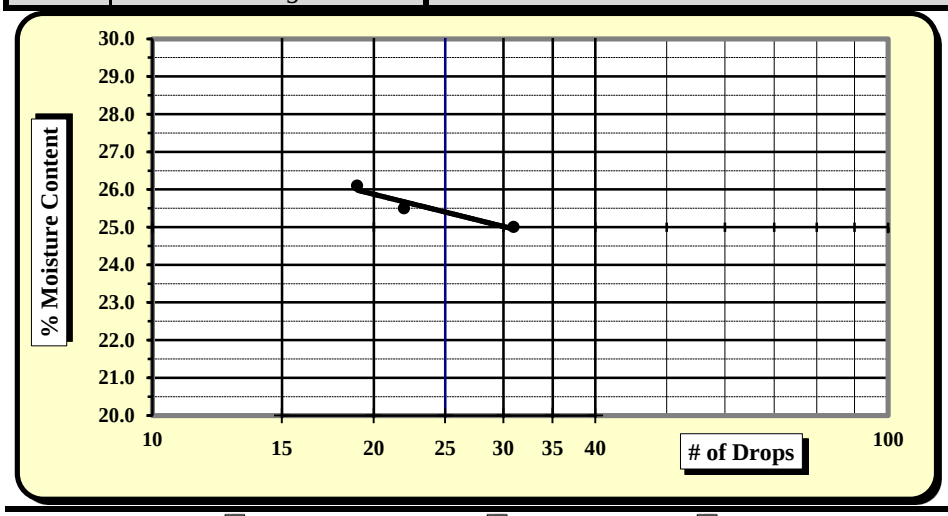
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-6	Sample No: 1		
		Depth: 1 - 2.5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

		Liquid Limit						Plastic Limit		
Pan # / Tare #:										
A	Tare Weight	11.50	11.14	10.85				11.33	10.75	
B	Wet Soil Weight + A	22.50	22.03	21.91				20.40	20.99	
C	Dry Soil Weight + A	20.30	19.82	19.62				19.16	19.57	
D	Water Weight (B-C)	2.20	2.21	2.29				1.24	1.42	
E	Dry Soil Weight (C-A)	8.80	8.68	8.77				7.83	8.82	
F	% Moisture (D/E)*100	25.0%	25.5%	26.1%				15.8%	16.1%	
N	# OF DROPS	31	22	19				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.0%**		



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 **25**
Plastic Limit **16**
Plastic Index **9**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

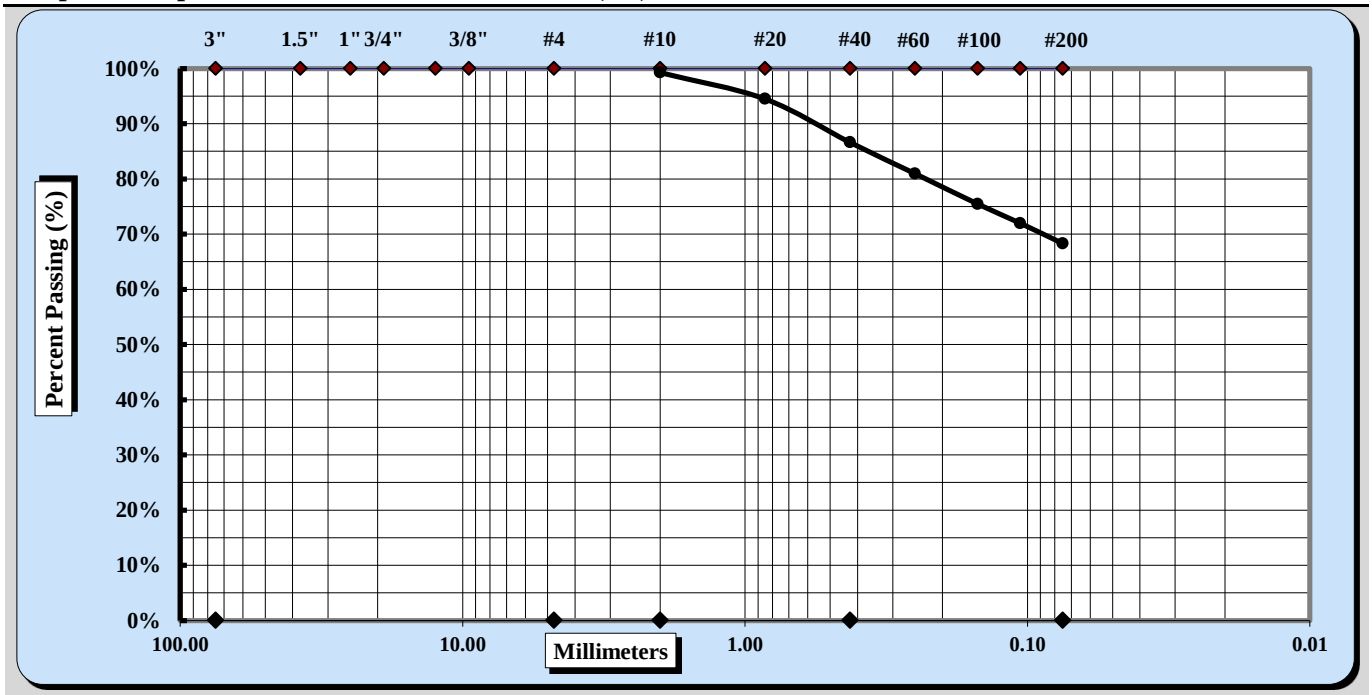
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-6	Type: SS		
		Depth:	3.5 - 5 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.7%	Fine Sand	18.3%
Gravel	0.0%	Medium Sand	12.6%	Silt & Clay	68.3%
Liquid Limit	40	Plastic Limit	23	Plastic Index	17

Coarse Sand	0.7%	Medium Sand	12.6%	Fine Sand	18.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

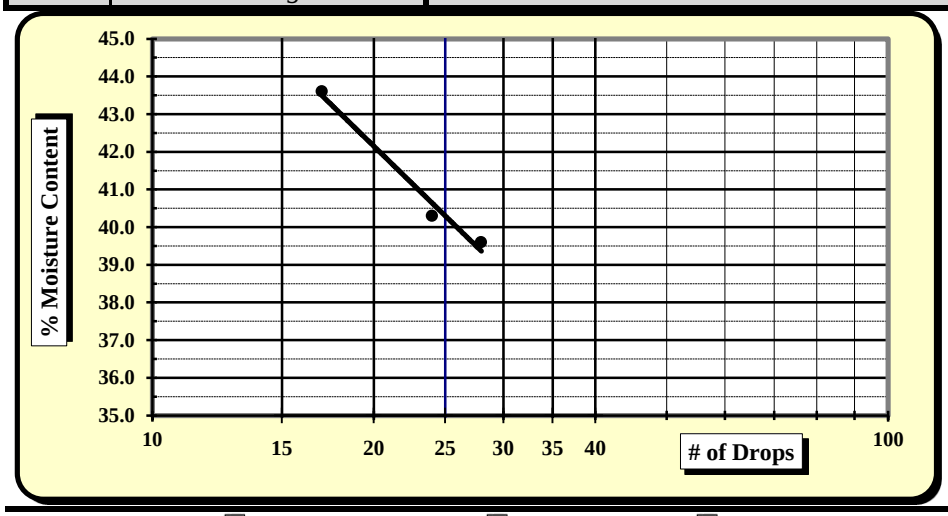
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-6	Sample No: 2		
		Depth: 3.5 - 5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	10.71	10.62	10.66				10.70	11.54	
B	Wet Soil Weight + A	20.73	20.44	20.31				19.43	22.13	
C	Dry Soil Weight + A	17.89	17.62	17.38				17.79	20.11	
D	Water Weight (B-C)	2.84	2.82	2.93				1.64	2.02	
E	Dry Soil Weight (C-A)	7.18	7.00	6.72				7.09	8.57	
F	% Moisture (D/E)*100	39.6%	40.3%	43.6%				23.1%	23.6%	
N	# OF DROPS	28	24	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**23.4%**		



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 **40**
Plastic Limit **23**
Plastic Index **17**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

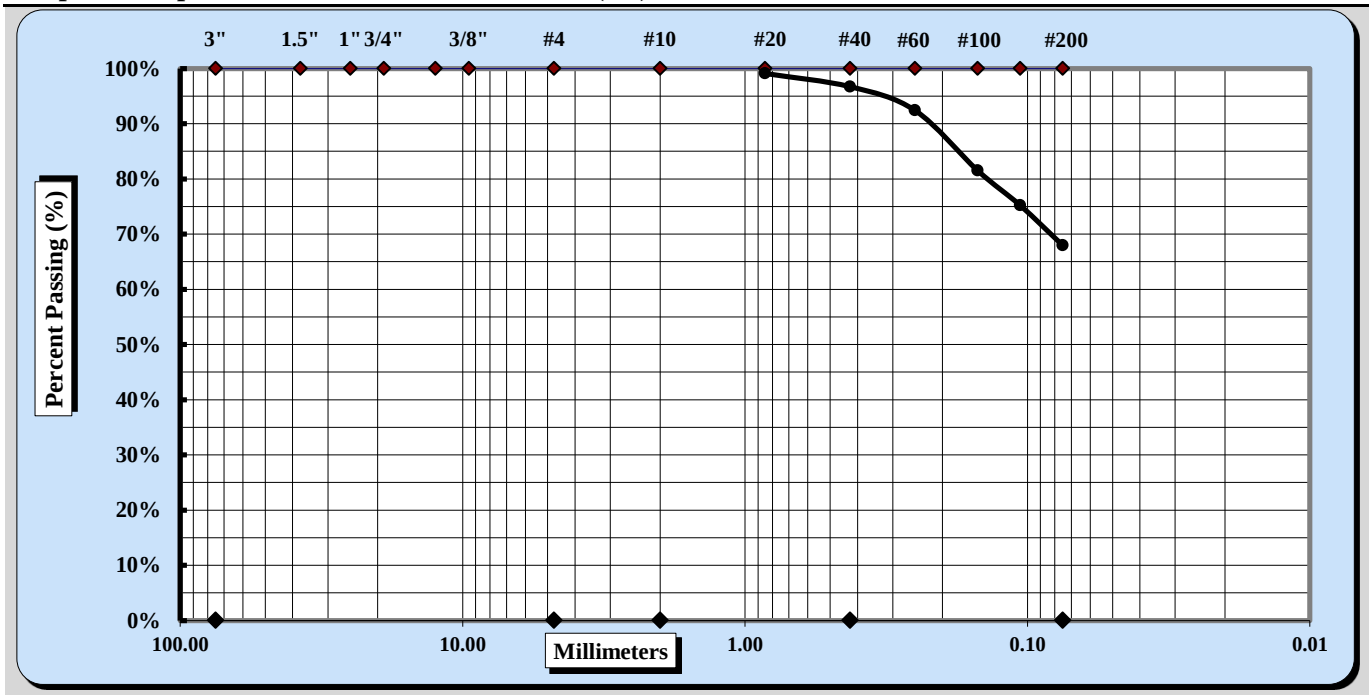
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-7	Type: SS		
		Depth:	1 - 2.5 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 20	Coarse Sand	0.1%	Fine Sand	28.8%
Gravel	0.0%	Medium Sand	3.2%	Silt & Clay	67.9%
Liquid Limit	37	Plastic Limit	24	Plastic Index	13

Coarse Sand	0.1%	Medium Sand	3.2%	Fine Sand	28.8%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

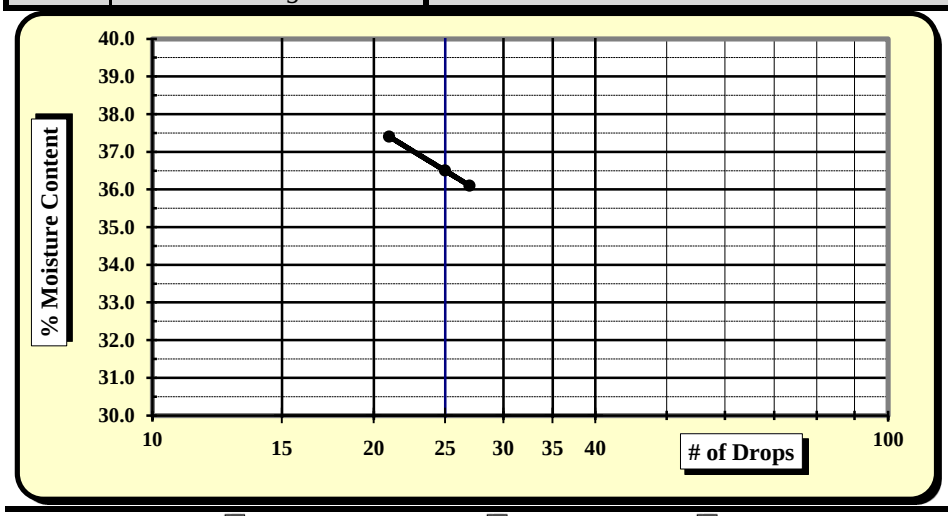
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-7	Sample No: 1		
		Depth: 1 - 2.5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	11.18	11.46	11.04				11.03	10.74	
B	Wet Soil Weight + A	21.63	22.12	21.59				20.06	19.46	
C	Dry Soil Weight + A	18.86	19.27	18.72				18.31	17.75	
D	Water Weight (B-C)	2.77	2.85	2.87				1.75	1.71	
E	Dry Soil Weight (C-A)	7.68	7.81	7.68				7.28	7.01	
F	% Moisture (D/E)*100	36.1%	36.5%	37.4%				24.0%	24.4%	
N	# OF DROPS	27	25	21				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.2%**		



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	**37**
Plastic Limit	**24**
Plastic Index	**13**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

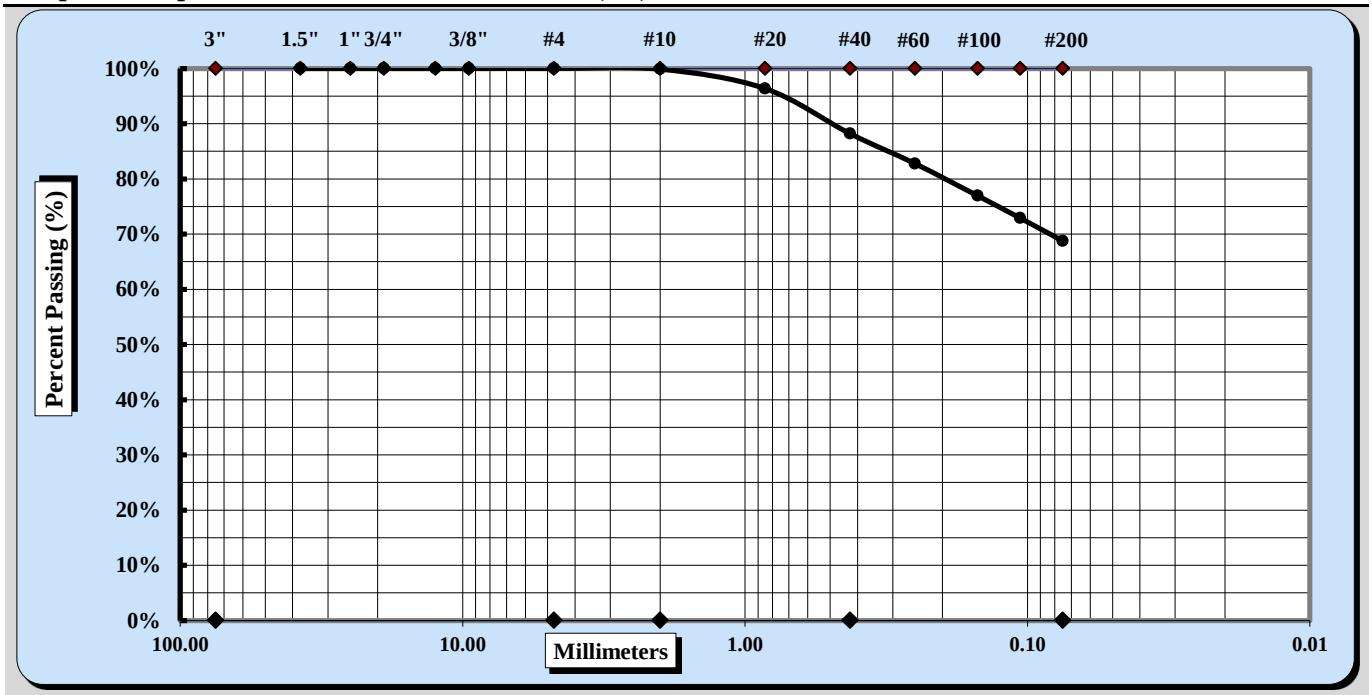
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-7	Type: SS		
		Depth:	3.5 - 5 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.1%	Fine Sand	19.4%
Gravel	0.0%	Medium Sand	11.7%	Silt & Clay	68.8%
Liquid Limit	34	Plastic Limit	18	Plastic Index	16

Coarse Sand	0.1%	Medium Sand	11.7%	Fine Sand	19.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

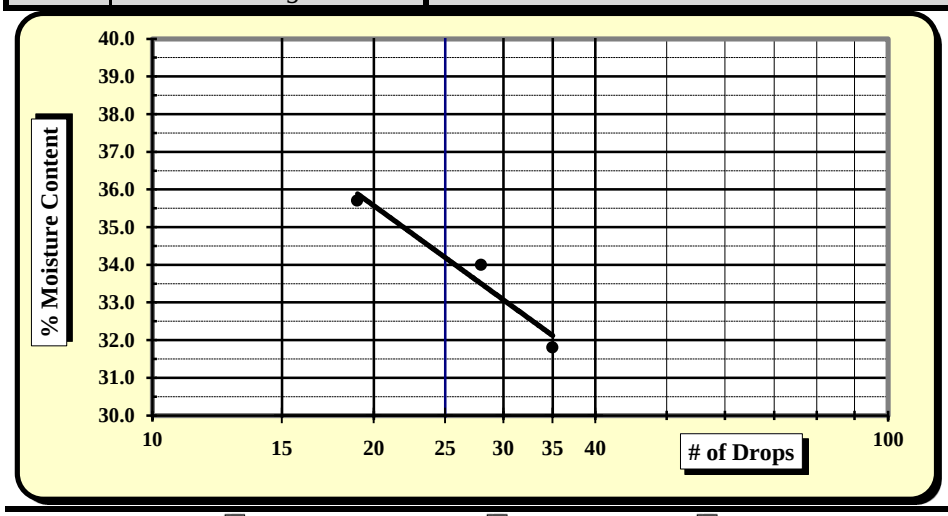
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-7	Sample No: 2		
		Depth: 3.5 - 5 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	10.70	10.67	10.71				10.62	10.73	
B	Wet Soil Weight + A	20.45	20.64	19.56				22.20	20.05	
C	Dry Soil Weight + A	18.10	18.11	17.23				20.45	18.68	
D	Water Weight (B-C)	2.35	2.53	2.33				1.75	1.37	
E	Dry Soil Weight (C-A)	7.40	7.44	6.52				9.83	7.95	
F	% Moisture (D/E)*100	31.8%	34.0%	35.7%				17.8%	17.2%	
N	# OF DROPS	35	28	19				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**17.5%**		



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	**34**
Plastic Limit	**18**
Plastic Index	**16**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Sieve Analysis of Soils

ASTM D422

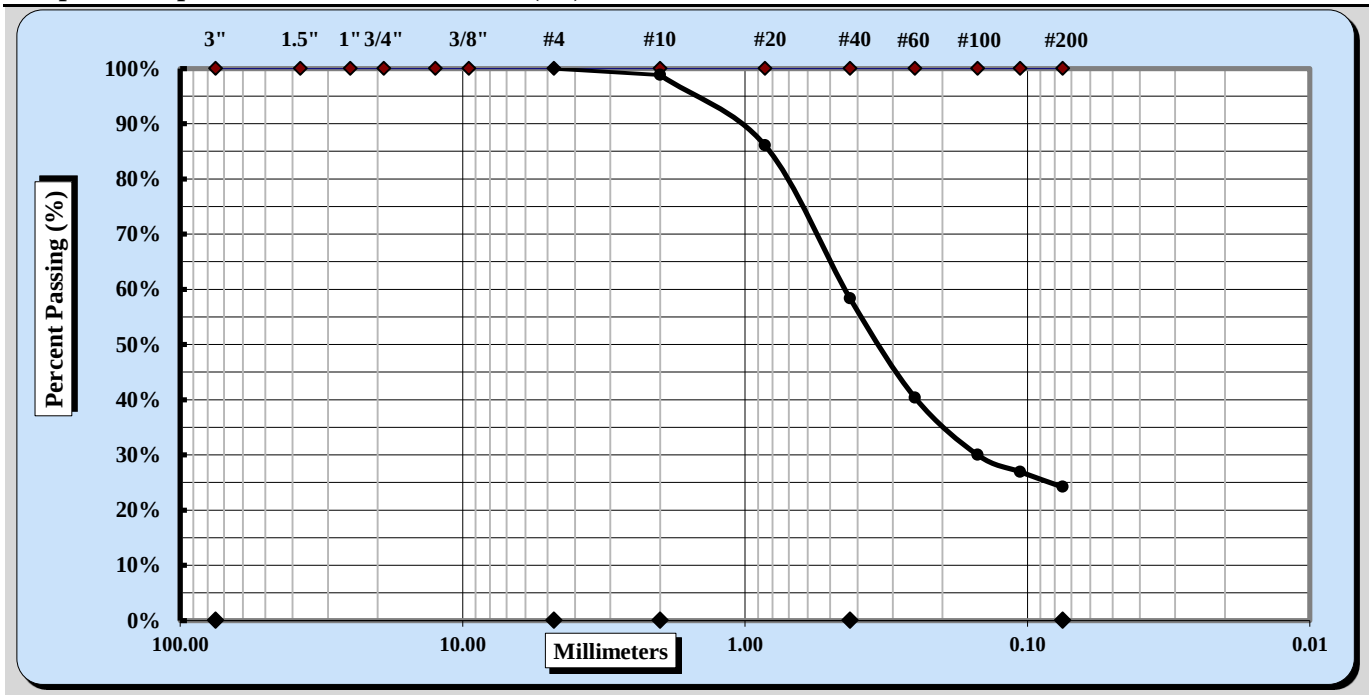
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-8	Type: SS		
		Depth:	0 - 2 ft

Sample Description: CLAYEY SAND (SC) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.2%	Fine Sand	34.2%
Gravel	0.0%	Medium Sand	40.5%	Silt & Clay	24.2%
Liquid Limit	22	Plastic Limit	14	Plastic Index	8

Coarse Sand	1.2%	Medium Sand	40.5%	Fine Sand	34.2%
Description of Sand & Gravel Particles:		Rounded	☐	Angular	☒
Hard & Durable	☒	Soft	☐	Weathered & Friable	☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

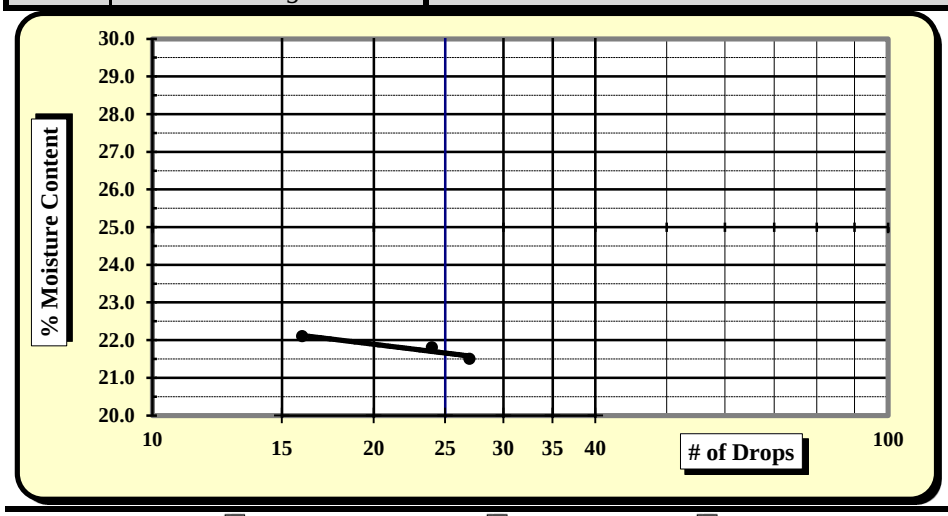
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-8	Sample No: 1		
		Depth: 0 - 2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

	Pan # / Tare #:	Liquid Limit						Plastic Limit		
A	Tare Weight	10.85	10.62	10.81				11.03	10.84	
B	Wet Soil Weight + A	21.21	20.16	22.26				17.79	17.20	
C	Dry Soil Weight + A	19.38	18.45	20.19				16.99	16.43	
D	Water Weight (B-C)	1.83	1.71	2.07				0.80	0.77	
E	Dry Soil Weight (C-A)	8.53	7.83	9.38				5.96	5.59	
F	% Moisture (D/E)*100	21.5%	21.8%	22.1%				13.4%	13.8%	
N	# OF DROPS	27	24	16				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**13.6%**		



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 **22**
Plastic Limit **14**
Plastic Index **8**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-2-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

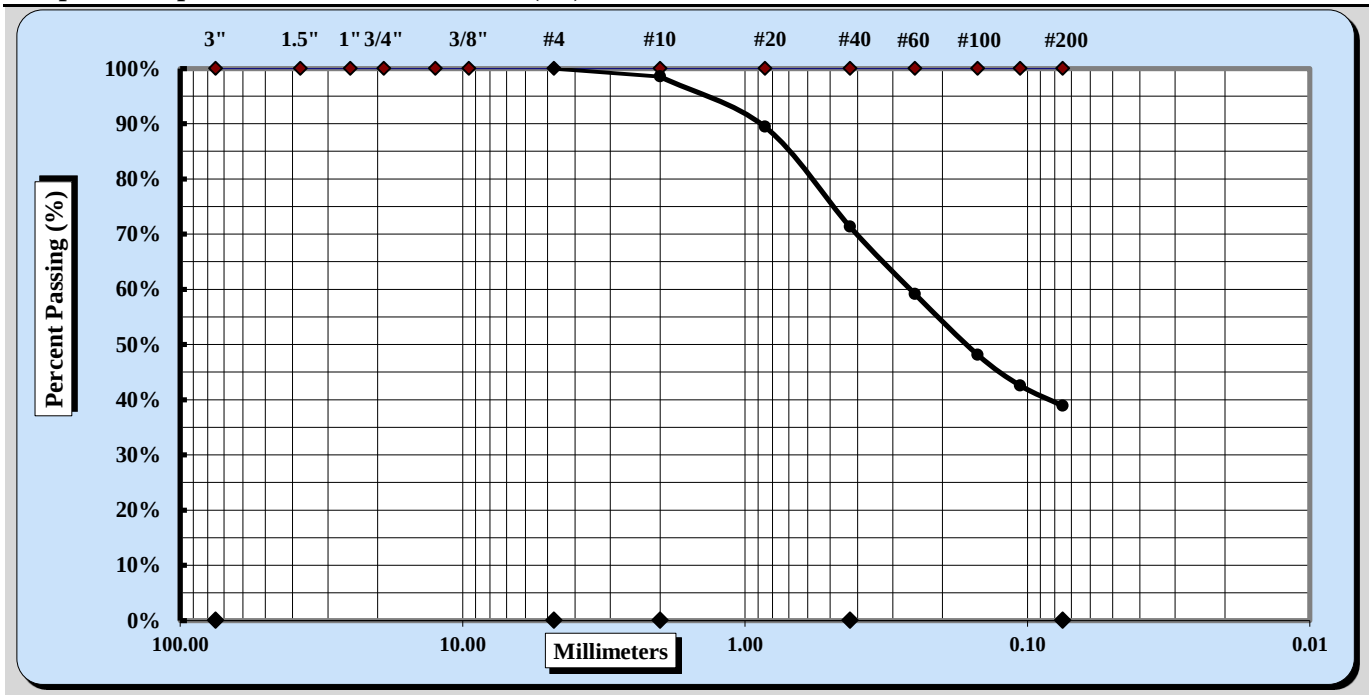
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-8	Type: SS		
		Depth:	2 - 4 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.5%	Fine Sand	32.4%
Gravel	0.0%	Medium Sand	27.2%	Silt & Clay	38.9%
Liquid Limit	26	Plastic Limit	15	Plastic Index	11

Coarse Sand	1.5%	Medium Sand	27.2%	Fine Sand	32.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

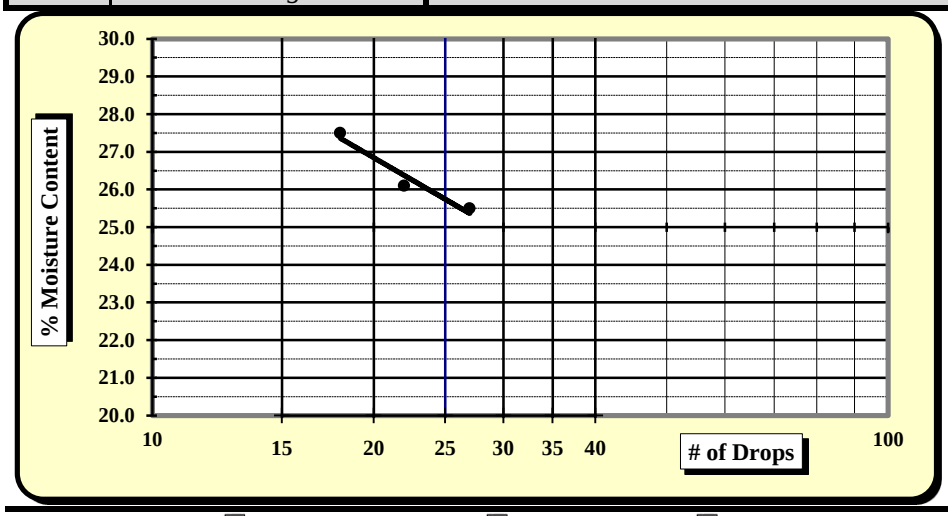
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-8	Sample No: 2		
		Depth: 2 - 4 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	10.81	10.73	11.17				10.75	11.13	
B	Wet Soil Weight + A	21.26	21.32	21.80				19.79	21.38	
C	Dry Soil Weight + A	19.14	19.13	19.51				18.59	20.01	
D	Water Weight (B-C)	2.12	2.19	2.29				1.20	1.37	
E	Dry Soil Weight (C-A)	8.33	8.40	8.34				7.84	8.88	
F	% Moisture (D/E)*100	25.5%	26.1%	27.5%				15.3%	15.4%	
N	# OF DROPS	27	22	18				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.4%**		



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	**26**
Plastic Limit	**15**
Plastic Index	**11**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

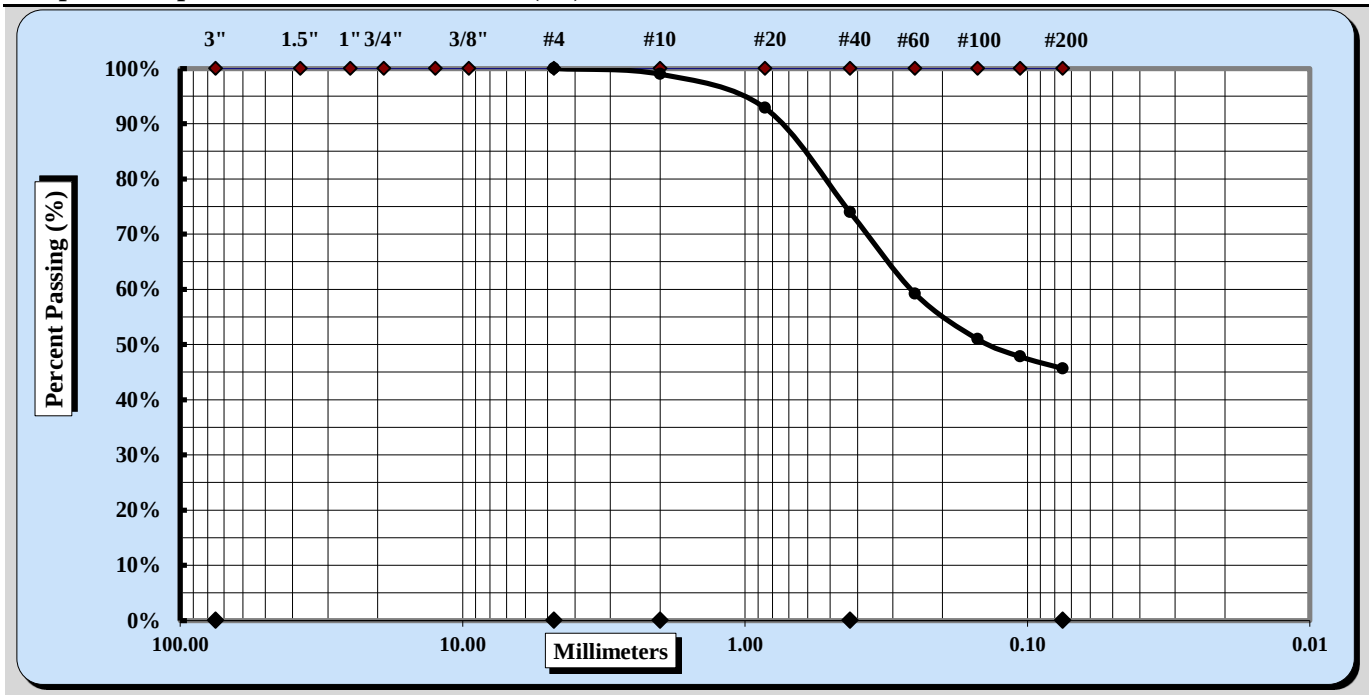
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-9	Type: SS		
		Depth:	0 - 2 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.0%	Fine Sand	28.3%
Gravel	0.0%	Medium Sand	25.0%	Silt & Clay	45.6%
Liquid Limit	40	Plastic Limit	20	Plastic Index	20

Coarse Sand	1.0%	Medium Sand	25.0%	Fine Sand	28.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

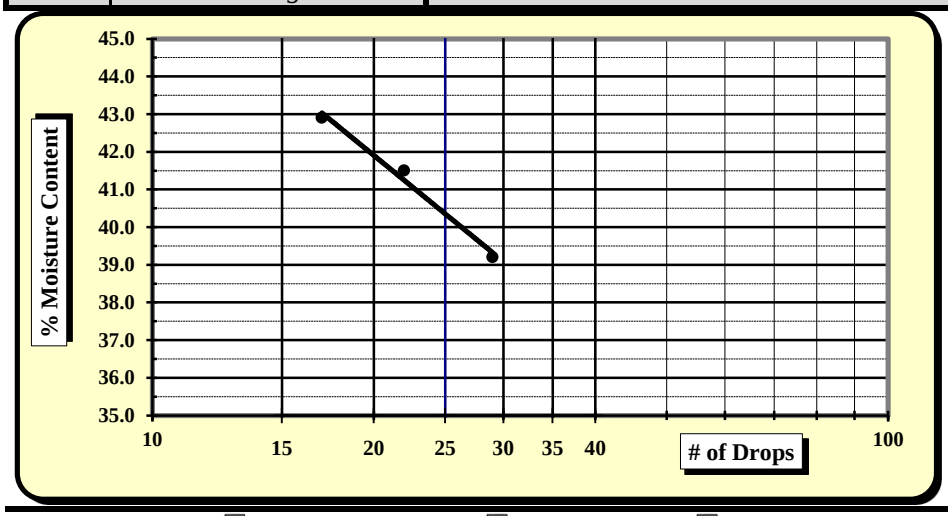
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-9	Sample No: 1		
		Depth: 0 - 2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

	Pan # / Tare #:	Liquid Limit						Plastic Limit		
A	Tare Weight	11.20	10.84	11.09				10.70	11.06	
B	Wet Soil Weight + A	20.12	20.32	18.59				20.02	19.33	
C	Dry Soil Weight + A	17.61	17.54	16.34				18.44	17.94	
D	Water Weight (B-C)	2.51	2.78	2.25				1.58	1.39	
E	Dry Soil Weight (C-A)	6.41	6.70	5.25				7.74	6.88	
F	% Moisture (D/E)*100	39.2%	41.5%	42.9%				20.4%	20.2%	
N	# OF DROPS	29	22	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**20.3%**		



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 **40**
Plastic Limit **20**
Plastic Index **20**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

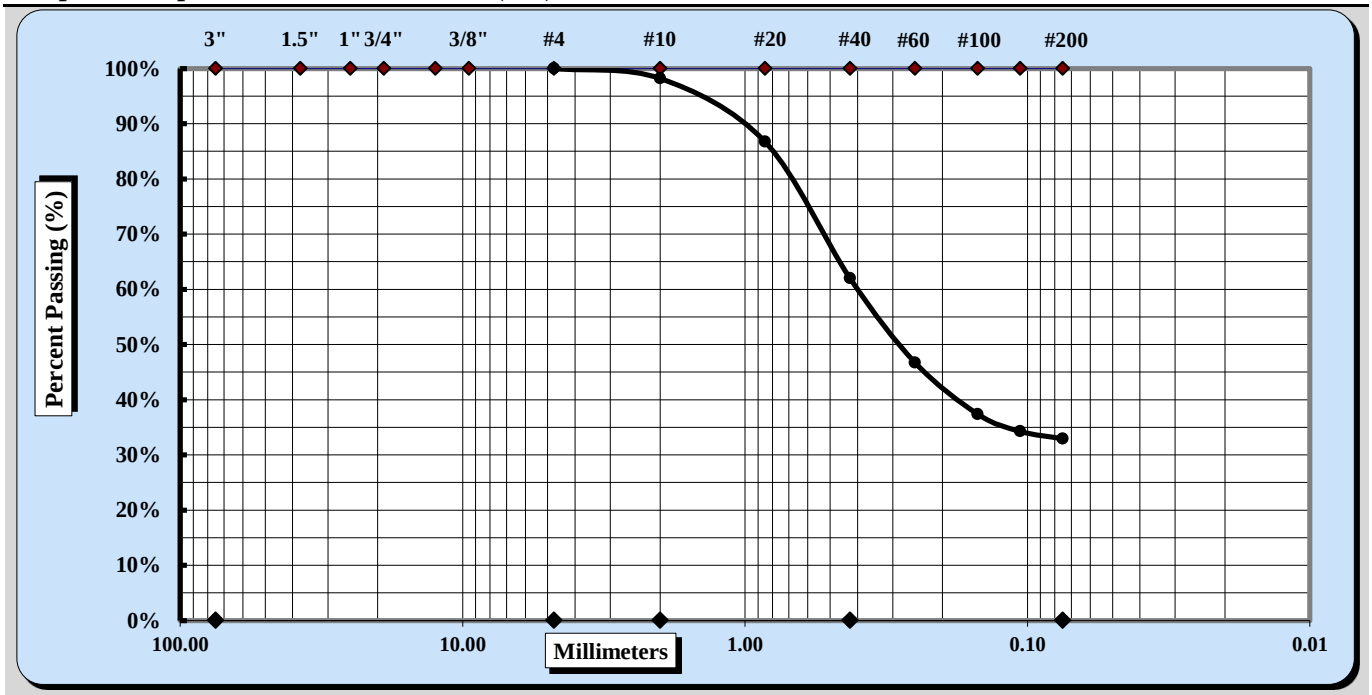
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-9	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.8%	Fine Sand	29.1%
Gravel	0.0%	Medium Sand	36.2%	Silt & Clay	32.9%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.8%	Medium Sand	36.2%	Fine Sand	29.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

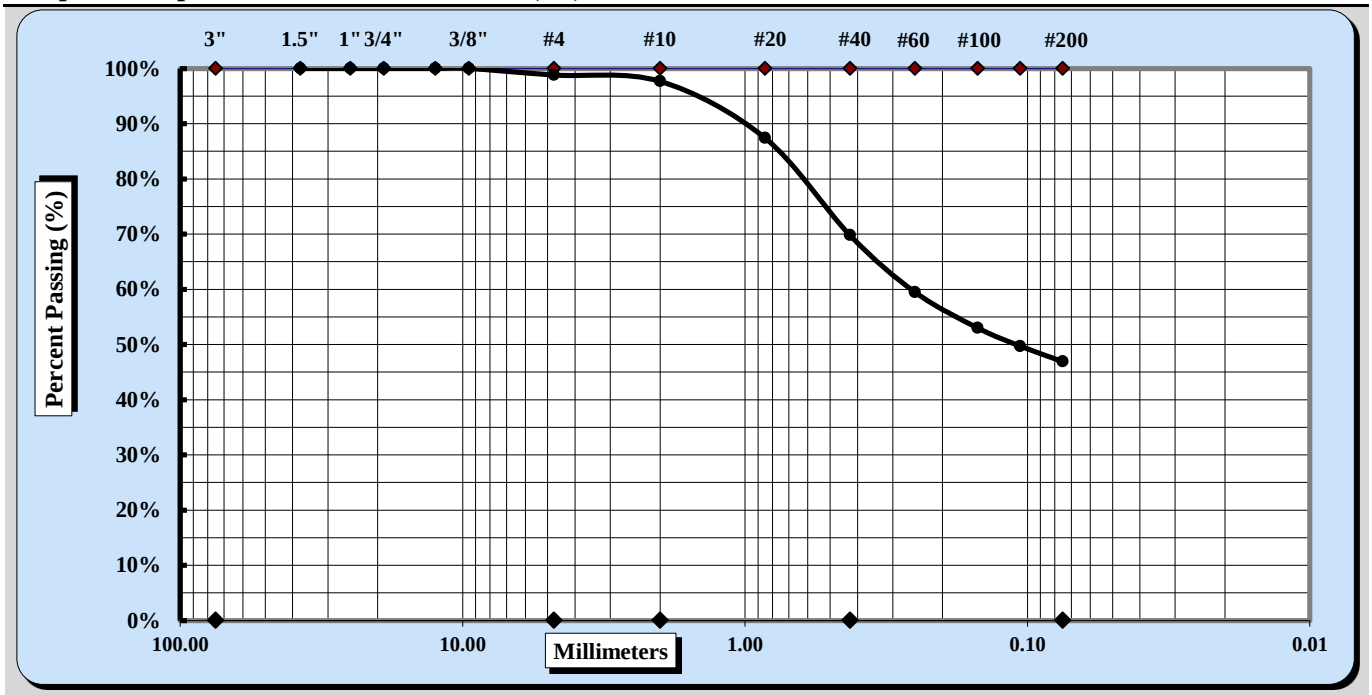
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-10	Type: SS		
		Depth:	0 - 2 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	1.1%	Fine Sand	22.9%
Gravel	1.2%	Medium Sand	27.9%	Silt & Clay	46.9%
Liquid Limit	31	Plastic Limit	16	Plastic Index	15

Coarse Sand	1.1%	Medium Sand	27.9%	Fine Sand	22.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

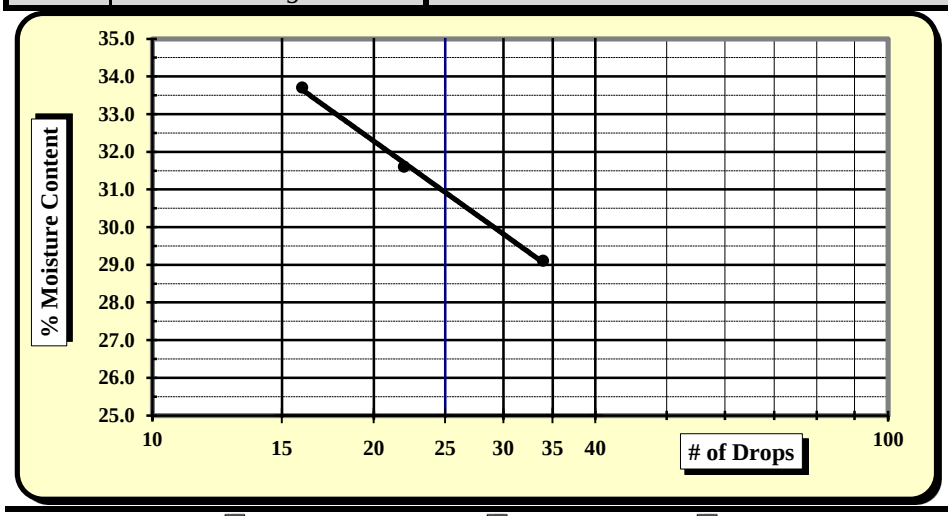
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-10	Sample No: 1		
		Depth: 0 - 2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	14.88	14.79	14.59				11.90	12.04	
B	Wet Soil Weight + A	23.76	23.08	22.65				19.91	23.08	
C	Dry Soil Weight + A	21.76	21.09	20.62				18.79	21.57	
D	Water Weight (B-C)	2.00	1.99	2.03				1.12	1.51	
E	Dry Soil Weight (C-A)	6.88	6.30	6.03				6.89	9.53	
F	% Moisture (D/E)*100	29.1%	31.6%	33.7%				16.3%	15.8%	
N	# OF DROPS	34	22	16				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.1%**		



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 **31**
Plastic Limit **16**
Plastic Index **15**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

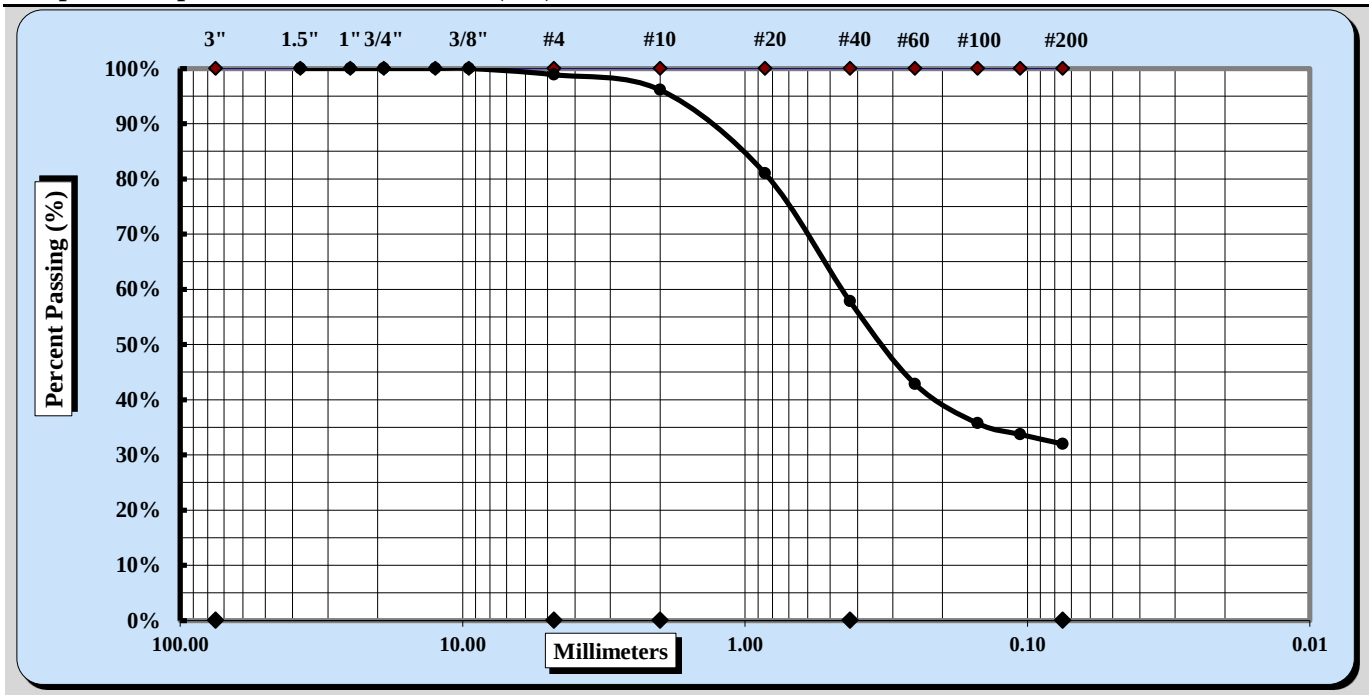
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-10	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.8%	Fine Sand	25.8%
Gravel	1.1%	Medium Sand	38.3%	Silt & Clay	32.0%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.8%	Medium Sand	38.3%	Fine Sand	25.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

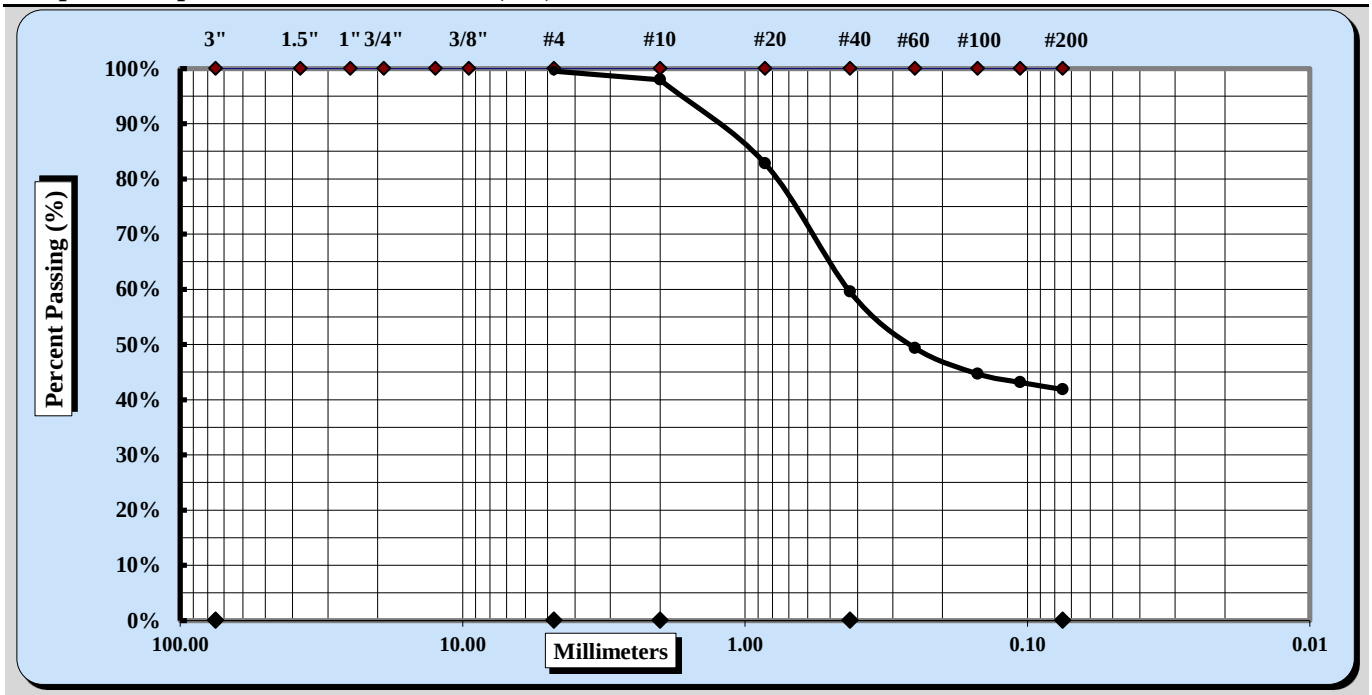
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-11	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.6%	Fine Sand	17.7%
Gravel	0.5%	Medium Sand	38.4%	Silt & Clay	41.9%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.6%	Medium Sand	38.4%	Fine Sand	17.7%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

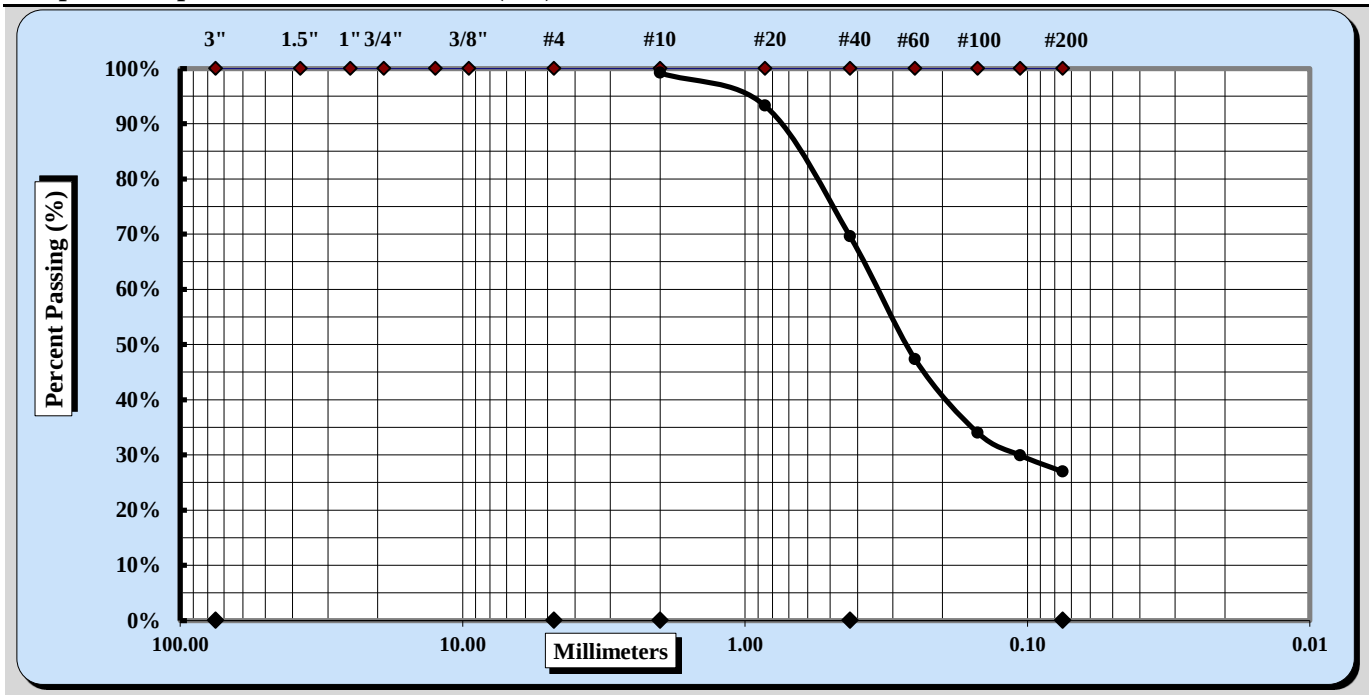
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-11	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.8%	Fine Sand	42.6%
Gravel	0.0%	Medium Sand	29.6%	Silt & Clay	27.0%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.8%	Medium Sand	29.6%	Fine Sand	42.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

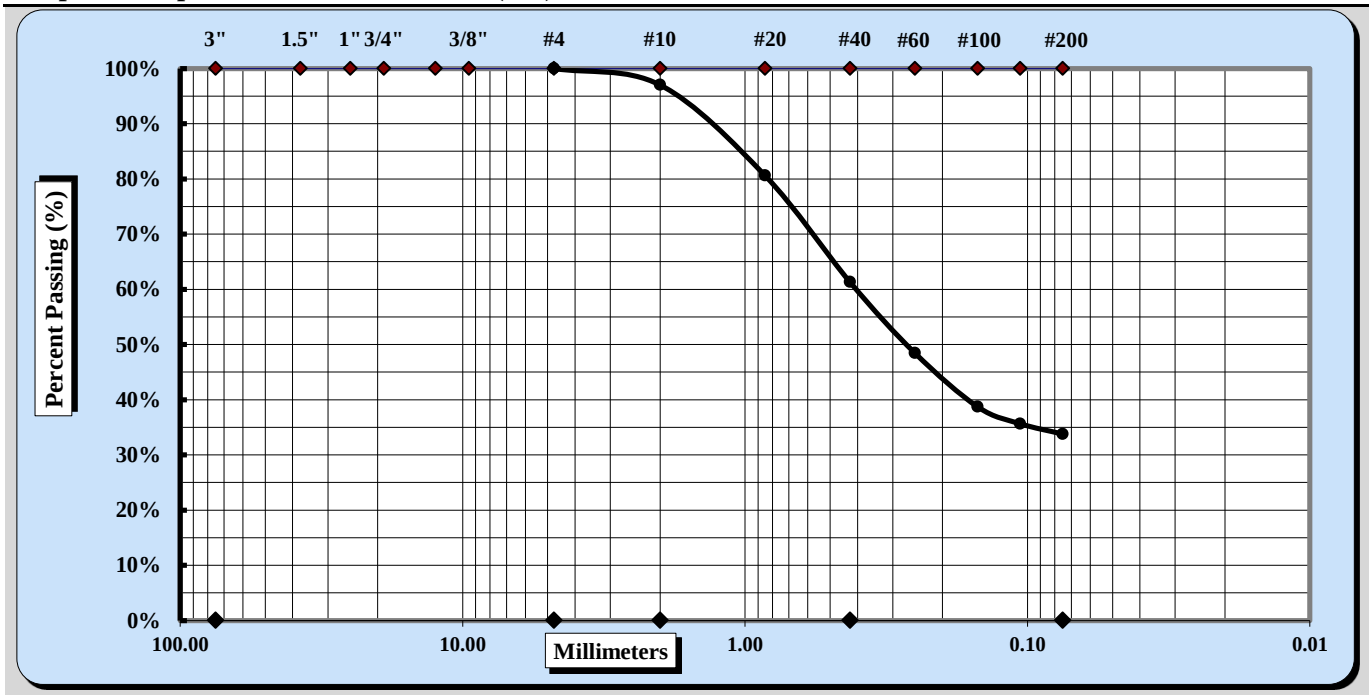
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-12	Type: SS	Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	3.0%	Fine Sand	27.5%
Gravel	0.0%	Medium Sand	35.7%	Silt & Clay	33.8%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	3.0%	Medium Sand	35.7%	Fine Sand	27.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

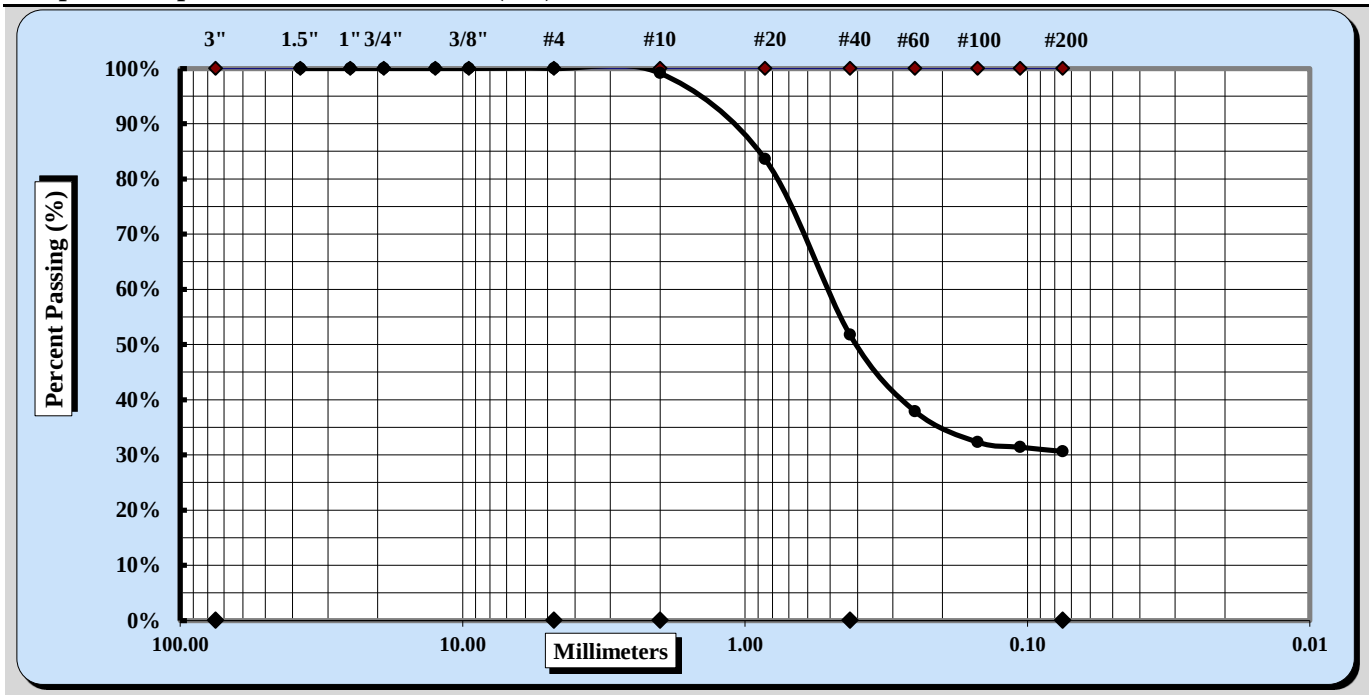
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-12	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.9%	Fine Sand	21.1%
Gravel	0.0%	Medium Sand	47.4%	Silt & Clay	30.6%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.9%	Medium Sand	47.4%	Fine Sand	21.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

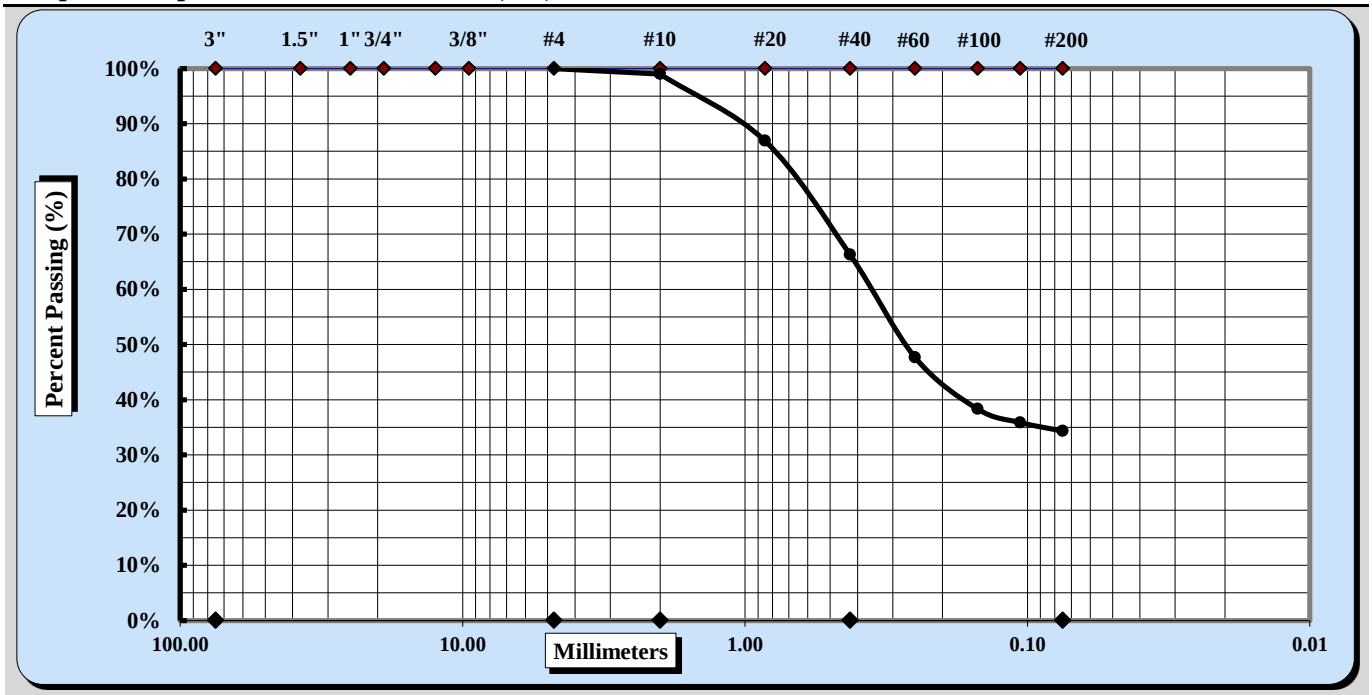
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-13	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.0%	Fine Sand	32.0%
Gravel	0.0%	Medium Sand	32.7%	Silt & Clay	34.3%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.0%	Medium Sand	32.7%	Fine Sand	32.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

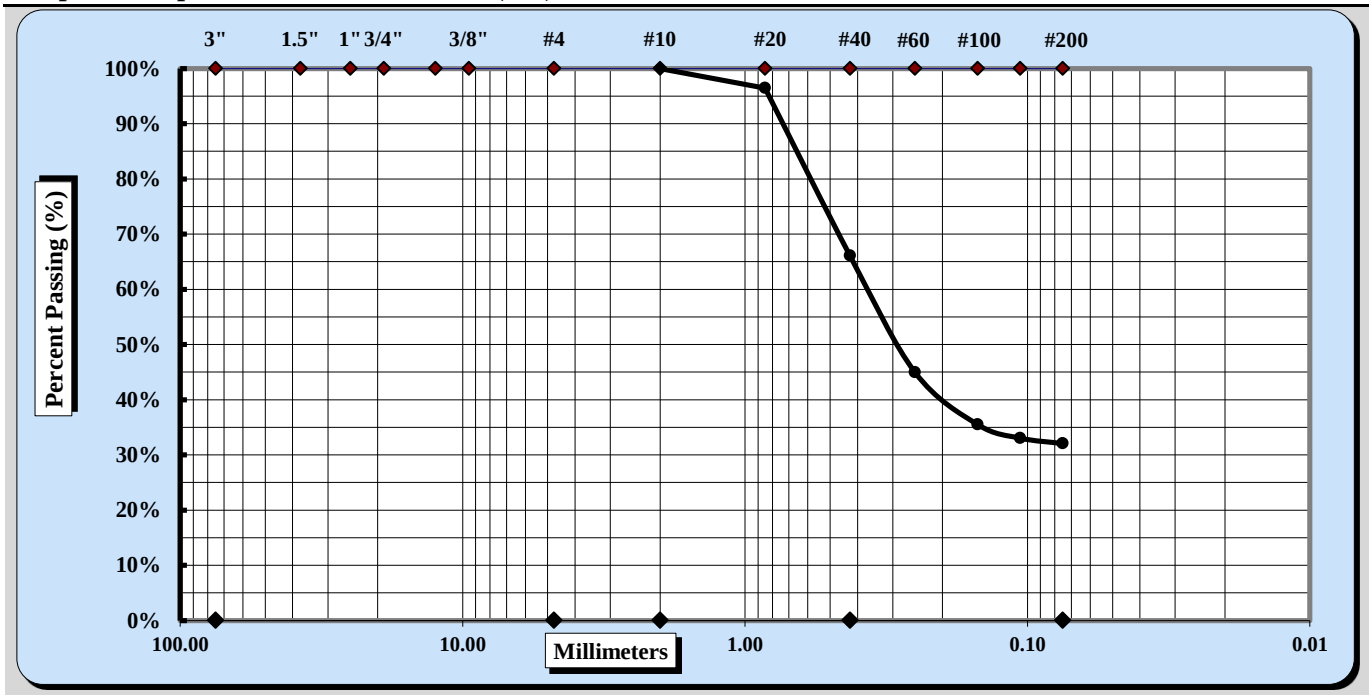
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-13	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.0%	Fine Sand	34.0%
Gravel	0.0%	Medium Sand	33.9%	Silt & Clay	32.1%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	0.0%	Medium Sand	33.9%	Fine Sand	34.0%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

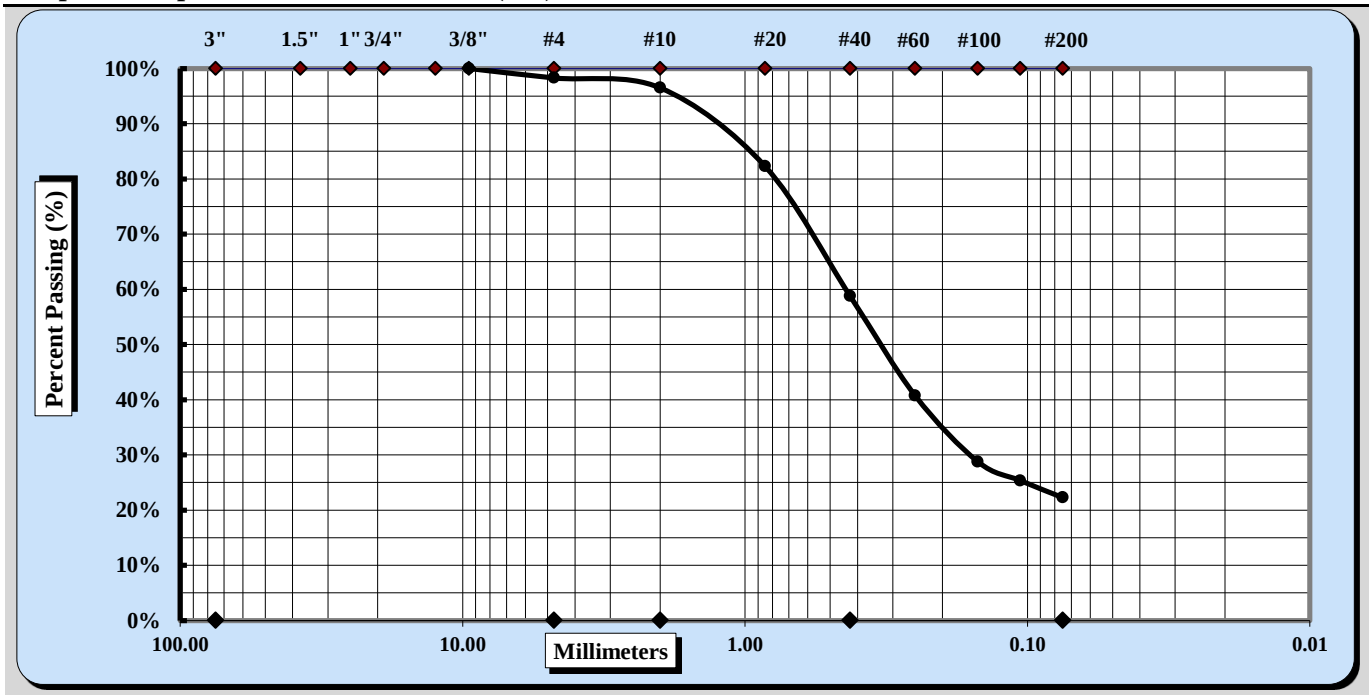
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-14	Type: SS	Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	1.8%	Fine Sand	36.5%
Gravel	1.7%	Medium Sand	37.7%	Silt & Clay	22.3%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.8%	Medium Sand	37.7%	Fine Sand	36.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

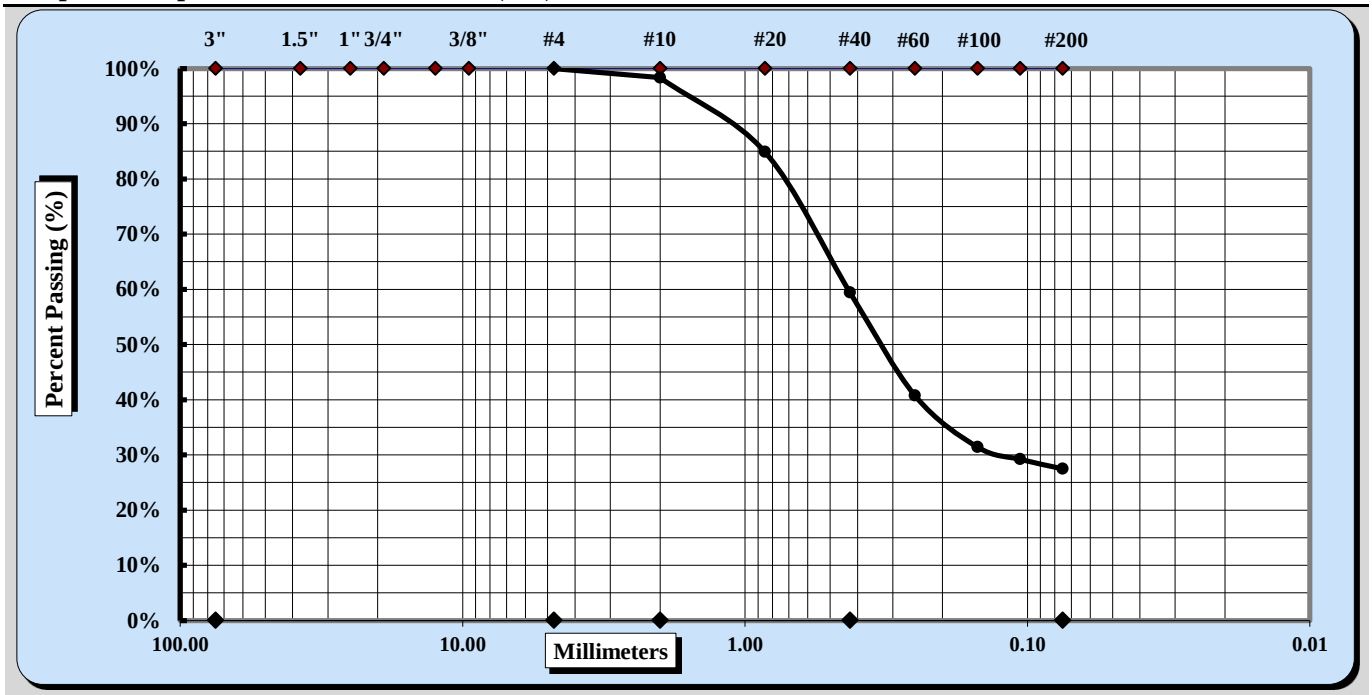
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-14	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.7%	Fine Sand	31.9%
Gravel	0.0%	Medium Sand	38.9%	Silt & Clay	27.5%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.7%	Medium Sand	38.9%	Fine Sand	31.9%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

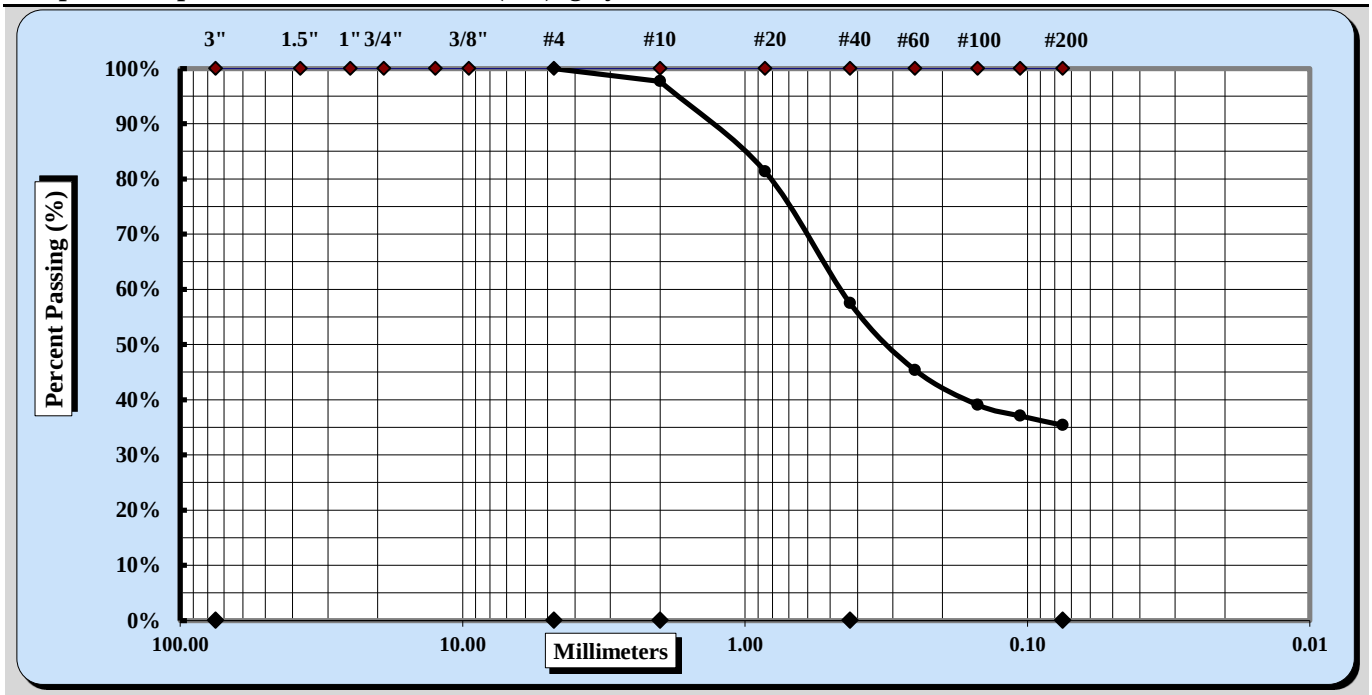
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-15	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM), gray **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.3%	Fine Sand	22.1%
Gravel	0.0%	Medium Sand	40.2%	Silt & Clay	35.4%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.3%	Medium Sand	40.2%	Fine Sand	22.1%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

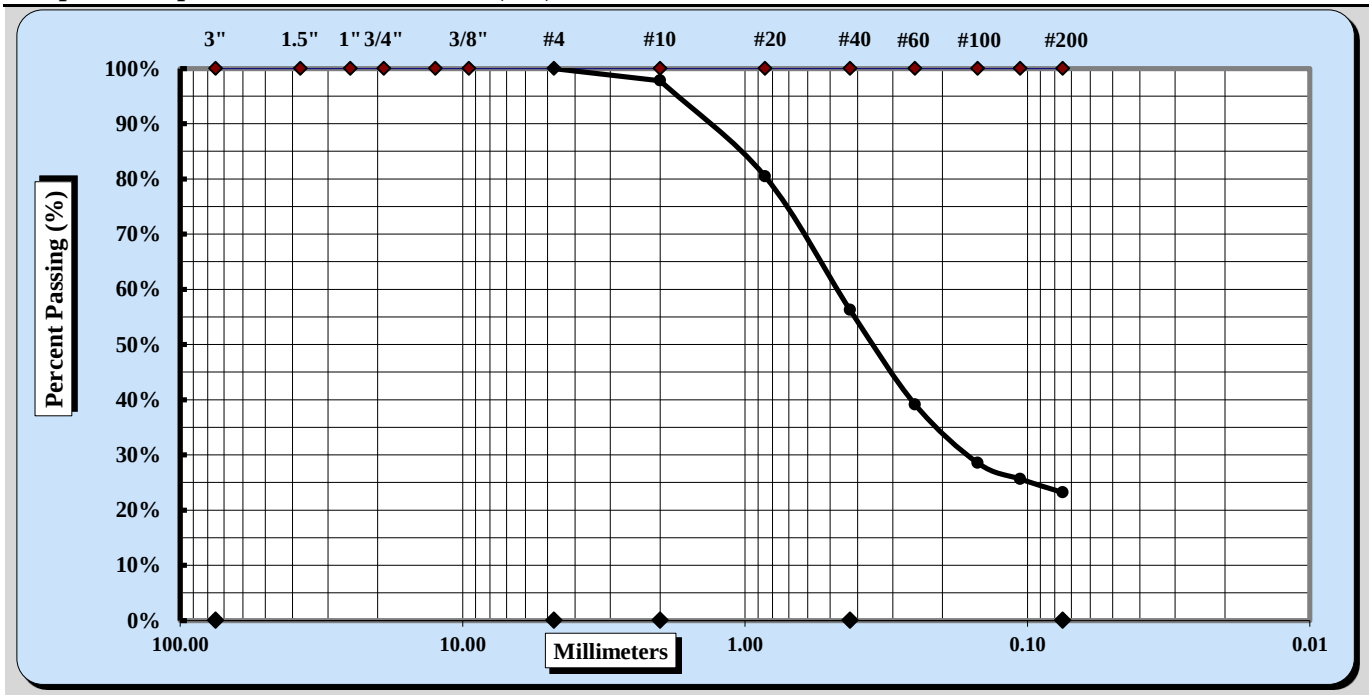
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-15	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.2%	Fine Sand	33.1%
Gravel	0.0%	Medium Sand	41.5%	Silt & Clay	23.2%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.2%	Medium Sand	41.5%	Fine Sand	33.1%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

Sieve Analysis of Soils

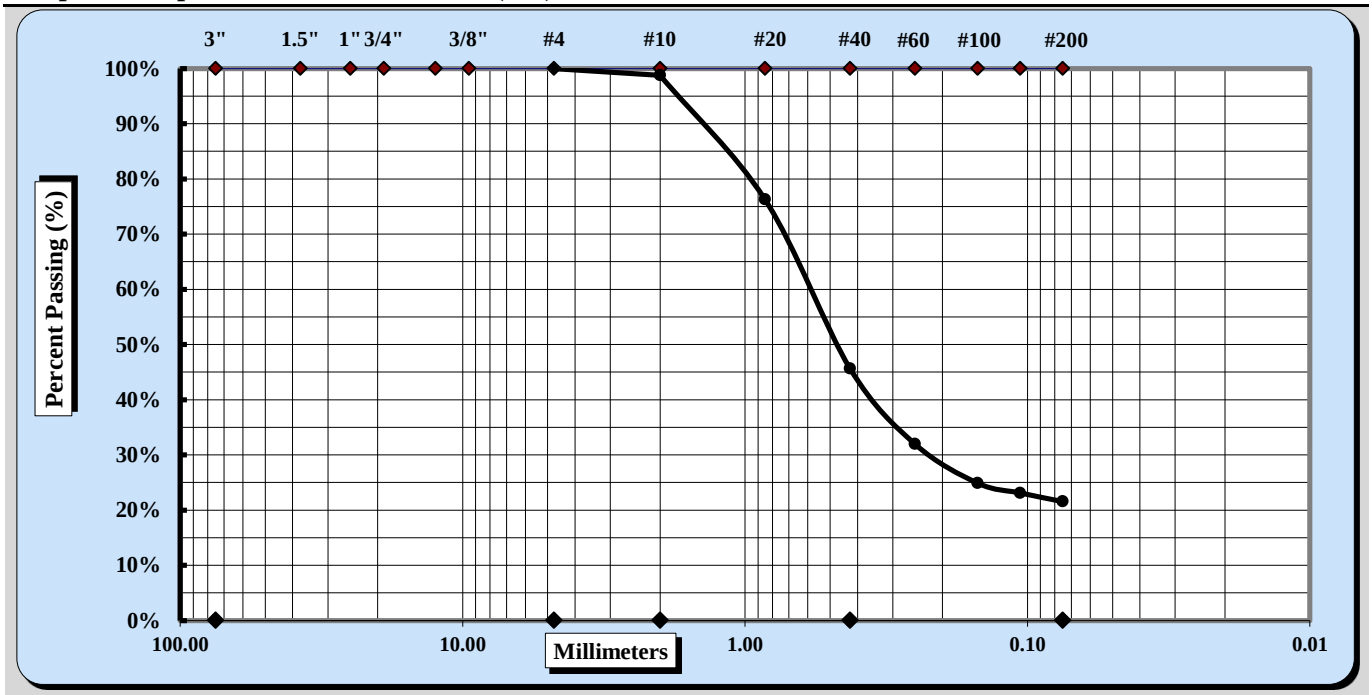
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-16	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.2%	Fine Sand	24.1%
Gravel	0.0%	Medium Sand	53.1%	Silt & Clay	21.5%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	1.2%	Medium Sand	53.1%	Fine Sand	24.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

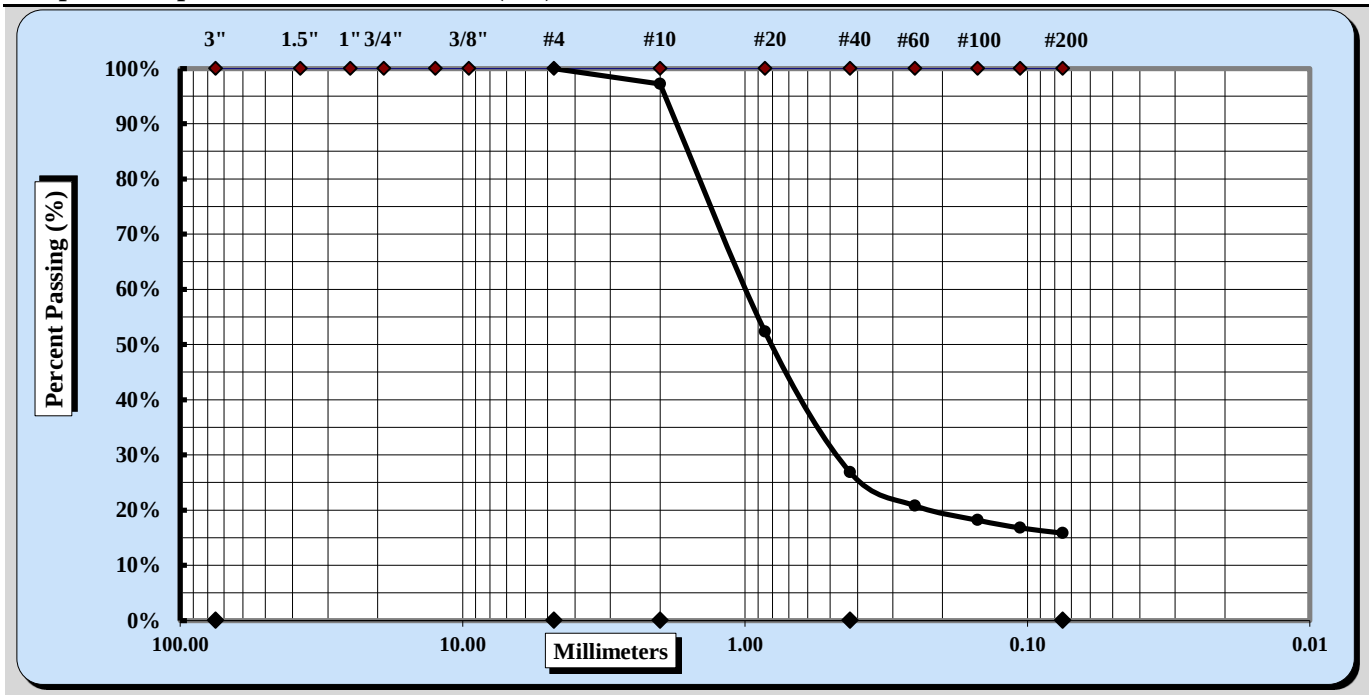
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-16	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.8%	Fine Sand	11.0%
Gravel	0.0%	Medium Sand	70.3%	Silt & Clay	15.8%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.8%	Medium Sand	70.3%	Fine Sand	11.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

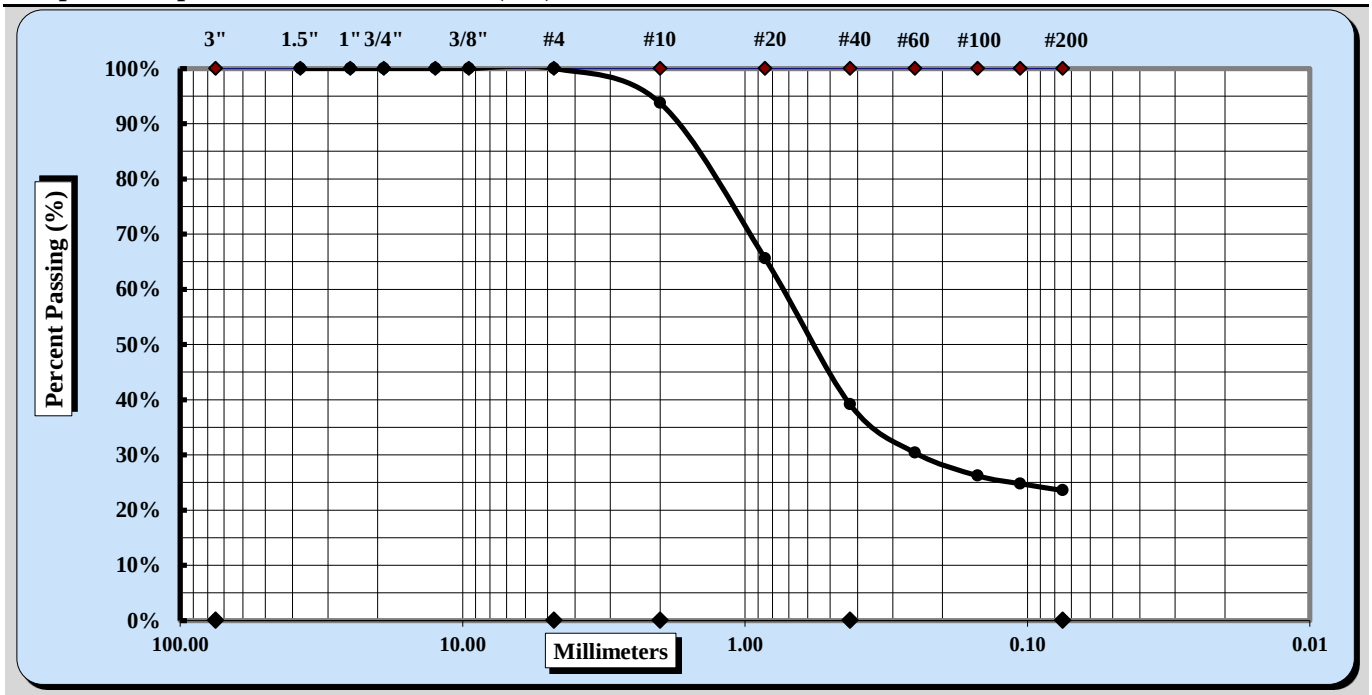
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-17	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	6.2%	Fine Sand	15.6%
Gravel	0.0%	Medium Sand	54.6%	Silt & Clay	23.6%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	6.2%	Medium Sand	54.6%	Fine Sand	15.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:341

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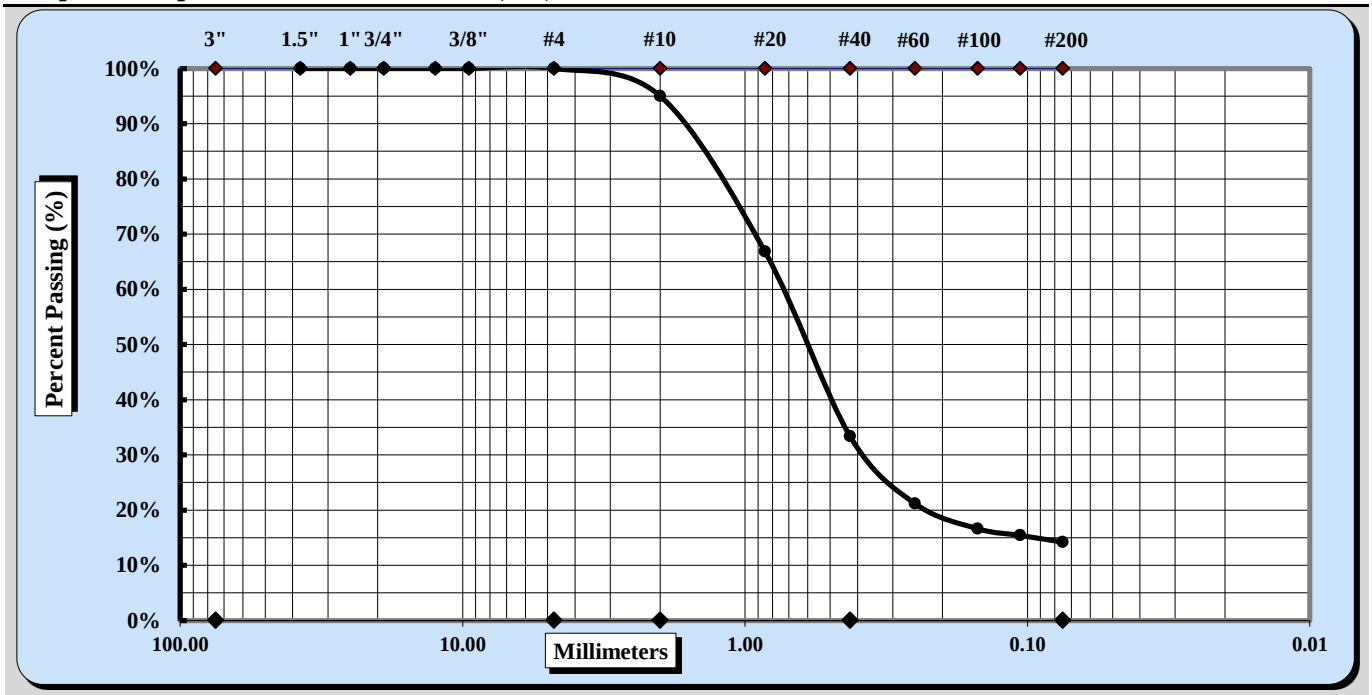
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-17	Type: SS	Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-1-b**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	5.0%	Fine Sand	19.2%
Gravel	0.0%	Medium Sand	61.6%	Silt & Clay	14.2%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	5.0%	Medium Sand	61.6%	Fine Sand	19.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

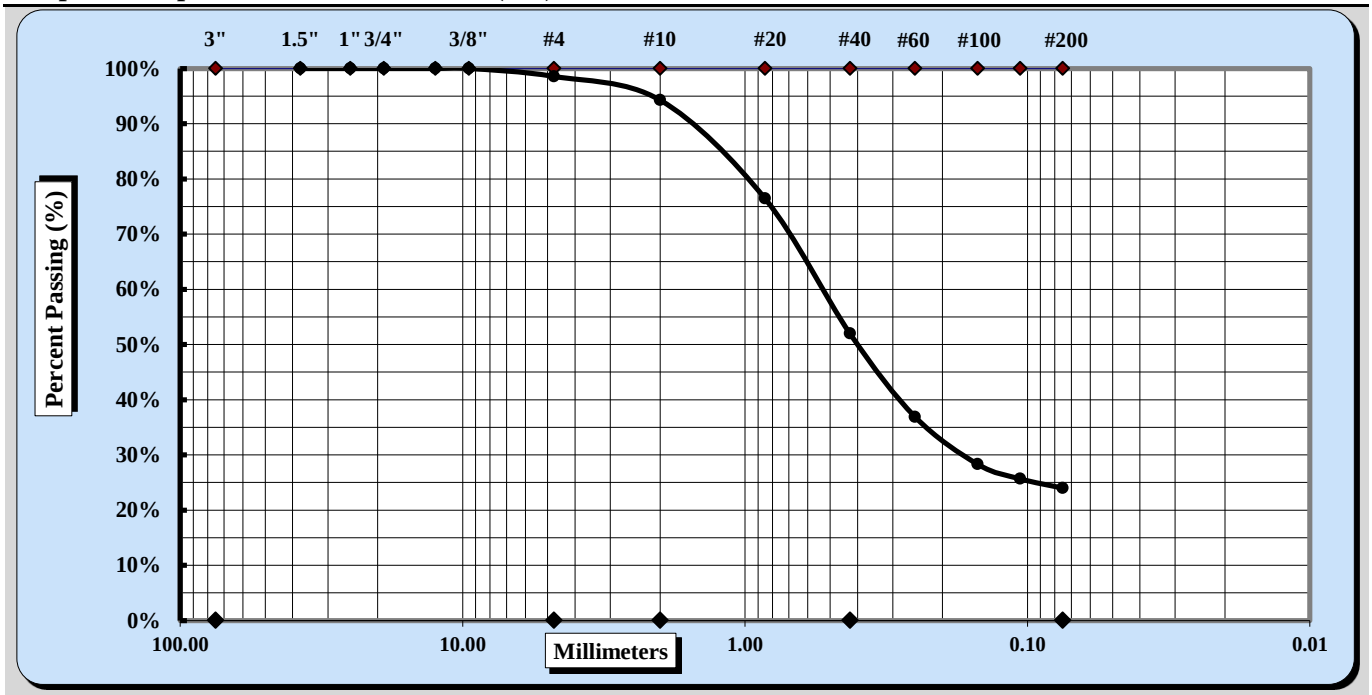
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-18	Type: SS	Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	4.3%	Fine Sand	28.0%
Gravel	1.4%	Medium Sand	42.3%	Silt & Clay	24.0%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	4.3%	Medium Sand	42.3%	Fine Sand	28.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

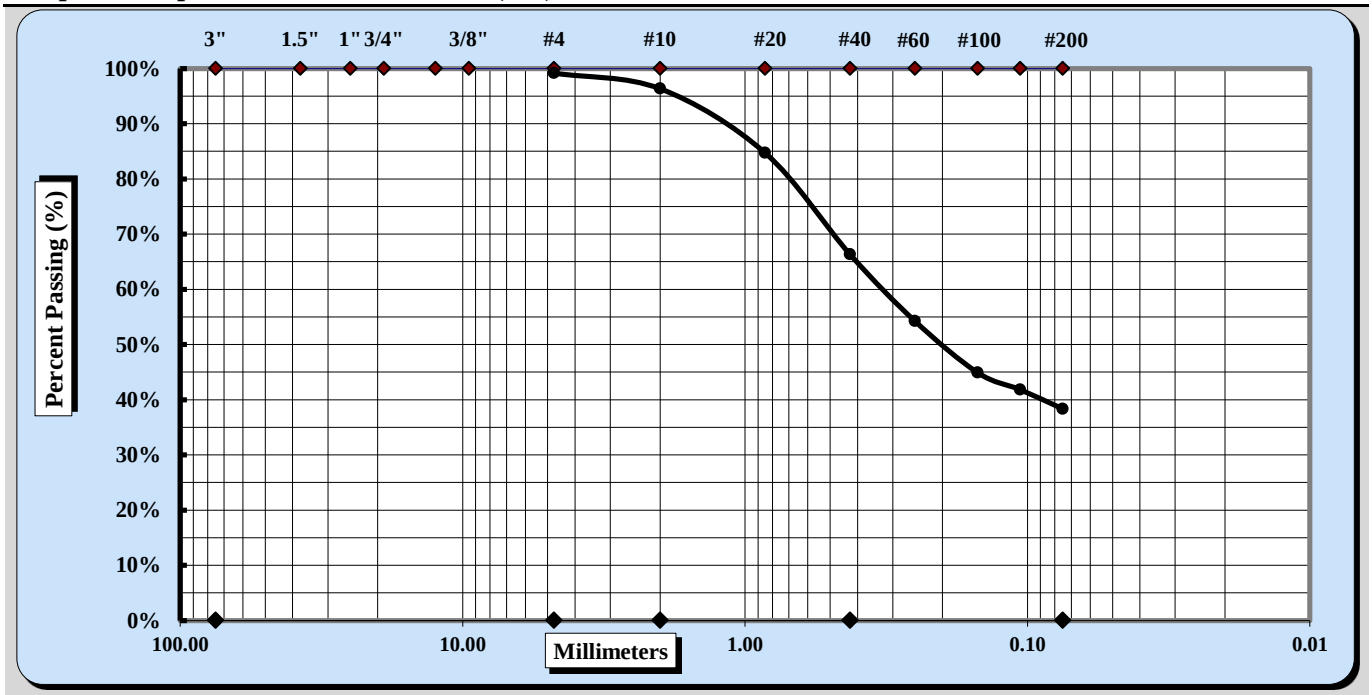
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-18	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILTY SAND (SM) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	2.8%	Fine Sand	28.0%
Gravel	0.8%	Medium Sand	30.0%	Silt & Clay	38.3%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.8%	Medium Sand	30.0%	Fine Sand	28.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

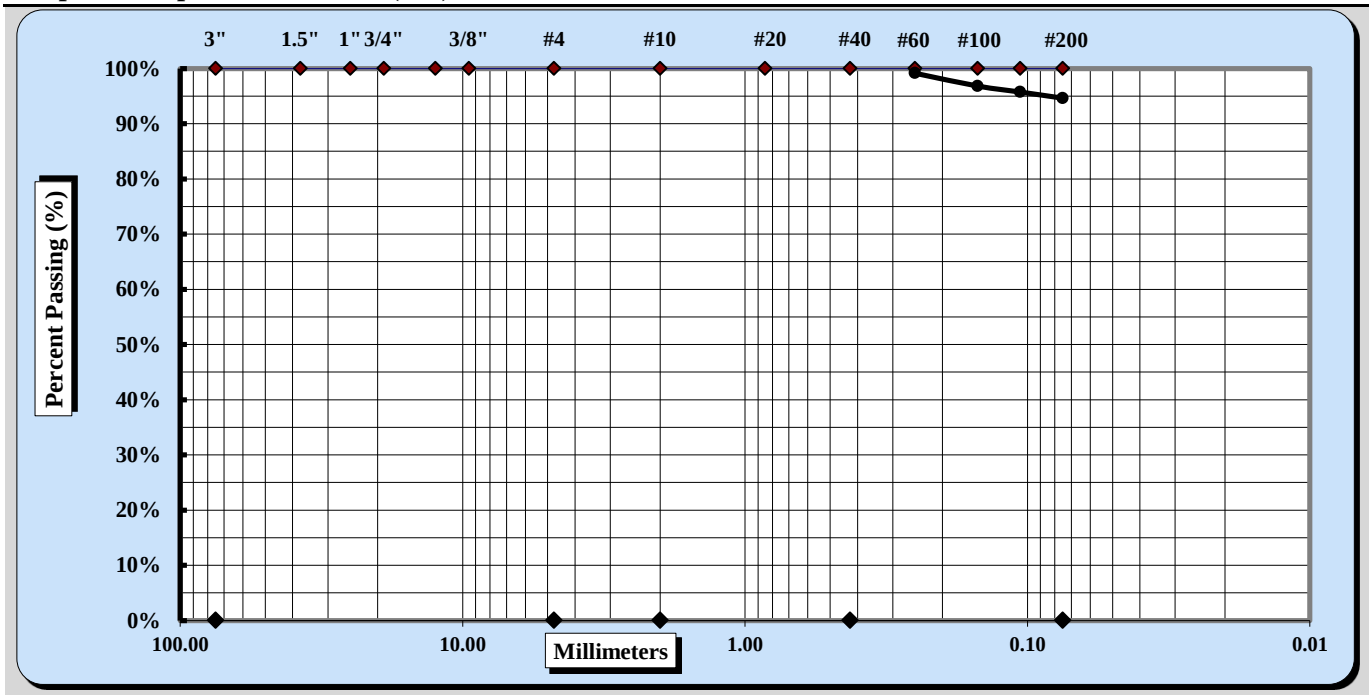
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-19	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILT (ML) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 60	Coarse Sand	0.0%	Fine Sand	5.4%
Gravel	0.0%	Medium Sand	0.0%	Silt & Clay	94.6%
Liquid Limit	43	Plastic Limit	32	Plastic Index	11

Coarse Sand	0.0%	Medium Sand	0.0%	Fine Sand	5.4%

Description of Sand & Gravel Particles: Rounded ☒ Angular ☐
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

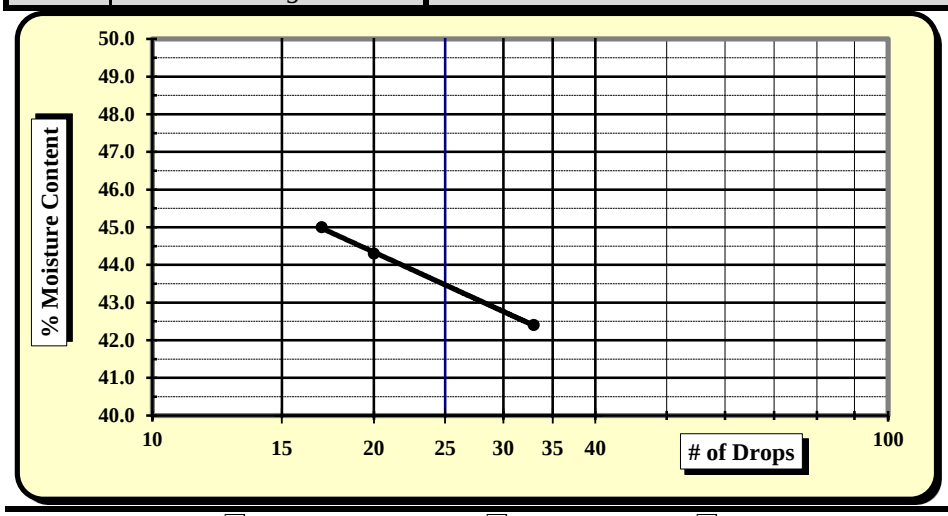
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-19	Sample No: 1		
		Depth: 0 - 2 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

		Liquid Limit						Plastic Limit		
Pan # / Tare #:										
A	Tare Weight	10.58	10.80	10.75				14.60	14.66	
B	Wet Soil Weight + A	20.39	19.89	20.10				23.08	23.05	
C	Dry Soil Weight + A	17.47	17.10	17.20				20.99	21.04	
D	Water Weight (B-C)	2.92	2.79	2.90				2.09	2.01	
E	Dry Soil Weight (C-A)	6.89	6.30	6.45				6.39	6.38	
F	% Moisture (D/E)*100	42.4%	44.3%	45.0%				32.7%	31.5%	
N	# OF DROPS	33	20	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**32.1%**		



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	**43**
Plastic Limit	**32**
Plastic Index	**11**
USCS Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

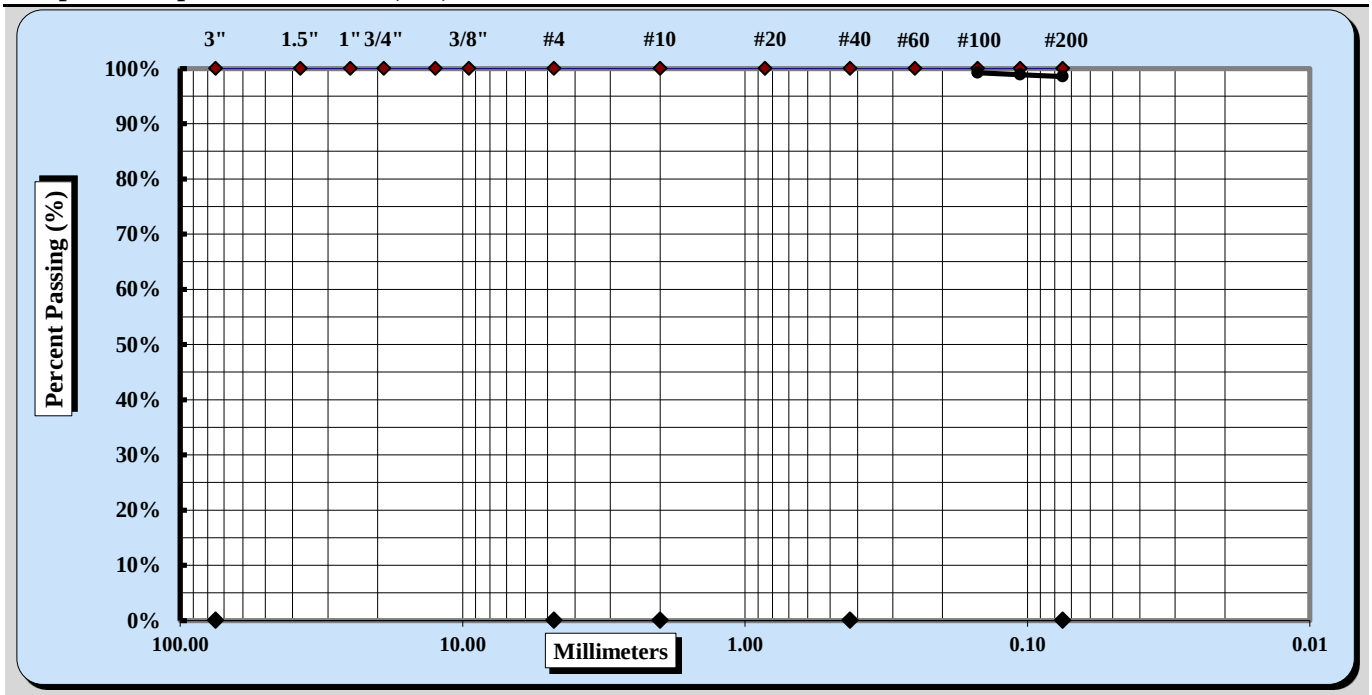
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-19	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SILT (ML) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 100	Coarse Sand	0.0%	Fine Sand	1.3%
Gravel	0.0%	Medium Sand	0.2%	Silt & Clay	98.5%
Liquid Limit	49	Plastic Limit	34	Plastic Index	15

Coarse Sand	0.0%	Medium Sand	0.2%	Fine Sand	1.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

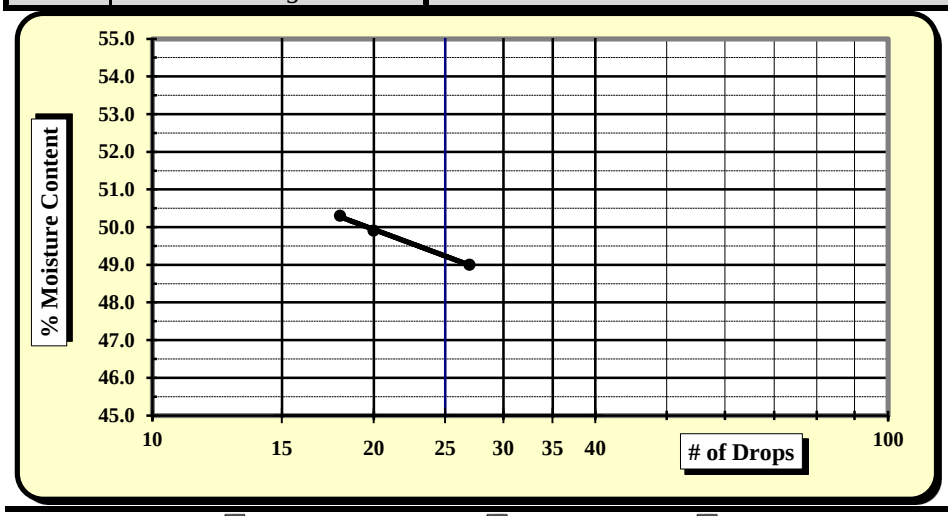
Log No.:341 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/25/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-19	Sample No: 2		
		Depth: 2 - 4 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	21.01	20.77	20.78				14.56	12.33	
B	Wet Soil Weight + A	30.56	30.78	28.61				22.08	24.49	
C	Dry Soil Weight + A	27.42	27.45	25.99				20.24	21.36	
D	Water Weight (B-C)	3.14	3.33	2.62				1.84	3.13	
E	Dry Soil Weight (C-A)	6.41	6.68	5.21				5.68	9.03	
F	% Moisture (D/E)*100	49.0%	49.9%	50.3%				32.4%	34.7%	
N	# OF DROPS	27	20	18				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**33.6%**		



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	**49**
Plastic Limit	**34**
Plastic Index	**15**
USCS Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/2/14*

Chisa Puckett and Stephen Yap	11/24/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

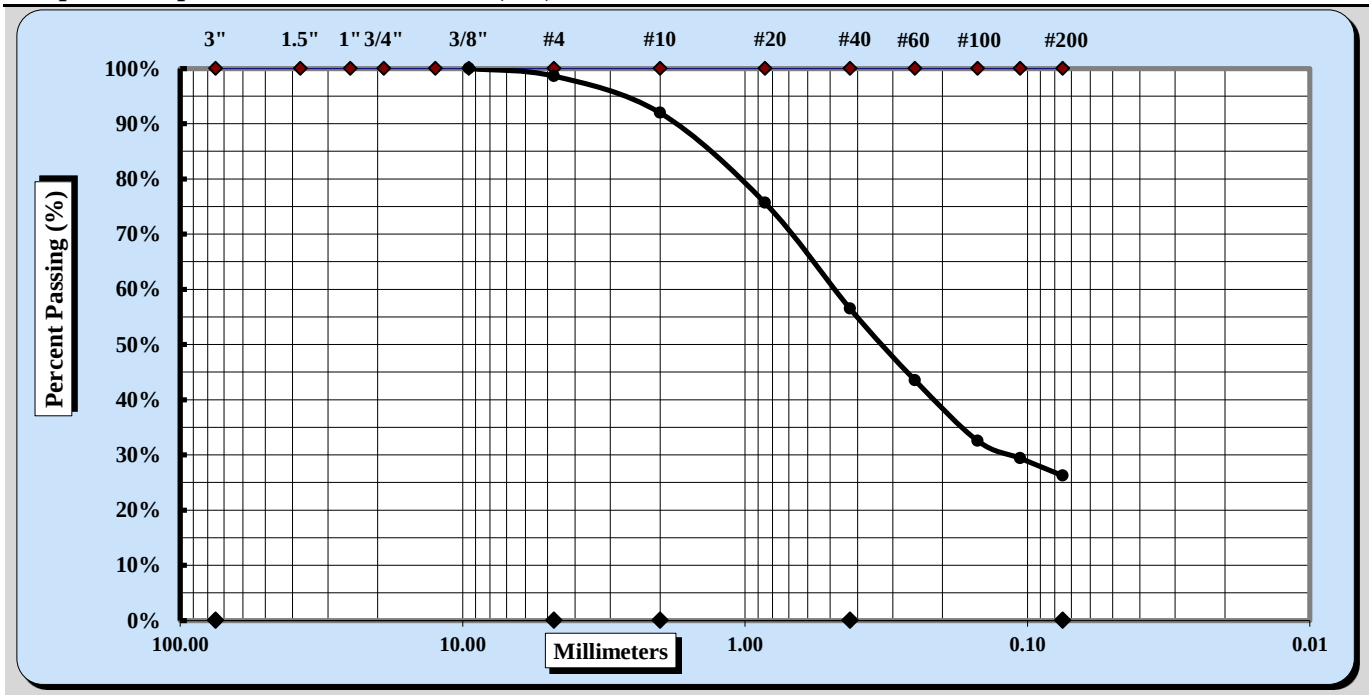
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-20	Type: SS		
		Depth:	0 - 2 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	6.7%	Fine Sand	30.3%
Gravel	1.4%	Medium Sand	35.5%	Silt & Clay	26.2%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	6.7%	Medium Sand	35.5%	Fine Sand	30.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

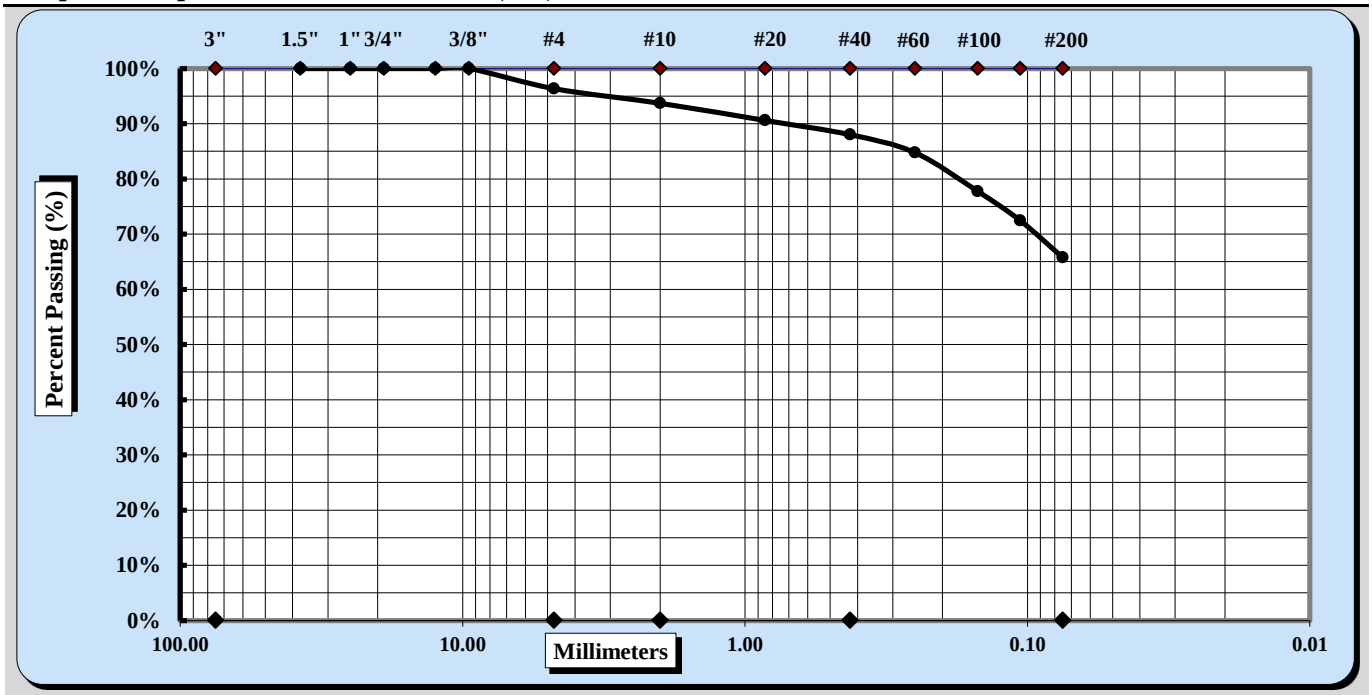
Quality Assurance

Sample Log No.:341

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/20/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: R-20	Type: SS		
		Depth:	2 - 4 ft

Sample Description: SANDY SILT (ML) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.7%	Fine Sand	22.3%
Gravel	3.7%	Medium Sand	5.7%	Silt & Clay	65.7%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

Coarse Sand	2.7%	Medium Sand	5.7%	Fine Sand	22.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D2216-T265-1
Revision No. 0
Revision Date: 02/22/08

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105 Lexington, KY 40505

Project #:	**1461-14-046** -	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
	-		

Sampling Method: Split Spoon

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***23954*** *Calibration Date:* ***10/7/14***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture	Note
		feet		grams	grams	grams	grams	%	
R-1	1	0 - 2	JR-53	180.55	285.27	277.67	7.60	**7.8%**	
R-1	2	2 - 4	JR-36	181.40	289.56	281.87	7.69	**7.7%**	
R-2	1	0 - 2	CMY	186.27	285.52	268.50	17.02	**20.7%**	
R-2	2	2 - 4	JR-47	180.99	303.89	292.13	11.76	**10.6%**	
R-3	1	1 - 2.5	JR-Dusty	185.33	289.18	281.38	7.80	**8.1%**	
R-3	2	3.5 - 5	U-1	10.75	31.28	26.90	4.38	**27.1%**	
R-4	1	1 - 2.5	mPond	180.74	287.16	277.15	10.01	**10.4%**	
R-4	2	3.5 - 5	AR-4	180.72	292.32	281.13	11.19	**11.1%**	
R-5	1	1 - 2.5	JR-4	181.83	282.37	273.57	8.80	**9.6%**	
R-5	2	3.5 - 5	JR-70	185.99	294.75	283.99	10.76	**11.0%**	
R-6	1	1 - 2.5	M	21.11	124.12	112.17	11.95	**13.1%**	
R-6	2	3.5 - 5	Toredor	21.04	124.84	108.24	16.60	**19.0%**	
R-7	1	1 - 2.5	Ravnos	21.18	124.51	111.34	13.17	**14.6%**	
R-7	2	3.5 - 5	Failte	20.94	123.62	116.94	6.68	**7.0%**	
R-8	1	0 - 2	Jam	20.77	120.12	112.35	7.77	**8.5%**	
R-8	2	2 - 4	26	27.52	129.71	119.82	9.89	**10.7%**	
R-9	1	0 - 2	David	20.83	126.81	112.75	14.06	**15.3%**	
R-9	2	2 - 4	91	22.62	129.89	118.01	11.88	**12.5%**	
R-10	1	0 - 2	SMS	20.63	121.21	110.79	10.42	**11.6%**	
R-10	2	2 - 4	Steve	20.96	142.33	131.03	11.30	**10.3%**	

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

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

Chisa Puckett			11/06/14
Technician Name			*Date*
N. Randy Rainwater	*Signature*	Project Engineer	12/01/14
Technical Responsibility		*Position*	*Date*

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105 Lexington, KY 40505

Project #: **1461-14-046** - Report Date: 11/26/14

Project Name: I-77 Widening Design/Build Preparation On-Call

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	%	
R-11	1	0 - 2	MH-1	181.00	316.80	303.11	13.69	**11.2%**	
R-11	2	2 - 4	MH-2	179.60	292.90	284.78	8.12	**7.7%**	
R-12	1	0 - 2	MH-3	179.60	281.20	272.35	8.85	**9.5%**	
R-12	2	2 - 4	MH-4	179.70	283.70	272.05	11.65	**12.6%**	
R-13	1	0 - 2	MH-5	179.80	290.40	281.04	9.36	**9.2%**	
R-13	2	2 - 4	MH-6	179.60	295.40	281.43	13.97	**13.7%**	
R-14	1	0 - 2	MH-7	180.00	286.10	279.60	6.50	**6.5%**	
R-14	2	2 - 4	MH-8	179.70	283.80	274.08	9.72	**10.3%**	
R-15	1	0 - 2	MH-9	179.80	280.50	271.53	8.97	**9.8%**	
R-15	2	2 - 4	MH-10	180.00	285.70	274.92	10.78	**11.4%**	
R-16	1	0 - 2	MH-11	180.10	305.20	293.32	11.88	**10.5%**	
R-16	2	2 - 4	MH-12	179.70	334.90	314.15	20.75	**15.4%**	
R-17	1	0 - 2	MI1	179.80	293.50	282.09	11.41	**11.2%**	
R-17	2	2 - 4	MI2	179.80	292.60	280.16	12.44	**12.4%**	
R-18	1	0 - 2	RB-01	179.70	282.70	276.31	6.39	**6.6%**	
R-18	2	2 - 4	RB-02	181.40	291.60	280.34	11.26	**11.4%**	
R-19	1	0 - 2	Meep	10.70	32.60	29.31	3.29	**17.7%**	
R-19	2	2 - 4	RB-4	179.90	279.70	268.15	11.55	**13.1%**	
R-20	1	0 - 2	RB-5	181.50	294.30	285.63	8.67	**8.3%**	
R-20	2	2 - 4	RB-6	179.80	281.60	273.71	7.89	**8.4%**	

Notes / Deviations / References

TEXTURAL CLASSIFICATION METHODS FOR SOIL SAMPLES

UNIFIED SOIL CLASSIFICATION SYSTEM

Recovered samples are classified in accordance with one or more of the classification systems described below. The geotechnical engineer also prepares the final boring records enclosed with the report.

Unified Classification System

Soil classification performed in general accordance with ASTM D 2487, "*Standard Practice for Description and Identification of Soils"* is based on laboratory analyses of grain size distribution and plasticity indices for selected samples. The system is limited to materials passing a 3-inch sieve, and provides 99 classifications for sands, gravels, silts, clays, and organic soils.

Unified Classification System (Visual-Manual Method)

Soils classified in general accordance with ASTM D 2488, "*Standard Practice for Description and Identification of Soils (Visual-Manual Method)"* are based on visual-manual manipulation of samples and do not rely on laboratory classification tests. The system provides 67 soil classifications for sands, gravels, silts, clays and organic soils. When used, reports will state that classification was based on visual-manual procedures.

Minimum Sample Size

Minimum required sample size by maximum particle size:

- No. 4 sieve 100g
- 3/8 in 200g
- 3/4 in 1.0 kg (2.2 lb)
- 1-1/2 in 8.0 kg (18 lb)
- 3 in 60.0 kg (132 lb)

If the field sample is smaller than the minimum amount, the description includes the remark, "Field sample size smaller than recommended."

Filled or Processed Materials

The UCS system is limited to naturally occurring soils only. Where UCS classifications are applied to manmade fill or processed materials, the soil symbols and descriptive names are shown in quotation marks and the soil narrative descriptions contain the notation that they are processed from manmade materials or have been placed into position by human activity.

MAJOR DIVISIONS (1)	(2)	(3)	UCS (4)	DESCRIPTION (5)		VISUAL APPEARANCE (6)
Coarse Grained Soils > 50% of Material retained by #200 Sieve	Gravel and Gravelly Soils >50% of Coarse Fraction Retained by #4 Sieve	Clean Gravels <10% fines	GW	<15% Sand	Well-Graded Gravel	Wide range in gravel sizes with substantial amounts of intermediate sizes
				>15% Sand	Well-Graded Gravel with Sand	
			GP	<15% Sand	Poorly Graded Gravel	Predominately one size or range of sizes with some intermediate sizes missing
				>15% Sand	Poorly Graded Gravel with Sand	
		Gravel with Fines	GM	>15% ML/ MH Fines	Silty Gravel	Nonplastic or low plasticity fines
			GC	>15% CL /CH Fines	Clayey Gravel	Plastic fines
	Sands and Sandy Soils >50% of Coarse Fraction Passes #4 Sieve	Clean Sands <10% fines	SW	<15% Gravel	Well-Graded Sand	Wide range in sand sizes with substantial amounts of intermediate sizes
				>15% Gravel	Well-Graded Sand with Gravel	
			SP	<15% Gravel	Poorly-Graded Sand	Predominately one size or range of sizes with some intermediate sizes missing
				>15% Gravel	Poorly-Graded Sand with Gravel	
		Sands with Fines	SM	<15% Gravel	Silty Sand	Nonplastic or low plasticity fines
				>15% Gravel	Silty Sand with Gravel	
			SC	<15% Gravel	Clayey Sand	Plastic fines
				>15% Gravel	Clayey Sand with Gravel	
Fine Grained Soils >50% of Material Smaller than #200 Sieve	Low Plasticity Silts and Lean Clays	LL < 50%	ML	<15% sand	Silt	No to slight dry strength, quick to slow dilatancy, no toughness
				15-25% sand	Silt with Sand	
				>30% sand	Sandy Silt	
			CL	<15% sand	Lean Clay	Medium to high dry strength, none to very slow dilatancy, medium toughness
				15-25% sand	Lean Clay with Sand	
				>30% sand	Sandy Lean Clay	
	Elastic Silts and Fat Clays	LL > 50%	MH	<15% sand	Elastic Silt	Slight to med dry strength, none to slow dilatancy, slight to med toughness
				15-25% sand	Elastic Silt with Sand	
				>30% sand	Sandy Elastic Silt	
			CH	<15% sand	Fat Clay	High to very high dry strength, no dilatancy, high toughness
				15-25% sand	Fat Clay with Sand	
				>30% sand	Sandy Fat Clay	
	Organic Soils $LL_{(oven\ dried)}$<75% $LL_{(in\text{-}situ)}$		OL/OH	<15% sand	Organic Soil	Slight to high dry strength, none to slow dilatancy, slight to med toughness
				15-25% sand	Organic Soil with Sand	
				>30% sand	Sandy Organic Soil	
Highly Organic Soils			PT	Peat, Humus, Muck, Swamp Soils		Odor, fibrous texture, color

Simplified Classification Table for Visual-Manual Procedure – ASTM D 2488 omitting some dual classifications

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AASHTO SOIL CLASSIFICATION SYSTEM

AASHTO Soil Classification System

Representative soil samples are selected for classification testing to provide grain size and plasticity data to allow classification of the samples in general accordance with the AASHTO Classification method described in ASTM D 3282, *"Standard Practice for Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes."* Soils are classified based on the result of laboratory tests of soil particle distribution and plasticity indices. The various groupings are empirically correlated to engineering behavior related to highway and airfield construction.

Group Index Computation

The group index is an empirical evaluation of in-group behavior of the "clayey-granular" or "silt-clay" materials as subgrade material when soils are placed in thin lifts with proper drainage and compaction. Group Index values are only computed for A-2, A-4, A-5, A-6, and A-7 groups.

Group Index = (F-35) x (0.2 + 0.005 x (LL-40))
+ 0.01 x (F-15) x (PI-10)

Where,

F = percentage fines
LL = Liquid Limit
PI = Plasticity Index

The Group Index is typically shown in parentheses immediately following the Group designation, for example A-5(7).

Application of Classification to Engineering Use

Under average conditions the supporting value of a subgrade is typically an inverse ratio of the group index. A group index of 0 indicates a "good" subgrade and a group index of 20 or greater indicates a "very poor" subgrade.

The group classification, including the group index, is useful for determining the relative quality of a soil or soil-aggregate mixture for use in earthwork structures, including embankments, subgrades, subbases, and base courses. However, the detailed design of important structures may require specific data concerning strength or performance characteristics not addressed by the classification.

MAJOR DIVISIONS			SIEVE ANALYSIS % PASSING			PLASTICITY		TYPICAL MATERIALS	RATING AS SUBGRADE
(1)	(2)	(3)	#10	#40	#200	LL	PI		
Granular Soils	A-1	A-1-a	50% max	30% max	15% max	---	6 max	Well graded mixtures of stone fragments or gravel, fine to coarse sands, and a nonplastic to feebly plastic soil binder. May also include manmade or processed materials without a soil binder.	Excellent
		A-1-b	---	50% max	25% max	---	---		
	A-3			51% min	10% max	---	N. P.	Fine beach, alluvial, or wind blown sands with insignificant fines, coarse sand or gravel	Excellent to Good
> 65% of Material retained by #200 Sieve	A-2	A-2-4	---	---	35% max	40max	10 max	Silty or Clayey Gravel or Sand – typically containing significant nonplastic to low plasticity fines.	Excellent to Good
		A-2-5	---	---	35% max	41min	10max		Excellent to Good
		A-2-6	---	---	35% max	40max	11min	Silty or Clayey Gravel or Sand – typically containing significant low to medium plastic fines and exhibiting a moderate cohesiveness when worked by hand.	Excellent to Good
		A-2-7	---	---	35% max	41min	11min		Excellent to Good
Silt-Clay Materials >65% of Material Passing #200 Sieve	A-4		---	---	36% min	40max	10max	Nonplastic to moderately plastic silty soils	Fair
	A-5		---	---	36% min	41min	10max	Diatomaceous or micaceous silty sands or sandy silts	
	A-6		---	---	36% min	40max	11min	Clayey soils or sand-clay mixtures having high volume change potential	Fair to Poor
	A-7	A-7-5	---	---	36% min	41min	11min <LL-30	Elastic soils having high volume change potential	
		A-7-6	---	---	36% min	41min	11min >LL-30	Elastic soils having extremely high volume change potential	

AASHTO Classification of Soils and Soil-Aggregate Mixtures (Note: Highly organic soils A-8 by inspection)

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LABORATORY SOIL CLASSIFICATION TESTING

LABORATORY SOIL CLASSIFICATION TESTS

Based on visual classification, the geotechnical engineer will assign certain laboratory tests to confirm visual classification or to determine some basic soil properties. Laboratory classification and moisture content tests are typically limited to samples which do not contain contamination. In addition, laboratory moisture content methods are limited in scope to samples which do not contain appreciable organic material, soluble solids such as salt or reactive solids such as cement.

Moisture Content Testing - Oven Drying

Procedures generally follow ASTM D 2216, "*Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass."* The sample is split as described in Section 9 of ASTM D 2216. This portion is placed in a drying oven and heated to approximately 110 degrees C overnight or until repetitive weighing gives a constant mass. The moisture content is computed as the mass of water removed by drying, divided by the mass of the sample dry, times 100 percent. No attempt is made to exclude any particular particle size from the sample.

Moisture Content Testing - Direct Heating Method

Procedures generally follow ASTM D 4959, *"Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil by the Direct Heating Method*." The sample is split as described in Section 9 of ASTM D 4643. The split portion is placed on a heating source with a minimum temperature of 110 degrees C until dry and uniform in color, avoiding localized overheating. After being removed and weighed, the sample is thoroughly mixed and returned to the heating source. This is repeated until a repetitive weighing gives a constant mass. The moisture content is computed as the mass of water removed by drying, divided by the mass of the sample dry, times 100 percent. No attempt is made to exclude any particular particle size from the sample.

Moisture Content Testing - Microwave Oven

Procedures generally follow those described ASTM D 4643*, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil by the Microwave Oven Method."* The sample is split as described in Section 9 of ASTM D 4643. A portion is heated for 3 minutes in a microwave oven having a minimum power of 700 Watts. After being removed and weighed, the sample is mixed and returned to the microwave for 1 minute. This process is repeated until achieving a constant mass after repetitive weighing. The moisture content is computed as the mass of water removed by drying, divided by the dry sample mass, times 100 percent. No attempt is made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Procedures generally follow those described by ASTM D 4318, "*Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils."*

Albert Atterberg originally defined "limits of consistency" of fine grained soils in terms of ease of deformation at various moisture contents. In current engineering usage, the *liquid lim*it of a soil is the moisture content marking the upper limit of viscous flow and the boundary with a semi-liquid state. The *plastic limit* is the lower limit of plastic behavior, above which a soil behaves plastically and below which it retains its shape upon drying. The *plasticity index* (PI) is the range of water content over which a soil behaves plastically. The PI is the difference between liquid limit and plastic limit values.

Sample preparation follows Section 10.1 of ASTM D 4318. The liquid limit is determined using the multipoint method (Method A) described in Section 11. The liquid limit is the moisture content requiring 25 drops of a hand operated liquid limit device to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content is adjusted and the test repeated to provide a minimum of three widely spaced combinations of N versus moisture content. The liquid limit moisture content is determined by straight line interpolation between the data points at N equals 25 blows on semi-log paper.

The plastic limit is determined using the procedure described in Section 17. A selected portion of the soil used in the liquid limit test is kneaded and rolled by hand until it can no longer be rolled to a 3.2 mm thread on a glass plate. Rolling and kneading is repeated until at least 6 grams of material accumulates. The moisture content is then determined using the methods described in ASTM D 2216.

Grain Size Analysis of Samples by Sieving

Procedures to determine the distribution of particle sizes greater than 75 μm generally follow ASTM D 421, "*Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants", and D 422, "Standard Test Method for Particle Size Analysis of Soils*." Samples are divided into two portions. The material coarser than the No. 30 U.S. sieve size fraction is dry sieved through a nest of standard sieves as described in Article 6. Material passing the No. 30 sieve is independently passed through a nest of sieves down to the No. 200 size.

Grain Size Analysis of Samples with Hydrometer

Procedures used to determine size distribution of fine grained soils by rate of sedimentation follows those described by ASTM D 421, "*Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants", and D 422, "Standard Test Method for Particle Size Analysis of Soils."*

Samples are divided into two portions. The material coarser than the No. 10 U.S. sieve size is dry sieved through a nest of standard sieves as described in Article 6. Material passing the No. 10 sieve is soaked in demineralized water and a dispersing agent, then placed in a glass sedimentation chamber. The specific gravity of the slurry is then recorded vs. time. Grain size distribution is calculated from the sedimentation rate of the various size particles. After the final hydrometer reading, the suspension is washed through the No. 200 sieve. The retained material is oven dried and passed through a standard nest of sieves.

Percent Fines Determination of Samples

A selected specimen of soils is washed over a No. 200 sieve after being thoroughly mixed and dried. This test is conducted in general accordance with ASTM D 1140, "*Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*." The test used Method A, using water to wash the sample through the sieve but not soaking the sample for any prescribed period of time. The percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

Percent Organics (Organic Loss on Ignition)

The content of relatively undecayed or undecomposed vegetative matter in the soils is determined for representative samples of topsoil or stained subsoils using the procedures described by AASHTO T-267, "Determination of Organic Content in Soils by Loss on Ignition." Representative samples of the minus No. 10 sieve size are dried at 105 C, then heated in a muffle furnace at 455 C for six hours. The resulting dry weight of the sample after ignition is then compared to the pre-ignition dry weight to estimate the organic content.

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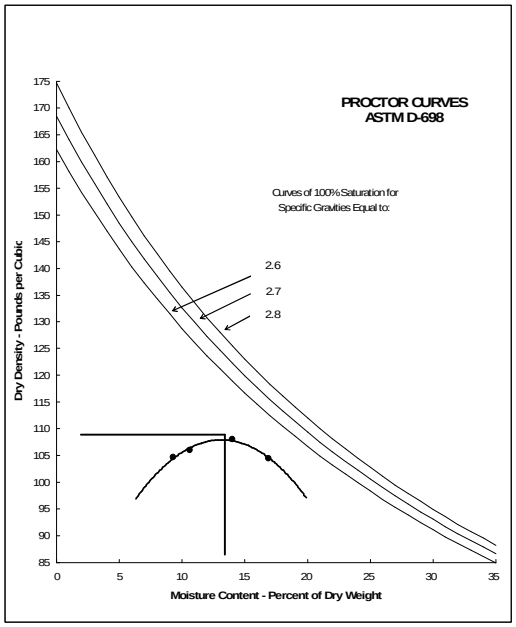
LABORATORY COMPACTION TESTING OF SOIL

LABORATORY COMPACTION TESTING

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.

Two alternate procedures are used for determining a moisture-density relationship for soils and granular materials. The determination of which procedure is more appropriate for the specific soils on a site is made by the geotechnical engineer after examination of the recovered bulk samples and considering local practice.

Each approach involves compaction of loose soils into a standard size mold using a specified compactive effort, then weighing back the unit weight of the soil and recording the moisture content.



Typical moisture- density curve indicates maximum dry density and optimum moisture content. Also shown are zero air voids curves for assumed specific gravity values.

Soil is compacted in the mold in three layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. Separate soils are used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure is 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.

Compaction Tests of Soils Using Standard Effort

Test procedures generally follow those described by ASTM D 698, "*Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 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 5.5 lbf rammer dropped from a height of 12 inches, producing a compactive effort of 12,400 lbf/ft^3. ASTM D 698 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 3 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 3 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 ¾ inch sieve.
- Soil in 3 layers with 56 blows per layer

Compaction Tests of Soils Using Modified Effort

The compactive effort will be greater when using a heavier roller on the site. To attempt to reproduce the effort applied by heavy rollers, a modified procedure applies a greater compactive effort in the laboratory. Test procedures generally follow 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

Correction for Oversize Material

Compaction testing performed using either ASTM D698 or D1557 place limits on the maximum particle size that can be used in the tests. Oversize materials are sieved out of the samples prior to performing moisture-density tests.

Where samples contain greater than 5 percent by weight exceeding the maximum size fraction, unit weight and moisture contents of all data points obtained in Proctor tests using either Standard or Modified effort must be corrected using the procedures outlined in ASTM D 4718, *"Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles."* Where this correction is made test data and report text so states.

LABORATORY CONSOLIDATION TESTING

OEDOMETER (CONSOLIDATION) TESTING

The data from the consolidation test are used to estimate the magnitude and rate of both total and differential settlement of a structure or earthfill. In this test method a saturated soil specimen is restrained laterally by a steel mold and loaded axially with total stress increments. As the specimen consolidates, measurements are made of the change in specimen height and plotted vs. time to determine the relationship between the effective stress and void ratio or strain, and the time rate at which consolidation occurs.

Procedures for determining the magnitude and rate of consolidation of laterally restrained soil generally follow those described in ASTM D 2435-04, *"Standard Test Method for One-Dimensional Consolidation of Soils."*

Sample Preparation and Seating

Undisturbed samples intended for use in consolidation testing are handled as Group C or D samples as described in ASTM D 4220. Extruded samples are each trimmed to a disc 2.5 inches in diameter and 1.0 inches thick as described in Section 9. Each disc is confined in a stainless steel ring and sandwiched between two porous stone plates. After application of a seating load of 100 lb/ft^2 to confine the specimen, the ring is placed in an oedometer and the sample immersed in water to full saturation.

Loading Schedule

Prepared specimens are loaded to the desired stress in accordance with the standard loading schedule described in Section 11.4.1 - 250, 500, 1000, 2000, 4000, 8000, etc. lbf/ft^2 – continuing at a load increment ratio determined by doubling the preceding increment until a maximum load equal to or greater than four times the preconsolidation stress is attained. Exceptions to the loading schedule of Section 11.4.1, or use of an alternate schedule as provided in Section 11.4.3, are noted in the report, if applicable.

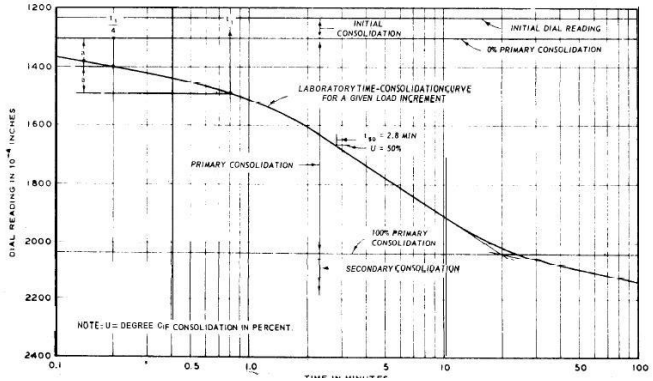
An unload-reload cycle can be imposed to better define the recompression curve in overconsolidated clays. The unload-reload cycle is imposed beginning at the first increment of load that exceeds the preconsolidation stress. Load increments on unload-reload cycles always span at least two decrements of pressure. Each decrement of load is equal to one-fourth of the preceding load when unloading.

The time sequence of readings for each load increment duration follows either Test Method "A" or "B" described in Section 11.5 and indicated on the attached test reports. Deformation of the sample is measured at each time interval using a micrometer dial gage. Measurements continue until sufficient readings are taken to confirm that primary consolidation is complete at each load increment.

Evaluation of secondary compression may be required for some samples. Where this is required longer duration times may be required for load increments above the preconsolidation stress. The laboratory report will describe any non-standard load increment durations.

Data Reduction and Plotting

Time deformation properties are plotted for each load increment using either the log time or square root of time methods described in Section 12.3 and the *coefficient of consolidation* C_v computed. Load deformation properties are plotted in terms of either void ratio at 100 percent consolidation for each loading increment vs. applied load or in terms of percentage strain (of initial sample height) vs. applied load plotted on log scale.



Time-consolidation curve at incremental load – log time method (from USACOE 1102-

The graphical representation of the sample under load was corrected for sample disturbance using the procedures recommended by the Norwegian Geotechnical Institute using the estimated effective vertical stress and the estimated preconsolidation stress.

Interpreted Values

The *preconsolidation stress* p_c of the specimen is estimated from the plot using the Casagrande construction described in Section 12.4.6, using the straight line portion of the virgin compression curve and the point of maximum curvature of the consolidation curve. The overconsolidation ratio (OCR) of the specimen is estimated by comparing the preconsolidation stress to the estimated vertical effective stress acting at the sample depth.

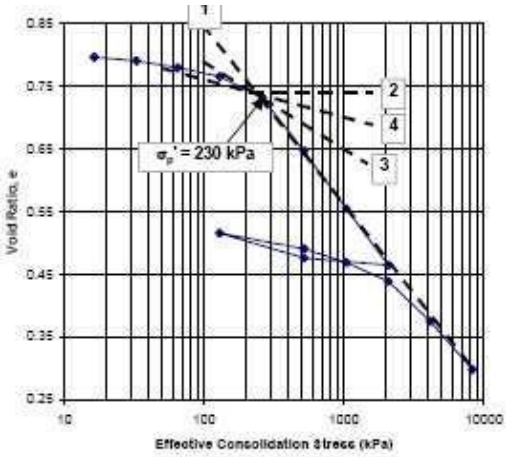


Illustration of Casagrande method to evaluate preconsolidation stress.(FHWA-IF-02-034)

The *compression index* C_c is estimated from the straight line portion of the semilog consolidation curve, above the preconsolidation stress.

The *percent initial consolidation* is determined for each load increment by comparing dial gage deflection immediately upon placement of the load increment (d_0) to the dial gage deflection at 100 percent consolidation for that increment (d_{100}). Percent initial consolidation is typically plotted arithmetically vs. load increment on a log plot.

The slope of the secondary branch of the settlement vs. time curve ($C\alpha$) is related to creep or secondary compression. Typically this trend is considered to be linear vs. the log of time. The secondary compression coefficient was estimated by comparing the deformation at two time intervals at least one log cycle apart.

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ASSESSMENT OF UNDISTURBED SAMPLE QUALITY

Nominally undisturbed specimens obtained using thin-walled tube samplers will become disturbed as a result of drilling, sampling, sample extrusion, and trimming. These processes change the effective stress condition in the soil sample. In most cases by the time extrusion of the sample has been completed, significant stress relief has occurred. The specimen is at a higher void ratio than the in-situ condition. A laboratory strength test performed on the specimen would likely have lower strength and a higher compressibility relative to the same soil at the in-situ void ratio.

Use of Consolidation Test Data

The strain to reach the in-situ effective stress (σ'_{vo}) will be greater for the disturbed sample when compared to an undisturbed specimen. The preconsolidation stress is difficult to determine due to rounding of the consolidation curve, generally leading to an under estimation of the reconsolidation stress. The recompression curve for the disturbed sample will have a steeper slope than that of an undisturbed specimen, while the apparent virgin compression curve will likely be flatter.

Assessment of Sample Quality Using Oedometer Test Data – after LaCasse et al (1985)

Range of OCR	Depth Interval (m)	V. Good Test if ε_r < %	Acceptable Test if < ε_r <	Likely Disturbed if ε_r > %
1 – 1.2	0 – 10 10 – 50	3 2	3 – 5 2 - 4	5 4
1.2 – 1.5	0 – 10 10 - 50	2 1	2 - 4 1 - 3	4 3
1.5 - 2	0 – 10 10 – 50	1.5 1.0	1.5-3.5 1 – 2.5	3.5 2.5
2 - 3	0 – 10 10 – 50	1.0 0.75	1 – 3 0.75 - 2	3 2
3 - 8	0 – 10 10 – 50	0.5 0.5	0.5 – 1 0.5 - 1	1 2

Sample disturbance can be estimated in the laboratory where oedometer or triaxial testing is performed, using the procedure by Lacasse et. al. (1985) as a guide. This assessment is based on estimated overconsolidation of the sample before removal, and the degree of strain required for the sample to withstand the in-situ vertical effective stress during initial loading in the oedometer or during the consolidation phase in the triaxial cell.

Since the loading of the sample up to the preconsolidation stress is "elastic," the response of the soil to application of load should be relatively stiff at applied stresses below the preconsolidation stress. So, as the amount of strain required to reach the initial effective stress in the ground increases, this reflects increased likelihood that the sample is actually disturbed.

Sample quality is judged to be "very good", "acceptable", or "likely to be disturbed" depending on the estimated OCR and strain ε exhibited at σ'_{vo}, according to the table shown above. For slightly overconsolidated soils (OCR 2-3), samples could be judged to be "acceptable" if the strain is less than 3 percent when the sample reaches the preconsolidation stress in the oedometer and "very good" if the strain is less than 1 percent.

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ELECTRO-CHEMICAL CLASSIFICATION TESTS

ELECTRO-CHEMICAL CLASSIFICATION TESTS

Electro chemical classification tests provide the engineer or geologist with quantitative information related to the aggressiveness of the soil conditions and the potential for deterioration of a foundation material. Electro chemical tests include (1) pH; (2) resistivity; (3) sulfate ion content; and (4) chloride ion content.

Soil pH Testing

Soil pH measures the activity of hydrogen ions in a water solution. The pH scale ranges from 0 (very acidic) to 14 (very alkaline or basic). Test methods follow those given by AASHTO T-289-91(2004), *"Determining pH for Soil for Use in Corrosion Testing."*

Moist samples are sieved and pulverized as described in Section 6.2. A 30mg sample is then suspended in distilled water for one hour. A pH meter is first standardized against a buffer solution of known pH, then the probe immersed in the suspended solution and the pH reading recorded. If the pH of the soil is below 4.5 the soil is reported as aggressive.

Field Resistivity Testing

Apparent resistivity of the soil is measured at selected locations by measuring the voltage potential between four equally spaced, in-line direct current electrodes in the Wenner Electrode Arrangement as described in ASTM D 6431, *"Standard Guide for Using the Direct Current Resistivity Method for Subsurface Investigation."* Using the measured voltages, resistivity is estimated using the approach described in "*A Method of Measuring Earth Resistivity*", U. S. Bureau of Standards Bulletin No. 258, by Dr. F. Wenner, in which the average resistivity of the soil to a depth of "A" is given by:

r = 191.5 x AE/I, where:

r = Average resistivity of soil, ohm-cm
A = Distance between electrodes, cm
E = Measured Voltage, Volts
I = Current, Amperes

Measurements employ a set of four electrodes in a linear array. Measurements at a single location are typically made in two orientations at right angles to one another. The location and orientation of each traverse is indicated in the report or on the boring location plan in the Appendix.

Successive measurements are made by varying the electrode spacing at horizontal intervals of 5, 10, 15, and 20 feet unless otherwise indicated in the report. The depth of measurement is considered roughly equivalent to the electrode spacing

Laboratory Minimum Soil Resistivity

This method is used to determine the soil corrosivity and identify conditions under which corrosion of metals in the soil may be reduced. Test methods follow those described in AASHTO T-288-91(2004), "*Determining Minimum Laboratory Soil Resistivity.*"

Tests are performed on about 1500 grams of air dried material obtained by splitting or quartering recovered samples. Testing is performed on material passing the No. 10 sieve size. Prepared samples are placed in a standard soil box and finger compacted. Resistance of the sample between the electrodes is measured with either an alternating current resistivity meter or a 12-V direct current resistivity meter.

After each test, the sample is removed from the box and moisture content adjusted by addition of distilled water to the soil. The sample is replaced in the box with finger compaction and the test repeated. Testing is preformed on successively higher moisture contents until a minimum resistivity value is recorded, which is reported as the resistivity. The minimum soil resistivity can occur at any soil moisture content.

Soil Corrosivity Versus Resistivity

Soil Corrosivity	Soil Resistivity (ohm-cm)
Very corrosive	0 to 2,000
Corrosive	2,000 to 5,000
Moderately corrosive	5,000 to 10,000
Mildly corrosive	10,000 to 25,000
Relatively less corrosive	25,000 to 50,000
Progressively non-corrosive	50,000 to 100,000

Laboratory Sulfate Ion Content Test

External sulfate can occur when concrete is in contact with sulfate containing water e.g. seawater, swamp water, ground water or sewage water. The often massive formation of gypsum and ettringite formed during the external sulfate attack may cause concrete to crack and scale.

Water soluble sulfate ion content is determined using either Method A or B as described by AASHTO T-290-95(2003), *"Determining Water-Soluble Sulfate Ion Content in Soil*." Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Gravimetric Method, determines sulfate content by precipitation of barium sulfate from a heated solution of the soil and chemical reagents. Method B, the Turbidimetric Method, relies on a photoelectric colorimeter to determine the turbidity of a barium sulfate suspension after chemical reagents are added. Laboratory test data sheets will indicate the method used.

Laboratory Chloride Ion Content Test

Water soluble chloride ion content is determined using either Method A or B as described by AASHTO T-291-94(2004), *"Determining Water-Soluble chloride Ion Content in Soil*." Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Mohr Titration Method, determines chloride ion content using silver nitrate in a suspended solution of the soil and distilled water. A reaction between a potassium chromate indicator solution and the silver nitrate produces a red-silver chromate precipitate.

Method B utilizes a pH/mV meter with chloride ion selective electrodes. When inserted into the suspension the meter records the activity of the chloride ions. These readings are compared to a set of calibration curves to determine the ion content in mg/kg.

Interpretation of Soil Corrosive Potential

Tests to characterize the aggressiveness of a soil environment are important for design applications that include metallic elements, especially for ground anchors comprised of high strength steel and for metallic reinforcements in mechanically stabilized earth walls.

If results from these tests indicate chloride ion content greater than 100 ppm or sulfate ion content greater than 200 ppm, then the soil should be considered as **aggressive**. If the pH of the soil is below 4.5 or the resistivity is less than 1000 ohms/cm, the soil is reported as **aggressive**.

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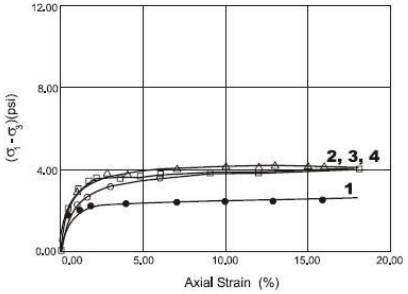
LABORATORY SHEAR STRENGTH TESTING

UU or "Q" Triaxial Shear Tests of Undisturbed Samples

Undrained strength tests performed using the UU or "Q" test method are described by ASTM D 2850, "*Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils."* This test is typically limited to cohesive soils having a permeability slower than 10^{-3} cm/sec, preserved as Group C samples as defined in ASTM D 4220.

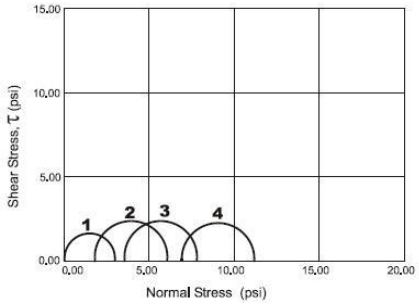
The UU test employs rapid application of both confining and axial stresses without permitting drainage of pore water. This condition simulates rapid loading of the soil during construction before sufficient time is allowed for the soil to consolidate. UU tests are performed on samples at their "as-received" moisture content, so that results may be applied to "construction conditions" in embankment stability analyses.

The extruded sample was encased in a rubber membrane and sealed to the specimen base and cap with rubber O-rings to prevent drainage of the specimen. In most cases UD samples are tested without trimming except for cutting the end surfaces plane and perpendicular to the longitudinal axis of the specimen.



The UU test is performed with the drain valve of the triaxial cell closed during all phases of the test and before the sample has a chance to consolidate (S<100 percent). The chamber is pressurized to the desired confining pressure and the sample allowed to stabilize at least 10 minutes before application of axial load. The sample is loaded axially by compressing the top platen into the sample at a constant rate of approximately one percent strain per minute.

Deformation of the sample and the applied stress is recorded electronically using LVDT strain gages. Failure of the specimens during the tests is defined as the maximum principal stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurs first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, and Mohr Circle plots at various increments of confining stress.



CU or "R" Triaxial Shear Tests of Undisturbed Samples

Shear tests performed using the CU or "R" test method are described by ASTM D 4767, *"Standard Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils*." This test is typically applicable to Group C samples as defined in ASTM D 4220.

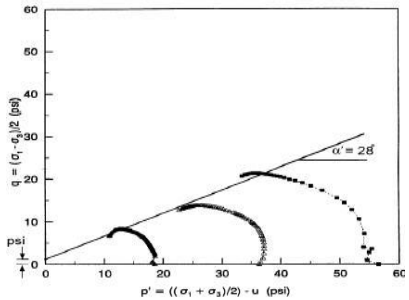
Samples tested using the R test method are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation. The measured shear strength can be applied to field conditions where soils that have been fully consolidated under one set of stresses are subjected to a change in stress without time for further consolidation to take place.

Measured pore pressures induced by the change in stress can be used to compute effective stress shear strength, which may be applied to field conditions in which full drainage can occur or to conditions in which pore pressures induced by loading can be estimated.

R test samples are prepared as generally described in Section 6 of ASTM D 4767. Each extruded sample is encased in a rubber membrane and sealed with rubber O-rings to prevent drainage of the specimen. UD samples are typically tested without trimming except for cutting end surfaces plane and perpendicular to the long axis of the specimen. Samples are saturated by back pressuring the pore water to drive the air in the void spaces into solution, after the system was saturated by applying a vacuum to the specimen and dry drainage system as described in section 8.2.

With the drainage valves of the triaxial cell closed, the cell pressure is increased with back pressure constant to confine the specimen. After attaining the desired confining pressure, the drainage ports are opened and the sample fully consolidated to equilibrium before applying axial load.

p-q plot of test results



The fully consolidated sample is loaded axially by compressing the top platen at a constant rate of one percent strain per minute, with drainage ports again closed. Sample deformation and applied stress is recorded electronically using LVDT strain gages and induced pore pressures measured using a stiff electronic pressure transducer.

Failure of the specimens during the tests is defined as the point of maximum effective stress obliquity, the maximum stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurs first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, induced pore pressure vs. applied strain, p'-q' diagram, and Mohr Circle plots at various increments of confining stress.

Triaxial Shear Tests of Remolded Samples

Specimens are prepared in a standard mold by compacting them at predetermined moisture contents to the dry density values prescribed by the geotechnical engineer. Compacted samples are then removed from the mold and the ends of each specimen carved by hand and trimmed as necessary to provide a surface perpendicular to the long axis.

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LABORATORY SHEAR STRENGTH TESTING (continued)

Unconfined Compressive Strength Tests of Undisturbed Cohesive Samples

The unconfined compressive strength of relatively undisturbed cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil*." Relatively undisturbed Group C samples of cohesive soils are extruded from the sampler and examined as described above.

Representative portions of each sample are split from the extruded material and prepared using the procedures described in Section 6.2 of ASTM D 2166. The ends of the specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

The prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length is attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formula in sections 8.2 and 8.3 of ASTM D 2166.

Unconfined Compressive Strength Tests of Remolded Cohesive Samples

The unconfined compressive strength of remolded cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.*" Specimens are prepared either from cohesive soils recovered from split spoon samples obtained as described in ASTM D 1586 and preserved as Group B samples, or from portions of failed undisturbed samples tested in unconfined compression.

Representative portions of remolded samples are prepared using the procedures described in Section 6.3 of ASTM D 2166. The ends of each specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

The prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length is attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formulae in sections 8.2 and 8.3 of ASTM D 2166.

Unconfined Compressive Strength Tests of Compacted Cohesive Samples

The unconfined compressive strength of compacted cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil."*

Specimens are prepared in a standard mold by compacting them at predetermined moisture contents to the dry density values prescribed by the geotechnical engineer. Compacted samples are then removed from the mold and specimens prepared using the procedures described in Section 6.4 of ASTM D 2166. The ends of each specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

Each prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length was attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formulae in sections 8.2 and 8.3 of ASTM D 2166.

Direct Simple Shear Testing of Undisturbed Samples

Shear tests are performed using the single shearing method described by ASTM D 3080, *"Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions*." This test is typically applicable to both coarse-grained and fine-grained soils preserved as Group C samples as defined in ASTM D 4220, or on remolded or recompacted samples.

Samples are tested by placing the specimen in a direct shear device and consolidating it under a predetermined normal load. The specimen is then sheared along a horizontal plane in the middle of the specimen. Shearing is performed at a slow rate (at least 50 times the estimated time for 50 percent consolidation of the sample) to limit buildup of pore pressures along the failure plane. Since drainage paths in the specimen are short, excess pore pressures are dissipated and the test is considered a drained test.

Failure of the specimens during the tests is defined as the point of maximum stress attained (peak stress) and at 15 to 20 percent strain (residual stress). Test output includes a plot of deviator stress vs. applied strain for various load increments and Mohr Circle plots at various increments of confining stress.

Pocket Penetrometer Tests

A pocket penetrometer is a spring operated device used to roughly estimate compressive strength for classification purposes of selected samples. The device is operated by pushing a 0.25-inch (6.4mm) diameter loading piston into the material being measured, up to a calibration groove machined on the piston 0.25 inches from the end. Strength in tons per sq. ft. or kg per sq. cm. to a maximum of 4.5 is obtained by noting the position of an indicating ring on the scale.

Pocket penetrometers are not individually calibrated. Calibration is on the basis of correlation studies relating the effective spring compression to unconfined compressive strength values determined by other methods.

Pocket Torvane Shear Tests

Pocket torvane devices are simple spring loaded hand-held blades used to estimate consistency of cohesive soills by correlation of torsion of the spring mechanism to compressive strength determined by other methods. Performed on cohesive materials, undisturbed samples, and intact chunks or disturbed samples. Test results are to be regarded with caution. Pocket torvane tests are used mainly for consistency classification and as guide for assigning shear tests.

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APPENDIX III-B

Appendix III–B – Bulk & UD Sample Classification and Physical Property Tests
Summary of Laboratory Test Results – Bulk & UD Samples
Laboratory Test Data Sheets – Bulk & UD Samples
Laboratory Test Procedures

Summary of Laboratory Test Data

I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 3: Bulk Samples – Bridge Abutments

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		Triaxial Shear (CU)		Max. Dry Density (pcf)	pH	Resistivity (ohm-cm)	Chloride (mg/kg)	Sulfate (mg/kg)	Organic Content (%)
					LL	PI	AASHTO	USCS	c′ (ksf)	ϕ′ (deg)						
B-1	0-15	Bulk	7.7	19	21	6	A-2-4	SC-SM	0.17	32.5	122.5	5.1	41,000	6.25	50.4	0.8
B-5	0-15	Bulk	13.8	42.5	33	16	A-6	SC	0.21	15.7	116.7	7.2	2,600	7.89	149	1.8
B-9	0-15	Bulk	15.4	56.2	38	21	A-6	CL	0.13	25.5	115.5	4.2	34,000	6.6	89.9	1.5
B-13	0-15	Bulk	15.7	52.3	41	22	A-7-6	CL	0.11	33.6	113.4	4.0	21,000	17.2	88.2	1.6
B-18	0-15	Bulk	11.2	28.6	25	11	A-2-6	SC	0.18	22.2	123.7	4.5	5,400	6.53	82.6	2.3

Table 4: Bulk Samples – Roadway

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		Max. Dry Density (pcf)	Specimen 1		Specimen 2		Specimen 3	
					LL	PI	AASHTO	USCS		% compaction	CBR	% compaction	CBR	% compaction	CBR
R-1	0-5	Bulk	14.7	14.6	NP	NP	A-1-b	SM	122.6	90.9	5.0	95.8	14.9	100.1	22.8
R-4	0-5	Bulk	11.3	33.3	29	13	A-2-6	SC	120.8	91.8	1.8	97.4	4.0	101.3	6.3
R-9	0-5	Bulk	8.7	28.6	26	10	A-2-4	SC	121.2	88.7	0.5	93.7	1.6	99.5	6.4
R-13	0-5	Bulk	12.3	33.5	28	12	A-2-6	SC	119.8	89.6	0.3	95.5	1.2	101.0	3.1
R-17	0-5	Bulk	11.6	21.5	25	8	A-1-b	SC	124.8	91.7	3.3	96.6	7.9	98.8	16.2
R-19	0-5	Bulk	15.6	75.5	40	11	A-6	ML	108.6	92.0	0.2	96.4	0.2	96.9	0.2

Summary of Laboratory Test Data

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Table 5: Undisturbed Samples – Shear Strength Testing

Sample Location	Sample Depth (feet)	Sample No.	Percent Finer #200	Atterberg Limits		Soil Classification		Triaxial Shear (CU)		Direct Shear	
				LL	PI	AASHTO	USCS	c′ (ksf)	ϕ′ (deg)	c (ksf)	ϕ (deg)
B-4	8-10	UD-1	80.1	49	27	A-7-6	CL	0.06	30.3		
B-7	18-20	UD-1	18.6	18	6	A-2-4	SC-SM			0	42.6
B-9	4-6	UD-1	61.9	33	16	A-6	CL			0	56.0
B-9	28-30	UD-2	36.4	30	15	A-6	SC			0	36.8
B-10	13-15	UD-1	46.7	37	20	A-6	SC			0.34	27.1
B-13	6-8	UD-1	57.0	36	19	A-6	CL			0.11	37.6
B-13	18.9-19.4	UD-2	54.7	34	15	A-6	CL	0.3	26.6		
B-13	38.8-40	UD-3	93.0	85	49	A-7-5	CH	1.10	6.6		
B-14	23-25	UD-1	27.5	30	14	A-2-6	SC	0.08	38.4		
B-14	28-30	UD-2	49.5	31	10	A-4	SC	0	41.0		
B-16	11-13	UD-1	54.7	76	34	A-7-5	MH	0.03	42.5		
B-17	6-8	UD-1	20.6	NP	NP	A-2-4	SM	0.07	18.5		

Table 6: Undisturbed Samples – Consolidation Testing

Sample Location	Sample Depth (feet)	Sample No.	Natural Moisture (%)	Percent Finer #200	Atterberg Limits		Soil Classification		In-Situ Moist Unit Weight (pcf)	In-Situ Void Ratio (e_0)	Compression Index C_C
					LL	PI	AASHTO	USCS			
B-14	23-25	UD-1	12.0	27.5	30	14	A-2-6	SC	127.9	0.472	0.09
B-14	28-30	UD-2	55.6	49.5	31	10	A-4	SC	87.8	2.150	0.76
B-16	11-13	UD-1	13.3	54.7	76	34	A-7-5	MH	126.8	0.480	0.10

Summary of Laboratory Test Data

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Table 7: Surface Wave Geophysics

Test Number	Location	Approx. Begin Station	Vs.100	Notes
SW-1	Bridge 1 SB South Abutment	1215+75	1598 ft./sec.	Adjacent boring is B-01 Max. definition depth is 160 ft.
SW-2	Bridge 2 NB North Abutment	1225+00	1492 ft./sec.	Adjacent boring is B-07 Max. definition depth is 130 ft.
SW-3	Bridge 3 SB South Abutment	1236+50	1552 ft./sec.	Adjacent boring is B-08 Max. definition depth is 160 ft.
SW-4	Bridge 4 NB North Abutment	1250+00	1292 ft./sec.	Adjacent boring is B-13 Max. definition depth is 135 ft.
SW-5	Bridge 5 NB North Abutment	1331+00	1222 ft./sec.	Adjacent boring is B-18 Max. definition depth is 140 ft.

Summary of Laboratory Test Data

I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 8: Seismic Parameters by Bridge

Bridge No.	Site Class	Hazard	pga	S_{DS}	S_{D1}	Mw	R	Geologic Condition
Bridge 1	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.29	117 km	
Bridge 2	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.29	117 km	
Bridge 3	C	FEE	0.13g	0.25g	0.11g	7.3	114.3km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.26	117 km	
Bridge 4	C	FEE	0.13g	0.25g	0.11g	7.3	114.6 km	Geologically Realistic
		SEE	0.33g	0.64g	0.30g	7.26	117.2 km	
Bridge 5	C	FEE	0.14g	0.25g	0.10g	7.3	115.8 km	Geologically Realistic
		SEE	0.34g	0.65g	0.28g	7.26	118.2 km	

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

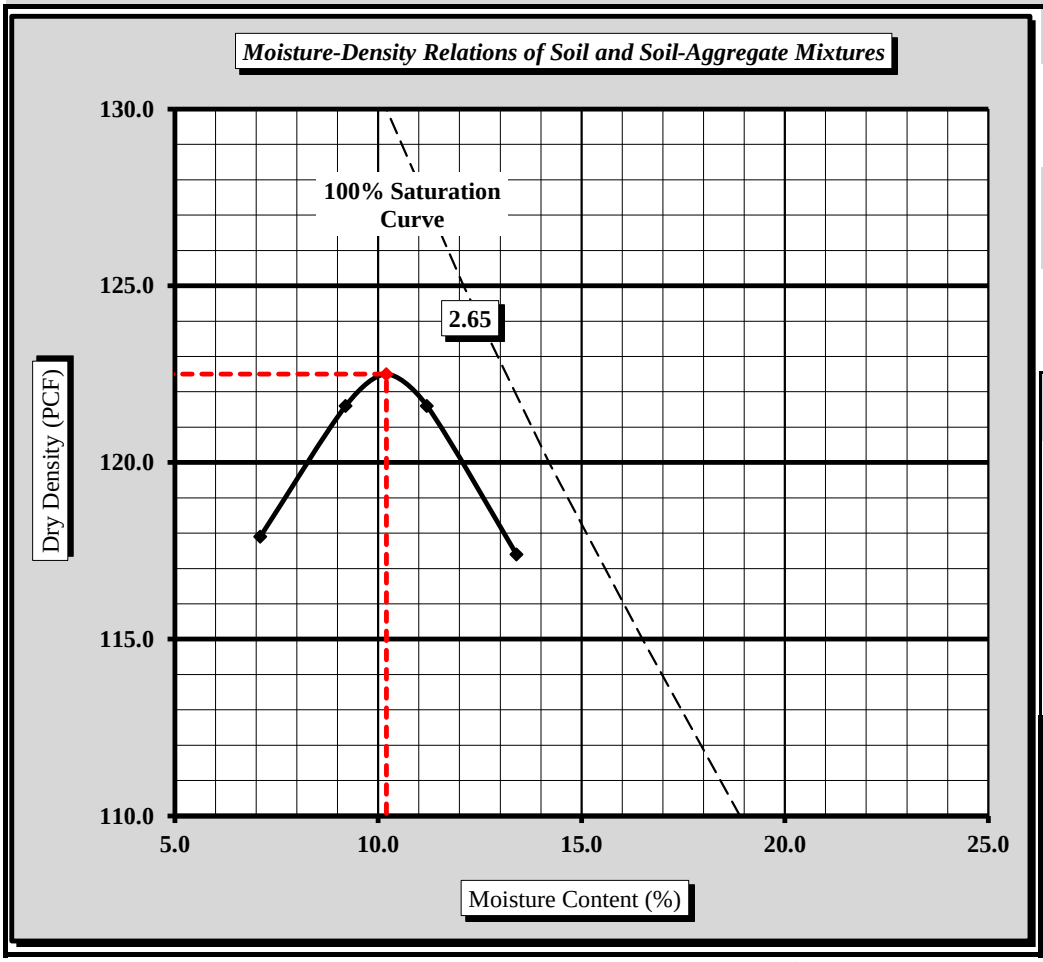
Sample Log No.: 342

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

S&ME Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/23/14 - 10/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-1		
		Depth:	0 - 15 ft
Sample Description:	SILTY, CLAYEY SAND (SC-SM)		A-2-4

Maximum Dry Density **122.5** **PCF.** **Optimum Moisture Content** **10.2%**

ASTM D698 - - Method B



Soil Properties

Natural Moisture Content	**7.7%**
Liquid Limit	**21**
Plastic Limit	**15**
Plastic Index	**6**

% Passing

3/8"	100.0%

Oversize Fraction

Bulk Gravity	
Absorption	**NA**
% 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 D698, D422, D4318, D2487; AASHTO M145

The specific gravity value of the 100% saturation curve is assumed.

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:342

Sieve Analysis of Soils

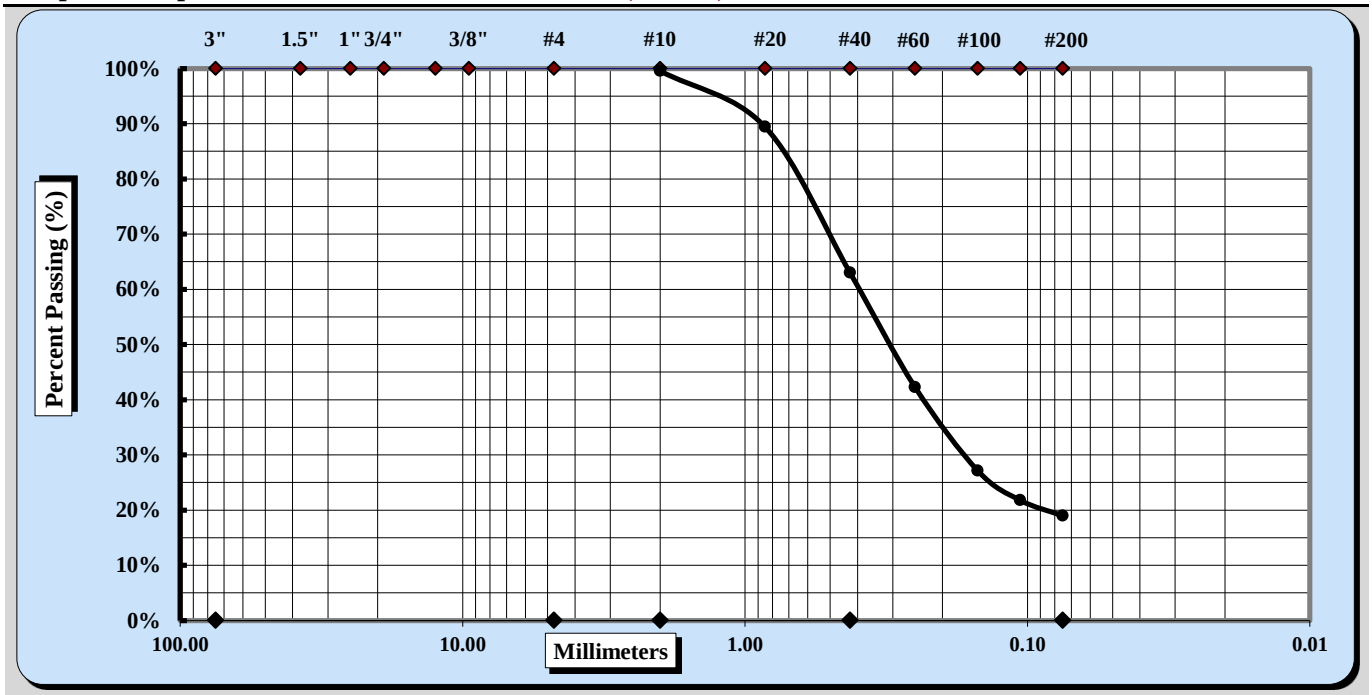
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/30/14 - 11/3/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Type: Bulk		
		Depth:	0 - 15 ft

Sample Description: SILTY, CLAYEY SAND (SC-SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	44.0%
Gravel	0.0%	Medium Sand	36.6%	Silt & Clay	19.0%
Liquid Limit	21	Plastic Limit	15	Plastic Index	6

Coarse Sand	0.4%	Medium Sand	36.6%	Fine Sand	44.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

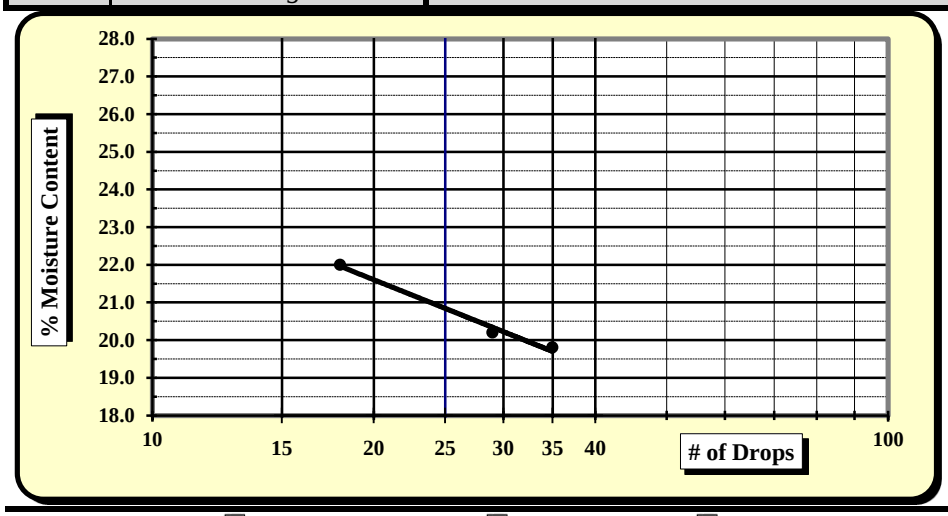
Log No.:342 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/4/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-1	Sample No: Bulk		
		Depth: 0 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	8	23	20				18	3	
A	Tare Weight	15.61	15.50	15.54				15.51	15.55	
B	Wet Soil Weight + A	31.86	32.85	33.53				25.26	24.91	
C	Dry Soil Weight + A	28.93	29.93	30.56				24.02	23.73	
D	Water Weight (B-C)	2.93	2.92	2.97				1.24	1.18	
E	Dry Soil Weight (C-A)	13.32	14.43	15.02				8.51	8.18	
F	% Moisture (D/E)*100	22.0%	20.2%	19.8%				14.6%	14.4%	
N	# OF DROPS	18	29	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**14.5%**		



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 **21**
Plastic Limit **15**
Plastic Index **6**
USCS Group Symbol **CL-ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-2-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/4/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

pH of Soil

AASHTO T 289

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/2/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-1	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	SILTY, CLAYEY SAND (SC-SM)		**A-2-4**

Equipment:

Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/14*	*Due:*	*3/17/15*
Sieve:	*#10*	*S&ME ID#*	*2487*	*Cal. Date:*	*9/4/14*	*Due:*	*3/4/15*
pH Meter:		*S&ME ID#*	*16576*	*Cal. Date:*	*12/2/14*		

pH Meter Calibration

Buffer Solution	***Results***
pH buffer 4.0	***4.01***
pH buffer 7.0	***7.00***
pH buffer 10.0	***10.01***
Buffer Temperature ^{0}C	***23.2°C***

Measuring pH of Soil

Beaker #: 8

Measurements	
Weight of Air Dry Soil (g)	***30.0***
Distilled Water (ml)	***30.0***
Temperature ^{0}C	***22.8°C***
pH Reading	***5.1***

Notes / Deviations / References: AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing

Michael D. Kelso — *Technician Name*
12/2/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-G57-1
Revision No. 0
Revision Date: 07/11/08
Sample Log No.: 342

Soil Resistivity

ASTM G57

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/12/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-1	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	SILTY, CLAYEY SAND (SC-SM)		**A-2-4**

Equipment:	*Standard Box*	*S&ME ID#*	*16577*		*Box Constant:*	*1*
Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/2014*	*Due:* *3/17/2015*
Oven		*S&ME ID#*	*12872*	*Cal. Date:*	*8/15/2014*	*Due:* *12/15/2014*
Decade Box (resistivity verification)		*S&ME ID#*	*19948*	*Cal. Date:*	*1/10/2014*	*Due:* *1/10/2015*

Moisture Content Determination

After 24-hr Condition

						Tare No.	***AA-32***	
					A	Tare Weight		31.81
					B	Wet Wt + Tare Wt		80.95
					C	Dry Wt. + Tare Wt.		72.97
					D	Water Weight	**B-C**	7.98
					E	Dry Weight	**C-A**	41.16
					F	**Moisture Content**	**100*D/E**	**19.4%**

Resistivity (ohms - cm)

After 24-hr Condition

			M	Multiplier Dial Setting	10000
			B	Balance Dial Reading to Null	4.1
			R	**RESISTIVITY (Ω-cm), (MxBxBC)**	**41,000**

Notes / Deviations / References:

24-hr conditioning achieved by saturating the soil with distilled water for 24 hours prior to testing.

Miller 400A Resistivity Meter, ID#26821

ASTM G57: Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

N. Randy Rainwater — *Technician Name*
11/12/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

S&ME

Sample Log No.:342 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1431-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/7/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-1	Sample No.:	Bulk
		Depth:	0 - 15 ft
Sample Description:	SILTY, CLAYEY SAND (SC-SM)		A-2-4

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	A
t	Tare Weight	*grams*	18.95
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	51.38
c	Ash Weight + Tare Wt.	*grams*	51.11
C	Ash Weight	*c-t*	32.16
B	Mass of Oven Dry Specimen	*(b-t)*	32.43
D	***% Ash Content***	*(C/B)*100*	**99.2%**
	% Organic Matter	*100-D*	**0.8%**

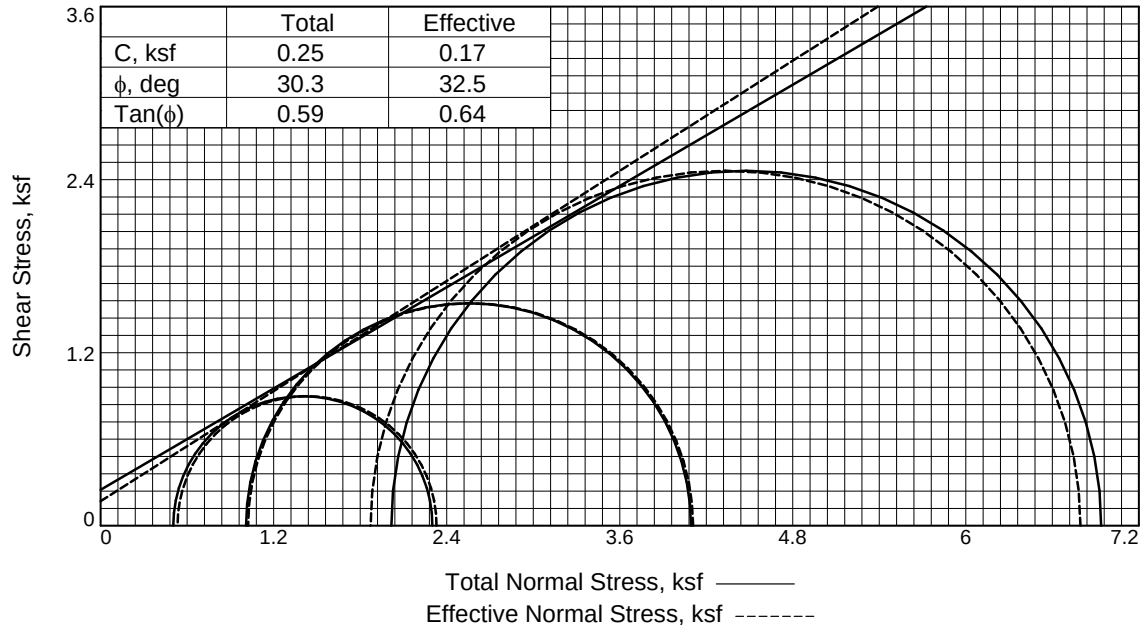
Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

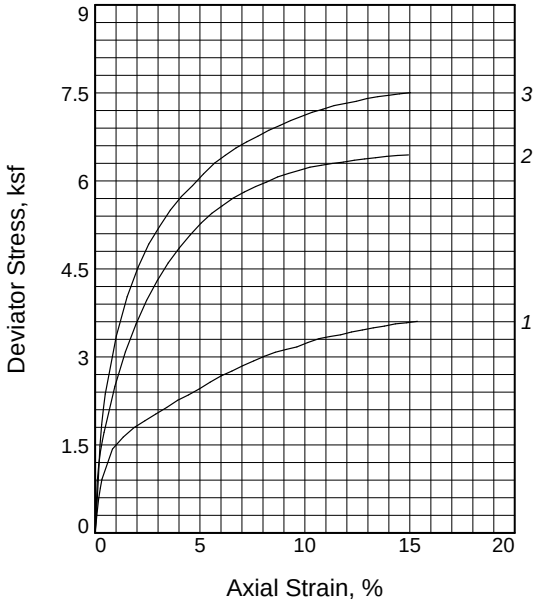
Derek Baker — *Technician Name*
11/7/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/1/2014 — *Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.25	0.17
ϕ, deg	30.3	32.5
Tan(ϕ)	0.59	0.64



Specimen No.		1	2	3
Initial	Water Content, %	10.2	10.2	10.2
	Dry Density, pcf	116.6	116.7	117.0
	Saturation, %	64.6	64.8	65.4
	Void Ratio	0.4187	0.4180	0.4140
	Diameter, in.	2.861	2.861	2.860
	Height, in.	5.739	5.748	5.748
At Test	Water Content, %	15.1	15.0	15.2
	Dry Density, pcf	118.3	118.5	118.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3989	0.3962	0.4015
	Diameter, in.	2.845	2.841	2.852
	Height, in.	5.723	5.739	5.730
Strain rate, %/min.		0.25	0.25	0.25
Back Pressure, psi		90.00	90.00	90.00
Cell Pressure, psi		93.50	97.00	104.00
Fail. Stress, ksf		1.80	3.09	4.92
Total Pore Pr., ksf		12.93	12.95	13.10
Ult. Stress, ksf		3.61	6.44	7.51
Total Pore Pr., ksf		12.11	11.36	11.89
$\bar{\sigma}_1$ Failure, ksf		2.33	4.11	6.79
$\bar{\sigma}_3$ Failure, ksf		0.53	1.02	1.87

Type of Test:
CU with Pore Pressures

Sample Type: Romolded to appr.95%MDD

Description: USCS: SILTY, CLAYEY SAND (SC-SM); AASHTO: A-2-4

LL= 21 **PL=** 15 **PI=** 6

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. MDD=122.5pcf at 10.2% moisture (D698). ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

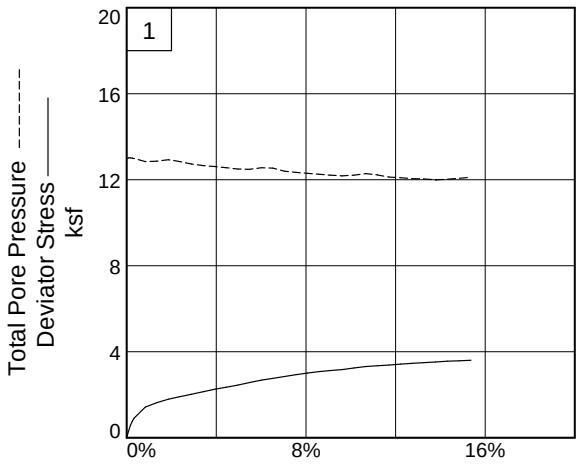
Location: B-1

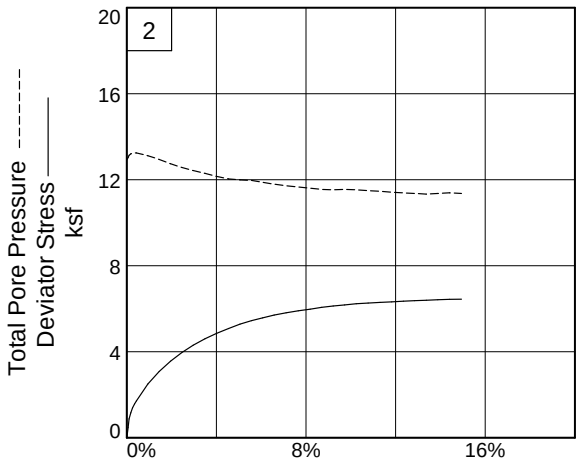
Sample Number: Log 342 **Depth:** 0 - 15 ft

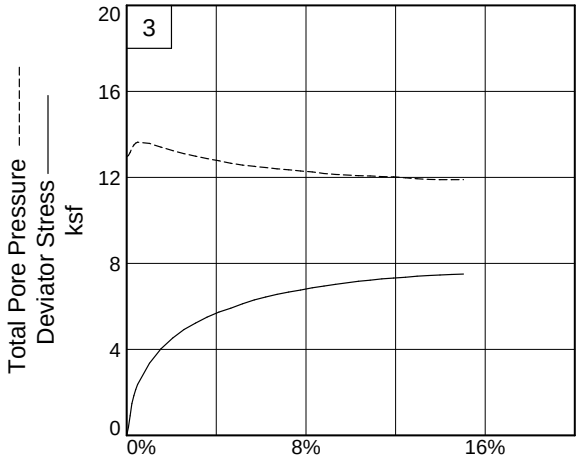
Proj. No.: 1461-14-046

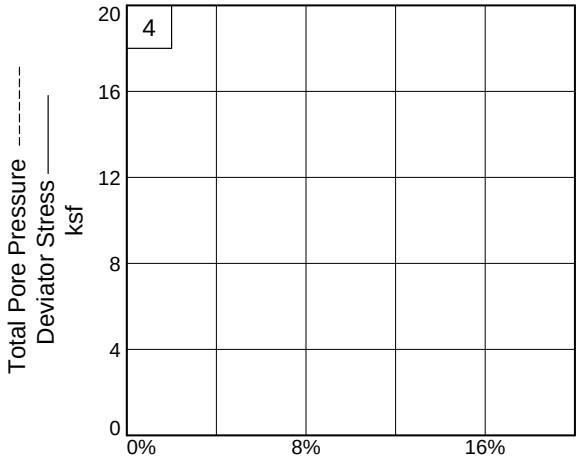
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

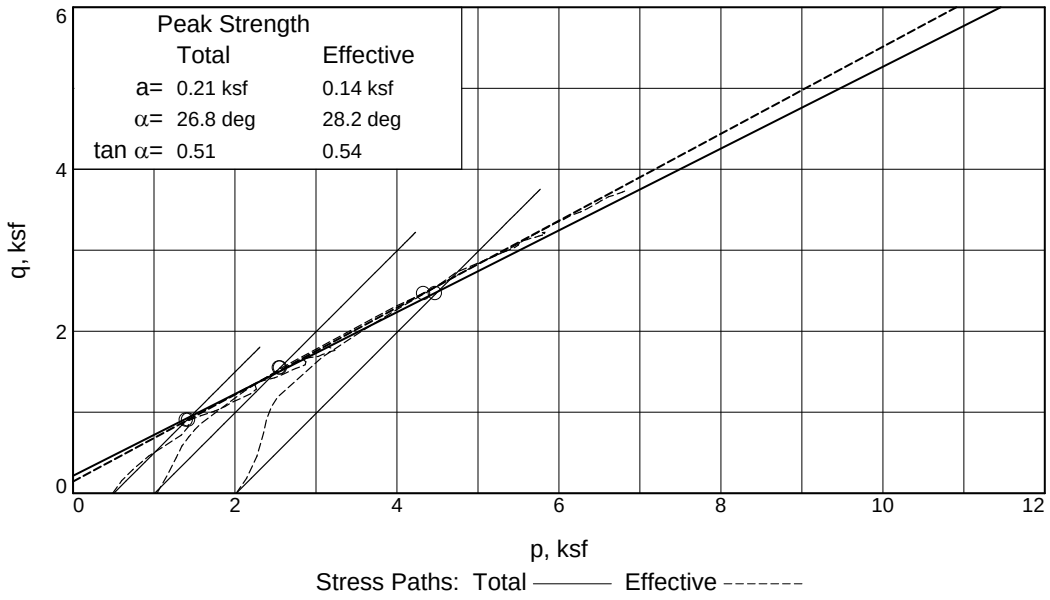
Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-1 **Depth:** 0 - 15 ft **Sample Number:** Log 342

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:10 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-1
Depth: 0 - 15 ft **Sample Number:** Log 342
Description: USCS: SILTY, CLAYEY SAND (SC-SM); AASHTO: A-2-4
Remarks: The specimens failed in bulging. MDD=122.5pcf at 10.2% moisture (D698). ASTM D4767.
Type of Sample: Romolded to appr.95%MDD
Assumed Specific Gravity=2.65 **LL=**21 **PL=**15 **PI=**6
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	183.310			1311.690
Moisture content: Dry soil+tare, gms.	166.960			1141.630
Moisture content: Tare, gms.	6.770			11.820
Moisture, %	10.2	15.1	15.1	15.1
Moist specimen weight, gms.	1244.40			
Diameter, in.	2.861	2.845	2.845	
Area, in.²	6.428	6.357	6.356	
Height, in.	5.739	5.723	5.723	
Net decrease in height, in.		0.016	0.000	
Net decrease in water volume, cc.			0.100	
Wet density, pcf	128.5	136.1	136.1	
Dry density, pcf	116.6	118.2	118.3	
Void ratio	0.4187	0.3991	0.3989	
Saturation, %	64.6	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 93.50 psi (13.46 ksf)
Consolidation back pressure = 90.00 psi (12.96 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 1.80 ksf **at reading no.** 7
Ult. Stress = 3.61 ksf **at reading no.** 33

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	0.49	0.49	1.00	90.10	0.49	0.00
1	0.0048	13.600	13.6	0.1	0.31	0.45	0.75	1.69	90.40	0.60	0.15
2	0.0096	25.600	25.6	0.2	0.58	0.45	1.03	2.30	90.40	0.74	0.29
3	0.0143	33.800	33.8	0.2	0.76	0.46	1.22	2.66	90.30	0.84	0.38
4	0.0189	40.500	40.5	0.3	0.91	0.48	1.39	2.92	90.20	0.93	0.46
5	0.0475	63.700	63.7	0.8	1.43	0.62	2.05	3.31	89.20	1.33	0.72
6	0.0768	73.100	73.1	1.3	1.63	0.60	2.24	3.70	89.30	1.42	0.82
7	0.1065	80.800	80.8	1.9	1.80	0.53	2.33	4.37	89.80	1.43	0.90
8	0.1359	86.400	86.4	2.4	1.91	0.62	2.53	4.09	89.20	1.57	0.96
9	0.1654	92.100	92.1	2.9	2.03	0.73	2.76	3.76	88.40	1.75	1.01
10	0.1955	97.800	97.8	3.4	2.14	0.81	2.95	3.65	87.90	1.88	1.07
11	0.2254	103.900	103.9	3.9	2.26	0.85	3.11	3.66	87.60	1.98	1.13
12	0.2548	108.700	108.7	4.5	2.35	0.91	3.26	3.59	87.20	2.08	1.18
13	0.2842	114.000	114.0	5.0	2.45	0.96	3.42	3.54	86.80	2.19	1.23
14	0.3139	120.100	120.1	5.5	2.57	0.98	3.55	3.63	86.70	2.27	1.29
15	0.3438	125.800	125.8	6.0	2.68	0.91	3.59	3.95	87.20	2.25	1.34
16	0.3732	130.300	130.3	6.5	2.76	0.92	3.68	3.99	87.10	2.30	1.38
17	0.4027	135.300	135.3	7.0	2.85	1.07	3.92	3.67	86.10	2.49	1.42
18	0.4324	140.000	140.0	7.6	2.93	1.12	4.06	3.61	85.70	2.59	1.47
19	0.4618	144.600	144.6	8.1	3.01	1.17	4.18	3.58	85.40	2.67	1.51
20	0.4913	148.700	148.7	8.6	3.08	1.21	4.29	3.55	85.10	2.75	1.54
21	0.5207	151.900	151.9	9.1	3.13	1.25	4.38	3.50	84.80	2.82	1.56
22	0.5503	154.900	154.9	9.6	3.17	1.28	4.45	3.48	84.60	2.87	1.59
23	0.5802	159.400	159.4	10.1	3.25	1.25	4.50	3.59	84.80	2.88	1.62
24	0.6105	163.600	163.6	10.7	3.31	1.18	4.49	3.80	85.30	2.84	1.66
25	0.6404	166.400	166.4	11.2	3.35	1.24	4.59	3.70	84.90	2.91	1.67
26	0.6699	168.900	168.9	11.7	3.38	1.34	4.72	3.52	84.20	3.03	1.69
27	0.6995	172.300	172.3	12.2	3.43	1.37	4.79	3.50	84.00	3.08	1.71
28	0.7290	175.000	175.0	12.7	3.46	1.41	4.87	3.45	83.70	3.14	1.73
29	0.7588	177.900	177.9	13.3	3.50	1.43	4.92	3.45	83.60	3.17	1.75
30	0.7888	180.500	180.5	13.8	3.53	1.47	4.99	3.40	83.30	3.23	1.76
31	0.8191	183.600	183.6	14.3	3.56	1.44	5.00	3.48	83.50	3.22	1.78
32	0.8492	185.700	185.7	14.8	3.58	1.40	4.98	3.57	83.80	3.19	1.79
33	0.8791	188.100	188.1	15.4	3.61	1.35	4.96	3.66	84.10	3.16	1.80

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	201.960			1318.860
Moisture content: Dry soil+tare, gms.	183.870			1149.640
Moisture content: Tare, gms.	6.860			17.840
Moisture, %	10.2	15.1	15.0	15.0
Moist specimen weight, gms.	1247.60			
Diameter, in.	2.861	2.844	2.841	
Area, in.²	6.430	6.352	6.341	
Height, in.	5.748	5.743	5.739	
Net decrease in height, in.		0.005	0.004	
Net decrease in water volume, cc.			1.500	
Wet density, pcf	128.6	136.0	136.2	
Dry density, pcf	116.7	118.2	118.5	
Void ratio	0.4180	0.3997	0.3962	
Saturation, %	64.8	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 97.00 psi (13.97 ksf)
Consolidation back pressure = 90.00 psi (12.96 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 3.09 ksf **at reading no.** 8
Ult. Stress = 6.44 ksf **at reading no.** 34

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	1.04	1.04	1.00	89.80	1.04	0.00
1	0.0035	20.800	20.8	0.1	0.47	0.94	1.41	1.50	90.50	1.17	0.24
2	0.0059	38.700	38.7	0.1	0.88	0.84	1.71	2.05	91.20	1.27	0.44
3	0.0102	51.300	51.3	0.2	1.16	0.76	1.93	2.52	91.70	1.34	0.58
4	0.0149	61.300	61.3	0.3	1.39	0.73	2.12	2.89	91.90	1.43	0.69
5	0.0198	69.300	69.3	0.3	1.57	0.72	2.29	3.18	92.00	1.50	0.78
6	0.0245	75.800	75.8	0.4	1.71	0.72	2.43	3.38	92.00	1.58	0.86
7	0.0541	111.100	111.1	0.9	2.50	0.85	3.35	3.94	91.10	2.10	1.25
8	0.0831	137.900	137.9	1.4	3.09	1.02	4.11	4.02	89.90	2.57	1.54
9	0.1120	160.000	160.0	2.0	3.56	1.22	4.79	3.91	88.50	3.01	1.78
10	0.1410	179.000	179.0	2.5	3.97	1.40	5.36	3.84	87.30	3.38	1.98
11	0.1703	195.400	195.4	3.0	4.31	1.54	5.85	3.79	86.30	3.69	2.15
12	0.2001	210.000	210.0	3.5	4.60	1.67	6.27	3.76	85.40	3.97	2.30
13	0.2304	222.800	222.8	4.0	4.86	1.81	6.67	3.68	84.40	4.24	2.43
14	0.2606	234.400	234.4	4.5	5.08	1.93	7.01	3.63	83.60	4.47	2.54
15	0.2901	245.000	245.0	5.1	5.28	1.97	7.26	3.68	83.30	4.61	2.64
16	0.3193	254.000	254.0	5.6	5.45	2.00	7.45	3.72	83.10	4.73	2.72
17	0.3482	261.500	261.5	6.1	5.58	2.09	7.67	3.67	82.50	4.88	2.79
18	0.3776	269.000	269.0	6.6	5.71	2.17	7.88	3.62	81.90	5.03	2.85
19	0.4083	275.500	275.5	7.1	5.81	2.25	8.06	3.59	81.40	5.15	2.91
20	0.4392	281.600	281.6	7.7	5.91	2.30	8.21	3.56	81.00	5.26	2.95
21	0.4696	286.900	286.9	8.2	5.98	2.36	8.34	3.53	80.60	5.35	2.99
22	0.4994	292.700	292.7	8.7	6.07	2.42	8.49	3.51	80.20	5.45	3.03
23	0.5289	297.200	297.2	9.2	6.13	2.43	8.56	3.52	80.10	5.50	3.06
24	0.5582	301.400	301.4	9.7	6.18	2.42	8.60	3.55	80.20	5.51	3.09

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.5878	305.900	305.9	10.2	6.24	2.43	8.67	3.56	80.10	5.55	3.12
26	0.6182	309.200	309.2	10.8	6.27	2.48	8.74	3.53	79.80	5.61	3.13
27	0.6486	312.700	312.7	11.3	6.30	2.51	8.80	3.51	79.60	5.65	3.15
28	0.6788	315.700	315.7	11.8	6.32	2.55	8.87	3.48	79.30	5.71	3.16
29	0.7085	319.100	319.1	12.3	6.35	2.58	8.93	3.46	79.10	5.75	3.18
30	0.7376	322.100	322.1	12.9	6.37	2.61	8.98	3.45	78.90	5.79	3.19
31	0.7671	325.100	325.1	13.4	6.40	2.64	9.03	3.43	78.70	5.83	3.20
32	0.7968	328.200	328.2	13.9	6.42	2.61	9.02	3.46	78.90	5.82	3.21
33	0.8271	331.100	331.1	14.4	6.44	2.58	9.01	3.50	79.10	5.80	3.22
34	0.8572	333.600	333.6	14.9	6.44	2.61	9.05	3.47	78.90	5.83	3.22

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	115.140			1320.940
Moisture content: Dry soil+tare, gms.	105.100			1149.510
Moisture content: Tare, gms.	6.890			18.030
Moisture, %	10.2	15.5	15.2	15.2
Moist specimen weight, gms.	1250.00			
Diameter, in.	2.860	2.859	2.852	
Area, in.²	6.424	6.421	6.387	
Height, in.	5.748	5.738	5.730	
Net decrease in height, in.		0.010	0.008	
Net decrease in water volume, cc.			4.000	
Wet density, pcf	129.0	135.4	135.9	
Dry density, pcf	117.0	117.3	118.0	
Void ratio	0.4140	0.4108	0.4015	
Saturation, %	65.4	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 104.00 psi (14.98 ksf)

Consolidation back pressure = 90.00 psi (12.96 ksf)

Consolidation effective confining stress = 2.02 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 4.92 ksf **at reading no.** 10

Ult. Stress = 7.51 ksf **at reading no.** 33

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	2.02	2.02	1.00	90.00	2.02	0.00
1	0.0042	16.500	16.5	0.1	0.37	1.96	2.33	1.19	90.40	2.14	0.19
2	0.0088	40.600	40.6	0.2	0.91	1.81	2.73	1.50	91.40	2.27	0.46
3	0.0133	65.700	65.7	0.2	1.48	1.61	3.09	1.92	92.80	2.35	0.74
4	0.0182	82.300	82.3	0.3	1.85	1.47	3.32	2.26	93.80	2.39	0.92
5	0.0232	95.200	95.2	0.4	2.14	1.38	3.52	2.55	94.40	2.45	1.07
6	0.0279	105.600	105.6	0.5	2.37	1.34	3.71	2.77	94.70	2.52	1.18
7	0.0581	150.500	150.5	1.0	3.36	1.40	4.76	3.40	94.30	3.08	1.68
8	0.0877	181.300	181.3	1.5	4.02	1.57	5.59	3.56	93.10	3.58	2.01
9	0.1174	205.000	205.0	2.0	4.53	1.73	6.25	3.62	92.00	3.99	2.26
10	0.1466	224.100	224.1	2.6	4.92	1.87	6.79	3.63	91.00	4.33	2.46

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
11	0.1760	239.000	239.0	3.1	5.22	1.99	7.21	3.63	90.20	4.60	2.61
12	0.2056	253.200	253.2	3.6	5.50	2.10	7.61	3.62	89.40	4.85	2.75
13	0.2359	265.300	265.3	4.1	5.73	2.20	7.94	3.60	88.70	5.07	2.87
14	0.2662	275.400	275.4	4.6	5.92	2.32	8.24	3.55	87.90	5.28	2.96
15	0.2963	286.300	286.3	5.2	6.12	2.40	8.53	3.55	87.30	5.47	3.06
16	0.3261	296.400	296.4	5.7	6.30	2.46	8.76	3.56	86.90	5.61	3.15
17	0.3555	304.400	304.4	6.2	6.44	2.52	8.96	3.55	86.50	5.74	3.22
18	0.3847	312.000	312.0	6.7	6.56	2.58	9.14	3.55	86.10	5.86	3.28
19	0.4142	318.700	318.7	7.2	6.67	2.62	9.29	3.54	85.80	5.95	3.33
20	0.4444	325.100	325.1	7.8	6.76	2.68	9.44	3.52	85.40	6.06	3.38
21	0.4745	332.000	332.0	8.3	6.86	2.72	9.59	3.52	85.10	6.15	3.43
22	0.5046	337.900	337.9	8.8	6.95	2.79	9.74	3.49	84.60	6.27	3.47
23	0.5343	343.900	343.9	9.3	7.03	2.84	9.87	3.48	84.30	6.35	3.51
24	0.5928	354.800	354.8	10.3	7.17	2.89	10.07	3.48	83.90	6.48	3.59
25	0.6225	359.400	359.4	10.9	7.22	2.91	10.13	3.48	83.80	6.52	3.61
26	0.6526	364.600	364.6	11.4	7.28	2.94	10.22	3.48	83.60	6.58	3.64
27	0.6827	368.700	368.7	11.9	7.32	2.95	10.27	3.48	83.50	6.61	3.66
28	0.7129	372.700	372.7	12.4	7.36	3.00	10.35	3.46	83.20	6.67	3.68
29	0.7425	377.400	377.4	13.0	7.41	3.04	10.44	3.44	82.90	6.74	3.70
30	0.7718	381.200	381.2	13.5	7.44	3.07	10.50	3.42	82.70	6.79	3.72
31	0.8013	384.700	384.7	14.0	7.46	3.08	10.54	3.42	82.60	6.81	3.73
32	0.8311	388.300	388.3	14.5	7.48	3.08	10.57	3.43	82.60	6.82	3.74
33	0.8612	391.800	391.8	15.0	7.51	3.08	10.59	3.44	82.60	6.83	3.75

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

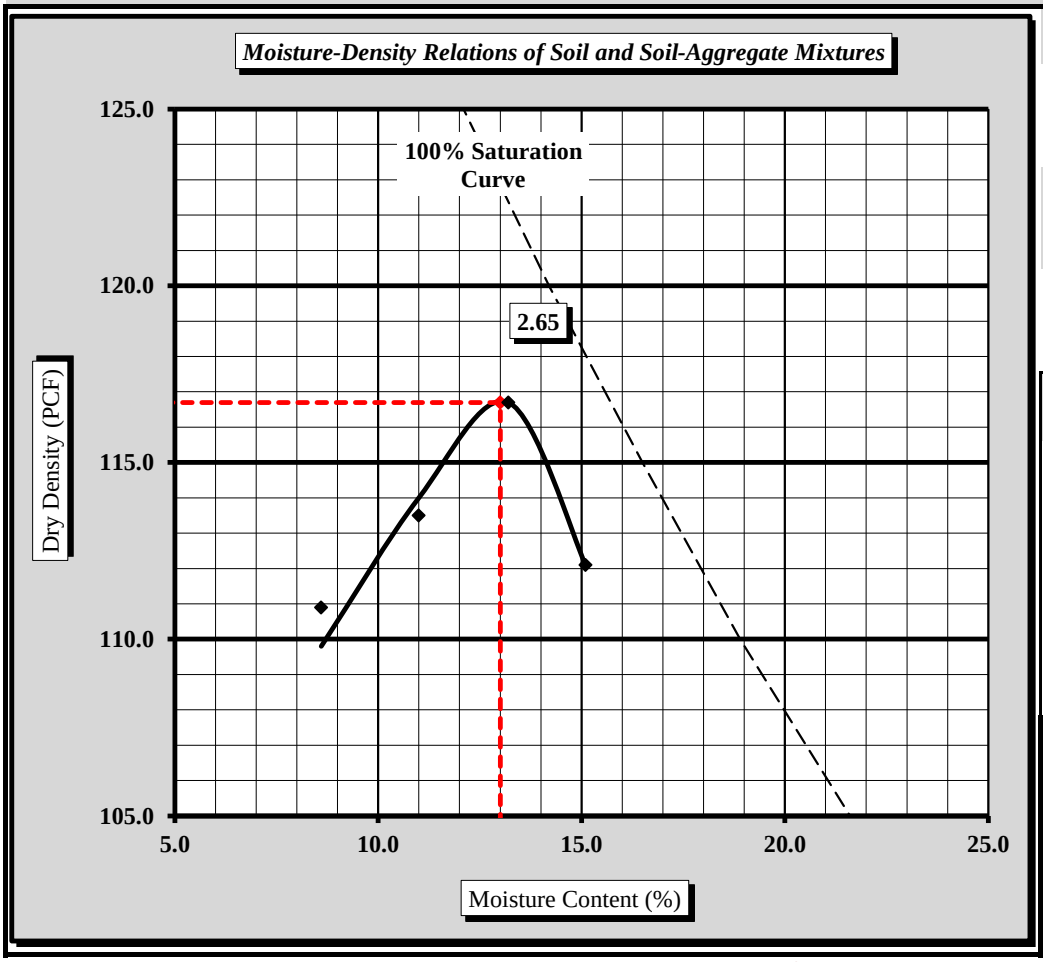
Sample Log No.: 343

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

S&ME Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/27/14 - 11/1/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-5		
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		A-6

Maximum Dry Density **116.7** **PCF.** **Optimum Moisture Content** **13.0%**

ASTM D698 - - Method B



Soil Properties

Natural Moisture Content	**13.8%**
Liquid Limit	**33**
Plastic Limit	**17**
Plastic Index	**16**

% Passing

3/8"	97.9%

Oversize Fraction

Bulk Gravity	
Absorption	
% Oversize	**NA**
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 D698, D422, D4318, D2487; AASTHO M145

The specific gravity value of the 100% saturation curve is assumed.

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:343

Sieve Analysis of Soils

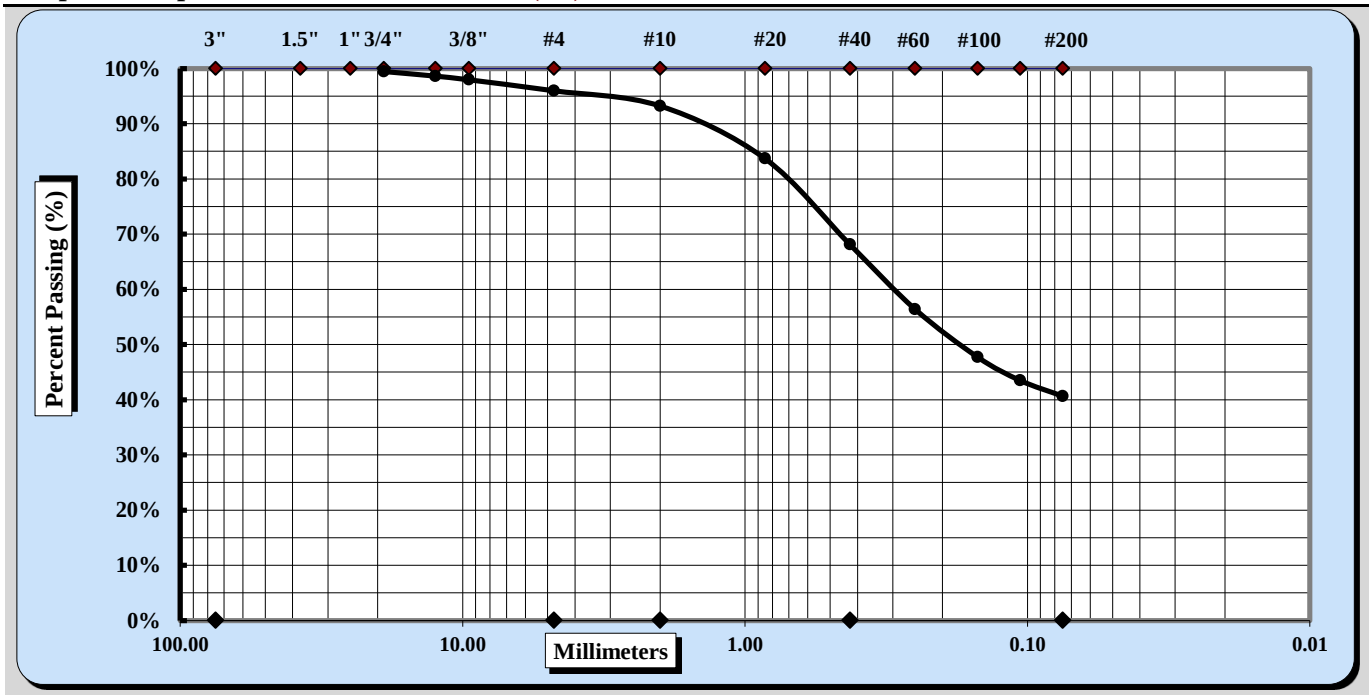
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/27/14-10/30/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Sample No: Bulk		
		Depth:	0 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	2.8%	Fine Sand	27.5%
Gravel	4.0%	Medium Sand	25.1%	Silt & Clay	40.6%
Liquid Limit	33	Plastic Limit	17	Plastic Index	16

Coarse Sand	2.8%	Medium Sand	25.1%	Fine Sand	27.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

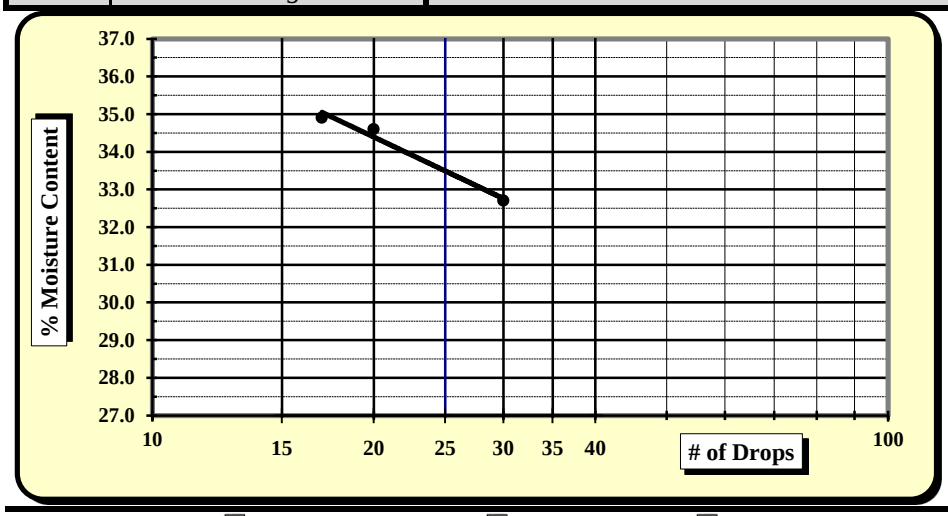
Log No.:343 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/4/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-5	Sample No: Bulk		
		Depth: 0 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	14	22	10				9	19	
A	Tare Weight	15.53	15.47	15.49				15.50	15.49	
B	Wet Soil Weight + A	28.79	29.45	30.70				24.14	24.71	
C	Dry Soil Weight + A	25.36	25.86	26.95				22.88	23.37	
D	Water Weight (B-C)	3.43	3.59	3.75				1.26	1.34	
E	Dry Soil Weight (C-A)	9.83	10.39	11.46				7.38	7.88	
F	% Moisture (D/E)*100	34.9%	34.6%	32.7%				17.1%	17.0%	
N	# OF DROPS	17	20	30				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**17.1%**		



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	**33**
Plastic Limit	**17**
Plastic Index	**16**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/4/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

pH of Soil

AASHTO T 289

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/2/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-5	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		**A-6**

Equipment:

Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/14*	*Due:*	*3/17/15*
Sieve:	*#10*	*S&ME ID#*	*2487*	*Cal. Date:*	*9/4/14*	*Due:*	*3/4/15*
pH Meter:		*S&ME ID#*	*16576*	*Cal. Date:*	*12/2/14*		

pH Meter Calibration

Buffer Solution	***Results***
pH buffer 4.0	***4.01***
pH buffer 7.0	***7.00***
pH buffer 10.0	***10.01***
Buffer Temperature ^{0}C	***23.2°C***

Measuring pH of Soil

Beaker #: 11

Measurements	
Weight of Air Dry Soil (g)	***30.0***
Distilled Water (ml)	***30.0***
Temperature ^{0}C	***23.3°C***
pH Reading	***7.2***

Notes / Deviations / References: AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing

Michael D. Kelso — *Technician Name*
12/2/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
 — *Signature*
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-G57-1
Revision No. 0
Revision Date: 07/11/08
Sample Log No.: 343

Soil Resistivity

ASTM G57

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/12/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-5	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		**A-6**

Equipment:	*Standard Box*	*S&ME ID#*	*16577*		*Box Constant:*	*1*
Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/2014*	*Due:* *3/17/2015*
Oven		*S&ME ID#*	*12872*	*Cal. Date:*	*8/15/2014*	*Due:* *12/15/2014*
Decade Box (resistivity verification)		*S&ME ID#*	*19948*	*Cal. Date:*	*1/10/2014*	*Due:* *1/10/2015*

Moisture Content Determination

After 24-hr Condition

					Tare No.	***AA-9***	
				A	Tare Weight		32.02
				B	Wet Wt + Tare Wt		84.13
				C	Dry Wt. + Tare Wt.		73.10
				D	Water Weight	**B-C**	11.03
				E	Dry Weight	**C-A**	41.08
				F	**Moisture Content**	**100*D/E**	**26.9%**

Resistivity (ohms - cm)

After 24-hr Condition

			M	Multiplier Dial Setting	1000
			B	Balance Dial Reading to Null	2.6
			R	**RESISTIVITY (Ω-cm), (MxBxBC)**	**2,600**

Notes / Deviations / References:

24-hr conditioning achieved by saturating the soil with distilled water for 24 hours prior to testing.

Miller 400A Resistivity Meter, ID#26821

ASTM G57: Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

N. Randy Rainwater	11/12/2014		
Technician Name	*17113*		
N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Moisture, Ash, and Organic Matter

Sample Log No.:343 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1431-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/7/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-5	Sample No.:	Bulk
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		A-6

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	B
t	Tare Weight	*grams*	19.45
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	57.69
c	Ash Weight + Tare Wt.	*grams*	56.99
C	Ash Weight	*c-t*	37.54
B	Mass of Oven Dry Specimen	*(b-t)*	38.24
D	***% Ash Content***	*(C/B)*100*	**98.2%**
	% Organic Matter	*100-D*	**1.8%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

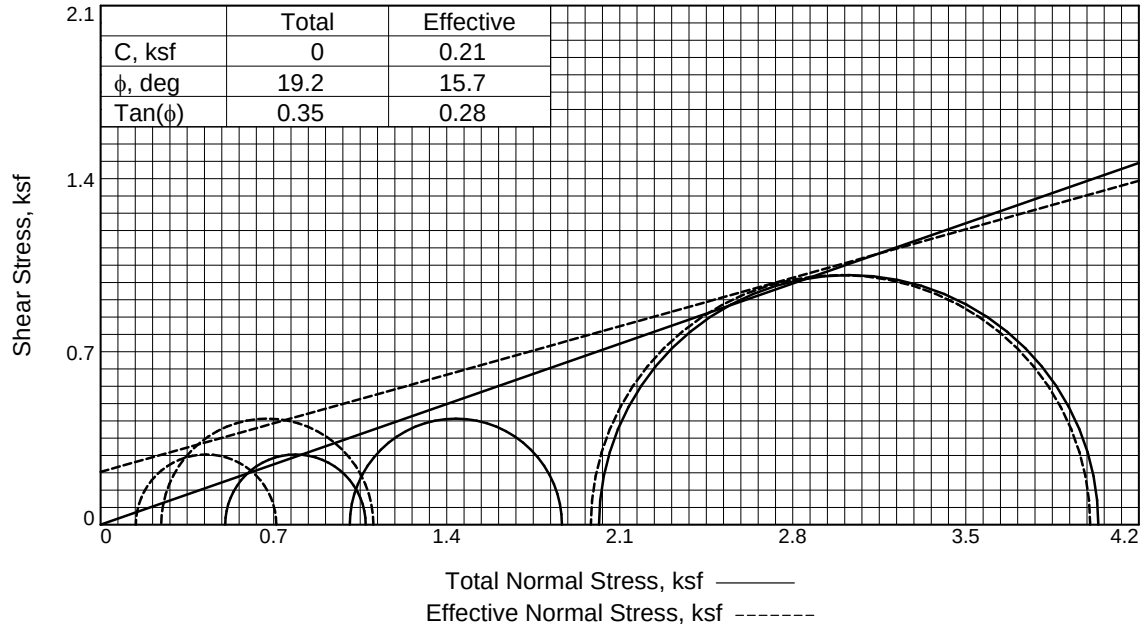
Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

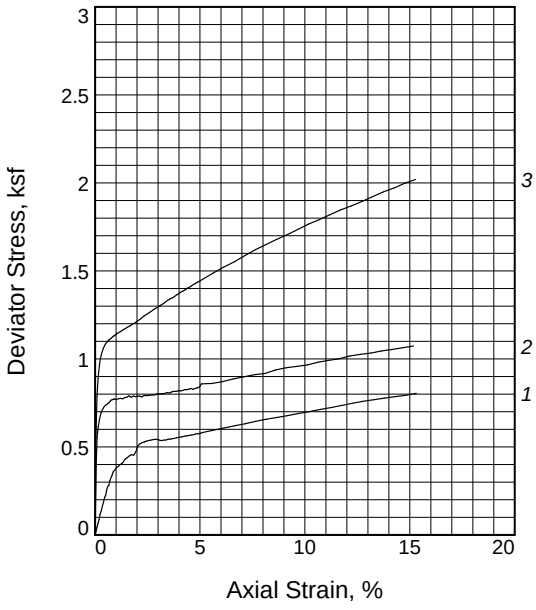
Derek Baker — *Technician Name*
11/7/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/1/2014 — *Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

	Total	Effective
C, ksf	0	0.21
ϕ, deg	19.2	15.7
Tan(ϕ)	0.35	0.28





Specimen No.		1	2	3
Initial	Water Content, %	13.2	13.6	13.4
	Dry Density, pcf	110.7	110.8	110.4
	Saturation, %	71.0	72.8	71.2
	Void Ratio	0.4943	0.4937	0.4982
	Diameter, in.	2.857	2.856	2.872
	Height, in.	6.017	6.001	5.957
At Test	Water Content, %	17.4	17.3	15.3
	Dry Density, pcf	113.1	113.4	117.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4624	0.4595	0.4067
	Diameter, in.	2.851	2.833	2.801
	Height, in.	5.914	5.959	5.883
Strain rate, %/min.		0.25	0.25	0.25
Back Pressure, psi		70.00	70.00	70.00
Cell Pressure, psi		73.50	77.00	84.00
Fail. Stress, ksf		0.57	0.86	2.02
Total Pore Pr., ksf		10.44	10.84	10.11
Ult. Stress, ksf		0.80	1.07	2.02
Total Pore Pr., ksf		10.40	10.77	10.11
$\bar{\sigma}_1$ Failure, ksf		0.71	1.10	4.00
$\bar{\sigma}_3$ Failure, ksf		0.14	0.25	1.98

Type of Test:
CU with Pore Pressures

Sample Type: Remolded to appr.95%MDD

Description: USCS: CLAYEY SAND (SC); AASHTO: A-6

LL= 33 **PL=** 17 **PI=** 16

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. MDD=116.7pcf at 13.0% moisture (D698). ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

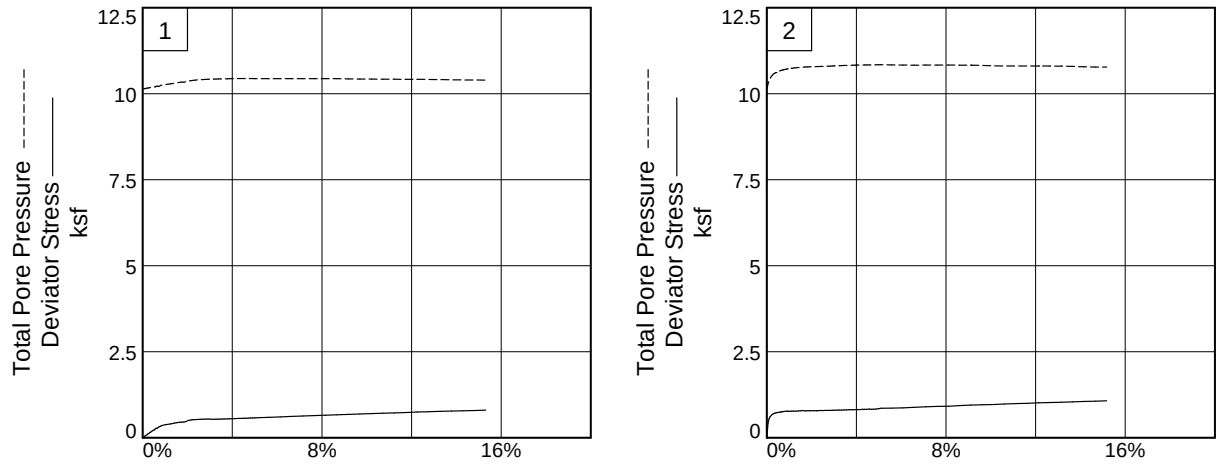
Location: B-5

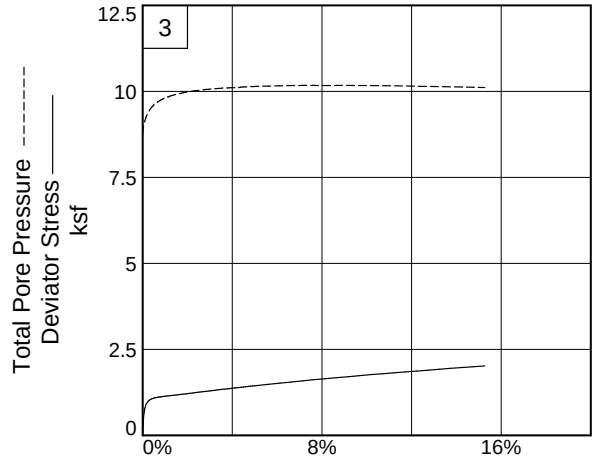
Sample Number: Log 343 **Depth:** 0 - 15 ft

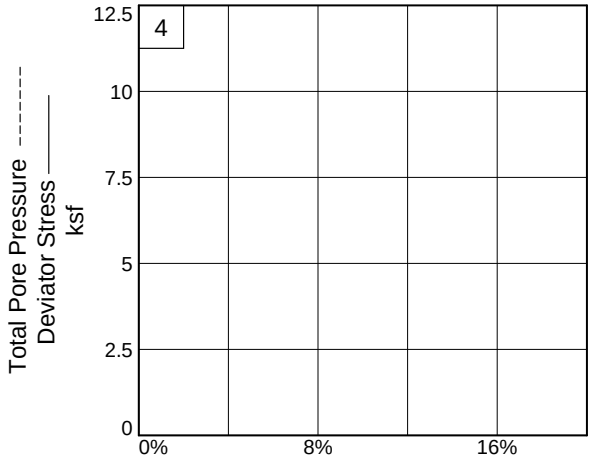
Proj. No.: 1461-14-046

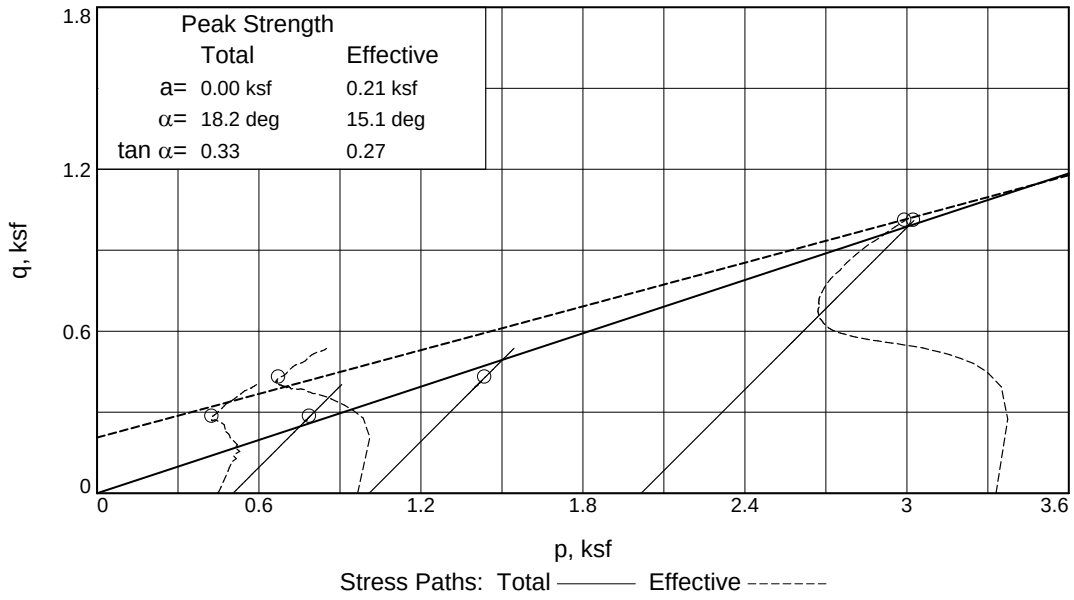
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14









Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-5 **Depth:** 0 - 15 ft **Sample Number:** Log 343

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:11 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-5
Depth: 0 - 15 ft **Sample Number:** Log 343
Description: USCS: CLAYEY SAND (SC); AASHTO: A-6
Remarks: The specimens failed in bulging. MDD=116.7pcf at 13.0% moisture (D698). ASTM D4767.
Type of Sample: Remolded to appr.95%MDD
Assumed Specific Gravity=2.65 **LL=**33 **PL=**17 **PI=**16
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	255.300			1331.510
Moisture content: Dry soil+tare, gms.	226.240			1136.330
Moisture content: Tare, gms.	6.800			17.770
Moisture, %	13.2	17.5	17.4	17.4
Moist specimen weight, gms.	1269.20			
Diameter, in.	2.857	2.844	2.851	
Area, in.²	6.409	6.355	6.382	
Height, in.	6.017	5.947	5.914	
Net decrease in height, in.		0.070	0.033	
Net decrease in water volume, cc.			0.800	
Wet density, pcf	125.4	132.8	132.9	
Dry density, pcf	110.7	113.0	113.1	
Void ratio	0.4943	0.4643	0.4624	
Saturation, %	71.0	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 73.50 psi (10.58 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.57 ksf **at reading no.** 51
Ult. Stress = 0.80 ksf **at reading no.** 76

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	2.975	0.0	0.0	0.00	0.45	0.45	1.00	70.40	0.45	0.00
1	0.0030	3.885	0.9	0.1	0.02	0.44	0.46	1.05	70.42	0.45	0.01
2	0.0053	4.943	2.0	0.1	0.04	0.44	0.48	1.10	70.47	0.46	0.02
3	0.0085	5.955	3.0	0.1	0.07	0.43	0.50	1.16	70.51	0.46	0.03
4	0.0117	7.050	4.1	0.2	0.09	0.42	0.52	1.22	70.56	0.47	0.05
5	0.0142	8.194	5.2	0.2	0.12	0.42	0.53	1.28	70.61	0.48	0.06
6	0.0178	9.224	6.2	0.3	0.14	0.41	0.55	1.34	70.65	0.48	0.07
7	0.0210	10.322	7.3	0.4	0.17	0.40	0.57	1.41	70.70	0.49	0.08
8	0.0239	11.306	8.3	0.4	0.19	0.40	0.58	1.47	70.75	0.49	0.09
9	0.0272	12.579	9.6	0.5	0.22	0.39	0.60	1.56	70.80	0.50	0.11
10	0.0300	12.992	10.0	0.5	0.22	0.38	0.61	1.59	70.84	0.50	0.11
11	0.0329	14.409	11.4	0.6	0.26	0.39	0.64	1.66	70.81	0.52	0.13
12	0.0356	15.261	12.3	0.6	0.28	0.37	0.64	1.75	70.94	0.51	0.14
13	0.0390	15.566	12.6	0.7	0.28	0.36	0.65	1.77	70.97	0.51	0.14
14	0.0420	16.824	13.8	0.7	0.31	0.37	0.68	1.83	70.91	0.53	0.16
15	0.0476	18.092	15.1	0.8	0.34	0.34	0.68	1.99	71.13	0.51	0.17
16	0.0511	18.972	16.0	0.9	0.36	0.34	0.70	2.05	71.13	0.52	0.18
17	0.0604	20.058	17.1	1.0	0.38	0.32	0.70	2.20	71.29	0.51	0.19
18	0.0723	20.991	18.0	1.2	0.40	0.30	0.70	2.35	71.43	0.50	0.20
19	0.0780	21.407	18.4	1.3	0.41	0.29	0.70	2.42	71.50	0.49	0.21
20	0.0840	22.260	19.3	1.4	0.43	0.28	0.71	2.55	71.58	0.49	0.21
21	0.0904	22.748	19.8	1.5	0.44	0.27	0.71	2.64	71.64	0.49	0.22
22	0.0968	23.242	20.3	1.6	0.45	0.26	0.71	2.76	71.72	0.48	0.22
23	0.1025	23.560	20.6	1.7	0.46	0.25	0.71	2.83	71.77	0.48	0.23
24	0.1087	23.448	20.5	1.8	0.45	0.25	0.70	2.84	71.79	0.47	0.23
25	0.1147	24.324	21.3	1.9	0.47	0.24	0.71	2.98	71.84	0.48	0.24
26	0.1208	25.902	22.9	2.0	0.51	0.22	0.72	3.33	71.99	0.47	0.25
27	0.1269	26.444	23.5	2.1	0.52	0.21	0.72	3.53	72.08	0.46	0.26
28	0.1325	26.765	23.8	2.2	0.52	0.20	0.72	3.69	72.15	0.46	0.26
29	0.1390	26.942	24.0	2.4	0.53	0.19	0.72	3.81	72.19	0.45	0.26
30	0.1454	27.220	24.2	2.5	0.53	0.18	0.72	3.93	72.24	0.45	0.27
31	0.1510	27.379	24.4	2.6	0.54	0.18	0.71	4.03	72.27	0.45	0.27
32	0.1569	27.524	24.5	2.7	0.54	0.17	0.71	4.12	72.30	0.44	0.27
33	0.1635	27.668	24.7	2.8	0.54	0.17	0.71	4.21	72.33	0.44	0.27
34	0.1692	27.758	24.8	2.9	0.54	0.17	0.71	4.28	72.35	0.44	0.27
35	0.1752	27.791	24.8	3.0	0.54	0.16	0.71	4.33	72.37	0.43	0.27
36	0.1812	27.597	24.6	3.1	0.54	0.16	0.70	4.35	72.38	0.43	0.27
37	0.1874	27.500	24.5	3.2	0.54	0.16	0.69	4.37	72.40	0.43	0.27
38	0.1935	27.662	24.7	3.3	0.54	0.16	0.70	4.44	72.41	0.43	0.27
39	0.1998	27.712	24.7	3.4	0.54	0.16	0.69	4.48	72.42	0.42	0.27
40	0.2060	27.962	25.0	3.5	0.54	0.15	0.70	4.55	72.43	0.43	0.27
41	0.2119	28.001	25.0	3.6	0.54	0.15	0.70	4.59	72.45	0.42	0.27
42	0.2175	28.157	25.2	3.7	0.55	0.15	0.70	4.63	72.45	0.42	0.27
43	0.2243	28.262	25.3	3.8	0.55	0.15	0.70	4.69	72.47	0.42	0.27
44	0.2299	28.440	25.5	3.9	0.55	0.15	0.70	4.74	72.47	0.42	0.28
45	0.2361	28.585	25.6	4.0	0.55	0.15	0.70	4.80	72.49	0.42	0.28
46	0.2421	28.683	25.7	4.1	0.56	0.15	0.70	4.82	72.49	0.42	0.28

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.2480	28.863	25.9	4.2	0.56	0.14	0.70	4.87	72.49	0.42	0.28
48	0.2541	29.030	26.1	4.3	0.56	0.14	0.71	4.92	72.50	0.42	0.28
49	0.2605	29.112	26.1	4.4	0.56	0.14	0.71	4.93	72.50	0.43	0.28
50	0.2665	29.258	26.3	4.5	0.57	0.14	0.71	4.97	72.51	0.43	0.28
51	0.2725	29.374	26.4	4.6	0.57	0.14	0.71	4.99	72.51	0.43	0.28
52	0.2784	29.467	26.5	4.7	0.57	0.14	0.71	4.97	72.50	0.43	0.28
53	0.2843	29.710	26.7	4.8	0.57	0.14	0.72	4.99	72.50	0.43	0.29
54	0.2909	29.770	26.8	4.9	0.57	0.14	0.72	4.99	72.50	0.43	0.29
55	0.2967	29.918	26.9	5.0	0.58	0.14	0.72	4.99	72.49	0.43	0.29
56	0.3027	30.173	27.2	5.1	0.58	0.15	0.73	5.00	72.49	0.44	0.29
57	0.3327	30.907	27.9	5.6	0.59	0.15	0.74	5.02	72.47	0.45	0.30
58	0.3630	31.661	28.7	6.1	0.61	0.15	0.75	5.12	72.48	0.45	0.30
59	0.3938	32.461	29.5	6.7	0.62	0.15	0.77	5.19	72.47	0.46	0.31
60	0.4234	33.137	30.2	7.2	0.63	0.15	0.78	5.27	72.47	0.46	0.32
61	0.4529	33.961	31.0	7.7	0.65	0.15	0.79	5.36	72.47	0.47	0.32
62	0.4832	34.709	31.7	8.2	0.66	0.15	0.81	5.45	72.47	0.48	0.33
63	0.5129	35.362	32.4	8.7	0.67	0.15	0.82	5.50	72.47	0.48	0.33
64	0.5431	36.072	33.1	9.2	0.68	0.15	0.83	5.42	72.44	0.49	0.34
65	0.5734	36.851	33.9	9.7	0.69	0.16	0.85	5.38	72.41	0.50	0.35
66	0.6041	37.580	34.6	10.2	0.70	0.16	0.86	5.40	72.39	0.51	0.35
67	0.6343	38.387	35.4	10.7	0.71	0.16	0.87	5.42	72.38	0.52	0.36
68	0.6644	39.097	36.1	11.2	0.72	0.16	0.89	5.43	72.36	0.53	0.36
69	0.6948	39.923	36.9	11.7	0.74	0.16	0.90	5.46	72.35	0.53	0.37
70	0.7248	40.748	37.8	12.3	0.75	0.17	0.91	5.50	72.35	0.54	0.37
71	0.7549	41.532	38.6	12.8	0.76	0.17	0.93	5.51	72.33	0.55	0.38
72	0.7850	42.236	39.3	13.3	0.77	0.18	0.94	5.39	72.28	0.56	0.38
73	0.8151	42.955	40.0	13.8	0.78	0.18	0.96	5.32	72.25	0.57	0.39
74	0.8453	43.601	40.6	14.3	0.79	0.18	0.97	5.30	72.23	0.58	0.39
75	0.8755	44.265	41.3	14.8	0.79	0.19	0.98	5.26	72.21	0.58	0.40
76	0.9055	45.073	42.1	15.3	0.80	0.19	0.99	5.27	72.19	0.59	0.40

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	239.500			1329.460
Moisture content: Dry soil+tare, gms.	220.810			1135.610
Moisture content: Tare, gms.	83.000			17.560
Moisture, %	13.6	17.7	17.3	17.3
Moist specimen weight, gms.	1269.50			
Diameter, in.	2.856	2.839	2.833	
Area, in.²	6.408	6.329	6.305	
Height, in.	6.001	5.970	5.959	
Net decrease in height, in.		0.031	0.011	
Net decrease in water volume, cc.			3.500	
Wet density, pcf	125.8	132.6	133.0	
Dry density, pcf	110.8	112.7	113.4	
Void ratio	0.4937	0.4678	0.4595	
Saturation, %	72.8	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 77.00 psi (11.09 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.86 ksf **at reading no.** 60
Ult. Stress = 1.07 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.791	0.0	0.0	0.00	0.97	0.97	1.00	70.30	0.97	0.00
1	0.0033	21.871	18.1	0.1	0.41	0.80	1.22	1.51	71.42	1.01	0.21
2	0.0060	28.176	24.4	0.1	0.56	0.71	1.26	1.79	72.08	0.99	0.28
3	0.0090	30.710	26.9	0.2	0.61	0.64	1.26	1.96	72.54	0.95	0.31
4	0.0122	32.431	28.6	0.2	0.65	0.59	1.24	2.11	72.90	0.92	0.33
5	0.0151	33.573	29.8	0.3	0.68	0.55	1.23	2.23	73.18	0.89	0.34
6	0.0176	34.449	30.7	0.3	0.70	0.52	1.22	2.35	73.40	0.87	0.35
7	0.0210	35.110	31.3	0.4	0.71	0.49	1.21	2.44	73.56	0.85	0.36
8	0.0241	35.555	31.8	0.4	0.72	0.47	1.20	2.52	73.71	0.84	0.36
9	0.0265	35.914	32.1	0.4	0.73	0.46	1.19	2.60	73.83	0.82	0.37
10	0.0297	36.240	32.4	0.5	0.74	0.44	1.18	2.67	73.94	0.81	0.37
11	0.0329	36.369	32.6	0.6	0.74	0.43	1.17	2.73	74.03	0.80	0.37
12	0.0365	36.734	32.9	0.6	0.75	0.42	1.16	2.79	74.10	0.79	0.37
13	0.0394	36.908	33.1	0.7	0.75	0.41	1.16	2.85	74.18	0.78	0.38
14	0.0426	37.228	33.4	0.7	0.76	0.40	1.16	2.91	74.24	0.78	0.38
15	0.0450	37.552	33.8	0.8	0.77	0.39	1.15	2.96	74.30	0.77	0.38
16	0.0487	37.696	33.9	0.8	0.77	0.38	1.15	3.01	74.35	0.77	0.38
17	0.0516	37.821	34.0	0.9	0.77	0.37	1.15	3.05	74.40	0.76	0.39
18	0.0544	37.955	34.2	0.9	0.77	0.37	1.14	3.10	74.44	0.76	0.39
19	0.0566	37.869	34.1	0.9	0.77	0.36	1.13	3.12	74.48	0.75	0.39
20	0.0602	37.827	34.0	1.0	0.77	0.36	1.13	3.15	74.52	0.74	0.38
21	0.0666	38.078	34.3	1.1	0.77	0.35	1.12	3.23	74.58	0.74	0.39
22	0.0726	38.168	34.4	1.2	0.78	0.34	1.12	3.28	74.64	0.73	0.39
23	0.0785	38.103	34.3	1.3	0.77	0.33	1.11	3.33	74.69	0.72	0.39
24	0.0845	38.459	34.7	1.4	0.78	0.33	1.11	3.39	74.74	0.72	0.39

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.0905	38.625	34.8	1.5	0.78	0.32	1.10	3.44	74.77	0.71	0.39
26	0.0962	38.961	35.2	1.6	0.79	0.32	1.11	3.49	74.80	0.71	0.40
27	0.1024	38.621	34.8	1.7	0.78	0.31	1.09	3.51	74.84	0.70	0.39
28	0.1088	39.004	35.2	1.8	0.79	0.31	1.10	3.56	74.86	0.70	0.39
29	0.1147	38.858	35.1	1.9	0.79	0.31	1.09	3.57	74.87	0.70	0.39
30	0.1203	38.992	35.2	2.0	0.79	0.30	1.09	3.59	74.89	0.70	0.39
31	0.1264	39.081	35.3	2.1	0.79	0.30	1.09	3.62	74.91	0.70	0.39
32	0.1330	38.905	35.1	2.2	0.78	0.30	1.08	3.62	74.92	0.69	0.39
33	0.1388	39.323	35.5	2.3	0.79	0.30	1.09	3.66	74.93	0.69	0.40
34	0.1451	39.324	35.5	2.4	0.79	0.30	1.09	3.68	74.95	0.69	0.40
35	0.1513	39.400	35.6	2.5	0.79	0.29	1.09	3.70	74.96	0.69	0.40
36	0.1570	39.499	35.7	2.6	0.79	0.29	1.09	3.72	74.98	0.69	0.40
37	0.1630	39.596	35.8	2.7	0.80	0.29	1.08	3.75	74.99	0.69	0.40
38	0.1688	39.649	35.9	2.8	0.80	0.29	1.08	3.77	75.01	0.68	0.40
39	0.1753	39.900	36.1	2.9	0.80	0.28	1.08	3.83	75.03	0.68	0.40
40	0.1806	39.953	36.2	3.0	0.80	0.28	1.08	3.86	75.06	0.68	0.40
41	0.1870	40.031	36.2	3.1	0.80	0.28	1.08	3.89	75.08	0.68	0.40
42	0.1935	40.126	36.3	3.2	0.80	0.27	1.08	3.92	75.09	0.68	0.40
43	0.1994	40.237	36.4	3.3	0.80	0.27	1.08	3.96	75.11	0.67	0.40
44	0.2054	40.499	36.7	3.4	0.81	0.27	1.08	4.02	75.14	0.67	0.40
45	0.2117	40.408	36.6	3.6	0.81	0.27	1.07	4.04	75.16	0.67	0.40
46	0.2177	40.752	37.0	3.7	0.81	0.26	1.08	4.08	75.17	0.67	0.41
47	0.2239	40.925	37.1	3.8	0.82	0.26	1.08	4.12	75.18	0.67	0.41
48	0.2295	40.937	37.1	3.9	0.82	0.26	1.08	4.14	75.20	0.67	0.41
49	0.2358	41.092	37.3	4.0	0.82	0.26	1.08	4.17	75.21	0.67	0.41
50	0.2420	41.159	37.4	4.1	0.82	0.26	1.08	4.19	75.22	0.67	0.41
51	0.2481	41.283	37.5	4.2	0.82	0.25	1.08	4.22	75.23	0.67	0.41
52	0.2541	41.572	37.8	4.3	0.83	0.25	1.08	4.26	75.24	0.67	0.41
53	0.2602	41.570	37.8	4.4	0.83	0.25	1.08	4.27	75.25	0.66	0.41
54	0.2659	41.753	38.0	4.5	0.83	0.25	1.08	4.30	75.26	0.67	0.41
55	0.2726	41.998	38.2	4.6	0.83	0.25	1.08	4.33	75.26	0.67	0.42
56	0.2782	41.749	38.0	4.7	0.83	0.25	1.08	4.32	75.27	0.66	0.41
57	0.2842	42.067	38.3	4.8	0.83	0.25	1.08	4.36	75.28	0.66	0.42
58	0.2902	42.257	38.5	4.9	0.84	0.25	1.08	4.37	75.28	0.67	0.42
59	0.2964	42.521	38.7	5.0	0.84	0.25	1.09	4.41	75.29	0.67	0.42
60	0.3025	43.376	39.6	5.1	0.86	0.25	1.10	4.50	75.30	0.67	0.43
61	0.3321	43.710	39.9	5.6	0.86	0.25	1.11	4.45	75.27	0.68	0.43
62	0.3623	44.410	40.6	6.1	0.87	0.26	1.13	4.41	75.22	0.69	0.44
63	0.3924	45.356	41.6	6.6	0.89	0.26	1.14	4.44	75.21	0.70	0.44
64	0.4227	46.160	42.4	7.1	0.90	0.26	1.16	4.50	75.22	0.71	0.45
65	0.4530	46.937	43.1	7.6	0.91	0.26	1.17	4.55	75.22	0.71	0.46
66	0.4826	47.514	43.7	8.1	0.92	0.26	1.17	4.58	75.22	0.72	0.46
67	0.5125	48.680	44.9	8.6	0.94	0.26	1.19	4.64	75.21	0.73	0.47
68	0.5427	49.561	45.8	9.1	0.95	0.26	1.21	4.66	75.19	0.74	0.48
69	0.5729	50.178	46.4	9.6	0.96	0.27	1.22	4.60	75.15	0.75	0.48
70	0.6028	50.868	47.1	10.1	0.97	0.28	1.24	4.50	75.08	0.76	0.48
71	0.6325	51.864	48.1	10.6	0.98	0.28	1.26	4.49	75.04	0.77	0.49

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
72	0.6626	52.664	48.9	11.1	0.99	0.28	1.27	4.53	75.05	0.78	0.50
73	0.6927	53.395	49.6	11.6	1.00	0.28	1.28	4.57	75.05	0.78	0.50
74	0.7230	54.445	50.7	12.1	1.02	0.28	1.30	4.61	75.05	0.79	0.51
75	0.7532	55.209	51.4	12.6	1.03	0.28	1.31	4.62	75.03	0.80	0.51
76	0.7833	55.908	52.1	13.1	1.03	0.29	1.32	4.61	75.01	0.80	0.52
77	0.8134	56.800	53.0	13.6	1.05	0.29	1.34	4.56	74.96	0.82	0.52
78	0.8436	57.552	53.8	14.2	1.05	0.31	1.36	4.45	74.88	0.83	0.53
79	0.8735	58.351	54.6	14.7	1.06	0.31	1.38	4.41	74.83	0.84	0.53
80	0.9041	59.196	55.4	15.2	1.07	0.31	1.39	4.42	74.82	0.85	0.54

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	169.000			1309.690
Moisture content: Dry soil+tare, gms.	149.870			1137.850
Moisture content: Tare, gms.	7.000			18.030
Moisture, %	13.4	16.6	15.3	15.3
Moist specimen weight, gms.	1268.60			
Diameter, in.	2.872	2.823	2.801	
Area, in.²	6.480	6.261	6.160	
Height, in.	5.957	5.930	5.883	
Net decrease in height, in.		0.027	0.047	
Net decrease in water volume, cc.			14.500	
Wet density, pcf	125.2	133.9	135.7	
Dry density, pcf	110.4	114.8	117.6	
Void ratio	0.4982	0.4410	0.4067	
Saturation, %	71.2	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 84.00 psi (12.10 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 2.02 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 2.02 ksf **at reading no.** 80

Ult. Stress = 2.02 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.355	0.0	0.0	0.00	3.33	3.33	1.00	60.87	3.33	0.00
1	0.0025	26.839	23.5	0.0	0.55	3.10	3.65	1.18	62.48	3.37	0.27
2	0.0056	37.075	33.7	0.1	0.79	2.96	3.74	1.27	63.47	3.35	0.39
3	0.0086	41.901	38.5	0.1	0.90	2.85	3.75	1.32	64.23	3.30	0.45
4	0.0120	44.577	41.2	0.2	0.96	2.77	3.73	1.35	64.80	3.25	0.48
5	0.0145	46.153	42.8	0.2	1.00	2.70	3.70	1.37	65.25	3.20	0.50
6	0.0177	47.366	44.0	0.3	1.03	2.65	3.67	1.39	65.62	3.16	0.51
7	0.0207	48.270	44.9	0.4	1.05	2.60	3.64	1.40	65.96	3.12	0.52
8	0.0233	48.944	45.6	0.4	1.06	2.56	3.62	1.42	66.24	3.09	0.53
9	0.0267	49.605	46.2	0.5	1.08	2.52	3.60	1.43	66.49	3.06	0.54
10	0.0293	50.050	46.7	0.5	1.09	2.49	3.57	1.44	66.72	3.03	0.54
11	0.0326	50.419	47.1	0.6	1.09	2.46	3.55	1.45	66.93	3.01	0.55

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.0357	50.727	47.4	0.6	1.10	2.43	3.53	1.45	67.11	2.98	0.55
13	0.0389	51.090	47.7	0.7	1.11	2.41	3.52	1.46	67.28	2.96	0.55
14	0.0416	51.283	47.9	0.7	1.11	2.39	3.50	1.47	67.43	2.94	0.56
15	0.0451	51.538	48.2	0.8	1.12	2.36	3.48	1.47	67.58	2.92	0.56
16	0.0480	51.774	48.4	0.8	1.12	2.35	3.47	1.48	67.71	2.91	0.56
17	0.0505	52.067	48.7	0.9	1.13	2.33	3.46	1.48	67.83	2.89	0.56
18	0.0536	52.196	48.8	0.9	1.13	2.31	3.44	1.49	67.94	2.88	0.57
19	0.0567	52.436	49.1	1.0	1.14	2.30	3.43	1.49	68.05	2.86	0.57
20	0.0593	52.662	49.3	1.0	1.14	2.28	3.42	1.50	68.15	2.85	0.57
21	0.0659	53.076	49.7	1.1	1.15	2.26	3.41	1.51	68.33	2.83	0.57
22	0.0720	53.423	50.1	1.2	1.16	2.23	3.39	1.52	68.49	2.81	0.58
23	0.0779	53.828	50.5	1.3	1.16	2.21	3.38	1.53	68.64	2.79	0.58
24	0.0839	54.197	50.8	1.4	1.17	2.19	3.37	1.53	68.76	2.78	0.59
25	0.0899	54.613	51.3	1.5	1.18	2.18	3.36	1.54	68.89	2.77	0.59
26	0.0959	54.931	51.6	1.6	1.19	2.16	3.35	1.55	68.99	2.75	0.59
27	0.1020	55.307	52.0	1.7	1.19	2.15	3.34	1.56	69.10	2.74	0.60
28	0.1081	55.721	52.4	1.8	1.20	2.13	3.33	1.56	69.19	2.73	0.60
29	0.1141	56.036	52.7	1.9	1.21	2.12	3.33	1.57	69.27	2.72	0.60
30	0.1194	56.486	53.1	2.0	1.22	2.11	3.33	1.58	69.36	2.72	0.61
31	0.1258	56.875	53.5	2.1	1.22	2.10	3.32	1.58	69.43	2.71	0.61
32	0.1318	57.406	54.1	2.2	1.24	2.09	3.32	1.59	69.50	2.71	0.62
33	0.1379	57.892	54.5	2.3	1.24	2.08	3.32	1.60	69.57	2.70	0.62
34	0.1437	58.272	54.9	2.4	1.25	2.07	3.32	1.61	69.63	2.70	0.63
35	0.1498	58.659	55.3	2.5	1.26	2.06	3.32	1.61	69.69	2.69	0.63
36	0.1558	59.098	55.7	2.6	1.27	2.05	3.32	1.62	69.74	2.69	0.63
37	0.1617	59.515	56.2	2.7	1.28	2.05	3.32	1.62	69.78	2.69	0.64
38	0.1679	59.979	56.6	2.9	1.29	2.04	3.33	1.63	69.84	2.68	0.64
39	0.1741	60.309	57.0	3.0	1.29	2.03	3.32	1.64	69.88	2.68	0.65
40	0.1802	60.782	57.4	3.1	1.30	2.03	3.33	1.64	69.93	2.68	0.65
41	0.1860	61.130	57.8	3.2	1.31	2.02	3.33	1.65	69.96	2.67	0.65
42	0.1920	61.526	58.2	3.3	1.32	2.02	3.33	1.65	70.00	2.67	0.66
43	0.1984	62.029	58.7	3.4	1.33	2.01	3.34	1.66	70.04	2.67	0.66
44	0.2038	62.434	59.1	3.5	1.33	2.01	3.34	1.66	70.07	2.67	0.67
45	0.2100	62.860	59.5	3.6	1.34	2.00	3.34	1.67	70.11	2.67	0.67
46	0.2164	63.165	59.8	3.7	1.35	2.00	3.34	1.67	70.13	2.67	0.67
47	0.2224	63.591	60.2	3.8	1.35	1.99	3.35	1.68	70.15	2.67	0.68
48	0.2277	64.003	60.6	3.9	1.36	1.99	3.35	1.68	70.18	2.67	0.68
49	0.2339	64.396	61.0	4.0	1.37	1.99	3.36	1.69	70.20	2.67	0.69
50	0.2403	64.890	61.5	4.1	1.38	1.99	3.37	1.69	70.21	2.68	0.69
51	0.2464	65.218	61.9	4.2	1.39	1.99	3.37	1.70	70.21	2.68	0.69
52	0.2524	65.610	62.3	4.3	1.39	1.98	3.38	1.70	70.23	2.68	0.70
53	0.2582	66.059	62.7	4.4	1.40	1.97	3.38	1.71	70.29	2.67	0.70
54	0.2641	66.381	63.0	4.5	1.41	1.97	3.38	1.71	70.32	2.67	0.70
55	0.2705	66.832	63.5	4.6	1.42	1.97	3.38	1.72	70.35	2.67	0.71
56	0.2762	67.244	63.9	4.7	1.42	1.96	3.39	1.73	70.37	2.67	0.71
57	0.2824	67.631	64.3	4.8	1.43	1.96	3.39	1.73	70.39	2.67	0.72
58	0.2884	68.041	64.7	4.9	1.44	1.96	3.39	1.74	70.42	2.67	0.72

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
59	0.2946	68.359	65.0	5.0	1.44	1.95	3.40	1.74	70.43	2.68	0.72
60	0.3007	68.815	65.5	5.1	1.45	1.95	3.40	1.74	70.45	2.68	0.73
61	0.3299	70.720	67.4	5.6	1.49	1.94	3.43	1.77	70.52	2.68	0.74
62	0.3601	72.683	69.3	6.1	1.52	1.93	3.45	1.79	70.58	2.69	0.76
63	0.3900	74.448	71.1	6.6	1.55	1.93	3.48	1.81	70.62	2.70	0.78
64	0.4200	76.465	73.1	7.1	1.59	1.92	3.51	1.82	70.64	2.72	0.79
65	0.4498	78.441	75.1	7.6	1.62	1.92	3.54	1.84	70.65	2.73	0.81
66	0.4792	80.218	76.9	8.1	1.65	1.93	3.58	1.86	70.62	2.75	0.83
67	0.5091	82.008	78.7	8.7	1.68	1.92	3.60	1.87	70.64	2.76	0.84
68	0.5396	83.754	80.4	9.2	1.71	1.92	3.63	1.89	70.65	2.78	0.85
69	0.5692	85.596	82.2	9.7	1.74	1.93	3.66	1.90	70.63	2.79	0.87
70	0.5989	87.501	84.1	10.2	1.77	1.93	3.69	1.92	70.62	2.81	0.88
71	0.6288	89.196	85.8	10.7	1.79	1.93	3.72	1.93	70.60	2.83	0.90
72	0.6587	91.033	87.7	11.2	1.82	1.93	3.75	1.94	70.57	2.84	0.91
73	0.6888	92.863	89.5	11.7	1.85	1.94	3.79	1.95	70.54	2.86	0.92
74	0.7187	94.468	91.1	12.2	1.87	1.95	3.82	1.96	70.48	2.88	0.93
75	0.7491	96.295	92.9	12.7	1.90	1.95	3.85	1.97	70.43	2.90	0.95
76	0.7789	98.175	94.8	13.2	1.92	1.96	3.88	1.98	70.41	2.92	0.96
77	0.8082	100.014	96.7	13.7	1.95	1.96	3.91	1.99	70.36	2.94	0.97
78	0.8388	101.752	98.4	14.3	1.97	1.97	3.94	2.00	70.32	2.96	0.99
79	0.8684	103.656	100.3	14.8	2.00	1.98	3.98	2.01	70.27	2.98	1.00
80	0.8983	105.351	102.0	15.3	2.02	1.98	4.00	2.02	70.23	2.99	1.01

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

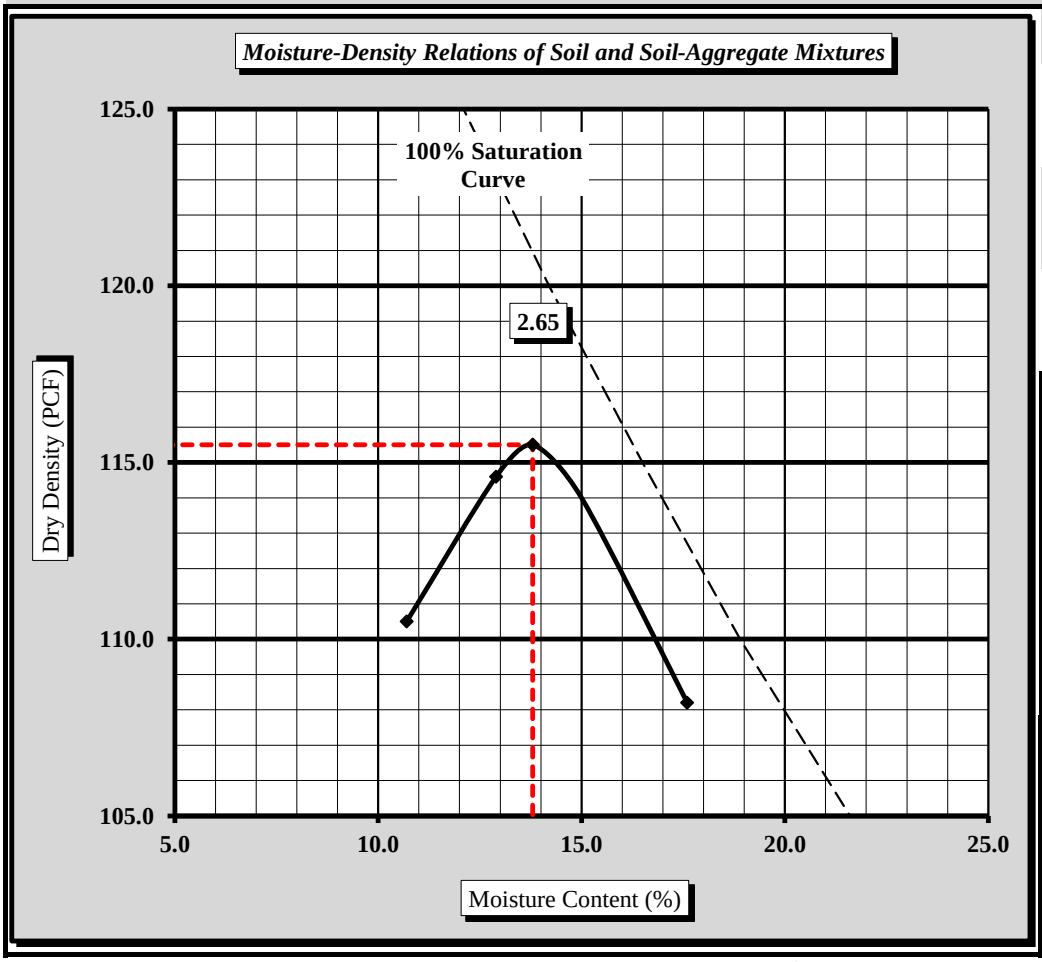
Sample Log No.: 344

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

S&ME Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/23/14 - 10/27/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-9		
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		A-6

Maximum Dry Density **115.5** **PCF.** **Optimum Moisture Content** **13.8%**

ASTM D698 - - Method B



Soil Properties

Natural Moisture Content	**15.4%**
Liquid Limit	**38**
Plastic Limit	**17**
Plastic Index	**21**

% Passing

3/8"	100.0%

Oversize Fraction

Bulk Gravity	
Absorption	
% Oversize	**NA**
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 D698, D422, D4318, D2487; AASHTO M145

The specific gravity value of the 100% saturation curve is assumed.

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:344

Sieve Analysis of Soils

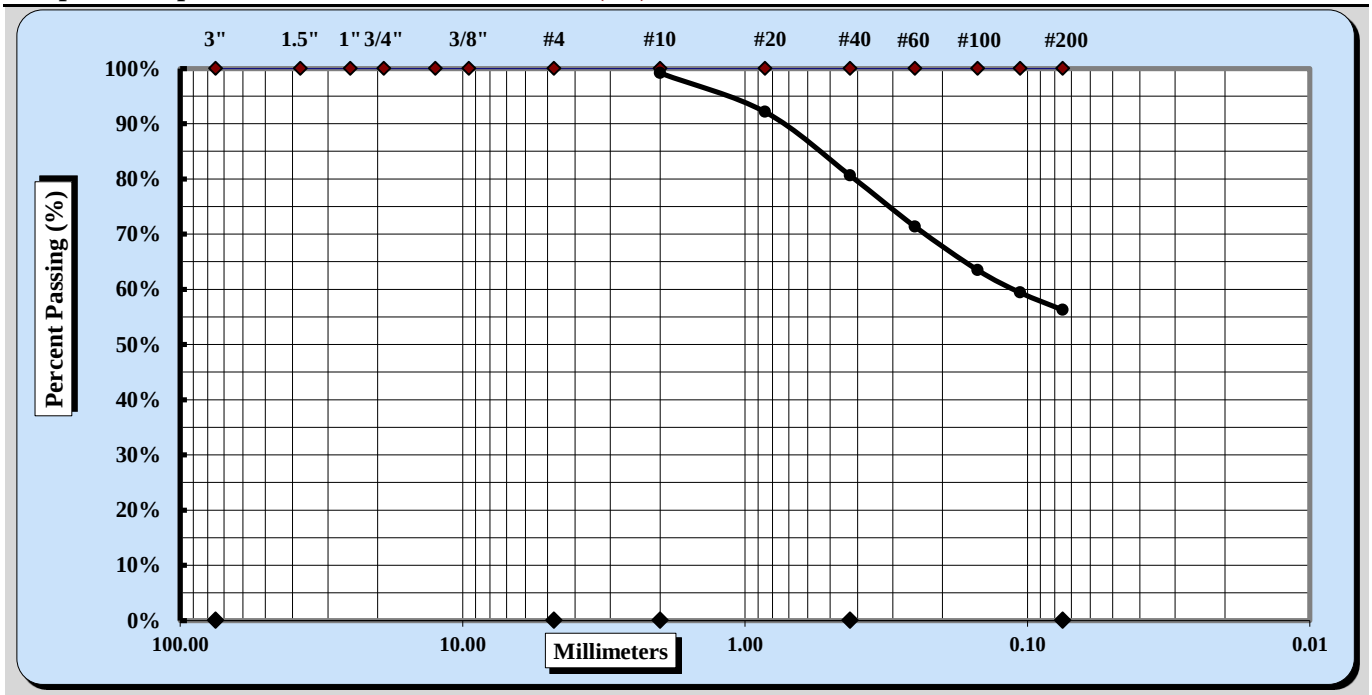
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/23/14 - 11/1/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: Bulk		
		Depth:	0 - 15 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.8%	Fine Sand	24.4%
Gravel	0.0%	Medium Sand	18.6%	Silt & Clay	56.3%
Liquid Limit	38	Plastic Limit	17	Plastic Index	21

Coarse Sand	0.8%	Medium Sand	18.6%	Fine Sand	24.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

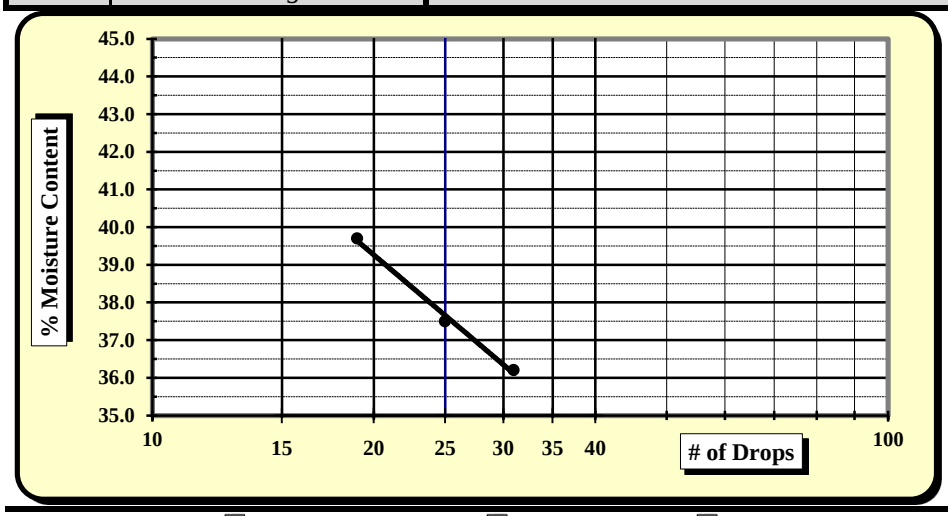
Log No.:344 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/4/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: Bulk		
		Depth: 0 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	2	17	1				33	36	
A	Tare Weight	15.60	15.57	15.42				21.27	21.05	
B	Wet Soil Weight + A	33.31	34.76	35.89				30.23	28.99	
C	Dry Soil Weight + A	28.28	29.53	30.45				28.90	27.82	
D	Water Weight (B-C)	5.03	5.23	5.44				1.33	1.17	
E	Dry Soil Weight (C-A)	12.68	13.96	15.03				7.63	6.77	
F	% Moisture (D/E)*100	39.7%	37.5%	36.2%				17.4%	17.3%	
N	# OF DROPS	19	25	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**17.4%**		



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 **38**
Plastic Limit **17**
Plastic Index **21**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/4/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

pH of Soil

AASHTO T 289

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/2/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID: B-9	Type: Bulk		
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		**A-6**

Equipment:

Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/14*	*Due:*	*3/17/15*
Sieve:	*#10*	*S&ME ID#*	*2487*	*Cal. Date:*	*9/4/14*	*Due:*	*3/4/15*
pH Meter:		*S&ME ID#*	*16576*	*Cal. Date:*	*12/2/14*		

pH Meter Calibration

Buffer Solution	***Results***
pH buffer 4.0	***4.01***
pH buffer 7.0	***7.00***
pH buffer 10.0	***10.01***
Buffer Temperature ^{0}C	***23.2°C***

Measuring pH of Soil

Beaker #: 8

Measurements	
Weight of Air Dry Soil (g)	***30.0***
Distilled Water (ml)	***30.1***
Temperature ^{0}C	***23.4°C***
pH Reading	***4.2***

Notes / Deviations / References: AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing

Michael D. Kelso	12/2/2014		
Technician Name	*Date*		
N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-G57-1
Revision No. 0
Revision Date: 07/11/08

Sample Log No.: 344

Soil Resistivity

ASTM G57

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID: B-9	Type: Bulk		
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		**A-6**

Equipment:	*Standard Box*	*S&ME ID#*	*16577*		*Box Constant:*	*1*
Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/2014*	*Due:* *3/17/2015*
Oven		*S&ME ID#*	*12872*	*Cal. Date:*	*8/15/2014*	*Due:* *12/15/2014*
Decade Box (resistivity verification)		*S&ME ID#*	*19948*	*Cal. Date:*	*1/10/2014*	*Due:* *1/10/2015*

Moisture Content Determination

After 24-hr Condition

						Tare No.	***K-29***	
					A	Tare Weight		44.77
					B	Wet Wt + Tare Wt		100.68
					C	Dry Wt. + Tare Wt.		86.94
					D	Water Weight	**B-C**	13.74
					E	Dry Weight	**C-A**	42.17
					F	**Moisture Content**	**100*D/E**	**32.6%**

Resistivity (ohms - cm)

After 24-hr Condition

			M	Multiplier Dial Setting	10000
			B	Balance Dial Reading to Null	3.4
			R	**RESISTIVITY (Ω-cm), (MxBxBC)**	**34,000**

Notes / Deviations / References:

24-hr conditioning achieved by saturating the soil with distilled water for 24 hours prior to testing.

Miller 400A Resistivity Meter, ID#26821

ASTM G57: Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

Larry Presley	12/1/2014		
Technician Name	*Date*		
N. Randy Rainwater	*Signature*	Project Engineer	12/3/2014
Technical Responsibility		*Position*	*Date*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

Sample Log No.:344 | *AASHTO T 267* | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1431-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/7/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-9	Sample No.:	Bulk
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		A-6

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	C
t	Tare Weight	*grams*	19.18
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	59.55
c	Ash Weight + Tare Wt.	*grams*	58.95
C	Ash Weight	*c-t*	39.77
B	Mass of Oven Dry Specimen	*(b-t)*	40.37
D	***% Ash Content***	*(C/B)*100*	**98.5%**
	% Organic Matter	*100-D*	**1.5%**

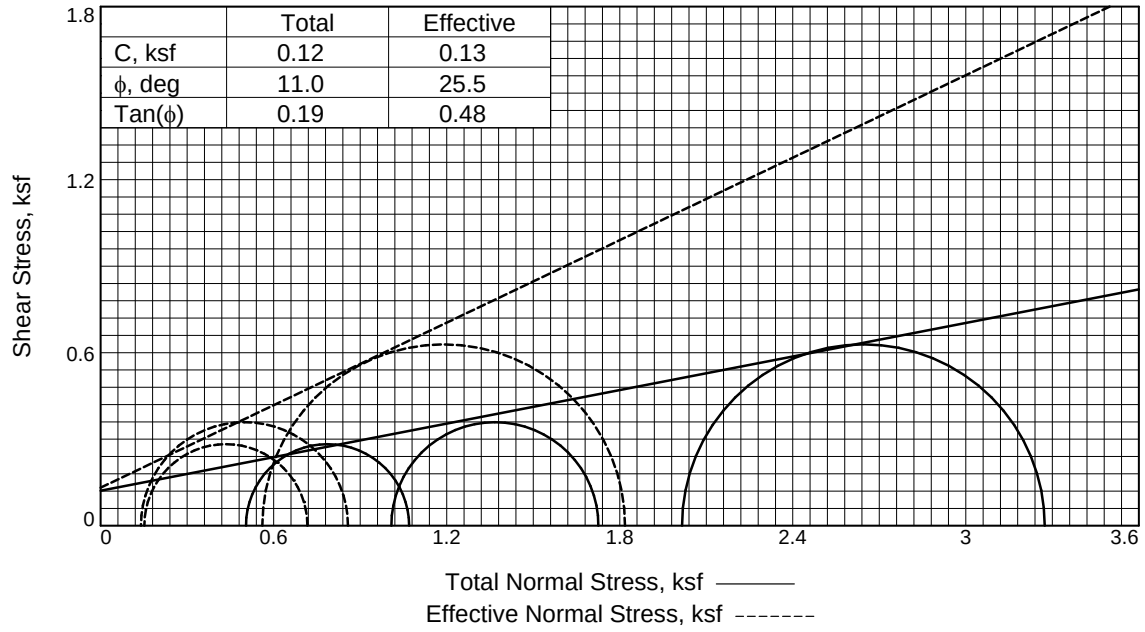
Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

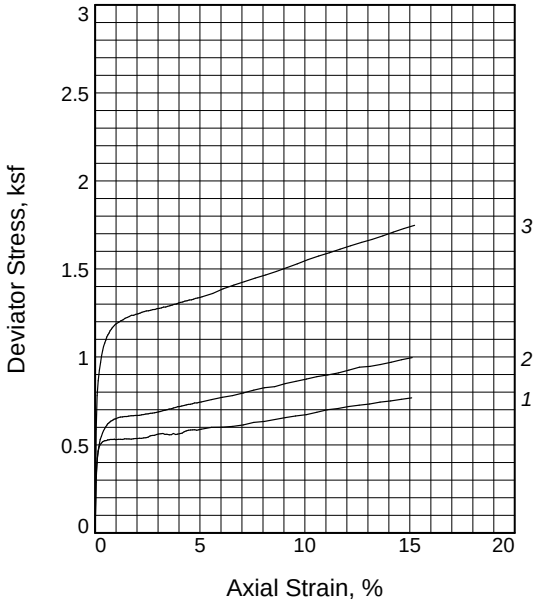
Derek Baker — *Technician Name*
11/7/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
 — *Signature*
Project Engineer — *Position*
12/1/2014 — *Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.12	0.13
ϕ, deg	11.0	25.5
Tan(ϕ)	0.19	0.48



Specimen No.		1	2	3
Initial	Water Content, %	13.7	13.9	13.8
	Dry Density, pcf	109.5	109.3	110.0
	Saturation, %	71.2	71.6	72.6
	Void Ratio	0.5110	0.5132	0.5045
	Diameter, in.	2.860	2.863	2.862
	Height, in.	6.013	6.003	5.979
At Test	Water Content, %	19.0	18.7	17.6
	Dry Density, pcf	110.1	110.7	112.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5025	0.4944	0.4663
	Diameter, in.	2.854	2.849	2.841
	Height, in.	6.005	5.985	5.912
Strain rate, %/min.		0.25	0.25	0.25
Back Pressure, psi		70.00	70.00	70.00
Cell Pressure, psi		73.50	77.00	84.00
Fail. Stress, ksf		0.57	0.72	1.26
Total Pore Pr., ksf		10.43	10.95	11.54
Ult. Stress, ksf		0.77	1.00	1.75
Total Pore Pr., ksf		10.39	10.74	11.49
$\bar{\sigma}_1$ Failure, ksf		0.72	0.86	1.82
$\bar{\sigma}_3$ Failure, ksf		0.15	0.14	0.56

Type of Test:
CU with Pore Pressures

Sample Type: Remolded to appr.95%MDD

Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6

LL= 38 **PL=** 17 **PI=** 21

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. MDD=115.5pcf at 13.8% moisture (D698). ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

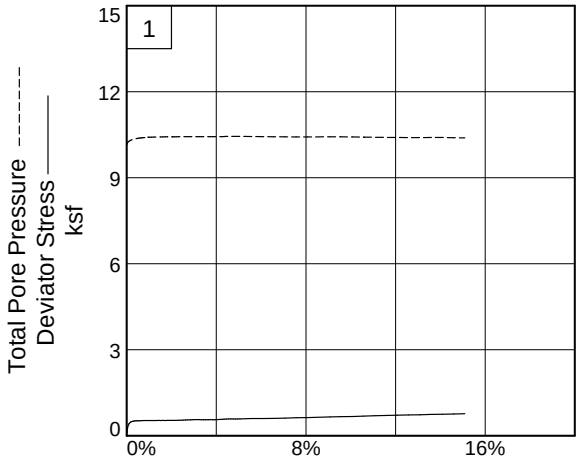
Location: B-9

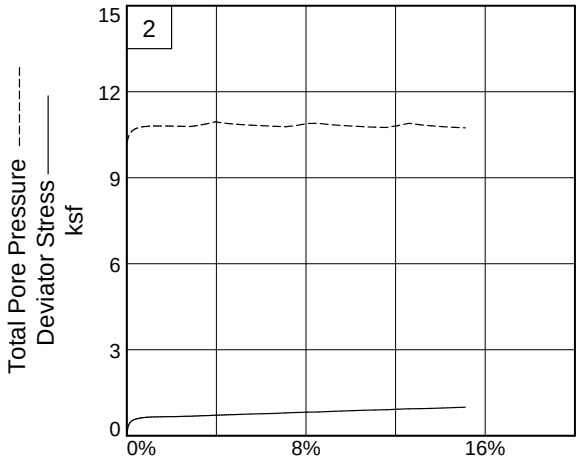
Sample Number: Log 344 **Depth:** 0 - 15 ft

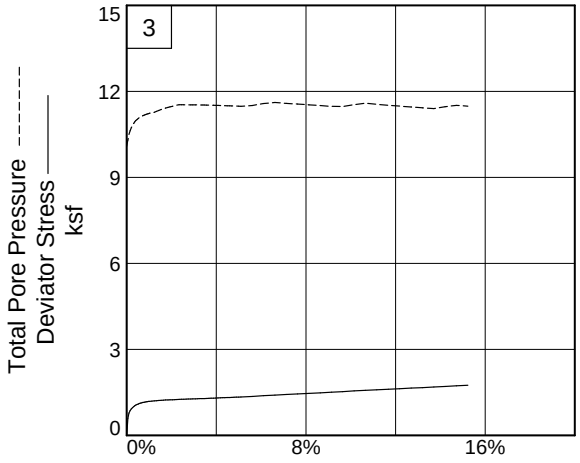
Proj. No.: 1461-14-046

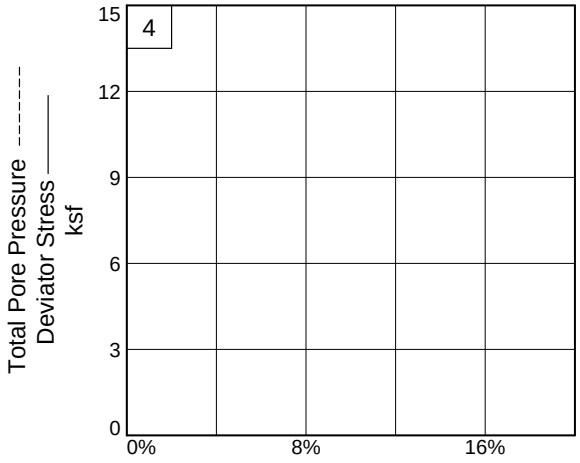
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

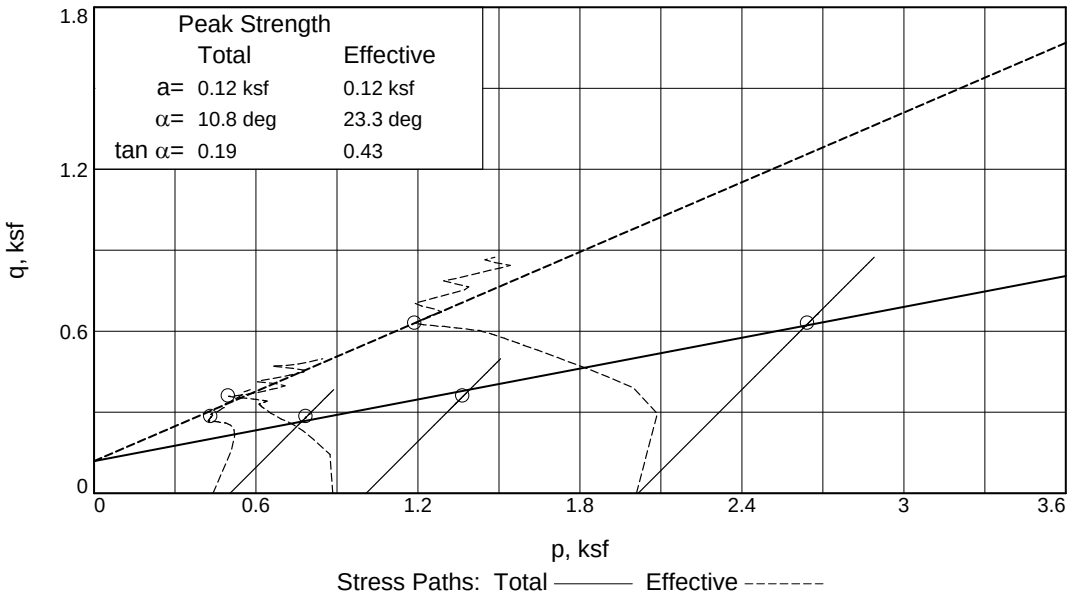
Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-9 **Depth:** 0 - 15 ft **Sample Number:** Log 344

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:12 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-9
Depth: 0 - 15 ft **Sample Number:** Log 344
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
Remarks: The specimens failed in bulging. MDD=115.5pcf at 13.8% moisture (D698). ASTM D4767.
Type of Sample: Remolded to appr.95%MDD
Assumed Specific Gravity=2.65 **LL=**38 **PL=**17 **PI=**21
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	272.500			1329.420
Moisture content: Dry soil+tare, gms.	249.630			1120.380
Moisture content: Tare, gms.	83.000			17.900
Moisture, %	13.7	19.0	19.0	19.0
Moist specimen weight, gms.	1262.60			
Diameter, in.	2.860	2.855	2.854	
Area, in.²	6.424	6.401	6.397	
Height, in.	6.013	6.009	6.005	
Net decrease in height, in.		0.004	0.004	
Net decrease in water volume, cc.			0.800	
Wet density, pcf	124.5	130.9	131.0	
Dry density, pcf	109.5	110.0	110.1	
Void ratio	0.5110	0.5044	0.5025	
Saturation, %	71.2	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 73.50 psi (10.58 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.57 ksf **at reading no.** 42
Ult. Stress = 0.77 ksf **at reading no.** 79

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.344	0.0	0.0	0.00	0.44	0.44	1.00	70.44	0.44	0.00
1	0.0029	17.289	13.9	0.0	0.31	0.35	0.67	1.89	71.06	0.51	0.16
2	0.0064	22.248	18.9	0.1	0.43	0.31	0.73	2.38	71.36	0.52	0.21
3	0.0095	24.161	20.8	0.2	0.47	0.28	0.75	2.64	71.52	0.52	0.23
4	0.0122	25.211	21.9	0.2	0.49	0.27	0.76	2.84	71.64	0.51	0.25
5	0.0154	25.788	22.4	0.3	0.50	0.25	0.76	2.99	71.74	0.51	0.25
6	0.0184	26.108	22.8	0.3	0.51	0.24	0.75	3.11	71.82	0.50	0.26
7	0.0210	26.434	23.1	0.3	0.52	0.23	0.75	3.23	71.89	0.49	0.26
8	0.0244	26.572	23.2	0.4	0.52	0.22	0.74	3.33	71.95	0.48	0.26
9	0.0276	26.758	23.4	0.5	0.52	0.22	0.74	3.43	72.00	0.48	0.26
10	0.0300	26.759	23.4	0.5	0.52	0.21	0.73	3.51	72.05	0.47	0.26
11	0.0331	26.789	23.4	0.6	0.52	0.20	0.73	3.59	72.09	0.47	0.26
12	0.0362	26.974	23.6	0.6	0.53	0.20	0.73	3.69	72.13	0.46	0.26
13	0.0399	26.986	23.6	0.7	0.53	0.19	0.72	3.76	72.17	0.46	0.26
14	0.0428	27.099	23.8	0.7	0.53	0.19	0.72	3.84	72.20	0.45	0.27
15	0.0461	27.138	23.8	0.8	0.53	0.18	0.71	3.92	72.24	0.45	0.27
16	0.0485	27.151	23.8	0.8	0.53	0.18	0.71	3.99	72.27	0.44	0.27
17	0.0523	27.141	23.8	0.9	0.53	0.17	0.70	4.07	72.30	0.44	0.27
18	0.0551	27.240	23.9	0.9	0.53	0.17	0.70	4.13	72.32	0.44	0.27
19	0.0578	27.132	23.8	1.0	0.53	0.17	0.70	4.09	72.31	0.44	0.27
20	0.0602	27.162	23.8	1.0	0.53	0.17	0.70	4.11	72.31	0.44	0.27
21	0.0668	27.234	23.9	1.1	0.53	0.17	0.70	4.15	72.33	0.43	0.27
22	0.0732	27.267	23.9	1.2	0.53	0.17	0.70	4.20	72.35	0.43	0.27
23	0.0793	27.274	23.9	1.3	0.53	0.16	0.70	4.24	72.36	0.43	0.27
24	0.0850	27.457	24.1	1.4	0.54	0.16	0.70	4.30	72.37	0.43	0.27
25	0.0911	27.436	24.1	1.5	0.53	0.16	0.69	4.33	72.38	0.43	0.27
26	0.0970	27.463	24.1	1.6	0.53	0.16	0.69	4.35	72.39	0.43	0.27
27	0.1034	27.412	24.1	1.7	0.53	0.16	0.69	4.37	72.40	0.42	0.27
28	0.1094	27.547	24.2	1.8	0.53	0.16	0.69	4.40	72.41	0.42	0.27
29	0.1155	27.647	24.3	1.9	0.54	0.16	0.69	4.43	72.41	0.42	0.27
30	0.1212	27.685	24.3	2.0	0.54	0.16	0.69	4.45	72.42	0.42	0.27
31	0.1274	27.756	24.4	2.1	0.54	0.15	0.69	4.47	72.42	0.42	0.27
32	0.1330	27.755	24.4	2.2	0.54	0.15	0.69	4.48	72.43	0.42	0.27
33	0.1393	27.932	24.6	2.3	0.54	0.15	0.69	4.51	72.43	0.42	0.27
34	0.1454	27.991	24.6	2.4	0.54	0.15	0.69	4.53	72.43	0.42	0.27
35	0.1516	28.153	24.8	2.5	0.54	0.15	0.70	4.55	72.44	0.43	0.27
36	0.1579	28.520	25.2	2.6	0.55	0.15	0.70	4.61	72.44	0.43	0.28
37	0.1634	28.657	25.3	2.7	0.55	0.15	0.71	4.63	72.44	0.43	0.28
38	0.1703	28.697	25.4	2.8	0.55	0.15	0.71	4.64	72.44	0.43	0.28
39	0.1755	28.935	25.6	2.9	0.56	0.15	0.71	4.68	72.44	0.43	0.28
40	0.1822	29.099	25.8	3.0	0.56	0.15	0.71	4.71	72.45	0.43	0.28
41	0.1885	29.190	25.8	3.1	0.56	0.15	0.72	4.71	72.45	0.43	0.28
42	0.1941	29.307	26.0	3.2	0.57	0.15	0.72	4.74	72.45	0.43	0.28
43	0.2001	29.067	25.7	3.3	0.56	0.15	0.71	4.70	72.45	0.43	0.28
44	0.2056	29.135	25.8	3.4	0.56	0.15	0.71	4.72	72.45	0.43	0.28
45	0.2123	29.029	25.7	3.5	0.56	0.15	0.71	4.70	72.45	0.43	0.28
46	0.2185	29.094	25.7	3.6	0.56	0.15	0.71	4.70	72.45	0.43	0.28

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.2243	29.441	26.1	3.7	0.57	0.15	0.72	4.75	72.45	0.43	0.28
48	0.2307	29.195	25.9	3.8	0.56	0.15	0.71	4.71	72.45	0.43	0.28
49	0.2365	29.310	26.0	3.9	0.56	0.15	0.71	4.72	72.45	0.43	0.28
50	0.2427	29.498	26.2	4.0	0.56	0.15	0.72	4.74	72.45	0.43	0.28
51	0.2488	29.611	26.3	4.1	0.57	0.15	0.72	4.76	72.45	0.43	0.28
52	0.2552	30.044	26.7	4.2	0.58	0.15	0.73	4.80	72.45	0.44	0.29
53	0.2607	30.283	26.9	4.3	0.58	0.15	0.73	4.95	72.48	0.44	0.29
54	0.2670	30.476	27.1	4.4	0.58	0.14	0.73	5.04	72.50	0.44	0.29
55	0.2732	30.588	27.2	4.5	0.59	0.14	0.73	5.10	72.51	0.44	0.29
56	0.2795	30.656	27.3	4.7	0.59	0.14	0.73	5.14	72.52	0.43	0.29
57	0.2851	30.707	27.4	4.7	0.59	0.14	0.73	5.16	72.52	0.43	0.29
58	0.2911	30.599	27.3	4.8	0.58	0.14	0.72	5.14	72.52	0.43	0.29
59	0.2974	30.757	27.4	5.0	0.59	0.14	0.73	5.15	72.52	0.43	0.29
60	0.3037	30.917	27.6	5.1	0.59	0.14	0.73	5.18	72.52	0.44	0.29
61	0.3335	31.586	28.2	5.6	0.60	0.15	0.75	5.12	72.49	0.45	0.30
62	0.3632	31.761	28.4	6.0	0.60	0.15	0.75	4.96	72.45	0.45	0.30
63	0.3941	32.139	28.8	6.6	0.61	0.16	0.76	4.90	72.42	0.46	0.30
64	0.4241	32.690	29.3	7.1	0.61	0.16	0.77	4.88	72.40	0.47	0.31
65	0.4541	33.524	30.2	7.6	0.63	0.16	0.79	4.91	72.38	0.47	0.31
66	0.4840	33.972	30.6	8.1	0.63	0.16	0.80	4.91	72.37	0.48	0.32
67	0.5445	35.367	32.0	9.1	0.66	0.16	0.81	5.21	72.42	0.48	0.33
68	0.5738	35.987	32.6	9.6	0.66	0.16	0.82	5.27	72.42	0.49	0.33
69	0.6046	36.543	33.2	10.1	0.67	0.16	0.83	5.13	72.37	0.50	0.34
70	0.6347	37.412	34.1	10.6	0.69	0.17	0.85	5.06	72.33	0.51	0.34
71	0.6647	38.340	35.0	11.1	0.70	0.17	0.87	5.04	72.29	0.52	0.35
72	0.6951	38.877	35.5	11.6	0.71	0.18	0.88	4.99	72.27	0.53	0.35
73	0.7254	39.633	36.3	12.1	0.72	0.18	0.90	4.98	72.25	0.54	0.36
74	0.7557	40.241	36.9	12.6	0.73	0.18	0.91	4.97	72.23	0.55	0.36
75	0.7858	40.780	37.4	13.1	0.73	0.19	0.92	4.95	72.21	0.55	0.37
76	0.8156	41.570	38.2	13.6	0.74	0.18	0.92	5.18	72.26	0.55	0.37
77	0.8462	42.147	38.8	14.1	0.75	0.18	0.93	5.20	72.26	0.55	0.38
78	0.8763	42.830	39.5	14.6	0.76	0.19	0.95	5.03	72.19	0.57	0.38
79	0.9061	43.505	40.2	15.1	0.77	0.19	0.96	4.94	72.15	0.58	0.38

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	225.000			1327.360
Moisture content: Dry soil+tare, gms.	198.460			1120.540
Moisture content: Tare, gms.	7.000			12.020
Moisture, %	13.9	19.1	18.7	18.7
Moist specimen weight, gms.	1262.70			
Diameter, in.	2.863	2.856	2.849	
Area, in.²	6.438	6.408	6.377	
Height, in.	6.003	5.999	5.985	
Net decrease in height, in.		0.004	0.014	
Net decrease in water volume, cc.			4.500	
Wet density, pcf	124.5	130.9	131.4	
Dry density, pcf	109.3	109.9	110.7	
Void ratio	0.5132	0.5052	0.4944	
Saturation, %	71.6	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 77.00 psi (11.09 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.72 ksf **at reading no.** 49
Ult. Stress = 1.00 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.828	0.0	0.0	0.00	0.88	0.88	1.00	70.86	0.88	0.00
1	0.0029	16.552	12.7	0.0	0.29	0.73	1.02	1.39	71.93	0.87	0.14
2	0.0057	21.481	17.7	0.1	0.40	0.61	1.01	1.65	72.74	0.81	0.20
3	0.0087	24.404	20.6	0.1	0.46	0.54	1.00	1.86	73.24	0.77	0.23
4	0.0121	26.166	22.3	0.2	0.50	0.49	0.99	2.03	73.60	0.74	0.25
5	0.0146	27.402	23.6	0.2	0.53	0.45	0.98	2.18	73.87	0.72	0.27
6	0.0179	28.203	24.4	0.3	0.55	0.42	0.97	2.31	74.09	0.69	0.27
7	0.0210	29.025	25.2	0.4	0.57	0.40	0.96	2.43	74.26	0.68	0.28
8	0.0241	29.677	25.8	0.4	0.58	0.38	0.96	2.55	74.39	0.67	0.29
9	0.0271	30.164	26.3	0.5	0.59	0.36	0.95	2.65	74.51	0.66	0.30
10	0.0302	30.649	26.8	0.5	0.60	0.35	0.95	2.74	74.59	0.65	0.30
11	0.0335	31.109	27.3	0.6	0.61	0.34	0.95	2.82	74.66	0.64	0.31
12	0.0360	31.437	27.6	0.6	0.62	0.33	0.95	2.89	74.73	0.64	0.31
13	0.0391	31.664	27.8	0.7	0.62	0.32	0.94	2.95	74.78	0.63	0.31
14	0.0420	31.931	28.1	0.7	0.63	0.31	0.94	3.01	74.82	0.63	0.32
15	0.0447	32.154	28.3	0.7	0.63	0.31	0.94	3.06	74.86	0.63	0.32
16	0.0481	32.313	28.5	0.8	0.64	0.30	0.94	3.10	74.89	0.62	0.32
17	0.0513	32.488	28.7	0.9	0.64	0.30	0.94	3.14	74.92	0.62	0.32
18	0.0542	32.713	28.9	0.9	0.65	0.30	0.94	3.18	74.94	0.62	0.32
19	0.0575	32.796	29.0	1.0	0.65	0.29	0.94	3.21	74.96	0.62	0.32
20	0.0605	32.926	29.1	1.0	0.65	0.29	0.94	3.24	74.98	0.62	0.33
21	0.0662	33.167	29.3	1.1	0.66	0.29	0.94	3.28	75.01	0.61	0.33
22	0.0725	33.337	29.5	1.2	0.66	0.28	0.94	3.33	75.04	0.61	0.33
23	0.0781	33.405	29.6	1.3	0.66	0.28	0.94	3.34	75.04	0.61	0.33
24	0.0843	33.555	29.7	1.4	0.66	0.28	0.94	3.35	75.04	0.61	0.33

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.0908	33.592	29.8	1.5	0.66	0.28	0.94	3.35	75.04	0.61	0.33
26	0.0959	33.720	29.9	1.6	0.66	0.28	0.95	3.35	75.04	0.61	0.33
27	0.1027	33.837	30.0	1.7	0.67	0.28	0.95	3.35	75.04	0.62	0.33
28	0.1084	33.859	30.0	1.8	0.67	0.28	0.95	3.35	75.03	0.62	0.33
29	0.1143	33.980	30.2	1.9	0.67	0.29	0.95	3.34	75.02	0.62	0.33
30	0.1208	34.008	30.2	2.0	0.67	0.29	0.96	3.32	75.00	0.62	0.33
31	0.1272	34.084	30.3	2.1	0.67	0.29	0.96	3.32	75.00	0.62	0.33
32	0.1328	34.245	30.4	2.2	0.67	0.29	0.96	3.31	74.98	0.63	0.34
33	0.1389	34.353	30.5	2.3	0.67	0.29	0.97	3.30	74.97	0.63	0.34
34	0.1449	34.512	30.7	2.4	0.68	0.29	0.97	3.30	74.96	0.63	0.34
35	0.1512	34.573	30.7	2.5	0.68	0.30	0.97	3.29	74.95	0.63	0.34
36	0.1571	34.728	30.9	2.6	0.68	0.30	0.98	3.29	74.94	0.64	0.34
37	0.1631	34.798	31.0	2.7	0.68	0.30	0.98	3.28	74.92	0.64	0.34
38	0.1694	34.936	31.1	2.8	0.68	0.30	0.98	3.28	74.92	0.64	0.34
39	0.1755	35.073	31.2	2.9	0.68	0.29	0.98	3.33	74.96	0.64	0.34
40	0.1813	35.254	31.4	3.0	0.69	0.28	0.97	3.45	75.05	0.63	0.34
41	0.1870	35.372	31.5	3.1	0.69	0.27	0.96	3.57	75.14	0.61	0.35
42	0.1935	35.615	31.8	3.2	0.69	0.25	0.95	3.72	75.23	0.60	0.35
43	0.1993	35.762	31.9	3.3	0.70	0.24	0.94	3.89	75.32	0.59	0.35
44	0.2053	35.953	32.1	3.4	0.70	0.23	0.93	4.08	75.42	0.58	0.35
45	0.2114	36.133	32.3	3.5	0.70	0.21	0.92	4.32	75.53	0.56	0.35
46	0.2178	36.259	32.4	3.6	0.71	0.19	0.90	4.62	75.65	0.55	0.35
47	0.2235	36.491	32.7	3.7	0.71	0.18	0.89	5.02	75.77	0.53	0.36
48	0.2300	36.667	32.8	3.8	0.71	0.16	0.87	5.50	75.90	0.51	0.36
49	0.2361	36.928	33.1	3.9	0.72	0.14	0.86	6.14	76.03	0.50	0.36
50	0.2416	36.999	33.2	4.0	0.72	0.15	0.87	5.78	75.96	0.51	0.36
51	0.2475	37.141	33.3	4.1	0.72	0.16	0.88	5.49	75.88	0.52	0.36
52	0.2541	37.349	33.5	4.2	0.72	0.17	0.90	5.22	75.81	0.53	0.36
53	0.2599	37.510	33.7	4.3	0.73	0.18	0.91	4.99	75.74	0.55	0.36
54	0.2661	37.671	33.8	4.4	0.73	0.19	0.92	4.83	75.68	0.56	0.37
55	0.2721	37.767	33.9	4.5	0.73	0.20	0.93	4.69	75.62	0.56	0.37
56	0.2778	37.940	34.1	4.6	0.73	0.21	0.94	4.57	75.57	0.57	0.37
57	0.2840	38.175	34.3	4.7	0.74	0.21	0.95	4.47	75.52	0.58	0.37
58	0.2905	38.226	34.4	4.9	0.74	0.22	0.96	4.37	75.48	0.59	0.37
59	0.2963	38.381	34.6	5.0	0.74	0.22	0.97	4.30	75.44	0.60	0.37
60	0.3026	38.537	34.7	5.1	0.74	0.23	0.97	4.22	75.40	0.60	0.37
61	0.3323	39.357	35.5	5.6	0.76	0.25	1.01	3.98	75.23	0.63	0.38
62	0.3627	40.161	36.3	6.1	0.77	0.27	1.05	3.80	75.09	0.66	0.39
63	0.3923	40.824	37.0	6.6	0.78	0.29	1.07	3.65	74.96	0.68	0.39
64	0.4230	41.759	37.9	7.1	0.80	0.31	1.11	3.57	74.85	0.71	0.40
65	0.4525	42.692	38.9	7.6	0.81	0.27	1.08	4.02	75.13	0.67	0.41
66	0.4828	43.571	39.7	8.1	0.83	0.19	1.02	5.26	75.66	0.61	0.41
67	0.5123	44.083	40.3	8.6	0.83	0.19	1.02	5.32	75.66	0.61	0.42
68	0.5422	45.163	41.3	9.1	0.85	0.23	1.08	4.62	75.37	0.66	0.42
69	0.5728	46.029	42.2	9.6	0.86	0.26	1.13	4.27	75.17	0.69	0.43
70	0.6028	46.906	43.1	10.1	0.87	0.29	1.16	4.05	75.01	0.72	0.44
71	0.6326	47.811	44.0	10.6	0.89	0.31	1.20	3.88	74.86	0.75	0.44

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
72	0.6635	48.553	44.7	11.1	0.90	0.33	1.23	3.74	74.73	0.78	0.45
73	0.6938	49.372	45.5	11.6	0.91	0.33	1.24	3.72	74.68	0.79	0.45
74	0.7238	50.433	46.6	12.1	0.93	0.27	1.20	4.39	75.11	0.74	0.46
75	0.7537	51.551	47.7	12.6	0.94	0.19	1.13	6.00	75.69	0.66	0.47
76	0.7837	52.066	48.2	13.1	0.95	0.24	1.19	4.93	75.33	0.71	0.47
77	0.8135	52.861	49.0	13.6	0.96	0.28	1.23	4.44	75.07	0.76	0.48
78	0.8443	53.837	50.0	14.1	0.97	0.31	1.28	4.18	74.88	0.79	0.48
79	0.8740	54.862	51.0	14.6	0.98	0.33	1.31	3.99	74.72	0.82	0.49
80	0.9044	55.793	52.0	15.1	1.00	0.35	1.35	3.85	74.57	0.85	0.50

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	201.700			1319.460
Moisture content: Dry soil+tare, gms.	177.980			1124.760
Moisture content: Tare, gms.	6.300			18.170
Moisture, %	13.8	19.3	17.6	17.6
Moist specimen weight, gms.	1263.30			
Diameter, in.	2.862	2.869	2.841	
Area, in.²	6.432	6.463	6.339	
Height, in.	5.979	5.979	5.912	
Net decrease in height, in.		0.000	0.067	
Net decrease in water volume, cc.			19.100	
Wet density, pcf	125.2	130.6	132.7	
Dry density, pcf	110.0	109.4	112.8	
Void ratio	0.5045	0.5119	0.4663	
Saturation, %	72.6	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 84.00 psi (12.10 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 2.02 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.26 ksf **at reading no.** 33

Ult. Stress = 1.75 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.801	0.0	0.0	0.00	2.01	2.01	1.00	70.05	2.01	0.00
1	0.0032	29.788	26.0	0.1	0.59	1.79	2.38	1.33	71.56	2.09	0.30
2	0.0058	38.197	34.4	0.1	0.78	1.61	2.39	1.49	72.83	2.00	0.39
3	0.0089	41.932	38.1	0.2	0.86	1.47	2.33	1.59	73.81	1.90	0.43
4	0.0122	44.625	40.8	0.2	0.93	1.36	2.29	1.68	74.54	1.82	0.46
5	0.0155	46.594	42.8	0.3	0.97	1.28	2.25	1.76	75.12	1.76	0.48
6	0.0184	48.217	44.4	0.3	1.01	1.21	2.22	1.83	75.57	1.72	0.50
7	0.0211	49.515	45.7	0.4	1.03	1.16	2.19	1.89	75.94	1.68	0.52
8	0.0239	50.624	46.8	0.4	1.06	1.11	2.17	1.95	76.26	1.64	0.53
9	0.0272	51.523	47.7	0.5	1.08	1.08	2.16	2.00	76.53	1.62	0.54
10	0.0304	52.284	48.5	0.5	1.10	1.04	2.14	2.05	76.76	1.59	0.55
11	0.0329	53.090	49.3	0.6	1.11	1.01	2.13	2.10	76.96	1.57	0.56

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.0362	53.677	49.9	0.6	1.13	0.99	2.11	2.14	77.14	1.55	0.56
13	0.0395	54.188	50.4	0.7	1.14	0.97	2.10	2.18	77.30	1.53	0.57
14	0.0423	54.746	50.9	0.7	1.15	0.95	2.09	2.22	77.44	1.52	0.57
15	0.0456	55.139	51.3	0.8	1.16	0.93	2.08	2.25	77.56	1.51	0.58
16	0.0483	55.521	51.7	0.8	1.17	0.91	2.08	2.28	77.68	1.49	0.58
17	0.0517	55.894	52.1	0.9	1.17	0.90	2.07	2.31	77.77	1.48	0.59
18	0.0545	56.207	52.4	0.9	1.18	0.88	2.06	2.34	77.87	1.47	0.59
19	0.0577	56.506	52.7	1.0	1.19	0.87	2.06	2.36	77.95	1.46	0.59
20	0.0602	56.703	52.9	1.0	1.19	0.86	2.05	2.38	78.02	1.46	0.59
21	0.0665	57.109	53.3	1.1	1.20	0.84	2.04	2.42	78.15	1.44	0.60
22	0.0726	57.533	53.7	1.2	1.21	0.83	2.03	2.46	78.26	1.43	0.60
23	0.0785	57.812	54.0	1.3	1.21	0.79	2.00	2.53	78.50	1.40	0.61
24	0.0847	58.293	54.5	1.4	1.22	0.76	1.98	2.61	78.73	1.37	0.61
25	0.0908	58.533	54.7	1.5	1.22	0.73	1.95	2.68	78.93	1.34	0.61
26	0.0965	58.829	55.0	1.6	1.23	0.70	1.93	2.75	79.12	1.32	0.61
27	0.1025	59.193	55.4	1.7	1.24	0.68	1.92	2.82	79.29	1.30	0.62
28	0.1088	59.256	55.5	1.8	1.24	0.66	1.89	2.88	79.44	1.27	0.62
29	0.1142	59.560	55.8	1.9	1.24	0.64	1.88	2.95	79.59	1.26	0.62
30	0.1207	59.762	56.0	2.0	1.25	0.62	1.86	3.02	79.73	1.24	0.62
31	0.1265	59.976	56.2	2.1	1.25	0.60	1.84	3.10	79.86	1.22	0.62
32	0.1322	60.254	56.5	2.2	1.25	0.58	1.83	3.17	79.99	1.20	0.63
33	0.1383	60.489	56.7	2.3	1.26	0.56	1.82	3.24	80.11	1.19	0.63
34	0.1446	60.717	56.9	2.4	1.26	0.56	1.82	3.24	80.10	1.19	0.63
35	0.1506	60.832	57.0	2.5	1.26	0.56	1.83	3.24	80.09	1.19	0.63
36	0.1567	61.019	57.2	2.7	1.27	0.56	1.83	3.24	80.08	1.20	0.63
37	0.1626	61.269	57.5	2.8	1.27	0.57	1.83	3.25	80.07	1.20	0.63
38	0.1690	61.361	57.6	2.9	1.27	0.57	1.84	3.24	80.07	1.20	0.64
39	0.1744	61.622	57.8	3.0	1.27	0.57	1.84	3.25	80.06	1.20	0.64
40	0.1811	61.753	58.0	3.1	1.28	0.57	1.84	3.25	80.06	1.21	0.64
41	0.1874	61.932	58.1	3.2	1.28	0.57	1.85	3.25	80.05	1.21	0.64
42	0.1928	62.199	58.4	3.3	1.28	0.57	1.85	3.25	80.04	1.21	0.64
43	0.1987	62.269	58.5	3.4	1.28	0.57	1.85	3.25	80.04	1.21	0.64
44	0.2043	62.494	58.7	3.5	1.29	0.57	1.86	3.25	80.02	1.22	0.64
45	0.2109	62.732	58.9	3.6	1.29	0.57	1.87	3.25	80.01	1.22	0.65
46	0.2171	62.972	59.2	3.7	1.29	0.58	1.87	3.25	80.00	1.22	0.65
47	0.2227	63.202	59.4	3.8	1.30	0.58	1.88	3.25	79.99	1.23	0.65
48	0.2291	63.379	59.6	3.9	1.30	0.58	1.88	3.24	79.97	1.23	0.65
49	0.2348	63.669	59.9	4.0	1.31	0.58	1.89	3.24	79.96	1.24	0.65
50	0.2410	63.920	60.1	4.1	1.31	0.58	1.89	3.24	79.94	1.24	0.65
51	0.2471	64.086	60.3	4.2	1.31	0.59	1.90	3.23	79.92	1.24	0.66
52	0.2534	64.389	60.6	4.3	1.32	0.59	1.91	3.23	79.90	1.25	0.66
53	0.2589	64.532	60.7	4.4	1.32	0.59	1.91	3.22	79.88	1.25	0.66
54	0.2653	64.819	61.0	4.5	1.32	0.60	1.92	3.22	79.86	1.26	0.66
55	0.2714	64.925	61.1	4.6	1.32	0.60	1.92	3.21	79.84	1.26	0.66
56	0.2775	65.160	61.4	4.7	1.33	0.60	1.93	3.20	79.81	1.27	0.66
57	0.2832	65.410	61.6	4.8	1.33	0.61	1.94	3.20	79.79	1.27	0.67
58	0.2892	65.611	61.8	4.9	1.34	0.61	1.94	3.19	79.77	1.28	0.67

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
59	0.2955	65.806	62.0	5.0	1.34	0.61	1.95	3.18	79.74	1.28	0.67
60	0.3015	66.042	62.2	5.1	1.34	0.62	1.96	3.18	79.72	1.29	0.67
61	0.3313	67.261	63.5	5.6	1.36	0.59	1.95	3.31	79.91	1.27	0.68
62	0.3607	68.836	65.0	6.1	1.39	0.52	1.91	3.67	80.39	1.21	0.69
63	0.3913	70.192	66.4	6.6	1.41	0.48	1.89	3.91	80.64	1.19	0.70
64	0.4213	71.493	67.7	7.1	1.43	0.51	1.94	3.78	80.43	1.23	0.71
65	0.4510	72.804	69.0	7.6	1.45	0.54	1.99	3.69	80.26	1.26	0.72
66	0.4808	74.043	70.2	8.1	1.47	0.56	2.03	3.60	80.08	1.30	0.73
67	0.5108	75.378	71.6	8.6	1.49	0.59	2.08	3.51	79.89	1.33	0.74
68	0.5407	76.844	73.0	9.1	1.51	0.62	2.13	3.44	79.70	1.37	0.75
69	0.5697	78.294	74.5	9.6	1.53	0.62	2.15	3.45	79.67	1.39	0.76
70	0.6001	79.897	76.1	10.2	1.55	0.56	2.11	3.78	80.12	1.33	0.78
71	0.6300	81.336	77.5	10.7	1.57	0.51	2.08	4.09	80.47	1.30	0.79
72	0.6598	82.687	78.9	11.2	1.59	0.55	2.14	3.90	80.19	1.34	0.80
73	0.6902	84.169	80.4	11.7	1.61	0.58	2.19	3.78	79.98	1.39	0.81
74	0.7202	85.594	81.8	12.2	1.63	0.61	2.24	3.68	79.76	1.43	0.82
75	0.7508	87.058	83.3	12.7	1.65	0.64	2.29	3.58	79.56	1.47	0.83
76	0.7801	88.389	84.6	13.2	1.67	0.67	2.34	3.49	79.35	1.50	0.83
77	0.8106	89.904	86.1	13.7	1.69	0.70	2.39	3.42	79.15	1.54	0.84
78	0.8400	91.491	87.7	14.2	1.71	0.63	2.34	3.71	79.61	1.49	0.85
79	0.8700	93.093	89.3	14.7	1.73	0.58	2.31	3.97	79.95	1.45	0.86
80	0.9001	94.575	90.8	15.2	1.75	0.61	2.36	3.86	79.76	1.48	0.87

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

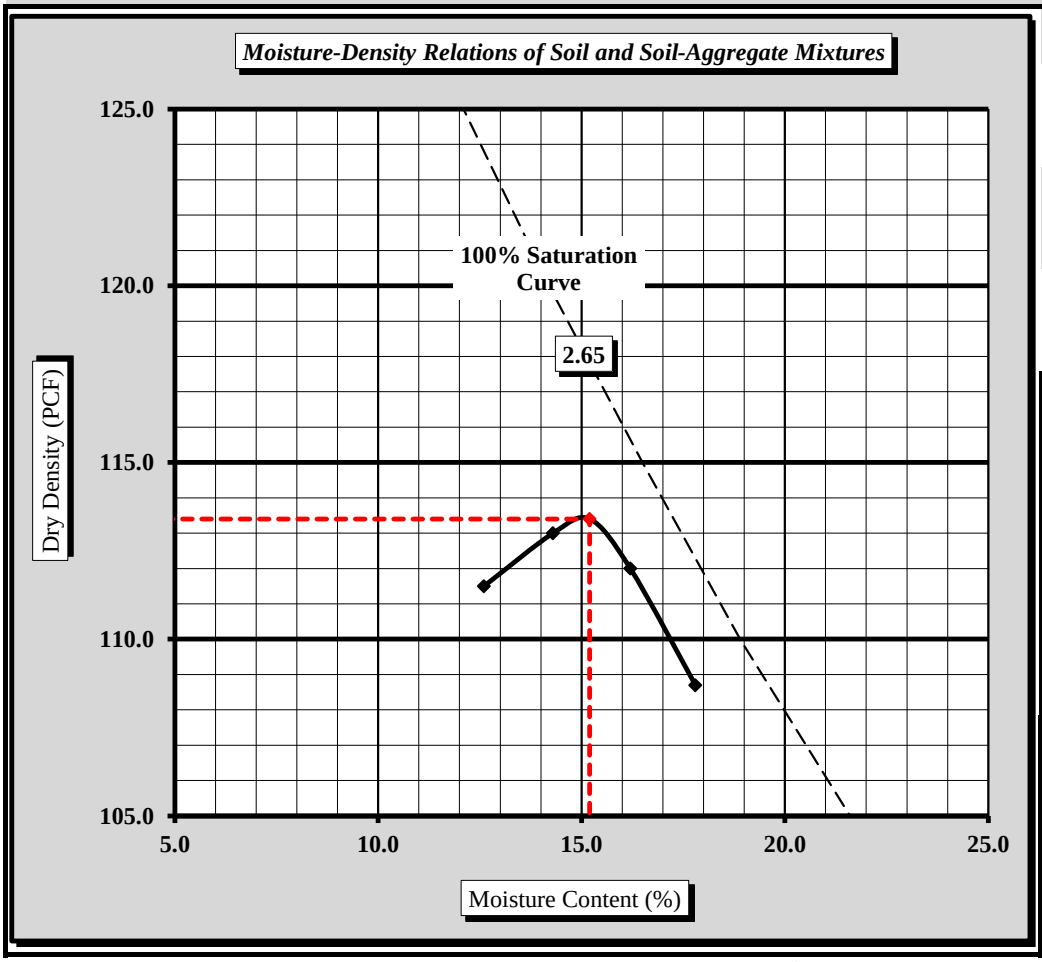
Sample Log No.: 345

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

S&ME Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/25/14 - 10/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-13		
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		A-7-6

Maximum Dry Density **113.4** **PCF.** **Optimum Moisture Content** **15.2%**

ASTM D698 - - Method B



Soil Properties

Natural Moisture Content	**15.7%**
Liquid Limit	**41**
Plastic Limit	**19**
Plastic Index	**22**

% Passing

3/8"	100.0%

Oversize Fraction

Bulk Gravity	
Absorption	
% Oversize	**NA**
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 D698, D422, D4318, D2487; AASTHO M145

The specific gravity value of the 100% saturation curve is assumed.

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:345

Sieve Analysis of Soils

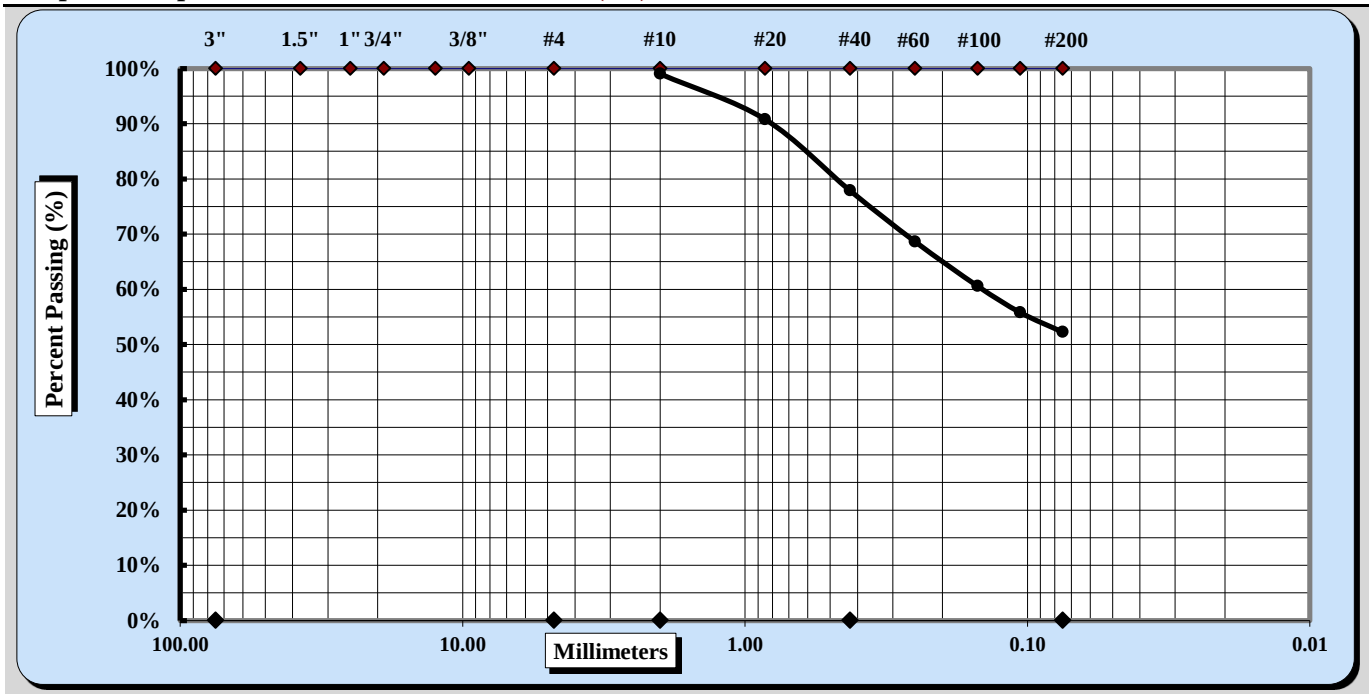
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/24/14 - 10/31/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: Bulk		
		Depth:	0 - 15 ft

Sample Description: SANDY LEAN CLAY (CL) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.9%	Fine Sand	25.6%
Gravel	0.0%	Medium Sand	21.2%	Silt & Clay	52.2%
Liquid Limit	41	Plastic Limit	19	Plastic Index	22

Coarse Sand	0.9%	Medium Sand	21.2%	Fine Sand	25.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

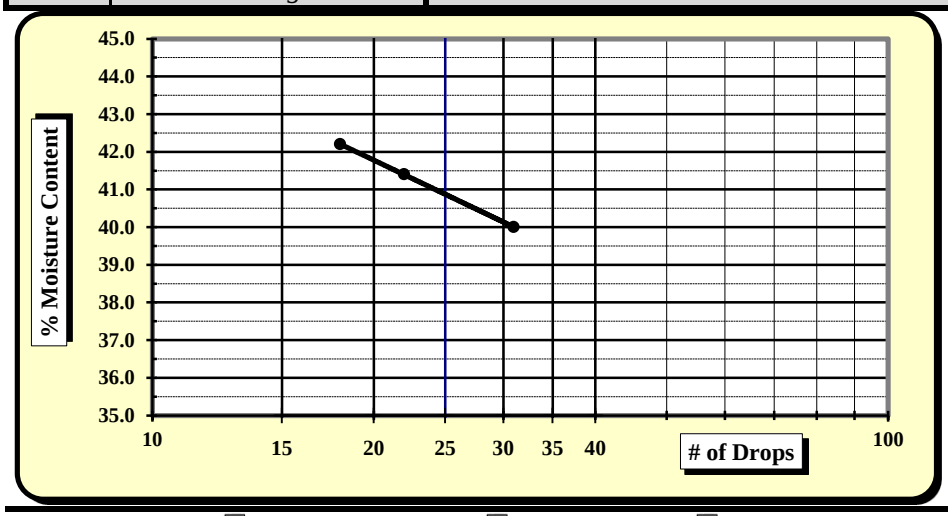
Log No.:345 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/5/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: Bulk		
		Depth: 0 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	15	12				16	21	
A	Tare Weight	15.52	15.40	15.63				15.70	15.58	
B	Wet Soil Weight + A	34.12	35.87	36.43				23.74	25.41	
C	Dry Soil Weight + A	28.60	29.88	30.49				22.45	23.83	
D	Water Weight (B-C)	5.52	5.99	5.94				1.29	1.58	
E	Dry Soil Weight (C-A)	13.08	14.48	14.86				6.75	8.25	
F	% Moisture (D/E)*100	42.2%	41.4%	40.0%				19.1%	19.2%	
N	# OF DROPS	18	22	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**19.2%**		



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	**41**
Plastic Limit	**19**
Plastic Index	**22**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/5/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

pH of Soil

AASHTO T 289

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/2/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-13	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		**A-7-6**

Equipment:

Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/14*	*Due:*	*3/17/15*
Sieve:	*#10*	*S&ME ID#*	*2487*	*Cal. Date:*	*9/4/14*	*Due:*	*3/4/15*
pH Meter:		*S&ME ID#*	*16576*	*Cal. Date:*	*12/2/14*		

pH Meter Calibration

Buffer Solution	***Results***
pH buffer 4.0	***4.01***
pH buffer 7.0	***7.00***
pH buffer 10.0	***10.01***
Buffer Temperature ^{0}C	***23.2°C***

Measuring pH of Soil

Beaker #: 7

Measurements	
Weight of Air Dry Soil (g)	***30.0***
Distilled Water (ml)	***30.1***
Temperature ^{0}C	***23.1°C***
pH Reading	***4.0***

Notes / Deviations / References: AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing

Michael D. Kelso	12/2/2014		
Technician Name	*Date*		
N. Randy Rainwater		Project Engineer	12/3/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-G57-1
Revision No. 0
Revision Date: 07/11/08

Sample Log No.: 345

Soil Resistivity

ASTM G57

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-13	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		**A-7-6**

Equipment:	*Standard Box*	*S&ME ID#*	*16577*		*Box Constant:*	*1*
Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/2014*	*Due:* *3/17/2015*
Oven		*S&ME ID#*	*12872*	*Cal. Date:*	*8/15/2014*	*Due:* *12/15/2014*
Decade Box (resistivity verification)		*S&ME ID#*	*19948*	*Cal. Date:*	*1/10/2014*	*Due:* *1/10/2015*

Moisture Content Determination

After 24-hr Condition

						Tare No.	***K-34***	
					A	Tare Weight		45.34
					B	Wet Wt + Tare Wt		150.79
					C	Dry Wt. + Tare Wt.		123.85
					D	Water Weight	**B-C**	26.94
					E	Dry Weight	**C-A**	78.51
					F	**Moisture Content**	**100*D/E**	**34.3%**

Resistivity (ohms - cm)

After 24-hr Condition

			M	Multiplier Dial Setting	10000
			B	Balance Dial Reading to Null	2.1
			R	**RESISTIVITY (Ω-cm), (MxBxBC)**	**21,000**

Notes / Deviations / References:

24-hr conditioning achieved by saturating the soil with distilled water for 24 hours prior to testing.

Miller 400A Resistivity Meter, ID#26821

ASTM G57: Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

Larry Presley — *Technician Name*

12/1/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

12/3/2014 — *Date*

Form No: TR-D2974-1
Revision No. 0
Revision Date: 07/10/08

Moisture, Ash, and Organic Matter

Sample Log No.:345 | *AASHTO T 267* | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1431-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/7/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-13	Sample No.:	Bulk
		Depth:	0 - 15 ft
Sample Description:	SANDY LEAN CLAY (CL)		A-7-6

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	6
t	Tare Weight	*grams*	16.61
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	55.62
c	Ash Weight + Tare Wt.	*grams*	55.01
C	Ash Weight	*c-t*	38.40
B	Mass of Oven Dry Specimen	*(b-t)*	39.01
D	***% Ash Content***	*(C/B)*100*	**98.4%**
	% Organic Matter	*100-D*	**1.6%**

Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

Derek Baker — *Technician Name*

11/7/2014 — *Date*

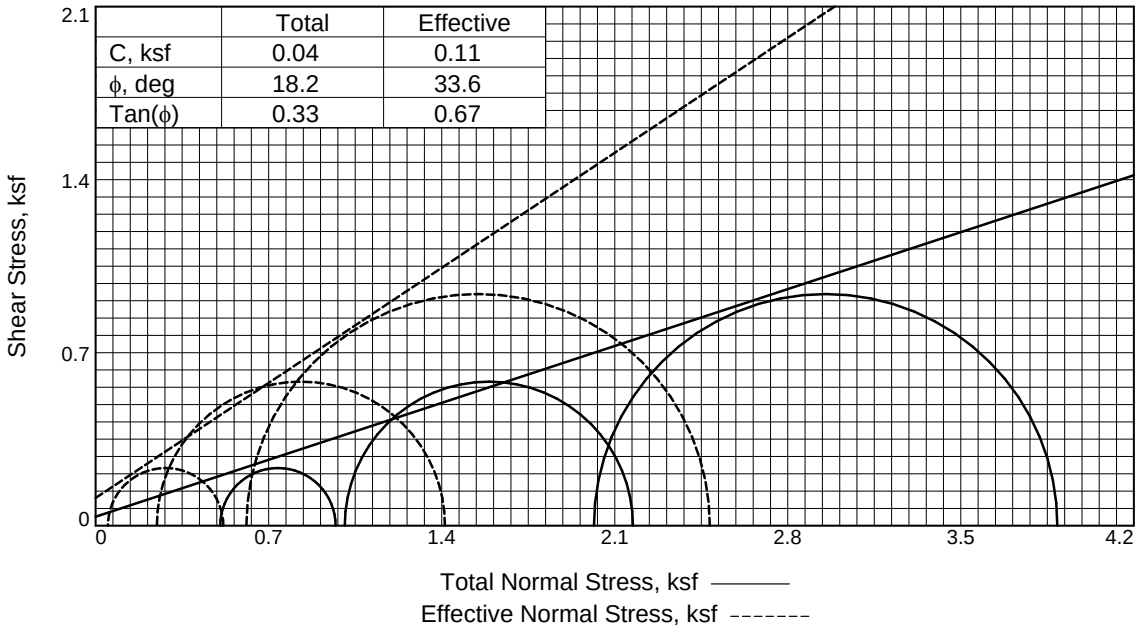
N. Randy Rainwater — *Technical Responsibility*

Signature

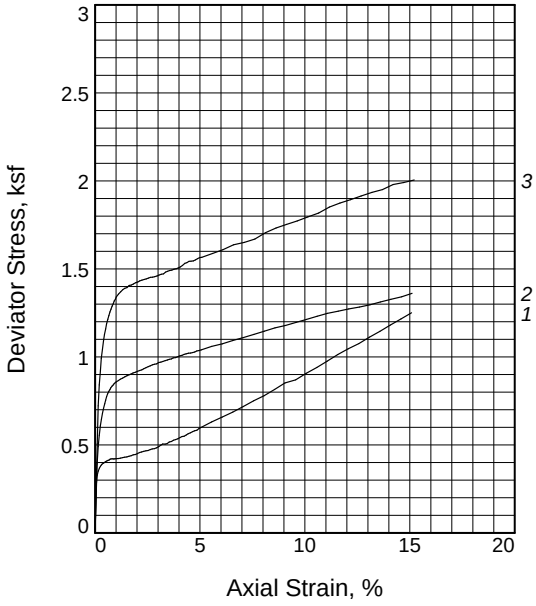
Project Engineer — *Position*

12/1/2014 — *Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.04	0.11
ϕ, deg	18.2	33.6
Tan(ϕ)	0.33	0.67



Specimen No.		1	2	3
Initial	Water Content, %	15.5	15.9	15.8
	Dry Density, pcf	108.0	106.7	107.1
	Saturation, %	77.3	76.4	77.0
	Void Ratio	0.5319	0.5501	0.5453
	Diameter, in.	2.857	2.861	2.862
	Height, in.	5.755	5.751	5.749
At Test	Water Content, %	19.2	20.0	18.9
	Dry Density, pcf	109.7	108.1	110.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5084	0.5309	0.5017
	Diameter, in.	2.837	2.847	2.834
	Height, in.	5.747	5.737	5.696
Strain rate, %/min.		0.25	0.25	0.25
Back Pressure, psi		90.00	90.00	90.00
Cell Pressure, psi		93.50	97.00	104.00
Fail. Stress, ksf		0.47	1.17	1.87
Total Pore Pr., ksf		13.41	13.72	14.37
Ult. Stress, ksf		1.25	1.36	2.01
Total Pore Pr., ksf		13.31	13.64	14.31
$\bar{\sigma}_1$ Failure, ksf		0.52	1.41	2.48
$\bar{\sigma}_3$ Failure, ksf		0.05	0.25	0.61

Type of Test:
CU with Pore Pressures

Sample Type: Remolded to appr.95%MDD

Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-7-6

LL= 41 **PL=** 19 **PI=** 22

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. MDD=113.4pcf at 15.2% moisture (D698). ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

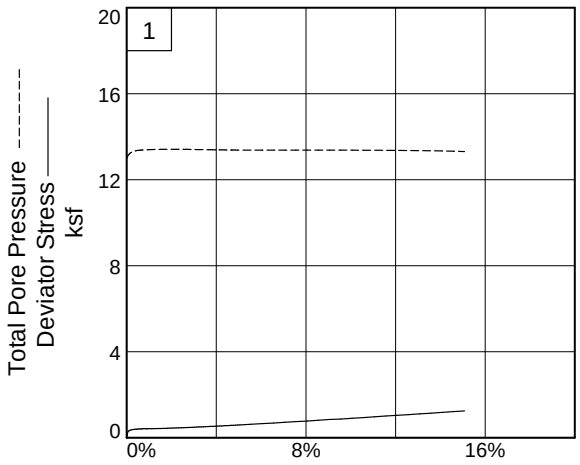
Location: B-13

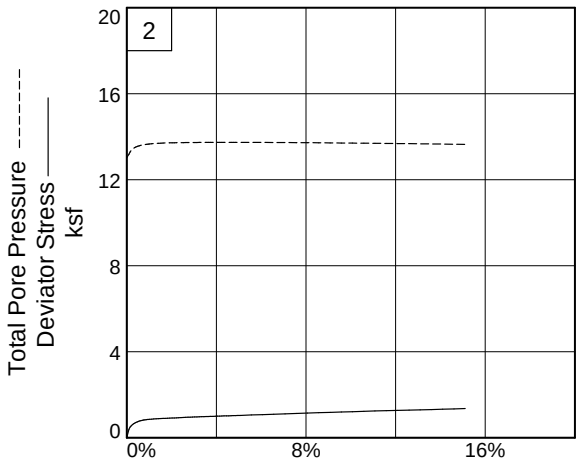
Sample Number: Log 345 **Depth:** 0 - 15 ft

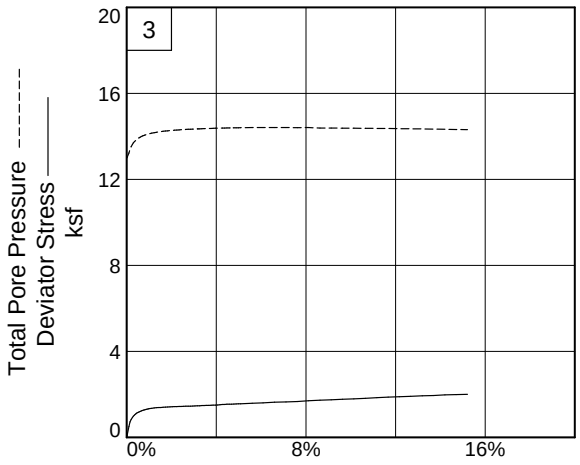
Proj. No.: 1461-14-046

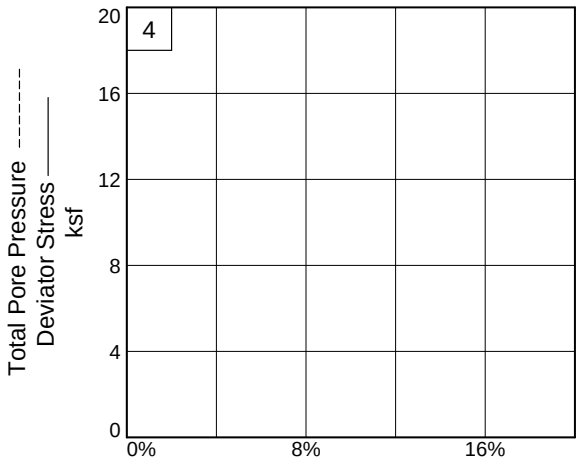
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

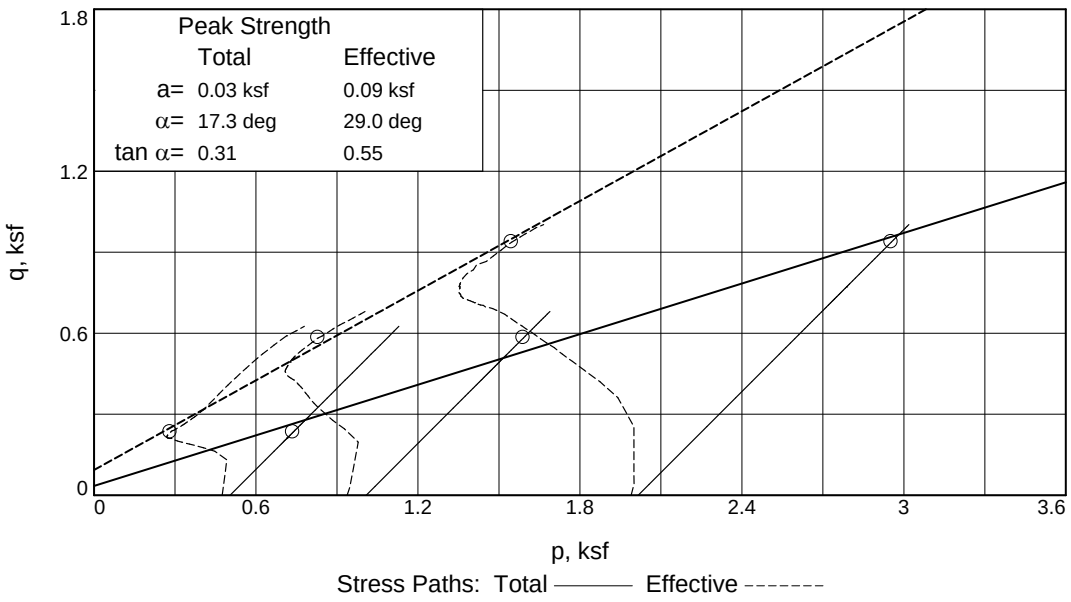
Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14











C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-13 **Depth:** 0 - 15 ft **Sample Number:** Log 345

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:15 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-13
Depth: 0 - 15 ft **Sample Number:** Log 345
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-7-6
Remarks: The specimens failed in bulging. MDD=113.4pcf at 15.2% moisture (D698). ASTM D4767.
Type of Sample: Remolded to appr.95%MDD
Assumed Specific Gravity=2.65 **LL=**41 **PL=**19 **PI=**22
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	76.200			1372.810
Moisture content: Dry soil+tare, gms.	66.880			1168.720
Moisture content: Tare, gms.	6.830			104.830
Moisture, %	15.5	19.3	19.2	19.2
Moist specimen weight, gms.	1208.50			
Diameter, in.	2.857	2.839	2.837	
Area, in.²	6.412	6.332	6.322	
Height, in.	5.755	5.750	5.747	
Net decrease in height, in.		0.005	0.003	
Net decrease in water volume, cc.			1.200	
Wet density, pcf	124.7	130.6	130.7	
Dry density, pcf	108.0	109.5	109.7	
Void ratio	0.5319	0.5114	0.5084	
Saturation, %	77.3	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 93.50 psi (13.46 ksf)
Consolidation back pressure = 90.00 psi (12.96 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.47 ksf **at reading no.** 34
Ult. Stress = 1.25 ksf **at reading no.** 80

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	4.133	0.0	0.0	0.00	0.47	0.47	1.00	90.20	0.47	0.00
1	0.0026	15.614	11.5	0.0	0.26	0.36	0.62	1.72	90.99	0.49	0.13
2	0.0057	18.461	14.3	0.1	0.33	0.28	0.61	2.14	91.52	0.45	0.16
3	0.0086	19.573	15.4	0.1	0.35	0.23	0.58	2.53	91.90	0.41	0.18
4	0.0119	20.338	16.2	0.2	0.37	0.19	0.56	2.92	92.17	0.38	0.18
5	0.0147	20.815	16.7	0.3	0.38	0.16	0.54	3.31	92.36	0.35	0.19
6	0.0174	21.160	17.0	0.3	0.39	0.14	0.53	3.69	92.50	0.34	0.19
7	0.0200	21.445	17.3	0.3	0.39	0.13	0.52	4.04	92.60	0.33	0.20
8	0.0234	21.659	17.5	0.4	0.40	0.12	0.51	4.40	92.69	0.32	0.20
9	0.0261	21.831	17.7	0.5	0.40	0.11	0.51	4.70	92.75	0.31	0.20
10	0.0287	22.011	17.9	0.5	0.41	0.10	0.51	5.03	92.80	0.30	0.20
11	0.0318	22.185	18.1	0.6	0.41	0.09	0.50	5.32	92.84	0.30	0.20
12	0.0354	22.355	18.2	0.6	0.41	0.09	0.50	5.66	92.89	0.29	0.21
13	0.0381	22.423	18.3	0.7	0.41	0.08	0.50	5.91	92.91	0.29	0.21
14	0.0411	22.680	18.5	0.7	0.42	0.08	0.50	6.19	92.94	0.29	0.21
15	0.0435	22.752	18.6	0.8	0.42	0.08	0.50	6.46	92.97	0.29	0.21
16	0.0470	22.781	18.6	0.8	0.42	0.08	0.50	6.61	92.98	0.29	0.21
17	0.0497	22.748	18.6	0.9	0.42	0.07	0.49	6.85	93.00	0.28	0.21
18	0.0522	22.766	18.6	0.9	0.42	0.07	0.49	7.09	93.02	0.28	0.21
19	0.0547	22.818	18.7	1.0	0.42	0.07	0.49	7.26	93.03	0.28	0.21
20	0.0579	22.855	18.7	1.0	0.42	0.06	0.49	7.51	93.05	0.28	0.21
21	0.0641	22.928	18.8	1.1	0.42	0.06	0.48	7.89	93.07	0.27	0.21
22	0.0699	23.023	18.9	1.2	0.43	0.06	0.48	8.21	93.09	0.27	0.21
23	0.0758	23.196	19.1	1.3	0.43	0.06	0.49	8.52	93.10	0.27	0.21
24	0.0812	23.300	19.2	1.4	0.43	0.05	0.49	8.84	93.12	0.27	0.22
25	0.0872	23.389	19.3	1.5	0.43	0.05	0.49	9.12	93.13	0.27	0.22
26	0.0928	23.597	19.5	1.6	0.44	0.05	0.49	9.36	93.14	0.27	0.22
27	0.0987	23.723	19.6	1.7	0.44	0.05	0.49	9.57	93.14	0.27	0.22
28	0.1046	24.012	19.9	1.8	0.44	0.05	0.50	9.78	93.15	0.27	0.22
29	0.1103	24.080	19.9	1.9	0.45	0.05	0.50	9.94	93.15	0.27	0.22
30	0.1160	24.347	20.2	2.0	0.45	0.05	0.50	10.04	93.15	0.28	0.23
31	0.1218	24.635	20.5	2.1	0.46	0.05	0.51	10.23	93.16	0.28	0.23
32	0.1272	24.780	20.6	2.2	0.46	0.05	0.51	10.30	93.16	0.28	0.23
33	0.1334	24.973	20.8	2.3	0.46	0.05	0.51	10.31	93.15	0.28	0.23
34	0.1393	25.131	21.0	2.4	0.47	0.05	0.52	10.40	93.16	0.28	0.23
35	0.1452	25.245	21.1	2.5	0.47	0.05	0.52	10.34	93.15	0.28	0.23
36	0.1510	25.509	21.4	2.6	0.47	0.05	0.52	10.56	93.16	0.29	0.24
37	0.1566	25.692	21.6	2.7	0.48	0.05	0.53	10.29	93.14	0.29	0.24
38	0.1624	25.786	21.7	2.8	0.48	0.05	0.53	9.89	93.13	0.29	0.24
39	0.1680	25.991	21.9	2.9	0.48	0.06	0.54	9.50	93.11	0.30	0.24
40	0.1743	26.341	22.2	3.0	0.49	0.06	0.55	9.36	93.09	0.30	0.25
41	0.1797	26.723	22.6	3.1	0.50	0.06	0.56	9.15	93.08	0.31	0.25
42	0.1855	27.064	22.9	3.2	0.51	0.06	0.57	9.06	93.06	0.32	0.25
43	0.1918	27.054	22.9	3.3	0.50	0.06	0.57	8.87	93.05	0.32	0.25
44	0.1972	27.213	23.1	3.4	0.51	0.07	0.57	8.72	93.04	0.32	0.25
45	0.2031	27.675	23.5	3.5	0.52	0.07	0.58	8.69	93.03	0.33	0.26
46	0.2093	27.834	23.7	3.6	0.52	0.07	0.59	8.54	93.02	0.33	0.26

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.2147	28.145	24.0	3.7	0.53	0.07	0.60	8.49	93.01	0.33	0.26
48	0.2204	28.338	24.2	3.8	0.53	0.07	0.60	8.40	93.00	0.34	0.27
49	0.2264	28.592	24.5	3.9	0.54	0.07	0.61	8.38	93.00	0.34	0.27
50	0.2323	28.933	24.8	4.0	0.54	0.07	0.62	8.33	92.99	0.35	0.27
51	0.2382	29.227	25.1	4.1	0.55	0.08	0.62	8.25	92.98	0.35	0.27
52	0.2437	29.313	25.2	4.2	0.55	0.08	0.63	8.16	92.97	0.35	0.27
53	0.2500	29.718	25.6	4.3	0.56	0.08	0.64	8.16	92.96	0.36	0.28
54	0.2552	30.026	25.9	4.4	0.56	0.08	0.64	8.14	92.95	0.36	0.28
55	0.2613	30.324	26.2	4.5	0.57	0.08	0.65	8.11	92.94	0.36	0.28
56	0.2674	30.652	26.5	4.7	0.58	0.08	0.66	8.07	92.93	0.37	0.29
57	0.2727	30.897	26.8	4.7	0.58	0.08	0.66	8.05	92.93	0.37	0.29
58	0.2787	31.066	26.9	4.8	0.58	0.08	0.67	8.00	92.92	0.38	0.29
59	0.2845	31.529	27.4	4.9	0.59	0.08	0.68	8.02	92.91	0.38	0.30
60	0.2903	31.866	27.7	5.1	0.60	0.09	0.69	8.03	92.91	0.39	0.30
61	0.3189	33.426	29.3	5.5	0.63	0.09	0.72	8.13	92.89	0.40	0.32
62	0.3480	34.914	30.8	6.1	0.66	0.09	0.75	8.43	92.88	0.42	0.33
63	0.3772	36.393	32.3	6.6	0.69	0.09	0.77	8.80	92.89	0.43	0.34
64	0.4060	38.079	33.9	7.1	0.72	0.09	0.81	9.10	92.88	0.45	0.36
65	0.4344	39.789	35.7	7.6	0.75	0.09	0.84	9.56	92.89	0.46	0.38
66	0.4630	41.384	37.3	8.1	0.78	0.09	0.87	9.92	92.89	0.48	0.39
67	0.4916	43.266	39.1	8.6	0.82	0.09	0.90	10.23	92.89	0.50	0.41
68	0.5201	45.298	41.2	9.0	0.85	0.09	0.94	10.60	92.88	0.52	0.43
69	0.5493	46.366	42.2	9.6	0.87	0.09	0.96	10.67	92.88	0.52	0.43
70	0.5783	48.398	44.3	10.1	0.91	0.09	1.00	11.02	92.87	0.54	0.45
71	0.6073	50.302	46.2	10.6	0.94	0.09	1.03	11.14	92.86	0.56	0.47
72	0.6355	52.295	48.2	11.1	0.98	0.10	1.07	11.26	92.84	0.58	0.49
73	0.6648	54.454	50.3	11.6	1.01	0.10	1.11	11.42	92.82	0.60	0.51
74	0.6933	56.378	52.2	12.1	1.05	0.10	1.15	11.32	92.80	0.62	0.52
75	0.7223	58.156	54.0	12.6	1.08	0.11	1.18	11.18	92.77	0.64	0.54
76	0.7514	60.303	56.2	13.1	1.11	0.11	1.22	11.07	92.73	0.67	0.56
77	0.7802	62.324	58.2	13.6	1.15	0.12	1.26	10.86	92.69	0.69	0.57
78	0.8088	64.469	60.3	14.1	1.18	0.12	1.30	10.60	92.65	0.71	0.59
79	0.8379	66.652	62.5	14.6	1.22	0.14	1.36	9.71	92.53	0.75	0.61
80	0.8666	68.800	64.7	15.1	1.25	0.15	1.40	9.13	92.43	0.78	0.63

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	112.310			1408.390
Moisture content: Dry soil+tare, gms.	97.870			1201.040
Moisture content: Tare, gms.	6.810			166.040
Moisture, %	15.9	20.6	20.0	20.0
Moist specimen weight, gms.	1200.40			
Diameter, in.	2.861	2.857	2.847	
Area, in.²	6.431	6.410	6.367	
Height, in.	5.751	5.750	5.737	
Net decrease in height, in.		0.001	0.013	
Net decrease in water volume, cc.			5.400	
Wet density, pcf	123.7	129.1	129.7	
Dry density, pcf	106.7	107.1	108.1	
Void ratio	0.5501	0.5447	0.5309	
Saturation, %	76.4	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 97.00 psi (13.97 ksf)
Consolidation back pressure = 90.00 psi (12.96 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 1.17 ksf **at reading no.** 67
Ult. Stress = 1.36 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	2.752	0.0	0.0	0.00	0.94	0.94	1.00	90.49	0.94	0.00
1	0.0009	5.638	2.9	0.0	0.07	0.92	0.98	1.07	90.64	0.95	0.03
2	0.0055	20.145	17.4	0.1	0.39	0.78	1.18	1.50	91.57	0.98	0.20
3	0.0084	24.513	21.8	0.1	0.49	0.68	1.17	1.72	92.26	0.93	0.25
4	0.0113	27.318	24.6	0.2	0.55	0.61	1.16	1.91	92.79	0.88	0.28
5	0.0145	29.680	26.9	0.3	0.61	0.55	1.16	2.10	93.17	0.86	0.30
6	0.0173	31.397	28.6	0.3	0.65	0.51	1.16	2.27	93.46	0.83	0.32
7	0.0201	32.914	30.2	0.4	0.68	0.48	1.16	2.43	93.70	0.82	0.34
8	0.0230	34.190	31.4	0.4	0.71	0.45	1.16	2.58	93.88	0.80	0.35
9	0.0263	35.370	32.6	0.5	0.73	0.43	1.16	2.72	94.04	0.79	0.37
10	0.0289	36.307	33.6	0.5	0.76	0.41	1.16	2.86	94.18	0.78	0.38
11	0.0317	37.201	34.4	0.6	0.77	0.39	1.17	2.99	94.29	0.78	0.39
12	0.0345	37.944	35.2	0.6	0.79	0.38	1.17	3.10	94.39	0.77	0.40
13	0.0375	38.536	35.8	0.7	0.80	0.36	1.17	3.21	94.47	0.77	0.40
14	0.0407	39.013	36.3	0.7	0.81	0.35	1.17	3.31	94.55	0.76	0.41
15	0.0430	39.482	36.7	0.7	0.82	0.34	1.17	3.40	94.62	0.76	0.41
16	0.0463	39.939	37.2	0.8	0.83	0.33	1.17	3.49	94.68	0.75	0.42
17	0.0496	40.284	37.5	0.9	0.84	0.33	1.17	3.58	94.73	0.75	0.42
18	0.0522	40.631	37.9	0.9	0.85	0.32	1.17	3.65	94.78	0.74	0.42
19	0.0553	40.888	38.1	1.0	0.85	0.31	1.17	3.73	94.82	0.74	0.43
20	0.0578	41.093	38.3	1.0	0.86	0.31	1.17	3.79	94.86	0.74	0.43
21	0.0639	41.496	38.7	1.1	0.87	0.30	1.16	3.92	94.94	0.73	0.43
22	0.0689	41.869	39.1	1.2	0.87	0.29	1.16	4.04	95.00	0.72	0.44
23	0.0751	42.173	39.4	1.3	0.88	0.28	1.16	4.14	95.06	0.72	0.44
24	0.0814	42.555	39.8	1.4	0.89	0.27	1.16	4.25	95.10	0.72	0.44

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.0874	42.853	40.1	1.5	0.89	0.27	1.16	4.33	95.14	0.71	0.45
26	0.0928	43.130	40.4	1.6	0.90	0.26	1.16	4.42	95.18	0.71	0.45
27	0.0985	43.377	40.6	1.7	0.90	0.26	1.16	4.49	95.21	0.71	0.45
28	0.1041	43.689	40.9	1.8	0.91	0.26	1.16	4.56	95.23	0.71	0.45
29	0.1101	43.918	41.2	1.9	0.91	0.25	1.17	4.62	95.25	0.71	0.46
30	0.1160	44.187	41.4	2.0	0.92	0.25	1.17	4.68	95.27	0.71	0.46
31	0.1215	44.439	41.7	2.1	0.92	0.25	1.17	4.73	95.28	0.71	0.46
32	0.1279	44.674	41.9	2.2	0.93	0.25	1.17	4.78	95.30	0.71	0.46
33	0.1328	44.965	42.2	2.3	0.93	0.24	1.18	4.82	95.31	0.71	0.47
34	0.1391	45.282	42.5	2.4	0.94	0.24	1.18	4.87	95.32	0.71	0.47
35	0.1451	45.612	42.9	2.5	0.94	0.24	1.19	4.92	95.32	0.71	0.47
36	0.1507	45.857	43.1	2.6	0.95	0.24	1.19	4.96	95.33	0.71	0.47
37	0.1568	46.173	43.4	2.7	0.96	0.24	1.19	4.99	95.34	0.72	0.48
38	0.1624	46.369	43.6	2.8	0.96	0.24	1.20	5.02	95.35	0.72	0.48
39	0.1682	46.528	43.8	2.9	0.96	0.24	1.20	5.05	95.35	0.72	0.48
40	0.1739	46.893	44.1	3.0	0.97	0.24	1.20	5.09	95.36	0.72	0.48
41	0.1798	47.057	44.3	3.1	0.97	0.24	1.21	5.11	95.36	0.72	0.49
42	0.1853	47.273	44.5	3.2	0.97	0.23	1.21	5.15	95.37	0.72	0.49
43	0.1915	47.543	44.8	3.3	0.98	0.23	1.21	5.18	95.37	0.72	0.49
44	0.1976	47.761	45.0	3.4	0.98	0.23	1.22	5.20	95.38	0.73	0.49
45	0.2028	47.984	45.2	3.5	0.99	0.23	1.22	5.23	95.38	0.73	0.49
46	0.2085	48.134	45.4	3.6	0.99	0.23	1.22	5.26	95.39	0.73	0.49
47	0.2139	48.432	45.7	3.7	0.99	0.23	1.23	5.29	95.39	0.73	0.50
48	0.2205	48.568	45.8	3.8	1.00	0.23	1.23	5.31	95.39	0.73	0.50
49	0.2264	48.874	46.1	3.9	1.00	0.23	1.23	5.34	95.40	0.73	0.50
50	0.2318	49.121	46.4	4.0	1.01	0.23	1.24	5.37	95.40	0.73	0.50
51	0.2377	49.317	46.6	4.1	1.01	0.23	1.24	5.39	95.40	0.73	0.50
52	0.2434	49.591	46.8	4.2	1.01	0.23	1.24	5.41	95.40	0.74	0.51
53	0.2489	49.777	47.0	4.3	1.02	0.23	1.25	5.43	95.40	0.74	0.51
54	0.2554	50.003	47.3	4.5	1.02	0.23	1.25	5.45	95.41	0.74	0.51
55	0.2612	50.090	47.3	4.6	1.02	0.23	1.25	5.45	95.41	0.74	0.51
56	0.2670	50.297	47.5	4.7	1.03	0.23	1.25	5.46	95.41	0.74	0.51
57	0.2726	50.497	47.7	4.8	1.03	0.23	1.26	5.48	95.41	0.74	0.51
58	0.2782	50.797	48.0	4.8	1.03	0.23	1.26	5.51	95.41	0.75	0.52
59	0.2846	50.969	48.2	5.0	1.04	0.23	1.27	5.51	95.41	0.75	0.52
60	0.2902	51.191	48.4	5.1	1.04	0.23	1.27	5.52	95.40	0.75	0.52
61	0.3188	52.387	49.6	5.6	1.06	0.23	1.29	5.58	95.39	0.76	0.53
62	0.3474	53.316	50.6	6.1	1.07	0.23	1.31	5.61	95.38	0.77	0.54
63	0.3763	54.475	51.7	6.6	1.09	0.24	1.33	5.64	95.36	0.78	0.55
64	0.4052	55.568	52.8	7.1	1.11	0.24	1.35	5.65	95.34	0.79	0.56
65	0.4341	56.732	54.0	7.6	1.13	0.24	1.37	5.67	95.32	0.81	0.56
66	0.4628	57.905	55.2	8.1	1.15	0.24	1.39	5.68	95.30	0.82	0.57
67	0.4917	59.124	56.4	8.6	1.17	0.25	1.41	5.71	95.28	0.83	0.58
68	0.5207	60.094	57.3	9.1	1.18	0.26	1.43	5.62	95.23	0.84	0.59
69	0.5495	61.265	58.5	9.6	1.20	0.26	1.46	5.59	95.19	0.86	0.60
70	0.5776	62.407	59.7	10.1	1.21	0.27	1.48	5.57	95.16	0.87	0.61
71	0.6070	63.628	60.9	10.6	1.23	0.27	1.50	5.57	95.13	0.89	0.62

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
72	0.6353	64.784	62.0	11.1	1.25	0.27	1.52	5.56	95.10	0.90	0.62
73	0.6646	65.780	63.0	11.6	1.26	0.28	1.54	5.51	95.06	0.91	0.63
74	0.6936	66.758	64.0	12.1	1.27	0.28	1.56	5.47	95.02	0.92	0.64
75	0.7227	67.675	64.9	12.6	1.28	0.29	1.57	5.42	94.98	0.93	0.64
76	0.7513	68.706	66.0	13.1	1.30	0.30	1.59	5.36	94.94	0.95	0.65
77	0.7799	69.891	67.1	13.6	1.31	0.30	1.62	5.32	94.89	0.96	0.66
78	0.8087	71.091	68.3	14.1	1.33	0.31	1.64	5.29	94.85	0.97	0.66
79	0.8380	72.232	69.5	14.6	1.34	0.32	1.66	5.24	94.80	0.99	0.67
80	0.8667	73.653	70.9	15.1	1.36	0.32	1.68	5.21	94.76	1.00	0.68

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	127.870			1413.740
Moisture content: Dry soil+tare, gms.	111.330			1216.950
Moisture content: Tare, gms.	6.900			177.460
Moisture, %	15.8	19.5	18.9	18.9
Moist specimen weight, gms.	1204.00			
Diameter, in.	2.862	2.835	2.834	
Area, in.²	6.433	6.314	6.310	
Height, in.	5.749	5.749	5.696	
Net decrease in height, in.		0.000	0.053	
Net decrease in water volume, cc.			5.900	
Wet density, pcf	124.0	130.3	131.0	
Dry density, pcf	107.1	109.1	110.2	
Void ratio	0.5453	0.5167	0.5017	
Saturation, %	77.0	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 104.00 psi (14.98 ksf)
Consolidation back pressure = 90.00 psi (12.96 ksf)
Consolidation effective confining stress = 2.02 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 1.87 ksf **at reading no.** 73
Ult. Stress = 2.01 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	2.894	0.0	0.0	0.00	1.99	1.99	1.00	90.18	1.99	0.00
1	0.0009	6.397	3.5	0.0	0.08	1.96	2.04	1.04	90.39	2.00	0.04
2	0.0058	25.186	22.3	0.1	0.51	1.75	2.25	1.29	91.88	2.00	0.25
3	0.0084	34.583	31.7	0.1	0.72	1.58	2.30	1.46	93.03	1.94	0.36
4	0.0115	39.835	36.9	0.2	0.84	1.45	2.29	1.58	93.91	1.87	0.42
5	0.0145	43.529	40.6	0.3	0.93	1.35	2.28	1.68	94.60	1.82	0.46
6	0.0169	46.460	43.6	0.3	0.99	1.28	2.27	1.78	95.14	1.77	0.50
7	0.0200	48.819	45.9	0.4	1.04	1.21	2.26	1.86	95.58	1.74	0.52
8	0.0231	50.975	48.1	0.4	1.09	1.16	2.25	1.94	95.95	1.71	0.55
9	0.0255	52.533	49.6	0.4	1.13	1.11	2.24	2.01	96.27	1.68	0.56
10	0.0288	53.950	51.1	0.5	1.16	1.07	2.23	2.08	96.54	1.65	0.58
11	0.0313	55.276	52.4	0.5	1.19	1.04	2.23	2.14	96.78	1.63	0.59

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.0345	56.410	53.5	0.6	1.21	1.01	2.22	2.20	97.00	1.62	0.61
13	0.0375	57.361	54.5	0.7	1.23	0.98	2.22	2.26	97.18	1.60	0.62
14	0.0403	58.282	55.4	0.7	1.26	0.96	2.21	2.31	97.35	1.58	0.63
15	0.0434	59.021	56.1	0.8	1.27	0.94	2.21	2.36	97.51	1.57	0.64
16	0.0460	59.797	56.9	0.8	1.29	0.92	2.20	2.41	97.64	1.56	0.64
17	0.0493	60.456	57.6	0.9	1.30	0.90	2.20	2.45	97.77	1.55	0.65
18	0.0521	61.165	58.3	0.9	1.32	0.88	2.20	2.50	97.88	1.54	0.66
19	0.0552	61.657	58.8	1.0	1.33	0.87	2.19	2.53	97.99	1.53	0.66
20	0.0574	62.233	59.3	1.0	1.34	0.85	2.19	2.57	98.09	1.52	0.67
21	0.0636	63.014	60.1	1.1	1.36	0.83	2.18	2.64	98.26	1.50	0.68
22	0.0696	63.694	60.8	1.2	1.37	0.80	2.18	2.70	98.41	1.49	0.69
23	0.0754	64.296	61.4	1.3	1.38	0.79	2.17	2.76	98.55	1.48	0.69
24	0.0810	64.690	61.8	1.4	1.39	0.77	2.16	2.81	98.67	1.46	0.70
25	0.0868	64.935	62.0	1.5	1.39	0.75	2.15	2.85	98.77	1.45	0.70
26	0.0926	65.525	62.6	1.6	1.41	0.74	2.15	2.90	98.86	1.44	0.70
27	0.0984	65.712	62.8	1.7	1.41	0.73	2.14	2.94	98.95	1.43	0.70
28	0.1042	66.030	63.1	1.8	1.41	0.72	2.13	2.97	99.03	1.42	0.71
29	0.1101	66.441	63.5	1.9	1.42	0.71	2.13	3.01	99.10	1.42	0.71
30	0.1160	66.670	63.8	2.0	1.43	0.70	2.12	3.05	99.16	1.41	0.71
31	0.1210	67.012	64.1	2.1	1.43	0.69	2.12	3.08	99.22	1.40	0.72
32	0.1273	67.262	64.4	2.2	1.44	0.68	2.12	3.11	99.28	1.40	0.72
33	0.1332	67.527	64.6	2.3	1.44	0.67	2.11	3.14	99.33	1.39	0.72
34	0.1387	67.718	64.8	2.4	1.44	0.67	2.11	3.17	99.38	1.39	0.72
35	0.1447	67.982	65.1	2.5	1.45	0.66	2.11	3.19	99.42	1.38	0.72
36	0.1505	68.281	65.4	2.6	1.45	0.65	2.11	3.23	99.47	1.38	0.73
37	0.1562	68.380	65.5	2.7	1.45	0.65	2.10	3.25	99.50	1.37	0.73
38	0.1621	68.561	65.7	2.8	1.46	0.64	2.10	3.27	99.54	1.37	0.73
39	0.1680	68.830	65.9	2.9	1.46	0.64	2.10	3.29	99.58	1.37	0.73
40	0.1736	69.123	66.2	3.0	1.47	0.63	2.10	3.32	99.61	1.36	0.73
41	0.1796	69.414	66.5	3.2	1.47	0.63	2.10	3.35	99.65	1.36	0.74
42	0.1857	69.585	66.7	3.3	1.47	0.62	2.10	3.36	99.67	1.36	0.74
43	0.1911	70.087	67.2	3.4	1.48	0.62	2.10	3.40	99.71	1.36	0.74
44	0.1967	70.368	67.5	3.5	1.49	0.61	2.10	3.42	99.73	1.36	0.74
45	0.2020	70.641	67.7	3.5	1.49	0.61	2.10	3.44	99.76	1.36	0.75
46	0.2084	70.813	67.9	3.7	1.49	0.61	2.10	3.46	99.78	1.35	0.75
47	0.2144	71.123	68.2	3.8	1.50	0.60	2.10	3.48	99.80	1.35	0.75
48	0.2197	71.293	68.4	3.9	1.50	0.60	2.10	3.50	99.83	1.35	0.75
49	0.2258	71.568	68.7	4.0	1.51	0.60	2.10	3.52	99.85	1.35	0.75
50	0.2316	71.950	69.1	4.1	1.51	0.59	2.11	3.54	99.87	1.35	0.76
51	0.2373	72.377	69.5	4.2	1.52	0.59	2.11	3.57	99.89	1.35	0.76
52	0.2438	73.035	70.1	4.3	1.53	0.59	2.12	3.60	99.91	1.36	0.77
53	0.2490	73.267	70.4	4.4	1.54	0.59	2.12	3.62	99.92	1.35	0.77
54	0.2549	73.699	70.8	4.5	1.54	0.58	2.13	3.64	99.94	1.36	0.77
55	0.2605	73.789	70.9	4.6	1.54	0.58	2.13	3.65	99.96	1.35	0.77
56	0.2664	73.929	71.0	4.7	1.55	0.58	2.13	3.66	99.97	1.35	0.77
57	0.2726	74.289	71.4	4.8	1.55	0.58	2.13	3.69	99.99	1.35	0.78
58	0.2782	74.686	71.8	4.9	1.56	0.58	2.13	3.71	100.00	1.36	0.78

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
59	0.2839	75.038	72.1	5.0	1.56	0.57	2.14	3.72	100.01	1.36	0.78
60	0.2898	75.202	72.3	5.1	1.57	0.57	2.14	3.74	100.02	1.36	0.78
61	0.3190	76.597	73.7	5.6	1.59	0.57	2.15	3.80	100.07	1.36	0.79
62	0.3468	77.969	75.1	6.1	1.61	0.56	2.17	3.86	100.10	1.37	0.80
63	0.3759	79.720	76.8	6.6	1.64	0.56	2.20	3.92	100.11	1.38	0.82
64	0.4051	80.759	77.9	7.1	1.65	0.56	2.21	3.93	100.09	1.39	0.83
65	0.4338	82.095	79.2	7.6	1.67	0.57	2.24	3.93	100.04	1.41	0.83
66	0.4627	84.274	81.4	8.1	1.71	0.56	2.27	4.03	100.08	1.42	0.85
67	0.4914	85.981	83.1	8.6	1.73	0.59	2.32	3.95	99.92	1.45	0.87
68	0.5200	87.442	84.5	9.1	1.75	0.59	2.34	3.97	99.90	1.47	0.88
69	0.5489	88.871	86.0	9.6	1.77	0.59	2.37	3.99	99.88	1.48	0.89
70	0.5776	90.434	87.5	10.1	1.80	0.60	2.39	4.01	99.86	1.49	0.90
71	0.6069	92.041	89.1	10.7	1.82	0.60	2.42	4.03	99.83	1.51	0.91
72	0.6361	94.216	91.3	11.2	1.85	0.60	2.46	4.06	99.80	1.53	0.93
73	0.6646	95.888	93.0	11.7	1.87	0.61	2.48	4.07	99.77	1.55	0.94
74	0.6930	97.351	94.5	12.2	1.89	0.62	2.51	4.07	99.72	1.56	0.95
75	0.7221	98.955	96.1	12.7	1.91	0.62	2.54	4.08	99.68	1.58	0.96
76	0.7514	100.555	97.7	13.2	1.93	0.63	2.56	4.08	99.63	1.60	0.97
77	0.7800	101.958	99.1	13.7	1.95	0.64	2.59	4.06	99.57	1.61	0.98
78	0.8091	104.000	101.1	14.2	1.98	0.65	2.62	4.07	99.52	1.63	0.99
79	0.8377	105.198	102.3	14.7	1.99	0.65	2.65	4.05	99.46	1.65	1.00
80	0.8662	106.514	103.6	15.2	2.01	0.66	2.67	4.02	99.39	1.67	1.00

Form No. TR-D698-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

Quality Assurance

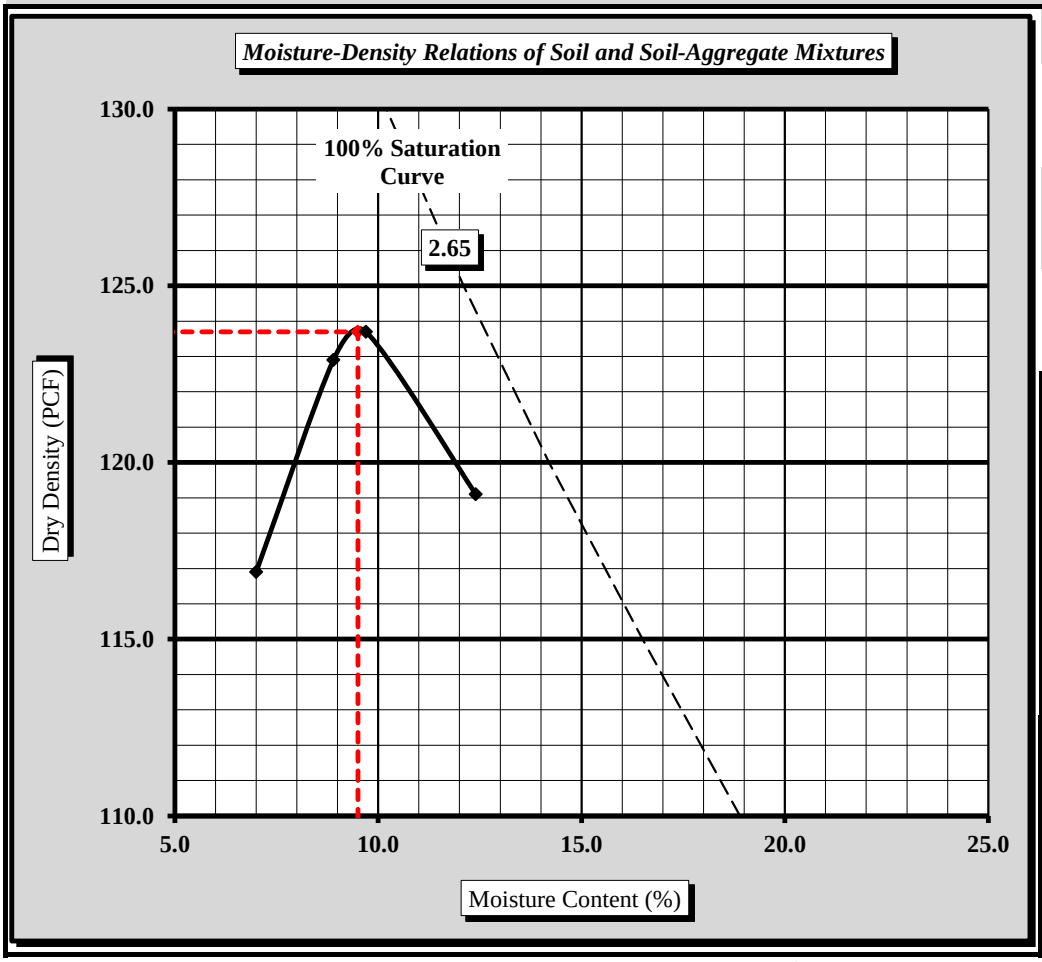
Sample Log No.: 346

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

S&ME Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/23/14 - 10/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-18		
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		A-2-6

Maximum Dry Density **123.7** **PCF.** **Optimum Moisture Content** **9.5%**

ASTM D698 - - Method B



Soil Properties

Natural Moisture Content	**11.2%**
Liquid Limit	**25**
Plastic Limit	**14**
Plastic Index	**11**

% Passing

3/8"	99.4%

Oversize Fraction

Bulk Gravity	
Absorption	**NA**
% 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 D698, D422, D4318, D2487; AASTHO M145

The specific gravity value of the 100% saturation curve is assumed.

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:346

Sieve Analysis of Soils

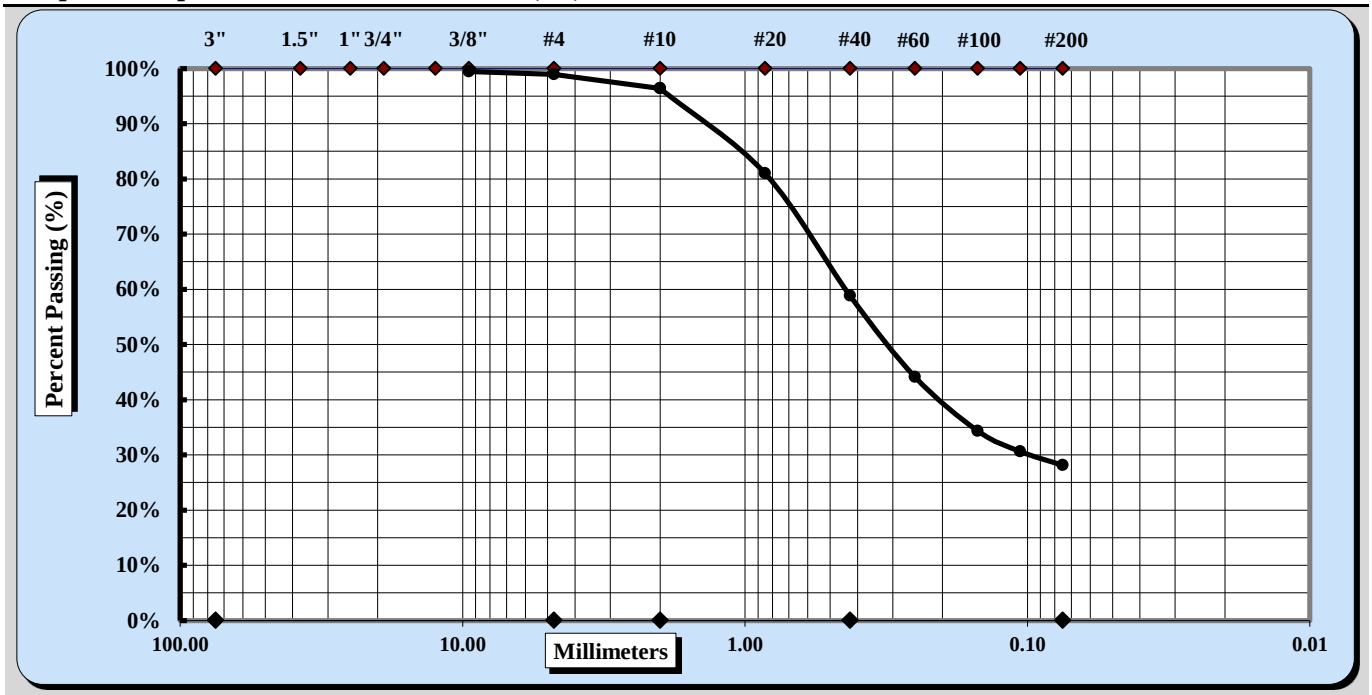
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/27/14 - 10/31/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Sample No: Bulk		
		Depth:	0 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-2-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Coarse Sand	2.6%	Fine Sand	30.7%
Gravel	1.1%	Medium Sand	37.5%	Silt & Clay	28.1%
Liquid Limit	25	Plastic Limit	14	Plastic Index	11

Coarse Sand	2.6%	Medium Sand	37.5%	Fine Sand	30.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

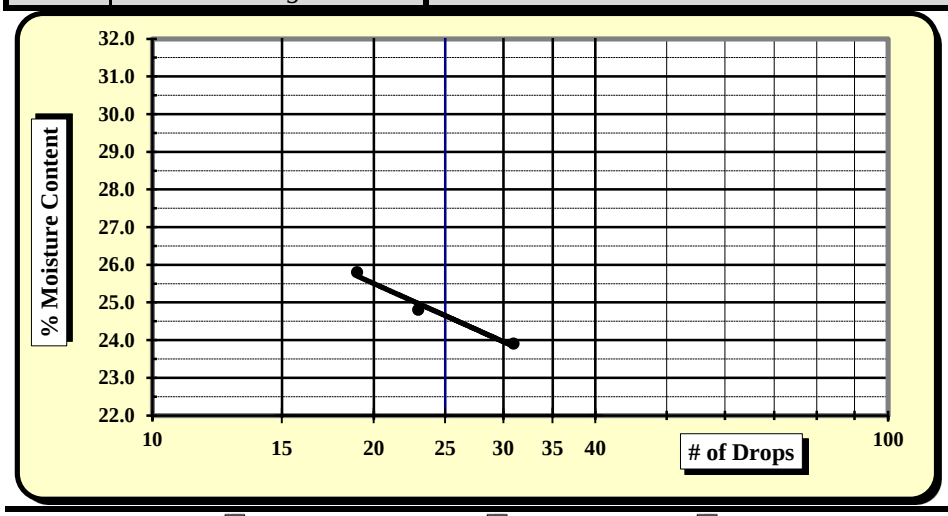
Log No.:346 *ASTM D4318* ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐ ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/5/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-18	Sample No: Bulk		
		Depth: 0 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	7	4	11				5	24	
A	Tare Weight	15.49	15.51	15.50				15.48	15.51	
B	Wet Soil Weight + A	33.65	34.56	35.85				25.29	24.09	
C	Dry Soil Weight + A	29.93	30.77	31.93				24.06	23.03	
D	Water Weight (B-C)	3.72	3.79	3.92				1.23	1.06	
E	Dry Soil Weight (C-A)	14.44	15.26	16.43				8.58	7.52	
F	% Moisture (D/E)*100	25.8%	24.8%	23.9%				14.3%	14.1%	
N	# OF DROPS	19	23	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**14.2%**		



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 **25**
Plastic Limit **14**
Plastic Index **11**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASTHO Classification A-2-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/5/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

pH of Soil

AASHTO T 289

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/2/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Sample ID:	B-18	Type: Bulk	
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		**A-2-6**

Equipment:

Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/14*	*Due:*	*3/17/15*
Sieve:	*#10*	*S&ME ID#*	*2487*	*Cal. Date:*	*9/4/14*	*Due:*	*3/4/15*
pH Meter:		*S&ME ID#*	*16576*	*Cal. Date:*	*12/2/14*		

pH Meter Calibration

Buffer Solution	***Results***
pH buffer 4.0	***4.01***
pH buffer 7.0	***7.00***
pH buffer 10.0	***10.01***
Buffer Temperature ^{0}C	***23.2°C***

Measuring pH of Soil

Beaker #: 10

Measurements	
Weight of Air Dry Soil (g)	***29.9***
Distilled Water (ml)	***30.0***
Temperature ^{0}C	***23.2°C***
pH Reading	***4.5***

Notes / Deviations / References: AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing

Michael D. Kelso — *Technician Name*
12/2/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/3/2014 — *Date*

Form No: TR-G57-1
Revision No. 0
Revision Date: 07/11/08

Sample Log No.: 346

Soil Resistivity

ASTM G57

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	12/2/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	12/1/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		

Sample ID: B-18 Type: Bulk

Depth: 0 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-2-6**

Equipment:	*Standard Box*	*S&ME ID#*	*16577*		*Box Constant:*	*1*	
Balance		*S&ME ID#*	*18435*	*Cal. Date:*	*3/17/2014*	*Due:*	*3/17/2015*
Oven		*S&ME ID#*	*12872*	*Cal. Date:*	*8/15/2014*	*Due:*	*12/15/2014*
Decade Box (resistivity verification)		*S&ME ID#*	*19948*	*Cal. Date:*	*1/10/2014*	*Due:*	*1/10/2015*

Moisture Content Determination

After 24-hr Condition

						Tare No.	***AA-7***	
					A	Tare Weight		32.55
					B	Wet Wt + Tare Wt		105.46
					C	Dry Wt. + Tare Wt.		90.71
					D	Water Weight	**B-C**	14.75
					E	Dry Weight	**C-A**	58.16
					F	**Moisture Content**	**100*D/E**	**25.4%**

Resistivity (ohms - cm)

After 24-hr Condition

			M	Multiplier Dial Setting	1000
			B	Balance Dial Reading to Null	5.4
			R	**RESISTIVITY (Ω-cm), (MxBxBC)**	**5,400**

Notes / Deviations / References:

24-hr conditioning achieved by saturating the soil with distilled water for 24 hours prior to testing.

Miller 400A Resistivity Meter, ID#26821

ASTM G57: Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

Larry Presley — *Technician Name*

12/1/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*

Signature

Project Engineer — *Position*

12/3/2014 — *Date*

Moisture, Ash, and Organic Matter

Sample Log No.:346 | *AASHTO T 267* | ***Quality Assurance***

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1431-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/7/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.:	B-18	Sample No.:	Bulk
		Depth:	0 - 15 ft
Sample Description:	CLAYEY SAND (SC)		A-2-6

Equipment: *Balance: 0.01 g.Readability, 500g. Minimum Capacity*

Balance: *S&ME ID #:* ***18435*** *Cal. Date:* ***3/17/14*** *Due:* ***3/17/15***

	***Muffle Furnace:* 455°C (+/-10°C)**	*Tare #*	AA
t	Tare Weight	*grams*	64.18
b	Mass of Oven Dry Specimen + Tare Wt.	*grams*	156.61
c	Ash Weight + Tare Wt.	*grams*	154.50
C	Ash Weight	*c-t*	90.32
B	Mass of Oven Dry Specimen	*(b-t)*	92.43
D	***% Ash Content***	*(C/B)*100*	**97.7%**
	% Organic Matter	*100-D*	**2.3%**

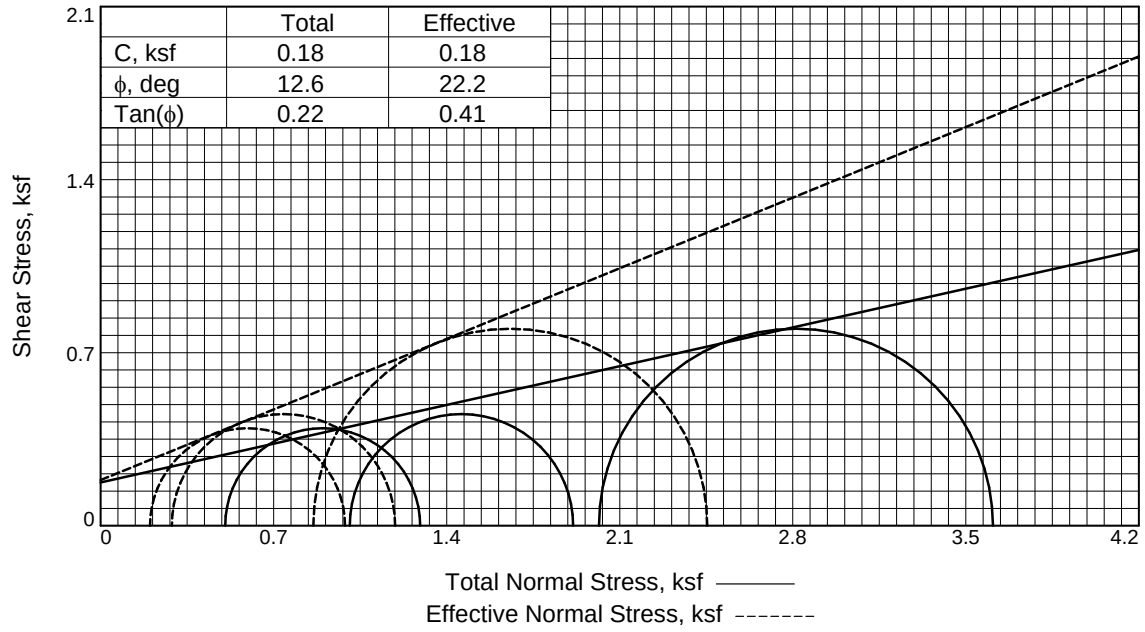
Muffle Furnace: *S&ME ID #:* ***16573*** *Cal. Date:* ***2/10/14*** *Due:* ***2/10/15***

Notes / Deviations / References: AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition

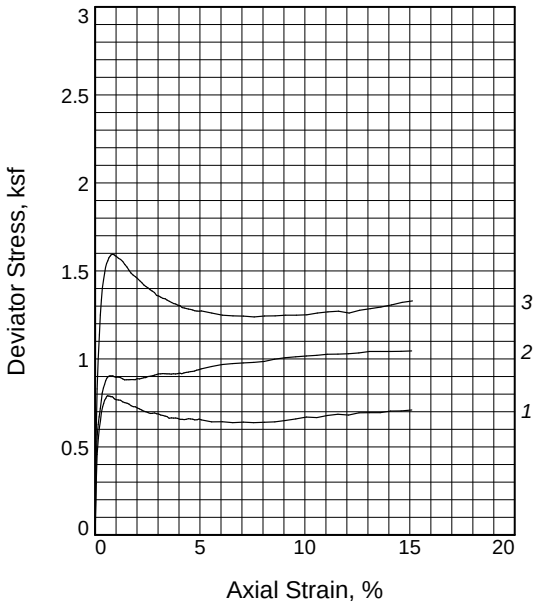
Derek Baker — *Technician Name*
11/7/2014 — *Date*

N. Randy Rainwater — *Technical Responsibility*
Signature
Project Engineer — *Position*
12/1/2014 — *Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.18	0.18
ϕ, deg	12.6	22.2
Tan(ϕ)	0.22	0.41



Specimen No.		1	2	3
Initial	Water Content, %	9.2	9.6	9.5
	Dry Density, pcf	117.9	116.8	117.6
	Saturation, %	60.2	60.9	62.1
	Void Ratio	0.4031	0.4167	0.4062
	Diameter, in.	2.859	2.863	2.858
	Height, in.	5.988	6.007	5.985
At Test	Water Content, %	14.8	13.9	13.2
	Dry Density, pcf	118.8	120.9	122.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3925	0.3688	0.3493
	Diameter, in.	2.851	2.818	2.805
	Height, in.	5.977	5.994	5.959
Strain rate, %/min.		0.25	0.25	0.25
Back Pressure, psi		70.00	60.00	70.00
Cell Pressure, psi		73.50	67.00	84.00
Fail. Stress, ksf		0.79	0.90	1.59
Total Pore Pr., ksf		10.38	9.36	11.24
Ult. Stress, ksf		0.71	1.05	1.33
Total Pore Pr., ksf		10.41	9.34	11.61
$\bar{\sigma}_1$ Failure, ksf		0.99	1.19	2.45
$\bar{\sigma}_3$ Failure, ksf		0.20	0.29	0.86

Type of Test:
CU with Pore Pressures

Sample Type: Remolded to appr.95%MDD

Description: USCS: CLAYEY SAND (SC); AASHTO: A-2-6

LL= 25 **PL=** 14 **PI=** 11

Assumed Specific Gravity= 2.65

Remarks: The specimens failed in bulging. MDD=123.7pcf at 9.5% moisture (D698). ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

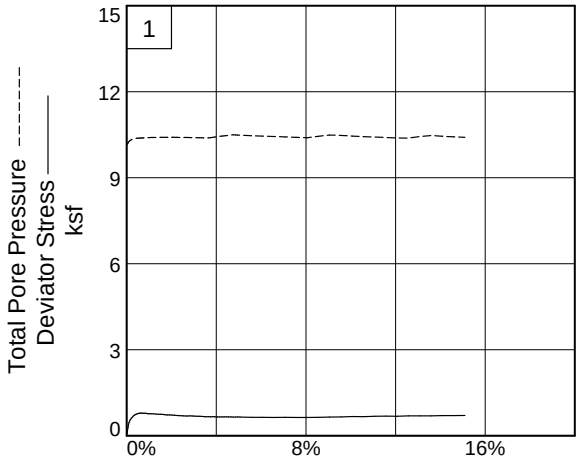
Location: B-18

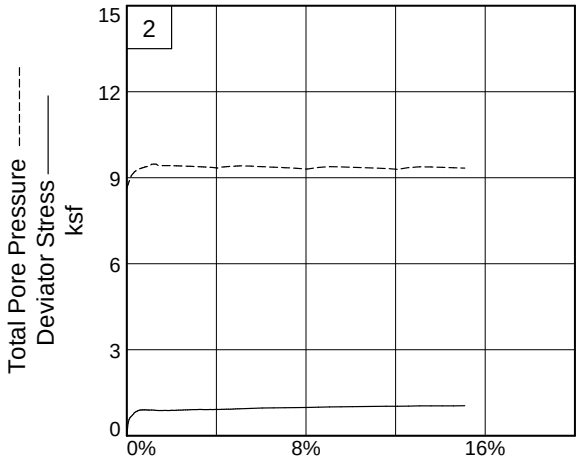
Sample Number: Log 346 **Depth:** 0 - 15 ft

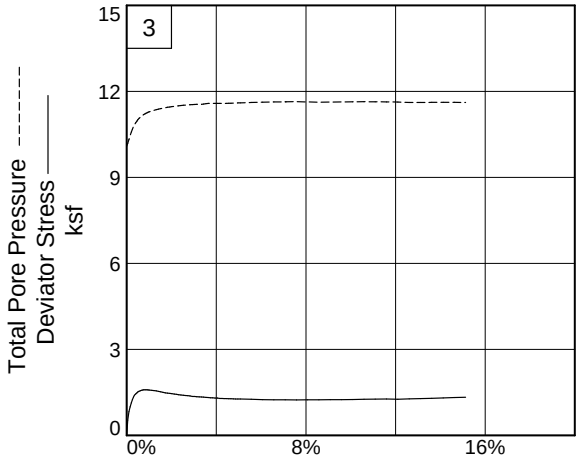
Proj. No.: 1461-14-046

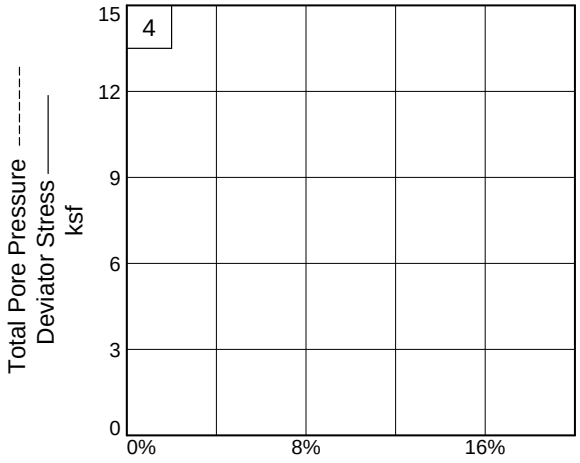
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

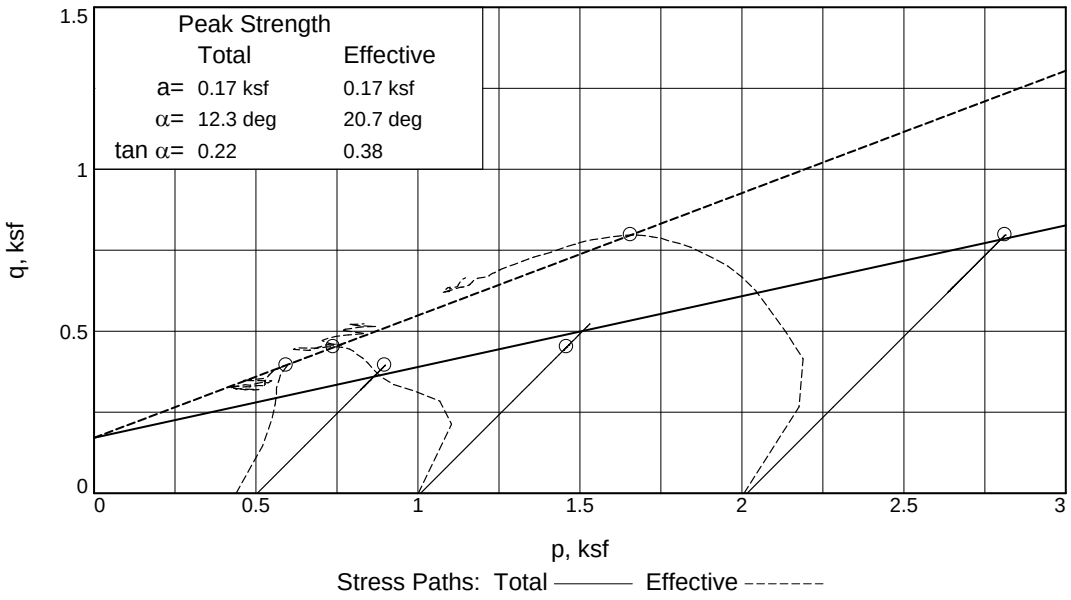
Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14











C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-18 **Depth:** 0 - 15 ft **Sample Number:** Log 346

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/1/14

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:17 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-18
Depth: 0 - 15 ft **Sample Number:** Log 346
Description: USCS: CLAYEY SAND (SC); AASHTO: A-2-6
Remarks: The specimens failed in bulging. MDD=123.7pcf at 9.5% moisture (D698). ASTM D4767.
Type of Sample: Remolded to appr.95%MDD
Assumed Specific Gravity=2.65 **LL=**25 **PL=**14 **PI=**11
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	244.000			1378.360
Moisture content: Dry soil+tare, gms.	224.100			1202.900
Moisture content: Tare, gms.	6.900			18.280
Moisture, %	9.2	15.0	14.8	14.8
Moist specimen weight, gms.	1298.70			
Diameter, in.	2.859	2.855	2.851	
Area, in.²	6.420	6.403	6.383	
Height, in.	5.988	5.981	5.977	
Net decrease in height, in.		0.007	0.004	
Net decrease in water volume, cc.			2.400	
Wet density, pcf	128.7	136.1	136.4	
Dry density, pcf	117.9	118.3	118.8	
Void ratio	0.4031	0.3979	0.3925	
Saturation, %	60.2	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 73.50 psi (10.58 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.79 ksf **at reading no.** 13
Ult. Stress = 0.71 ksf **at reading no.** 80

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	3.222	0.0	0.0	0.00	0.44	0.44	1.00	70.45	0.44	0.00
1	0.0033	16.180	13.0	0.1	0.29	0.37	0.67	1.78	70.90	0.52	0.15
2	0.0059	23.496	20.3	0.1	0.46	0.32	0.78	2.42	71.27	0.55	0.23
3	0.0092	27.557	24.3	0.2	0.55	0.28	0.83	2.92	71.52	0.56	0.27
4	0.0123	30.283	27.1	0.2	0.61	0.26	0.87	3.36	71.71	0.56	0.30
5	0.0153	32.063	28.8	0.3	0.65	0.24	0.89	3.72	71.84	0.56	0.32
6	0.0182	34.141	30.9	0.3	0.70	0.22	0.92	4.12	71.95	0.57	0.35
7	0.0215	35.597	32.4	0.4	0.73	0.21	0.94	4.45	72.03	0.58	0.36
8	0.0246	36.483	33.3	0.4	0.75	0.21	0.95	4.60	72.06	0.58	0.37
9	0.0272	37.312	34.1	0.5	0.77	0.21	0.97	4.72	72.07	0.59	0.38
10	0.0304	37.794	34.6	0.5	0.78	0.20	0.98	4.80	72.08	0.59	0.39
11	0.0333	38.328	35.1	0.6	0.79	0.20	0.99	4.88	72.09	0.60	0.39
12	0.0360	38.496	35.3	0.6	0.79	0.20	0.99	4.93	72.10	0.60	0.40
13	0.0394	38.409	35.2	0.7	0.79	0.20	0.99	4.95	72.11	0.59	0.39
14	0.0426	38.403	35.2	0.7	0.79	0.20	0.99	4.99	72.13	0.59	0.39
15	0.0454	38.290	35.1	0.8	0.79	0.20	0.98	5.01	72.14	0.59	0.39
16	0.0486	38.371	35.1	0.8	0.79	0.19	0.98	5.07	72.16	0.59	0.39
17	0.0517	38.163	34.9	0.9	0.78	0.19	0.97	5.11	72.18	0.58	0.39
18	0.0546	37.874	34.7	0.9	0.77	0.19	0.96	5.13	72.20	0.58	0.39
19	0.0574	37.727	34.5	1.0	0.77	0.19	0.96	5.16	72.21	0.57	0.39
20	0.0605	37.621	34.4	1.0	0.77	0.18	0.95	5.18	72.22	0.57	0.38
21	0.0665	37.601	34.4	1.1	0.77	0.18	0.95	5.25	72.25	0.56	0.38
22	0.0726	37.574	34.4	1.2	0.77	0.18	0.94	5.28	72.26	0.56	0.38
23	0.0788	37.208	34.0	1.3	0.76	0.18	0.93	5.26	72.27	0.56	0.38
24	0.0849	37.022	33.8	1.4	0.75	0.18	0.93	5.27	72.28	0.55	0.38
25	0.0909	36.934	33.7	1.5	0.75	0.18	0.92	5.26	72.28	0.55	0.37
26	0.0962	36.738	33.5	1.6	0.74	0.18	0.92	5.24	72.28	0.55	0.37
27	0.1026	36.324	33.1	1.7	0.73	0.18	0.91	5.18	72.28	0.54	0.37
28	0.1086	36.119	32.9	1.8	0.73	0.18	0.90	5.15	72.28	0.54	0.36
29	0.1147	36.120	32.9	1.9	0.73	0.18	0.90	5.14	72.28	0.54	0.36
30	0.1206	35.845	32.6	2.0	0.72	0.18	0.90	5.09	72.28	0.54	0.36
31	0.1267	35.645	32.4	2.1	0.72	0.18	0.89	5.05	72.27	0.53	0.36
32	0.1326	35.415	32.2	2.2	0.71	0.18	0.89	5.01	72.27	0.53	0.36
33	0.1387	35.124	31.9	2.3	0.70	0.18	0.88	4.95	72.27	0.53	0.35
34	0.1449	35.034	31.8	2.4	0.70	0.18	0.88	4.91	72.26	0.53	0.35
35	0.1512	34.825	31.6	2.5	0.69	0.18	0.87	4.86	72.25	0.53	0.35
36	0.1573	34.661	31.4	2.6	0.69	0.18	0.87	4.82	72.25	0.53	0.35
37	0.1629	34.720	31.5	2.7	0.69	0.18	0.87	4.81	72.24	0.53	0.35
38	0.1690	34.850	31.6	2.8	0.69	0.18	0.88	4.80	72.23	0.53	0.35
39	0.1753	34.696	31.5	2.9	0.69	0.18	0.87	4.75	72.22	0.53	0.34
40	0.1808	34.652	31.4	3.0	0.69	0.19	0.87	4.71	72.21	0.53	0.34
41	0.1870	34.410	31.2	3.1	0.68	0.19	0.87	4.65	72.20	0.53	0.34
42	0.1934	34.334	31.1	3.2	0.68	0.19	0.87	4.61	72.19	0.53	0.34
43	0.1995	34.189	31.0	3.3	0.68	0.19	0.87	4.55	72.18	0.53	0.34
44	0.2048	34.123	30.9	3.4	0.67	0.19	0.86	4.51	72.17	0.53	0.34
45	0.2109	33.682	30.5	3.5	0.66	0.19	0.86	4.43	72.16	0.52	0.33
46	0.2176	33.847	30.6	3.6	0.67	0.20	0.86	4.41	72.14	0.53	0.33

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.2235	33.779	30.6	3.7	0.66	0.19	0.85	4.50	72.18	0.52	0.33
48	0.2295	33.867	30.6	3.8	0.66	0.18	0.84	4.78	72.28	0.51	0.33
49	0.2351	33.777	30.6	3.9	0.66	0.16	0.83	5.06	72.37	0.49	0.33
50	0.2417	33.568	30.3	4.0	0.66	0.15	0.81	5.33	72.45	0.48	0.33
51	0.2476	33.616	30.4	4.1	0.66	0.14	0.80	5.68	72.52	0.47	0.33
52	0.2537	33.583	30.4	4.2	0.66	0.13	0.79	6.02	72.59	0.46	0.33
53	0.2597	33.654	30.4	4.3	0.66	0.12	0.78	6.40	72.66	0.45	0.33
54	0.2659	33.862	30.6	4.4	0.66	0.11	0.77	6.85	72.72	0.44	0.33
55	0.2718	33.857	30.6	4.5	0.66	0.10	0.76	7.38	72.78	0.43	0.33
56	0.2783	33.795	30.6	4.7	0.66	0.09	0.75	7.95	72.84	0.42	0.33
57	0.2837	33.654	30.4	4.7	0.65	0.09	0.74	8.54	72.90	0.41	0.33
58	0.2906	33.741	30.5	4.9	0.66	0.09	0.74	8.34	72.88	0.42	0.33
59	0.2962	33.944	30.7	5.0	0.66	0.09	0.75	7.96	72.84	0.42	0.33
60	0.3024	33.753	30.5	5.1	0.65	0.10	0.75	7.56	72.81	0.43	0.33
61	0.3321	33.378	30.2	5.6	0.64	0.12	0.76	6.47	72.68	0.44	0.32
62	0.3621	33.587	30.4	6.1	0.64	0.13	0.78	5.84	72.58	0.45	0.32
63	0.3923	33.506	30.3	6.6	0.64	0.15	0.79	5.34	72.48	0.47	0.32
64	0.4224	33.821	30.6	7.1	0.64	0.16	0.80	5.01	72.39	0.48	0.32
65	0.4517	33.808	30.6	7.6	0.64	0.17	0.81	4.67	72.29	0.49	0.32
66	0.4822	34.096	30.9	8.1	0.64	0.19	0.83	4.40	72.19	0.51	0.32
67	0.5121	34.391	31.2	8.6	0.64	0.14	0.78	5.67	72.54	0.46	0.32
68	0.5414	34.930	31.7	9.1	0.65	0.10	0.75	7.80	72.84	0.42	0.33
69	0.5718	35.535	32.3	9.6	0.66	0.11	0.77	7.02	72.74	0.44	0.33
70	0.6018	36.231	33.0	10.1	0.67	0.13	0.80	6.10	72.59	0.47	0.33
71	0.6318	36.268	33.0	10.6	0.67	0.15	0.82	5.46	72.46	0.48	0.33
72	0.6620	37.077	33.9	11.1	0.68	0.17	0.84	5.10	72.35	0.51	0.34
73	0.6917	37.590	34.4	11.6	0.69	0.18	0.87	4.79	72.24	0.52	0.34
74	0.7220	37.558	34.3	12.1	0.68	0.20	0.88	4.46	72.13	0.54	0.34
75	0.7515	38.413	35.2	12.6	0.69	0.20	0.90	4.45	72.10	0.55	0.35
76	0.7818	38.677	35.5	13.1	0.70	0.15	0.85	5.64	72.46	0.50	0.35
77	0.8120	38.887	35.7	13.6	0.70	0.11	0.81	7.25	72.73	0.46	0.35
78	0.8417	39.549	36.3	14.1	0.70	0.14	0.84	6.13	72.55	0.49	0.35
79	0.8718	39.801	36.6	14.6	0.70	0.16	0.86	5.49	72.41	0.51	0.35
80	0.9022	40.300	37.1	15.1	0.71	0.17	0.88	5.07	72.29	0.53	0.36

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	196.300			1364.080
Moisture content: Dry soil+tare, gms.	179.740			1198.890
Moisture content: Tare, gms.	6.800			11.970
Moisture, %	9.6	14.3	13.9	13.9
Moist specimen weight, gms.	1299.10			
Diameter, in.	2.863	2.827	2.818	
Area, in.²	6.439	6.278	6.235	
Height, in.	6.007	5.999	5.994	
Net decrease in height, in.		0.008	0.005	
Net decrease in water volume, cc.			4.700	
Wet density, pcf	128.0	137.1	137.7	
Dry density, pcf	116.8	119.9	120.9	
Void ratio	0.4167	0.3793	0.3688	
Saturation, %	60.9	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 67.00 psi (9.65 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.25
Fail. Stress = 0.90 ksf **at reading no.** 15
Ult. Stress = 1.05 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	5.198	0.0	0.0	0.00	1.00	1.00	1.00	60.05	1.00	0.00
1	0.0032	23.655	18.5	0.1	0.43	0.89	1.32	1.48	60.81	1.10	0.21
2	0.0062	29.855	24.7	0.1	0.57	0.78	1.35	1.73	61.56	1.07	0.28
3	0.0088	32.419	27.2	0.1	0.63	0.68	1.31	1.92	62.28	0.99	0.31
4	0.0116	34.306	29.1	0.2	0.67	0.59	1.26	2.14	62.90	0.93	0.34
5	0.0150	36.429	31.2	0.3	0.72	0.53	1.24	2.37	63.35	0.88	0.36
6	0.0182	38.463	33.3	0.3	0.77	0.48	1.24	2.60	63.67	0.86	0.38
7	0.0205	40.183	35.0	0.3	0.81	0.44	1.25	2.82	63.93	0.84	0.40
8	0.0239	41.498	36.3	0.4	0.84	0.41	1.25	3.03	64.14	0.83	0.42
9	0.0274	42.408	37.2	0.5	0.86	0.39	1.24	3.22	64.33	0.81	0.43
10	0.0301	43.319	38.1	0.5	0.88	0.36	1.24	3.41	64.48	0.80	0.44
11	0.0333	43.934	38.7	0.6	0.89	0.34	1.23	3.58	64.61	0.79	0.44
12	0.0361	44.274	39.1	0.6	0.90	0.33	1.23	3.73	64.72	0.78	0.45
13	0.0395	44.490	39.3	0.7	0.90	0.31	1.21	3.88	64.82	0.76	0.45
14	0.0424	44.614	39.4	0.7	0.90	0.30	1.20	4.01	64.91	0.75	0.45
15	0.0456	44.613	39.4	0.8	0.90	0.29	1.19	4.14	65.00	0.74	0.45
16	0.0480	44.622	39.4	0.8	0.90	0.28	1.18	4.25	65.07	0.73	0.45
17	0.0510	44.663	39.5	0.9	0.90	0.27	1.17	4.38	65.14	0.72	0.45
18	0.0543	44.503	39.3	0.9	0.90	0.26	1.16	4.49	65.21	0.71	0.45
19	0.0576	44.441	39.2	1.0	0.90	0.25	1.15	4.60	65.27	0.70	0.45
20	0.0605	44.359	39.2	1.0	0.90	0.24	1.14	4.71	65.33	0.69	0.45
21	0.0664	44.476	39.3	1.1	0.90	0.18	1.08	5.98	65.75	0.63	0.45
22	0.0725	44.391	39.2	1.2	0.89	0.17	1.07	6.14	65.79	0.62	0.45
23	0.0786	44.139	38.9	1.3	0.89	0.17	1.06	6.17	65.81	0.62	0.44
24	0.0844	43.912	38.7	1.4	0.88	0.22	1.11	4.94	65.44	0.66	0.44

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.0904	43.976	38.8	1.5	0.88	0.22	1.11	4.94	65.45	0.66	0.44
26	0.0968	44.013	38.8	1.6	0.88	0.22	1.10	4.96	65.45	0.66	0.44
27	0.1022	44.100	38.9	1.7	0.88	0.22	1.11	4.95	65.45	0.67	0.44
28	0.1090	44.136	38.9	1.8	0.88	0.22	1.11	4.93	65.44	0.67	0.44
29	0.1146	44.121	38.9	1.9	0.88	0.23	1.11	4.90	65.43	0.67	0.44
30	0.1204	44.435	39.2	2.0	0.89	0.23	1.12	4.90	65.42	0.67	0.44
31	0.1267	44.417	39.2	2.1	0.89	0.23	1.12	4.86	65.40	0.67	0.44
32	0.1331	44.598	39.4	2.2	0.89	0.23	1.12	4.83	65.39	0.68	0.44
33	0.1388	44.792	39.6	2.3	0.89	0.23	1.13	4.81	65.37	0.68	0.45
34	0.1450	44.886	39.7	2.4	0.89	0.24	1.13	4.77	65.35	0.68	0.45
35	0.1510	45.191	40.0	2.5	0.90	0.24	1.14	4.74	65.33	0.69	0.45
36	0.1573	45.307	40.1	2.6	0.90	0.24	1.15	4.71	65.31	0.69	0.45
37	0.1630	45.431	40.2	2.7	0.90	0.25	1.15	4.67	65.29	0.70	0.45
38	0.1695	45.635	40.4	2.8	0.91	0.25	1.16	4.63	65.26	0.70	0.45
39	0.1758	45.858	40.7	2.9	0.91	0.25	1.16	4.60	65.24	0.71	0.46
40	0.1816	46.061	40.9	3.0	0.92	0.26	1.17	4.56	65.21	0.71	0.46
41	0.1874	46.104	40.9	3.1	0.92	0.26	1.18	4.52	65.19	0.72	0.46
42	0.1930	46.231	41.0	3.2	0.92	0.26	1.18	4.47	65.17	0.72	0.46
43	0.1996	46.239	41.0	3.3	0.92	0.27	1.18	4.42	65.14	0.73	0.46
44	0.2054	46.238	41.0	3.4	0.92	0.27	1.19	4.37	65.11	0.73	0.46
45	0.2117	46.268	41.1	3.5	0.92	0.28	1.19	4.32	65.08	0.73	0.46
46	0.2177	46.264	41.1	3.6	0.91	0.28	1.20	4.25	65.05	0.74	0.46
47	0.2238	46.387	41.2	3.7	0.92	0.29	1.20	4.20	65.01	0.74	0.46
48	0.2299	46.385	41.2	3.8	0.91	0.29	1.21	4.14	64.97	0.75	0.46
49	0.2359	46.511	41.3	3.9	0.92	0.30	1.22	4.07	64.93	0.76	0.46
50	0.2423	46.663	41.5	4.0	0.92	0.31	1.23	4.00	64.87	0.77	0.46
51	0.2478	46.564	41.4	4.1	0.92	0.31	1.22	3.99	64.87	0.76	0.46
52	0.2539	46.813	41.6	4.2	0.92	0.28	1.20	4.32	65.08	0.74	0.46
53	0.2602	47.002	41.8	4.3	0.92	0.27	1.19	4.43	65.13	0.73	0.46
54	0.2663	47.119	41.9	4.4	0.93	0.26	1.19	4.52	65.17	0.73	0.46
55	0.2723	47.291	42.1	4.5	0.93	0.26	1.19	4.60	65.21	0.72	0.46
56	0.2782	47.397	42.2	4.6	0.93	0.25	1.18	4.69	65.25	0.72	0.46
57	0.2843	47.545	42.3	4.7	0.93	0.25	1.18	4.77	65.28	0.71	0.47
58	0.2904	47.808	42.6	4.8	0.94	0.24	1.18	4.87	65.32	0.71	0.47
59	0.2964	47.970	42.8	4.9	0.94	0.24	1.18	4.95	65.35	0.71	0.47
60	0.3027	48.215	43.0	5.1	0.94	0.23	1.18	5.05	65.38	0.70	0.47
61	0.3327	49.080	43.9	5.6	0.96	0.24	1.20	4.91	65.30	0.72	0.48
62	0.3627	49.829	44.6	6.1	0.97	0.26	1.23	4.68	65.17	0.75	0.48
63	0.3927	50.312	45.1	6.6	0.97	0.28	1.25	4.48	65.05	0.77	0.49
64	0.4230	50.727	45.5	7.1	0.98	0.30	1.27	4.29	64.94	0.79	0.49
65	0.4528	51.132	45.9	7.6	0.98	0.32	1.30	4.11	64.81	0.81	0.49
66	0.4827	51.615	46.4	8.1	0.99	0.34	1.33	3.86	64.61	0.84	0.49
67	0.5128	52.493	47.3	8.6	1.00	0.29	1.29	4.46	64.99	0.79	0.50
68	0.5427	53.158	48.0	9.1	1.01	0.26	1.27	4.86	65.19	0.76	0.50
69	0.5733	53.653	48.5	9.6	1.01	0.27	1.28	4.75	65.13	0.78	0.51
70	0.6033	54.136	48.9	10.1	1.02	0.28	1.30	4.57	65.03	0.79	0.51
71	0.6334	54.623	49.4	10.6	1.02	0.30	1.32	4.44	64.94	0.81	0.51

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
72	0.6633	55.167	50.0	11.1	1.03	0.31	1.34	4.31	64.84	0.82	0.51
73	0.6937	55.498	50.3	11.6	1.03	0.33	1.35	4.15	64.74	0.84	0.51
74	0.7242	55.906	50.7	12.1	1.03	0.35	1.38	3.90	64.54	0.87	0.51
75	0.7535	56.435	51.2	12.6	1.03	0.30	1.33	4.49	64.94	0.81	0.52
76	0.7837	57.133	51.9	13.1	1.04	0.27	1.31	4.92	65.15	0.79	0.52
77	0.8140	57.448	52.3	13.6	1.04	0.27	1.32	4.82	65.10	0.79	0.52
78	0.8441	57.750	52.6	14.1	1.04	0.29	1.33	4.64	65.01	0.81	0.52
79	0.8738	58.098	52.9	14.6	1.04	0.30	1.34	4.50	64.93	0.82	0.52
80	0.9044	58.534	53.3	15.1	1.05	0.31	1.36	4.37	64.84	0.83	0.52

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	238.900			1360.750
Moisture content: Dry soil+tare, gms.	218.740			1204.350
Moisture content: Tare, gms.	7.000			17.860
Moisture, %	9.5	14.0	13.2	13.2
Moist specimen weight, gms.	1298.40			
Diameter, in.	2.858	2.822	2.805	
Area, in.²	6.414	6.257	6.181	
Height, in.	5.985	5.982	5.959	
Net decrease in height, in.		0.003	0.023	
Net decrease in water volume, cc.			9.700	
Wet density, pcf	128.8	137.6	138.8	
Dry density, pcf	117.6	120.7	122.6	
Void ratio	0.4062	0.3710	0.3493	
Saturation, %	62.1	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 84.00 psi (12.10 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 2.02 ksf

Strain rate, %/min. = 0.25

Fail. Stress = 1.59 ksf **at reading no.** 17

Ult. Stress = 1.33 ksf **at reading no.** 80

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	2.908	0.0	0.0	0.00	2.01	2.01	1.00	70.07	2.01	0.00
1	0.0027	25.793	22.9	0.0	0.53	1.91	2.44	1.28	70.74	2.18	0.27
2	0.0058	38.563	35.7	0.1	0.83	1.77	2.60	1.47	71.68	2.19	0.41
3	0.0090	45.827	42.9	0.2	1.00	1.64	2.63	1.61	72.64	2.13	0.50
4	0.0123	51.812	48.9	0.2	1.14	1.52	2.65	1.75	73.47	2.08	0.57
5	0.0151	56.688	53.8	0.3	1.25	1.42	2.67	1.88	74.15	2.04	0.62
6	0.0179	60.384	57.5	0.3	1.33	1.33	2.67	2.00	74.75	2.00	0.67
7	0.0206	63.291	60.4	0.3	1.40	1.26	2.66	2.12	75.28	1.96	0.70
8	0.0240	65.359	62.5	0.4	1.45	1.19	2.64	2.22	75.74	1.91	0.72
9	0.0272	67.004	64.1	0.5	1.49	1.13	2.62	2.31	76.14	1.88	0.74
10	0.0296	68.463	65.6	0.5	1.52	1.08	2.60	2.41	76.49	1.84	0.76
11	0.0329	69.483	66.6	0.6	1.54	1.04	2.58	2.49	76.81	1.81	0.77

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.0363	70.176	67.3	0.6	1.56	1.00	2.55	2.56	77.08	1.77	0.78
13	0.0390	70.940	68.0	0.7	1.57	0.96	2.54	2.64	77.31	1.75	0.79
14	0.0423	71.336	68.4	0.7	1.58	0.93	2.51	2.70	77.53	1.72	0.79
15	0.0450	71.678	68.8	0.8	1.59	0.91	2.50	2.75	77.71	1.70	0.79
16	0.0484	71.882	69.0	0.8	1.59	0.88	2.48	2.81	77.87	1.68	0.80
17	0.0513	71.915	69.0	0.9	1.59	0.86	2.45	2.85	78.02	1.66	0.80
18	0.0545	71.886	69.0	0.9	1.59	0.84	2.43	2.89	78.16	1.64	0.80
19	0.0569	71.680	68.8	1.0	1.59	0.82	2.41	2.93	78.28	1.62	0.79
20	0.0599	71.583	68.7	1.0	1.58	0.81	2.39	2.96	78.39	1.60	0.79
21	0.0665	71.142	68.2	1.1	1.57	0.78	2.35	3.02	78.59	1.57	0.79
22	0.0725	70.943	68.0	1.2	1.57	0.76	2.32	3.07	78.75	1.54	0.78
23	0.0785	70.504	67.6	1.3	1.55	0.73	2.29	3.11	78.90	1.51	0.78
24	0.0845	69.801	66.9	1.4	1.54	0.71	2.25	3.15	79.04	1.48	0.77
25	0.0905	69.247	66.3	1.5	1.52	0.70	2.22	3.18	79.16	1.46	0.76
26	0.0962	68.541	65.6	1.6	1.50	0.68	2.19	3.21	79.26	1.43	0.75
27	0.1026	67.869	65.0	1.7	1.49	0.67	2.15	3.23	79.37	1.41	0.74
28	0.1083	67.428	64.5	1.8	1.48	0.65	2.13	3.26	79.47	1.39	0.74
29	0.1149	67.104	64.2	1.9	1.47	0.64	2.11	3.29	79.56	1.37	0.73
30	0.1201	66.776	63.9	2.0	1.46	0.63	2.09	3.32	79.64	1.36	0.73
31	0.1265	66.281	63.4	2.1	1.44	0.62	2.06	3.34	79.71	1.34	0.72
32	0.1327	65.857	62.9	2.2	1.43	0.61	2.04	3.36	79.78	1.32	0.72
33	0.1382	65.352	62.4	2.3	1.42	0.60	2.02	3.38	79.85	1.31	0.71
34	0.1444	65.017	62.1	2.4	1.41	0.59	2.00	3.39	79.90	1.30	0.71
35	0.1506	64.714	61.8	2.5	1.40	0.58	1.99	3.41	79.96	1.28	0.70
36	0.1567	64.331	61.4	2.6	1.39	0.57	1.97	3.43	80.02	1.27	0.70
37	0.1624	64.056	61.1	2.7	1.39	0.57	1.95	3.44	80.06	1.26	0.69
38	0.1685	63.744	60.8	2.8	1.38	0.56	1.94	3.45	80.10	1.25	0.69
39	0.1749	63.102	60.2	2.9	1.36	0.56	1.92	3.45	80.14	1.24	0.68
40	0.1808	63.016	60.1	3.0	1.36	0.55	1.91	3.46	80.17	1.23	0.68
41	0.1863	62.758	59.8	3.1	1.35	0.55	1.90	3.46	80.19	1.22	0.68
42	0.1929	62.539	59.6	3.2	1.34	0.55	1.89	3.45	80.19	1.22	0.67
43	0.1992	62.507	59.6	3.3	1.34	0.55	1.89	3.44	80.19	1.22	0.67
44	0.2046	62.226	59.3	3.4	1.33	0.54	1.87	3.47	80.25	1.21	0.67
45	0.2109	61.972	59.1	3.5	1.33	0.52	1.85	3.54	80.37	1.19	0.66
46	0.2174	61.740	58.8	3.6	1.32	0.52	1.84	3.55	80.41	1.18	0.66
47	0.2235	61.521	58.6	3.8	1.31	0.52	1.83	3.55	80.42	1.17	0.66
48	0.2288	61.493	58.6	3.8	1.31	0.52	1.83	3.55	80.42	1.17	0.66
49	0.2350	61.262	58.4	3.9	1.31	0.52	1.82	3.53	80.42	1.17	0.65
50	0.2414	61.162	58.3	4.1	1.30	0.52	1.82	3.52	80.42	1.17	0.65
51	0.2476	60.782	57.9	4.2	1.29	0.52	1.81	3.51	80.42	1.16	0.65
52	0.2535	60.735	57.8	4.3	1.29	0.52	1.81	3.50	80.42	1.16	0.64
53	0.2593	60.647	57.7	4.4	1.29	0.52	1.80	3.50	80.42	1.16	0.64
54	0.2653	60.583	57.7	4.5	1.28	0.51	1.80	3.49	80.42	1.16	0.64
55	0.2716	60.542	57.6	4.6	1.28	0.51	1.79	3.50	80.44	1.15	0.64
56	0.2773	60.461	57.6	4.7	1.28	0.51	1.79	3.51	80.47	1.15	0.64
57	0.2835	60.316	57.4	4.8	1.27	0.50	1.78	3.52	80.50	1.14	0.64
58	0.2896	60.305	57.4	4.9	1.27	0.50	1.77	3.54	80.52	1.14	0.64

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
59	0.2958	60.325	57.4	5.0	1.27	0.50	1.77	3.55	80.54	1.13	0.64
60	0.3019	60.454	57.5	5.1	1.27	0.50	1.77	3.57	80.56	1.13	0.64
61	0.3313	60.222	57.3	5.6	1.26	0.48	1.74	3.61	80.65	1.11	0.63
62	0.3616	59.983	57.1	6.1	1.25	0.47	1.72	3.65	80.72	1.10	0.62
63	0.3916	60.102	57.2	6.6	1.24	0.46	1.71	3.69	80.79	1.09	0.62
64	0.4216	60.351	57.4	7.1	1.24	0.46	1.70	3.70	80.80	1.08	0.62
65	0.4517	60.437	57.5	7.6	1.24	0.45	1.69	3.72	80.84	1.07	0.62
66	0.4813	61.018	58.1	8.1	1.24	0.46	1.71	3.68	80.78	1.09	0.62
67	0.5112	61.362	58.5	8.6	1.24	0.47	1.72	3.62	80.70	1.10	0.62
68	0.5413	61.857	58.9	9.1	1.25	0.47	1.72	3.66	80.75	1.09	0.62
69	0.5714	62.178	59.3	9.6	1.25	0.46	1.71	3.69	80.78	1.09	0.62
70	0.6013	62.647	59.7	10.1	1.25	0.46	1.71	3.73	80.81	1.08	0.63
71	0.6311	63.447	60.5	10.6	1.26	0.46	1.72	3.76	80.83	1.09	0.63
72	0.6611	64.126	61.2	11.1	1.27	0.46	1.73	3.77	80.82	1.09	0.63
73	0.6911	64.633	61.7	11.6	1.27	0.46	1.73	3.74	80.78	1.10	0.64
74	0.7213	64.472	61.6	12.1	1.26	0.47	1.73	3.69	80.75	1.10	0.63
75	0.7515	65.627	62.7	12.6	1.28	0.48	1.76	3.64	80.64	1.12	0.64
76	0.7816	66.428	63.5	13.1	1.29	0.48	1.77	3.67	80.66	1.12	0.64
77	0.8114	67.269	64.4	13.6	1.30	0.48	1.78	3.70	80.67	1.13	0.65
78	0.8418	68.240	65.3	14.1	1.31	0.48	1.78	3.74	80.68	1.13	0.65
79	0.8716	69.335	66.4	14.6	1.32	0.48	1.80	3.77	80.69	1.14	0.66
80	0.9013	70.157	67.2	15.1	1.33	0.48	1.81	3.76	80.65	1.15	0.66

MICROBAC®

CERTIFICATE OF ANALYSIS

Randy Rainwater
S & ME, Inc. - Louisville
1413 Topside Rd.
Louisville, TN 37777

Date Reported: 11/12/2014
Date Received: 11/5/2014
Cust #: RS007
PO#: 3714276

Workorder: **1419770** **Project:** 1461-14-046

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
B-1, 0-15' Sampled: 10/17/2014 00:00								
1419770-01 (Solid)								
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Sulfate, Water Soluble	**50.4**	mg/kg	5		12.5	AJW	11/10/2014 19:54	ASTM D4327
B-1, 0-15' Sampled: 10/17/2014 00:00								
1419770-01RE1 (Solid)								
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Chloride, Water Soluble	**6.25**	mg/kg	1		2.50	AJW	11/11/2014 10:15	ASTM D4327
B-5, 0-15' Sampled: 10/17/2014 00:00								
1419770-02RE1 (Solid)								
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Chloride, Water Soluble	**7.89**	mg/kg	1		2.49	AJW	11/11/2014 10:22	ASTM D4327
B-5, 0-15' Sampled: 10/17/2014 00:00								
1419770-02RE2 (Solid)								
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Sulfate, Water Soluble	**149**	mg/kg	10		24.9	AJW	11/11/2014 10:30	ASTM D4327
B-9, 0-15' Sampled: 10/17/2014 00:00								
1419770-03 (Solid)								
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Sulfate, Water Soluble	**89.9**	mg/kg	5		12.5	AJW	11/10/2014 20:10	ASTM D4327
B-9, 0-15' Sampled: 10/17/2014 00:00								
1419770-03RE1 (Solid)								

MICROBAC®

CERTIFICATE OF ANALYSIS

Randy Rainwater
S & ME, Inc. - Louisville
1413 Topside Rd.
Louisville, TN 37777

Date Reported: 11/12/2014
Date Received: 11/5/2014
Cust #: RS007
PO#: 3714276

Workorder: **1419770** **Project:** 1461-14-046

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
B-9, 0-15' Sampled: 10/17/2014 00:00								
					1419770-03RE1 (Solid)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Chloride, Water Soluble	**6.60**	mg/kg	1		2.49	AJW	11/11/2014 10:38	ASTM D4327
B-13, 0-15' Sampled: 10/17/2014 00:00								
					1419770-04 (Solid)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Sulfate, Water Soluble	**88.2**	mg/kg	5		12.4	AJW	11/10/2014 20:34	ASTM D4327
B-13, 0-15' Sampled: 10/17/2014 00:00								
					1419770-04RE1 (Solid)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Chloride, Water Soluble	**17.2**	mg/kg	1		2.47	AJW	11/11/2014 10:46	ASTM D4327
B-18, 0-15' Sampled: 10/17/2014 00:00								
					1419770-05 (Solid)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Sulfate, Water Soluble	**82.6**	mg/kg	5		12.4	AJW	11/10/2014 20:42	ASTM D4327
B-18, 0-15' Sampled: 10/17/2014 00:00								
					1419770-05RE1 (Solid)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
Chloride, Water Soluble	**6.53**	mg/kg	1		2.48	AJW	11/11/2014 11:10	ASTM D4327

Microbac Laboratories, Inc.
505 East Broadway Avenue Maryville, TN 37804-5744 | 865-977-1200 p | 865-984-8616 f | www.microbac.com
2109 West Market Street Johnson City, TN 37064 | 423.926.6385 p | 423.926.6997 f | www.microbac.com
2631 Grandview Avenue Nashville, TN 37211 | 615.242.1480 p | 612.242.5522 f | www.microbac.com

MICROBAC®

CERTIFICATE OF ANALYSIS

Randy Rainwater		**Date Reported:**	11/12/2014
S & ME, Inc. - Louisville		**Date Received:**	11/5/2014
1413 Topside Rd.		**Cust #:**	RS007
Louisville, TN 37777		**PO#:**	3714276

Workorder: **1419770** **Project:** 1461-14-046

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	12/31/2014
FL	State of Florida NELAC	E87966	06/30/2015
GA	Georgia Dept Natural Resources	980	04/30/2017
NCENV	NC Environmental	678	12/31/2014
TN_DW	State of Tennessee	TN02017	04/30/2017
USDA	US Department of Agriculture		12/31/2014

Notes and Definitions

M1	Matrix spike recovery is outside of acceptance limits, biased high.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Maraea Branner, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact J Trevor Boyce, President at president@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

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MICROBAC LABORATORIES, INC.
KNOXVILLE DIVISION
505 EAST BROADWAY
MARYVILLE, TN 37804
PHONE: (865) 977-1200 FAX: (865) 984-8616

CHAIN OF CUSTOI

1419770-01
S & ME, Inc. - Louisville

Sampled: 10/17/2014 00:00

Project ID:	1461-14-046
Permit #:	NA
If drinking water, State Reported?:	☐ Yes ☐ No

Report To:	N. Randy Rainwater
	S&ME, Inc.
	1413 Topside Road
	Louisville, TN 37777
Phone:	970-0003 Fax: 970-2313
E-mail:	rrainwater@smeinc.com

	Accounts Payable
	1413 Topside Road
	Louisville, TN 37777
P.O. #:	3714276
Quote #:	S&ME

Sampler:

Sample Hazards: None

ANALYSIS REQUIRED

FOR LAB CHECK-IN ONLY

Temp Rec'd 26.0 C

Properly Preserved: ☐ Yes ☐ No

Remarks:

Sample ID	Sample Date	Sample Time	Sample Type	# of Cont's.	Soluble Sulfates	Soluble Chlorides	Sample #
					Please Mark Testing Required (X)		
B-1, 0-15'	10/17/14	NA	Soil	1	X	X	
B-5, 0-15'	10/17/14	NA	Soil	1	X	X	
B-9, 0-15'	10/17/14	NA	Soil	1	X	X	
B-13, 0-15'	10/17/14	NA	Soil	1	X	X	
B-18, 0-15'	10/17/14	NA	Soil	1	X	X	

PRIORITY
☒ Standard
☐ Next Day
☐ 2-3 Day
(Surcharge may apply for non-standard TAT)

Special Instructions / Comments...

ASTM D 4327 Method for Sulfate and Chloride

Customer #:
Job Temp.:
Project:

Relinquished By:	Date:	Time:	Received By:	Relinquished By:	Date:	Time:	Received By:
	11/5/14	10:51					
Relinquished By:	Date:	Time:	Received By:	Relinquished By:	Date:	Time:	Received By:

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: SxME

Date/Time Received: 11.5.14 10:50

Work Order: 1419770

No. of Samples: 5

Received By:

Checklist Completed By:

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No ☑	
Shipping container in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☑
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☐	No ☑	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Form No: TR-D2216-T265-2
Revision No. 0
Revision Date: 02/22/08

Laboratory Determination of Water Content

ASTM D 2216 ☑ *AASHTO T 265* ☐ ***Quality Assurance***

S&ME, Inc. Columbia, 134 Suber Road, Columbia, South Carolina

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-10/30
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, North Charletson, SC		
Sample by:	S&ME	Sample Date(s):	Varies
Sampling Method:	Bulk	Drill Rig :	NI

Method: **A (1%)** ☐ **B (0.1%)** ☑ *Balance ID.* ***25711*** *Calibration Date:* ***8/15/2014***

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft.		grams	grams	grams	grams	%
R-1	Bulk	0-5	40	259.63	933.36	847.24	86.12	**14.7%**
R-4	Bulk	0-5	206	286.74	850.79	793.32	57.47	**11.3%**
R-9	Bulk	0-5	42	255.51	784.61	742.43	42.18	**8.7%**
R-13	Bulk	0-5	59	264.22	728.71	677.96	50.75	**12.3%**
R-17	Bulk	0-5	302	264.54	702.85	657.25	45.60	**11.6%**
R-19	Bulk	0-5	153	288.98	791.53	723.75	67.78	**15.6%**

Notes / Deviations / References

NI: Not Included.

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

M. Wolfe — *Technician Name*

NICET 123218 — *Certification Type / No.*

Matthew Wolfe — *Technical Responsibility*

_____ — *Signature*

Laboratory Quality Manager — *Position*

11/4/2014 — *Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

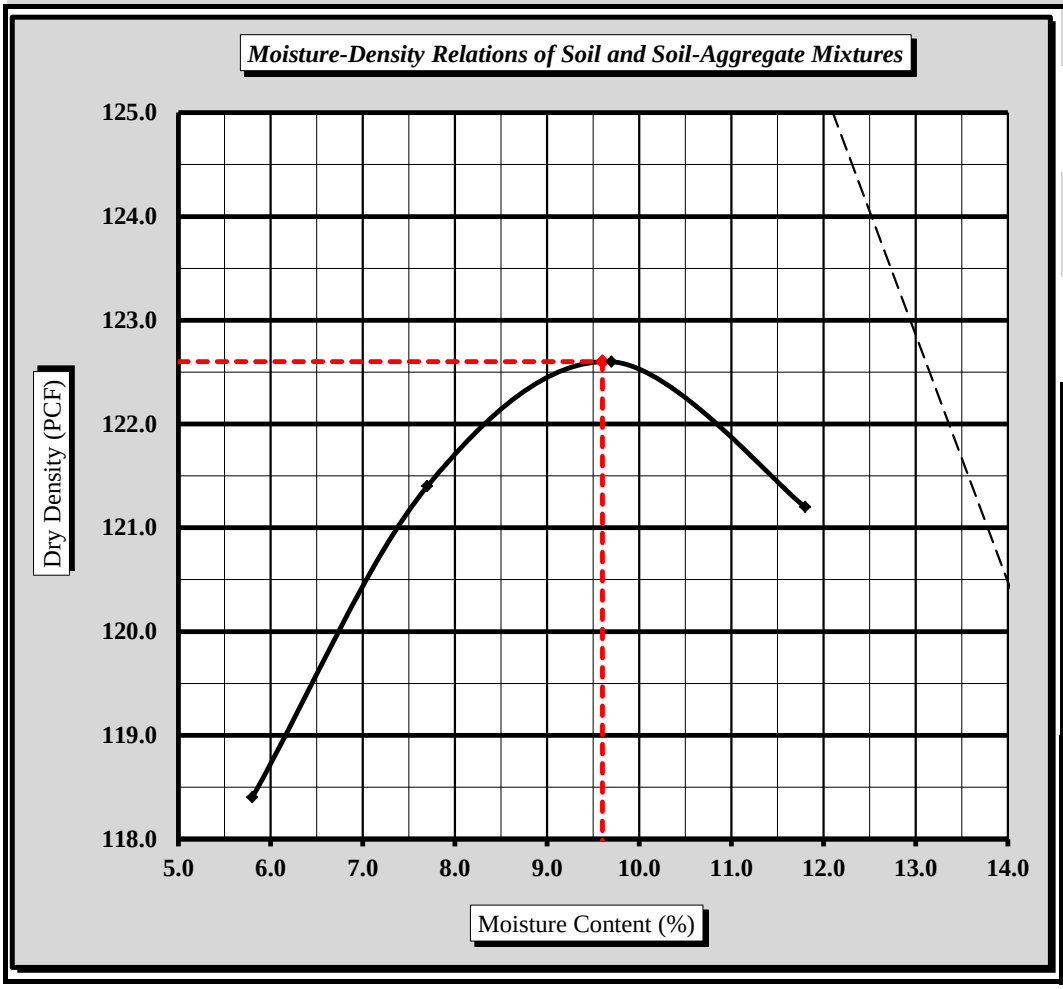
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/6
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
	Sample #: Bulk	Sample Date:	Varies
Location: R-1		Depth:	0-5 ft.
Sample Description:	Silty Sand (SM), A-1-b		

Maximum Dry Density **122.6** **PCF.** **Optimum Moisture Content** **9.6%**

ASTM D 698 - - Method B



Soil Properties	
Delivered Moisture Content	**14.7%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**NP**
Plastic Limit	**NP**
Plastic Index	**NP**

% Passing	
3/8"	98.8%
#4	97.1%
#10	94.7%
#20	80.3%
#40	48.6%
#60	30.2%
#100	21.3%
#200	14.6%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	
MDD	**122.6**
Opt. MC	**9.6%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

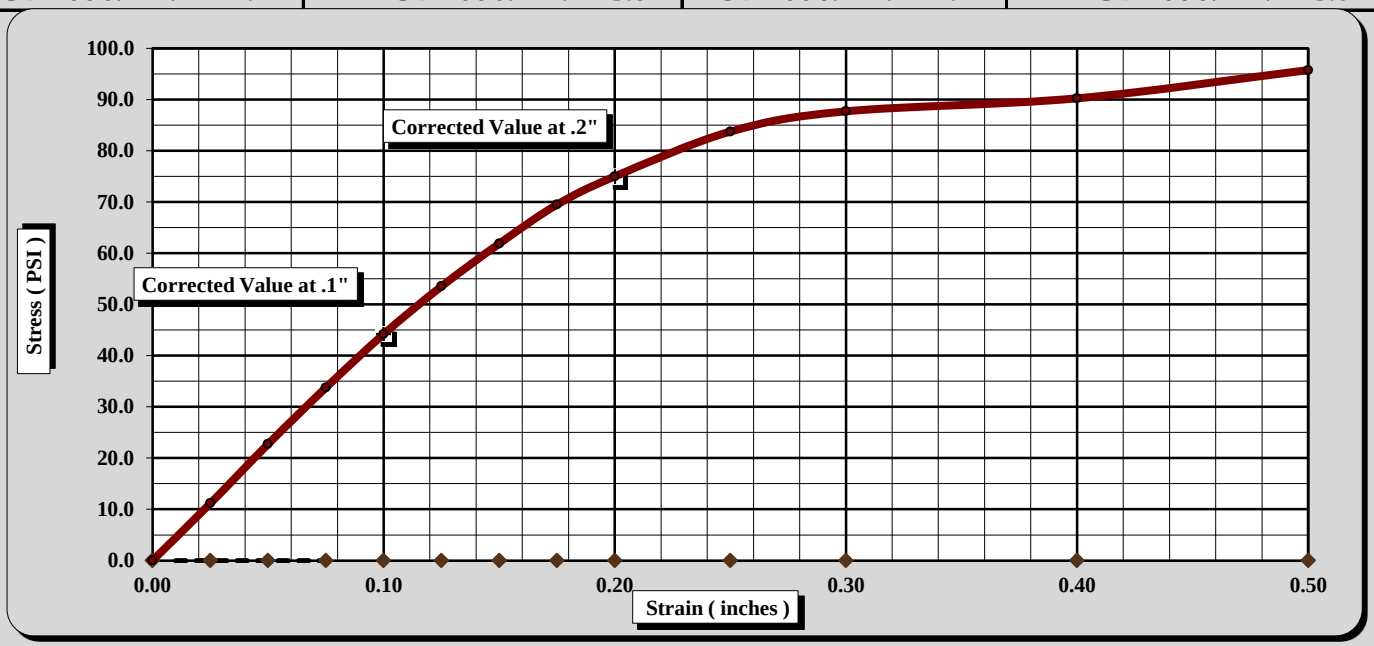
Project #:	**1461-14-046**	Report Date:	11/13/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-1	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Silty Sand (SM), A-1-b

ASTM D 698 *Method A* Maximum Dry Density: **122.6 PCF** Optimum Moisture Content: **9.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.4	**CBR at 0.2 in. 5.0**	**CBR at 0.1 in. 4.4**	**CBR at 0.2 in. 5.0**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	8	Final Dry Density (PCF)	109.2
Initial Dry Density (PCF)	111.4	Average Final Moisture Content	12.6%
Moisture Content of the Compacted Specimen	10.2%	Moisture Content (top 1" after soaking)	13.2%
Percent Compaction	90.9%	Percent Swell	0.0%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	NP	Plastic Index	NP	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/13/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

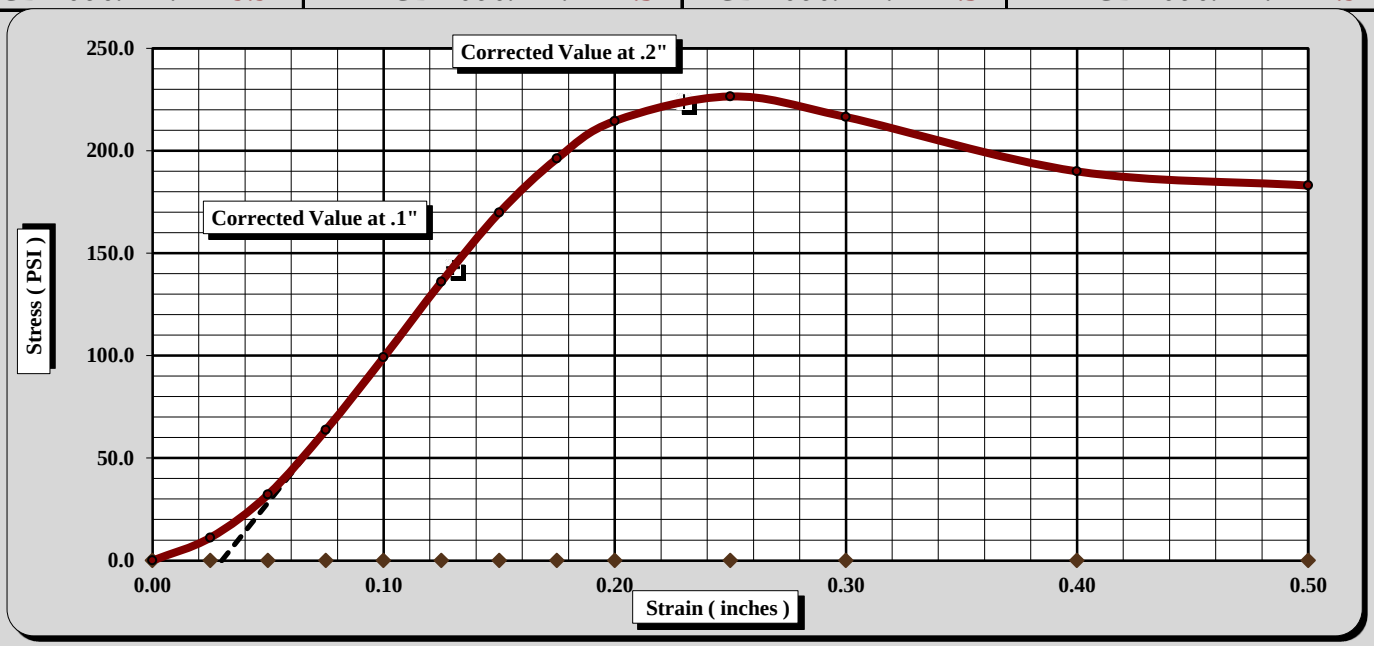
Project #:	**1461-14-046**	Report Date:	11/13/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-1	Sample #: Bulk	Sample Date: Varies	
	Offset: N/A	Depth: 0-5 ft.	

Sample Description: Silty Sand (SM), A-1-b

ASTM D 698 *Method A* Maximum Dry Density: **122.6 PCF** Optimum Moisture Content: **9.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 9.9	**CBR at 0.2 in. 14.3**	**CBR at 0.1 in. 14.3**	**CBR at 0.2 in. 14.9**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	35	Final Dry Density (PCF)	117.2
Initial Dry Density (PCF)	117.4	Average Final Moisture Content	10.6%
Moisture Content of the Compacted Specimen	10.2%	Moisture Content (top 1" after soaking)	11.5%
Percent Compaction	95.8%	Percent Swell	0.0%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	NP	Plastic Index	NP	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/13/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

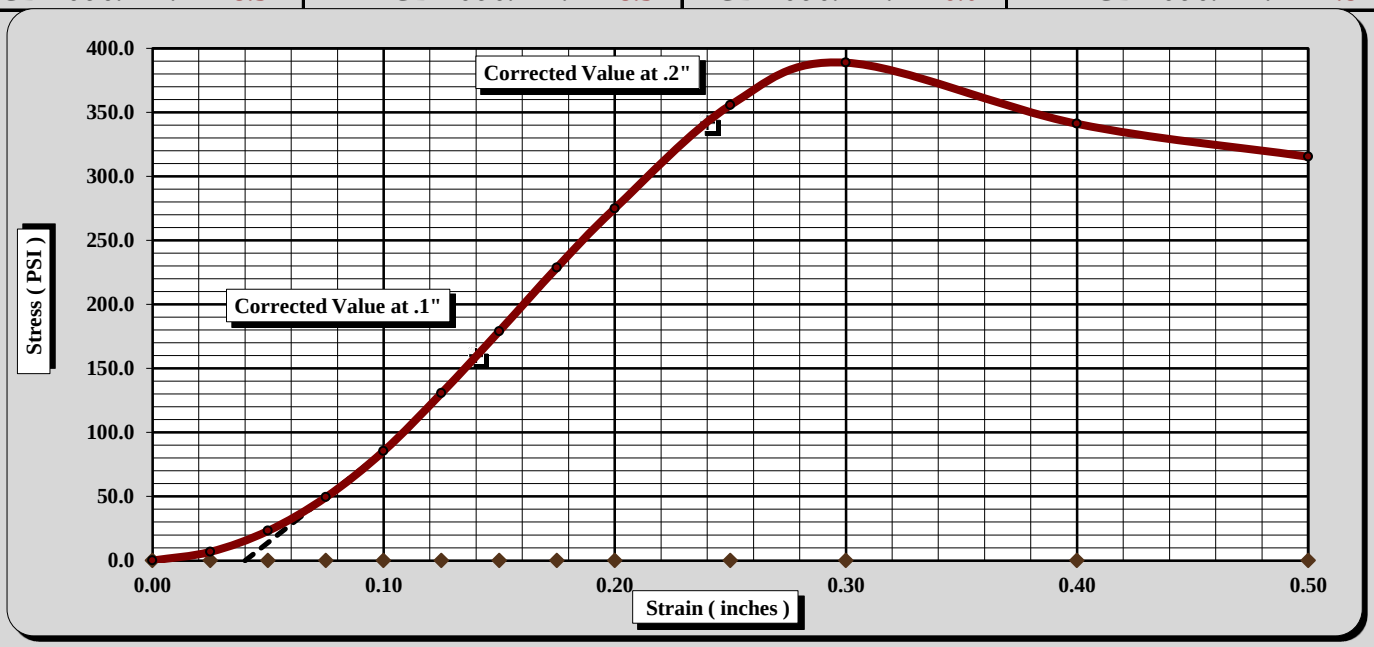
Project #:	**1461-14-046**	Report Date:	11/13/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-1	Sample #: Bulk	Sample Date: Varies	
	Offset: N/A	Depth: 0-5 ft.	

Sample Description: Silty Sand (SM), A-1-b

ASTM D 698 ***Method A*** Maximum Dry Density: **122.6 PCF** Optimum Moisture Content: **9.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 8.5	**CBR at 0.2 in. 18.3**	**CBR at 0.1 in. 16.0**	**CBR at 0.2 in. 22.8**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	71	Final Dry Density (PCF)	122.8
Initial Dry Density (PCF)	122.8	Average Final Moisture Content	10.4%
Moisture Content of the Compacted Specimen	10.2%	Moisture Content (top 1" after soaking)	10.8%
Percent Compaction	100.1%	Percent Swell	-0.1%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	NP	Plastic Index	NP	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/13/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

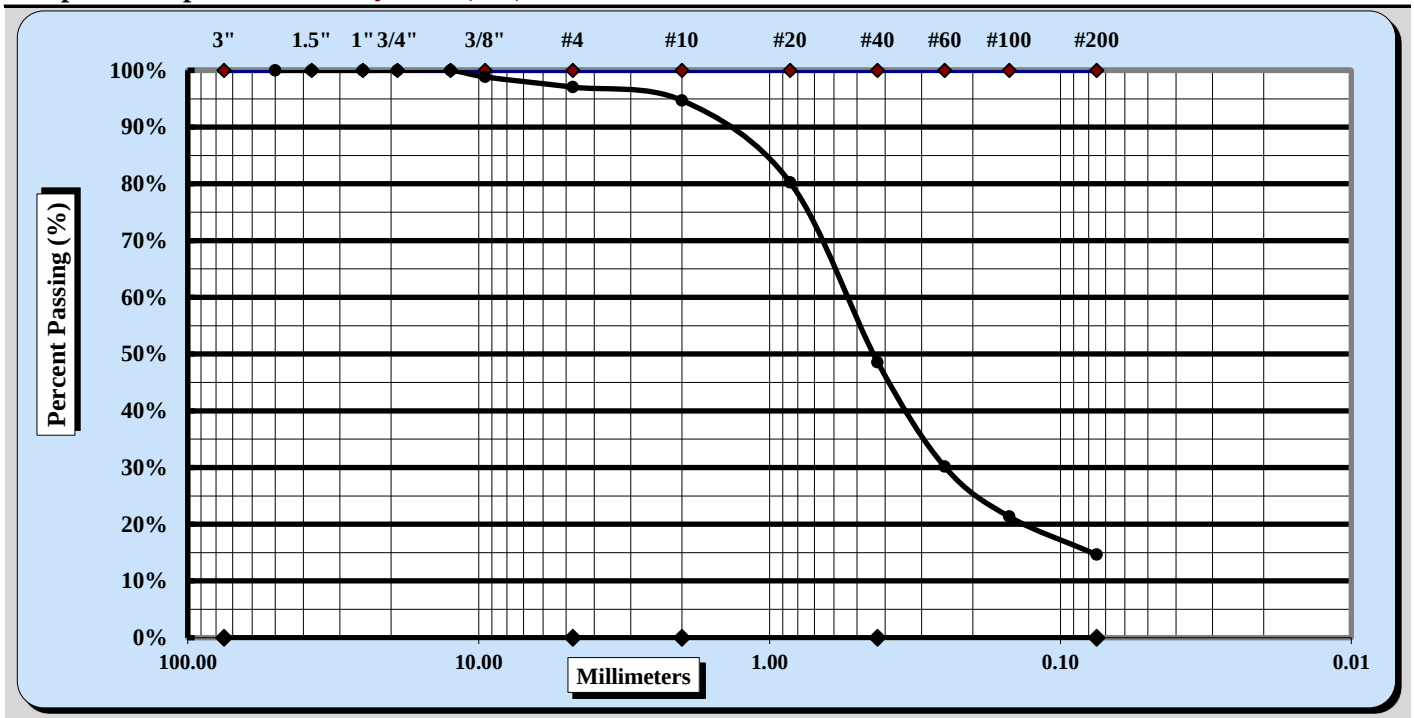
ASTM D 422

Quality Assurance

S&ME, Inc. - Columbia, 134 Suber Road Columbia SC 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-1	Sample #: Bulk	Sample Date:	Varies
		Depth:	0-5 ft.

Sample Description: Silty Sand (SM), A-1-b



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size		Coarse Sand	2.3%	Fine Sand	33.9%
Gravel	2.9%	Medium Sand	46.1%	Silt & Clay	14.6%

Cc = **N/A** **Cu =** **N/A** Moisture Content 14.7%

Coarse Sand	2.3%	Medium Sand	46.1%	Fine Sand	33.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Matthew Wolfe		Lab Quality Manager	10/22/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

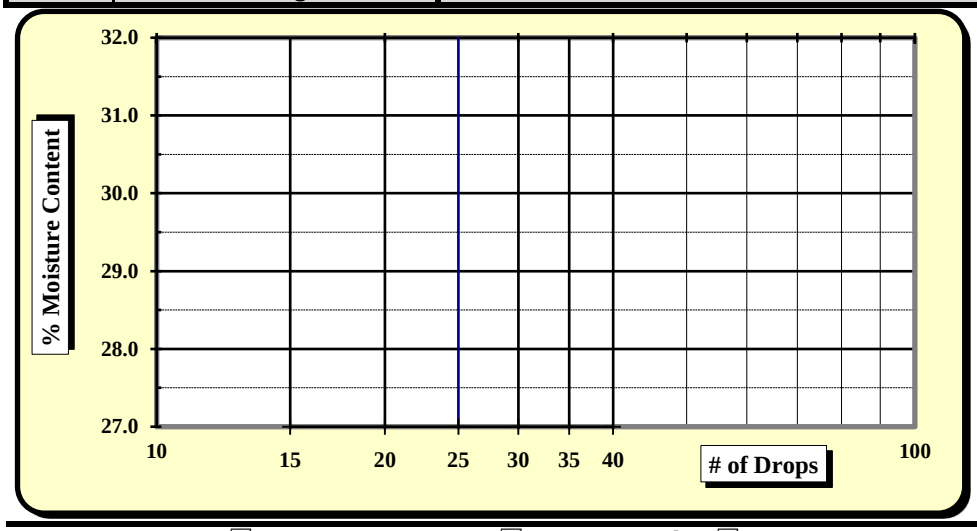
Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | ***Quality Assurance***

S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s)	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: R-1	Sample No: Bulk	Sample Date: Varies	
		Depth: 0-5 ft.	
Description:	Silty Sand (SM), A-1-b		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

		Liquid Limit						Plastic Limit		
Pan #	2									
	Tare #:									
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



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	**NP**
Plastic Limit	**NP**
Plastic Index	**NP**
Group Symbol	**SM**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References:

The material was determined to be non-plastic.

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	11/4/2014	Matthew Wolfe	11/4/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

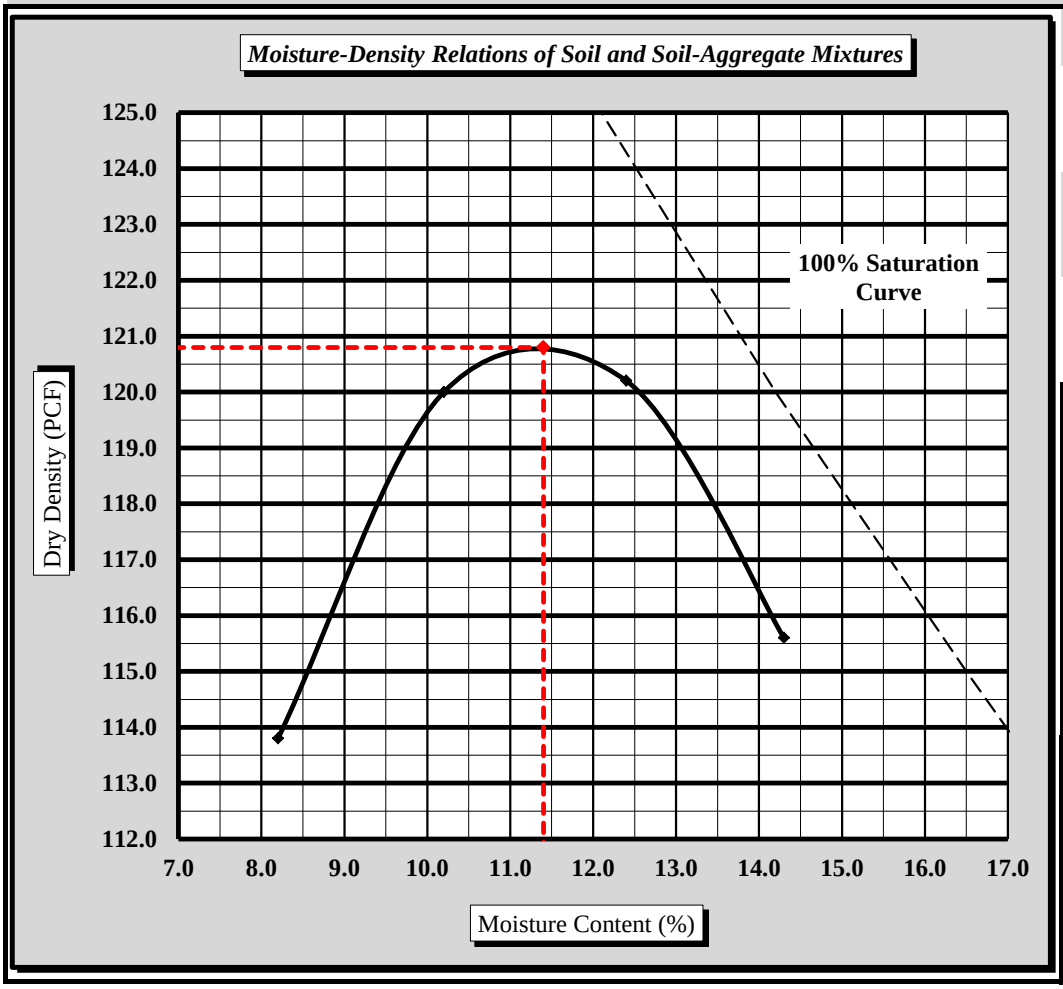
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	10/22/2014
Project Name:	I-77 Widening	Test Date(s):	10/20-10/22
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-4	Sample #: Bulk	Sample Date:	9/2/2014
		Depth:	0-5 ft.
Sample Description:	Clayey Sand (SC), A-2-6		

Maximum Dry Density **120.8** **PCF.** **Optimum Moisture Content** **11.4%**

ASTM D 698 - - Method A



Soil Properties	
Natural Moisture Content	**11.3%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**29**
Plastic Limit	**16**
Plastic Index	**13**

% Passing	
3/8"	100.0%
#4	99.8%
#10	98.1%
#20	83.7%
#40	61.8%
#60	47.8%
#100	40.1%
#200	33.3%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	0.2%
MDD	**120.8**
Opt. MC	**11.4%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	10/22/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

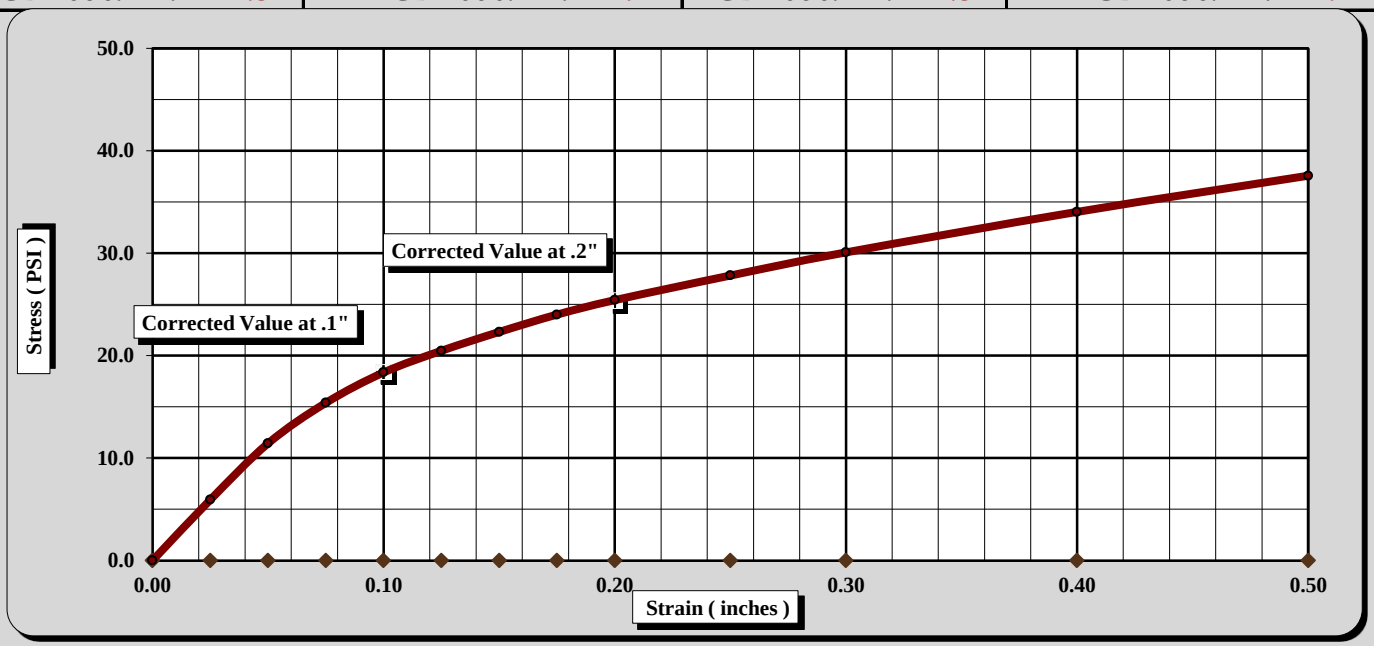
Project #:	**1461-14-046**	Report Date:	10/28/2014
Project Name:	I-77 Widening	Test Date(s):	10/24-10/28/2014
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-4	Sample #: Bulk	Sample Date: 9/2/2014
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **120.8 PCF** Optimum Moisture Content: **11.4%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 1.8	**CBR at 0.2 in. 1.7**	**CBR at 0.1 in. 1.8**	**CBR at 0.2 in. 1.7**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	18	Final Dry Density (PCF)	105.1
Initial Dry Density (PCF)	110.9	Average Final Moisture Content	16.0%
Moisture Content of the Compacted Specimen	10.8%	Moisture Content (top 1" after soaking)	15.1%
Percent Compaction	91.8%	Percent Swell	0.7%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	29	Plastic Index	13	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	10/28/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

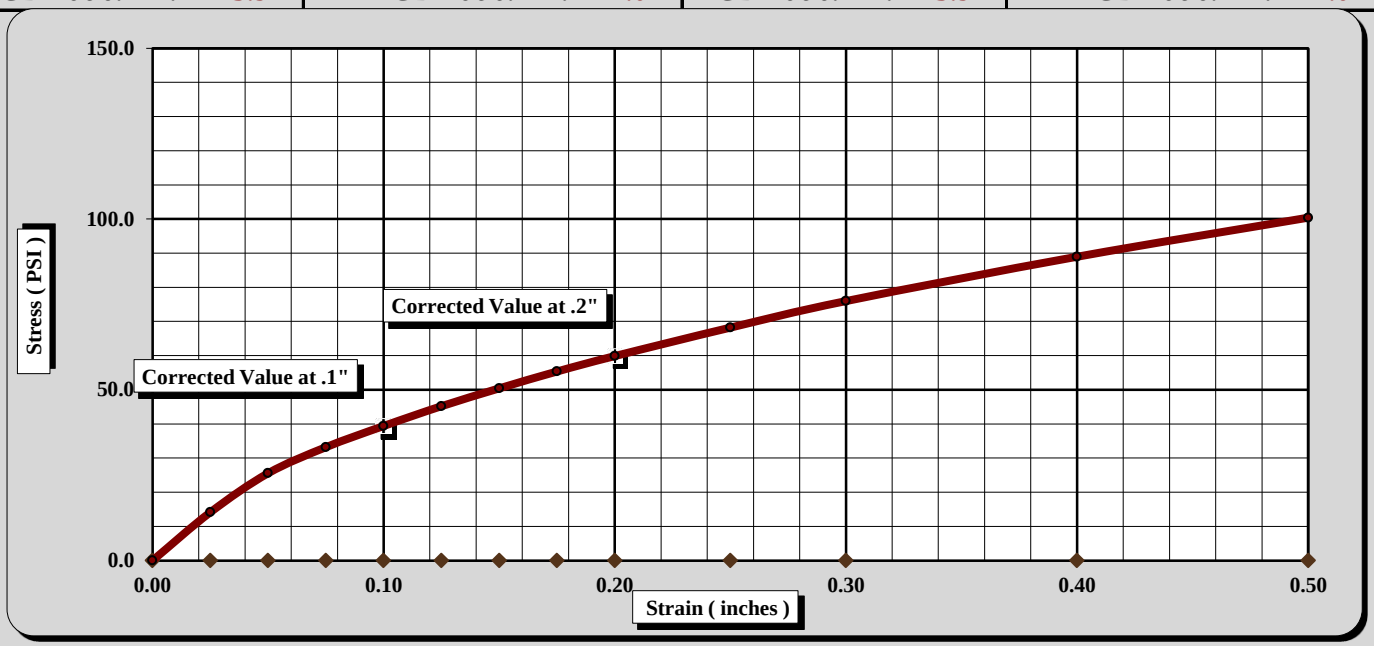
Project #:	**1461-14-046**	Report Date:	10/28/2014
Project Name:	I-77 Widening	Test Date(s):	10/24-10/28/2014
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-4	Sample #: Bulk	Sample Date:	9/2/2014
	Offset: N/A	Depth:	0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **120.8 PCF** Optimum Moisture Content: **11.4%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 3.9	**CBR at 0.2 in. 4.0**	**CBR at 0.1 in. 3.9**	**CBR at 0.2 in. 4.0**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	27	Final Dry Density (PCF)	114.3
Initial Dry Density (PCF)	117.6	Average Final Moisture Content	13.5%
Moisture Content of the Compacted Specimen	10.8%	Moisture Content (top 1" after soaking)	14.1%
Percent Compaction	97.4%	Percent Swell	0.4%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	29	Plastic Index	13	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	10/28/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

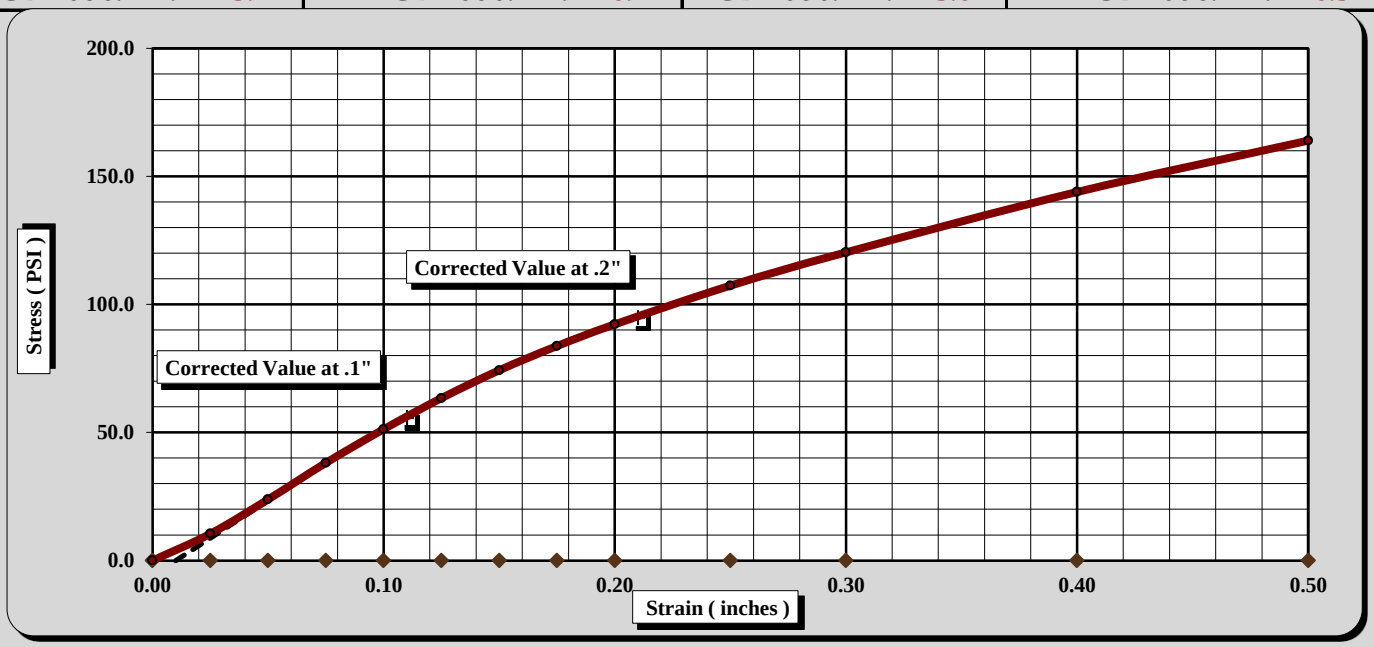
Project #:	**1461-14-046**	Report Date:	10/28/2014
Project Name:	I-77 Widening	Test Date(s):	10/24-10/28/2014
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-4	Sample #: Bulk	Sample Date: 9/2/2014
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **120.8 PCF** Optimum Moisture Content: **11.4%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 5.1	**CBR at 0.2 in. 6.1**	**CBR at 0.1 in. 5.6**	**CBR at 0.2 in. 6.3**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	45	Final Dry Density (PCF)	120.4
Initial Dry Density (PCF)	122.4	Average Final Moisture Content	12.4%
Moisture Content of the Compacted Specimen	10.8%	Moisture Content (top 1" after soaking)	13.3%
Percent Compaction	101.3%	Percent Swell	0.0%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	29	Plastic Index	13	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	10/28/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

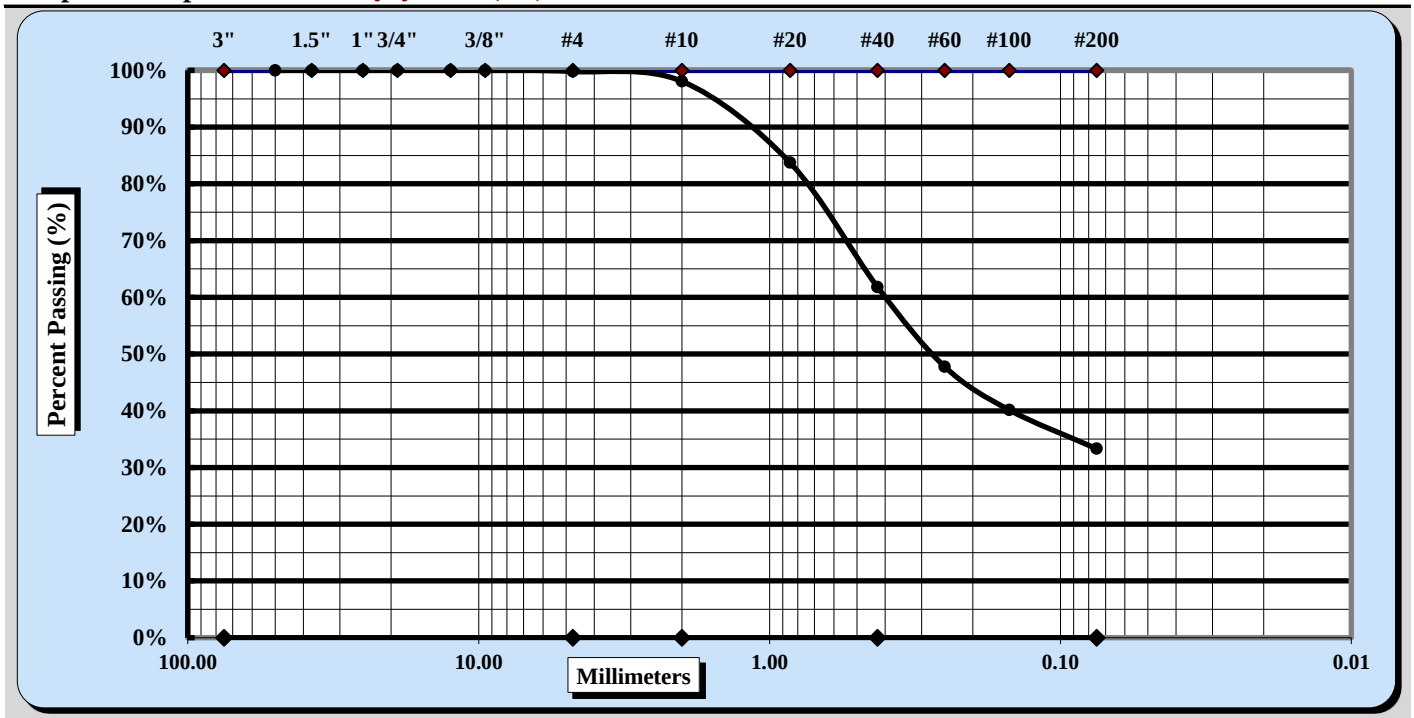
ASTM D 422

Quality Assurance

S&ME, Inc. - Columbia, 134 Suber Road Columbia SC 29210

Project #:	**1461-14-046**	Report Date:	10/22/2014
Project Name:	I-77 Widening	Test Date(s):	10/20-10/22
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-4	Sample #: Bulk	Sample Date:	9/2/2014
		Depth:	0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4.75 mm	Coarse Sand	1.7%	Fine Sand	28.5%
Gravel	0.2%	Medium Sand	36.3%	Silt & Clay	33.3%

Cc = **N/A** **Cu =** **N/A** Moisture Content 11.3%

Coarse Sand	1.7%	Medium Sand	36.3%	Fine Sand	28.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Matthew Wolfe		Lab Quality Manager	10/22/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

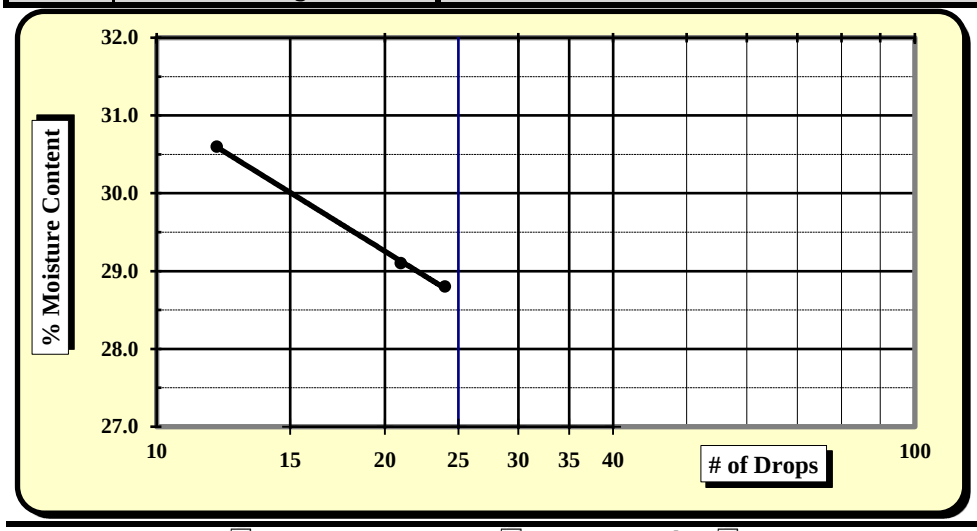
S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	10/22/2014
Project Name:	I-77 Widening	Test Date(s)	10/20-10/22
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: R-4	Sample No: Bulk	Sample Date: 9/2/2014	
		Depth: 0-5 ft.	

Description: Clayey Sand (SC), A-2-6

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

		Liquid Limit						Plastic Limit		
Pan #	608									
	Tare #:	13	46	219				31	4	
A	Tare Weight	13.55	13.61	13.73				13.72	13.55	
B	Wet Soil Weight + A	24.82	23.89	23.21				20.09	21.39	
C	Dry Soil Weight + A	22.30	21.57	20.99				19.25	20.32	
D	Water Weight (B-C)	2.52	2.32	2.22				0.84	1.07	
E	Dry Soil Weight (C-A)	8.75	7.96	7.26				5.53	6.77	
F	% Moisture (D/E)*100	28.8%	29.1%	30.6%				15.2%	15.8%	
N	# OF DROPS	24	21	12				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.5%**		



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 **29**
Plastic Limit **16**
Plastic Index **13**
Group Symbol **SC**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References:

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	10/22/2014	Matthew Wolfe	10/22/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

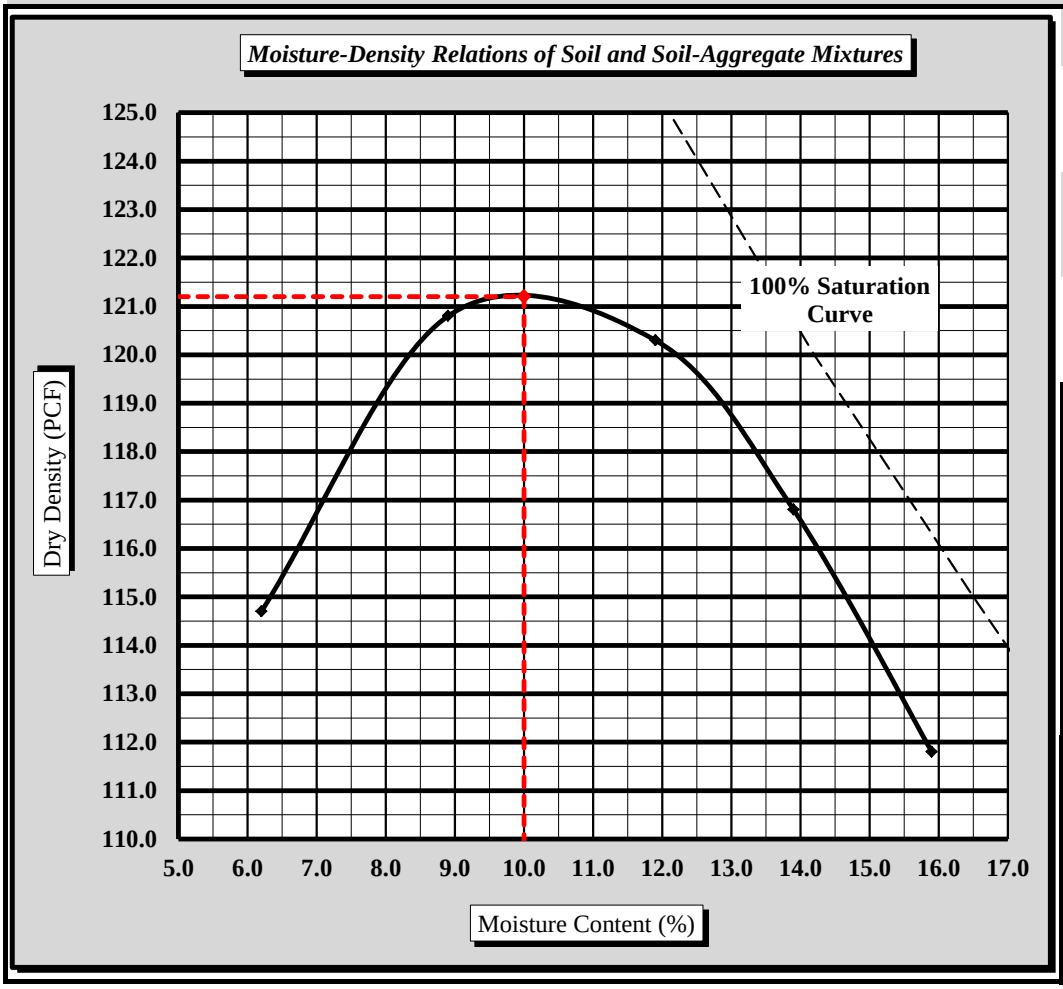
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	11/11/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/6
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
	Sample #: Bulk	Sample Date:	Varies
Location: R-9		Depth:	0-5 ft.
Sample Description:	Clayey Sand (SC), A-2-4		

Maximum Dry Density **121.2** **PCF.** **Optimum Moisture Content** **10.0%**

ASTM D 698 - - Method A



Soil Properties	
Delivered Moisture Content	**8.7%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**26**
Plastic Limit	**16**
Plastic Index	**10**

% Passing	
3/8"	99.6%
#4	98.9%
#10	96.0%
#20	81.7%
#40	60.0%
#60	44.6%
#100	36.0%
#200	28.6%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	
MDD	**121.2**
Opt. MC	**10.0%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	11/11/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

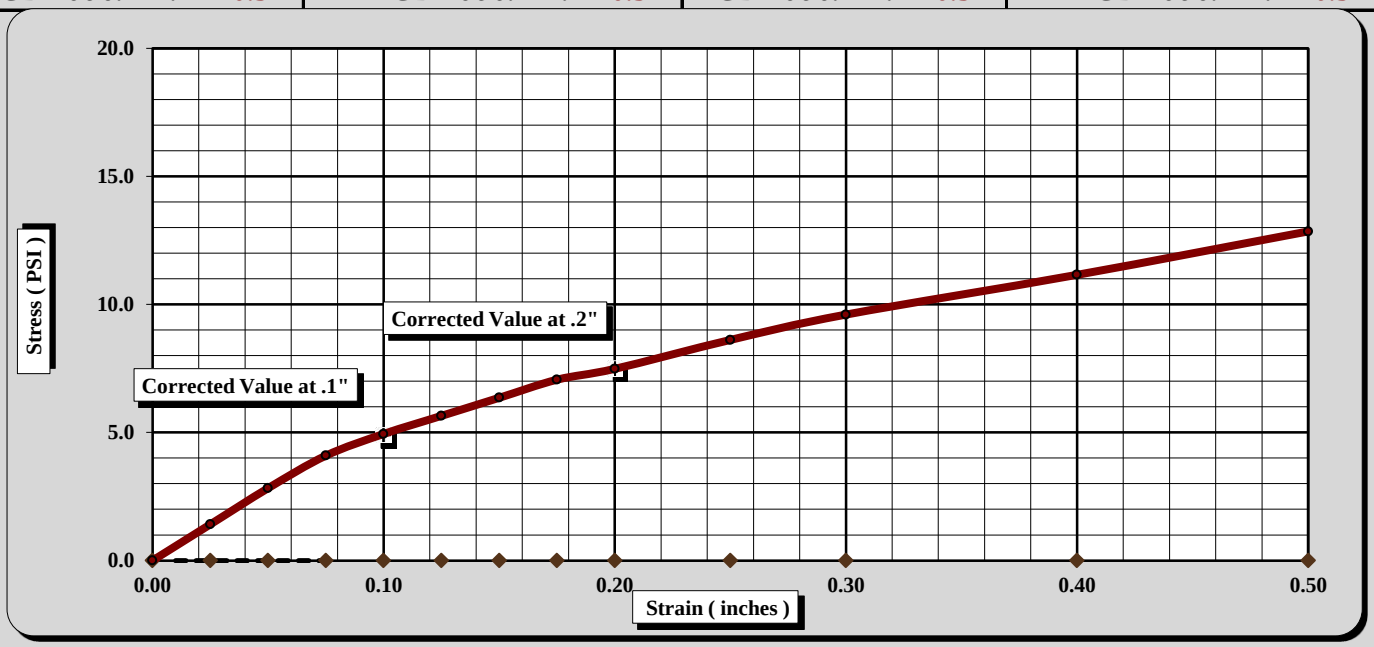
Project #:	**1461-14-046**	Report Date:	11/11/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-9	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-4

ASTM D 698 ***Method A*** Maximum Dry Density: **121.2 PCF** Optimum Moisture Content: **10.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.5	**CBR at 0.2 in. 0.5**	**CBR at 0.1 in. 0.5**	**CBR at 0.2 in. 0.5**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	18	Final Dry Density (PCF)	98.8
Initial Dry Density (PCF)	107.6	Average Final Moisture Content	17.9%
Moisture Content of the Compacted Specimen	10.1%	Moisture Content (top 1" after soaking)	20.3%
Percent Compaction	88.7%	Percent Swell	1.5%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	26	Plastic Index	10	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/11/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

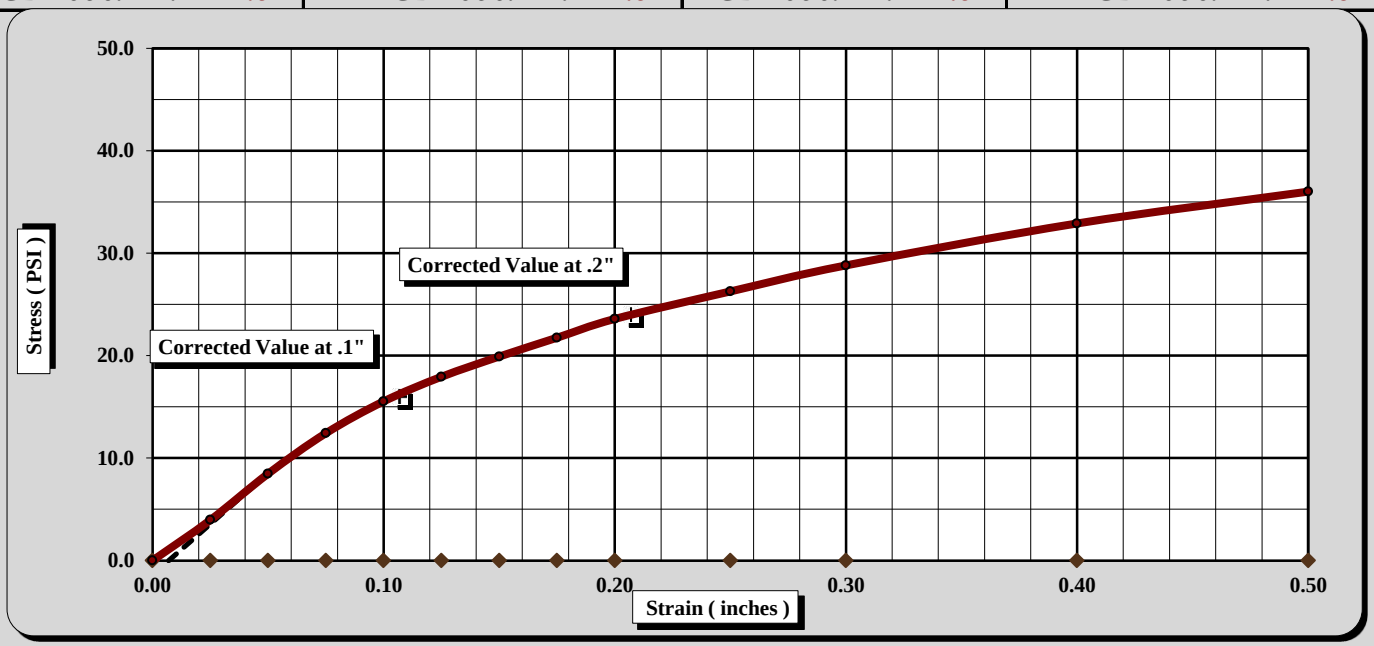
Project #:	**1461-14-046**	Report Date:	11/11/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-9	Sample #: Bulk	Sample Date: Varies	
	Offset: N/A	Depth: 0-5 ft.	

Sample Description: Clayey Sand (SC), A-2-4

ASTM D 698 ***Method A*** Maximum Dry Density: **121.2 PCF** Optimum Moisture Content: **10.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 1.6	**CBR at 0.2 in. 1.6**	**CBR at 0.1 in. 1.6**	**CBR at 0.2 in. 1.6**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	35	Final Dry Density (PCF)	109.3
Initial Dry Density (PCF)	113.6	Average Final Moisture Content	12.9%
Moisture Content of the Compacted Specimen	10.1%	Moisture Content (top 1" after soaking)	15.5%
Percent Compaction	93.7%	Percent Swell	1.3%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	26	Plastic Index	10	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/11/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

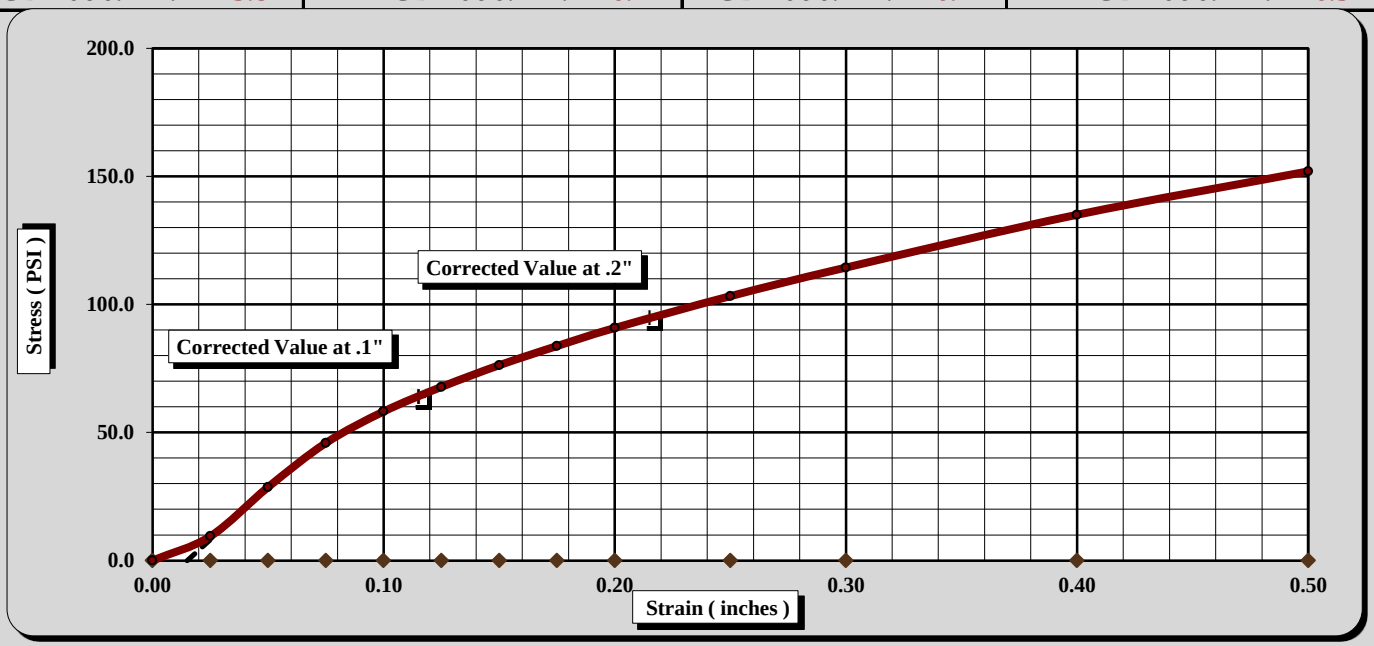
Project #:	**1461-14-046**	Report Date:	11/11/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/11
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-9	Sample #: Bulk	Sample Date: Varies	
	Offset: N/A	Depth: 0-5 ft.	

Sample Description: Clayey Sand (SC), A-2-4

ASTM D 698 ***Method A*** Maximum Dry Density: **121.2 PCF** Optimum Moisture Content: **10.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 5.8	**CBR at 0.2 in. 6.1**	**CBR at 0.1 in. 6.4**	**CBR at 0.2 in. 6.3**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	63	Final Dry Density (PCF)	113.0
Initial Dry Density (PCF)	120.5	Average Final Moisture Content	16.3%
Moisture Content of the Compacted Specimen	10.1%	Moisture Content (top 1" after soaking)	17.4%
Percent Compaction	99.5%	Percent Swell	0.8%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	26	Plastic Index	10	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/11/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

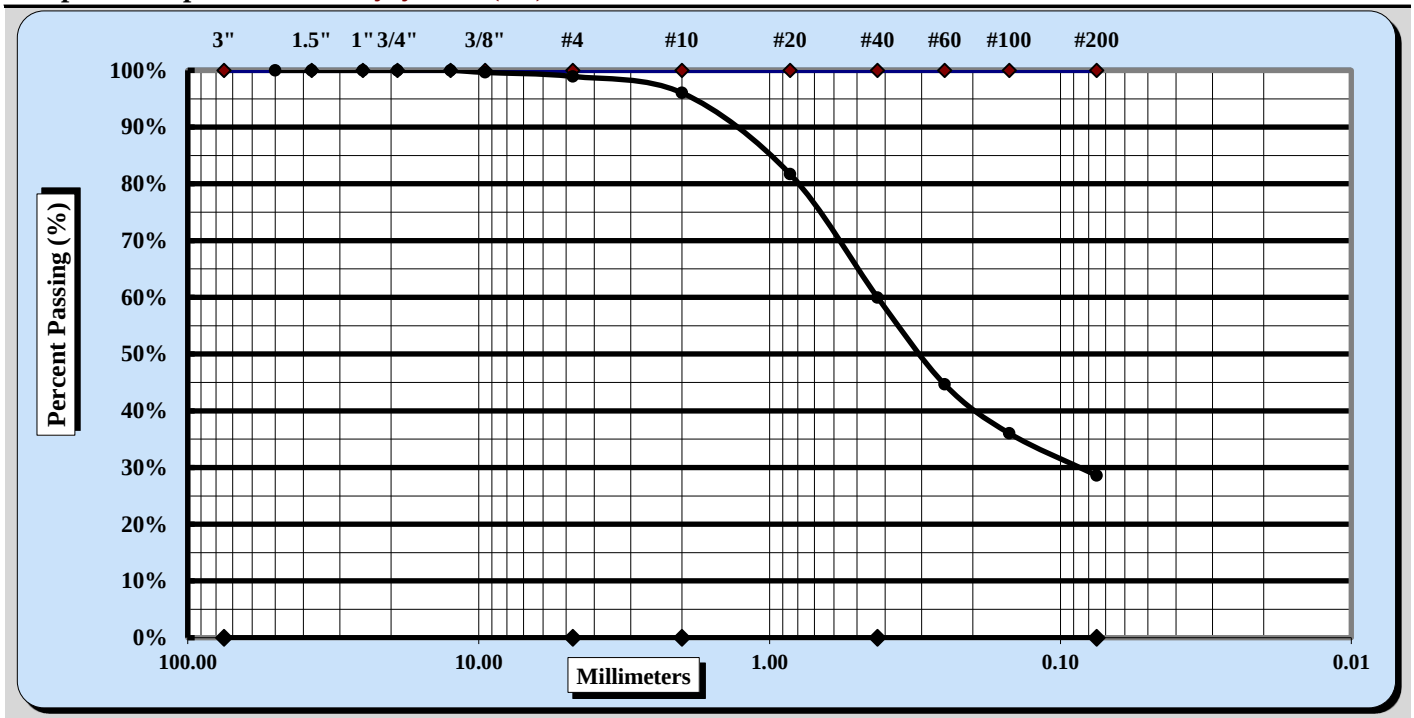
ASTM D 422

Quality Assurance

S&ME, Inc. - Columbia, 134 Suber Road Columbia SC 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-9	Sample #: Bulk	Sample Date:	Varies
		Depth:	0-5 ft.

Sample Description: Clayey Sand (SC), A-2-4



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	9.5 mm	Coarse Sand	2.9%	Fine Sand	31.4%
Gravel	1.1%	Medium Sand	36.1%	Silt & Clay	28.6%

Cc = **N/A** **Cu =** **N/A** Moisture Content 8.7%

Coarse Sand	2.9%	Medium Sand	36.1%	Fine Sand	31.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Matthew Wolfe		Lab Quality Manager	11/4/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

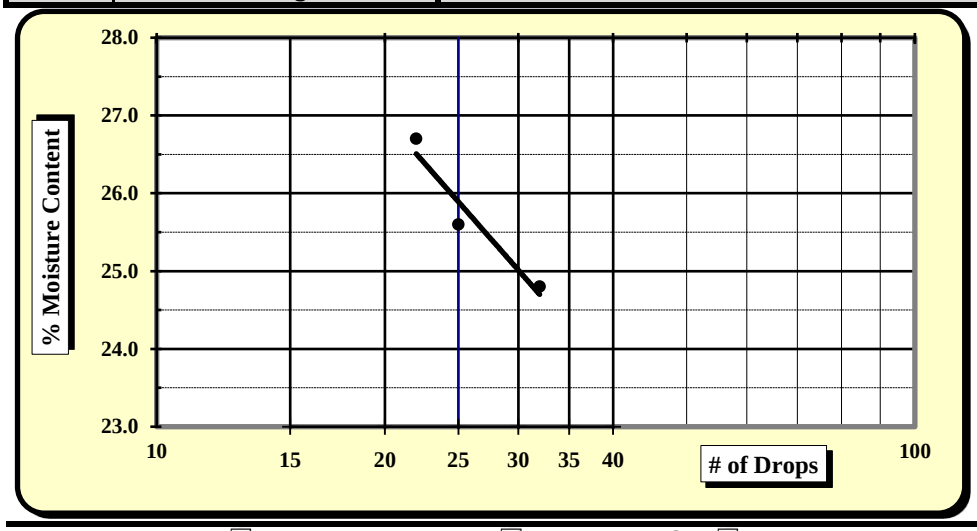
S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s)	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: R-9	Sample No: Bulk	Sample Date: Varies	
		Depth: 0-5 ft.	

Description: Clayey Sand (SC), A-2-4

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

		Liquid Limit						Plastic Limit		
Pan #	30									
	Tare #:	46	20	31				235	239	
A	Tare Weight	13.65	13.64	13.71				13.82	13.72	
B	Wet Soil Weight + A	24.31	25.53	26.15				20.54	21.50	
C	Dry Soil Weight + A	22.19	23.11	23.53				19.63	20.43	
D	Water Weight (B-C)	2.12	2.42	2.62				0.91	1.07	
E	Dry Soil Weight (C-A)	8.54	9.47	9.82				5.81	6.71	
F	% Moisture (D/E)*100	24.8%	25.6%	26.7%				15.7%	15.9%	
N	# OF DROPS	32	25	22				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.8%**		



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 **26**
Plastic Limit **16**
Plastic Index **10**
Group Symbol **SC**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References:

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	11/4/2014	Matthew Wolfe	11/4/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

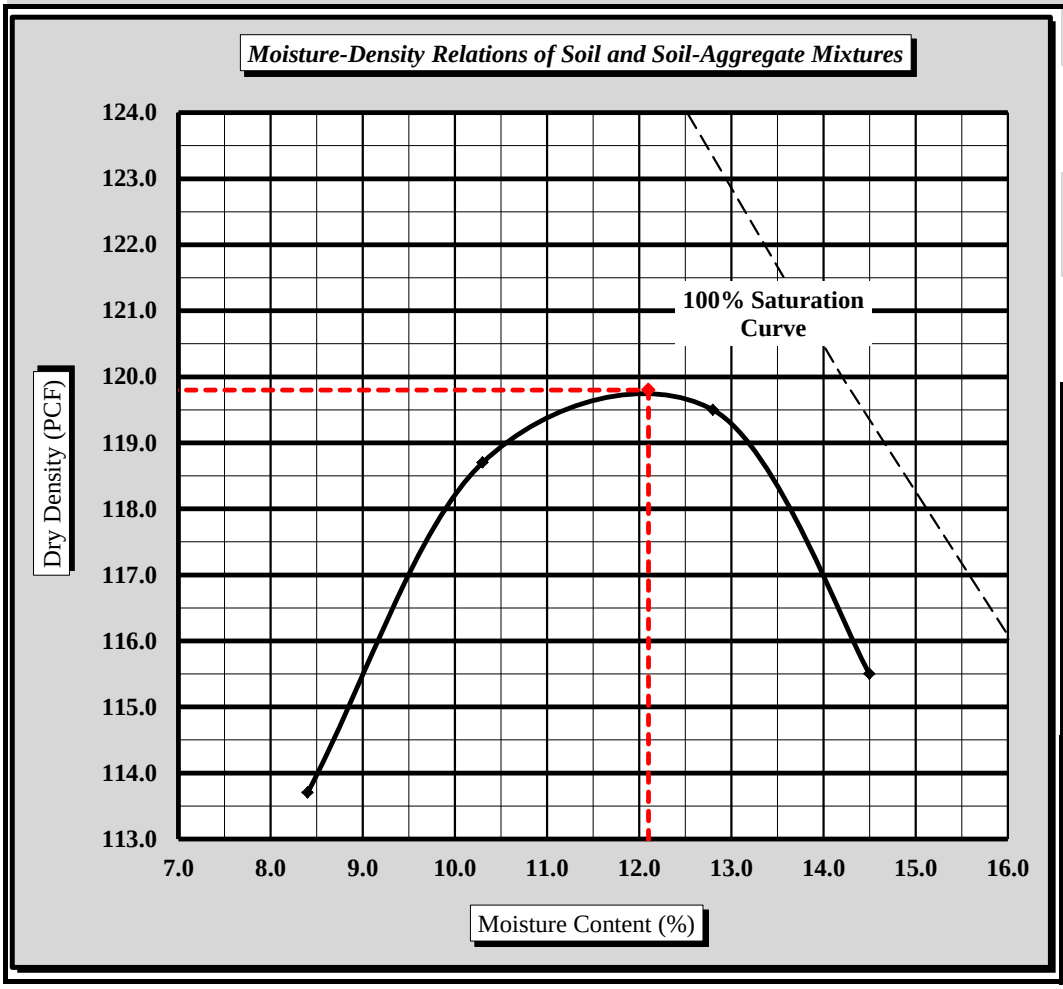
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/6
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
	Sample #: Bulk	Sample Date:	Varies
Location: R-13		Depth:	0-5 ft.
Sample Description:	Clayey Sand (SC), A-2-6		

Maximum Dry Density **119.8** **PCF.** **Optimum Moisture Content** **12.1%**

ASTM D 698 - - Method A



Soil Properties	
Delivered Moisture Content	**12.3%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**28**
Plastic Limit	**16**
Plastic Index	**12**

% Passing	
3/8"	100.0%
#4	100.0%
#10	99.1%
#20	87.8%
#40	61.0%
#60	45.0%
#100	37.9%
#200	33.5%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	
MDD	**119.8**
Opt. MC	**12.1%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

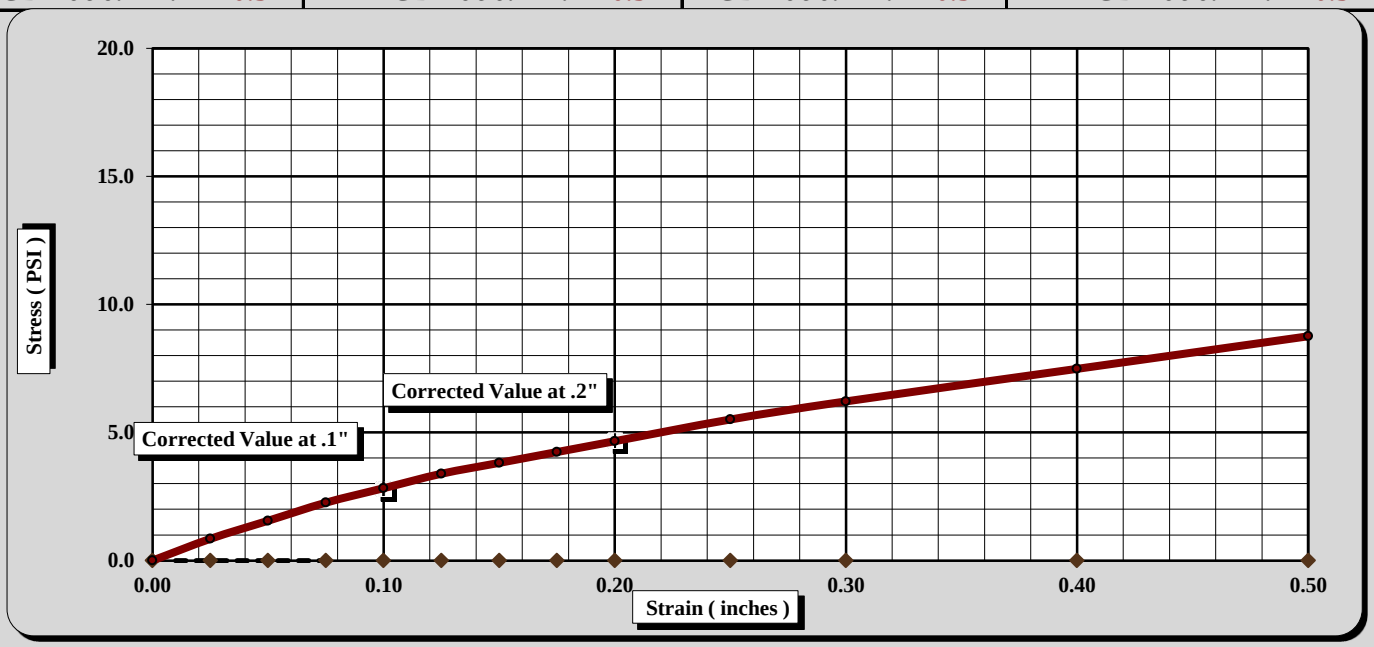
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-13	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **119.8 PCF** Optimum Moisture Content: **12.1%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.3	**CBR at 0.2 in. 0.3**	**CBR at 0.1 in. 0.3**	**CBR at 0.2 in. 0.3**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	18	Final Dry Density (PCF)	98.1
Initial Dry Density (PCF)	107.4	Average Final Moisture Content	18.5%
Moisture Content of the Compacted Specimen	10.9%	Moisture Content (top 1" after soaking)	20.7%
Percent Compaction	89.6%	Percent Swell	2.5%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	28	Plastic Index	12	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

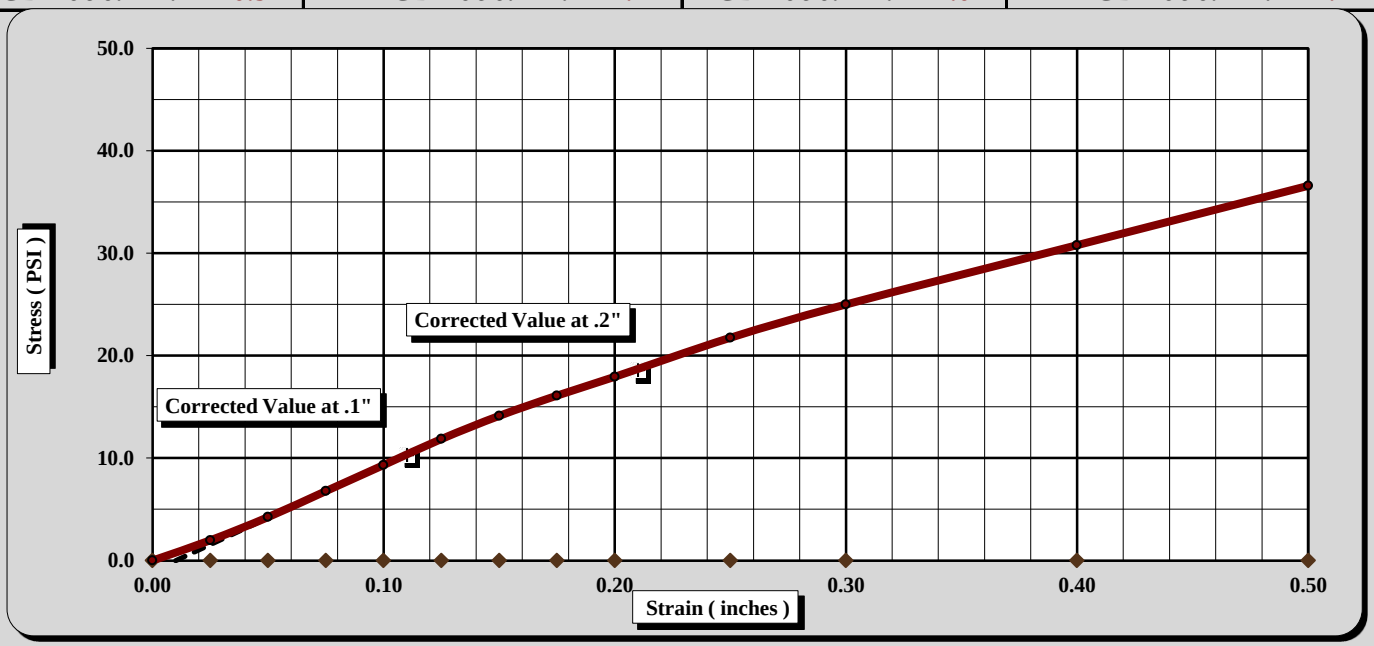
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-13	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **119.8 PCF** Optimum Moisture Content: **12.1%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.9	**CBR at 0.2 in. 1.2**	**CBR at 0.1 in. 1.0**	**CBR at 0.2 in. 1.2**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	41	Final Dry Density (PCF)	107.4
Initial Dry Density (PCF)	114.4	Average Final Moisture Content	15.3%
Moisture Content of the Compacted Specimen	10.8%	Moisture Content (top 1" after soaking)	18.7%
Percent Compaction	95.5%	Percent Swell	2.6%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	28	Plastic Index	12	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

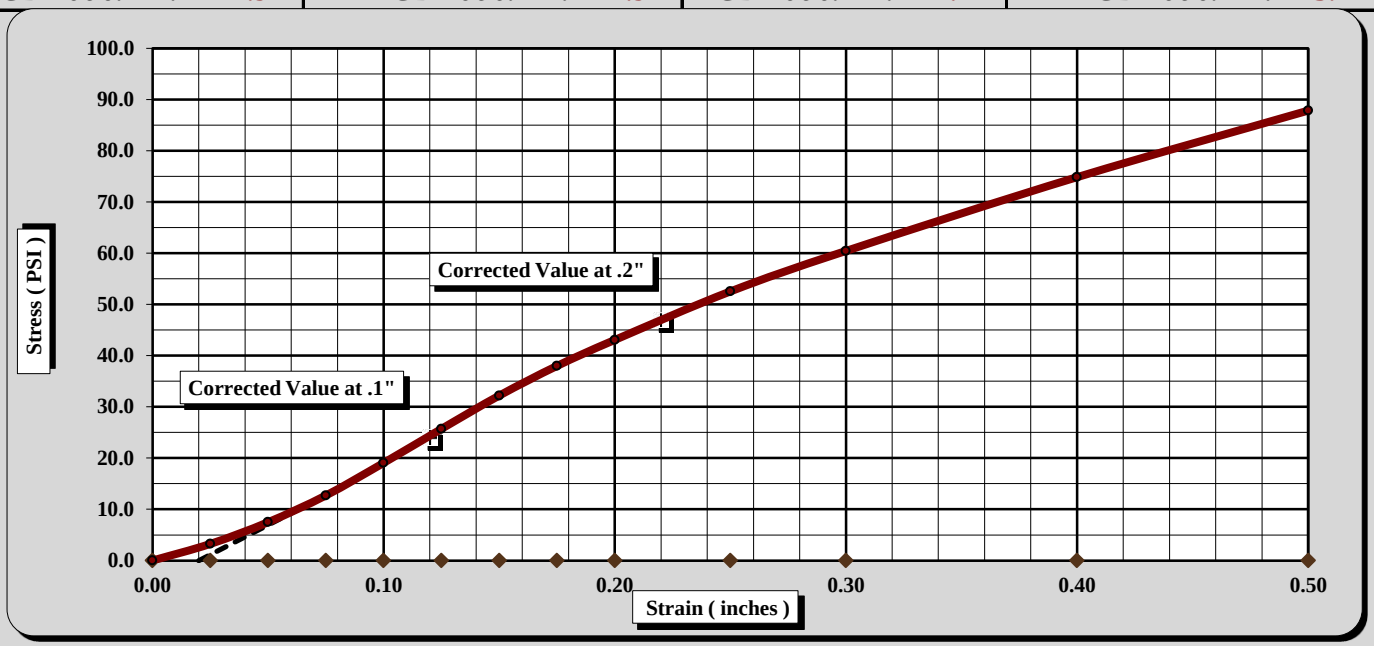
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-13	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6

ASTM D 698 ***Method A*** Maximum Dry Density: **119.8 PCF** Optimum Moisture Content: **12.1%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 1.9	**CBR at 0.2 in. 2.9**	**CBR at 0.1 in. 2.4**	**CBR at 0.2 in. 3.1**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	61	Final Dry Density (PCF)	114.3
Initial Dry Density (PCF)	121.1	Average Final Moisture Content	14.3%
Moisture Content of the Compacted Specimen	10.4%	Moisture Content (top 1" after soaking)	17.2%
Percent Compaction	101.0%	Percent Swell	2.1%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	28	Plastic Index	12	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

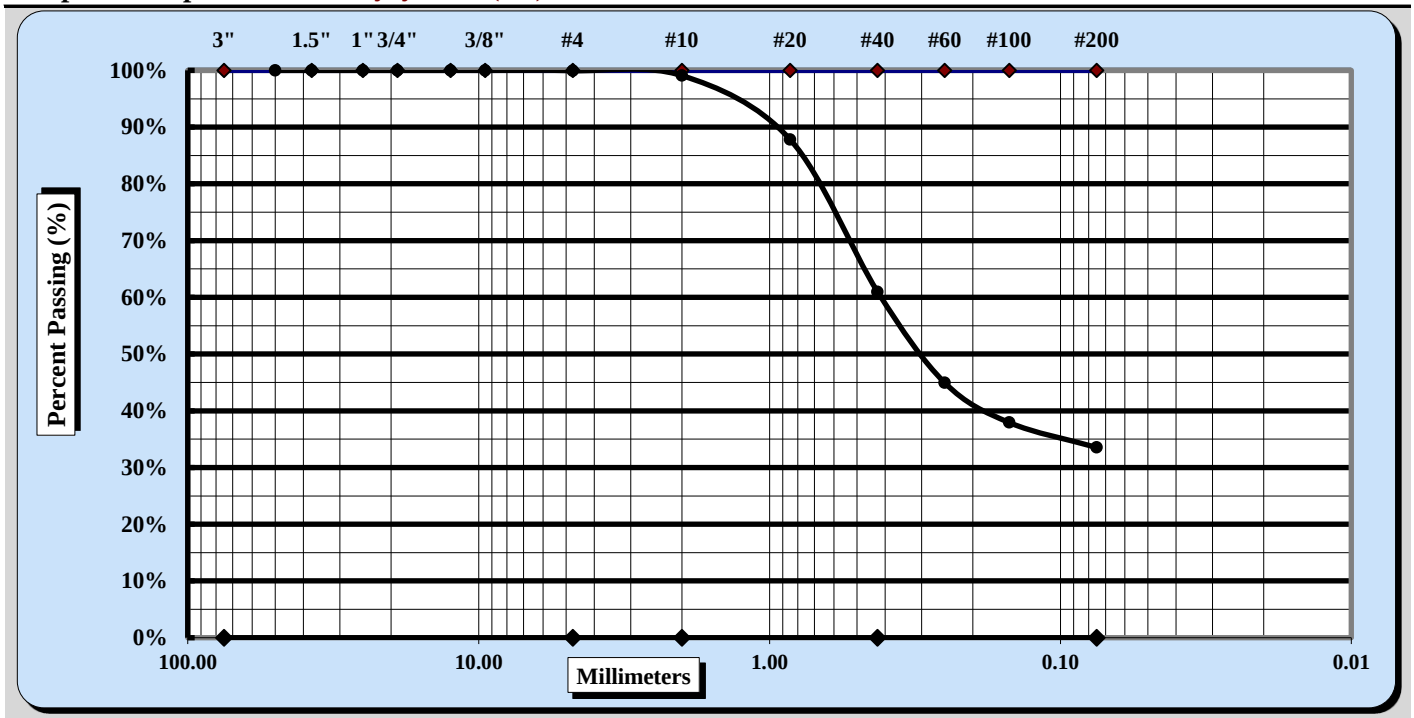
ASTM D 422

Quality Assurance

S&ME, Inc. - Columbia, 134 Suber Road Columbia SC 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-13	Sample #: Bulk	Sample Date:	Varies
		Depth:	0-5 ft.

Sample Description: Clayey Sand (SC), A-2-6



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4.75 mm	Coarse Sand	0.9%	Fine Sand	27.4%
Gravel	0.0%	Medium Sand	38.1%	Silt & Clay	33.5%

Cc = **N/A** **Cu =** **N/A** Moisture Content 12.3%

Coarse Sand	0.9%	Medium Sand	38.1%	Fine Sand	27.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Matthew Wolfe		Lab Quality Manager	10/22/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

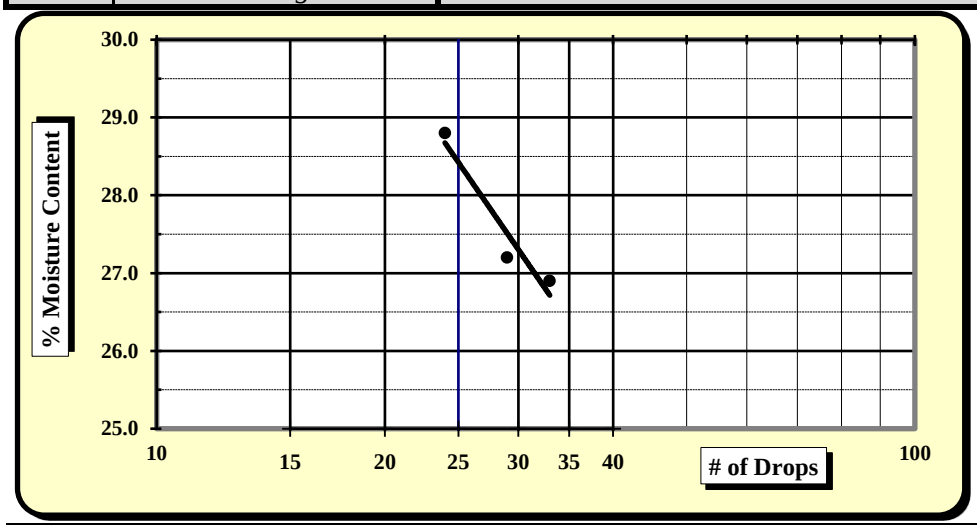
S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s)	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: R-13	Sample No: Bulk	Sample Date: Varies	
		Depth: 0-5 ft.	

Description: Clayey Sand (SC), A-2-6

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

		Liquid Limit						Plastic Limit		
Pan #	31									
	Tare #:	210	30	25				13	131	
A	Tare Weight	13.85	13.67	13.65				13.55	13.46	
B	Wet Soil Weight + A	25.41	22.78	25.55				20.10	20.16	
C	Dry Soil Weight + A	22.96	20.83	22.89				19.22	19.21	
D	Water Weight (B-C)	2.45	1.95	2.66				0.88	0.95	
E	Dry Soil Weight (C-A)	9.11	7.16	9.24				5.67	5.75	
F	% Moisture (D/E)*100	26.9%	27.2%	28.8%				15.5%	16.5%	
N	# OF DROPS	33	29	24				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.0%**		



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 **28**
Plastic Limit **16**
Plastic Index **12**
Group Symbol **SC**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References:

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	11/4/2014	Matthew Wolfe	11/4/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

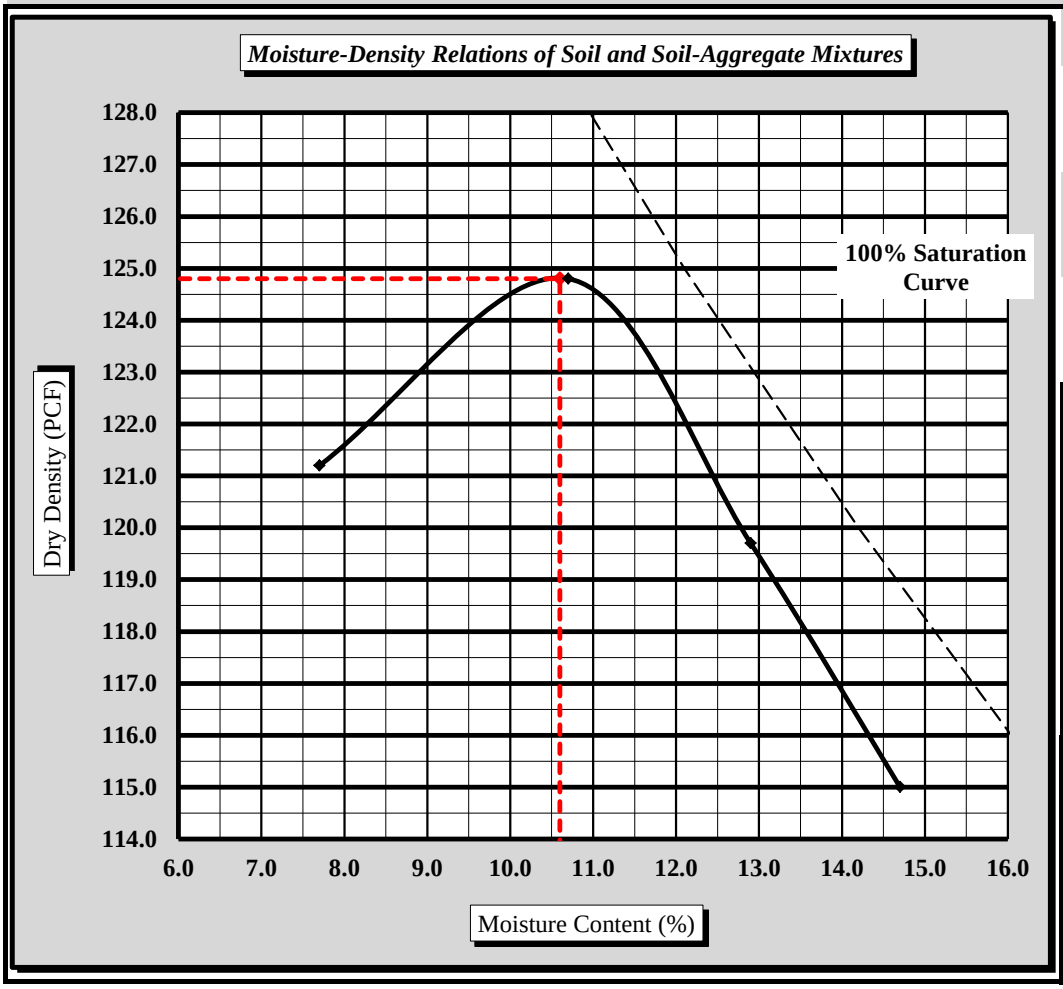
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/7
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
	Sample #: Bulk	Sample Date:	Varies
Location: R-17		Depth:	0-5 ft.
Sample Description:	Clayey Sand (SC), A-1-b		

Maximum Dry Density **124.8** **PCF.** **Optimum Moisture Content** **10.6%**

ASTM D 698 - - Method A



Soil Properties	
Delivered Moisture Content	**11.6%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**25**
Plastic Limit	**17**
Plastic Index	**8**

% Passing	
3/8"	100.0%
#4	99.2%
#10	93.4%
#20	71.6%
#40	42.0%
#60	29.5%
#100	25.1%
#200	21.5%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	
MDD	**124.8**
Opt. MC	**10.6%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	11/7/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

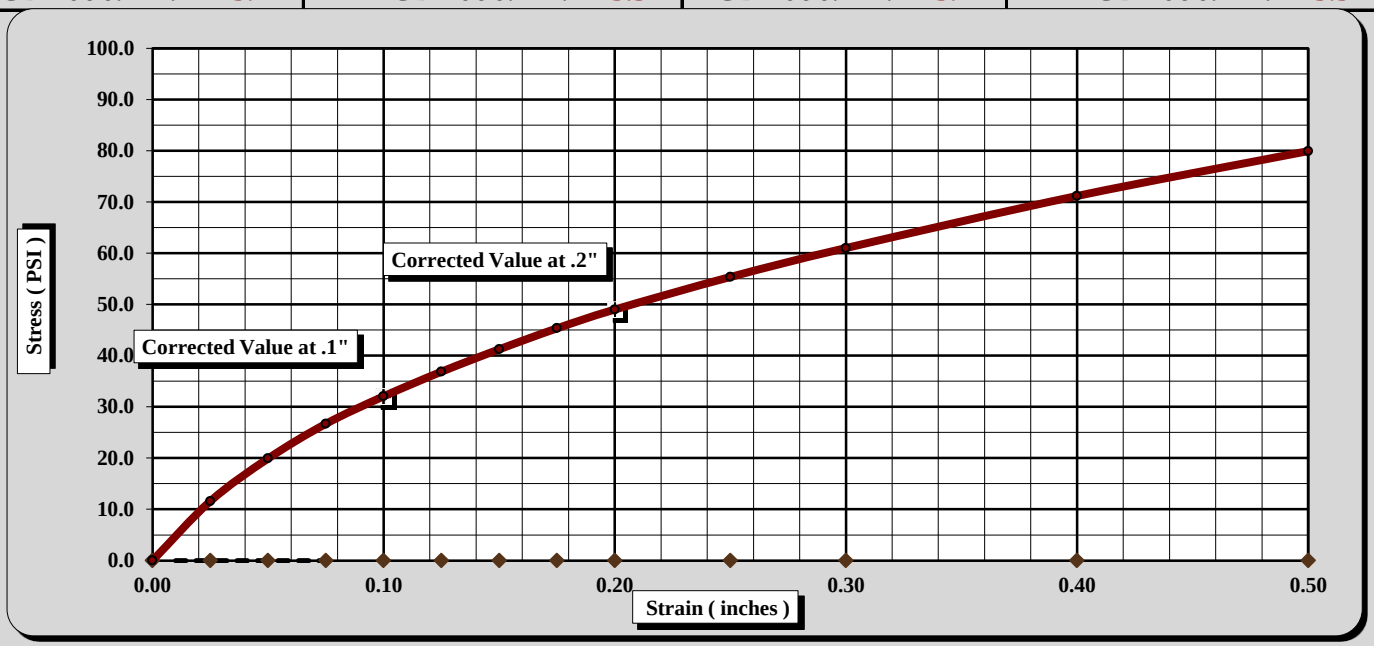
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-17	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-1-b

ASTM D 698 *Method A* Maximum Dry Density: **124.8 PCF** Optimum Moisture Content: **10.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 3.2	**CBR at 0.2 in. 3.3**	**CBR at 0.1 in. 3.2**	**CBR at 0.2 in. 3.3**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	10	Final Dry Density (PCF)	112.2
Initial Dry Density (PCF)	114.5	Average Final Moisture Content	12.6%
Moisture Content of the Compacted Specimen	10.3%	Moisture Content (top 1" after soaking)	14.4%
Percent Compaction	91.7%	Percent Swell	0.1%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	25	Plastic Index	8	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-3
Revision No. 1
Revision Date: 9/29/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

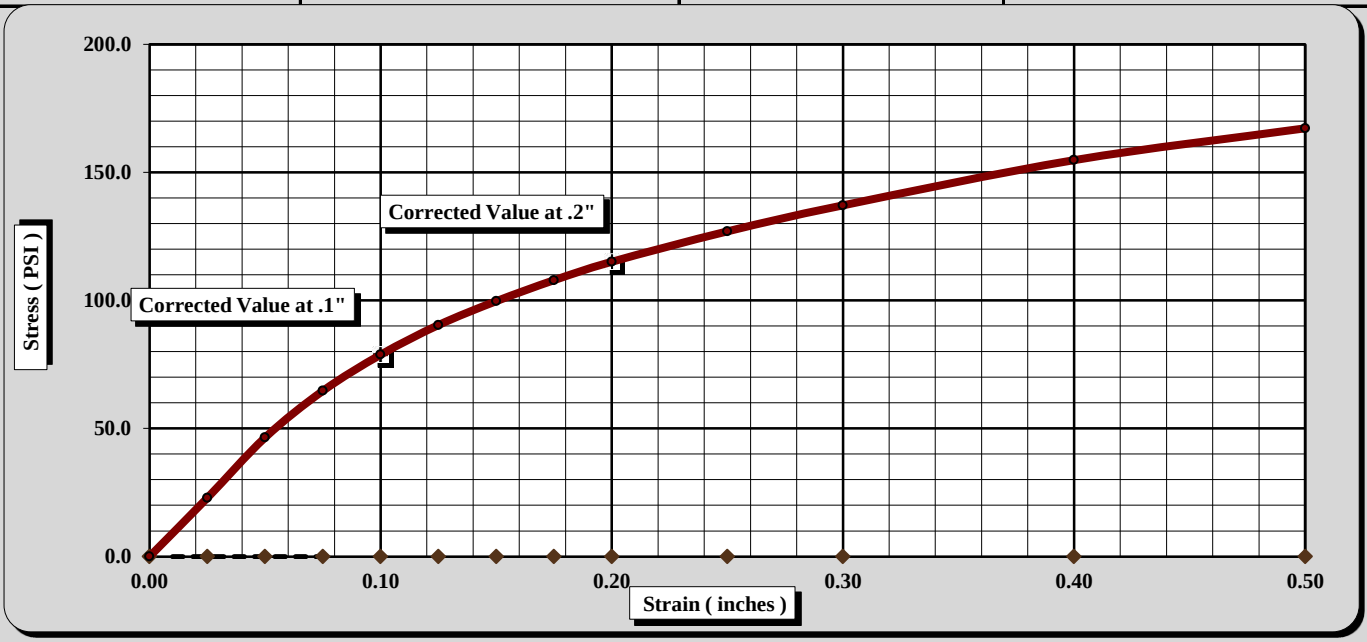
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/7-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-17	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Clayey Sand (SC), A-1-b

ASTM D 698 *Method A* Maximum Dry Density: **124.8 PCF** Optimum Moisture Content: **10.6%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 7.9	**CBR at 0.2 in. 7.7**	**CBR at 0.1 in. 7.9**	**CBR at 0.2 in. 7.7**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	36	Final Dry Density (PCF)	117.9
Initial Dry Density (PCF)	120.5	Average Final Moisture Content	11.7%
Moisture Content of the Compacted Specimen	9.3%	Moisture Content (top 1" after soaking)	13.2%
Percent Compaction	96.6%	Percent Swell	0.2%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	51.0
Liquid Limit	25	Plastic Index	8	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D698-2
Revision No. : 1
Revision Date: 8/27/2014

Moisture - Density Report

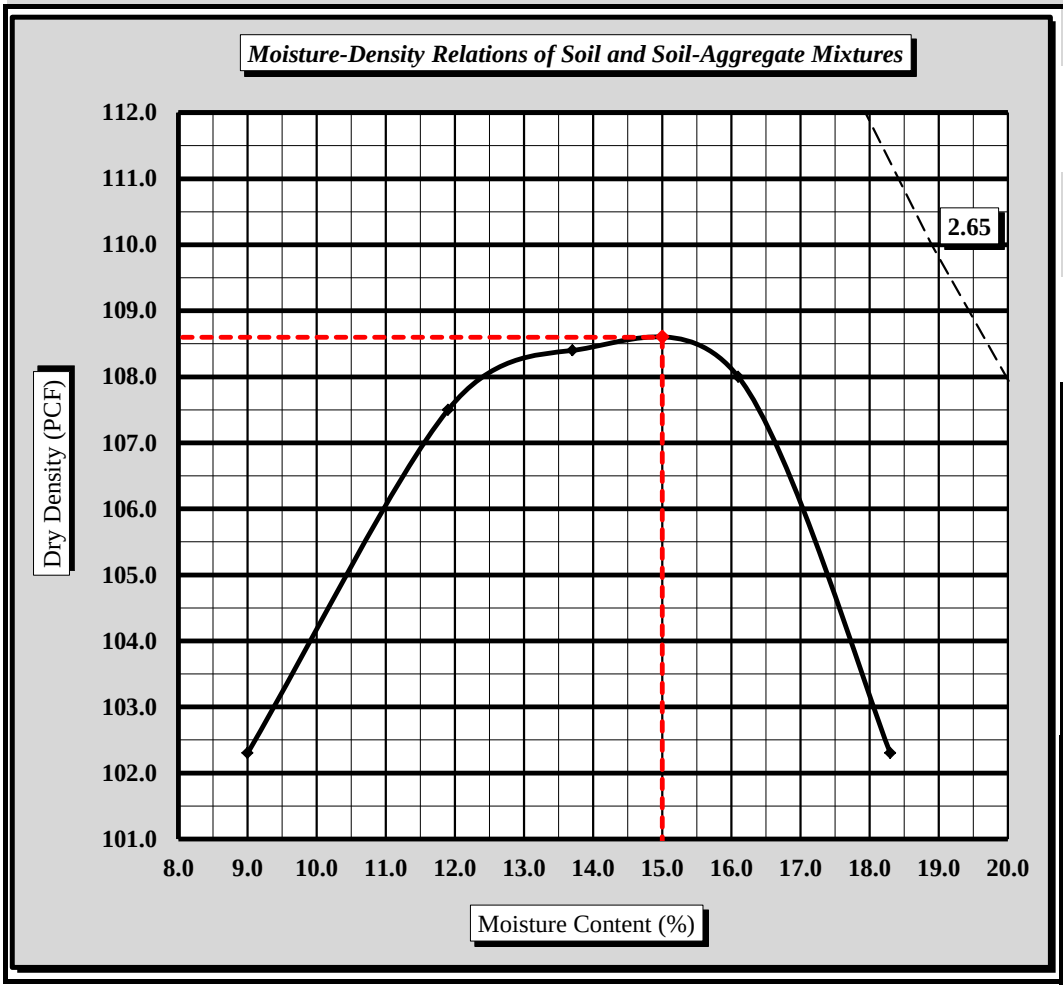
Quality Assurance

S&ME, Inc. Columbia Branch, 134 Suber Road, Columbia SC 29210

S&ME Project #:	**1461-14-046**	Report Date:	11/6/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/6
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
	Sample #: Bulk	Sample Date:	Varies
Location: R-19		Depth:	0-5 ft.
Sample Description:	Silt with Sand (ML), A-6		

Maximum Dry Density **108.6** **PCF.** **Optimum Moisture Content** **15.0%**

ASTM D 698 - - Method B



Soil Properties	
Delivered Moisture Content	**15.6%**
Specific Gravity of Soil (D854)	**TNP**
Liquid Limit	**40**
Plastic Limit	**29**
Plastic Index	**11**

% Passing	
3/8"	98.8%
#4	98.4%
#10	96.0%
#20	92.0%
#40	87.2%
#60	83.5%
#100	80.3%
#200	75.5%

Oversize Fraction	
Bulk Gravity	N/A
Absorption	N/A
% Oversize	
MDD	**108.6**
Opt. MC	**15.0%**

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

TNP: Test Not Performed. NP: Non-plastic. NI: Information not included.

Matthew Wolfe		Laboratory Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

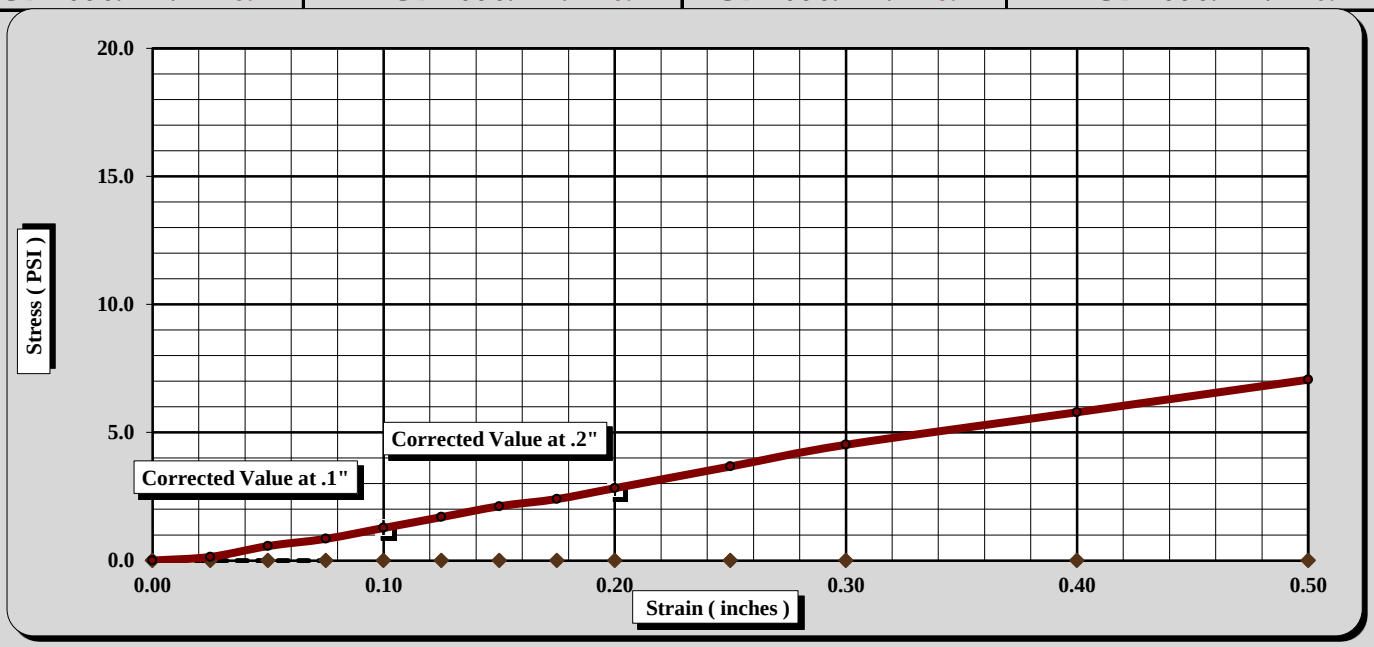
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-19	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Silt with Sand (ML), A-6

ASTM D 698 ***Method A*** Maximum Dry Density: **108.6 PCF** Optimum Moisture Content: **15.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.1	**CBR at 0.2 in. 0.2**	**CBR at 0.1 in. 0.1**	**CBR at 0.2 in. 0.2**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	27	Final Dry Density (PCF)	86.3
Initial Dry Density (PCF)	99.9	Average Final Moisture Content	29.4%
Moisture Content of the Compacted Specimen	19.3%	Moisture Content (top 1" after soaking)	33.6%
Percent Compaction	92.0%	Percent Swell	6.6%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	40	Plastic Index	11	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

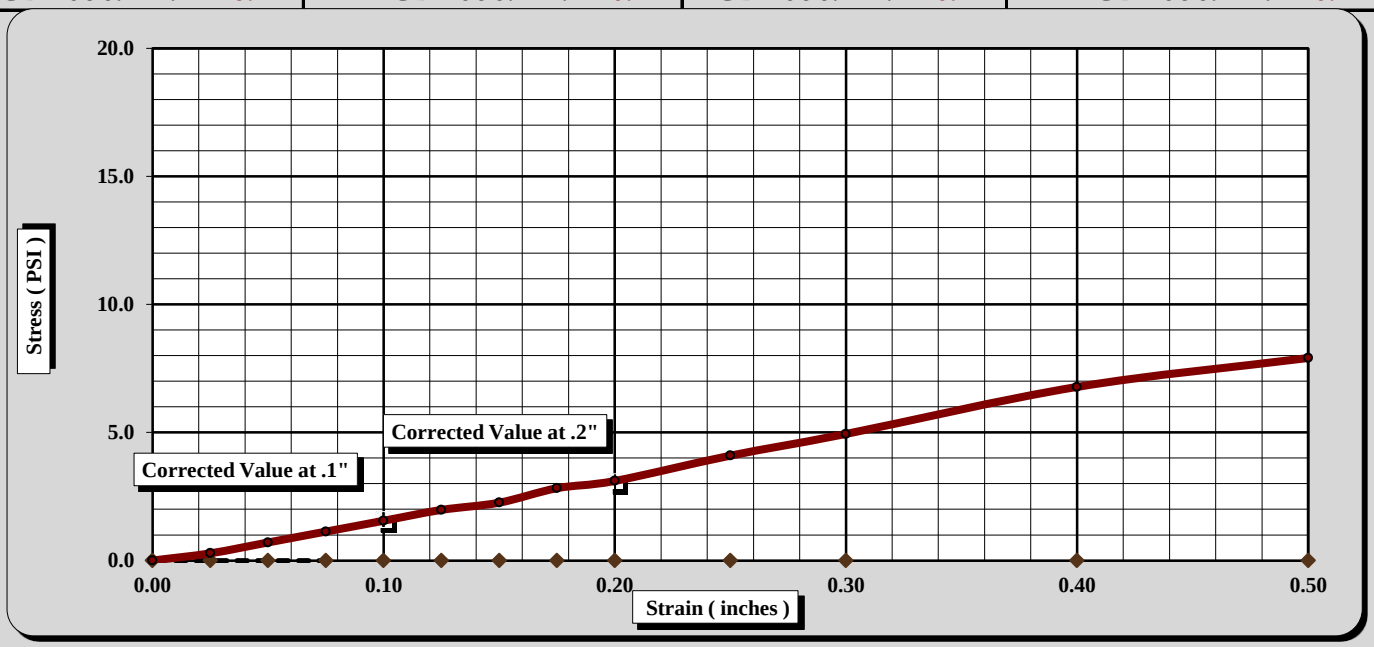
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-19	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Silt with Sand (ML), A-6

ASTM D 698 ***Method A*** Maximum Dry Density: **108.6 PCF** Optimum Moisture Content: **15.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.2	**CBR at 0.2 in. 0.2**	**CBR at 0.1 in. 0.2**	**CBR at 0.2 in. 0.2**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	71	Final Dry Density (PCF)	86.1
Initial Dry Density (PCF)	104.7	Average Final Moisture Content	28.0%
Moisture Content of the Compacted Specimen	16.1%	Moisture Content (top 1" after soaking)	33.1%
Percent Compaction	96.4%	Percent Swell	10.2%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	40	Plastic Index	11	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CBR (California Bearing Ratio) of Laboratory Compacted Soil

ASTM D 1883

Quality Assurance

S&ME, Inc. - Columbia 134 Suber Road, Columbia, South Carolina 29210

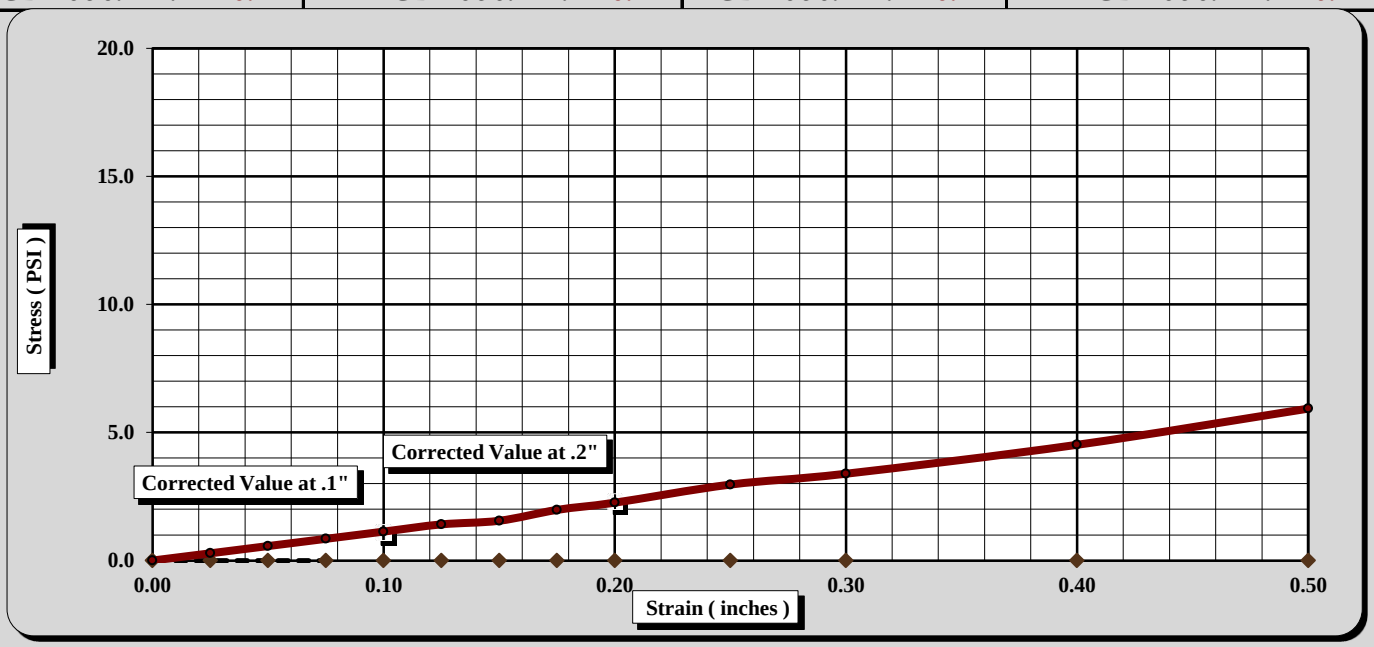
Project #:	**1461-14-046**	Report Date:	11/17/2014
Project Name:	I-77 Widening	Test Date(s):	11/13-11/17
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #:	R-19	Sample #: Bulk	Sample Date: Varies
		Offset: N/A	Depth: 0-5 ft.

Sample Description: Silt with Sand (ML), A-6

ASTM D 698 ***Method A*** Maximum Dry Density: **108.6 PCF** Optimum Moisture Content: **15.0%**

Compaction Test performed on the Fine Fraction only % Retained on the 3/4" sieve: **0.0%**

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 0.1	**CBR at 0.2 in. 0.2**	**CBR at 0.1 in. 0.1**	**CBR at 0.2 in. 0.2**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold. ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	76	Final Dry Density (PCF)	86.9
Initial Dry Density (PCF)	105.2	Average Final Moisture Content	28.7%
Moisture Content of the Compacted Specimen	18.3%	Moisture Content (top 1" after soaking)	33.5%
Percent Compaction	96.9%	Percent Swell	11.2%

Soak Time:	96 hours	Surcharge Weight	10.0	Surcharge Wt. per sq. Ft.	50.9
Liquid Limit	40	Plastic Index	11	Apparent Relative Density	N/A

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

Matthew Wolfe		Lab Quality Manager	11/17/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Sieve Analysis of Soils

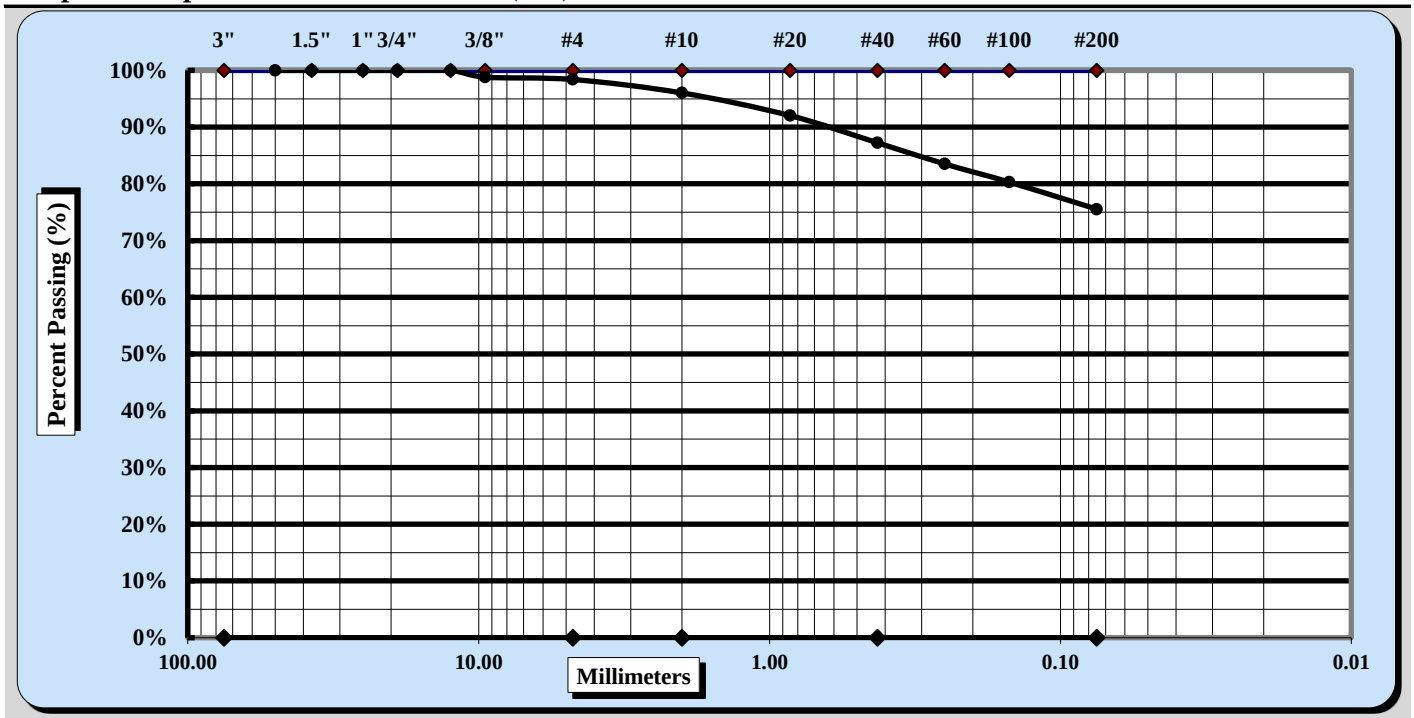
ASTM D 422

Quality Assurance

S&ME, Inc. - Columbia, 134 Suber Road Columbia SC 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s):	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring #: R-19	Sample #: Bulk	Sample Date:	Varies
		Depth:	0-5 ft.

Sample Description: Silt with Sand (ML), A-6



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	9.5 mm	Coarse Sand	2.4%	Fine Sand	11.7%
Gravel	1.6%	Medium Sand	8.8%	Silt & Clay	75.5%

Cc = **N/A** **Cu =** **N/A** Moisture Content 15.6%

Coarse Sand	2.4%	Medium Sand	8.8%	Fine Sand	11.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Matthew Wolfe		Lab Quality Manager	11/4/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Log No.: 780 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

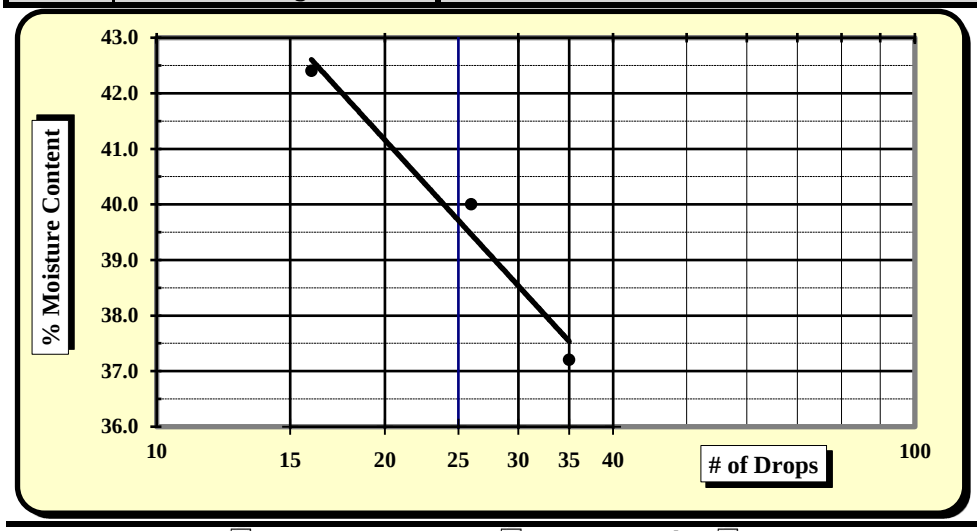
S&ME, Inc. - Columbia, 134 Suber Road, Columbia, South Carolina 29210

Project #:	**1461-14-046**	Report Date:	11/4/2014
Project Name:	I-77 Widening	Test Date(s)	10/29-11/4
Client Name:	HDR, Inc.		
Client Address:	3955 Faber Place Drive, Suite 300, N. Charleston, SC		
Boring No.: R-19	Sample No: Bulk	Sample Date: Varies	
		Depth: 0-5 ft.	

Description: Silt with Sand (ML), A-6

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	15425	8/15/2014	Flat Grooving tool	25775	2/20/2014
LL Apparatus	11436	2/20/2014	No. 40 Sieve	21775	6/23/2014
Oven	25722	3/31/2014			

Pan # 5		Liquid Limit						Plastic Limit		
	Tare #:	229	141	44				36	240	
A	Tare Weight	13.69	13.59	13.77				13.75	13.80	
B	Wet Soil Weight + A	21.88	20.94	24.72				20.14	20.61	
C	Dry Soil Weight + A	19.66	18.84	21.46				18.69	19.08	
D	Water Weight (B-C)	2.22	2.10	3.26				1.45	1.53	
E	Dry Soil Weight (C-A)	5.97	5.25	7.69				4.94	5.28	
F	% Moisture (D/E)*100	37.2%	40.0%	42.4%				29.4%	29.0%	
N	# OF DROPS	35	26	16				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**29.2%**		



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 **40**
Plastic Limit **29**
Plastic Index **11**
Group Symbol **ML**

Multipoint Method ☑
One-point Method ☐

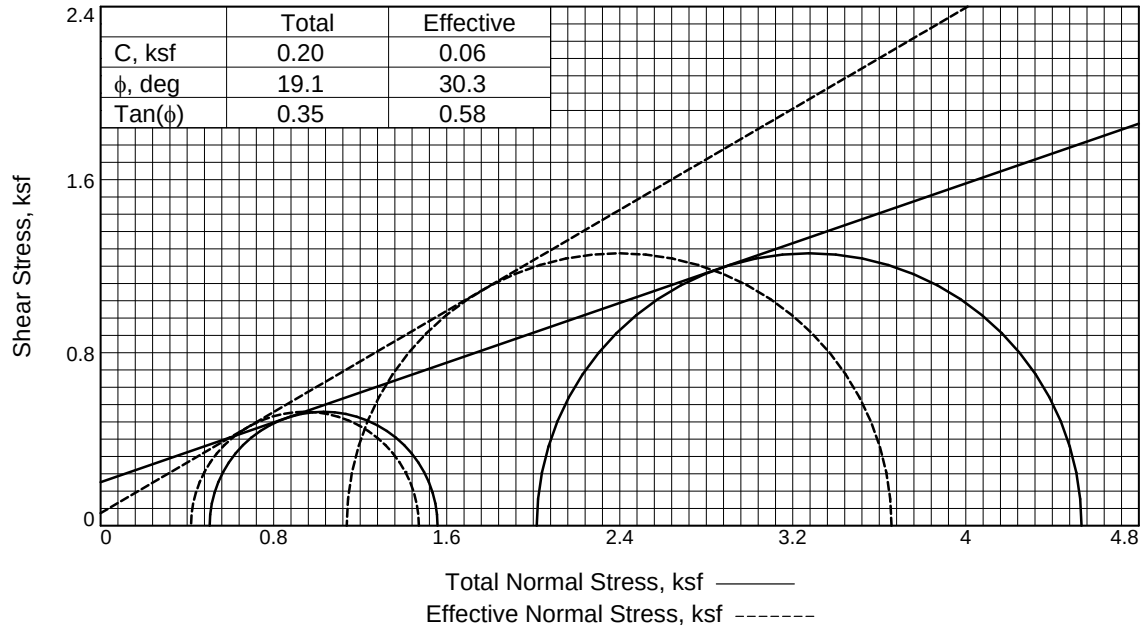
Wet Preparation ☐ Dry Preparation ☐ Air Dried ☑

Notes / Deviations / References:

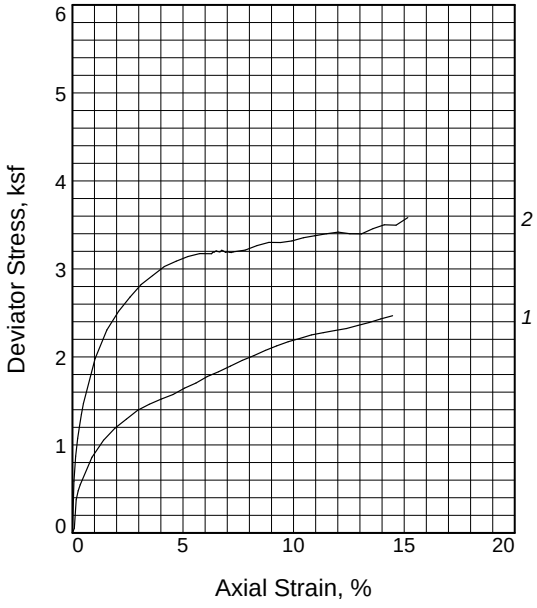
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

M. Wolfe	11/4/2014	Matthew Wolfe	11/4/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.20	0.06
ϕ, deg	19.1	30.3
Tan(ϕ)	0.35	0.58



Specimen No.		1	2
Initial	Water Content, %	16.4	22.1
	Dry Density, pcf	108.4	103.3
	Saturation, %	82.4	97.2
	Void Ratio	0.5258	0.6019
	Diameter, in.	2.861	2.864
	Height, in.	5.748	5.744
At Test	Water Content, %	19.3	21.9
	Dry Density, pcf	109.5	104.6
	Saturation, %	100.0	100.0
	Void Ratio	0.5107	0.5811
	Diameter, in.	2.852	2.852
	Height, in.	5.729	5.719
Strain rate, %/min.		0.01	0.01
Back Pressure, psi		60.00	60.00
Cell Pressure, psi		63.50	74.00
Fail. Stress, ksf		1.05	2.52
Total Pore Pr., ksf		8.73	9.52
Ult. Stress, ksf		2.47	3.58
Total Pore Pr., ksf		7.70	8.21
$\bar{\sigma}_1$ Failure, ksf		1.47	3.66
$\bar{\sigma}_3$ Failure, ksf		0.42	1.14

Type of Test:
CU with Pore Pressures
Sample Type: Intact Sample
Description: USCS: LEAN CLAY WITH SAND (CL); AASHTO: A-7-6
LL= 49 **PL=** 22 **PI=** 27
Assumed Specific Gravity= 2.65
Remarks: Specimen 1 failed in bulging. Specimen 2 failed in shear. ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

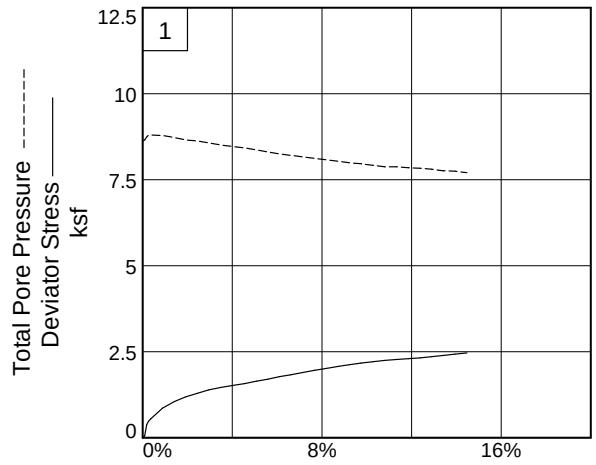
Location: B-4

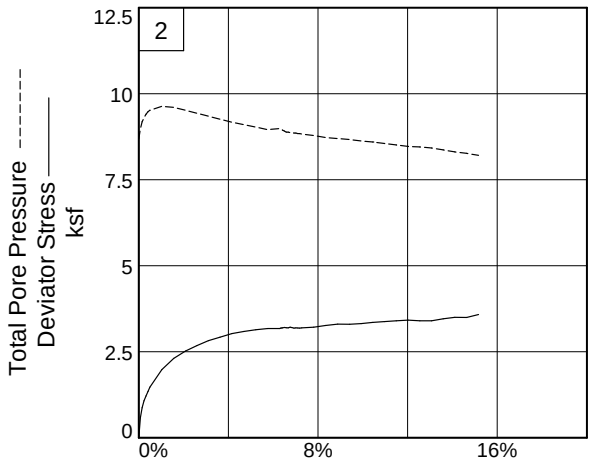
Sample Number: Log 347 **Depth:** 8 - 10 ft

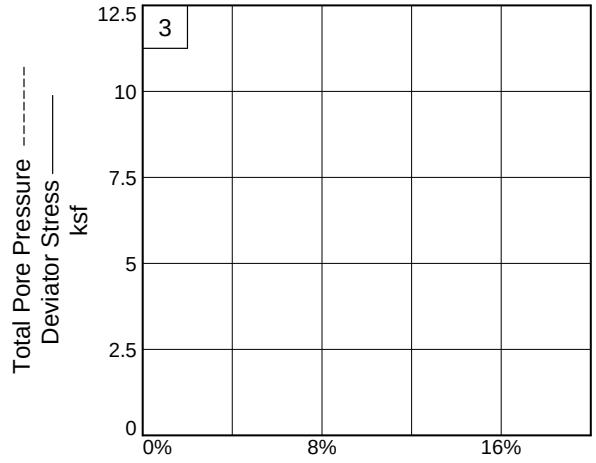
Proj. No.: 1461-14-046

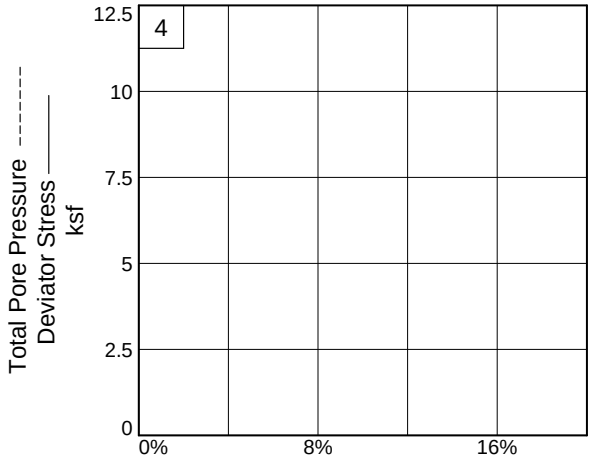
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

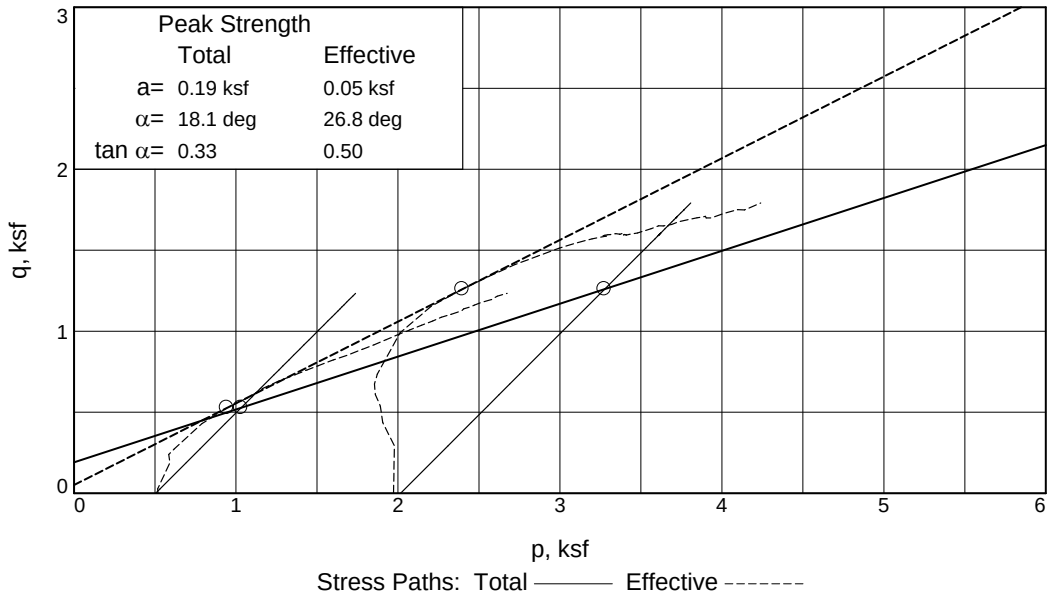
Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-4 **Depth:** 8 - 10 ft **Sample Number:** Log 347

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:19 AM

Date: 9/23/2014
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-4
Depth: 8 - 10 ft **Sample Number:** Log 347
Description: USCS: LEAN CLAY WITH SAND (CL); AASHTO: A-7-6
Remarks: Specimen 1 failed in bulging. Specimen 2 failed in shear. ASTM D4767.
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**49 **PL=**22 **PI=**27
Test Method: ASTM D4767 (COE uniform strain specimen parameter calculation method)

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	93.670			1255.430
Moisture content: Dry soil+tare, gms.	81.460			1035.660
Moisture content: Tare, gms.	6.810			18.020
Moisture, %	16.4	19.5	19.3	21.6
Moist specimen weight, gms.	1224.00			
Diameter, in.	2.861	2.855	2.852	
Area, in.²	6.430	6.401	6.388	
Height, in.	5.748	5.735	5.729	
Net decrease in height, in.		0.013	0.006	
Wet density, pcf	126.2	130.4	130.6	
Dry density, pcf	108.4	109.2	109.5	
Void ratio	0.5258	0.5154	0.5107	
Saturation, %	82.4	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 63.50 psi (9.14 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.01
Fail. Stress = 1.05 ksf **at reading no.** 6
Ult. Stress = 2.47 ksf **at reading no.** 31

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	0.52	0.52	1.00	59.90	0.52	0.00
1	0.0050	2.400	2.4	0.1	0.05	0.49	0.54	1.11	60.10	0.52	0.03
2	0.0100	16.800	16.8	0.2	0.38	0.40	0.78	1.94	60.70	0.59	0.19
3	0.0150	21.300	21.3	0.3	0.48	0.35	0.82	2.39	61.10	0.59	0.24
4	0.0202	24.400	24.4	0.4	0.55	0.35	0.89	2.59	61.10	0.62	0.27
5	0.0507	38.500	38.5	0.9	0.86	0.36	1.22	3.39	61.00	0.79	0.43
6	0.0808	47.400	47.4	1.4	1.05	0.42	1.47	3.52	60.60	0.94	0.53
7	0.1105	53.900	53.9	1.9	1.19	0.49	1.68	3.43	60.10	1.09	0.60
8	0.1398	58.800	58.8	2.4	1.29	0.52	1.81	3.49	59.90	1.17	0.65
9	0.1691	63.700	63.7	3.0	1.39	0.58	1.97	3.42	59.50	1.27	0.70
10	0.1992	67.200	67.2	3.5	1.46	0.63	2.10	3.31	59.10	1.36	0.73
11	0.2300	70.300	70.3	4.0	1.52	0.68	2.20	3.25	58.80	1.44	0.76
12	0.2607	73.100	73.1	4.6	1.57	0.72	2.29	3.18	58.50	1.51	0.79
13	0.2906	76.900	76.9	5.1	1.65	0.78	2.42	3.12	58.10	1.60	0.82
14	0.3200	80.000	80.0	5.6	1.70	0.84	2.54	3.04	57.70	1.69	0.85
15	0.3494	84.000	84.0	6.1	1.78	0.89	2.67	2.99	57.30	1.78	0.89
16	0.3788	87.000	87.0	6.6	1.83	0.94	2.77	2.96	57.00	1.85	0.92
17	0.4091	90.600	90.6	7.1	1.90	0.98	2.88	2.94	56.70	1.93	0.95
18	0.4399	94.200	94.2	7.7	1.96	1.02	2.98	2.92	56.40	2.00	0.98
19	0.4702	97.400	97.4	8.2	2.02	1.07	3.08	2.89	56.10	2.07	1.01
20	0.5000	100.800	100.8	8.7	2.07	1.11	3.18	2.87	55.80	2.15	1.04
21	0.5294	103.900	103.9	9.2	2.13	1.15	3.28	2.85	55.50	2.21	1.06
22	0.5588	106.800	106.8	9.8	2.17	1.18	3.35	2.84	55.30	2.27	1.09
23	0.5884	109.200	109.2	10.3	2.21	1.22	3.43	2.80	55.00	2.33	1.10
24	0.6190	111.900	111.9	10.8	2.25	1.27	3.52	2.78	54.70	2.39	1.13
25	0.6496	113.900	113.9	11.3	2.28	1.27	3.54	2.80	54.70	2.41	1.14
26	0.6799	115.800	115.8	11.9	2.30	1.30	3.60	2.78	54.50	2.45	1.15
27	0.7098	117.600	117.6	12.4	2.32	1.31	3.63	2.77	54.40	2.47	1.16
28	0.7392	120.100	120.1	12.9	2.36	1.34	3.70	2.76	54.20	2.52	1.18
29	0.7685	122.500	122.5	13.4	2.39	1.38	3.77	2.73	53.90	2.58	1.20
30	0.7986	125.400	125.4	13.9	2.43	1.40	3.83	2.74	53.80	2.61	1.22
31	0.8292	128.000	128.0	14.5	2.47	1.44	3.91	2.71	53.50	2.67	1.23

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	46.360			861.590
Moisture content: Dry soil+tare, gms.	39.200			706.430
Moisture content: Tare, gms.	6.780			18.400
Moisture, %	22.1	23.0	21.9	22.6
Moist specimen weight, gms.	1224.60			
Diameter, in.	2.864	2.869	2.852	
Area, in.²	6.442	6.465	6.386	
Height, in.	5.744	5.754	5.719	
Net decrease in height, in.		-0.010	0.035	
Wet density, pcf	126.1	126.4	127.6	
Dry density, pcf	103.3	102.7	104.6	
Void ratio	0.6019	0.6103	0.5811	
Saturation, %	97.2	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 74.00 psi (10.66 ksf)

Consolidation back pressure = 60.00 psi (8.64 ksf)

Consolidation effective confining stress = 2.02 ksf

Strain rate, %/min. = 0.01

Fail. Stress = 2.52 ksf **at reading no.** 9

Ult. Stress = 3.58 ksf **at reading no.** 45

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	1.97	1.97	1.00	60.30	1.97	0.00
1	0.0040	26.000	26.0	0.1	0.59	1.68	2.27	1.35	62.30	1.98	0.29
2	0.0086	38.800	38.8	0.2	0.87	1.47	2.34	1.59	63.80	1.91	0.44
3	0.0135	47.800	47.8	0.2	1.08	1.35	2.43	1.79	64.60	1.89	0.54
4	0.0184	54.100	54.1	0.3	1.22	1.25	2.47	1.97	65.30	1.86	0.61
5	0.0234	60.000	60.0	0.4	1.35	1.18	2.53	2.14	65.80	1.85	0.67
6	0.0284	65.500	65.5	0.5	1.47	1.14	2.61	2.29	66.10	1.87	0.73
7	0.0589	88.800	88.8	1.0	1.98	1.02	3.00	2.94	66.90	2.01	0.99
8	0.0892	103.900	103.9	1.6	2.31	1.05	3.36	3.19	66.70	2.20	1.15
9	0.1193	114.100	114.1	2.1	2.52	1.14	3.66	3.21	66.10	2.40	1.26
10	0.1486	122.000	122.0	2.6	2.68	1.22	3.90	3.19	65.50	2.56	1.34
11	0.1778	129.200	129.2	3.1	2.82	1.31	4.13	3.15	64.90	2.72	1.41
12	0.2072	134.600	134.6	3.6	2.93	1.40	4.32	3.09	64.30	2.86	1.46
13	0.2377	140.100	140.1	4.2	3.03	1.48	4.51	3.04	63.70	3.00	1.51
14	0.2683	143.700	143.7	4.7	3.09	1.56	4.64	2.99	63.20	3.10	1.54
15	0.2988	147.000	147.0	5.2	3.14	1.63	4.77	2.93	62.70	3.20	1.57
16	0.3290	149.400	149.4	5.8	3.17	1.70	4.87	2.87	62.20	3.29	1.59
17	0.3597	150.200	150.2	6.3	3.17	1.67	4.84	2.90	62.40	3.26	1.59
18	0.3621	150.800	150.8	6.3	3.19	1.68	4.87	2.89	62.30	3.28	1.59
19	0.3645	151.200	151.2	6.4	3.19	1.70	4.89	2.88	62.20	3.30	1.60
20	0.3669	151.300	151.3	6.4	3.19	1.71	4.91	2.86	62.10	3.31	1.60
21	0.3717	152.000	152.0	6.5	3.20	1.74	4.95	2.84	61.90	3.34	1.60
22	0.3766	151.800	151.8	6.6	3.20	1.77	4.97	2.81	61.70	3.37	1.60
23	0.3814	151.800	151.8	6.7	3.19	1.77	4.97	2.80	61.70	3.37	1.60
24	0.3863	152.800	152.8	6.8	3.21	1.79	5.00	2.80	61.60	3.39	1.61
25	0.3912	152.400	152.4	6.8	3.20	1.79	4.99	2.79	61.60	3.39	1.60

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.3962	151.900	151.9	6.9	3.19	1.80	4.99	2.77	61.50	3.39	1.59
27	0.4011	152.400	152.4	7.0	3.20	1.80	5.00	2.78	61.50	3.40	1.60
28	0.4060	152.300	152.3	7.1	3.19	1.81	5.00	2.76	61.40	3.41	1.60
29	0.4110	152.300	152.3	7.2	3.19	1.81	5.00	2.76	61.40	3.41	1.59
30	0.4159	152.800	152.8	7.3	3.19	1.83	5.02	2.75	61.30	3.43	1.60
31	0.4465	154.600	154.6	7.8	3.21	1.87	5.09	2.72	61.00	3.48	1.61
32	0.4773	158.000	158.0	8.3	3.27	1.93	5.19	2.69	60.60	3.56	1.63
33	0.5080	160.700	160.7	8.9	3.30	1.96	5.26	2.69	60.40	3.61	1.65
34	0.5384	161.600	161.6	9.4	3.30	1.99	5.29	2.66	60.20	3.64	1.65
35	0.5677	163.400	163.4	9.9	3.32	2.03	5.35	2.63	59.90	3.69	1.66
36	0.5972	166.100	166.1	10.4	3.35	2.06	5.41	2.63	59.70	3.74	1.68
37	0.6268	168.200	168.2	11.0	3.38	2.10	5.48	2.61	59.40	3.79	1.69
38	0.6573	170.400	170.4	11.5	3.40	2.15	5.55	2.58	59.10	3.85	1.70
39	0.6872	172.300	172.3	12.0	3.42	2.19	5.61	2.56	58.80	3.90	1.71
40	0.7175	172.400	172.4	12.5	3.40	2.20	5.60	2.54	58.70	3.90	1.70
41	0.7474	173.400	173.4	13.1	3.40	2.23	5.63	2.52	58.50	3.93	1.70
42	0.7770	177.500	177.5	13.6	3.46	2.29	5.75	2.51	58.10	4.02	1.73
43	0.8066	180.800	180.8	14.1	3.50	2.35	5.85	2.49	57.70	4.10	1.75
44	0.8368	181.700	181.7	14.6	3.50	2.39	5.89	2.46	57.40	4.14	1.75
45	0.8672	187.300	187.3	15.2	3.58	2.45	6.03	2.46	57.00	4.24	1.79

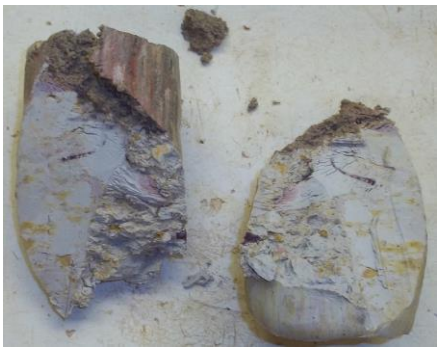
ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

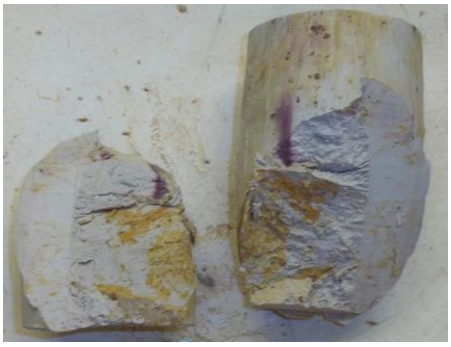
Sample ID: B-4
Depth: 8 - 10 ft Log No.: 347

Failed Specimens

Specimen No.: 1
Effective Confining Pressure: 0.5 ksf
Notes: Specimen failed in bulging



Specimen No.: 2
Effective Confining Pressure: 2 ksf
Notes: Specimen failed in shear



Sheared By: Michael D. Kelso
Reviewed By: N. Randy Rainwater Date: 12/3/2014

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:347

Sieve Analysis of Soils

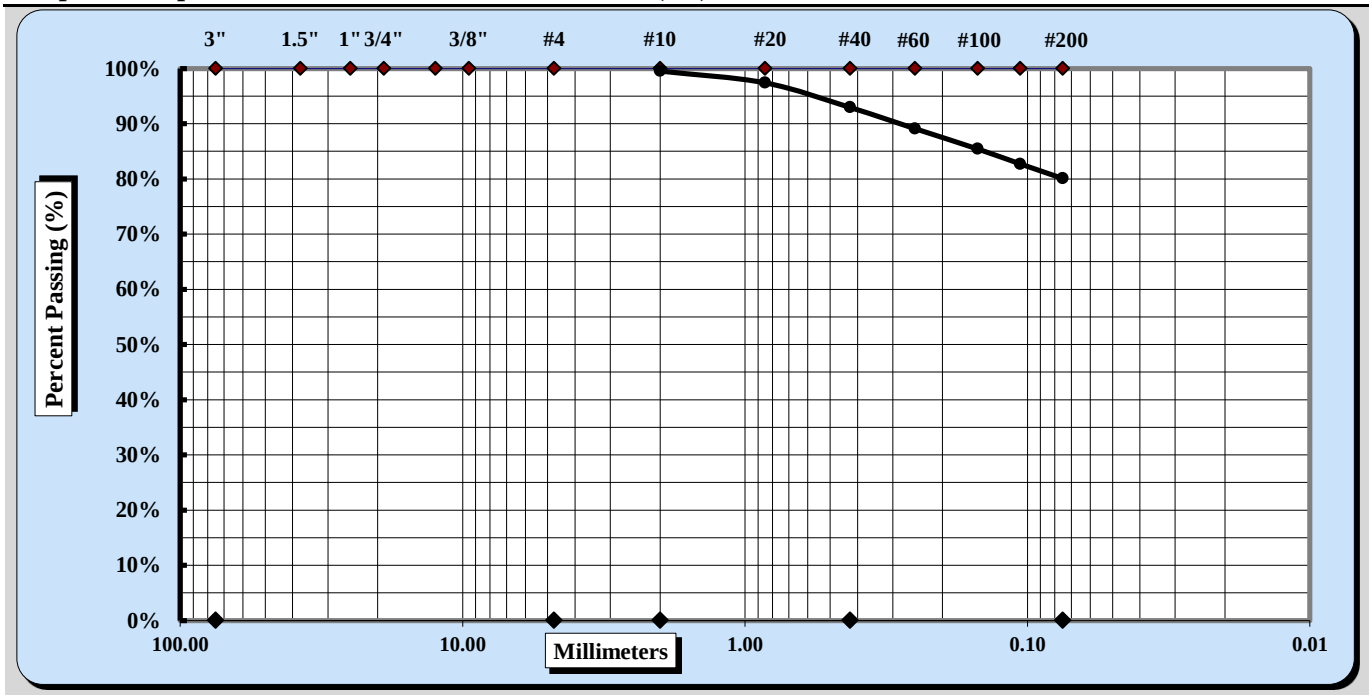
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	10/24/14 - 11/4/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Type: UD		
		Depth:	8 - 10 ft

Sample Description: LEAN CLAY WITH SAND (CL) **A-7-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	12.9%
Gravel	0.1%	Medium Sand	6.6%	Silt & Clay	80.1%
Liquid Limit	49	Plastic Limit	22	Plastic Index	27

Coarse Sand	0.4%	Medium Sand	6.6%	Fine Sand	12.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

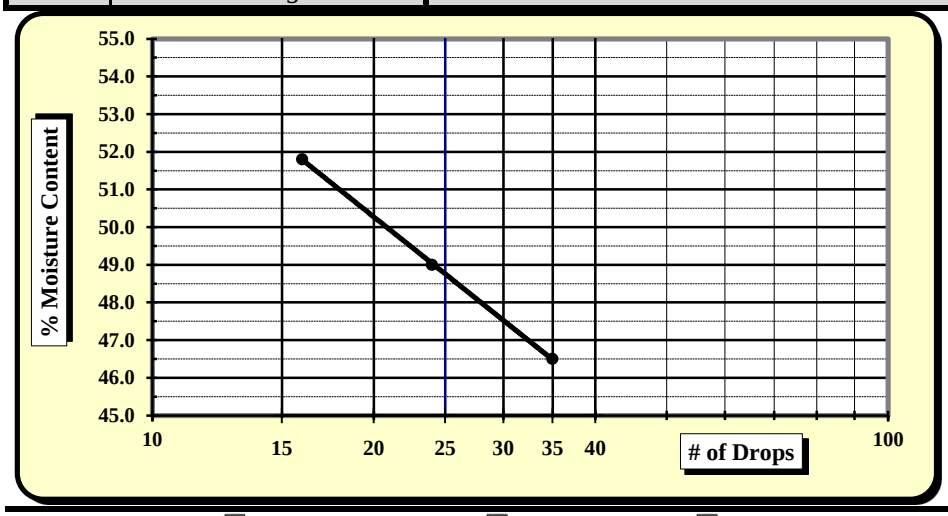
Log No.:347 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/5/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-4	Sample No: UD		
		Depth: 8 - 10 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	18	8	20				23	3	
A	Tare Weight	15.50	15.61	15.54				15.50	15.55	
B	Wet Soil Weight + A	29.37	30.88	31.70				24.61	24.07	
C	Dry Soil Weight + A	24.64	25.86	26.57				23.00	22.56	
D	Water Weight (B-C)	4.73	5.02	5.13				1.61	1.51	
E	Dry Soil Weight (C-A)	9.14	10.25	11.03				7.50	7.01	
F	% Moisture (D/E)*100	51.8%	49.0%	46.5%				21.5%	21.5%	
N	# OF DROPS	16	24	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.5%**		



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	**49**
Plastic Limit	**22**
Plastic Index	**27**
USCS Group Symbol	**CL**

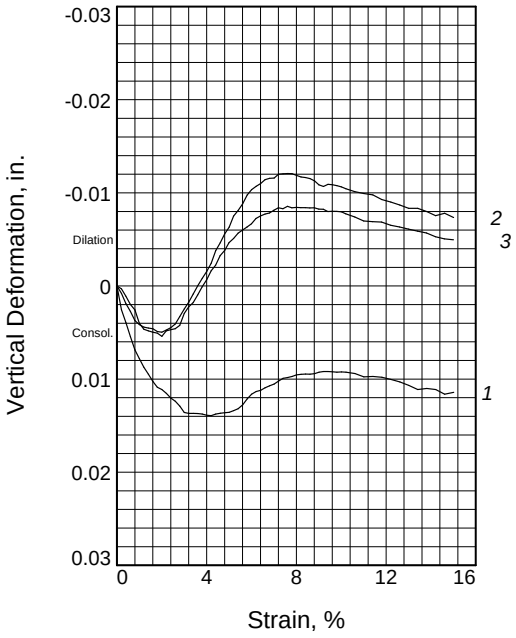
Multipoint Method ☑
One-point Method ☐

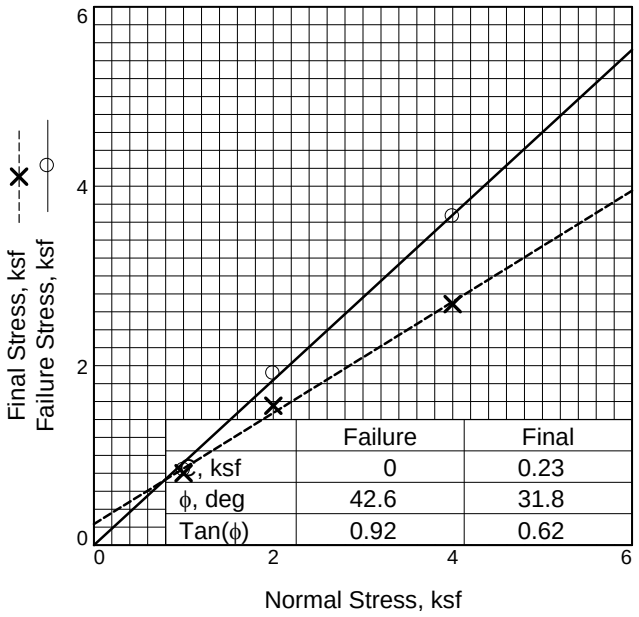
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

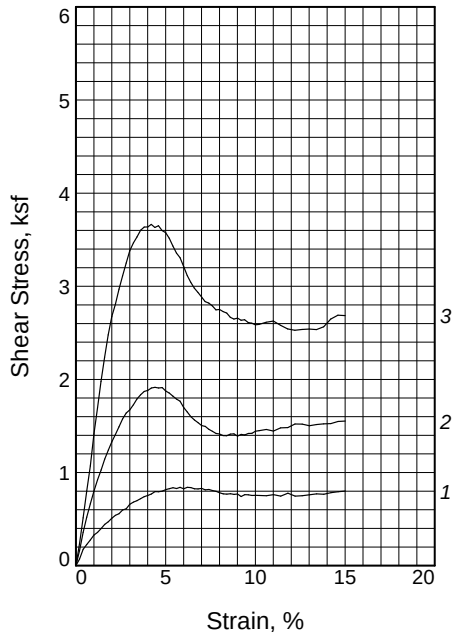
Notes / Deviations / References: **AASHTO Classification A-7-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/5/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*







Specimen No.		1	2	3
Initial	Water Content, %	8.4	7.0	9.0
	Dry Density, pcf	110.4	116.3	117.6
	Saturation, %	44.6	44.1	58.5
	Void Ratio	0.4990	0.4222	0.4065
	Diameter, in.	2.500	2.500	2.502
	Height, in.	1.432	1.430	1.431
At Test	Water Content, %	15.2	13.1	13.3
	Dry Density, pcf	113.5	118.6	121.2
	Diameter, in.	2.500	2.500	2.502
	Height, in.	1.392	1.402	1.389
Normal Stress, ksf		1.00	2.00	4.00
Failure Stress, ksf		0.84	1.91	3.66
Strain, %		5.4	4.4	4.2
Final Stress, ksf		0.80	1.55	2.69
Strain, %		15.0	15.0	15.0
Strain rate, %/min.		0.13	0.13	0.13

Sample Type: Intact Sample
Description: USCS: SILTY, CLAYEY SAND (SC-SM); AASHTO: A-2-4
LL= 18 **PL=** 12 **PI=** 6
Assumed Specific Gravity= 2.65
Remarks: ASTM D3080

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-7
Sample Number: Log 348 **Depth:** 18 - 20 ft
Proj. No.: 1461-14-046

DIRECT SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

DIRECT SHEAR TEST

12/2/2014

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-7
Depth: 18 - 20 ft **Sample Number:** Log 348
Description: USCS: SILTY, CLAYEY SAND (SC-SM); AASHTO: A-2-4
Remarks: ASTM D3080
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**18 **PL=**12 **PI=**6

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	122.700		247.370
Moisture content: Dry soil+tare, gms.	113.720		216.410
Moisture content: Tare, gms.	6.810		12.190
Moisture, %	8.4	15.2	15.2
Moist specimen weight, gms.	220.70		
Diameter, in.	2.500	2.500	
Area, in.²	4.909	4.909	
Height, in.	1.432	1.392	
Net decrease in height, in.		0.040	
Wet density, pcf	119.6	130.7	
Dry density, pcf	110.4	113.5	
Void ratio	0.4990		
Saturation, %	44.6		

Test Readings for Specimen No. 1

Normal stress = 1 ksf
Strain rate, %/min. = 0.13
Failure Stress = 0.84 ksf **at reading no.** 27
Final Stress = 0.80 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	1.061	0.0	0.0	0.00	-1.1191
1	0.0050	3.493	2.4	0.2	0.07	-1.1216
2	0.0100	7.048	6.0	0.4	0.18	-1.1230
3	0.0150	8.772	7.7	0.6	0.23	-1.1245
4	0.0200	10.435	9.4	0.8	0.28	-1.1259
5	0.0250	12.273	11.2	1.0	0.33	-1.1269
6	0.0300	13.233	12.2	1.2	0.36	-1.1278
7	0.0350	14.634	13.6	1.4	0.40	-1.1285
8	0.0400	16.144	15.1	1.6	0.44	-1.1293
9	0.0450	17.154	16.1	1.8	0.47	-1.1299
10	0.0500	18.399	17.3	2.0	0.51	-1.1302
11	0.0550	19.483	18.4	2.2	0.54	-1.1306
12	0.0600	20.066	19.0	2.4	0.56	-1.1311
13	0.0650	21.451	20.4	2.6	0.60	-1.1315

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
14	0.0701	21.886	20.8	2.8	0.61	-1.1320
15	0.0751	23.551	22.5	3.0	0.66	-1.1327
16	0.0801	24.307	23.2	3.2	0.68	-1.1328
17	0.0851	24.844	23.8	3.4	0.70	-1.1328
18	0.0901	25.570	24.5	3.6	0.72	-1.1328
19	0.0951	26.310	25.2	3.8	0.74	-1.1328
20	0.1001	26.745	25.7	4.0	0.75	-1.1330
21	0.1051	27.280	26.2	4.2	0.77	-1.1330
22	0.1101	28.169	27.1	4.4	0.80	-1.1328
23	0.1151	28.138	27.1	4.6	0.79	-1.1327
24	0.1201	28.326	27.3	4.8	0.80	-1.1327
25	0.1251	28.890	27.8	5.0	0.82	-1.1326
26	0.1301	29.253	28.2	5.2	0.83	-1.1325
27	0.1351	29.577	28.5	5.4	0.84	-1.1323
28	0.1401	29.301	28.2	5.6	0.83	-1.1318
29	0.1451	29.736	28.7	5.8	0.84	-1.1312
30	0.1501	29.176	28.1	6.0	0.82	-1.1307
31	0.1552	29.736	28.7	6.2	0.84	-1.1304
32	0.1602	29.640	28.6	6.4	0.84	-1.1303
33	0.1652	29.199	28.1	6.6	0.83	-1.1300
34	0.1702	29.142	28.1	6.8	0.82	-1.1298
35	0.1752	29.328	28.3	7.0	0.83	-1.1296
36	0.1802	28.789	27.7	7.2	0.81	-1.1293
37	0.1852	28.947	27.9	7.4	0.82	-1.1290
38	0.1902	28.575	27.5	7.6	0.81	-1.1289
39	0.1952	28.269	27.2	7.8	0.80	-1.1288
40	0.2002	27.720	26.7	8.0	0.78	-1.1286
41	0.2052	27.336	26.3	8.2	0.77	-1.1286
42	0.2102	27.235	26.2	8.4	0.77	-1.1285
43	0.2152	27.385	26.3	8.6	0.77	-1.1286
44	0.2202	27.163	26.1	8.8	0.77	-1.1285
45	0.2252	27.269	26.2	9.0	0.77	-1.1283
46	0.2302	26.357	25.3	9.2	0.74	-1.1283
47	0.2352	27.022	26.0	9.4	0.76	-1.1283
48	0.2402	27.021	26.0	9.6	0.76	-1.1283
49	0.2452	26.740	25.7	9.8	0.75	-1.1283
50	0.2503	26.801	25.7	10.0	0.76	-1.1283
51	0.2553	26.744	25.7	10.2	0.75	-1.1283
52	0.2653	26.663	25.6	10.6	0.75	-1.1285
53	0.2753	27.045	26.0	11.0	0.76	-1.1288
54	0.2853	26.486	25.4	11.4	0.75	-1.1288
55	0.2953	27.581	26.5	11.8	0.78	-1.1289
56	0.3053	26.519	25.5	12.2	0.75	-1.1291
57	0.3153	26.654	25.6	12.6	0.75	-1.1294
58	0.3253	26.998	25.9	13.0	0.76	-1.1297
59	0.3353	27.357	26.3	13.4	0.77	-1.1302
60	0.3453	27.194	26.1	13.8	0.77	-1.1301

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
61	0.3553	27.777	26.7	14.2	0.78	-1.1302
62	0.3653	28.097	27.0	14.6	0.79	-1.1307
63	0.3753	28.369	27.3	15.0	0.80	-1.1305

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	156.240		251.470
Moisture content: Dry soil+tare, gms.	146.400		223.700
Moisture content: Tare, gms.	6.450		12.150
Moisture, %	7.0	13.1	13.1
Moist specimen weight, gms.	229.40		
Diameter, in.	2.500	2.500	
Area, in.²	4.910	4.910	
Height, in.	1.430	1.402	
Net decrease in height, in.		0.028	
Wet density, pcf	124.5	134.2	
Dry density, pcf	116.3	118.6	
Void ratio	0.4222		
Saturation, %	44.1		

Test Readings for Specimen No. 2

Normal stress = 2 ksf

Strain rate, %/min. = 0.13

Failure Stress = 1.91 ksf **at reading no.** 22

Final Stress = 1.55 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-1.773	0.0	0.0	0.00	-1.1236
1	0.0050	3.723	5.5	0.2	0.16	-1.1244
2	0.0100	10.407	12.2	0.4	0.36	-1.1255
3	0.0150	15.976	17.7	0.6	0.52	-1.1263
4	0.0200	20.835	22.6	0.8	0.66	-1.1273
5	0.0250	25.489	27.3	1.0	0.80	-1.1278
6	0.0300	29.655	31.4	1.2	0.92	-1.1280
7	0.0350	33.224	35.0	1.4	1.03	-1.1281
8	0.0400	37.269	39.0	1.6	1.15	-1.1282
9	0.0450	40.528	42.3	1.8	1.24	-1.1285
10	0.0500	43.567	45.3	2.0	1.33	-1.1286
11	0.0550	46.218	48.0	2.2	1.41	-1.1283
12	0.0600	49.060	50.8	2.4	1.49	-1.1281
13	0.0650	51.955	53.7	2.6	1.58	-1.1277
14	0.0700	54.080	55.9	2.8	1.64	-1.1269
15	0.0750	55.285	57.1	3.0	1.67	-1.1261
16	0.0801	57.130	58.9	3.2	1.73	-1.1253
17	0.0851	59.245	61.0	3.4	1.79	-1.1245
18	0.0901	60.783	62.6	3.6	1.83	-1.1236
19	0.0951	61.978	63.8	3.8	1.87	-1.1228
20	0.1001	62.399	64.2	4.0	1.88	-1.1220

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
21	0.1051	63.268	65.0	4.2	1.91	-1.1212
22	0.1101	63.493	65.3	4.4	1.91	-1.1198
23	0.1151	63.278	65.1	4.6	1.91	-1.1190
24	0.1201	63.431	65.2	4.8	1.91	-1.1180
25	0.1251	62.155	63.9	5.0	1.88	-1.1173
26	0.1301	61.439	63.2	5.2	1.85	-1.1161
27	0.1351	60.302	62.1	5.4	1.82	-1.1155
28	0.1401	59.212	61.0	5.6	1.79	-1.1148
29	0.1451	58.423	60.2	5.8	1.77	-1.1138
30	0.1501	56.151	57.9	6.0	1.70	-1.1133
31	0.1551	54.506	56.3	6.2	1.65	-1.1129
32	0.1601	52.753	54.5	6.4	1.60	-1.1126
33	0.1651	51.545	53.3	6.6	1.56	-1.1122
34	0.1701	50.560	52.3	6.8	1.53	-1.1120
35	0.1752	49.528	51.3	7.0	1.50	-1.1120
36	0.1802	49.213	51.0	7.2	1.50	-1.1116
37	0.1852	48.123	49.9	7.4	1.46	-1.1116
38	0.1902	47.412	49.2	7.6	1.44	-1.1115
39	0.1952	46.647	48.4	7.8	1.42	-1.1115
40	0.2002	46.437	48.2	8.0	1.41	-1.1117
41	0.2052	45.860	47.6	8.2	1.40	-1.1119
42	0.2102	45.812	47.6	8.4	1.40	-1.1120
43	0.2152	46.390	48.2	8.6	1.41	-1.1121
44	0.2202	46.470	48.2	8.8	1.42	-1.1123
45	0.2252	45.668	47.4	9.0	1.39	-1.1127
46	0.2302	46.294	48.1	9.2	1.41	-1.1129
47	0.2352	46.074	47.8	9.4	1.40	-1.1127
48	0.2402	46.642	48.4	9.6	1.42	-1.1127
49	0.2452	46.676	48.4	9.8	1.42	-1.1128
50	0.2502	47.475	49.2	10.0	1.44	-1.1129
51	0.2552	47.641	49.4	10.2	1.45	-1.1131
52	0.2652	48.086	49.9	10.6	1.46	-1.1135
53	0.2752	47.525	49.3	11.0	1.45	-1.1137
54	0.2852	48.683	50.5	11.4	1.48	-1.1138
55	0.2952	48.793	50.6	11.8	1.48	-1.1143
56	0.3052	50.102	51.9	12.2	1.52	-1.1146
57	0.3152	50.039	51.8	12.6	1.52	-1.1149
58	0.3252	49.475	51.2	13.0	1.50	-1.1153
59	0.3353	49.902	51.7	13.4	1.52	-1.1153
60	0.3453	50.144	51.9	13.8	1.52	-1.1156
61	0.3553	50.255	52.0	14.2	1.53	-1.1160
62	0.3653	50.995	52.8	14.6	1.55	-1.1158
63	0.3753	51.176	52.9	15.0	1.55	-1.1162

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	243.650		255.140
Moisture content: Dry soil+tare, gms.	224.150		226.660
Moisture content: Tare, gms.	6.940		12.050
Moisture, %	9.0	13.3	13.3
Moist specimen weight, gms.	236.60		
Diameter, in.	2.502	2.502	
Area, in.²	4.915	4.915	
Height, in.	1.431	1.389	
Net decrease in height, in.		0.042	
Wet density, pcf	128.2	137.3	
Dry density, pcf	117.6	121.2	
Void ratio	0.4065		
Saturation, %	58.5		

Test Readings for Specimen No. 3

Normal stress = 4 ksf

Strain rate, %/min. = 0.13

Failure Stress = 3.66 ksf **at reading no.** 21

Final Stress = 2.69 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-0.015	0.0	0.0	0.00	-1.1279
1	0.0050	8.070	8.1	0.2	0.24	-1.1282
2	0.0100	17.516	17.5	0.4	0.51	-1.1290
3	0.0150	27.307	27.3	0.6	0.80	-1.1299
4	0.0200	36.496	36.5	0.8	1.07	-1.1305
5	0.0250	48.254	48.3	1.0	1.41	-1.1319
6	0.0300	57.825	57.8	1.2	1.69	-1.1325
7	0.0350	67.506	67.5	1.4	1.98	-1.1327
8	0.0400	76.343	76.4	1.6	2.24	-1.1329
9	0.0450	84.559	84.6	1.8	2.48	-1.1330
10	0.0500	91.303	91.3	2.0	2.68	-1.1333
11	0.0550	95.811	95.8	2.2	2.81	-1.1327
12	0.0600	101.320	101.3	2.4	2.97	-1.1326
13	0.0650	106.199	106.2	2.6	3.11	-1.1325
14	0.0700	110.885	110.9	2.8	3.25	-1.1321
15	0.0750	115.417	115.4	3.0	3.38	-1.1308
16	0.0801	118.256	118.3	3.2	3.47	-1.1301
17	0.0850	120.472	120.5	3.4	3.53	-1.1297
18	0.0900	122.898	122.9	3.6	3.60	-1.1289
19	0.0950	124.098	124.1	3.8	3.64	-1.1280
20	0.1001	124.113	124.1	4.0	3.64	-1.1272
21	0.1051	125.049	125.1	4.2	3.66	-1.1263
22	0.1101	123.928	123.9	4.4	3.63	-1.1257
23	0.1151	124.553	124.6	4.6	3.65	-1.1246
24	0.1201	122.829	122.8	4.8	3.60	-1.1241
25	0.1251	122.031	122.0	5.0	3.58	-1.1232
26	0.1301	119.981	120.0	5.2	3.52	-1.1228
27	0.1351	117.133	117.1	5.4	3.43	-1.1222

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
28	0.1401	114.540	114.6	5.6	3.36	-1.1219
29	0.1451	112.819	112.8	5.8	3.31	-1.1216
30	0.1501	109.595	109.6	6.0	3.21	-1.1212
31	0.1551	106.318	106.3	6.2	3.12	-1.1206
32	0.1601	103.843	103.9	6.4	3.04	-1.1204
33	0.1651	101.711	101.7	6.6	2.98	-1.1202
34	0.1701	100.138	100.2	6.8	2.93	-1.1200
35	0.1751	98.497	98.5	7.0	2.89	-1.1198
36	0.1801	96.744	96.8	7.2	2.84	-1.1195
37	0.1851	96.227	96.2	7.4	2.82	-1.1196
38	0.1901	95.211	95.2	7.6	2.79	-1.1193
39	0.1951	93.719	93.7	7.8	2.75	-1.1195
40	0.2001	93.868	93.9	8.0	2.75	-1.1195
41	0.2052	93.079	93.1	8.2	2.73	-1.1195
42	0.2102	92.544	92.6	8.4	2.71	-1.1195
43	0.2152	91.015	91.0	8.6	2.67	-1.1195
44	0.2202	90.341	90.4	8.8	2.65	-1.1195
45	0.2252	90.723	90.7	9.0	2.66	-1.1196
46	0.2302	89.921	89.9	9.2	2.64	-1.1197
47	0.2352	90.104	90.1	9.4	2.64	-1.1199
48	0.2402	89.099	89.1	9.6	2.61	-1.1199
49	0.2452	88.861	88.9	9.8	2.60	-1.1199
50	0.2502	88.268	88.3	10.0	2.59	-1.1199
51	0.2552	88.425	88.4	10.2	2.59	-1.1201
52	0.2652	89.214	89.2	10.6	2.61	-1.1205
53	0.2752	89.640	89.7	11.0	2.63	-1.1209
54	0.2852	88.053	88.1	11.4	2.58	-1.1210
55	0.2952	86.750	86.8	11.8	2.54	-1.1210
56	0.3052	86.248	86.3	12.2	2.53	-1.1214
57	0.3152	86.534	86.5	12.6	2.54	-1.1216
58	0.3252	86.697	86.7	13.0	2.54	-1.1218
59	0.3353	86.497	86.5	13.4	2.53	-1.1220
60	0.3453	87.518	87.5	13.8	2.56	-1.1222
61	0.3553	90.362	90.4	14.2	2.65	-1.1226
62	0.3653	91.785	91.8	14.6	2.69	-1.1228
63	0.3753	91.641	91.7	15.0	2.69	-1.1229

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:348

Sieve Analysis of Soils

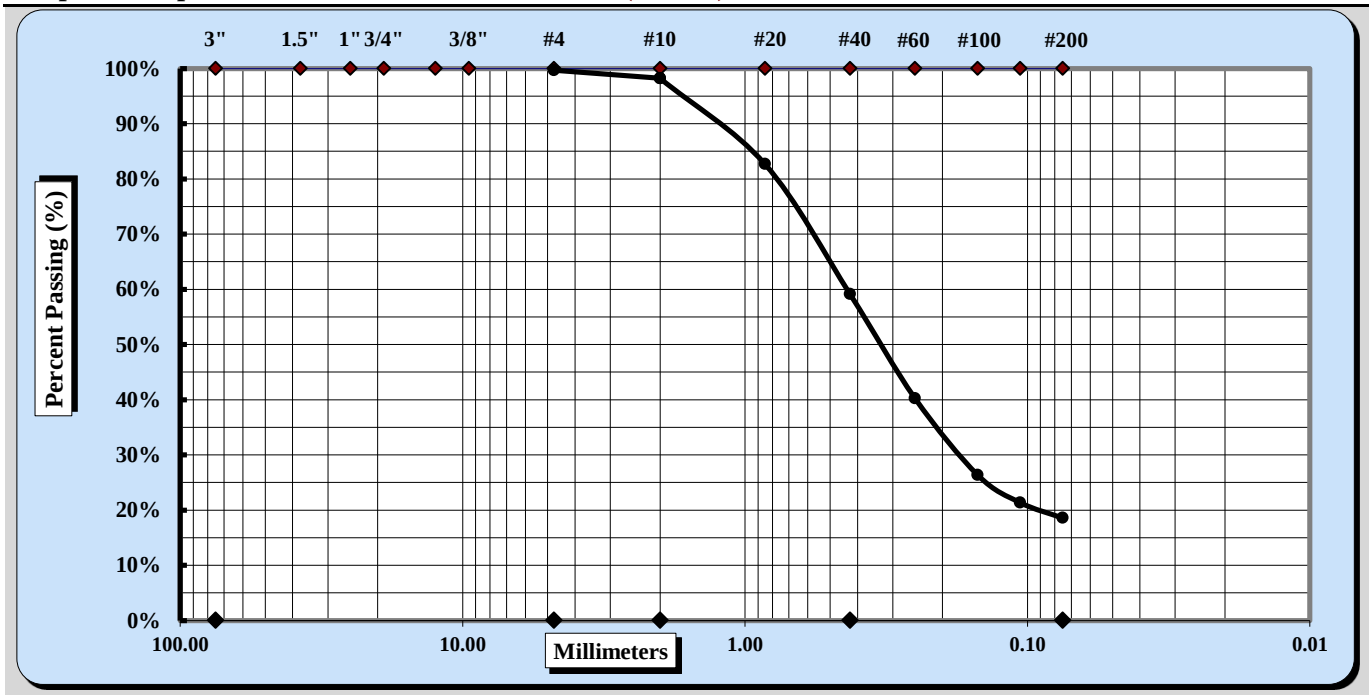
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Type: UD		
		Depth:	18 - 20 ft

Sample Description: SILTY, CLAYEY SAND (SC-SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.5%	Fine Sand	40.6%
Gravel	0.3%	Medium Sand	39.1%	Silt & Clay	18.6%
Liquid Limit	18	Plastic Limit	12	Plastic Index	6

Coarse Sand	1.5%	Medium Sand	39.1%	Fine Sand	40.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

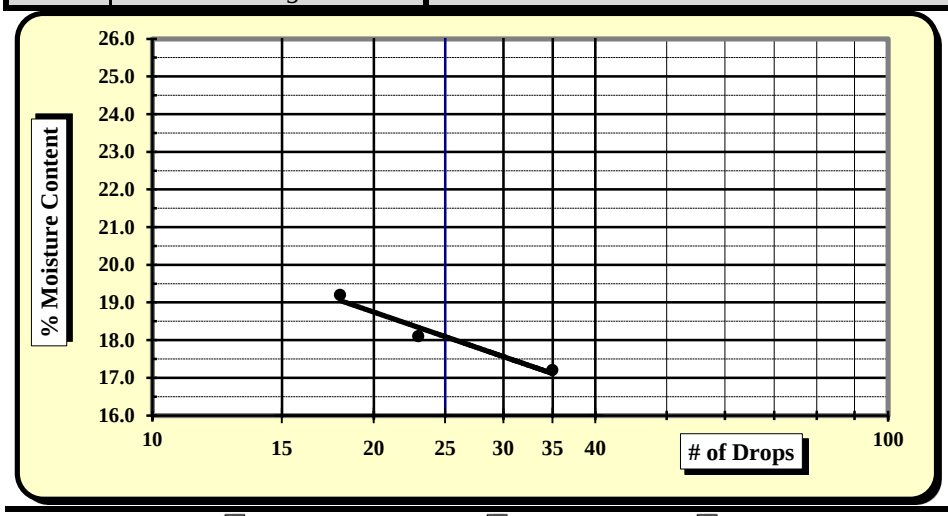
Log No.:348 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/5/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-7	Sample No: UD		
		Depth: 18 - 20 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	9	22	14				10	19	
A	Tare Weight	15.50	15.47	15.54				15.49	15.49	
B	Wet Soil Weight + A	28.72	29.07	30.60				24.53	25.16	
C	Dry Soil Weight + A	26.59	26.99	28.39				23.58	24.14	
D	Water Weight (B-C)	2.13	2.08	2.21				0.95	1.02	
E	Dry Soil Weight (C-A)	11.09	11.52	12.85				8.09	8.65	
F	% Moisture (D/E)*100	19.2%	18.1%	17.2%				11.7%	11.8%	
N	# OF DROPS	18	23	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**11.8%**		



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 **18**
Plastic Limit **12**
Plastic Index **6**
USCS Group Symbol **CL-ML**

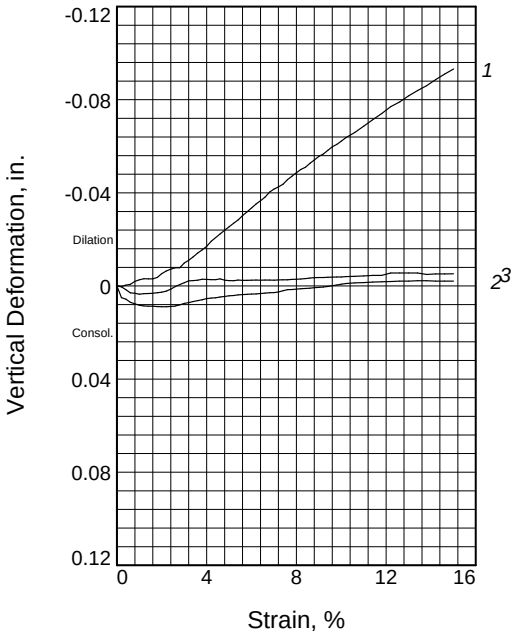
Multipoint Method ☑
One-point Method ☐

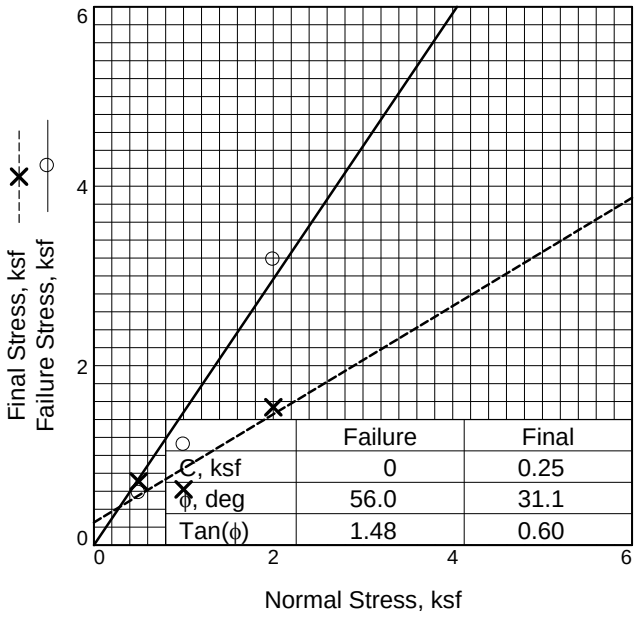
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

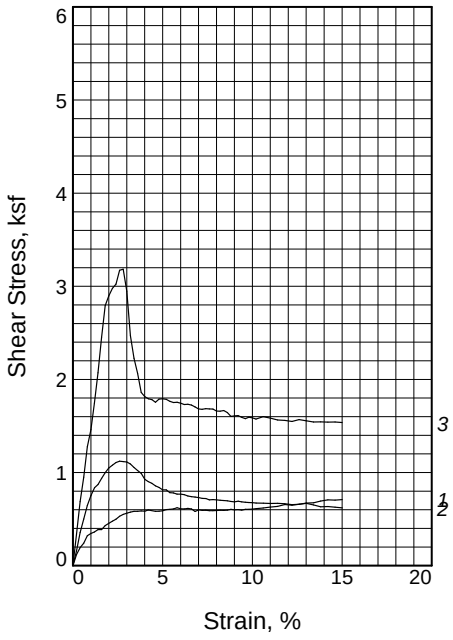
Notes / Deviations / References: **AASHTO Classification A-2-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/5/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*







Specimen No.		1	2	3
Initial	Water Content, %	12.3	13.2	13.7
	Dry Density, pcf	111.3	115.4	113.3
	Saturation, %	67.1	80.7	78.8
	Void Ratio	0.4866	0.4330	0.4598
	Diameter, in.	2.500	2.501	2.501
	Height, in.	1.438	1.438	1.436
At Test	Water Content, %	19.5	16.0	18.2
	Dry Density, pcf	111.8	117.3	116.7
	Diameter, in.	2.500	2.501	2.501
	Height, in.	1.432	1.415	1.395
Normal Stress, ksf		0.50	1.00	2.00
Failure Stress, ksf		0.58	1.12	3.18
Strain, %		3.4	2.6	2.8
Final Stress, ksf		0.71	0.62	1.54
Strain, %		15.0	15.0	15.0
Strain rate, %/min.		0.13	0.13	0.13

Sample Type: Intact Sample
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
LL= 33 **PL=** 17 **PI=** 16
Assumed Specific Gravity= 2.65
Remarks: ASTM D3080

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-9
Sample Number: Log 349 **Depth:** 4 - 6 ft
Proj. No.: 1461-14-046

DIRECT SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

DIRECT SHEAR TEST

12/2/2014

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-9
Depth: 4 - 6 ft **Sample Number:** Log 349
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
Remarks: ASTM D3080
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**33 **PL=**17 **PI=**16

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	133.260		244.500
Moisture content: Dry soil+tare, gms.	119.350		205.660
Moisture content: Tare, gms.	6.430		6.790
Moisture, %	12.3	19.5	19.5
Moist specimen weight, gms.	231.60		
Diameter, in.	2.500	2.500	
Area, in.²	4.909	4.909	
Height, in.	1.438	1.432	
Net decrease in height, in.		0.006	
Wet density, pcf	125.0	133.6	
Dry density, pcf	111.3	111.8	
Void ratio	0.4866		
Saturation, %	67.1		

Test Readings for Specimen No. 1

Normal stress = 0.5 ksf
Strain rate, %/min. = 0.13
Failure Stress = 0.58 ksf **at reading no.** 17
Final Stress = 0.71 ksf **at reading no.** 62

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.449	0.0	0.0	0.00	-1.0565
1	0.0050	4.502	4.1	0.2	0.12	-1.0567
2	0.0100	7.080	6.6	0.4	0.19	-1.0561
3	0.0150	8.653	8.2	0.6	0.24	-1.0558
4	0.0200	11.405	11.0	0.8	0.32	-1.0546
5	0.0250	12.246	11.8	1.0	0.35	-1.0538
6	0.0300	12.781	12.3	1.2	0.36	-1.0534
7	0.0350	13.635	13.2	1.4	0.39	-1.0534
8	0.0400	13.668	13.2	1.6	0.39	-1.0534
9	0.0450	15.117	14.7	1.8	0.43	-1.0528
10	0.0500	15.923	15.5	2.0	0.45	-1.0512
11	0.0550	16.718	16.3	2.2	0.48	-1.0501
12	0.0600	17.473	17.0	2.4	0.50	-1.0493
13	0.0650	18.546	18.1	2.6	0.53	-1.0487

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
14	0.0700	19.202	18.8	2.8	0.55	-1.0487
15	0.0750	19.626	19.2	3.0	0.56	-1.0466
16	0.0800	20.043	19.6	3.2	0.57	-1.0455
17	0.0850	20.309	19.9	3.4	0.58	-1.0440
18	0.0900	20.357	19.9	3.6	0.58	-1.0423
19	0.0950	20.497	20.0	3.8	0.59	-1.0410
20	0.1000	20.401	20.0	4.0	0.59	-1.0395
21	0.1050	20.830	20.4	4.2	0.60	-1.0373
22	0.1150	20.333	19.9	4.6	0.58	-1.0342
23	0.1200	20.381	19.9	4.8	0.58	-1.0326
24	0.1251	20.529	20.1	5.0	0.59	-1.0310
25	0.1301	20.987	20.5	5.2	0.60	-1.0296
26	0.1351	21.065	20.6	5.4	0.60	-1.0281
27	0.1401	21.189	20.7	5.6	0.61	-1.0263
28	0.1451	21.648	21.2	5.8	0.62	-1.0246
29	0.1501	21.251	20.8	6.0	0.61	-1.0230
30	0.1551	21.223	20.8	6.2	0.61	-1.0213
31	0.1601	21.413	21.0	6.4	0.61	-1.0199
32	0.1651	21.230	20.8	6.6	0.61	-1.0183
33	0.1701	20.266	19.8	6.8	0.58	-1.0162
34	0.1751	20.874	20.4	7.0	0.60	-1.0149
35	0.1801	20.696	20.2	7.2	0.59	-1.0139
36	0.1851	20.701	20.3	7.4	0.59	-1.0128
37	0.1901	20.571	20.1	7.6	0.59	-1.0109
38	0.1951	20.553	20.1	7.8	0.59	-1.0093
39	0.2001	20.648	20.2	8.0	0.59	-1.0078
40	0.2051	20.721	20.3	8.2	0.59	-1.0064
41	0.2101	20.657	20.2	8.4	0.59	-1.0055
42	0.2151	20.750	20.3	8.6	0.60	-1.0038
43	0.2202	21.067	20.6	8.8	0.60	-1.0024
44	0.2251	20.892	20.4	9.0	0.60	-1.0008
45	0.2302	20.989	20.5	9.2	0.60	-0.9998
46	0.2352	20.769	20.3	9.4	0.60	-0.9983
47	0.2402	21.050	20.6	9.6	0.60	-0.9967
48	0.2452	21.041	20.6	9.8	0.60	-0.9956
49	0.2502	21.180	20.7	10.0	0.61	-0.9943
50	0.2552	21.312	20.9	10.2	0.61	-0.9928
51	0.2652	21.533	21.1	10.6	0.62	-0.9905
52	0.2752	21.886	21.4	11.0	0.63	-0.9878
53	0.2852	22.120	21.7	11.4	0.64	-0.9851
54	0.2952	22.838	22.4	11.8	0.66	-0.9824
55	0.3052	22.597	22.1	12.2	0.65	-0.9795
56	0.3152	22.943	22.5	12.6	0.66	-0.9775
57	0.3252	23.353	22.9	13.0	0.67	-0.9748
58	0.3352	23.454	23.0	13.4	0.67	-0.9725
59	0.3452	24.082	23.6	13.8	0.69	-0.9705
60	0.3552	24.523	24.1	14.2	0.71	-0.9679

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
61	0.3652	24.457	24.0	14.6	0.70	-0.9655
62	0.3753	24.639	24.2	15.0	0.71	-0.9633

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	296.520		254.200
Moisture content: Dry soil+tare, gms.	263.370		220.100
Moisture content: Tare, gms.	11.890		7.020
Moisture, %	13.2	16.0	16.0
Moist specimen weight, gms.	242.20		
Diameter, in.	2.501	2.501	
Area, in.²	4.911	4.911	
Height, in.	1.438	1.415	
Net decrease in height, in.		0.022	
Wet density, pcf	130.7	136.0	
Dry density, pcf	115.4	117.3	
Void ratio	0.4330		
Saturation, %	80.7		

Test Readings for Specimen No. 2

Normal stress = 1 ksf

Strain rate, %/min. = 0.13

Failure Stress = 1.12 ksf **at reading no.** 13

Final Stress = 0.62 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	1.314	0.0	0.0	0.00	-1.0888
1	0.0049	6.770	5.5	0.2	0.16	-1.0938
2	0.0099	13.455	12.1	0.4	0.36	-1.0944
3	0.0150	18.366	17.1	0.6	0.50	-1.0958
4	0.0200	23.357	22.0	0.8	0.65	-1.0964
5	0.0250	26.975	25.7	1.0	0.75	-1.0970
6	0.0300	29.874	28.6	1.2	0.84	-1.0974
7	0.0350	31.034	29.7	1.4	0.87	-1.0974
8	0.0400	33.285	32.0	1.6	0.94	-1.0975
9	0.0450	35.372	34.1	1.8	1.00	-1.0976
10	0.0500	37.093	35.8	2.0	1.05	-1.0977
11	0.0550	38.129	36.8	2.2	1.08	-1.0977
12	0.0600	39.094	37.8	2.4	1.11	-1.0976
13	0.0650	39.557	38.2	2.6	1.12	-1.0974
14	0.0700	39.449	38.1	2.8	1.12	-1.0969
15	0.0750	39.256	37.9	3.0	1.11	-1.0963
16	0.0800	38.549	37.2	3.2	1.09	-1.0959
17	0.0850	37.288	36.0	3.4	1.05	-1.0955
18	0.0900	36.165	34.9	3.6	1.02	-1.0951
19	0.0950	35.110	33.8	3.8	0.99	-1.0947
20	0.1000	32.907	31.6	4.0	0.93	-1.0942
21	0.1050	32.105	30.8	4.2	0.90	-1.0939

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
22	0.1101	31.447	30.1	4.4	0.88	-1.0939
23	0.1151	30.533	29.2	4.6	0.86	-1.0935
24	0.1201	29.927	28.6	4.8	0.84	-1.0933
25	0.1251	29.077	27.8	5.0	0.81	-1.0930
26	0.1301	29.072	27.8	5.2	0.81	-1.0929
27	0.1351	28.063	26.7	5.4	0.78	-1.0926
28	0.1401	27.964	26.6	5.6	0.78	-1.0925
29	0.1451	27.524	26.2	5.8	0.77	-1.0923
30	0.1501	27.486	26.2	6.0	0.77	-1.0922
31	0.1551	27.305	26.0	6.2	0.76	-1.0921
32	0.1601	26.808	25.5	6.4	0.75	-1.0920
33	0.1651	26.582	25.3	6.6	0.74	-1.0918
34	0.1701	26.439	25.1	6.8	0.74	-1.0917
35	0.1751	26.234	24.9	7.0	0.73	-1.0916
36	0.1802	25.931	24.6	7.2	0.72	-1.0913
37	0.1851	25.875	24.6	7.4	0.72	-1.0908
38	0.1902	25.394	24.1	7.6	0.71	-1.0904
39	0.1952	25.526	24.2	7.8	0.71	-1.0903
40	0.2002	25.389	24.1	8.0	0.71	-1.0901
41	0.2052	25.245	23.9	8.2	0.70	-1.0900
42	0.2102	25.173	23.9	8.4	0.70	-1.0898
43	0.2152	25.088	23.8	8.6	0.70	-1.0897
44	0.2202	24.838	23.5	8.8	0.69	-1.0895
45	0.2252	24.653	23.3	9.0	0.68	-1.0894
46	0.2302	24.900	23.6	9.2	0.69	-1.0892
47	0.2352	24.653	23.3	9.4	0.68	-1.0889
48	0.2402	24.517	23.2	9.6	0.68	-1.0886
49	0.2452	24.438	23.1	9.8	0.68	-1.0883
50	0.2502	24.360	23.0	10.0	0.68	-1.0880
51	0.2552	24.228	22.9	10.2	0.67	-1.0877
52	0.2652	24.175	22.9	10.6	0.67	-1.0874
53	0.2752	24.088	22.8	11.0	0.67	-1.0873
54	0.2852	24.132	22.8	11.4	0.67	-1.0871
55	0.2953	23.988	22.7	11.8	0.66	-1.0869
56	0.3053	23.629	22.3	12.2	0.65	-1.0869
57	0.3153	23.801	22.5	12.6	0.66	-1.0867
58	0.3253	24.131	22.8	13.0	0.67	-1.0867
59	0.3353	23.564	22.2	13.4	0.65	-1.0865
60	0.3453	22.857	21.5	13.8	0.63	-1.0865
61	0.3553	22.951	21.6	14.2	0.63	-1.0867
62	0.3653	22.699	21.4	14.6	0.63	-1.0867
63	0.3753	22.484	21.2	15.0	0.62	-1.0867

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	277.750		256.900
Moisture content: Dry soil+tare, gms.	245.760		219.170
Moisture content: Tare, gms.	11.880		12.020
Moisture, %	13.7	18.2	18.2
Moist specimen weight, gms.	238.50		
Diameter, in.	2.501	2.501	
Area, in.²	4.911	4.911	
Height, in.	1.436	1.395	
Net decrease in height, in.		0.041	
Wet density, pcf	128.8	137.9	
Dry density, pcf	113.3	116.7	
Void ratio	0.4598		
Saturation, %	78.8		

Test Readings for Specimen No. 3

Normal stress = 2 ksf

Strain rate, %/min. = 0.13

Failure Stress = 3.18 ksf **at reading no.** 14

Final Stress = 1.54 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-0.735	0.0	0.0	0.00	-1.0837
1	0.0050	10.865	11.6	0.2	0.34	-1.0841
2	0.0099	22.727	23.5	0.4	0.69	-1.0853
3	0.0150	31.633	32.4	0.6	0.95	-1.0866
4	0.0200	42.802	43.5	0.8	1.28	-1.0868
5	0.0250	49.112	49.8	1.0	1.46	-1.0872
6	0.0300	58.739	59.5	1.2	1.74	-1.0870
7	0.0350	69.879	70.6	1.4	2.07	-1.0869
8	0.0400	82.947	83.7	1.6	2.45	-1.0868
9	0.0450	94.493	95.2	1.8	2.79	-1.0865
10	0.0500	98.077	98.8	2.0	2.90	-1.0863
11	0.0550	100.805	101.5	2.2	2.98	-1.0859
12	0.0600	102.372	103.1	2.4	3.02	-1.0850
13	0.0650	107.445	108.2	2.6	3.17	-1.0839
14	0.0700	107.841	108.6	2.8	3.18	-1.0831
15	0.0750	99.797	100.5	3.0	2.95	-1.0823
16	0.0800	83.496	84.2	3.2	2.47	-1.0815
17	0.0850	75.221	76.0	3.4	2.23	-1.0813
18	0.0900	69.679	70.4	3.6	2.06	-1.0812
19	0.0950	62.699	63.4	3.8	1.86	-1.0808
20	0.1001	61.170	61.9	4.0	1.82	-1.0808
21	0.1051	60.353	61.1	4.2	1.79	-1.0809
22	0.1101	60.082	60.8	4.4	1.78	-1.0809
23	0.1151	59.093	59.8	4.6	1.75	-1.0806
24	0.1200	60.269	61.0	4.8	1.79	-1.0812
25	0.1250	60.349	61.1	5.0	1.79	-1.0814
26	0.1301	60.192	60.9	5.2	1.79	-1.0814
27	0.1351	59.455	60.2	5.4	1.77	-1.0811

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
28	0.1401	59.005	59.7	5.6	1.75	-1.0813
29	0.1451	59.116	59.9	5.8	1.76	-1.0812
30	0.1501	58.754	59.5	6.0	1.74	-1.0812
31	0.1551	58.267	59.0	6.2	1.73	-1.0811
32	0.1601	58.377	59.1	6.4	1.73	-1.0812
33	0.1651	58.052	58.8	6.6	1.72	-1.0811
34	0.1701	57.388	58.1	6.8	1.70	-1.0811
35	0.1751	56.680	57.4	7.0	1.68	-1.0812
36	0.1801	56.512	57.2	7.2	1.68	-1.0811
37	0.1851	56.743	57.5	7.4	1.69	-1.0810
38	0.1901	56.665	57.4	7.6	1.68	-1.0810
39	0.1951	56.608	57.3	7.8	1.68	-1.0808
40	0.2001	55.883	56.6	8.0	1.66	-1.0808
41	0.2051	55.809	56.5	8.2	1.66	-1.0807
42	0.2101	56.049	56.8	8.4	1.67	-1.0805
43	0.2151	55.328	56.1	8.6	1.64	-1.0803
44	0.2201	53.943	54.7	8.8	1.60	-1.0801
45	0.2251	54.125	54.9	9.0	1.61	-1.0800
46	0.2301	54.239	55.0	9.2	1.61	-1.0800
47	0.2351	53.580	54.3	9.4	1.59	-1.0799
48	0.2402	53.087	53.8	9.6	1.58	-1.0799
49	0.2452	53.651	54.4	9.8	1.59	-1.0798
50	0.2502	53.377	54.1	10.0	1.59	-1.0798
51	0.2552	52.934	53.7	10.2	1.57	-1.0797
52	0.2652	53.814	54.5	10.6	1.60	-1.0795
53	0.2752	53.294	54.0	11.0	1.58	-1.0793
54	0.2852	52.604	53.3	11.4	1.56	-1.0791
55	0.2952	52.472	53.2	11.8	1.56	-1.0791
56	0.3052	52.047	52.8	12.2	1.55	-1.0781
57	0.3152	52.758	53.5	12.6	1.57	-1.0781
58	0.3252	52.327	53.1	13.0	1.56	-1.0781
59	0.3352	51.875	52.6	13.4	1.54	-1.0781
60	0.3452	51.926	52.7	13.8	1.54	-1.0787
61	0.3552	51.813	52.5	14.2	1.54	-1.0785
62	0.3652	51.870	52.6	14.6	1.54	-1.0785
63	0.3752	51.655	52.4	15.0	1.54	-1.0784

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:349

Sieve Analysis of Soils

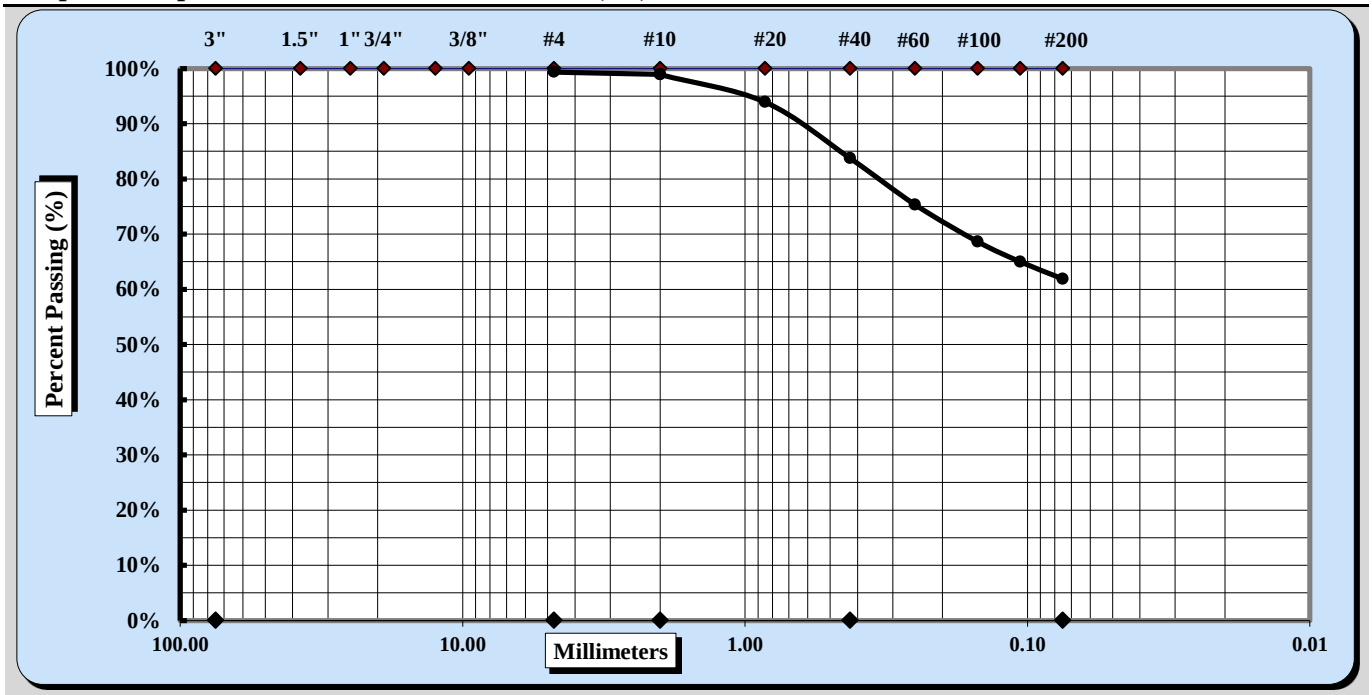
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/19/14-11/21/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Type: UD		
		Depth:	4 - 6 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	0.5%	Fine Sand	21.8%
Gravel	0.6%	Medium Sand	15.2%	Silt & Clay	61.9%
Liquid Limit	33	Plastic Limit	17	Plastic Index	16

Coarse Sand	0.5%	Medium Sand	15.2%	Fine Sand	21.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

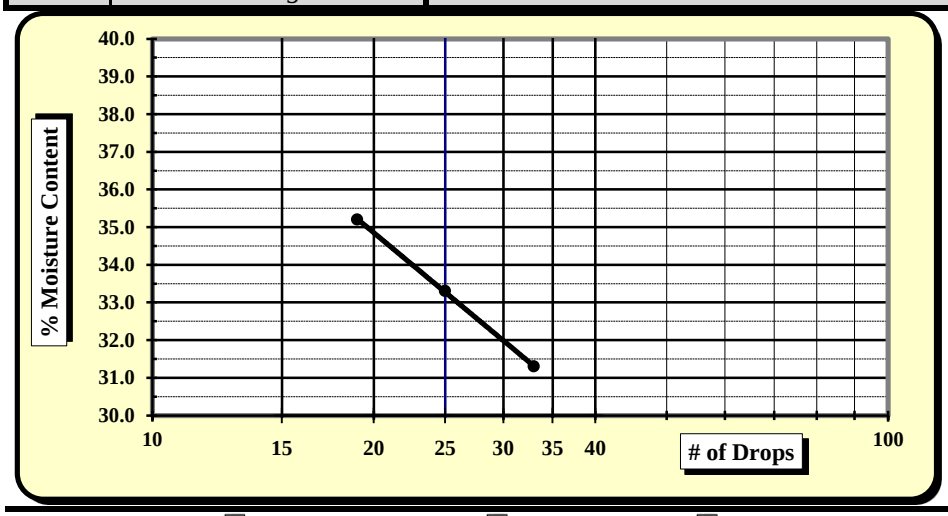
Log No.:349 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/21/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: UD		
		Depth: 4 - 6 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	19	21	14				3	9	
A	Tare Weight	15.49	15.58	15.54				15.55	15.50	
B	Wet Soil Weight + A	31.85	32.77	33.35				25.01	24.91	
C	Dry Soil Weight + A	27.59	28.48	29.10				23.68	23.58	
D	Water Weight (B-C)	4.26	4.29	4.25				1.33	1.33	
E	Dry Soil Weight (C-A)	12.10	12.90	13.56				8.13	8.08	
F	% Moisture (D/E)*100	35.2%	33.3%	31.3%				16.4%	16.5%	
N	# OF DROPS	19	25	33				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.5%**		



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 **33**
Plastic Limit **17**
Plastic Index **16**
USCS Group Symbol **CL**

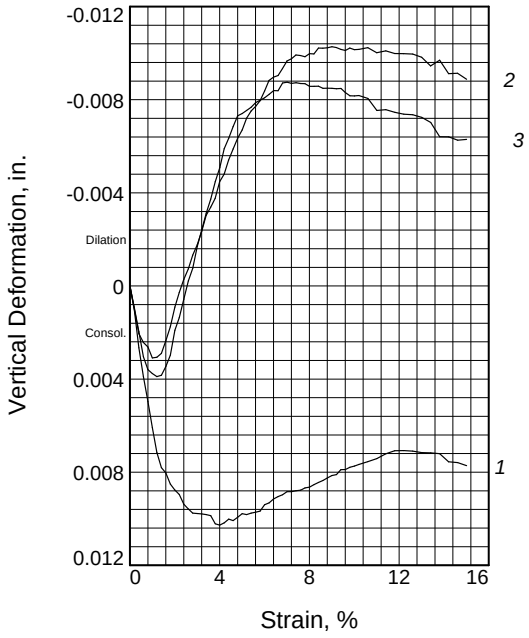
Multipoint Method ☑
One-point Method ☐

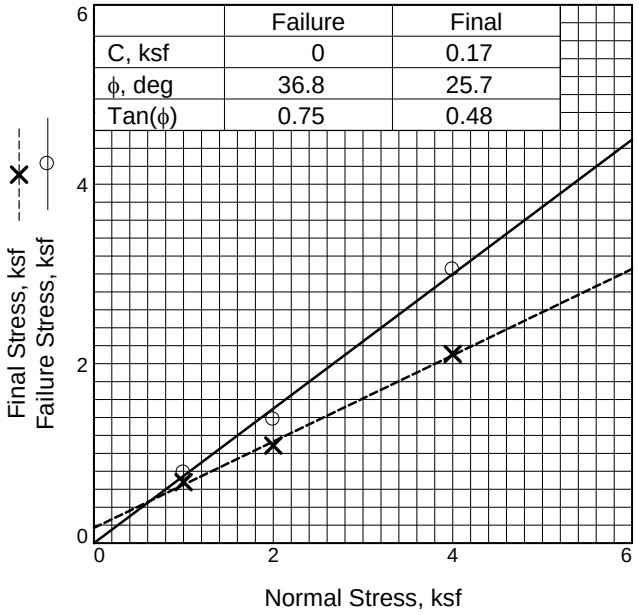
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

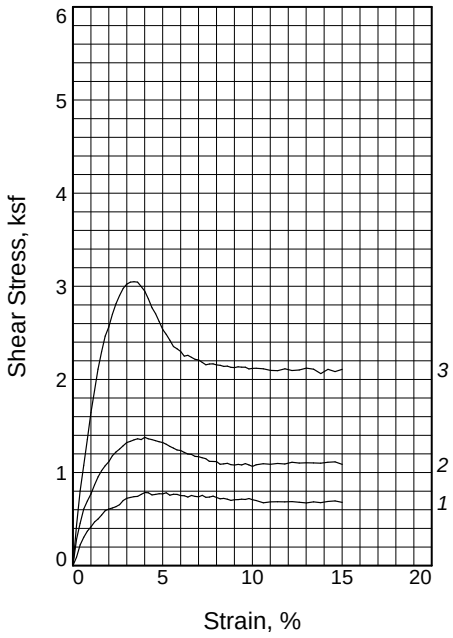
Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/21/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*







Specimen No.		1	2	3
Initial	Water Content, %	12.5	12.3	10.2
	Dry Density, pcf	113.3	117.4	123.3
	Saturation, %	72.2	80.0	79.1
	Void Ratio	0.4600	0.4090	0.3412
	Diameter, in.	2.500	2.501	2.500
	Height, in.	1.439	1.437	1.434
At Test	Water Content, %	15.0	14.2	12.7
	Dry Density, pcf	115.5	121.0	127.9
	Diameter, in.	2.500	2.501	2.500
	Height, in.	1.411	1.395	1.382
Normal Stress, ksf		1.00	2.00	4.00
Failure Stress, ksf		0.79	1.38	3.05
Strain, %		4.0	4.0	3.4
Final Stress, ksf		0.68	1.09	2.11
Strain, %		15.0	15.0	15.0
Strain rate, %/min.		0.13	0.13	0.13

Sample Type: Intact Sample
Description: USCS: CLAYEY SAND (SC); AASHTO: A-6
LL= 30 **PL=** 15 **PI=** 15
Assumed Specific Gravity= 2.65
Remarks: ASTM D3080

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-9
Sample Number: Log 350 **Depth:** 28 - 30 ft
Proj. No.: 1461-14-046

DIRECT SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

DIRECT SHEAR TEST

12/2/2014

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-9
Depth: 28 - 30 ft **Sample Number:** Log 350
Description: USCS: CLAYEY SAND (SC); AASHTO: A-6
Remarks: ASTM D3080
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**30 **PL=**15 **PI=**15

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	141.360		246.500
Moisture content: Dry soil+tare, gms.	126.360		215.220
Moisture content: Tare, gms.	6.750		7.060
Moisture, %	12.5	15.0	15.0
Moist specimen weight, gms.	236.40		
Diameter, in.	2.500	2.500	
Area, in.²	4.909	4.909	
Height, in.	1.439	1.411	
Net decrease in height, in.		0.028	
Wet density, pcf	127.5	132.9	
Dry density, pcf	113.3	115.5	
Void ratio	0.4600		
Saturation, %	72.2		

Test Readings for Specimen No. 1

Normal stress = 1 ksf
Strain rate, %/min. = 0.13
Failure Stress = 0.79 ksf **at reading no.** 20
Final Stress = 0.68 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-1.535	0.0	0.0	0.00	-1.1143
1	0.0049	1.575	3.1	0.2	0.09	-1.1153
2	0.0099	6.051	7.6	0.4	0.22	-1.1169
3	0.0150	8.845	10.4	0.6	0.30	-1.1182
4	0.0200	11.081	12.6	0.8	0.37	-1.1192
5	0.0250	12.661	14.2	1.0	0.42	-1.1203
6	0.0300	14.420	16.0	1.2	0.47	-1.1214
7	0.0350	15.587	17.1	1.4	0.50	-1.1221
8	0.0400	16.986	18.5	1.6	0.54	-1.1223
9	0.0450	18.606	20.1	1.8	0.59	-1.1228
10	0.0500	19.194	20.7	2.0	0.61	-1.1230
11	0.0550	19.556	21.1	2.2	0.62	-1.1232
12	0.0600	20.038	21.6	2.4	0.63	-1.1236
13	0.0650	20.803	22.3	2.6	0.66	-1.1238

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
14	0.0700	22.298	23.8	2.8	0.70	-1.1240
15	0.0750	23.121	24.7	3.0	0.72	-1.1240
16	0.0800	23.435	25.0	3.2	0.73	-1.1240
17	0.0850	23.722	25.3	3.4	0.74	-1.1241
18	0.0900	23.798	25.3	3.6	0.74	-1.1241
19	0.0950	24.543	26.1	3.8	0.77	-1.1245
20	0.1000	25.252	26.8	4.0	0.79	-1.1245
21	0.1050	25.155	26.7	4.2	0.78	-1.1244
22	0.1101	24.352	25.9	4.4	0.76	-1.1243
23	0.1151	24.534	26.1	4.6	0.76	-1.1243
24	0.1201	24.800	26.3	4.8	0.77	-1.1242
25	0.1251	24.725	26.3	5.0	0.77	-1.1240
26	0.1301	25.123	26.7	5.2	0.78	-1.1241
27	0.1351	24.258	25.8	5.4	0.76	-1.1240
28	0.1401	24.606	26.1	5.6	0.77	-1.1240
29	0.1451	24.539	26.1	5.8	0.76	-1.1239
30	0.1501	24.131	25.7	6.0	0.75	-1.1237
31	0.1551	24.047	25.6	6.2	0.75	-1.1236
32	0.1601	23.593	25.1	6.4	0.74	-1.1234
33	0.1651	24.172	25.7	6.6	0.75	-1.1233
34	0.1701	23.823	25.4	6.8	0.74	-1.1232
35	0.1751	23.685	25.2	7.0	0.74	-1.1231
36	0.1801	24.186	25.7	7.2	0.75	-1.1231
37	0.1851	23.464	25.0	7.4	0.73	-1.1231
38	0.1901	23.574	25.1	7.6	0.74	-1.1230
39	0.1951	23.919	25.5	7.8	0.75	-1.1229
40	0.2001	23.416	25.0	8.0	0.73	-1.1229
41	0.2052	22.943	24.5	8.2	0.72	-1.1228
42	0.2101	23.091	24.6	8.4	0.72	-1.1227
43	0.2151	22.806	24.3	8.6	0.71	-1.1226
44	0.2202	22.327	23.9	8.8	0.70	-1.1225
45	0.2251	22.610	24.1	9.0	0.71	-1.1224
46	0.2301	22.642	24.2	9.2	0.71	-1.1224
47	0.2352	22.777	24.3	9.4	0.71	-1.1221
48	0.2402	22.705	24.2	9.6	0.71	-1.1221
49	0.2452	23.029	24.6	9.8	0.72	-1.1220
50	0.2502	22.618	24.2	10.0	0.71	-1.1220
51	0.2552	22.314	23.8	10.2	0.70	-1.1219
52	0.2652	21.449	23.0	10.6	0.67	-1.1218
53	0.2752	21.836	23.4	11.0	0.69	-1.1217
54	0.2852	21.844	23.4	11.4	0.69	-1.1215
55	0.2952	21.820	23.4	11.8	0.69	-1.1213
56	0.3052	21.893	23.4	12.2	0.69	-1.1213
57	0.3152	21.648	23.2	12.6	0.68	-1.1214
58	0.3252	21.420	23.0	13.0	0.67	-1.1214
59	0.3352	21.807	23.3	13.4	0.68	-1.1214
60	0.3452	21.525	23.1	13.8	0.68	-1.1215

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
61	0.3552	21.954	23.5	14.2	0.69	-1.1218
62	0.3652	22.168	23.7	14.6	0.70	-1.1218
63	0.3753	21.615	23.2	15.0	0.68	-1.1220

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	160.610		257.270
Moisture content: Dry soil+tare, gms.	143.710		226.130
Moisture content: Tare, gms.	6.840		6.880
Moisture, %	12.3	14.2	14.2
Moist specimen weight, gms.	244.40		
Diameter, in.	2.501	2.501	
Area, in.²	4.911	4.911	
Height, in.	1.437	1.395	
Net decrease in height, in.		0.042	
Wet density, pcf	131.9	138.1	
Dry density, pcf	117.4	121.0	
Void ratio	0.4090		
Saturation, %	80.0		

Test Readings for Specimen No. 2

Normal stress = 2 ksf

Strain rate, %/min. = 0.13

Failure Stress = 1.38 ksf **at reading no.** 20

Final Stress = 1.09 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-0.232	0.0	0.0	0.00	-1.1137
1	0.0049	9.395	9.6	0.2	0.28	-1.1147
2	0.0099	15.271	15.5	0.4	0.45	-1.1157
3	0.0150	20.492	20.7	0.6	0.61	-1.1161
4	0.0200	23.411	23.6	0.8	0.69	-1.1163
5	0.0250	26.011	26.2	1.0	0.77	-1.1168
6	0.0300	29.325	29.6	1.2	0.87	-1.1168
7	0.0350	32.289	32.5	1.4	0.95	-1.1166
8	0.0400	34.528	34.8	1.6	1.02	-1.1161
9	0.0450	36.383	36.6	1.8	1.07	-1.1155
10	0.0500	37.805	38.0	2.0	1.12	-1.1146
11	0.0550	40.031	40.3	2.2	1.18	-1.1140
12	0.0600	41.385	41.6	2.4	1.22	-1.1134
13	0.0650	42.444	42.7	2.6	1.25	-1.1130
14	0.0700	43.673	43.9	2.8	1.29	-1.1124
15	0.0750	44.839	45.1	3.0	1.32	-1.1119
16	0.0800	45.278	45.5	3.2	1.33	-1.1113
17	0.0850	45.809	46.0	3.4	1.35	-1.1107
18	0.0900	46.200	46.4	3.6	1.36	-1.1103
19	0.0950	45.908	46.1	3.8	1.35	-1.1099
20	0.1000	46.764	47.0	4.0	1.38	-1.1092

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
21	0.1050	46.229	46.5	4.2	1.36	-1.1089
22	0.1100	45.918	46.2	4.4	1.35	-1.1083
23	0.1150	45.521	45.8	4.6	1.34	-1.1078
24	0.1201	45.145	45.4	4.8	1.33	-1.1074
25	0.1251	44.848	45.1	5.0	1.32	-1.1070
26	0.1301	44.199	44.4	5.2	1.30	-1.1065
27	0.1351	43.433	43.7	5.4	1.28	-1.1062
28	0.1401	42.793	43.0	5.6	1.26	-1.1060
29	0.1451	42.111	42.3	5.8	1.24	-1.1057
30	0.1501	41.947	42.2	6.0	1.24	-1.1053
31	0.1551	41.259	41.5	6.2	1.22	-1.1049
32	0.1601	40.638	40.9	6.4	1.20	-1.1047
33	0.1651	40.533	40.8	6.6	1.20	-1.1047
34	0.1701	39.793	40.0	6.8	1.17	-1.1044
35	0.1751	39.684	39.9	7.0	1.17	-1.1040
36	0.1801	39.287	39.5	7.2	1.16	-1.1039
37	0.1851	38.934	39.2	7.4	1.15	-1.1038
38	0.1901	37.976	38.2	7.6	1.12	-1.1038
39	0.1951	37.945	38.2	7.8	1.12	-1.1039
40	0.2001	37.854	38.1	8.0	1.12	-1.1037
41	0.2051	36.875	37.1	8.2	1.09	-1.1037
42	0.2101	37.047	37.3	8.4	1.09	-1.1035
43	0.2151	37.228	37.5	8.6	1.10	-1.1035
44	0.2201	36.759	37.0	8.8	1.08	-1.1035
45	0.2251	36.606	36.8	9.0	1.08	-1.1034
46	0.2302	36.865	37.1	9.2	1.09	-1.1035
47	0.2352	36.630	36.9	9.4	1.08	-1.1035
48	0.2402	37.147	37.4	9.6	1.10	-1.1036
49	0.2452	36.635	36.9	9.8	1.08	-1.1035
50	0.2502	36.101	36.3	10.0	1.07	-1.1036
51	0.2552	36.693	36.9	10.2	1.08	-1.1035
52	0.2652	37.099	37.3	10.6	1.09	-1.1035
53	0.2752	36.898	37.1	11.0	1.09	-1.1037
54	0.2852	37.170	37.4	11.4	1.10	-1.1036
55	0.2952	36.992	37.2	11.8	1.09	-1.1037
56	0.3052	37.606	37.8	12.2	1.11	-1.1037
57	0.3152	37.332	37.6	12.6	1.10	-1.1037
58	0.3252	37.415	37.6	13.0	1.10	-1.1039
59	0.3352	37.400	37.6	13.4	1.10	-1.1042
60	0.3452	37.276	37.5	13.8	1.10	-1.1040
61	0.3553	37.608	37.8	14.2	1.11	-1.1046
62	0.3652	37.754	38.0	14.6	1.11	-1.1046
63	0.3753	36.850	37.1	15.0	1.09	-1.1048

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	226.980		263.510
Moisture content: Dry soil+tare, gms.	206.650		234.680
Moisture content: Tare, gms.	6.990		6.950
Moisture, %	10.2	12.7	12.7
Moist specimen weight, gms.	251.00		
Diameter, in.	2.500	2.500	
Area, in.²	4.908	4.908	
Height, in.	1.434	1.382	
Net decrease in height, in.		0.051	
Wet density, pcf	135.9	144.1	
Dry density, pcf	123.3	127.9	
Void ratio	0.3412		
Saturation, %	79.1		

Test Readings for Specimen No. 3

Normal stress = 4 ksf

Strain rate, %/min. = 0.13

Failure Stress = 3.05 ksf **at reading no.** 17

Final Stress = 2.11 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-0.246	0.0	0.0	0.00	-1.1135
1	0.0050	14.453	14.7	0.2	0.43	-1.1145
2	0.0100	27.109	27.4	0.4	0.80	-1.1155
3	0.0150	36.473	36.7	0.6	1.08	-1.1166
4	0.0200	45.942	46.2	0.8	1.36	-1.1171
5	0.0250	55.744	56.0	1.0	1.64	-1.1173
6	0.0300	63.819	64.1	1.2	1.88	-1.1174
7	0.0350	71.635	71.9	1.4	2.11	-1.1174
8	0.0400	78.065	78.3	1.6	2.30	-1.1170
9	0.0450	83.774	84.0	1.8	2.47	-1.1165
10	0.0500	87.137	87.4	2.0	2.56	-1.1155
11	0.0550	91.747	92.0	2.2	2.70	-1.1149
12	0.0600	95.631	95.9	2.4	2.81	-1.1141
13	0.0650	98.651	98.9	2.6	2.90	-1.1133
14	0.0700	101.231	101.5	2.8	2.98	-1.1128
15	0.0750	102.764	103.0	3.0	3.02	-1.1118
16	0.0800	103.495	103.7	3.2	3.04	-1.1111
17	0.0850	103.661	103.9	3.4	3.05	-1.1104
18	0.0901	103.519	103.8	3.6	3.04	-1.1098
19	0.0950	101.898	102.1	3.8	3.00	-1.1091
20	0.1001	100.213	100.5	4.0	2.95	-1.1085
21	0.1051	97.374	97.6	4.2	2.86	-1.1077
22	0.1101	94.125	94.4	4.4	2.77	-1.1072
23	0.1151	91.952	92.2	4.6	2.71	-1.1067
24	0.1201	89.067	89.3	4.8	2.62	-1.1062
25	0.1251	86.124	86.4	5.0	2.53	-1.1061
26	0.1301	84.366	84.6	5.2	2.48	-1.1060
27	0.1351	82.221	82.5	5.4	2.42	-1.1059

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
28	0.1401	79.965	80.2	5.6	2.35	-1.1057
29	0.1451	79.126	79.4	5.8	2.33	-1.1056
30	0.1501	78.137	78.4	6.0	2.30	-1.1055
31	0.1551	76.450	76.7	6.2	2.25	-1.1053
32	0.1601	76.707	77.0	6.4	2.26	-1.1052
33	0.1651	75.977	76.2	6.6	2.24	-1.1052
34	0.1701	75.270	75.5	6.8	2.22	-1.1048
35	0.1751	75.021	75.3	7.0	2.21	-1.1048
36	0.1801	74.142	74.4	7.2	2.18	-1.1048
37	0.1851	73.253	73.5	7.4	2.16	-1.1048
38	0.1901	73.565	73.8	7.6	2.17	-1.1049
39	0.1951	73.592	73.8	7.8	2.17	-1.1049
40	0.2002	73.197	73.4	8.0	2.15	-1.1050
41	0.2051	73.062	73.3	8.2	2.15	-1.1050
42	0.2101	72.661	72.9	8.4	2.14	-1.1050
43	0.2152	72.751	73.0	8.6	2.14	-1.1051
44	0.2202	72.354	72.6	8.8	2.13	-1.1051
45	0.2252	72.250	72.5	9.0	2.13	-1.1051
46	0.2302	72.518	72.8	9.2	2.14	-1.1051
47	0.2352	72.369	72.6	9.4	2.13	-1.1051
48	0.2402	72.380	72.6	9.6	2.13	-1.1052
49	0.2452	71.729	72.0	9.8	2.11	-1.1054
50	0.2502	71.950	72.2	10.0	2.12	-1.1054
51	0.2552	71.983	72.2	10.2	2.12	-1.1054
52	0.2652	71.777	72.0	10.6	2.11	-1.1055
53	0.2752	71.213	71.5	11.0	2.10	-1.1060
54	0.2852	71.100	71.3	11.4	2.09	-1.1060
55	0.2952	71.783	72.0	11.8	2.11	-1.1061
56	0.3052	71.189	71.4	12.2	2.10	-1.1062
57	0.3152	71.356	71.6	12.6	2.10	-1.1062
58	0.3252	72.060	72.3	13.0	2.12	-1.1063
59	0.3352	71.633	71.9	13.4	2.11	-1.1065
60	0.3453	70.025	70.3	13.8	2.06	-1.1071
61	0.3552	71.589	71.8	14.2	2.11	-1.1071
62	0.3653	70.770	71.0	14.6	2.08	-1.1073
63	0.3753	71.590	71.8	15.0	2.11	-1.1073

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:350

Sieve Analysis of Soils

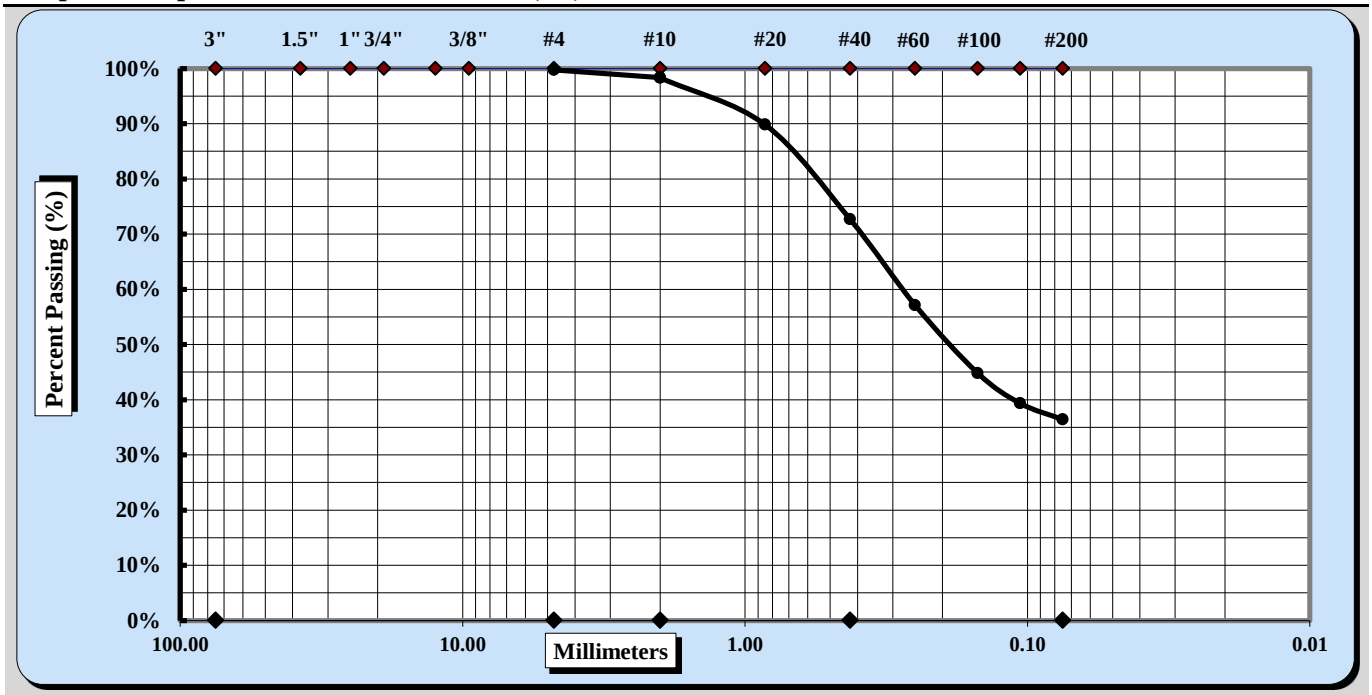
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/19/14 - 11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Type: UD		
		Depth:	28 - 30 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.4%	Fine Sand	36.3%
Gravel	0.3%	Medium Sand	25.6%	Silt & Clay	36.4%
Liquid Limit	30	Plastic Limit	15	Plastic Index	15

Coarse Sand	1.4%	Medium Sand	25.6%	Fine Sand	36.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

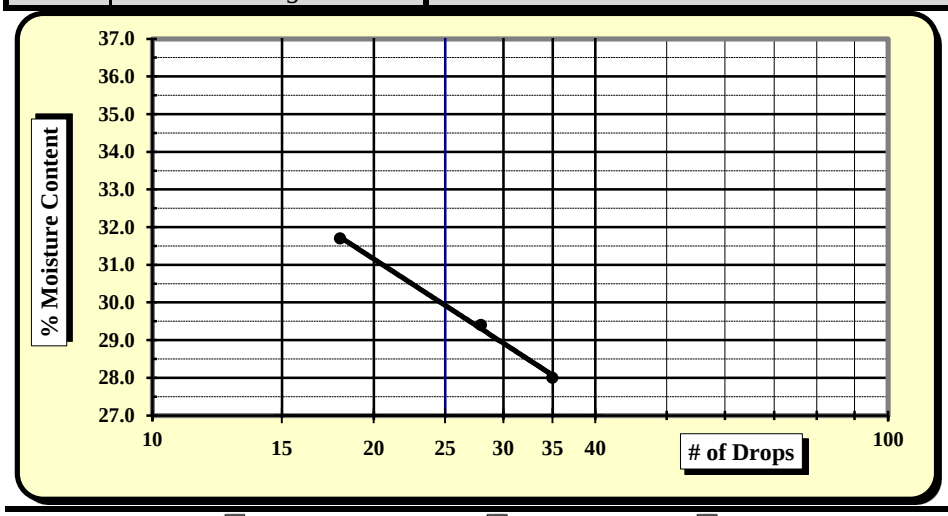
Log No.:350 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-9	Sample No: UD		
		Depth: 28 - 30 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	19	21	23				24	17	
A	Tare Weight	15.49	15.58	15.50				15.51	15.57	
B	Wet Soil Weight + A	31.58	32.09	33.96				24.21	24.90	
C	Dry Soil Weight + A	27.71	28.34	29.92				23.11	23.72	
D	Water Weight (B-C)	3.87	3.75	4.04				1.10	1.18	
E	Dry Soil Weight (C-A)	12.22	12.76	14.42				7.60	8.15	
F	% Moisture (D/E)*100	31.7%	29.4%	28.0%				14.5%	14.5%	
N	# OF DROPS	18	28	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**14.5%**		



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 **30**
Plastic Limit **15**
Plastic Index **15**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

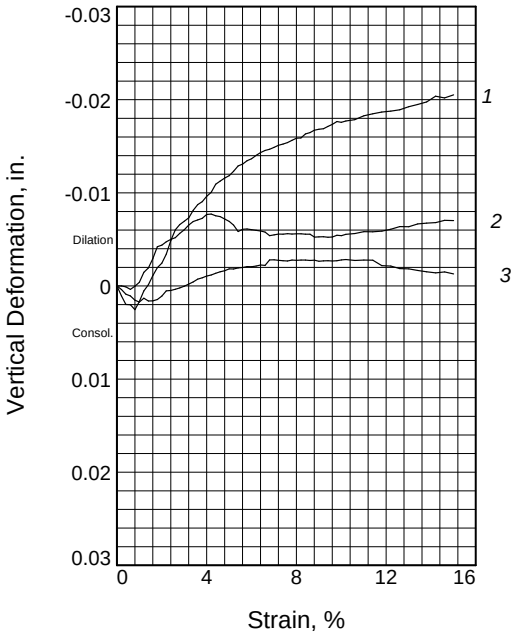
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

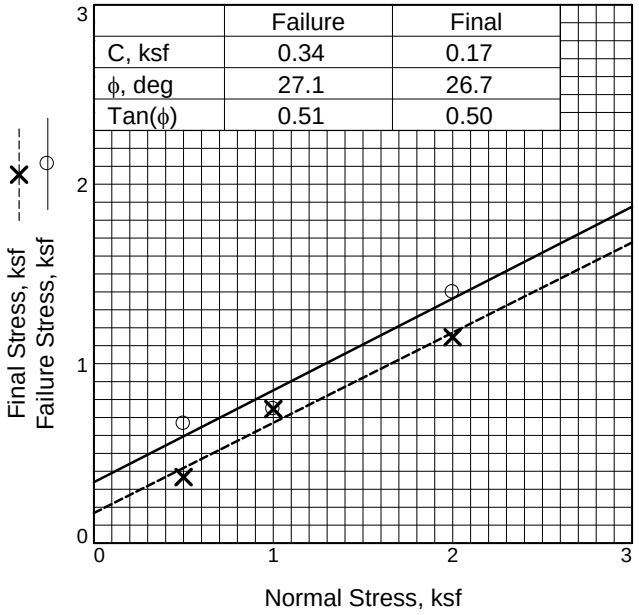
Notes / Deviations / References: **AASHTO Classification A-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

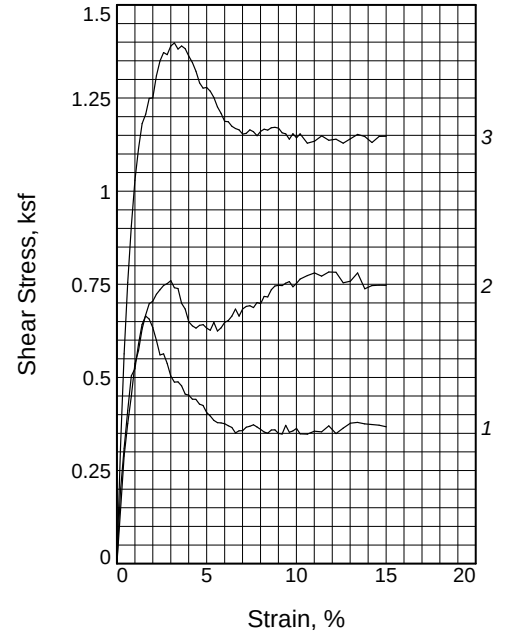
Derek Baker	11/24/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





	Failure	Final
C, ksf	0.34	0.17
ϕ, deg	27.1	26.7
Tan(ϕ)	0.51	0.50



Specimen No.		1	2	3
Initial	Water Content, %	13.5	16.2	15.4
	Dry Density, pcf	110.3	108.6	109.4
	Saturation, %	71.7	82.1	79.8
	Void Ratio	0.4999	0.5226	0.5120
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.438	1.442	1.441
At Test	Water Content, %	19.0	19.5	19.5
	Void Ratio	0.4810	0.5080	0.4607
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.420	1.428	1.392
Normal Stress, ksf		0.50	1.00	2.00
Failure Stress, ksf		0.67	0.75	1.40
Strain, %		1.6	2.6	3.2
Final Stress, ksf		0.37	0.75	1.15
Strain, %		15.0	15.0	15.0
Strain rate, %/min.		0.13	0.13	0.13

Sample Type: Intact Sample
Description: USCS: CLAYEY SAND (SC); AASHTO: A-6
LL= 37 **PL=** 17 **PI=** 20
Assumed Specific Gravity= 2.65
Remarks: ASTM D3080

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-10
Sample Number: Log 351 **Depth:** 13 - 15 ft
Proj. No.: 1461-14-046

DIRECT SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

DIRECT SHEAR TEST

12/18/2014

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 146114046
Location: B-10
Depth: 13 - 15 ft **Sample Number:** Log 351
Description: USCS: CLAYEY SAND (SC); AASHTO: A-6
Remarks: ASTM D3080
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**37 **PL=**17 **PI=**20

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	209.840		246.010
Moisture content: Dry soil+tare, gms.	185.600		207.700
Moisture content: Tare, gms.	6.310		6.390
Moisture, %	13.5	19.0	19.0
Moist specimen weight, gms.	232.00		
Diameter, in.	2.500	2.500	
Area, in.²	4.910	4.910	
Height, in.	1.438	1.420	
Net decrease in height, in.		0.018	
Wet density, pcf	125.2	133.0	
Dry density, pcf	110.3	111.7	
Void ratio	0.4999	0.4810	
Saturation, %	71.7	104.8	

Test Readings for Specimen No. 1

Normal stress = 0.5 ksf
Strain rate, %/min. = 0.13
Failure Stress = 0.67 ksf **at reading no.** 8
Final Stress = 0.37 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.345	0.0	0.0	0.00	-1.0836
1	0.0050	7.072	6.7	0.2	0.20	-1.0847
2	0.0100	10.904	10.6	0.4	0.31	-1.0856
3	0.0150	14.371	14.0	0.6	0.41	-1.0856
4	0.0200	17.529	17.2	0.8	0.50	-1.0861
5	0.0250	18.184	17.8	1.0	0.52	-1.0853
6	0.0300	20.459	20.1	1.2	0.59	-1.0841
7	0.0350	22.216	21.9	1.4	0.64	-1.0835
8	0.0400	23.019	22.7	1.6	0.67	-1.0825
9	0.0450	22.737	22.4	1.8	0.66	-1.0816
10	0.0500	21.953	21.6	2.0	0.63	-1.0811
11	0.0550	20.788	20.4	2.2	0.60	-1.0802
12	0.0600	19.451	19.1	2.4	0.56	-1.0787
13	0.0650	19.550	19.2	2.6	0.56	-1.0776

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
14	0.0700	18.666	18.3	2.8	0.54	-1.0770
15	0.0750	17.510	17.2	3.0	0.50	-1.0766
16	0.0800	16.960	16.6	3.2	0.49	-1.0763
17	0.0850	16.985	16.6	3.4	0.49	-1.0755
18	0.0900	16.617	16.3	3.6	0.48	-1.0748
19	0.0950	15.863	15.5	3.8	0.46	-1.0745
20	0.1000	15.766	15.4	4.0	0.45	-1.0740
21	0.1050	15.400	15.1	4.2	0.44	-1.0735
22	0.1100	15.390	15.0	4.4	0.44	-1.0727
23	0.1150	14.941	14.6	4.6	0.43	-1.0723
24	0.1201	14.822	14.5	4.8	0.42	-1.0720
25	0.1251	14.180	13.8	5.0	0.41	-1.0717
26	0.1301	13.856	13.5	5.2	0.40	-1.0713
27	0.1351	13.455	13.1	5.4	0.38	-1.0707
28	0.1401	13.255	12.9	5.6	0.38	-1.0705
29	0.1451	13.221	12.9	5.8	0.38	-1.0701
30	0.1501	13.158	12.8	6.0	0.38	-1.0699
31	0.1551	12.973	12.6	6.2	0.37	-1.0696
32	0.1601	12.809	12.5	6.4	0.37	-1.0693
33	0.1651	12.308	12.0	6.6	0.35	-1.0690
34	0.1701	12.509	12.2	6.8	0.36	-1.0689
35	0.1751	12.514	12.2	7.0	0.36	-1.0687
36	0.1801	12.830	12.5	7.2	0.37	-1.0685
37	0.1851	12.924	12.6	7.4	0.37	-1.0683
38	0.1901	13.053	12.7	7.6	0.37	-1.0682
39	0.1951	12.853	12.5	7.8	0.37	-1.0679
40	0.2001	12.643	12.3	8.0	0.36	-1.0677
41	0.2051	12.395	12.0	8.2	0.35	-1.0677
42	0.2102	12.284	11.9	8.4	0.35	-1.0673
43	0.2152	12.576	12.2	8.6	0.36	-1.0671
44	0.2202	12.594	12.2	8.8	0.36	-1.0669
45	0.2252	12.266	11.9	9.0	0.35	-1.0668
46	0.2302	12.209	11.9	9.2	0.35	-1.0667
47	0.2352	13.010	12.7	9.4	0.37	-1.0665
48	0.2402	12.376	12.0	9.6	0.35	-1.0662
49	0.2452	12.490	12.1	9.8	0.36	-1.0659
50	0.2502	12.724	12.4	10.0	0.36	-1.0660
51	0.2552	12.228	11.9	10.2	0.35	-1.0659
52	0.2652	12.197	11.9	10.6	0.35	-1.0657
53	0.2752	12.471	12.1	11.0	0.36	-1.0653
54	0.2852	12.408	12.1	11.4	0.35	-1.0651
55	0.2952	12.954	12.6	11.8	0.37	-1.0649
56	0.3052	12.250	11.9	12.2	0.35	-1.0648
57	0.3152	12.748	12.4	12.6	0.36	-1.0647
58	0.3253	13.202	12.9	13.0	0.38	-1.0643
59	0.3352	13.277	12.9	13.4	0.38	-1.0641
60	0.3453	13.144	12.8	13.8	0.38	-1.0638

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
61	0.3552	13.073	12.7	14.2	0.37	-1.0632
62	0.3653	13.019	12.7	14.6	0.37	-1.0634
63	0.3753	12.877	12.5	15.0	0.37	-1.0631

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	479.770		242.340
Moisture content: Dry soil+tare, gms.	414.590		203.860
Moisture content: Tare, gms.	12.120		6.470
Moisture, %	16.2	19.5	19.5
Moist specimen weight, gms.	234.50		
Diameter, in.	2.500	2.500	
Area, in.²	4.908	4.908	
Height, in.	1.442	1.428	
Net decrease in height, in.		0.014	
Wet density, pcf	126.2	131.1	
Dry density, pcf	108.6	109.7	
Void ratio	0.5226	0.5080	
Saturation, %	82.1	101.7	

Test Readings for Specimen No. 2

Normal stress = 1 ksf

Strain rate, %/min. = 0.13

Failure Stress = 0.75 ksf **at reading no.** 13

Final Stress = 0.75 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-1.056	0.0	0.0	0.00	-1.0917
1	0.0049	3.847	4.9	0.2	0.14	-1.0917
2	0.0100	8.797	9.9	0.4	0.29	-1.0918
3	0.0150	11.759	12.8	0.6	0.38	-1.0920
4	0.0200	14.275	15.3	0.8	0.45	-1.0917
5	0.0250	17.234	18.3	1.0	0.54	-1.0913
6	0.0300	18.451	19.5	1.2	0.57	-1.0902
7	0.0350	20.420	21.5	1.4	0.63	-1.0897
8	0.0400	21.681	22.7	1.6	0.67	-1.0887
9	0.0450	22.732	23.8	1.8	0.70	-1.0875
10	0.0500	22.956	24.0	2.0	0.70	-1.0873
11	0.0550	23.592	24.6	2.2	0.72	-1.0869
12	0.0600	24.008	25.1	2.4	0.74	-1.0867
13	0.0650	24.395	25.5	2.6	0.75	-1.0865
14	0.0700	24.570	25.6	2.8	0.75	-1.0860
15	0.0750	24.834	25.9	3.0	0.76	-1.0856
16	0.0800	24.188	25.2	3.2	0.74	-1.0851
17	0.0850	24.121	25.2	3.4	0.74	-1.0848
18	0.0900	22.761	23.8	3.6	0.70	-1.0846
19	0.0950	22.235	23.3	3.8	0.68	-1.0844
20	0.1000	21.075	22.1	4.0	0.65	-1.0840

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
21	0.1050	20.697	21.8	4.2	0.64	-1.0839
22	0.1101	20.501	21.6	4.4	0.63	-1.0841
23	0.1151	20.754	21.8	4.6	0.64	-1.0842
24	0.1201	20.817	21.9	4.8	0.64	-1.0845
25	0.1251	20.491	21.5	5.0	0.63	-1.0847
26	0.1301	20.295	21.4	5.2	0.63	-1.0851
27	0.1351	21.022	22.1	5.4	0.65	-1.0858
28	0.1401	20.224	21.3	5.6	0.62	-1.0856
29	0.1451	20.519	21.6	5.8	0.63	-1.0855
30	0.1501	21.016	22.1	6.0	0.65	-1.0856
31	0.1551	21.188	22.2	6.2	0.65	-1.0857
32	0.1601	21.589	22.6	6.4	0.66	-1.0858
33	0.1651	22.244	23.3	6.6	0.68	-1.0859
34	0.1701	21.588	22.6	6.8	0.66	-1.0863
35	0.1751	22.255	23.3	7.0	0.68	-1.0862
36	0.1801	22.489	23.5	7.2	0.69	-1.0861
37	0.1851	22.550	23.6	7.4	0.69	-1.0861
38	0.1901	22.379	23.4	7.6	0.69	-1.0861
39	0.1951	22.842	23.9	7.8	0.70	-1.0861
40	0.2001	22.742	23.8	8.0	0.70	-1.0861
41	0.2051	23.396	24.5	8.2	0.72	-1.0861
42	0.2101	23.353	24.4	8.4	0.72	-1.0861
43	0.2152	24.007	25.1	8.6	0.74	-1.0861
44	0.2202	24.355	25.4	8.8	0.75	-1.0864
45	0.2252	24.414	25.5	9.0	0.75	-1.0864
46	0.2302	24.389	25.4	9.2	0.75	-1.0864
47	0.2352	24.605	25.7	9.4	0.75	-1.0864
48	0.2402	24.748	25.8	9.6	0.76	-1.0864
49	0.2452	24.284	25.3	9.8	0.74	-1.0862
50	0.2502	24.598	25.7	10.0	0.75	-1.0863
51	0.2552	24.981	26.0	10.2	0.76	-1.0861
52	0.2652	25.306	26.4	10.6	0.77	-1.0860
53	0.2752	25.541	26.6	11.0	0.78	-1.0858
54	0.2852	25.249	26.3	11.4	0.77	-1.0858
55	0.2952	25.631	26.7	11.8	0.78	-1.0858
56	0.3052	25.613	26.7	12.2	0.78	-1.0856
57	0.3152	24.647	25.7	12.6	0.75	-1.0853
58	0.3252	24.785	25.8	13.0	0.76	-1.0853
59	0.3352	25.541	26.6	13.4	0.78	-1.0850
60	0.3453	24.097	25.2	13.8	0.74	-1.0849
61	0.3552	24.390	25.4	14.2	0.75	-1.0849
62	0.3653	24.422	25.5	14.6	0.75	-1.0846
63	0.3753	24.408	25.5	15.0	0.75	-1.0846

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	210.610		244.140
Moisture content: Dry soil+tare, gms.	183.380		206.190
Moisture content: Tare, gms.	6.810		12.010
Moisture, %	15.4	19.5	19.5
Moist specimen weight, gms.	234.50		
Diameter, in.	2.500	2.500	
Area, in.²	4.908	4.908	
Height, in.	1.441	1.392	
Net decrease in height, in.		0.049	
Wet density, pcf	126.3	135.4	
Dry density, pcf	109.4	113.3	
Void ratio	0.5120	0.4607	
Saturation, %	79.8	112.4	

Test Readings for Specimen No. 3

Normal stress = 2 ksf

Strain rate, %/min. = 0.13

Failure Stress = 1.40 ksf **at reading no.** 16

Final Stress = 1.15 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	2.582	0.0	0.0	0.00	-1.1188
1	0.0049	13.284	10.7	0.2	0.31	-1.1191
2	0.0100	21.779	19.2	0.4	0.56	-1.1196
3	0.0150	28.312	25.7	0.6	0.75	-1.1198
4	0.0200	33.465	30.9	0.8	0.91	-1.1203
5	0.0250	37.664	35.1	1.0	1.03	-1.1205
6	0.0300	40.564	38.0	1.2	1.11	-1.1201
7	0.0350	42.851	40.3	1.4	1.18	-1.1204
8	0.0400	43.722	41.1	1.6	1.21	-1.1204
9	0.0450	45.159	42.6	1.8	1.25	-1.1202
10	0.0500	45.203	42.6	2.0	1.25	-1.1198
11	0.0550	47.218	44.6	2.2	1.31	-1.1193
12	0.0600	48.580	46.0	2.4	1.35	-1.1192
13	0.0650	49.354	46.8	2.6	1.37	-1.1191
14	0.0700	49.153	46.6	2.8	1.37	-1.1190
15	0.0750	49.955	47.4	3.0	1.39	-1.1188
16	0.0800	50.229	47.6	3.2	1.40	-1.1186
17	0.0850	49.668	47.1	3.4	1.38	-1.1183
18	0.0900	49.956	47.4	3.6	1.39	-1.1180
19	0.0950	49.708	47.1	3.8	1.38	-1.1179
20	0.1000	49.025	46.4	4.0	1.36	-1.1177
21	0.1051	48.436	45.9	4.2	1.35	-1.1176
22	0.1101	47.633	45.1	4.4	1.32	-1.1174
23	0.1150	46.574	44.0	4.6	1.29	-1.1172
24	0.1200	46.089	43.5	4.8	1.28	-1.1171
25	0.1251	46.158	43.6	5.0	1.28	-1.1169
26	0.1301	45.810	43.2	5.2	1.27	-1.1169
27	0.1351	45.235	42.7	5.4	1.25	-1.1168

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
28	0.1401	44.372	41.8	5.6	1.23	-1.1168
29	0.1451	43.789	41.2	5.8	1.21	-1.1167
30	0.1501	43.058	40.5	6.0	1.19	-1.1167
31	0.1551	43.015	40.4	6.2	1.19	-1.1166
32	0.1601	42.602	40.0	6.4	1.17	-1.1165
33	0.1651	42.392	39.8	6.6	1.17	-1.1165
34	0.1701	42.279	39.7	6.8	1.16	-1.1160
35	0.1751	41.883	39.3	7.0	1.15	-1.1159
36	0.1801	41.964	39.4	7.2	1.16	-1.1160
37	0.1851	42.274	39.7	7.4	1.16	-1.1160
38	0.1901	42.102	39.5	7.6	1.16	-1.1161
39	0.1951	41.743	39.2	7.8	1.15	-1.1160
40	0.2001	42.139	39.6	8.0	1.16	-1.1160
41	0.2051	42.332	39.7	8.2	1.17	-1.1160
42	0.2102	42.255	39.7	8.4	1.16	-1.1160
43	0.2152	42.465	39.9	8.6	1.17	-1.1160
44	0.2202	42.513	39.9	8.8	1.17	-1.1160
45	0.2252	42.432	39.8	9.0	1.17	-1.1161
46	0.2302	42.002	39.4	9.2	1.16	-1.1161
47	0.2352	41.906	39.3	9.4	1.15	-1.1160
48	0.2402	41.426	38.8	9.6	1.14	-1.1161
49	0.2452	41.924	39.3	9.8	1.15	-1.1160
50	0.2502	41.547	39.0	10.0	1.14	-1.1160
51	0.2552	41.915	39.3	10.2	1.15	-1.1159
52	0.2652	41.061	38.5	10.6	1.13	-1.1160
53	0.2752	41.238	38.7	11.0	1.13	-1.1160
54	0.2852	41.730	39.1	11.4	1.15	-1.1160
55	0.2952	41.327	38.7	11.8	1.14	-1.1166
56	0.3052	41.423	38.8	12.2	1.14	-1.1166
57	0.3153	41.061	38.5	12.6	1.13	-1.1169
58	0.3253	41.457	38.9	13.0	1.14	-1.1169
59	0.3353	41.857	39.3	13.4	1.15	-1.1171
60	0.3453	41.663	39.1	13.8	1.15	-1.1172
61	0.3553	41.118	38.5	14.2	1.13	-1.1173
62	0.3653	41.672	39.1	14.6	1.15	-1.1172
63	0.3753	41.687	39.1	15.0	1.15	-1.1175

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:351

Sieve Analysis of Soils

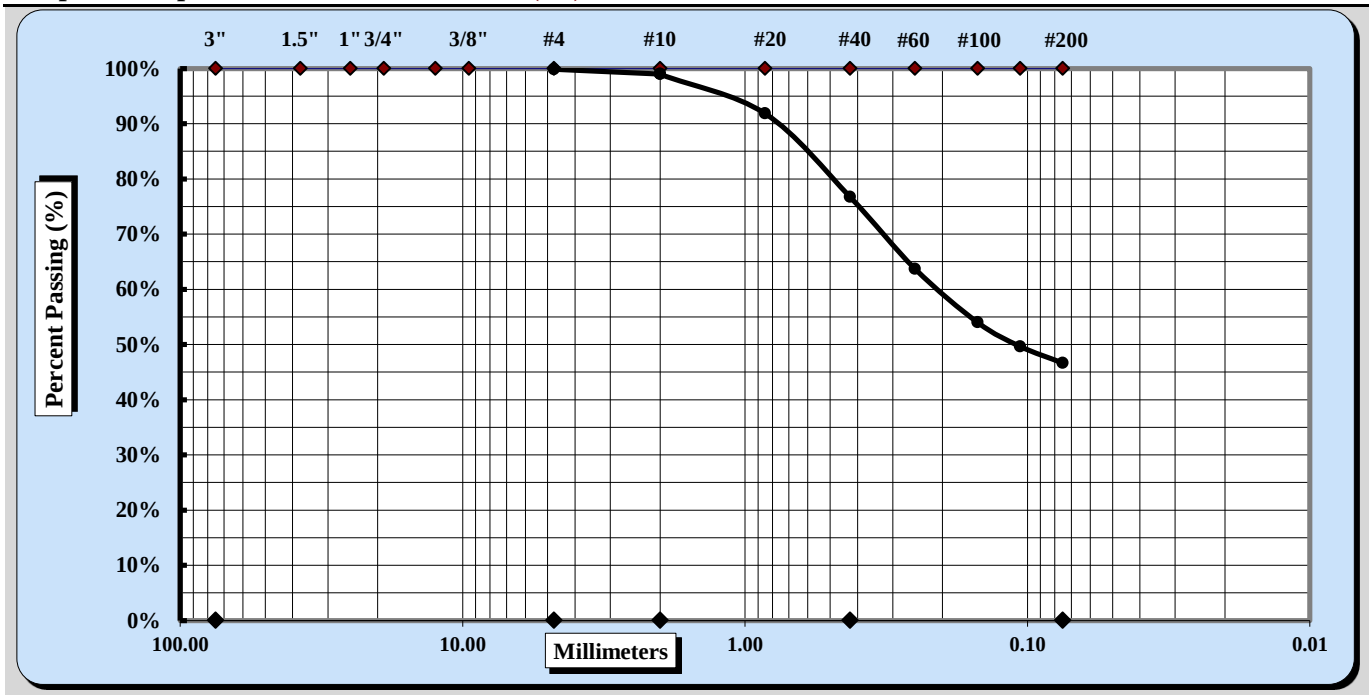
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/26/14-11/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Type: UD		
		Depth:	13 - 15 ft

Sample Description: CLAYEY SAND (SC) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	0.9%	Fine Sand	30.1%
Gravel	0.1%	Medium Sand	22.2%	Silt & Clay	46.7%
Liquid Limit	37	Plastic Limit	17	Plastic Index	20

Coarse Sand	0.9%	Medium Sand	22.2%	Fine Sand	30.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

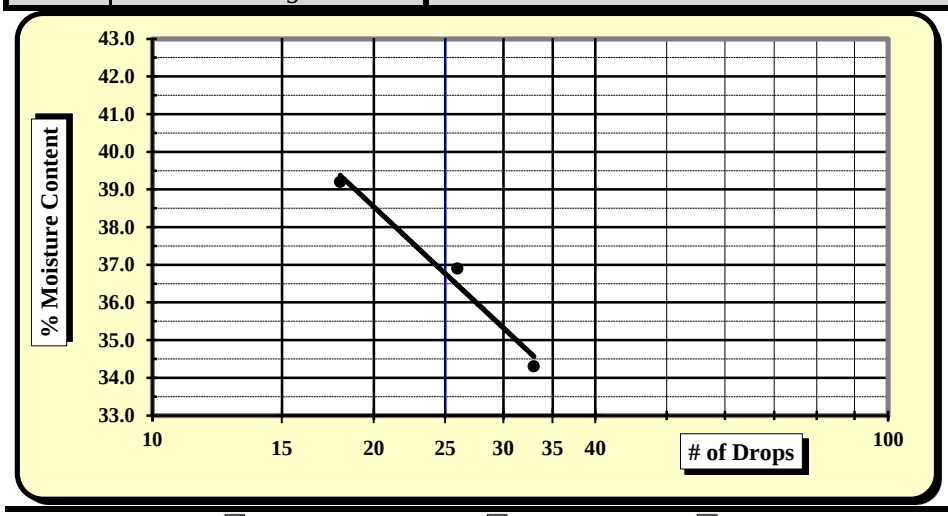
Log No.:351 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/24/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-10	Sample No: UD		
		Depth: 13 - 15 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	14	5	9				1	3	
A	Tare Weight	15.54	15.48	15.50				15.41	15.55	
B	Wet Soil Weight + A	31.34	32.63	33.52				23.99	24.21	
C	Dry Soil Weight + A	26.89	28.01	28.92				22.76	22.98	
D	Water Weight (B-C)	4.45	4.62	4.60				1.23	1.23	
E	Dry Soil Weight (C-A)	11.35	12.53	13.42				7.35	7.43	
F	% Moisture (D/E)*100	39.2%	36.9%	34.3%				16.7%	16.6%	
N	# OF DROPS	18	26	33				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.7%**		



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 **37**
Plastic Limit **17**
Plastic Index **20**
USCS Group Symbol **CL**

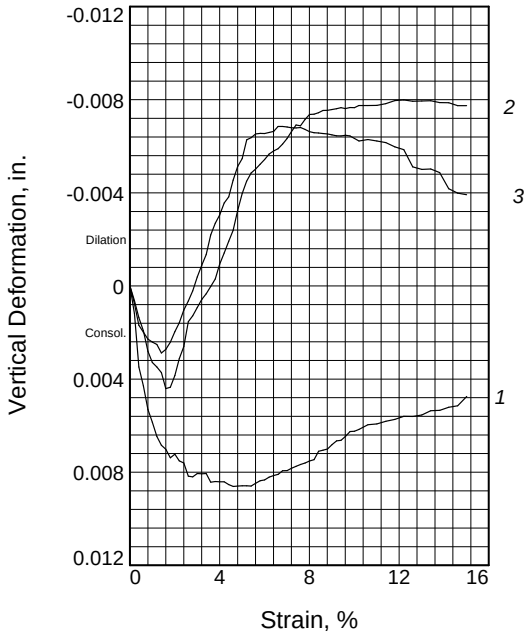
Multipoint Method ☑
One-point Method ☐

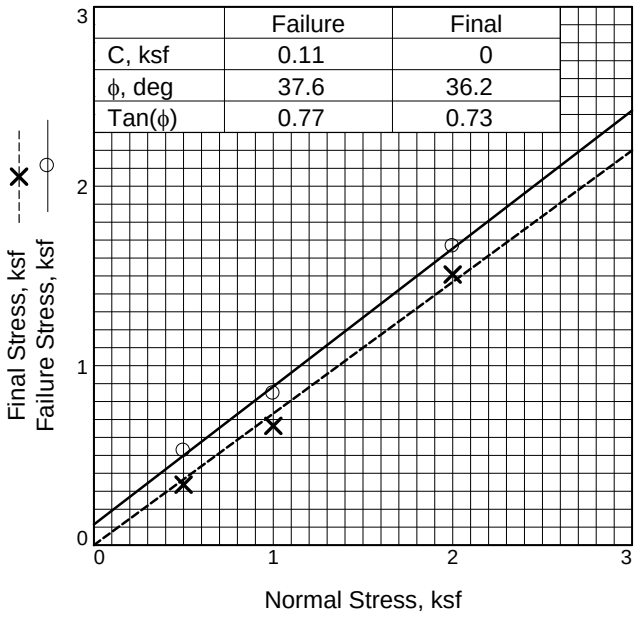
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-6**

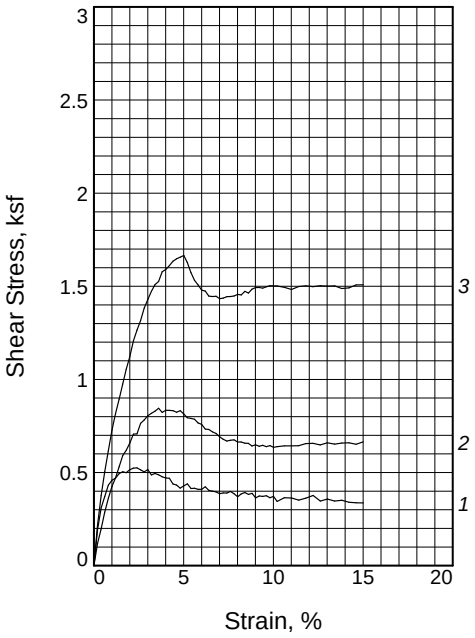
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/24/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*





	Failure	Final
C, ksf	0.11	0
ϕ, deg	37.6	36.2
Tan(ϕ)	0.77	0.73



Specimen No.		1	2	3
Initial	Water Content, %	14.3	14.8	12.6
	Dry Density, pcf	111.6	111.0	113.3
	Saturation, %	78.4	80.2	72.7
	Void Ratio	0.4830	0.4901	0.4607
	Diameter, in.	2.499	2.500	2.500
	Height, in.	1.442	1.439	1.439
At Test	Water Content, %	20.5	18.8	19.1
	Dry Density, pcf	113.6	113.3	117.4
	Diameter, in.	2.499	2.500	2.500
	Height, in.	1.415	1.410	1.389
Normal Stress, ksf		0.50	1.00	2.00
Failure Stress, ksf		0.53	0.85	1.67
Strain, %		2.4	3.6	5.0
Final Stress, ksf		0.34	0.66	1.51
Strain, %		15.0	15.0	15.0
Strain rate, %/min.		0.13	0.13	0.13

Sample Type: Intact Sample
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
LL= 36 **PL=** 17 **PI=** 19
Assumed Specific Gravity= 2.65
Remarks: ASTM D3080

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-13
Sample Number: Log 352 **Depth:** 6 - 8 ft
Proj. No.: 1461-14-046

DIRECT SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

DIRECT SHEAR TEST

12/2/2014

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-13
Depth: 6 - 8 ft **Sample Number:** Log 352
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
Remarks: ASTM D3080
Type of Sample: Intact Sample
Assumed Specific Gravity=2.65 **LL=**36 **PL=**17 **PI=**19

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	543.280		250.470
Moisture content: Dry soil+tare, gms.	476.850		209.860
Moisture content: Tare, gms.	11.890		11.890
Moisture, %	14.3	20.5	20.5
Moist specimen weight, gms.	236.70		
Diameter, in.	2.499	2.499	
Area, in.²	4.906	4.906	
Height, in.	1.442	1.415	
Net decrease in height, in.		0.026	
Wet density, pcf	127.5	136.9	
Dry density, pcf	111.6	113.6	
Void ratio	0.4830		
Saturation, %	78.4		

Test Readings for Specimen No. 1

Normal stress = 0.5 ksf
Strain rate, %/min. = 0.13
Failure Stress = 0.53 ksf **at reading no.** 12
Final Stress = 0.34 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	1.215	0.0	0.0	0.00	-1.0771
1	0.0050	7.780	6.6	0.2	0.19	-1.0783
2	0.0100	11.760	10.5	0.4	0.31	-1.0805
3	0.0150	13.856	12.6	0.6	0.37	-1.0814
4	0.0200	15.944	14.7	0.8	0.43	-1.0824
5	0.0250	16.838	15.6	1.0	0.46	-1.0829
6	0.0300	17.235	16.0	1.2	0.47	-1.0835
7	0.0350	18.060	16.8	1.4	0.49	-1.0839
8	0.0400	18.385	17.2	1.6	0.50	-1.0841
9	0.0450	18.224	17.0	1.8	0.50	-1.0844
10	0.0500	18.753	17.5	2.0	0.51	-1.0843
11	0.0550	19.044	17.8	2.2	0.52	-1.0846
12	0.0600	19.111	17.9	2.4	0.53	-1.0847
13	0.0650	18.740	17.5	2.6	0.51	-1.0852

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
14	0.0700	18.366	17.2	2.8	0.50	-1.0853
15	0.0750	18.797	17.6	3.0	0.52	-1.0851
16	0.0800	17.808	16.6	3.2	0.49	-1.0851
17	0.0850	18.090	16.9	3.4	0.50	-1.0851
18	0.0900	17.826	16.6	3.6	0.49	-1.0855
19	0.0950	17.463	16.2	3.8	0.48	-1.0855
20	0.1000	17.259	16.0	4.0	0.47	-1.0855
21	0.1050	17.200	16.0	4.2	0.47	-1.0855
22	0.1101	16.140	14.9	4.4	0.44	-1.0856
23	0.1151	15.954	14.7	4.6	0.43	-1.0857
24	0.1201	15.405	14.2	4.8	0.42	-1.0857
25	0.1251	15.802	14.6	5.0	0.43	-1.0856
26	0.1301	16.173	15.0	5.2	0.44	-1.0856
27	0.1351	15.314	14.1	5.4	0.41	-1.0857
28	0.1401	15.380	14.2	5.6	0.42	-1.0855
29	0.1451	15.176	14.0	5.8	0.41	-1.0854
30	0.1501	15.170	14.0	6.0	0.41	-1.0854
31	0.1551	15.630	14.4	6.2	0.42	-1.0853
32	0.1601	14.980	13.8	6.4	0.40	-1.0852
33	0.1651	14.846	13.6	6.6	0.40	-1.0851
34	0.1701	14.722	13.5	6.8	0.40	-1.0850
35	0.1751	14.382	13.2	7.0	0.39	-1.0850
36	0.1801	14.526	13.3	7.2	0.39	-1.0849
37	0.1851	14.488	13.3	7.4	0.39	-1.0848
38	0.1901	14.786	13.6	7.6	0.40	-1.0847
39	0.1952	14.378	13.2	7.8	0.39	-1.0847
40	0.2002	13.809	12.6	8.0	0.37	-1.0846
41	0.2052	14.335	13.1	8.2	0.39	-1.0845
42	0.2102	14.582	13.4	8.4	0.39	-1.0842
43	0.2152	14.254	13.0	8.6	0.38	-1.0841
44	0.2202	14.439	13.2	8.8	0.39	-1.0841
45	0.2252	13.627	12.4	9.0	0.36	-1.0839
46	0.2302	13.967	12.8	9.2	0.37	-1.0837
47	0.2352	13.885	12.7	9.4	0.37	-1.0837
48	0.2402	13.995	12.8	9.6	0.38	-1.0835
49	0.2452	13.630	12.4	9.8	0.36	-1.0833
50	0.2502	13.889	12.7	10.0	0.37	-1.0833
51	0.2552	12.964	11.7	10.2	0.34	-1.0832
52	0.2652	13.642	12.4	10.6	0.36	-1.0830
53	0.2752	13.602	12.4	11.0	0.36	-1.0830
54	0.2853	13.200	12.0	11.4	0.35	-1.0829
55	0.2952	13.571	12.4	11.8	0.36	-1.0828
56	0.3053	14.042	12.8	12.2	0.38	-1.0827
57	0.3153	13.031	11.8	12.6	0.35	-1.0827
58	0.3253	13.399	12.2	13.0	0.36	-1.0826
59	0.3353	13.031	11.8	13.4	0.35	-1.0824
60	0.3453	13.164	11.9	13.8	0.35	-1.0824

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
61	0.3553	12.801	11.6	14.2	0.34	-1.0823
62	0.3653	12.711	11.5	14.6	0.34	-1.0822
63	0.3753	12.686	11.5	15.0	0.34	-1.0818

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	172.780		252.840
Moisture content: Dry soil+tare, gms.	151.290		214.780
Moisture content: Tare, gms.	6.430		12.060
Moisture, %	14.8	18.8	18.8
Moist specimen weight, gms.	236.30		
Diameter, in.	2.500	2.500	
Area, in.²	4.908	4.908	
Height, in.	1.439	1.410	
Net decrease in height, in.		0.029	
Wet density, pcf	127.5	134.5	
Dry density, pcf	111.0	113.3	
Void ratio	0.4901		
Saturation, %	80.2		

Test Readings for Specimen No. 2

Normal stress = 1 ksf

Strain rate, %/min. = 0.13

Failure Stress = 0.85 ksf **at reading no.** 18

Final Stress = 0.66 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	0.000	0.0	0.0	0.00	-1.0976
1	0.0050	4.061	4.1	0.2	0.12	-1.0982
2	0.0100	6.708	6.7	0.4	0.20	-1.0989
3	0.0150	9.794	9.8	0.6	0.29	-1.0995
4	0.0200	12.300	12.3	0.8	0.36	-1.1004
5	0.0250	14.479	14.5	1.0	0.42	-1.1009
6	0.0300	16.071	16.1	1.2	0.47	-1.1010
7	0.0350	18.090	18.1	1.4	0.53	-1.1013
8	0.0400	20.136	20.1	1.6	0.59	-1.1020
9	0.0450	21.129	21.1	1.8	0.62	-1.1019
10	0.0500	22.424	22.4	2.0	0.66	-1.1014
11	0.0550	24.059	24.1	2.2	0.71	-1.1007
12	0.0600	24.115	24.1	2.4	0.71	-1.1002
13	0.0650	26.045	26.0	2.6	0.76	-1.0991
14	0.0700	26.658	26.7	2.8	0.78	-1.0988
15	0.0750	27.440	27.4	3.0	0.81	-1.0985
16	0.0800	27.881	27.9	3.2	0.82	-1.0981
17	0.0850	28.257	28.3	3.4	0.83	-1.0979
18	0.0900	28.803	28.8	3.6	0.85	-1.0976
19	0.0950	28.047	28.0	3.8	0.82	-1.0973
20	0.1000	28.434	28.4	4.0	0.83	-1.0966

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
21	0.1050	28.416	28.4	4.2	0.83	-1.0961
22	0.1100	28.354	28.4	4.4	0.83	-1.0956
23	0.1150	28.057	28.1	4.6	0.82	-1.0952
24	0.1201	28.349	28.3	4.8	0.83	-1.0943
25	0.1250	27.765	27.8	5.0	0.81	-1.0936
26	0.1300	27.059	27.1	5.2	0.79	-1.0931
27	0.1350	26.934	26.9	5.4	0.79	-1.0927
28	0.1401	26.794	26.8	5.6	0.79	-1.0925
29	0.1450	26.128	26.1	5.8	0.77	-1.0923
30	0.1501	25.846	25.8	6.0	0.76	-1.0921
31	0.1551	24.985	25.0	6.2	0.73	-1.0919
32	0.1601	24.923	24.9	6.4	0.73	-1.0918
33	0.1651	24.493	24.5	6.6	0.72	-1.0917
34	0.1701	24.188	24.2	6.8	0.71	-1.0915
35	0.1751	23.590	23.6	7.0	0.69	-1.0912
36	0.1801	23.117	23.1	7.2	0.68	-1.0909
37	0.1851	22.792	22.8	7.4	0.67	-1.0907
38	0.1901	22.945	22.9	7.6	0.67	-1.0907
39	0.1951	23.023	23.0	7.8	0.68	-1.0904
40	0.2001	22.634	22.6	8.0	0.66	-1.0902
41	0.2051	22.616	22.6	8.2	0.66	-1.0902
42	0.2101	22.411	22.4	8.4	0.66	-1.0901
43	0.2151	22.382	22.4	8.6	0.66	-1.0900
44	0.2201	21.905	21.9	8.8	0.64	-1.0900
45	0.2252	22.123	22.1	9.0	0.65	-1.0900
46	0.2302	21.837	21.8	9.2	0.64	-1.0900
47	0.2352	22.028	22.0	9.4	0.65	-1.0899
48	0.2402	21.774	21.8	9.6	0.64	-1.0899
49	0.2452	21.975	22.0	9.8	0.64	-1.0899
50	0.2502	21.656	21.7	10.0	0.64	-1.0899
51	0.2552	21.770	21.8	10.2	0.64	-1.0898
52	0.2652	21.924	21.9	10.6	0.64	-1.0898
53	0.2752	21.909	21.9	11.0	0.64	-1.0898
54	0.2852	21.933	21.9	11.4	0.64	-1.0897
55	0.2952	22.330	22.3	11.8	0.66	-1.0896
56	0.3052	22.391	22.4	12.2	0.66	-1.0896
57	0.3152	22.090	22.1	12.6	0.65	-1.0896
58	0.3252	22.478	22.5	13.0	0.66	-1.0896
59	0.3352	22.233	22.2	13.4	0.65	-1.0896
60	0.3452	22.421	22.4	13.8	0.66	-1.0897
61	0.3552	22.481	22.5	14.2	0.66	-1.0897
62	0.3652	22.219	22.2	14.6	0.65	-1.0898
63	0.3752	22.649	22.6	15.0	0.66	-1.0898

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	299.250		255.520
Moisture content: Dry soil+tare, gms.	266.460		215.740
Moisture content: Tare, gms.	6.940		6.960
Moisture, %	12.6	19.1	19.1
Moist specimen weight, gms.	236.50		
Diameter, in.	2.500	2.500	
Area, in.²	4.908	4.908	
Height, in.	1.439	1.389	
Net decrease in height, in.		0.050	
Wet density, pcf	127.6	139.7	
Dry density, pcf	113.3	117.4	
Void ratio	0.4607		
Saturation, %	72.7		

Test Readings for Specimen No. 3

Normal stress = 2 ksf

Strain rate, %/min. = 0.13

Failure Stress = 1.67 ksf **at reading no.** 25

Final Stress = 1.51 ksf **at reading no.** 63

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
0	0.0000	-0.242	0.0	0.0	0.00	-1.1101
1	0.0050	7.183	7.4	0.2	0.22	-1.1108
2	0.0100	12.556	12.8	0.4	0.38	-1.1118
3	0.0150	16.938	17.2	0.6	0.50	-1.1121
4	0.0200	20.770	21.0	0.8	0.62	-1.1124
5	0.0250	24.525	24.8	1.0	0.73	-1.1125
6	0.0300	27.572	27.8	1.2	0.82	-1.1126
7	0.0350	30.215	30.5	1.4	0.89	-1.1130
8	0.0400	33.010	33.3	1.6	0.98	-1.1128
9	0.0450	35.675	35.9	1.8	1.05	-1.1125
10	0.0500	38.007	38.2	2.0	1.12	-1.1120
11	0.0550	40.878	41.1	2.2	1.21	-1.1117
12	0.0600	42.860	43.1	2.4	1.26	-1.1111
13	0.0650	44.605	44.8	2.6	1.32	-1.1107
14	0.0700	46.884	47.1	2.8	1.38	-1.1103
15	0.0750	48.445	48.7	3.0	1.43	-1.1097
16	0.0800	49.946	50.2	3.2	1.47	-1.1092
17	0.0850	51.173	51.4	3.4	1.51	-1.1087
18	0.0900	51.751	52.0	3.6	1.53	-1.1079
19	0.0950	53.552	53.8	3.8	1.58	-1.1074
20	0.1000	53.949	54.2	4.0	1.59	-1.1070
21	0.1050	54.676	54.9	4.2	1.61	-1.1065
22	0.1100	55.483	55.7	4.4	1.64	-1.1063
23	0.1150	55.903	56.1	4.6	1.65	-1.1055
24	0.1201	56.200	56.4	4.8	1.66	-1.1049
25	0.1251	56.529	56.8	5.0	1.67	-1.1046
26	0.1301	55.258	55.5	5.2	1.63	-1.1038
27	0.1351	53.414	53.7	5.4	1.57	-1.1037

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress ksf	Vertical Def. Dial in.
28	0.1401	51.994	52.2	5.6	1.53	-1.1035
29	0.1451	51.135	51.4	5.8	1.51	-1.1035
30	0.1501	50.179	50.4	6.0	1.48	-1.1035
31	0.1551	50.007	50.2	6.2	1.47	-1.1035
32	0.1601	49.076	49.3	6.4	1.45	-1.1034
33	0.1651	49.000	49.2	6.6	1.44	-1.1032
34	0.1701	49.056	49.3	6.8	1.45	-1.1032
35	0.1751	48.623	48.9	7.0	1.43	-1.1032
36	0.1801	48.701	48.9	7.2	1.44	-1.1033
37	0.1851	48.989	49.2	7.4	1.44	-1.1033
38	0.1902	49.013	49.3	7.6	1.45	-1.1033
39	0.1951	49.096	49.3	7.8	1.45	-1.1034
40	0.2001	49.391	49.6	8.0	1.46	-1.1034
41	0.2052	49.309	49.6	8.2	1.45	-1.1035
42	0.2102	49.960	50.2	8.4	1.47	-1.1035
43	0.2152	49.639	49.9	8.6	1.46	-1.1035
44	0.2202	50.356	50.6	8.8	1.48	-1.1035
45	0.2252	50.637	50.9	9.0	1.49	-1.1036
46	0.2302	50.672	50.9	9.2	1.49	-1.1036
47	0.2352	50.537	50.8	9.4	1.49	-1.1036
48	0.2402	50.787	51.0	9.6	1.50	-1.1036
49	0.2452	50.975	51.2	9.8	1.50	-1.1036
50	0.2502	50.962	51.2	10.0	1.50	-1.1037
51	0.2552	50.929	51.2	10.2	1.50	-1.1039
52	0.2652	50.700	50.9	10.6	1.49	-1.1038
53	0.2752	50.289	50.5	11.0	1.48	-1.1039
54	0.2852	50.835	51.1	11.4	1.50	-1.1039
55	0.2952	50.954	51.2	11.8	1.50	-1.1041
56	0.3052	50.815	51.1	12.2	1.50	-1.1042
57	0.3152	50.981	51.2	12.6	1.50	-1.1050
58	0.3252	50.897	51.1	13.0	1.50	-1.1051
59	0.3353	50.962	51.2	13.4	1.50	-1.1051
60	0.3452	50.471	50.7	13.8	1.49	-1.1052
61	0.3553	50.596	50.8	14.2	1.49	-1.1059
62	0.3653	51.125	51.4	14.6	1.51	-1.1061
63	0.3753	51.150	51.4	15.0	1.51	-1.1062

Sieve Analysis of Soils

ASTM D422

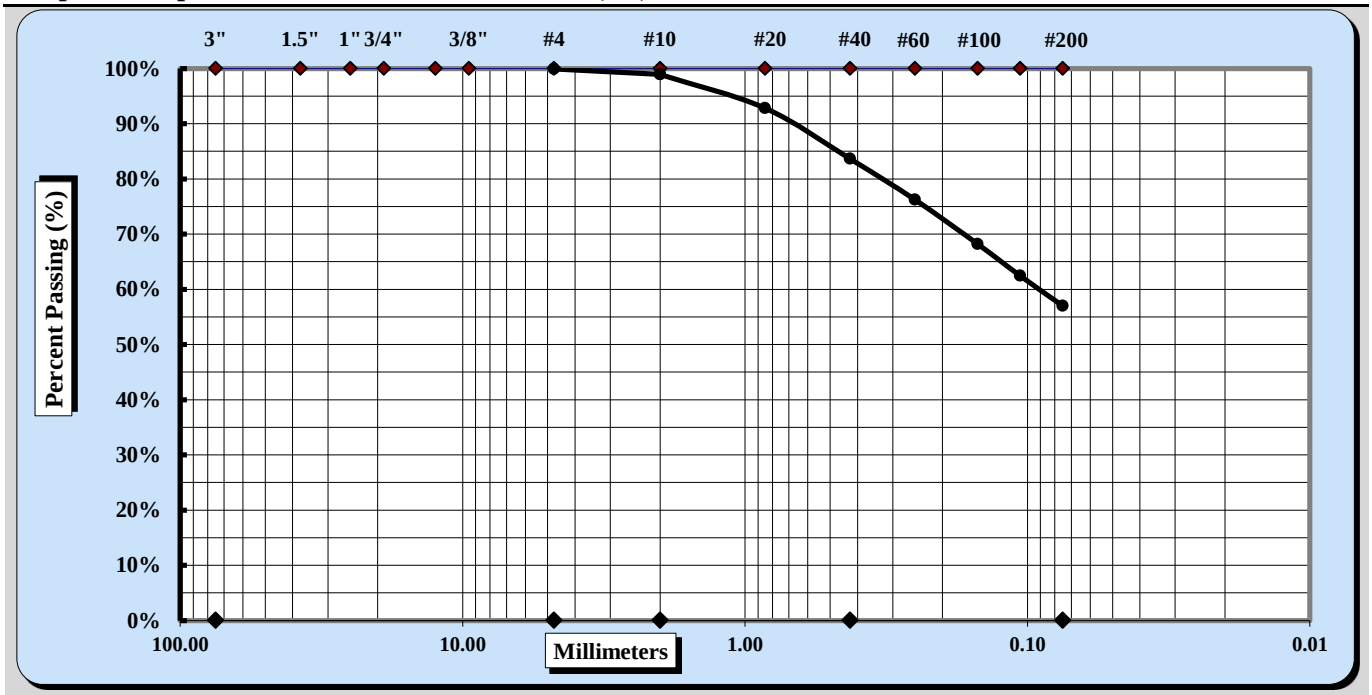
Quality Assurance

Sample Log No.:352

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/26/14-11/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Type: UD		
		Depth:	6 - 8 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.0%	Fine Sand	26.6%
Gravel	0.1%	Medium Sand	15.3%	Silt & Clay	57.0%
Liquid Limit	36	Plastic Limit	17	Plastic Index	19

Coarse Sand	1.0%	Medium Sand	15.3%	Fine Sand	26.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

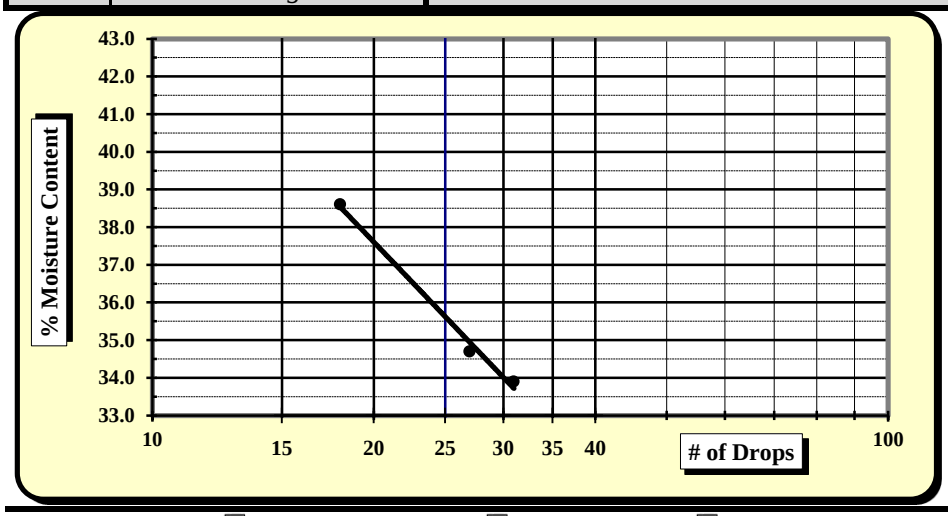
Log No.:352 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: UD		
		Depth: 6 - 8 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	18	22				2	7	
A	Tare Weight	15.52	15.50	15.47				15.61	15.48	
B	Wet Soil Weight + A	30.29	31.07	32.74				23.91	24.50	
C	Dry Soil Weight + A	26.18	27.06	28.37				22.73	23.21	
D	Water Weight (B-C)	4.11	4.01	4.37				1.18	1.29	
E	Dry Soil Weight (C-A)	10.66	11.56	12.90				7.12	7.73	
F	% Moisture (D/E)*100	38.6%	34.7%	33.9%				16.6%	16.7%	
N	# OF DROPS	18	27	31				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.7%**		



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 **36**
Plastic Limit **17**
Plastic Index **19**
USCS Group Symbol **CL**

Multipoint Method ☑
One-point Method ☐

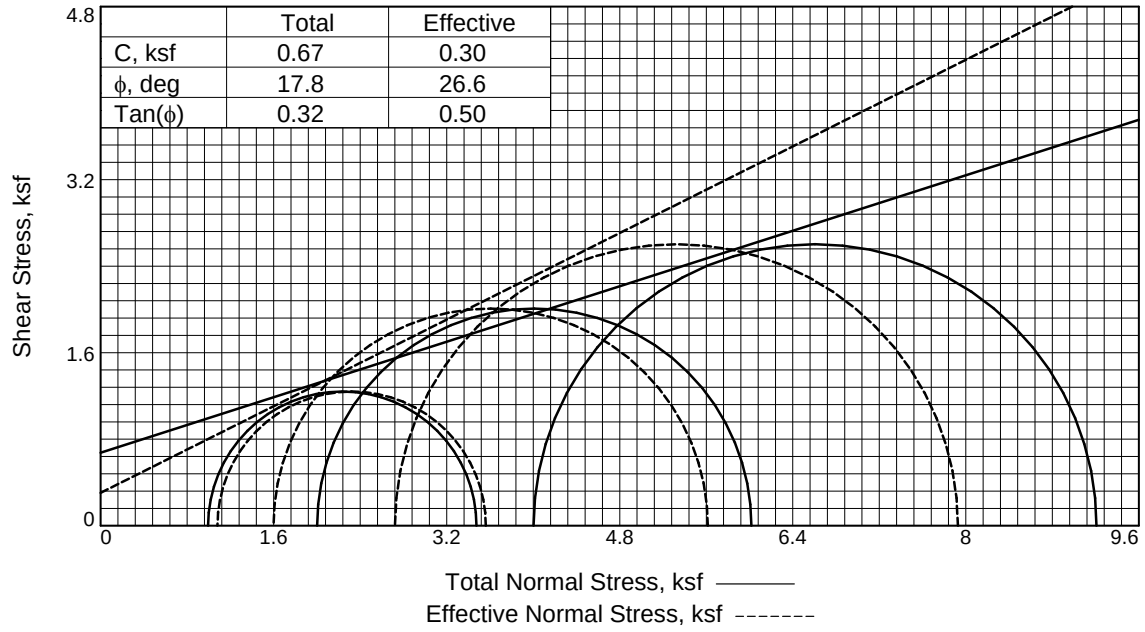
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASTHO Classification A-6**

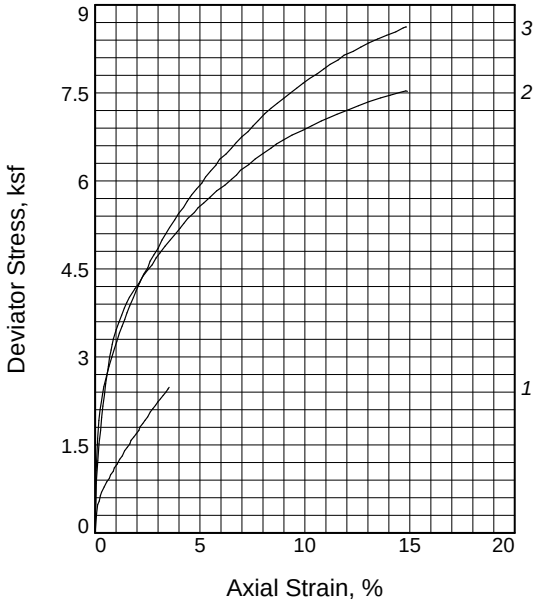
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/25/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.67	0.30
ϕ, deg	17.8	26.6
Tan(ϕ)	0.32	0.50



Sample No.		1	2	3
Initial	Water Content, %	16.2	16.2	14.9
	Dry Density, pcf	116.9	116.9	116.9
	Saturation, %	97.3	97.3	89.5
	Void Ratio	0.4523	0.4523	0.4528
	Diameter, in.	2.842	2.842	2.852
	Height, in.	5.573	5.573	5.590
At Test	Water Content, %	16.0	10.9	14.9
	Dry Density, pcf	118.4	131.0	120.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4344	0.2967	0.4048
	Diameter, in.	2.830	2.736	2.820
	Height, in.	5.550	5.369	5.528
Strain rate, %/min.		0.03	0.03	0.03
Back Pressure, psi		81.00	80.70	85.70
Cell Pressure, psi		87.90	94.60	113.50
Fail. Stress, ksf		2.48	4.02	5.21
Total Pore Pr., ksf		11.58	12.02	13.62
Ult. Stress, ksf		2.48	7.53	8.62
Total Pore Pr., ksf		11.58	9.92	11.91
$\bar{\sigma}_1$ Failure, ksf		3.56	5.61	7.93
$\bar{\sigma}_3$ Failure, ksf		1.08	1.60	2.72

Type of Test:
CU with Pore Pressures

Sample Type: Intact Specimen

Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6

LL= 34 **PL=** 19 **PI=** 15

Specific Gravity= 2.72

Remarks: The specimens failed in bulging. Multistage testing was performed on a single specimen for effective confining pressures 1 and 2 (ASTM STP 977). ASTM D4767

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

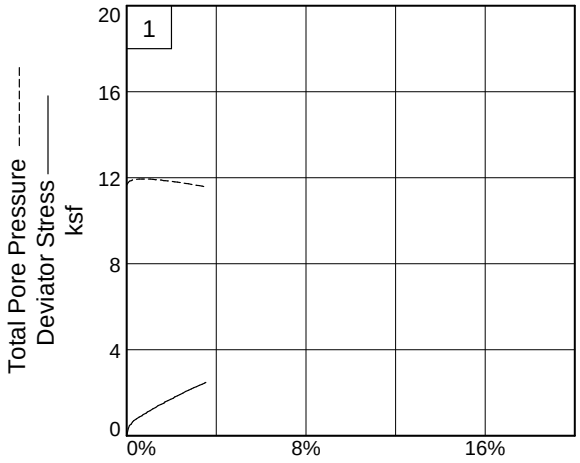
Location: B-13

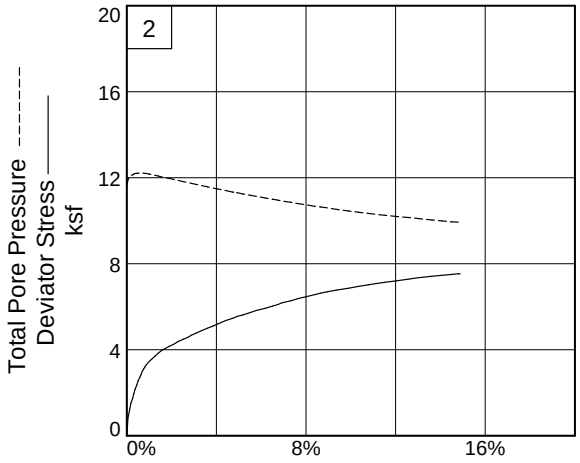
Sample Number: Log 353 **Depth:** 18.4 - 19.9 ft

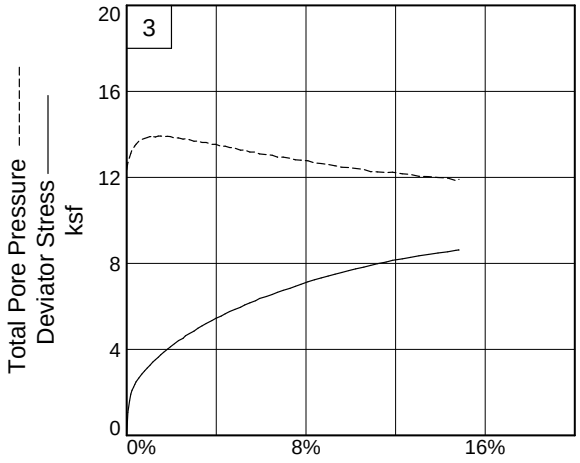
Proj. No.: 1461-14-046

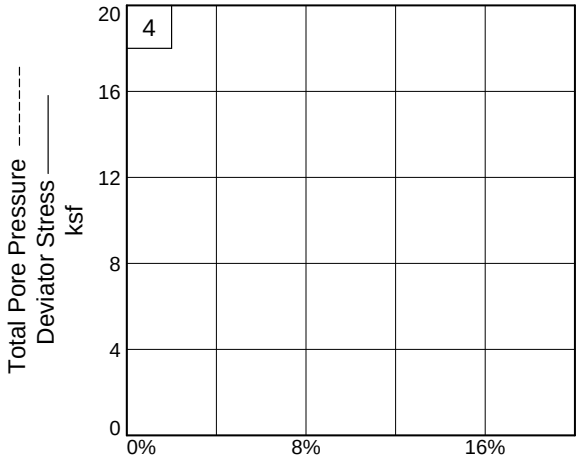
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

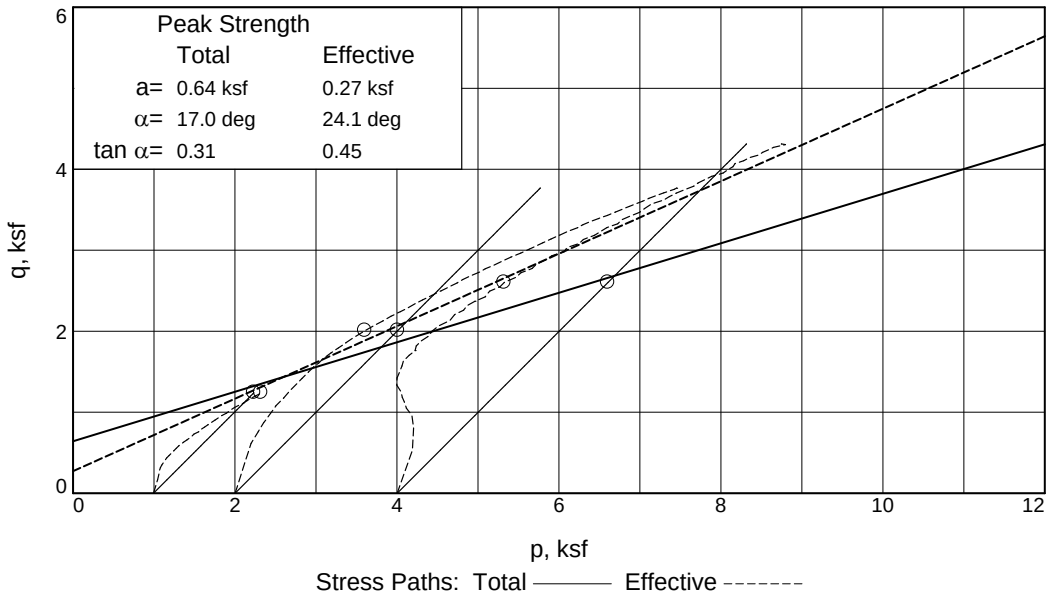
Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-13 **Depth:** 18.4 - 19.9 ft **Sample Number:** Log 353

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 2:21 PM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-13
Depth: 18.4 - 19.9 ft **Sample Number:** Log 353
Description: USCS: SANDY LEAN CLAY (CL); AASHTO: A-6
Remarks: The specimens failed in bulging. Multistage testing was performed on a single specimen for effective confining pressures 1 and 2 (ASTM STP 977). ASTM D4767
Type of Sample: Intact Specimen
Specific Gravity=2.72 **LL=**34 **PL=**19 **PI=**15
Test Method: ASTM D4767 (COE uniform strain specimen parameter calculation method)

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	116.180			117.700
Moisture content: Dry soil+tare, gms.	100.000			100.000
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	16.2	16.5	16.0	17.7
Moist specimen weight, gms.	1260.60			
Diameter, in.	2.842	2.839	2.830	
Area, in.²	6.344	6.332	6.291	
Height, in.	5.573	5.568	5.550	
Net decrease in height, in.		0.005	0.018	
Wet density, pcf	135.8	136.6	137.3	
Dry density, pcf	116.9	117.2	118.4	
Void ratio	0.4523	0.4484	0.4344	
Saturation, %	97.3	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 87.90 psi (12.66 ksf)
Consolidation back pressure = 81.00 psi (11.66 ksf)
Consolidation effective confining stress = 0.99 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 2.48 ksf **at reading no.** 34
Ult. Stress = 2.48 ksf **at reading no.** 34

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0850	33.100	0.0	0.0	0.00	0.99	0.99	1.00	81.00	0.99	0.00
1	0.0890	47.600	14.5	0.1	0.33	0.88	1.21	1.38	81.80	1.04	0.17
2	0.0920	54.200	21.1	0.1	0.48	0.82	1.30	1.59	82.20	1.06	0.24
3	0.0960	56.900	23.8	0.2	0.54	0.79	1.34	1.69	82.40	1.06	0.27
4	0.0990	60.800	27.7	0.3	0.63	0.76	1.40	1.83	82.60	1.08	0.32
5	0.1020	63.500	30.4	0.3	0.69	0.75	1.44	1.93	82.70	1.10	0.35
6	0.1090	67.500	34.4	0.4	0.78	0.73	1.52	2.07	82.80	1.13	0.39
7	0.1160	71.400	38.3	0.6	0.87	0.72	1.59	2.21	82.90	1.16	0.44
8	0.1230	74.100	41.0	0.7	0.93	0.72	1.65	2.29	82.90	1.19	0.47
9	0.1260	76.700	43.6	0.7	0.99	0.72	1.71	2.38	82.90	1.22	0.50
10	0.1330	79.400	46.3	0.9	1.05	0.72	1.77	2.46	82.90	1.25	0.53
11	0.1360	82.000	48.9	0.9	1.11	0.72	1.83	2.54	82.90	1.27	0.55
12	0.1430	84.700	51.6	1.0	1.17	0.72	1.89	2.62	82.90	1.30	0.58
13	0.1500	88.600	55.5	1.2	1.26	0.73	1.99	2.71	82.80	1.36	0.63
14	0.1570	91.300	58.2	1.3	1.31	0.75	2.06	2.76	82.70	1.41	0.66
15	0.1630	95.200	62.1	1.4	1.40	0.76	2.16	2.84	82.60	1.46	0.70
16	0.1700	97.900	64.8	1.5	1.46	0.76	2.22	2.91	82.60	1.49	0.73
17	0.1770	100.500	67.4	1.7	1.52	0.79	2.31	2.92	82.40	1.55	0.76
18	0.1800	103.200	70.1	1.7	1.58	0.79	2.37	2.99	82.40	1.58	0.79
19	0.1870	105.800	72.7	1.8	1.63	0.81	2.44	3.03	82.30	1.62	0.82
20	0.1940	108.500	75.4	2.0	1.69	0.82	2.51	3.06	82.20	1.67	0.85
21	0.2010	111.100	78.0	2.1	1.75	0.84	2.58	3.09	82.10	1.71	0.87
22	0.2040	113.800	80.7	2.1	1.81	0.85	2.66	3.13	82.00	1.75	0.90
23	0.2110	116.400	83.3	2.3	1.86	0.86	2.73	3.16	81.90	1.80	0.93
24	0.2170	119.000	85.9	2.4	1.92	0.88	2.80	3.19	81.80	1.84	0.96
25	0.2240	121.700	88.6	2.5	1.98	0.91	2.88	3.18	81.60	1.90	0.99
26	0.2310	125.700	92.6	2.6	2.06	0.92	2.99	3.24	81.50	1.95	1.03
27	0.2380	128.300	95.2	2.8	2.12	0.94	3.05	3.26	81.40	2.00	1.06
28	0.2450	131.000	97.9	2.9	2.18	0.96	3.14	3.26	81.20	2.05	1.09
29	0.2510	133.600	100.5	3.0	2.23	0.99	3.23	3.25	81.00	2.11	1.12
30	0.2580	136.200	103.1	3.1	2.29	1.01	3.29	3.27	80.90	2.15	1.14
31	0.2650	138.900	105.8	3.2	2.34	1.02	3.37	3.29	80.80	2.19	1.17
32	0.2720	141.500	108.4	3.4	2.40	1.05	3.45	3.28	80.60	2.25	1.20
33	0.2780	144.200	111.1	3.5	2.45	1.08	3.53	3.27	80.40	2.31	1.23
34	0.2810	145.500	112.4	3.5	2.48	1.08	3.56	3.30	80.40	2.32	1.24

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	116.180			491.570
Moisture content: Dry soil+tare, gms.	100.000			462.710
Moisture content: Tare, gms.	0.000			280.150
Moisture, %	16.2	16.5	10.9	15.8
Moist specimen weight, gms.	1260.60			
Diameter, in.	2.842	2.839	2.736	
Area, in.²	6.344	6.332	5.879	
Height, in.	5.573	5.568	5.369	
Net decrease in height, in.		0.005	0.199	
Wet density, pcf	135.8	136.6	145.2	
Dry density, pcf	116.9	117.2	131.0	
Void ratio	0.4523	0.4484	0.2967	
Saturation, %	97.3	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 94.60 psi (13.62 ksf)

Consolidation back pressure = 80.70 psi (11.62 ksf)

Consolidation effective confining stress = 2.00 ksf

Strain rate, %/min. = 0.03

Fail. Stress = 4.02 ksf **at reading no.** 20

Ult. Stress = 7.53 ksf **at reading no.** 62

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.2390	35.700	0.0	0.0	0.00	2.00	2.00	1.00	80.70	2.00	0.00
1	0.2420	70.100	34.4	0.1	0.84	1.71	2.56	1.49	82.70	2.13	0.42
2	0.2460	86.000	50.3	0.1	1.23	1.58	2.81	1.78	83.60	2.20	0.62
3	0.2490	97.900	62.2	0.2	1.52	1.53	3.05	2.00	84.00	2.29	0.76
4	0.2530	107.100	71.4	0.3	1.74	1.48	3.23	2.18	84.30	2.36	0.87
5	0.2560	116.400	80.7	0.3	1.97	1.45	3.42	2.35	84.50	2.44	0.99
6	0.2590	124.300	88.6	0.4	2.16	1.43	3.59	2.52	84.70	2.51	1.08
7	0.2630	132.300	96.6	0.4	2.36	1.43	3.78	2.65	84.70	2.60	1.18
8	0.2660	140.200	104.5	0.5	2.55	1.41	3.96	2.80	84.80	2.68	1.27
9	0.2700	146.800	111.1	0.6	2.71	1.41	4.12	2.92	84.80	2.76	1.35
10	0.2730	152.100	116.4	0.6	2.83	1.41	4.24	3.01	84.80	2.83	1.42
11	0.2760	158.700	123.0	0.7	2.99	1.41	4.40	3.12	84.80	2.91	1.50
12	0.2800	164.000	128.3	0.8	3.12	1.41	4.53	3.21	84.80	2.97	1.56
13	0.2830	168.000	132.3	0.8	3.21	1.43	4.64	3.25	84.70	3.03	1.61
14	0.2860	172.000	136.3	0.9	3.31	1.43	4.73	3.32	84.70	3.08	1.65
15	0.2930	178.600	142.9	1.0	3.46	1.45	4.92	3.38	84.50	3.19	1.73
16	0.3000	183.900	148.2	1.1	3.59	1.48	5.07	3.42	84.30	3.28	1.79
17	0.3070	189.200	153.5	1.3	3.71	1.51	5.22	3.46	84.10	3.37	1.86
18	0.3140	194.400	158.7	1.4	3.83	1.54	5.37	3.49	83.90	3.46	1.92
19	0.3200	198.400	162.7	1.5	3.92	1.57	5.49	3.50	83.70	3.53	1.96
20	0.3270	202.400	166.7	1.6	4.02	1.60	5.61	3.51	83.50	3.61	2.01
21	0.3410	209.000	173.3	1.9	4.16	1.66	5.82	3.51	83.10	3.74	2.08
22	0.3510	213.000	177.3	2.1	4.25	1.70	5.95	3.50	82.80	3.83	2.13
23	0.3610	218.300	182.6	2.3	4.37	1.74	6.11	3.51	82.50	3.93	2.19
24	0.3740	223.500	187.8	2.5	4.48	1.80	6.28	3.49	82.10	4.04	2.24
25	0.3850	227.500	191.8	2.7	4.57	1.84	6.41	3.48	81.80	4.13	2.29

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.3950	232.800	197.1	2.9	4.69	1.89	6.57	3.48	81.50	4.23	2.34
27	0.4050	236.800	201.1	3.1	4.77	1.93	6.70	3.47	81.20	4.32	2.39
28	0.4180	242.100	206.4	3.3	4.89	1.99	6.87	3.46	80.80	4.43	2.44
29	0.4320	247.400	211.7	3.6	5.00	2.04	7.04	3.44	80.40	4.54	2.50
30	0.4460	252.600	216.9	3.9	5.11	2.10	7.21	3.43	80.00	4.66	2.55
31	0.4560	256.600	220.9	4.0	5.19	2.15	7.34	3.42	79.70	4.74	2.60
32	0.4660	260.600	224.9	4.2	5.28	2.17	7.45	3.43	79.50	4.81	2.64
33	0.4760	264.600	228.9	4.4	5.36	2.22	7.58	3.42	79.20	4.90	2.68
34	0.4930	269.800	234.1	4.7	5.46	2.29	7.75	3.39	78.70	5.02	2.73
35	0.5030	273.800	238.1	4.9	5.55	2.32	7.86	3.39	78.50	5.09	2.77
36	0.5170	277.800	242.1	5.2	5.62	2.38	8.00	3.37	78.10	5.19	2.81
37	0.5340	283.100	247.4	5.5	5.73	2.43	8.16	3.35	77.70	5.30	2.86
38	0.5500	288.400	252.7	5.8	5.83	2.49	8.32	3.34	77.30	5.41	2.92
39	0.5710	293.700	258.0	6.2	5.93	2.56	8.49	3.31	76.80	5.53	2.96
40	0.5880	298.900	263.2	6.5	6.03	2.62	8.65	3.30	76.40	5.63	3.01
41	0.6010	302.900	267.2	6.7	6.10	2.66	8.77	3.29	76.10	5.72	3.05
42	0.6110	306.900	271.2	6.9	6.18	2.71	8.89	3.28	75.80	5.80	3.09
43	0.6320	312.200	276.5	7.3	6.28	2.76	9.04	3.27	75.40	5.90	3.14
44	0.6490	317.500	281.8	7.6	6.38	2.82	9.20	3.26	75.00	6.01	3.19
45	0.6690	322.800	287.1	8.0	6.47	2.88	9.35	3.25	74.60	6.11	3.23
46	0.6890	328.000	292.3	8.4	6.56	2.95	9.51	3.22	74.10	6.23	3.28
47	0.7030	332.000	296.3	8.6	6.63	2.98	9.61	3.22	73.90	6.30	3.32
48	0.7200	336.000	300.3	9.0	6.70	3.02	9.72	3.21	73.60	6.37	3.35
49	0.7430	341.300	305.6	9.4	6.78	3.10	9.88	3.19	73.10	6.49	3.39
50	0.7700	346.600	310.9	9.9	6.86	3.17	10.03	3.17	72.60	6.60	3.43
51	0.7940	351.900	316.2	10.3	6.94	3.23	10.17	3.15	72.20	6.70	3.47
52	0.8180	357.100	321.4	10.8	7.02	3.28	10.31	3.14	71.80	6.79	3.51
53	0.8380	361.100	325.4	11.2	7.08	3.33	10.41	3.13	71.50	6.87	3.54
54	0.8580	365.100	329.4	11.5	7.14	3.37	10.51	3.12	71.20	6.94	3.57
55	0.8860	370.400	334.7	12.1	7.21	3.43	10.64	3.10	70.80	7.03	3.60
56	0.9130	375.700	340.0	12.6	7.28	3.47	10.75	3.10	70.50	7.11	3.64
57	0.9400	381.000	345.3	13.1	7.35	3.53	10.88	3.08	70.10	7.20	3.68
58	0.9700	386.200	350.5	13.6	7.42	3.59	11.00	3.07	69.70	7.29	3.71
59	0.9940	390.200	354.5	14.1	7.46	3.63	11.09	3.06	69.40	7.36	3.73
60	1.0180	394.200	358.5	14.5	7.51	3.67	11.18	3.04	69.10	7.43	3.75
61	1.0340	396.800	361.1	14.8	7.53	3.69	11.22	3.04	69.00	7.45	3.77
62	1.0380	396.800	361.1	14.9	7.53	3.70	11.23	3.03	68.90	7.46	3.76

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	114.900			491.570
Moisture content: Dry soil+tare, gms.	100.000			462.310
Moisture content: Tare, gms.	0.000			280.150
Moisture, %	14.9	16.4	14.9	16.1
Moist specimen weight, gms.	1258.88			
Diameter, in.	2.852	2.848	2.820	
Area, in.²	6.388	6.370	6.247	
Height, in.	5.590	5.582	5.528	
Net decrease in height, in.		0.008	0.054	
Wet density, pcf	134.3	136.7	138.9	
Dry density, pcf	116.9	117.4	120.9	
Void ratio	0.4528	0.4466	0.4048	
Saturation, %	89.5	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 113.50 psi (16.34 ksf)
Consolidation back pressure = 85.70 psi (12.34 ksf)
Consolidation effective confining stress = 4.00 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 5.21 ksf **at reading no.** 28
Ult. Stress = 8.62 ksf **at reading no.** 68

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1280	41.000	0.0	0.0	0.00	4.00	4.00	1.00	85.70	4.00	0.00
1	0.1310	87.300	46.3	0.1	1.07	3.66	4.72	1.29	88.10	4.19	0.53
2	0.1350	111.100	70.1	0.1	1.61	3.40	5.01	1.47	89.90	4.21	0.81
3	0.1380	124.300	83.3	0.2	1.92	3.23	5.14	1.59	91.10	4.18	0.96
4	0.1410	132.300	91.3	0.2	2.10	3.07	5.17	1.68	92.20	4.12	1.05
5	0.1450	138.900	97.9	0.3	2.25	2.97	5.22	1.76	92.90	4.09	1.12
6	0.1480	144.200	103.2	0.4	2.37	2.88	5.25	1.82	93.50	4.07	1.19
7	0.1510	149.500	108.5	0.4	2.49	2.81	5.30	1.89	94.00	4.05	1.25
8	0.1580	157.400	116.4	0.5	2.67	2.66	5.33	2.00	95.00	4.00	1.33
9	0.1650	165.300	124.3	0.7	2.85	2.58	5.42	2.10	95.60	4.00	1.42
10	0.1720	172.000	131.0	0.8	3.00	2.53	5.53	2.18	95.90	4.03	1.50
11	0.1790	178.600	137.6	0.9	3.14	2.49	5.63	2.26	96.20	4.06	1.57
12	0.1850	183.900	142.9	1.0	3.26	2.45	5.71	2.33	96.50	4.08	1.63
13	0.1920	190.500	149.5	1.2	3.41	2.45	5.85	2.39	96.50	4.15	1.70
14	0.1990	195.800	154.8	1.3	3.52	2.46	5.99	2.43	96.40	4.22	1.76
15	0.2060	201.100	160.1	1.4	3.64	2.42	6.06	2.50	96.70	4.24	1.82
16	0.2120	206.300	165.3	1.5	3.75	2.42	6.17	2.55	96.70	4.30	1.88
17	0.2190	211.600	170.6	1.6	3.87	2.45	6.32	2.58	96.50	4.38	1.93
18	0.2290	218.300	177.3	1.8	4.01	2.43	6.45	2.65	96.60	4.44	2.01
19	0.2360	223.500	182.5	2.0	4.12	2.45	6.57	2.68	96.50	4.51	2.06
20	0.2460	230.200	189.2	2.1	4.27	2.52	6.79	2.69	96.00	4.65	2.13
21	0.2560	236.800	195.8	2.3	4.41	2.51	6.91	2.76	96.10	4.71	2.20
22	0.2670	242.100	201.1	2.5	4.52	2.56	7.08	2.76	95.70	4.82	2.26
23	0.2730	247.400	206.4	2.6	4.63	2.55	7.18	2.82	95.80	4.87	2.32
24	0.2830	252.600	211.6	2.8	4.74	2.59	7.33	2.83	95.50	4.96	2.37
25	0.2940	257.900	216.9	3.0	4.85	2.66	7.51	2.82	95.00	5.09	2.42

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
26	0.3040	264.600	223.6	3.2	4.99	2.65	7.64	2.88	95.10	5.14	2.50
27	0.3140	269.800	228.8	3.4	5.10	2.72	7.82	2.87	94.60	5.27	2.55
28	0.3240	275.100	234.1	3.5	5.21	2.72	7.93	2.91	94.60	5.32	2.60
29	0.3380	281.700	240.7	3.8	5.34	2.81	8.15	2.90	94.00	5.48	2.67
30	0.3480	287.000	246.0	4.0	5.45	2.81	8.25	2.94	94.00	5.53	2.72
31	0.3610	292.300	251.3	4.2	5.55	2.89	8.44	2.92	93.40	5.67	2.77
32	0.3710	297.600	256.6	4.4	5.66	2.89	8.55	2.95	93.40	5.72	2.83
33	0.3820	302.900	261.9	4.6	5.76	2.95	8.71	2.95	93.00	5.83	2.88
34	0.3950	308.200	267.2	4.8	5.86	2.98	8.84	2.97	92.80	5.91	2.93
35	0.4090	313.500	272.5	5.1	5.96	3.08	9.04	2.93	92.10	6.06	2.98
36	0.4190	318.800	277.8	5.3	6.07	3.07	9.13	2.98	92.20	6.10	3.03
37	0.4320	324.100	283.1	5.5	6.17	3.17	9.34	2.95	91.50	6.25	3.08
38	0.4460	329.400	288.4	5.8	6.27	3.17	9.43	2.98	91.50	6.30	3.13
39	0.4560	334.700	293.7	5.9	6.37	3.25	9.62	2.96	90.90	6.44	3.18
40	0.4730	339.900	298.9	6.2	6.46	3.28	9.74	2.97	90.70	6.51	3.23
41	0.4870	345.200	304.2	6.5	6.56	3.31	9.87	2.98	90.50	6.59	3.28
42	0.5000	350.500	309.5	6.7	6.65	3.40	10.05	2.96	89.90	6.73	3.33
43	0.5140	355.800	314.8	7.0	6.75	3.40	10.15	2.99	89.90	6.77	3.38
44	0.5310	361.100	320.1	7.3	6.84	3.46	10.30	2.98	89.50	6.88	3.42
45	0.5440	366.400	325.4	7.5	6.94	3.53	10.46	2.97	89.00	7.00	3.47
46	0.5580	371.700	330.7	7.8	7.03	3.54	10.57	2.98	88.90	7.06	3.52
47	0.5750	378.300	337.3	8.1	7.15	3.57	10.72	3.00	88.70	7.14	3.57
48	0.5910	383.600	342.6	8.4	7.24	3.67	10.91	2.97	88.00	7.29	3.62
49	0.6080	388.900	347.9	8.7	7.32	3.70	11.02	2.98	87.80	7.36	3.66
50	0.6250	394.200	353.2	9.0	7.41	3.74	11.15	2.98	87.50	7.45	3.71
51	0.6420	399.500	358.5	9.3	7.50	3.80	11.30	2.97	87.10	7.55	3.75
52	0.6590	404.800	363.8	9.6	7.58	3.87	11.45	2.96	86.60	7.66	3.79
53	0.6760	410.100	369.1	9.9	7.67	3.89	11.55	2.97	86.50	7.72	3.83
54	0.6930	415.300	374.3	10.2	7.75	3.93	11.68	2.97	86.20	7.80	3.87
55	0.7130	420.600	379.6	10.6	7.82	3.97	11.80	2.97	85.90	7.89	3.91
56	0.7300	425.900	384.9	10.9	7.91	4.08	11.98	2.94	85.20	8.03	3.95
57	0.7470	431.200	390.2	11.2	7.99	4.09	12.08	2.95	85.10	8.08	3.99
58	0.7680	436.500	395.5	11.6	8.06	4.12	12.18	2.96	84.90	8.15	4.03
59	0.7840	441.800	400.8	11.9	8.14	4.10	12.25	2.98	85.00	8.18	4.07
60	0.8080	447.100	406.1	12.3	8.21	4.18	12.39	2.97	84.50	8.28	4.11
61	0.8280	452.400	411.4	12.7	8.28	4.20	12.49	2.97	84.30	8.35	4.14
62	0.8490	457.700	416.7	13.0	8.35	4.29	12.64	2.95	83.70	8.47	4.18
63	0.8720	463.000	422.0	13.5	8.42	4.31	12.72	2.96	83.60	8.52	4.21
64	0.8960	468.300	427.3	13.9	8.48	4.35	12.83	2.95	83.30	8.59	4.24
65	0.9200	473.500	432.5	14.3	8.54	4.38	12.92	2.95	83.10	8.65	4.27
66	0.9400	478.800	437.8	14.7	8.61	4.49	13.10	2.92	82.30	8.80	4.30
67	0.9470	480.200	439.2	14.8	8.62	4.44	13.06	2.94	82.70	8.75	4.31
68	0.9480	480.200	439.2	14.8	8.62	4.44	13.06	2.94	82.70	8.75	4.31

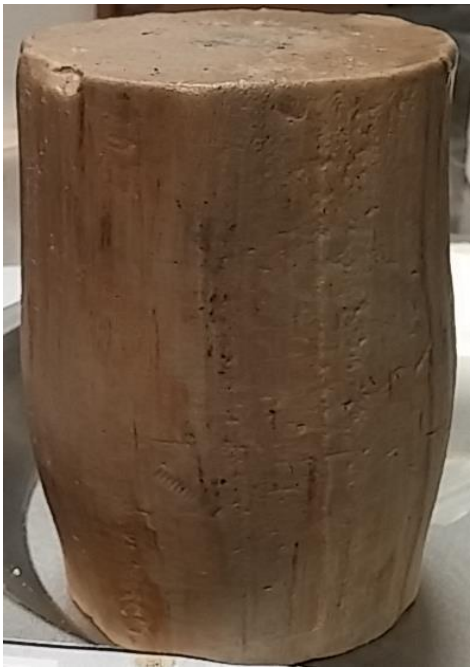
ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

Sample ID: B-13
Depth: 18.4 - 19.9 ft Log No.: 353

Failed Specimens

Specimen No.: 1 & 2 (staged)
Effective Confining Pressure: 1 & 2 ksf (staged)
Notes: The specimen failed in bulging. Specimen 3 (4 ksf) was similar in appearance and failure mode.



Sheared By: Jacob J. Folsom
Reviewed By: N. Randy Rainwater Date: 12/4/2014

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sieve Analysis of Soils

ASTM D422

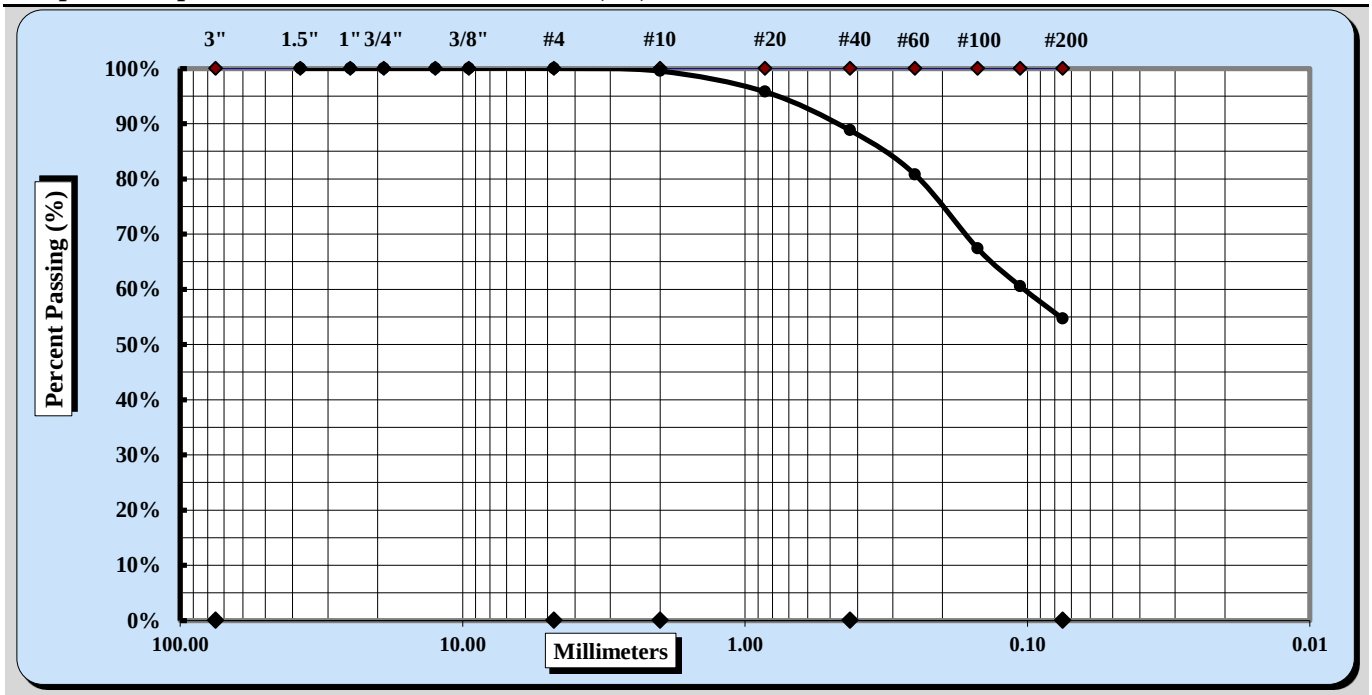
Quality Assurance

Sample Log No.:353

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Type: UD		
		Depth:	18.9 - 19.4 ft

Sample Description: SANDY LEAN CLAY (CL) **A-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.5%	Fine Sand	34.1%
Gravel	0.0%	Medium Sand	10.7%	Silt & Clay	54.7%
Liquid Limit	34	Plastic Limit	19	Plastic Index	15

Coarse Sand	0.5%	Medium Sand	10.7%	Fine Sand	34.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

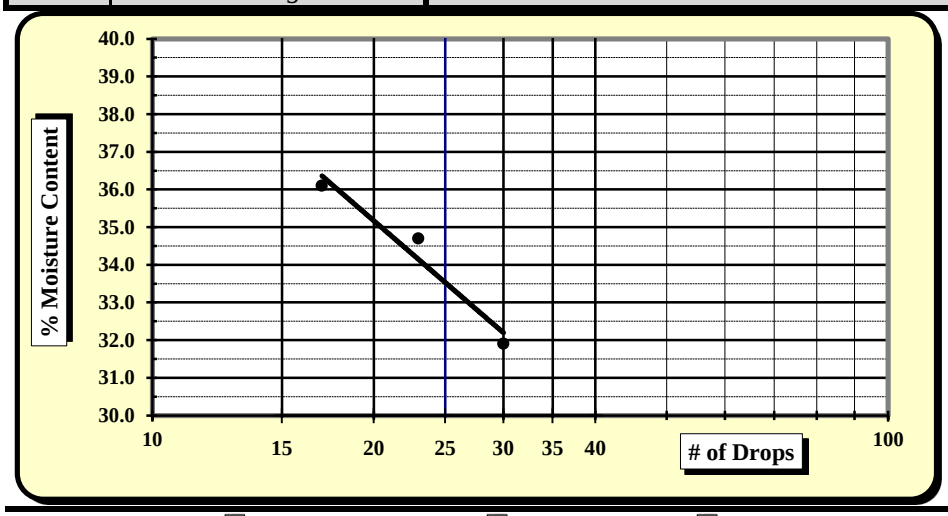
Log No.:353 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: UD		
		Depth: 18.9 - 19.4 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

	Pan # / Tare #:	Liquid Limit						Plastic Limit		
A	Tare Weight	11.49	11.14	10.84				11.32	10.75	
B	Wet Soil Weight + A	24.07	21.96	22.86				22.17	20.17	
C	Dry Soil Weight + A	21.03	19.17	19.67				20.45	18.66	
D	Water Weight (B-C)	3.04	2.79	3.19				1.72	1.51	
E	Dry Soil Weight (C-A)	9.54	8.03	8.83				9.13	7.91	
F	% Moisture (D/E)*100	31.9%	34.7%	36.1%				18.8%	19.1%	
N	# OF DROPS	30	23	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**19.0%**		



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	**34**
Plastic Limit	**19**
Plastic Index	**15**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

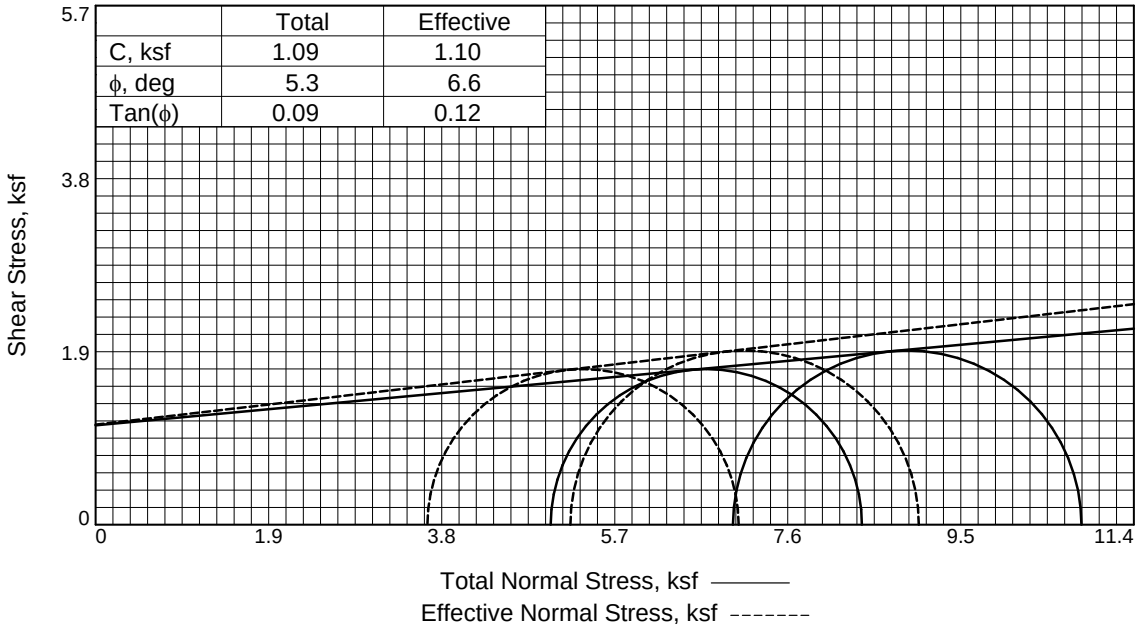
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-6**

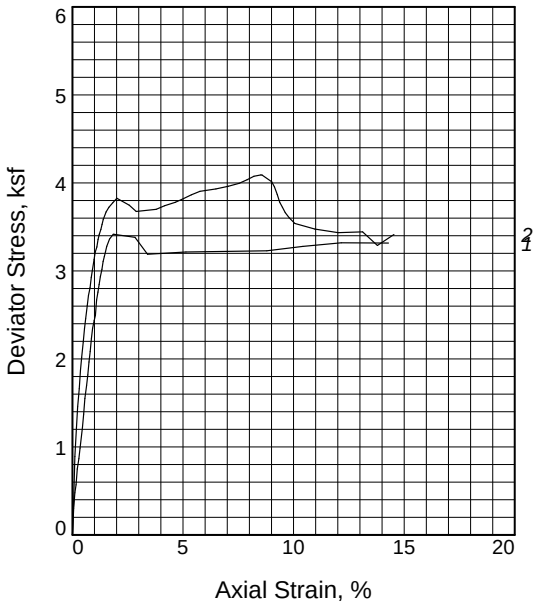
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/1/14*

Bill Adams and Stephen Yap	11/25/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	1.09	1.10
ϕ, deg	5.3	6.6
Tan(ϕ)	0.09	0.12



Sample No.		1	2
Initial	Water Content, %	27.7	30.1
	Dry Density, pcf	95.1	90.7
	Saturation, %	96.1	93.8
	Void Ratio	0.7853	0.8726
	Diameter, in.	2.821	2.840
	Height, in.	5.590	5.671
At Test	Water Content, %	28.2	30.8
	Dry Density, pcf	96.0	92.4
	Saturation, %	100.0	100.0
	Void Ratio	0.7684	0.8374
	Diameter, in.	2.838	2.852
	Height, in.	5.472	5.518
Strain rate, %/min.		0.01	0.01
Back Pressure, psi		79.90	78.40
Cell Pressure, psi		114.60	127.00
Fail. Stress, ksf		3.42	3.83
Total Pore Pr., ksf		12.86	13.08
Ult. Stress, ksf		3.32	3.41
Total Pore Pr., ksf		12.02	12.53
$\bar{\sigma}_1$ Failure, ksf		7.06	9.04
$\bar{\sigma}_3$ Failure, ksf		3.64	5.21

Type of Test:
CU with Pore Pressures

Sample Type: Intact Specimen

Description: USCS: FAT CLAY(CH); AASHTO: A-7-5

LL= 85 **PL=** 36 **PI=** 49

Specific Gravity= 2.72

Remarks: The specimens failed in shear. 30 psi effective confining pressure required to prevent swell during saturation. ASTM D4767

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

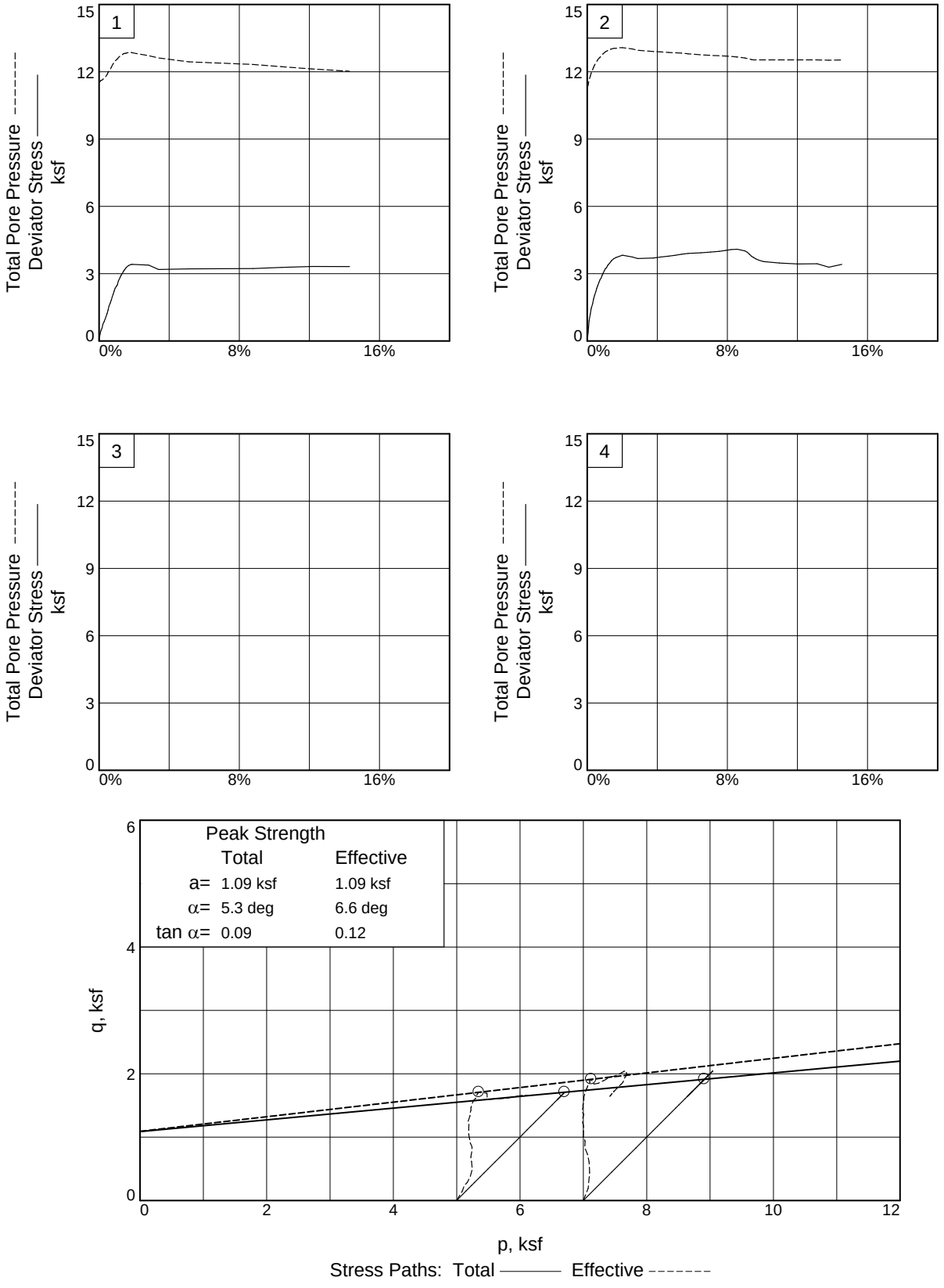
Location: B-13

Sample Number: Log 354 **Depth:** 38.8 - 40.0 ft

Proj. No.: 1461-14-046

TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14



C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-13 **Depth:** 38.8 - 40.0 ft **Sample Number:** Log 354

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 2:20 PM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-13
Depth: 38.8 - 40.0 ft **Sample Number:** Log 354
Description: USCS: FAT CLAY(CH); AASHTO: A-7-5
Remarks: The specimens failed in shear. 30 psi effective confining pressure required to prevent swell during saturation. ASTM D4767
Type of Sample: Intact Specimen
Specific Gravity=2.72 **LL=**85 **PL=**36 **PI=**49
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	127.740			128.250
Moisture content: Dry soil+tare, gms.	100.000			100.000
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	27.7	29.2	28.2	28.2
Moist specimen weight, gms.	1114.28			
Diameter, in.	2.821	2.827	2.838	
Area, in.²	6.250	6.278	6.325	
Height, in.	5.590	5.590	5.472	
Net decrease in height, in.		0.000	0.118	
Net decrease in water volume, cc.			8.000	
Wet density, pcf	121.5	122.3	123.1	
Dry density, pcf	95.1	94.7	96.0	
Void ratio	0.7853	0.7933	0.7684	
Saturation, %	96.1	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 114.60 psi (16.50 ksf)
Consolidation back pressure = 79.90 psi (11.51 ksf)
Consolidation effective confining stress = 5.00 ksf
Strain rate, %/min. = 0.01
Fail. Stress = 3.42 ksf **at reading no.** 28
Ult. Stress = 3.32 ksf **at reading no.** 36

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.4340	39.500	0.0	0.0	0.00	5.00	5.00	1.00	79.90	5.00	0.00
1	0.4370	52.700	13.2	0.1	0.30	4.94	5.24	1.06	80.30	5.09	0.15
2	0.4400	60.600	21.1	0.1	0.48	4.88	5.36	1.10	80.70	5.12	0.24
3	0.4430	64.600	25.1	0.2	0.57	4.88	5.45	1.12	80.70	5.17	0.29
4	0.4460	72.500	33.0	0.2	0.75	4.84	5.59	1.15	81.00	5.21	0.37
5	0.4500	77.700	38.2	0.3	0.87	4.80	5.66	1.18	81.30	5.23	0.43
6	0.4530	83.000	43.5	0.3	0.99	4.75	5.74	1.21	81.60	5.25	0.49
7	0.4590	93.500	54.0	0.5	1.22	4.62	5.85	1.26	82.50	5.23	0.61
8	0.4620	100.100	60.6	0.5	1.37	4.54	5.91	1.30	83.10	5.22	0.69
9	0.4650	108.000	68.5	0.6	1.55	4.46	6.01	1.35	83.60	5.24	0.78
10	0.4690	114.600	75.1	0.6	1.70	4.39	6.09	1.39	84.10	5.24	0.85
11	0.4720	119.900	80.4	0.7	1.82	4.31	6.12	1.42	84.70	5.21	0.91
12	0.4750	126.500	87.0	0.7	1.97	4.22	6.19	1.47	85.30	5.20	0.98
13	0.4780	131.800	92.3	0.8	2.08	4.15	6.23	1.50	85.80	5.19	1.04
14	0.4810	138.300	98.8	0.9	2.23	4.08	6.31	1.55	86.30	5.19	1.12
15	0.4840	143.600	104.1	0.9	2.35	4.02	6.37	1.58	86.70	5.19	1.17
16	0.4880	147.600	108.1	1.0	2.44	3.97	6.41	1.61	87.00	5.19	1.22
17	0.4910	150.200	110.7	1.0	2.49	3.93	6.43	1.63	87.30	5.18	1.25
18	0.4940	158.100	118.6	1.1	2.67	3.87	6.54	1.69	87.70	5.21	1.34
19	0.4970	162.100	122.6	1.2	2.76	3.83	6.59	1.72	88.00	5.21	1.38
20	0.5000	166.000	126.5	1.2	2.85	3.80	6.65	1.75	88.20	5.22	1.42
21	0.5030	170.000	130.5	1.3	2.93	3.76	6.69	1.78	88.50	5.23	1.47
22	0.5070	173.900	134.4	1.3	3.02	3.73	6.75	1.81	88.70	5.24	1.51
23	0.5100	177.900	138.4	1.4	3.11	3.70	6.81	1.84	88.90	5.25	1.55
24	0.5130	180.500	141.0	1.4	3.16	3.69	6.85	1.86	89.00	5.27	1.58
25	0.5160	183.100	143.6	1.5	3.22	3.69	6.91	1.87	89.00	5.30	1.61
26	0.5190	185.800	146.3	1.6	3.28	3.67	6.95	1.89	89.10	5.31	1.64
27	0.5260	189.700	150.2	1.7	3.36	3.64	7.01	1.92	89.30	5.32	1.68
28	0.5350	192.400	152.9	1.8	3.42	3.64	7.06	1.94	89.30	5.35	1.71
29	0.5380	192.400	152.9	1.9	3.42	3.66	7.07	1.93	89.20	5.37	1.71
30	0.5890	192.400	152.9	2.8	3.38	3.79	7.17	1.89	88.30	5.48	1.69
31	0.6200	184.500	145.0	3.4	3.19	3.89	7.08	1.82	87.60	5.48	1.59
32	0.7150	188.400	148.9	5.1	3.22	4.06	7.28	1.79	86.40	5.67	1.61
33	0.9150	195.000	155.5	8.8	3.23	4.18	7.41	1.77	85.60	5.79	1.61
34	1.0040	200.300	160.8	10.4	3.28	4.28	7.56	1.77	84.90	5.92	1.64
35	1.0990	205.500	166.0	12.2	3.32	4.38	7.70	1.76	84.20	6.04	1.66
36	1.2160	209.500	170.0	14.3	3.32	4.48	7.80	1.74	83.50	6.14	1.66

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	130.090			201.130
Moisture content: Dry soil+tare, gms.	100.000			160.090
Moisture content: Tare, gms.	0.000			26.780
Moisture, %	30.1	33.1	30.8	30.8
Moist specimen weight, gms.	1112.38			
Diameter, in.	2.840	2.861	2.852	
Area, in.²	6.335	6.431	6.388	
Height, in.	5.671	5.671	5.518	
Net decrease in height, in.		0.000	0.153	
Net decrease in water volume, cc.			20.000	
Wet density, pcf	118.0	118.9	120.9	
Dry density, pcf	90.7	89.3	92.4	
Void ratio	0.8726	0.9010	0.8374	
Saturation, %	93.8	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 127.00 psi (18.29 ksf)
Consolidation back pressure = 78.40 psi (11.29 ksf)
Consolidation effective confining stress = 7.00 ksf
Strain rate, %/min. = 0.01
Fail. Stress = 3.83 ksf **at reading no.** 27
Ult. Stress = 3.41 ksf **at reading no.** 55

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1650	43.700	0.0	0.0	0.00	7.00	7.00	1.00	78.40	7.00	0.00
1	0.1680	60.800	17.1	0.1	0.39	6.88	7.27	1.06	79.20	7.08	0.19
2	0.1710	83.300	39.6	0.1	0.89	6.65	7.54	1.13	80.80	7.10	0.45
3	0.1750	97.900	54.2	0.2	1.22	6.48	7.70	1.19	82.00	7.09	0.61
4	0.1780	108.500	64.8	0.2	1.46	6.34	7.79	1.23	83.00	7.06	0.73
5	0.1820	117.700	74.0	0.3	1.66	6.19	7.86	1.27	84.00	7.02	0.83
6	0.1850	127.000	83.3	0.4	1.87	6.09	7.96	1.31	84.70	7.03	0.94
7	0.1880	133.600	89.9	0.4	2.02	5.99	8.01	1.34	85.40	7.00	1.01
8	0.1920	141.500	97.8	0.5	2.19	5.90	8.10	1.37	86.00	7.00	1.10
9	0.1950	148.100	104.4	0.5	2.34	5.83	8.17	1.40	86.50	7.00	1.17
10	0.1980	153.400	109.7	0.6	2.46	5.76	8.22	1.43	87.00	6.99	1.23
11	0.2020	160.100	116.4	0.7	2.61	5.69	8.29	1.46	87.50	6.99	1.30
12	0.2050	165.300	121.6	0.7	2.72	5.64	8.37	1.48	87.80	7.01	1.36
13	0.2090	169.300	125.6	0.8	2.81	5.57	8.38	1.50	88.30	6.98	1.40
14	0.2120	174.600	130.9	0.9	2.93	5.53	8.46	1.53	88.60	6.99	1.46
15	0.2150	178.600	134.9	0.9	3.01	5.49	8.50	1.55	88.90	6.99	1.51
16	0.2190	183.900	140.2	1.0	3.13	5.44	8.57	1.57	89.20	7.01	1.56
17	0.2220	187.800	144.1	1.0	3.21	5.40	8.61	1.60	89.50	7.01	1.61
18	0.2260	190.500	146.8	1.1	3.27	5.37	8.64	1.61	89.70	7.01	1.64
19	0.2290	194.400	150.7	1.2	3.36	5.34	8.70	1.63	89.90	7.02	1.68
20	0.2320	197.100	153.4	1.2	3.42	5.33	8.74	1.64	90.00	7.04	1.71
21	0.2360	199.700	156.0	1.3	3.47	5.30	8.77	1.66	90.20	7.03	1.74
22	0.2390	202.400	158.7	1.3	3.53	5.28	8.81	1.67	90.30	7.05	1.76
23	0.2420	205.000	161.3	1.4	3.59	5.27	8.86	1.68	90.40	7.06	1.79
24	0.2490	209.000	165.3	1.5	3.67	5.24	8.91	1.70	90.60	7.08	1.83

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.2560	211.600	167.9	1.6	3.72	5.24	8.96	1.71	90.60	7.10	1.86
26	0.2660	214.300	170.6	1.8	3.78	5.21	8.99	1.72	90.80	7.10	1.89
27	0.2760	216.900	173.2	2.0	3.83	5.21	9.04	1.73	90.80	7.13	1.91
28	0.3070	214.300	170.6	2.6	3.75	5.27	9.02	1.71	90.40	7.14	1.87
29	0.3240	211.600	167.9	2.9	3.68	5.33	9.00	1.69	90.00	7.17	1.84
30	0.3740	214.300	170.6	3.8	3.70	5.39	9.09	1.69	89.60	7.24	1.85
31	0.3950	216.900	173.2	4.2	3.74	5.40	9.14	1.69	89.50	7.27	1.87
32	0.4220	219.600	175.9	4.7	3.78	5.43	9.21	1.70	89.30	7.32	1.89
33	0.4420	222.200	178.5	5.0	3.82	5.44	9.27	1.70	89.20	7.35	1.91
34	0.4620	224.900	181.2	5.4	3.86	5.46	9.32	1.71	89.10	7.39	1.93
35	0.4830	227.500	183.8	5.8	3.90	5.49	9.39	1.71	88.90	7.44	1.95
36	0.5230	230.200	186.5	6.5	3.93	5.53	9.46	1.71	88.60	7.50	1.97
37	0.5540	232.800	189.1	7.0	3.96	5.56	9.52	1.71	88.40	7.54	1.98
38	0.5810	235.400	191.7	7.5	4.00	5.57	9.57	1.72	88.30	7.57	2.00
39	0.6010	238.100	194.4	7.9	4.04	5.59	9.62	1.72	88.20	7.61	2.02
40	0.6180	240.700	197.0	8.2	4.08	5.60	9.68	1.73	88.10	7.64	2.04
41	0.6350	242.100	198.4	8.5	4.09	5.63	9.72	1.73	87.90	7.68	2.05
42	0.6380	242.100	198.4	8.6	4.09	5.63	9.72	1.73	87.90	7.67	2.04
43	0.6620	239.400	195.7	9.0	4.01	5.67	9.69	1.71	87.60	7.68	2.01
44	0.6690	236.800	193.1	9.1	3.96	5.70	9.66	1.69	87.40	7.68	1.98
45	0.6760	232.800	189.1	9.3	3.87	5.72	9.58	1.68	87.30	7.65	1.93
46	0.6820	228.800	185.1	9.4	3.78	5.75	9.53	1.66	87.10	7.64	1.89
47	0.6890	226.200	182.5	9.5	3.72	5.76	9.48	1.65	87.00	7.62	1.86
48	0.6960	223.500	179.8	9.6	3.66	5.76	9.42	1.64	87.00	7.59	1.83
49	0.7060	220.900	177.2	9.8	3.60	5.76	9.36	1.63	87.00	7.56	1.80
50	0.7200	218.300	174.6	10.1	3.54	5.76	9.30	1.61	87.00	7.53	1.77
51	0.7700	216.900	173.2	11.0	3.48	5.76	9.24	1.60	87.00	7.50	1.74
52	0.8280	216.900	173.2	12.0	3.44	5.76	9.20	1.60	87.00	7.48	1.72
53	0.8890	219.600	175.9	13.1	3.45	5.76	9.21	1.60	87.00	7.48	1.72
54	0.9260	213.000	169.3	13.8	3.29	5.77	9.06	1.57	86.90	7.42	1.65
55	0.9670	220.900	177.2	14.5	3.41	5.76	9.17	1.59	87.00	7.47	1.71

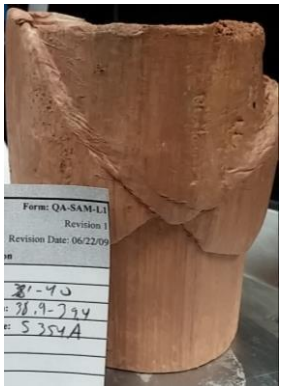
ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

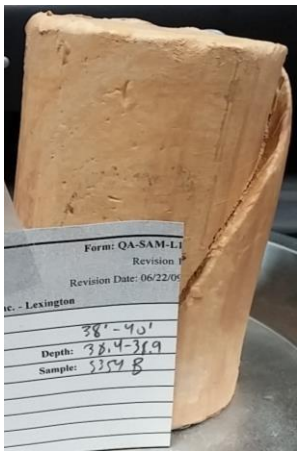
Sample ID: B-13
Depth: 38.8 - 40.0 ft Log No.: 354

Failed Specimens

Specimen No.: 1
Effective Confining Pressure: 5 ksf
Notes: Specimen failed in shear



Specimen No.: 2
Effective Confining Pressure: 7 ksf
Notes: Specimen failed in shear



Sheared By: Jacob J. Folsom
Reviewed By: N. Randy Rainwater Date: 12/4/2014

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:354

Sieve Analysis of Soils

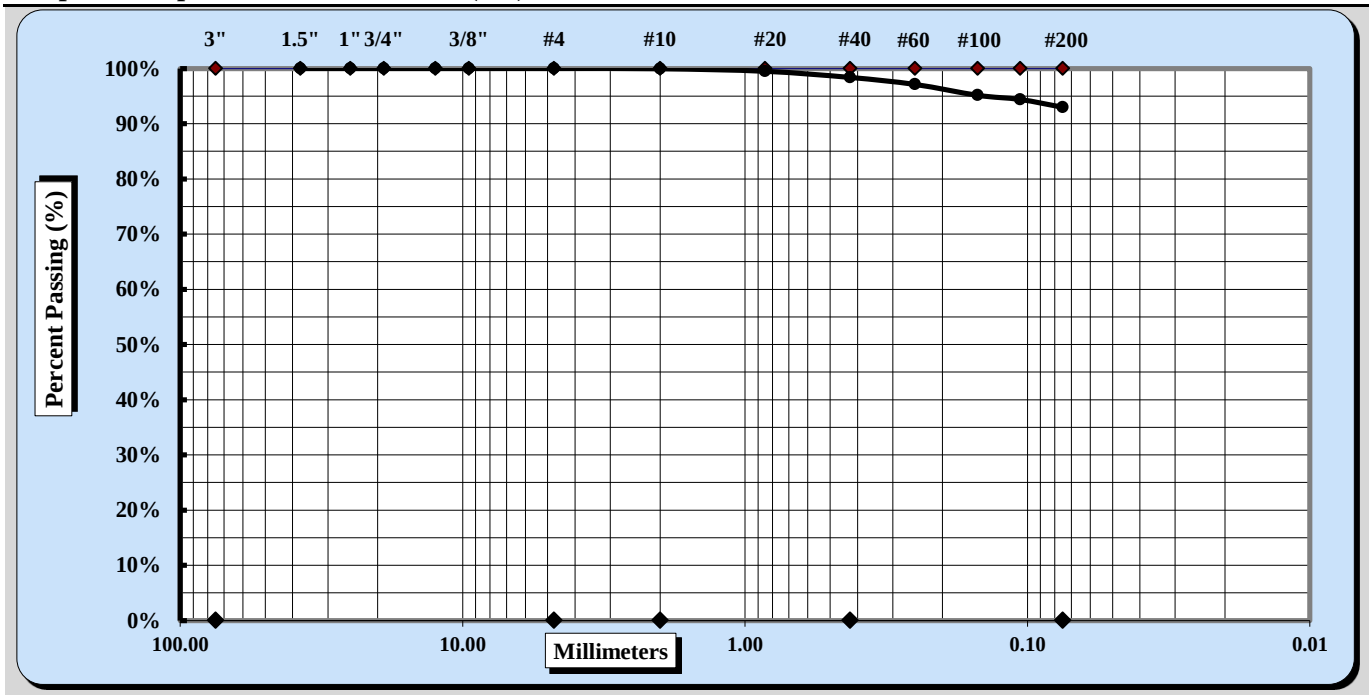
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Type: UD	Depth:	38.8 - 40 ft

Sample Description: FAT CLAY (CH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 20	Coarse Sand	0.0%	Fine Sand	5.4%
Gravel	0.0%	Medium Sand	1.6%	Silt & Clay	93.0%
Liquid Limit	85	Plastic Limit	36	Plastic Index	49

Coarse Sand	0.0%	Medium Sand	1.6%	Fine Sand	5.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

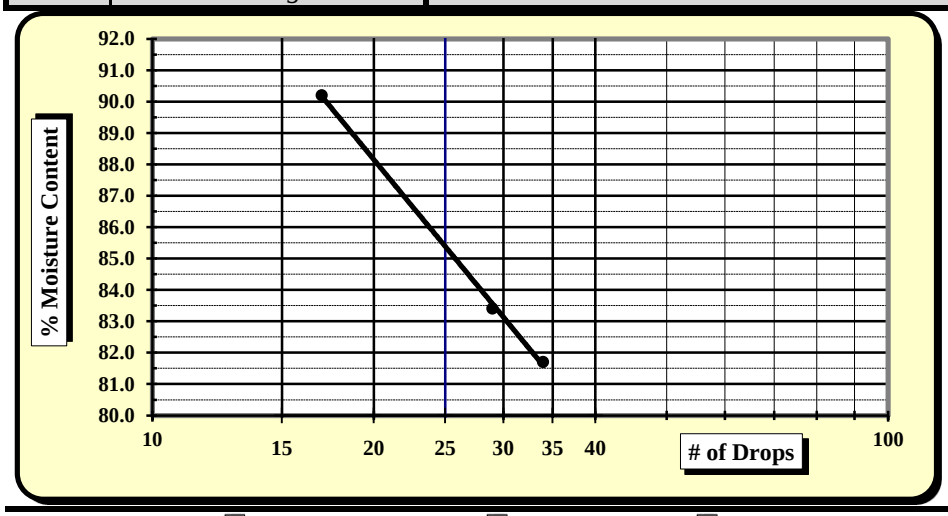
Log No.:354 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40405

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-13	Sample No: UD		
		Depth: 38.8 - 40 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	23954	10/7/2014	Grooving tool	11/7/2014	11/7/2014
LL Apparatus	24422	9/18/2014	No. 40 Sieve	24411	7/6/2014
Oven	23974	9/5/2014			

Pan # / Tare #:		Liquid Limit						Plastic Limit		
A	Tare Weight	10.64	10.76	10.78				11.15	10.63	
B	Wet Soil Weight + A	20.36	21.56	19.93				20.89	18.27	
C	Dry Soil Weight + A	15.99	16.65	15.59				18.33	16.27	
D	Water Weight (B-C)	4.37	4.91	4.34				2.56	2.00	
E	Dry Soil Weight (C-A)	5.35	5.89	4.81				7.18	5.64	
F	% Moisture (D/E)*100	81.7%	83.4%	90.2%				35.7%	35.5%	
N	# OF DROPS	34	29	17				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**35.6%**		



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	**85**
Plastic Limit	**36**
Plastic Index	**49**
USCS Group Symbol	**CH**

Multipoint Method ☑
One-point Method ☐

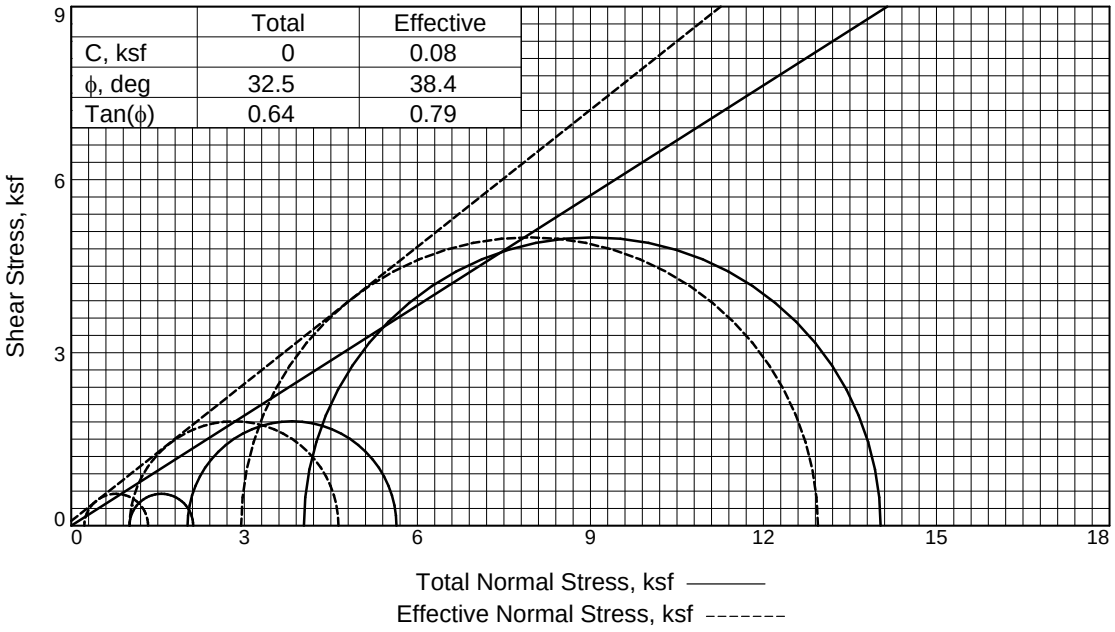
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ ***USCS Group Symbol is for minus No. 40 portion***

Notes / Deviations / References: **AASHTO Classification A-7-5**

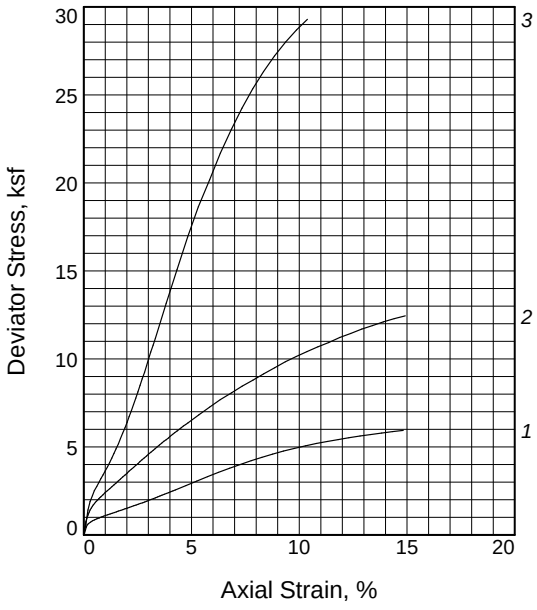
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils *Reviewed by N. Randy Rainwater 12/1/14*

Bill Adams and Stephen Yap	11/25/2014	Jacob Folsom	11/26/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0	0.08
ϕ, deg	32.5	38.4
Tan(ϕ)	0.64	0.79



Specimen No.		1	2	3
Initial	Water Content, %	12.5	12.6	10.9
	Dry Density, pcf	120.4	119.9	121.2
	Saturation, %	88.3	87.6	79.3
	Void Ratio	0.3740	0.3800	0.3648
	Diameter, in.	2.856	2.857	2.862
	Height, in.	5.739	5.738	5.748
At Test	Water Content, %	14.3	13.3	12.3
	Dry Density, pcf	120.0	122.4	124.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3783	0.3518	0.3256
	Diameter, in.	2.868	2.836	2.840
	Height, in.	5.709	5.706	5.670
Strain rate, %/min.		0.09	0.09	0.09
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		67.00	74.00	88.00
Fail. Stress, ksf		1.1	3.6	10.0
Total Pore Pr., ksf		9.4	9.6	9.7
Ult. Stress, ksf		5.9	12.4	29.3
Total Pore Pr., ksf		7.4	6.3	2.7
$\bar{\sigma}_1$ Failure, ksf		1.3	4.6	12.9
$\bar{\sigma}_3$ Failure, ksf		0.2	1.0	2.9

Type of Test:
CU with Pore Pressures
Sample Type: Intact Sample
Description: USCS: CLAYEY SAND (SC); AASHTO: A-2-6
LL= 30 **PL=** 16 **PI=** 14
Specific Gravity= 2.65
Remarks: The specimens failed in bulging. ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

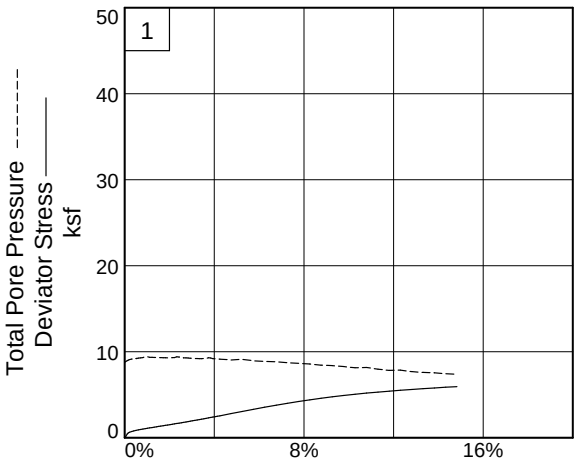
Location: B-14

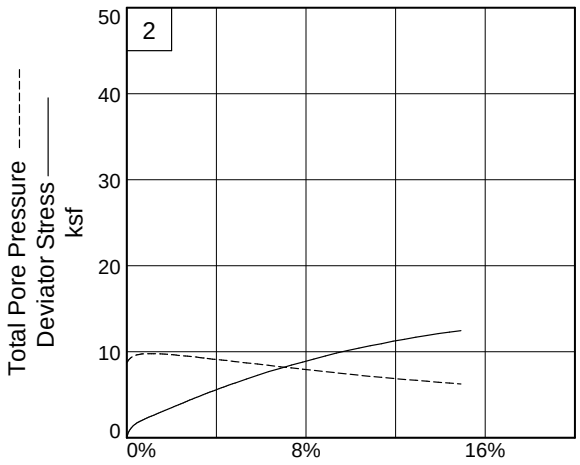
Sample Number: Log 355 **Depth:** 23 - 25 ft

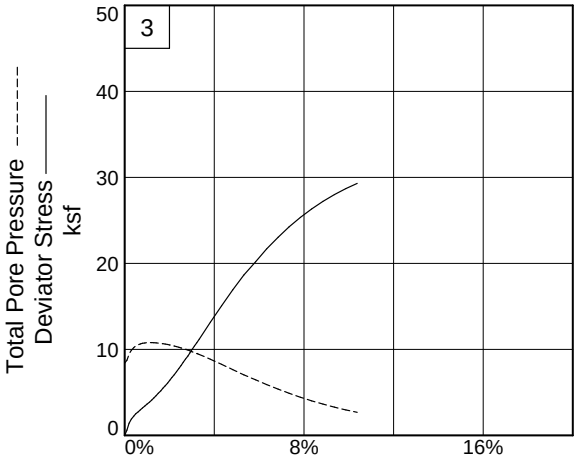
Proj. No.: 1461-14-046

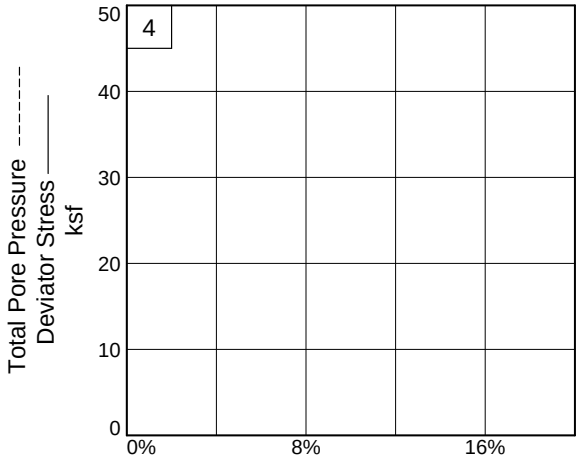
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

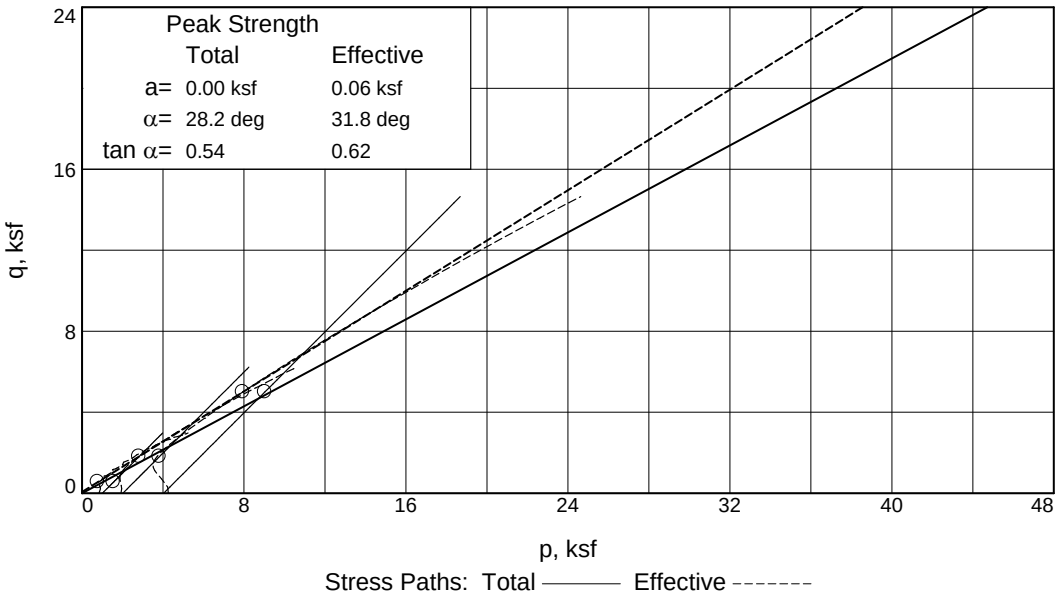
Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14











C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-14 **Depth:** 23 - 25 ft **Sample Number:** Log 355

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:21 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-14
Depth: 23 - 25 ft **Sample Number:** Log 355
Description: USCS: CLAYEY SAND (SC); AASHTO: A-2-6
Remarks: The specimens failed in bulging. ASTM D4767.
Type of Sample: Intact Sample
Specific Gravity=2.65 **LL=**30 **PL=**16 **PI=**14
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	60.550			1335.300
Moisture content: Dry soil+tare, gms.	54.550			1170.720
Moisture content: Tare, gms.	6.420			17.980
Moisture, %	12.5	14.7	14.3	14.3
Moist specimen weight, gms.	1306.60			
Diameter, in.	2.856	2.876	2.868	
Area, in.²	6.405	6.495	6.459	
Height, in.	5.739	5.721	5.709	
Net decrease in height, in.		0.018	0.012	
Net decrease in water volume, cc.			4.600	
Wet density, pcf	135.4	136.6	137.2	
Dry density, pcf	120.4	119.1	120.0	
Void ratio	0.3740	0.3888	0.3783	
Saturation, %	88.3	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 67.00 psi (9.65 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.09
Fail. Stress = 1.11 ksf **at reading no.** 12
Ult. Stress = 5.94 ksf **at reading no.** 65

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	2.584	0.0	0.0	0.00	0.84	0.84	1.00	61.18	0.84	0.00
1	0.0022	7.531	4.9	0.0	0.11	0.80	0.91	1.14	61.42	0.86	0.06
2	0.0064	22.189	19.6	0.1	0.44	0.69	1.13	1.63	62.21	0.91	0.22
3	0.0091	27.964	25.4	0.2	0.56	0.62	1.18	1.92	62.72	0.90	0.28
4	0.0122	31.265	28.7	0.2	0.64	0.56	1.20	2.13	63.08	0.88	0.32
5	0.0181	35.513	32.9	0.3	0.73	0.50	1.23	2.46	63.51	0.87	0.37
6	0.0230	38.792	36.2	0.4	0.80	0.46	1.26	2.75	63.81	0.86	0.40
7	0.0289	41.457	38.9	0.5	0.86	0.44	1.30	2.98	63.98	0.87	0.43
8	0.0349	44.007	41.4	0.6	0.92	0.39	1.31	3.36	64.30	0.85	0.46
9	0.0408	46.253	43.7	0.7	0.97	0.35	1.32	3.76	64.57	0.83	0.48
10	0.0463	48.451	45.9	0.8	1.01	0.32	1.33	4.17	64.78	0.83	0.51
11	0.0521	50.701	48.1	0.9	1.06	0.22	1.28	5.83	65.47	0.75	0.53
12	0.0579	52.670	50.1	1.0	1.11	0.23	1.33	5.91	65.44	0.78	0.55
13	0.0635	54.612	52.0	1.1	1.15	0.29	1.44	4.92	64.97	0.87	0.57
14	0.0696	56.589	54.0	1.2	1.19	0.30	1.49	4.98	64.92	0.89	0.59
15	0.0751	58.639	56.1	1.3	1.23	0.30	1.54	5.05	64.88	0.92	0.62
16	0.0813	60.662	58.1	1.4	1.28	0.31	1.59	5.11	64.84	0.95	0.64
17	0.0867	62.528	59.9	1.5	1.32	0.32	1.64	5.08	64.76	0.98	0.66
18	0.0918	64.441	61.9	1.6	1.36	0.33	1.68	5.15	64.73	1.01	0.68
19	0.0980	66.345	63.8	1.7	1.40	0.34	1.74	5.10	64.63	1.04	0.70
20	0.1039	68.448	65.9	1.8	1.44	0.35	1.79	5.13	64.58	1.07	0.72
21	0.1094	70.441	67.9	1.9	1.48	0.36	1.85	5.10	64.49	1.10	0.74
22	0.1154	72.389	69.8	2.0	1.52	0.34	1.87	5.43	64.61	1.11	0.76
23	0.1214	74.533	71.9	2.1	1.57	0.33	1.90	5.77	64.71	1.11	0.78
24	0.1268	76.574	74.0	2.2	1.61	0.32	1.93	6.05	64.78	1.13	0.81
25	0.1327	78.813	76.2	2.3	1.66	0.23	1.89	8.06	65.37	1.06	0.83
26	0.1385	80.760	78.2	2.4	1.70	0.26	1.96	7.63	65.22	1.11	0.85
27	0.1443	82.867	80.3	2.5	1.74	0.33	2.08	6.21	64.67	1.21	0.87
28	0.1499	84.930	82.3	2.6	1.79	0.35	2.14	6.11	64.57	1.24	0.89
29	0.1562	87.047	84.5	2.7	1.83	0.36	2.20	6.03	64.47	1.28	0.92
30	0.1615	89.252	86.7	2.8	1.88	0.38	2.25	5.98	64.38	1.32	0.94
31	0.1671	91.402	88.8	2.9	1.92	0.40	2.32	5.84	64.24	1.36	0.96
32	0.1723	93.659	91.1	3.0	1.97	0.41	2.38	5.83	64.17	1.39	0.98
33	0.1787	95.891	93.3	3.1	2.02	0.43	2.44	5.72	64.03	1.43	1.01
34	0.1847	98.268	95.7	3.2	2.06	0.44	2.51	5.68	63.94	1.47	1.03
35	0.1900	100.590	98.0	3.3	2.11	0.46	2.57	5.62	63.82	1.51	1.06
36	0.1960	102.944	100.4	3.4	2.16	0.44	2.61	5.86	63.91	1.52	1.08
37	0.2017	105.423	102.8	3.5	2.21	0.43	2.64	6.11	63.99	1.54	1.11
38	0.2071	107.651	105.1	3.6	2.26	0.43	2.69	6.28	64.03	1.56	1.13
39	0.2135	110.359	107.8	3.7	2.31	0.35	2.66	7.64	64.58	1.50	1.16
40	0.2192	112.590	110.0	3.8	2.36	0.37	2.73	7.34	64.42	1.55	1.18
41	0.2248	114.951	112.4	3.9	2.41	0.45	2.86	6.30	63.85	1.66	1.20
42	0.2305	117.411	114.8	4.0	2.46	0.47	2.93	6.20	63.72	1.70	1.23
43	0.2361	119.746	117.2	4.1	2.50	0.49	2.99	6.10	63.59	1.74	1.25
44	0.2425	122.291	119.7	4.2	2.56	0.51	3.06	6.05	63.49	1.78	1.28
45	0.2708	134.630	132.0	4.7	2.80	0.60	3.40	5.69	62.84	2.00	1.40
46	0.2995	147.550	145.0	5.2	3.06	0.53	3.59	6.80	63.33	2.06	1.53

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.3281	160.172	157.6	5.7	3.31	0.70	4.01	5.75	62.16	2.35	1.66
48	0.3567	172.671	170.1	6.2	3.56	0.77	4.33	5.60	61.63	2.55	1.78
49	0.3861	184.771	182.2	6.8	3.79	0.81	4.60	5.68	61.38	2.70	1.89
50	0.4145	196.325	193.7	7.3	4.01	0.92	4.93	5.33	60.58	2.93	2.00
51	0.4436	207.753	205.2	7.8	4.22	1.00	5.21	5.24	60.09	3.10	2.11
52	0.4719	218.288	215.7	8.3	4.41	1.07	5.49	5.11	59.54	3.28	2.21
53	0.5003	228.567	226.0	8.8	4.60	1.20	5.80	4.82	58.64	3.50	2.30
54	0.5289	238.235	235.7	9.3	4.77	1.26	6.03	4.79	58.26	3.64	2.38
55	0.5581	247.212	244.6	9.8	4.92	1.37	6.29	4.59	57.48	3.83	2.46
56	0.5871	255.563	253.0	10.3	5.06	1.51	6.57	4.35	56.51	4.04	2.53
57	0.6162	263.942	261.4	10.8	5.20	1.48	6.67	4.52	56.76	4.07	2.60
58	0.6453	271.196	268.6	11.3	5.31	1.68	6.99	4.17	55.36	4.33	2.66
59	0.6740	278.036	275.5	11.8	5.42	1.81	7.23	3.99	54.41	4.52	2.71
60	0.7024	285.357	282.8	12.3	5.53	1.78	7.31	4.11	54.65	4.54	2.76
61	0.7319	291.738	289.2	12.8	5.62	1.96	7.58	3.87	53.38	4.77	2.81
62	0.7604	298.015	295.4	13.3	5.71	2.05	7.76	3.78	52.75	4.91	2.85
63	0.7891	304.153	301.6	13.8	5.79	2.09	7.88	3.77	52.48	4.99	2.90
64	0.8180	310.124	307.5	14.3	5.87	2.20	8.08	3.67	51.70	5.14	2.94
65	0.8465	315.528	312.9	14.8	5.94	2.27	8.21	3.62	51.25	5.24	2.97

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	88.980			1325.830
Moisture content: Dry soil+tare, gms.	79.810			1172.550
Moisture content: Tare, gms.	6.770			18.050
Moisture, %	12.6	14.0	13.3	13.3
Moist specimen weight, gms.	1303.10			
Diameter, in.	2.857	2.850	2.836	
Area, in.²	6.412	6.380	6.316	
Height, in.	5.738	5.724	5.706	
Net decrease in height, in.		0.014	0.018	
Net decrease in water volume, cc.			7.800	
Wet density, pcf	134.9	137.6	138.6	
Dry density, pcf	119.9	120.8	122.4	
Void ratio	0.3800	0.3697	0.3518	
Saturation, %	87.6	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 74.00 psi (10.66 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 2.02 ksf
Strain rate, %/min. = 0.09
Fail. Stress = 3.62 ksf **at reading no.** 29
Ult. Stress = 12.45 ksf **at reading no.** 76

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	8.046	0.0	0.0	0.00	1.92	1.92	1.00	60.64	1.92	0.00
1	0.0029	27.692	19.6	0.1	0.45	1.74	2.18	1.26	61.95	1.96	0.22
2	0.0056	40.796	32.8	0.1	0.75	1.57	2.31	1.48	63.13	1.94	0.37
3	0.0084	50.411	42.4	0.1	0.96	1.43	2.40	1.67	64.05	1.92	0.48
4	0.0113	58.223	50.2	0.2	1.14	1.33	2.47	1.86	64.80	1.90	0.57
5	0.0143	64.764	56.7	0.3	1.29	1.24	2.53	2.04	65.42	1.88	0.64
6	0.0166	70.393	62.3	0.3	1.42	1.16	2.58	2.22	65.93	1.87	0.71
7	0.0198	75.160	67.1	0.3	1.52	1.10	2.63	2.38	66.33	1.87	0.76
8	0.0229	79.447	71.4	0.4	1.62	1.06	2.68	2.53	66.65	1.87	0.81
9	0.0251	83.263	75.2	0.4	1.71	1.02	2.73	2.67	66.92	1.87	0.85
10	0.0284	86.670	78.6	0.5	1.78	0.99	2.77	2.80	67.12	1.88	0.89
11	0.0309	89.991	81.9	0.5	1.86	0.98	2.84	2.90	67.22	1.91	0.93
12	0.0341	93.197	85.2	0.6	1.93	0.94	2.87	3.05	67.45	1.91	0.96
13	0.0371	96.068	88.0	0.7	1.99	0.91	2.91	3.19	67.66	1.91	1.00
14	0.0398	98.946	90.9	0.7	2.06	0.90	2.96	3.28	67.74	1.93	1.03
15	0.0429	101.776	93.7	0.8	2.12	0.90	3.02	3.37	67.78	1.96	1.06
16	0.0456	104.358	96.3	0.8	2.18	0.89	3.07	3.44	67.81	1.98	1.09
17	0.0515	109.540	101.5	0.9	2.29	0.89	3.18	3.58	67.82	2.04	1.15
18	0.0566	114.740	106.7	1.0	2.41	0.89	3.29	3.72	67.85	2.09	1.20
19	0.0627	119.844	111.8	1.1	2.52	0.88	3.40	3.87	67.91	2.14	1.26
20	0.0690	124.784	116.7	1.2	2.63	0.88	3.51	3.98	67.88	2.20	1.31
21	0.0748	129.961	121.9	1.3	2.74	0.88	3.62	4.11	67.88	2.25	1.37
22	0.0802	134.915	126.9	1.4	2.85	0.89	3.74	4.21	67.82	2.32	1.43
23	0.0859	139.846	131.8	1.5	2.96	0.90	3.86	4.29	67.75	2.38	1.48
24	0.0916	145.034	137.0	1.6	3.07	0.91	3.99	4.36	67.65	2.45	1.54

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.0973	149.790	141.7	1.7	3.18	0.93	4.11	4.42	67.54	2.52	1.59
26	0.1032	155.247	147.2	1.8	3.30	0.95	4.25	4.46	67.38	2.60	1.65
27	0.1088	160.056	152.0	1.9	3.40	0.98	4.38	4.48	67.22	2.68	1.70
28	0.1148	165.158	157.1	2.0	3.51	1.00	4.51	4.51	67.05	2.76	1.75
29	0.1200	170.256	162.2	2.1	3.62	1.01	4.63	4.58	66.98	2.82	1.81
30	0.1258	175.361	167.3	2.2	3.73	1.05	4.78	4.57	66.74	2.91	1.87
31	0.1318	180.431	172.4	2.3	3.84	1.08	4.92	4.56	66.50	3.00	1.92
32	0.1376	185.457	177.4	2.4	3.95	1.11	5.05	4.57	66.32	3.08	1.97
33	0.1437	190.512	182.5	2.5	4.06	1.12	5.18	4.61	66.20	3.15	2.03
34	0.1488	195.646	187.6	2.6	4.17	1.15	5.32	4.62	66.01	3.23	2.08
35	0.1546	200.651	192.6	2.7	4.27	1.17	5.44	4.65	65.87	3.31	2.14
36	0.1604	205.942	197.9	2.8	4.38	1.19	5.58	4.67	65.70	3.39	2.19
37	0.1665	210.915	202.9	2.9	4.49	1.22	5.71	4.68	65.54	3.46	2.25
38	0.1716	216.144	208.1	3.0	4.60	1.24	5.85	4.70	65.35	3.55	2.30
39	0.1779	220.700	212.7	3.1	4.70	1.27	5.97	4.69	65.17	3.62	2.35
40	0.1836	225.710	217.7	3.2	4.80	1.32	6.12	4.65	64.86	3.72	2.40
41	0.1891	230.672	222.6	3.3	4.91	1.35	6.26	4.64	64.63	3.80	2.45
42	0.1948	235.611	227.6	3.4	5.01	1.39	6.40	4.62	64.38	3.89	2.51
43	0.2008	240.689	232.6	3.5	5.12	1.40	6.52	4.65	64.27	3.96	2.56
44	0.2062	245.447	237.4	3.6	5.22	1.44	6.66	4.62	63.99	4.05	2.61
45	0.2120	250.473	242.4	3.7	5.32	1.48	6.80	4.60	63.73	4.14	2.66
46	0.2183	254.973	246.9	3.8	5.41	1.51	6.93	4.58	63.49	4.22	2.71
47	0.2242	259.714	251.7	3.9	5.51	1.54	7.05	4.59	63.33	4.29	2.76
48	0.2290	264.366	256.3	4.0	5.61	1.56	7.17	4.59	63.16	4.37	2.80
49	0.2351	269.365	261.3	4.1	5.71	1.59	7.30	4.60	62.98	4.44	2.86
50	0.2410	274.354	266.3	4.2	5.81	1.61	7.43	4.60	62.79	4.52	2.91
51	0.2469	278.544	270.5	4.3	5.90	1.64	7.54	4.60	62.62	4.59	2.95
52	0.2529	283.484	275.4	4.4	6.00	1.67	7.67	4.60	62.43	4.67	3.00
53	0.2581	288.031	280.0	4.5	6.09	1.70	7.79	4.59	62.22	4.74	3.05
54	0.2638	292.628	284.6	4.6	6.19	1.73	7.92	4.57	61.97	4.83	3.09
55	0.2698	297.006	289.0	4.7	6.28	1.77	8.04	4.56	61.74	4.90	3.14
56	0.2759	301.482	293.4	4.8	6.37	1.80	8.17	4.54	61.51	4.98	3.18
57	0.3045	324.188	316.1	5.3	6.82	1.95	8.77	4.50	60.47	5.36	3.41
58	0.3330	346.366	338.3	5.8	7.26	2.08	9.35	4.49	59.53	5.72	3.63
59	0.3615	368.108	360.1	6.3	7.69	2.23	9.92	4.44	58.49	6.08	3.84
60	0.3908	388.013	380.0	6.8	8.07	2.40	10.47	4.36	57.32	6.44	4.03
61	0.4194	408.434	400.4	7.4	8.46	2.53	10.99	4.34	56.43	6.76	4.23
62	0.4480	426.984	418.9	7.9	8.80	2.68	11.49	4.28	55.36	7.09	4.40
63	0.4765	446.128	438.1	8.4	9.15	2.82	11.98	4.24	54.40	7.40	4.58
64	0.5057	465.425	457.4	8.9	9.50	2.96	12.46	4.21	53.45	7.71	4.75
65	0.5339	484.527	476.5	9.4	9.85	3.11	12.95	4.17	52.44	8.03	4.92
66	0.5625	501.516	493.5	9.9	10.14	3.24	13.38	4.13	51.52	8.31	5.07
67	0.5911	517.782	509.7	10.4	10.42	3.38	13.80	4.08	50.53	8.59	5.21
68	0.6200	534.328	526.3	10.9	10.69	3.52	14.22	4.03	49.53	8.87	5.35
69	0.6488	549.240	541.2	11.4	10.94	3.63	14.56	4.02	48.82	9.09	5.47
70	0.6781	566.669	558.6	11.9	11.22	3.76	14.98	3.99	47.90	9.37	5.61
71	0.7069	581.336	573.3	12.4	11.45	3.88	15.33	3.95	47.08	9.60	5.73

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
72	0.7362	597.064	589.0	12.9	11.70	3.97	15.66	3.95	46.44	9.82	5.85
73	0.7643	610.611	602.6	13.4	11.90	4.08	15.98	3.92	45.67	10.03	5.95
74	0.7932	625.043	617.0	13.9	12.11	4.20	16.31	3.88	44.82	10.26	6.06
75	0.8218	637.679	629.6	14.4	12.29	4.29	16.58	3.86	44.18	10.44	6.14
76	0.8511	649.844	641.8	14.9	12.45	4.40	16.85	3.83	43.47	10.62	6.22

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	100.640			1323.560
Moisture content: Dry soil+tare, gms.	91.420			1180.080
Moisture content: Tare, gms.	6.940			12.180
Moisture, %	10.9	12.7	12.3	12.3
Moist specimen weight, gms.	1305.20			
Diameter, in.	2.862	2.838	2.840	
Area, in.²	6.435	6.327	6.336	
Height, in.	5.748	5.727	5.670	
Net decrease in height, in.		0.021	0.057	
Net decrease in water volume, cc.			5.100	
Wet density, pcf	134.4	139.5	140.1	
Dry density, pcf	121.2	123.7	124.8	
Void ratio	0.3648	0.3370	0.3256	
Saturation, %	79.3	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 88.00 psi (12.67 ksf)

Consolidation back pressure = 60.00 psi (8.64 ksf)

Consolidation effective confining stress = 4.03 ksf

Strain rate, %/min. = 0.09

Fail. Stress = 10.00 ksf **at reading no.** 30

Ult. Stress = 29.30 ksf **at reading no.** 47

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	30.422	0.0	0.0	0.00	4.26	4.26	1.00	58.38	4.26	0.00
1	0.0057	57.661	27.2	0.1	0.62	3.92	4.54	1.16	60.79	4.23	0.31
2	0.0110	92.662	62.2	0.2	1.41	3.22	4.63	1.44	65.62	3.93	0.71
3	0.0167	114.035	83.6	0.3	1.89	2.77	4.67	1.68	68.75	3.72	0.95
4	0.0228	129.340	98.9	0.4	2.24	2.47	4.71	1.91	70.83	3.59	1.12
5	0.0279	141.740	111.3	0.5	2.52	2.27	4.79	2.11	72.25	3.53	1.26
6	0.0343	152.334	121.9	0.6	2.75	2.13	4.88	2.29	73.23	3.50	1.38
7	0.0398	162.497	132.1	0.7	2.98	2.03	5.01	2.47	73.91	3.52	1.49
8	0.0450	172.314	141.9	0.8	3.20	1.96	5.16	2.63	74.37	3.56	1.60
9	0.0509	182.343	151.9	0.9	3.42	1.92	5.34	2.78	74.68	3.63	1.71
10	0.0567	192.412	162.0	1.0	3.65	1.89	5.54	2.93	74.87	3.71	1.82
11	0.0626	202.713	172.3	1.1	3.87	1.88	5.75	3.06	74.94	3.82	1.94
12	0.0683	213.761	183.3	1.2	4.12	1.88	6.00	3.19	74.95	3.94	2.06
13	0.0738	225.056	194.6	1.3	4.37	1.89	6.26	3.31	74.86	4.07	2.18
14	0.0796	236.919	206.5	1.4	4.63	1.91	6.54	3.42	74.74	4.22	2.31
15	0.0851	249.200	218.8	1.5	4.90	1.93	6.83	3.53	74.57	4.38	2.45

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
16	0.0914	262.240	231.8	1.6	5.18	1.97	7.15	3.64	74.34	4.56	2.59
17	0.0965	275.837	245.4	1.7	5.48	2.00	7.49	3.74	74.08	4.75	2.74
18	0.1024	289.127	258.7	1.8	5.77	2.05	7.82	3.82	73.77	4.94	2.89
19	0.1087	303.450	273.0	1.9	6.09	2.10	8.18	3.90	73.45	5.14	3.04
20	0.1140	317.970	287.5	2.0	6.40	2.15	8.55	3.98	73.07	5.35	3.20
21	0.1193	332.905	302.5	2.1	6.73	2.21	8.94	4.05	72.65	5.58	3.37
22	0.1254	348.359	317.9	2.2	7.07	2.28	9.34	4.11	72.20	5.81	3.53
23	0.1310	364.241	333.8	2.3	7.41	2.35	9.76	4.16	71.71	6.05	3.71
24	0.1368	380.844	350.4	2.4	7.77	2.42	10.19	4.21	71.19	6.31	3.89
25	0.1427	397.282	366.9	2.5	8.13	2.50	10.63	4.25	70.64	6.56	4.06
26	0.1482	414.515	384.1	2.6	8.50	2.58	11.09	4.29	70.06	6.83	4.25
27	0.1539	431.566	401.1	2.7	8.87	2.67	11.54	4.32	69.47	7.10	4.44
28	0.1601	448.984	418.6	2.8	9.24	2.75	12.00	4.36	68.90	7.37	4.62
29	0.1653	466.487	436.1	2.9	9.62	2.84	12.47	4.38	68.25	7.65	4.81
30	0.1708	484.017	453.6	3.0	10.00	2.95	12.94	4.40	67.55	7.94	5.00
31	0.1764	502.334	471.9	3.1	10.39	3.04	13.43	4.42	66.88	8.24	5.20
32	0.1825	520.647	490.2	3.2	10.78	3.14	13.93	4.43	66.17	8.54	5.39
33	0.1885	539.184	508.8	3.3	11.18	3.25	14.43	4.44	65.44	8.84	5.59
34	0.2168	632.613	602.2	3.8	13.16	3.81	16.97	4.45	61.54	10.39	6.58
35	0.2452	723.350	692.9	4.3	15.07	4.40	19.47	4.42	57.41	11.94	7.53
36	0.2734	813.110	782.7	4.8	16.93	5.02	21.95	4.37	53.15	13.48	8.47
37	0.3016	896.917	866.5	5.3	18.65	5.62	24.27	4.32	48.94	14.95	9.32
38	0.3312	973.432	943.0	5.8	20.18	6.21	26.39	4.25	44.90	16.30	10.09
39	0.3592	1049.401	1019.0	6.3	21.69	6.76	28.45	4.21	41.07	17.60	10.85
40	0.3884	1118.927	1088.5	6.9	23.05	7.28	30.33	4.16	37.42	18.81	11.52
41	0.4161	1181.472	1151.1	7.3	24.24	7.77	32.02	4.12	34.02	19.89	12.12
42	0.4447	1240.606	1210.2	7.8	25.35	8.23	33.58	4.08	30.86	20.90	12.67
43	0.4730	1294.267	1263.8	8.3	26.33	8.65	34.98	4.04	27.93	21.81	13.16
44	0.5017	1343.916	1313.5	8.8	27.21	9.03	36.24	4.01	25.31	22.63	13.61
45	0.5308	1389.739	1359.3	9.4	28.00	9.38	37.39	3.98	22.85	23.38	14.00
46	0.5596	1431.094	1400.7	9.9	28.69	9.70	38.39	3.96	20.65	24.05	14.35
47	0.5884	1468.732	1438.3	10.4	29.30	9.99	39.28	3.93	18.66	24.63	14.65

ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

Sample ID: B-14
Depth: 23 - 25 ft Log No.: 355

Failed Specimens

Specimen No.: 1
Effective Confining Pressure: 1 ksf
Notes: Specimen failed in bulging


Specimen No.: 2
Effective Confining Pressure: 2 ksf
Notes: Specimen failed in bulging


Specimen No.: 3
Effective Confining Pressure: 4 ksf
Notes: Specimen failed in bulging


Sheared By: Michael D. Kelso
Reviewed By: N. Randy Rainwater Date: 12/3/2014

Sieve Analysis of Soils

ASTM D422

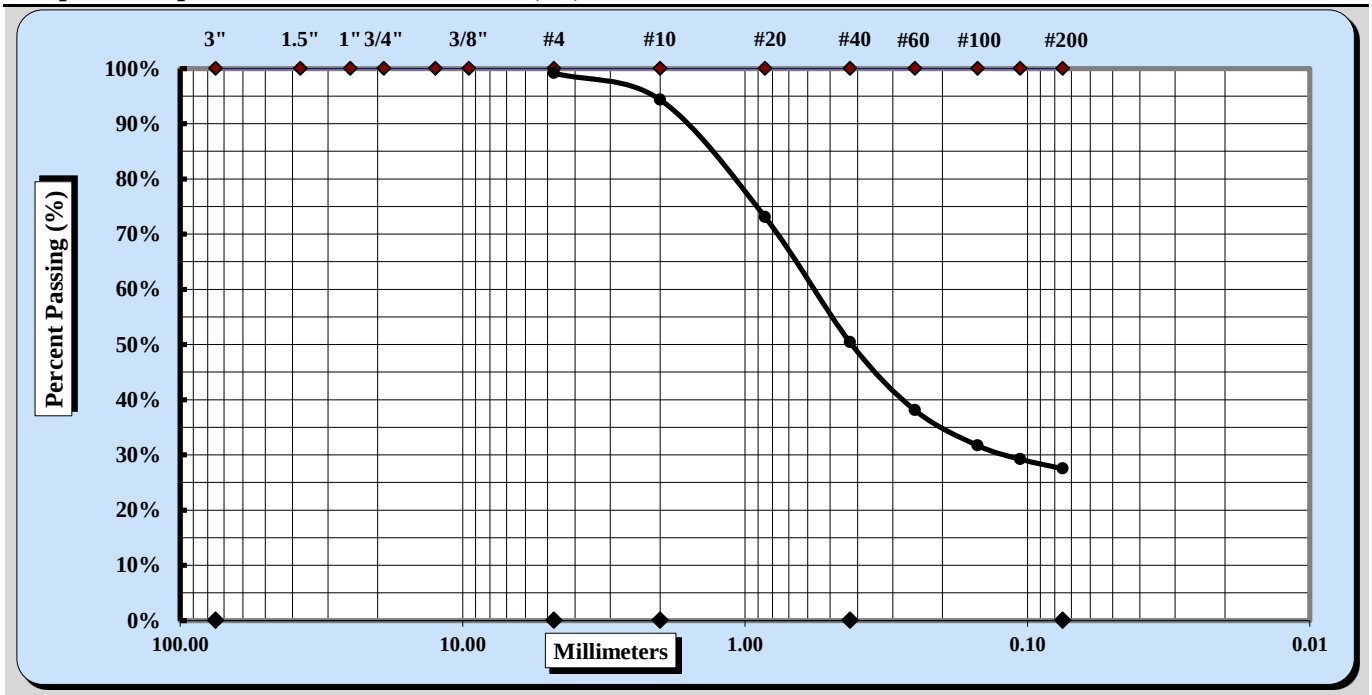
Quality Assurance

Sample Log No.:355

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: UD		
		Depth:	23 - 25 ft

Sample Description: CLAYEY SAND (SC) **A-2-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	4.8%	Fine Sand	22.9%
Gravel	0.9%	Medium Sand	43.9%	Silt & Clay	27.5%
Liquid Limit	30	Plastic Limit	16	Plastic Index	14

Coarse Sand	4.8%	Medium Sand	43.9%	Fine Sand	22.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

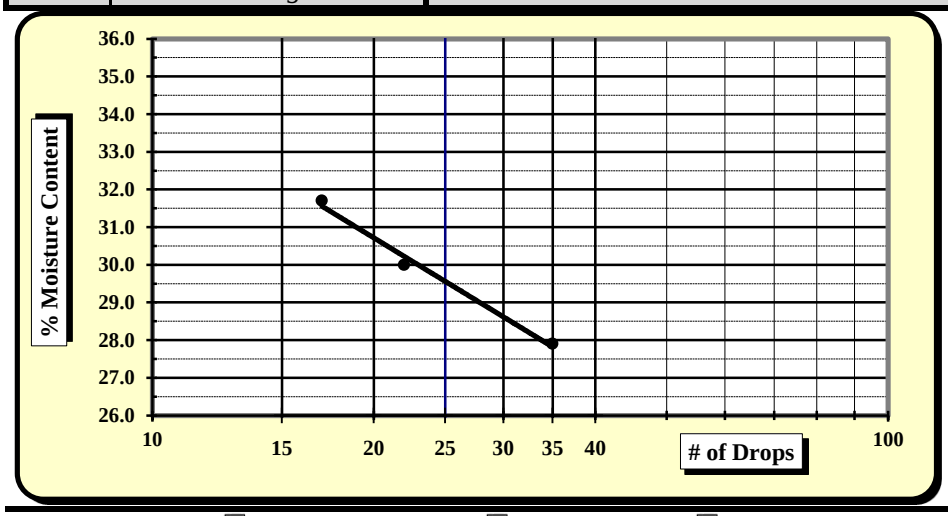
Log No.:355 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/21/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: UD		
		Depth: 23 - 25 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	17	24	23				1	5	
A	Tare Weight	15.57	15.51	15.50				15.42	15.48	
B	Wet Soil Weight + A	28.54	29.58	30.45				25.07	24.97	
C	Dry Soil Weight + A	25.42	26.33	27.19				23.73	23.66	
D	Water Weight (B-C)	3.12	3.25	3.26				1.34	1.31	
E	Dry Soil Weight (C-A)	9.85	10.82	11.69				8.31	8.18	
F	% Moisture (D/E)*100	31.7%	30.0%	27.9%				16.1%	16.0%	
N	# OF DROPS	17	22	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.1%**		



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	**30**
Plastic Limit	**16**
Plastic Index	**14**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

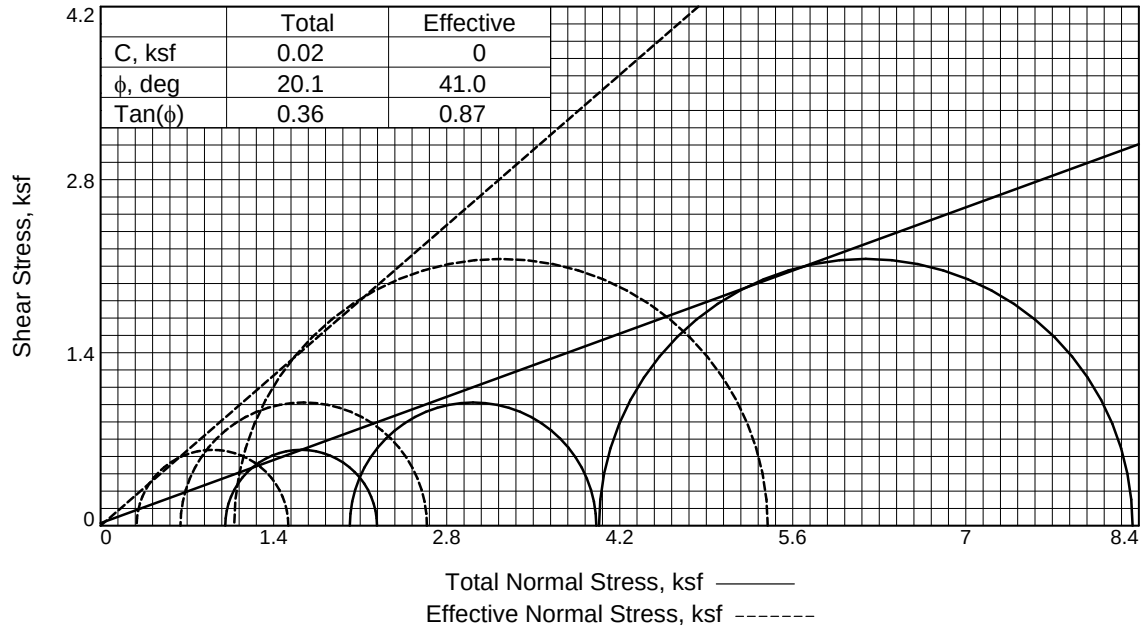
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

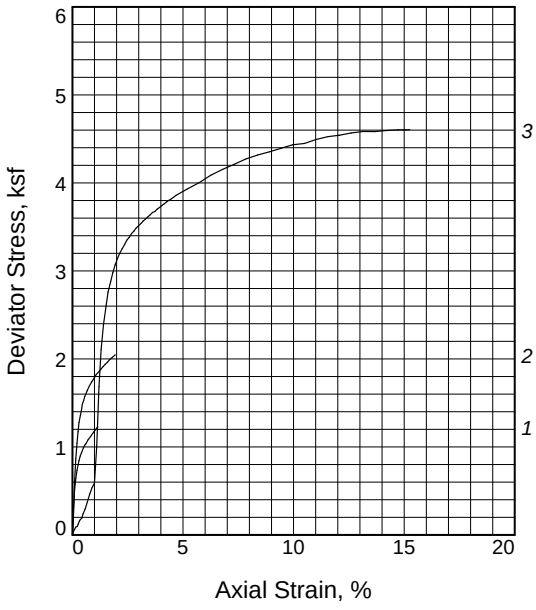
Notes / Deviations / References: **AASHTO Classification A-2-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/21/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Specimen No.		1	2	3
Initial	Water Content, %	49.6	49.6	49.6
	Dry Density, pcf	71.5	71.5	71.5
	Saturation, %	104.0	104.0	104.0
	Void Ratio	1.2011	1.2011	1.2011
	Diameter, in.	2.855	2.855	2.855
	Height, in.	5.745	5.745	5.745
At Test	Water Content, %	37.6	36.5	34.4
	Dry Density, pcf	80.7	82.0	84.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9485	0.9186	0.8656
	Diameter, in.	2.706	2.704	2.699
	Height, in.	5.659	5.582	5.448
Strain rate, %/min.		0.01	0.01	0.01
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		67.00	74.00	88.00
Fail. Stress, ksf		1.23	1.99	4.32
Total Pore Pr., ksf		9.36	10.01	11.59
Ult. Stress, ksf		1.23	2.05	4.60
Total Pore Pr., ksf		9.36	9.94	11.33
$\bar{\sigma}_1$ Failure, ksf		1.52	2.64	5.40
$\bar{\sigma}_3$ Failure, ksf		0.29	0.65	1.08

Type of Test:
CU with Pore Pressures

Sample Type: Intact Sample

Description: USCS: CLAYEY SAND (SC); AASHTO: A-4

LL= 31 **PL=** 21 **PI=** 10

Specific Gravity= 2.52

Remarks: Single specimen staged test (Ref: ASTM STP 977). The specimen failed in bulging. ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

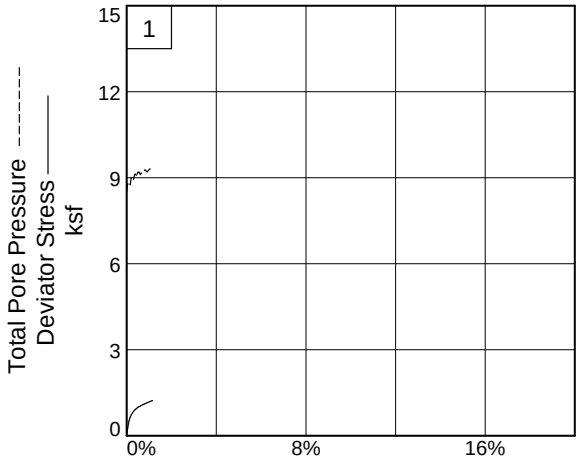
Location: B-14

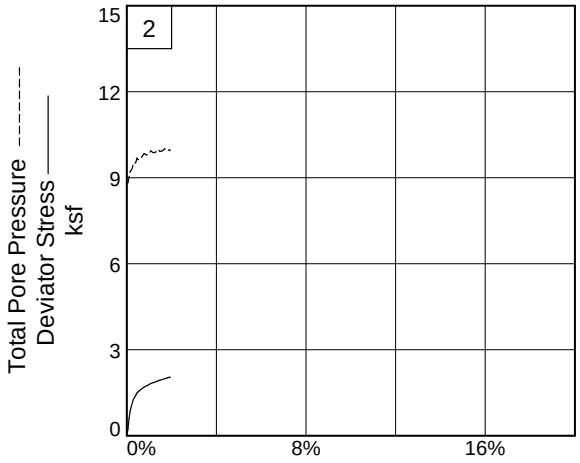
Sample Number: Log 356 **Depth:** 28 - 30 ft

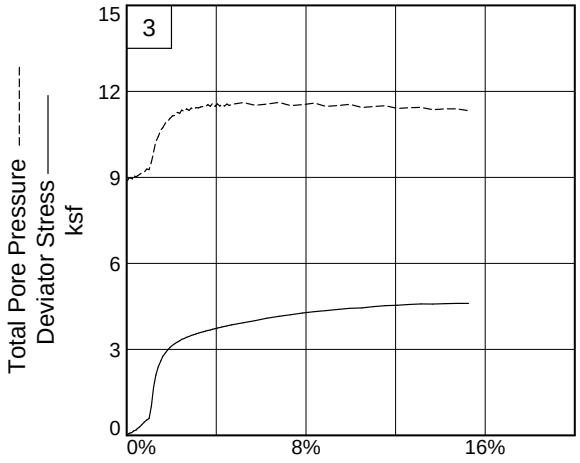
Proj. No.: 1461-14-046

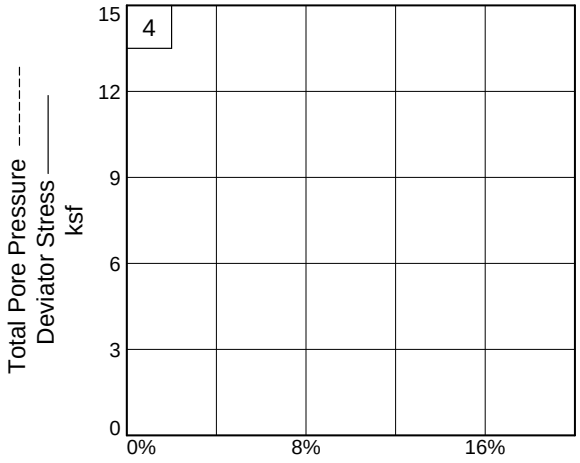
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

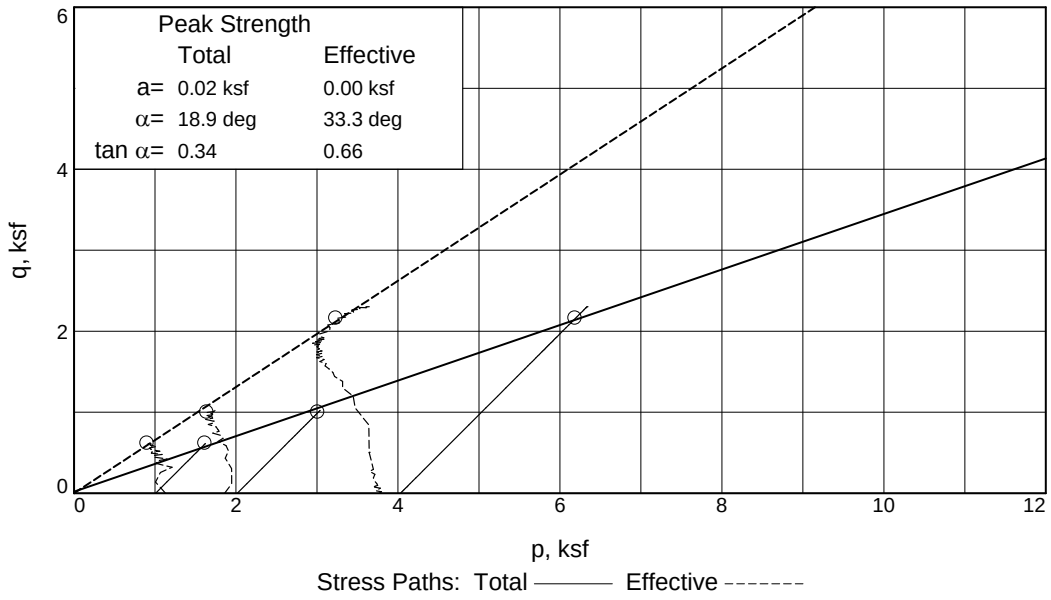
Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-14 **Depth:** 28 - 30 ft **Sample Number:** Log 356

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:23 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-14
Depth: 28 - 30 ft **Sample Number:** Log 356
Description: USCS: CLAYEY SAND (SC); AASHTO: A-4
Remarks: Single specimen staged test (Ref: ASTM STP 977). The specimen failed in bulging. ASTM D4767.
Type of Sample: Intact Sample
Specific Gravity=2.52 **LL=**31 **PL=**21 **PI=**10
Test Method: ASTM D 4767 Method B (staged method triaxial test)

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	200.740			984.540
Moisture content: Dry soil+tare, gms.	136.490			735.860
Moisture content: Tare, gms.	6.900			11.910
Moisture, %	49.6	39.1	37.6	34.4
Moist specimen weight, gms.	1032.00			
Diameter, in.	2.855	2.725	2.706	
Area, in.²	6.401	5.831	5.753	
Height, in.	5.745	5.688	5.659	
Net decrease in height, in.		0.057	0.029	
Net decrease in water volume, cc.			10.000	
Wet density, pcf	106.9	110.2	111.1	
Dry density, pcf	71.5	79.3	80.7	
Void ratio	1.2011	0.9851	0.9485	
Saturation, %	104.0	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 67.00 psi (9.65 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.01
Fail. Stress = 1.23 ksf **at reading no.** 18
Ult. Stress = 1.23 ksf **at reading no.** 18

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	4.919	0.0	0.0	0.00	1.13	1.13	1.00	59.15	1.13	0.00
1	0.0027	15.893	11.0	0.0	0.27	0.87	1.14	1.32	60.97	1.01	0.14
2	0.0055	25.421	20.5	0.1	0.51	0.81	1.32	1.63	61.37	1.07	0.26
3	0.0087	30.517	25.6	0.2	0.64	0.89	1.53	1.72	60.81	1.21	0.32
4	0.0118	34.379	29.5	0.2	0.74	0.65	1.38	2.14	62.51	1.01	0.37
5	0.0147	36.975	32.1	0.3	0.80	0.63	1.43	2.28	62.66	1.03	0.40
6	0.0170	38.818	33.9	0.3	0.85	0.72	1.57	2.17	61.97	1.15	0.42
7	0.0200	40.814	35.9	0.4	0.90	0.53	1.43	2.69	63.31	0.98	0.45
8	0.0231	42.226	37.3	0.4	0.93	0.52	1.45	2.79	63.39	0.99	0.47
9	0.0253	43.289	38.4	0.4	0.96	0.61	1.57	2.57	62.77	1.09	0.48
10	0.0283	44.679	39.8	0.5	0.99	0.46	1.45	3.16	63.81	0.95	0.50
11	0.0313	45.793	40.9	0.6	1.02	0.45	1.47	3.25	63.85	0.96	0.51
12	0.0347	46.585	41.7	0.6	1.04	0.54	1.58	2.92	63.25	1.06	0.52
13	0.0405	48.524	43.6	0.7	1.08	0.41	1.49	3.66	64.17	0.95	0.54
14	0.0465	49.999	45.1	0.8	1.12	0.38	1.50	3.97	64.38	0.94	0.56
15	0.0517	51.399	46.5	0.9	1.15	0.44	1.60	3.59	63.91	1.02	0.58
16	0.0574	52.860	47.9	1.0	1.19	0.35	1.54	4.41	64.58	0.94	0.59
17	0.0634	54.128	49.2	1.1	1.22	0.34	1.56	4.57	64.63	0.95	0.61
18	0.0653	54.535	49.6	1.2	1.23	0.29	1.52	5.22	64.98	0.90	0.61

Parameters for Specimen No. 2

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	200.740			984.540
Moisture content: Dry soil+tare, gms.	136.490			735.860
Moisture content: Tare, gms.	6.900			11.910
Moisture, %	49.6		36.5	34.4
Moist specimen weight, gms.	1032.00			
Diameter, in.	2.855		2.704	
Area, in.²	6.401		5.743	
Height, in.	5.745		5.582	
Net decrease in height, in.		0.151	0.012	
Net decrease in water volume, cc.			8.200	
Wet density, pcf	106.9		111.9	
Dry density, pcf	71.5		82.0	
Void ratio	1.2011		0.9186	
Saturation, %	104.0		100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 74.00 psi (10.66 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 2.02 ksf
Strain rate, %/min. = 0.01
Fail. Stress = 1.99 ksf **at reading no.** 22
Ult. Stress = 2.05 ksf **at reading no.** 25

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	8.060	0.0	0.0	0.00	1.86	1.86	1.00	61.09	1.86	0.00
1	0.0029	17.443	9.4	0.1	0.24	1.83	2.06	1.13	61.30	1.95	0.12
2	0.0056	32.508	24.4	0.1	0.61	1.64	2.25	1.37	62.62	1.95	0.31
3	0.0085	42.629	34.6	0.2	0.87	1.43	2.30	1.60	64.04	1.87	0.43
4	0.0116	49.702	41.6	0.2	1.04	1.39	2.43	1.75	64.37	1.91	0.52
5	0.0143	54.985	46.9	0.3	1.17	1.29	2.46	1.91	65.04	1.88	0.59
6	0.0167	59.181	51.1	0.3	1.28	1.14	2.42	2.12	66.08	1.78	0.64
7	0.0200	62.319	54.3	0.4	1.36	1.16	2.52	2.17	65.94	1.84	0.68
8	0.0230	65.110	57.1	0.4	1.42	1.10	2.53	2.29	66.33	1.82	0.71
9	0.0251	67.551	59.5	0.4	1.49	0.97	2.46	2.53	67.25	1.71	0.74
10	0.0284	69.372	61.3	0.5	1.53	1.03	2.56	2.49	66.88	1.79	0.76
11	0.0312	71.068	63.0	0.6	1.57	0.99	2.56	2.58	67.12	1.78	0.79
12	0.0372	73.843	65.8	0.7	1.64	0.93	2.57	2.75	67.51	1.75	0.82
13	0.0431	76.273	68.2	0.8	1.70	0.81	2.51	3.10	68.38	1.66	0.85
14	0.0490	78.105	70.0	0.9	1.74	0.86	2.60	3.02	68.01	1.73	0.87
15	0.0548	79.796	71.7	1.0	1.78	0.83	2.61	3.15	68.24	1.72	0.89
16	0.0600	81.568	73.5	1.1	1.82	0.72	2.54	3.55	69.03	1.63	0.91
17	0.0661	82.787	74.7	1.2	1.85	0.79	2.64	3.36	68.55	1.71	0.93
18	0.0720	84.159	76.1	1.3	1.88	0.76	2.65	3.46	68.69	1.71	0.94
19	0.0777	85.485	77.4	1.4	1.91	0.67	2.58	3.87	69.36	1.63	0.96
20	0.0829	86.558	78.5	1.5	1.94	0.74	2.68	3.62	68.85	1.71	0.97
21	0.0891	87.698	79.6	1.6	1.97	0.72	2.68	3.73	69.01	1.70	0.98
22	0.0944	88.956	80.9	1.7	1.99	0.65	2.64	4.09	69.52	1.64	1.00
23	0.1003	89.964	81.9	1.8	2.02	0.72	2.74	3.80	68.99	1.73	1.01
24	0.1064	91.040	83.0	1.9	2.04	0.68	2.73	3.98	69.25	1.70	1.02

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.1083	91.233	83.2	1.9	2.05	0.72	2.76	3.85	69.02	1.74	1.02

Parameters for Specimen No. 3

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	200.740			984.540
Moisture content: Dry soil+tare, gms.	136.490			735.860
Moisture content: Tare, gms.	6.900			11.910
Moisture, %	49.6		34.4	34.4
Moist specimen weight, gms.	1032.00			
Diameter, in.	2.855		2.699	
Area, in.²	6.401		5.722	
Height, in.	5.745		5.448	
Net decrease in height, in.		0.272	0.026	
Net decrease in water volume, cc.			14.500	
Wet density, pcf	106.9		113.3	
Dry density, pcf	71.5		84.3	
Void ratio	1.2011		0.8656	
Saturation, %	104.0		100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 88.00 psi (12.67 ksf)

Consolidation back pressure = 60.00 psi (8.64 ksf)

Consolidation effective confining stress = 4.03 ksf

Strain rate, %/min. = 0.01

Fail. Stress = 4.32 ksf **at reading no.** 56

Ult. Stress = 4.60 ksf **at reading no.** 69

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	7.750	0.0	0.0	0.00	3.77	3.77	1.00	61.83	3.77	0.00
1	0.0021	9.076	1.3	0.0	0.03	3.78	3.81	1.01	61.74	3.80	0.02
2	0.0051	10.160	2.4	0.1	0.06	3.70	3.76	1.02	62.30	3.73	0.03
3	0.0081	11.240	3.5	0.1	0.09	3.69	3.77	1.02	62.40	3.73	0.04
4	0.0115	11.590	3.8	0.2	0.10	3.71	3.81	1.03	62.23	3.76	0.05
5	0.0143	12.689	4.9	0.3	0.12	3.72	3.84	1.03	62.16	3.78	0.06
6	0.0174	14.062	6.3	0.3	0.16	3.61	3.76	1.04	62.96	3.68	0.08
7	0.0197	14.696	6.9	0.4	0.17	3.63	3.81	1.05	62.76	3.72	0.09
8	0.0233	15.402	7.7	0.4	0.19	3.65	3.85	1.05	62.63	3.75	0.10
9	0.0260	17.292	9.5	0.5	0.24	3.62	3.86	1.07	62.87	3.74	0.12
10	0.0314	19.531	11.8	0.6	0.29	3.57	3.86	1.08	63.22	3.72	0.15
11	0.0368	22.825	15.1	0.7	0.38	3.51	3.88	1.11	63.64	3.70	0.19
12	0.0430	26.485	18.7	0.8	0.47	3.48	3.95	1.13	63.83	3.71	0.23
13	0.0489	29.456	21.7	0.9	0.54	3.38	3.92	1.16	64.53	3.65	0.27
14	0.0544	31.368	23.6	1.0	0.59	3.40	3.99	1.17	64.37	3.70	0.29
15	0.0600	48.281	40.5	1.1	1.01	3.14	4.15	1.32	66.19	3.64	0.50
16	0.0654	75.575	67.8	1.2	1.69	2.80	4.48	1.60	68.58	3.64	0.84
17	0.0709	92.639	84.9	1.3	2.11	2.42	4.52	1.87	71.22	3.47	1.05
18	0.0768	104.233	96.5	1.4	2.39	2.25	4.64	2.06	72.37	3.45	1.20
19	0.0830	112.660	104.9	1.5	2.60	2.02	4.62	2.29	74.00	3.32	1.30

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
20	0.0878	119.259	111.5	1.6	2.76	1.94	4.70	2.43	74.55	3.32	1.38
21	0.0944	124.285	116.5	1.7	2.88	1.78	4.66	2.62	75.67	3.22	1.44
22	0.0998	128.447	120.7	1.8	2.98	1.70	4.69	2.75	76.16	3.20	1.49
23	0.1052	132.102	124.4	1.9	3.07	1.62	4.68	2.90	76.78	3.15	1.53
24	0.1110	135.196	127.4	2.0	3.14	1.53	4.67	3.05	77.37	3.10	1.57
25	0.1169	137.812	130.1	2.1	3.20	1.51	4.71	3.12	77.51	3.11	1.60
26	0.1228	140.008	132.3	2.3	3.25	1.41	4.66	3.31	78.21	3.04	1.63
27	0.1288	142.172	134.4	2.4	3.30	1.44	4.74	3.30	78.03	3.09	1.65
28	0.1339	144.136	136.4	2.5	3.35	1.32	4.67	3.53	78.82	3.00	1.67
29	0.1399	145.678	137.9	2.6	3.38	1.38	4.76	3.45	78.43	3.07	1.69
30	0.1457	147.557	139.8	2.7	3.42	1.28	4.71	3.67	79.09	3.00	1.71
31	0.1517	148.887	141.1	2.8	3.45	1.34	4.79	3.59	78.73	3.06	1.73
32	0.1571	150.451	142.7	2.9	3.49	1.26	4.74	3.78	79.28	3.00	1.74
33	0.1625	151.534	143.8	3.0	3.51	1.30	4.82	3.69	78.94	3.06	1.76
34	0.1688	152.892	145.1	3.1	3.54	1.23	4.77	3.87	79.43	3.00	1.77
35	0.1742	154.134	146.4	3.2	3.57	1.25	4.81	3.86	79.34	3.03	1.78
36	0.1800	155.260	147.5	3.3	3.59	1.22	4.81	3.95	79.55	3.01	1.79
37	0.1861	156.506	148.8	3.4	3.62	1.19	4.81	4.03	79.73	3.00	1.81
38	0.1915	157.558	149.8	3.5	3.64	1.20	4.84	4.03	79.66	3.02	1.82
39	0.1973	158.799	151.0	3.6	3.66	1.13	4.80	4.23	80.13	2.96	1.83
40	0.2031	159.449	151.7	3.7	3.68	1.19	4.87	4.08	79.71	3.03	1.84
41	0.2086	160.704	153.0	3.8	3.70	1.09	4.80	4.38	80.40	2.95	1.85
42	0.2146	161.668	153.9	3.9	3.72	1.19	4.91	4.13	79.74	3.05	1.86
43	0.2204	162.770	155.0	4.0	3.74	1.11	4.85	4.37	80.29	2.98	1.87
44	0.2264	163.791	156.0	4.2	3.76	1.19	4.95	4.17	79.77	3.07	1.88
45	0.2315	164.670	156.9	4.2	3.78	1.12	4.90	4.38	80.23	3.01	1.89
46	0.2374	165.694	157.9	4.4	3.80	1.18	4.99	4.21	79.78	3.08	1.90
47	0.2438	166.649	158.9	4.5	3.82	1.12	4.94	4.42	80.25	3.03	1.91
48	0.2493	167.571	159.8	4.6	3.84	1.17	5.00	4.29	79.91	3.08	1.92
49	0.2552	168.610	160.9	4.7	3.86	1.12	4.98	4.44	80.21	3.05	1.93
50	0.2838	172.624	164.9	5.2	3.93	1.06	5.00	4.70	80.62	3.03	1.97
51	0.3128	176.603	168.9	5.7	4.01	1.15	5.16	4.47	79.98	3.16	2.00
52	0.3410	181.029	173.3	6.3	4.09	1.12	5.20	4.67	80.25	3.16	2.04
53	0.3703	184.871	177.1	6.8	4.15	1.06	5.21	4.93	80.65	3.14	2.08
54	0.3987	188.314	180.6	7.3	4.21	1.17	5.38	4.60	79.88	3.28	2.11
55	0.4275	191.967	184.2	7.8	4.27	1.13	5.41	4.76	80.12	3.27	2.14
56	0.4561	194.968	187.2	8.4	4.32	1.08	5.40	5.00	80.50	3.24	2.16
57	0.4849	197.614	189.9	8.9	4.35	1.20	5.55	4.64	79.69	3.37	2.18
58	0.5140	200.560	192.8	9.4	4.39	1.17	5.56	4.77	79.90	3.36	2.20
59	0.5423	203.392	195.6	10.0	4.43	1.12	5.56	4.94	80.19	3.34	2.22
60	0.5717	205.253	197.5	10.5	4.45	1.23	5.68	4.61	79.45	3.46	2.22
61	0.6005	208.437	200.7	11.0	4.49	1.20	5.69	4.74	79.66	3.45	2.25
62	0.6289	211.026	203.3	11.5	4.53	1.17	5.70	4.86	79.87	3.43	2.26
63	0.6581	213.040	205.3	12.1	4.54	1.27	5.81	4.58	79.20	3.54	2.27
64	0.6870	215.461	207.7	12.6	4.57	1.24	5.81	4.68	79.39	3.52	2.28
65	0.7161	217.499	209.7	13.1	4.58	1.23	5.82	4.72	79.45	3.52	2.29
66	0.7444	218.671	210.9	13.7	4.58	1.31	5.90	4.49	78.89	3.60	2.29

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
67	0.7733	220.583	212.8	14.2	4.60	1.28	5.88	4.58	79.09	3.58	2.30
68	0.8022	222.277	214.5	14.7	4.60	1.28	5.88	4.59	79.10	3.58	2.30
69	0.8311	223.635	215.9	15.3	4.60	1.34	5.95	4.43	78.67	3.65	2.30

ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

Sample ID: B-14
Depth: 28 - 30 ft Log No.: 356

Failed Specimen

Specimen No.: 1
Effective Confining Pressure: 1, 2, 4 ksf
Notes: Specimen failed with bulging. Single specimen multi-staged test.

Sheared By: Michael D. Kelso
Reviewed By: N. Randy Rainwater Date: 12/3/2014

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:356

Sieve Analysis of Soils

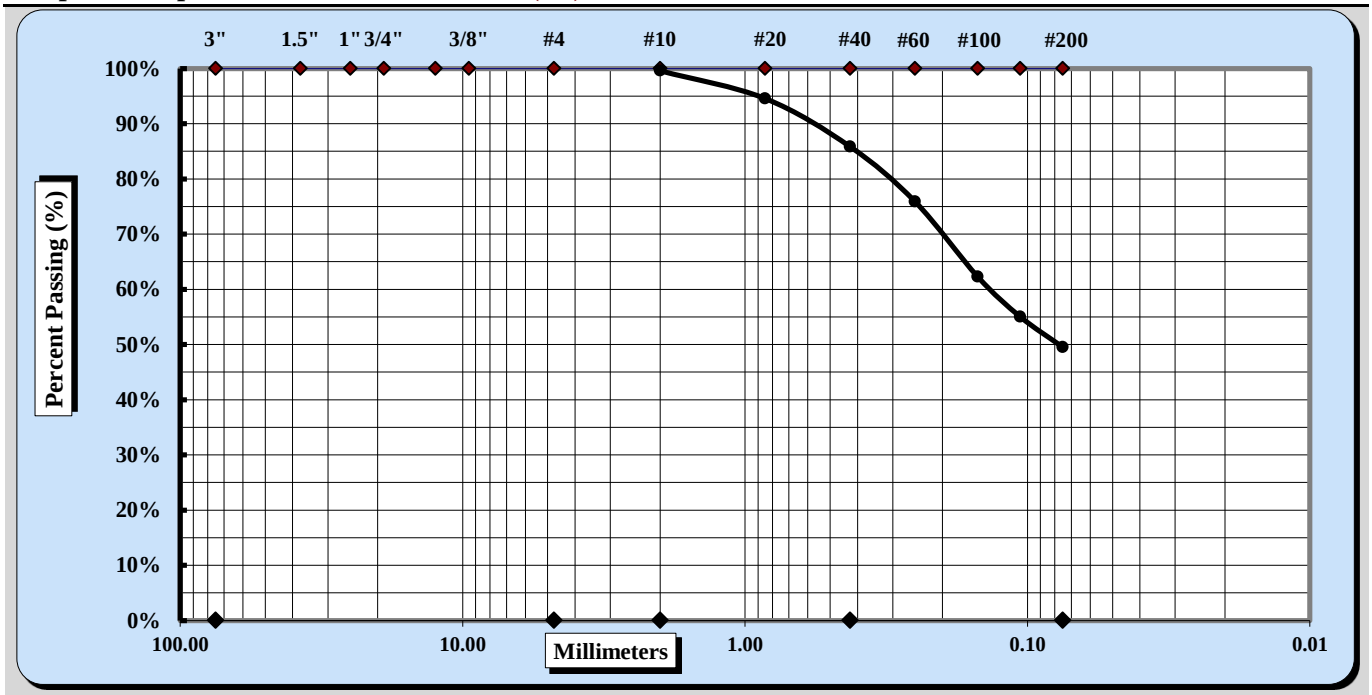
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/25/14 - 11/26/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: UD		
		Depth:	28 - 30 ft

Sample Description: CLAYEY SAND (SC) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	36.3%
Gravel	0.0%	Medium Sand	13.7%	Silt & Clay	49.5%
Liquid Limit	31	Plastic Limit	21	Plastic Index	10

Coarse Sand	0.4%	Medium Sand	13.7%	Fine Sand	36.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

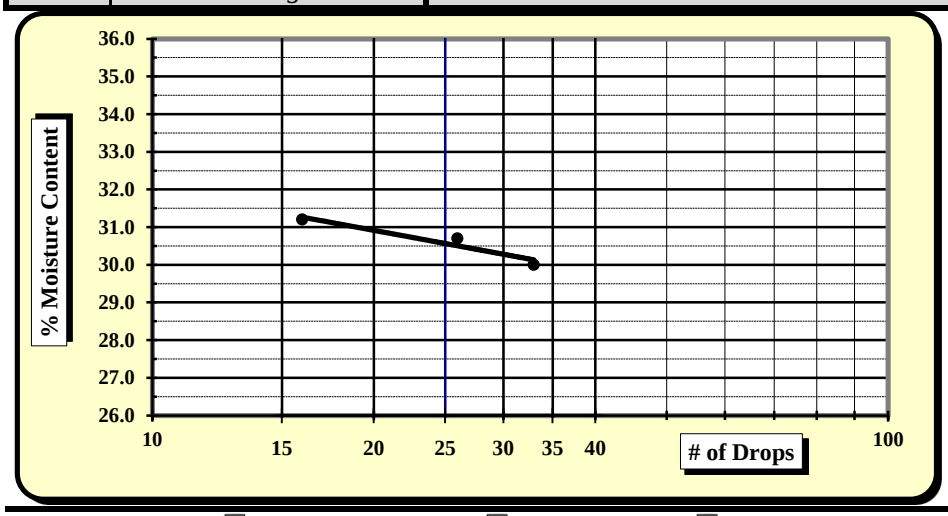
Log No.:356 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/21/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: UD		
		Depth: 28 - 30 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	18	22				7	11	
A	Tare Weight	15.52	15.50	15.47				15.48	15.50	
B	Wet Soil Weight + A	32.80	33.37	34.92				25.82	24.81	
C	Dry Soil Weight + A	28.69	29.17	30.43				24.00	23.17	
D	Water Weight (B-C)	4.11	4.20	4.49				1.82	1.64	
E	Dry Soil Weight (C-A)	13.17	13.67	14.96				8.52	7.67	
F	% Moisture (D/E)*100	31.2%	30.7%	30.0%				21.4%	21.4%	
N	# OF DROPS	16	26	33				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.4%**		



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	**31**
Plastic Limit	**21**
Plastic Index	**10**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

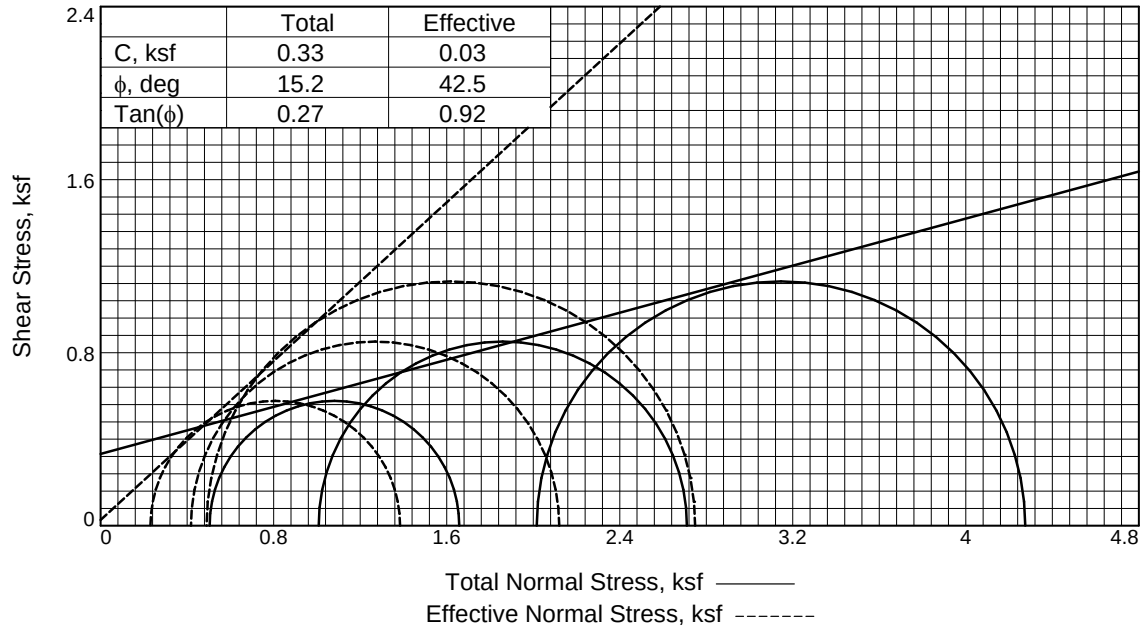
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-4**

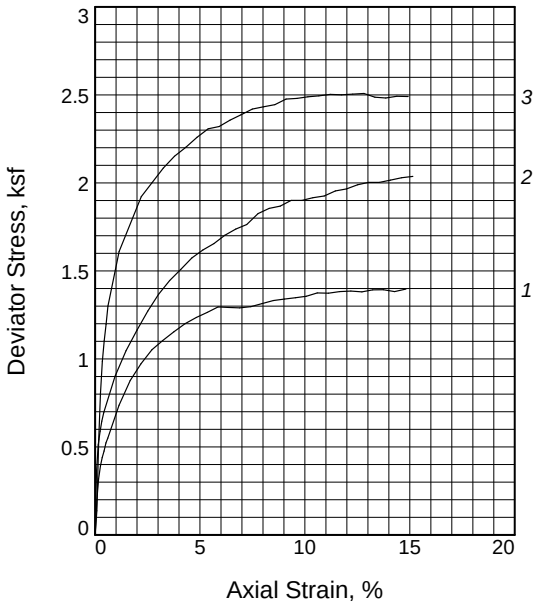
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/21/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.33	0.03
ϕ, deg	15.2	42.5
Tan(ϕ)	0.27	0.92



Specimen No.		1	2	3
Initial	Water Content, %	47.8	39.0	54.0
	Dry Density, pcf	68.8	80.7	61.8
	Saturation, %	90.6	99.2	85.6
	Void Ratio	1.3866	1.0342	1.6585
	Diameter, in.	2.844	2.844	2.843
	Height, in.	5.735	5.744	5.735
At Test	Water Content, %	44.0	34.5	55.3
	Dry Density, pcf	76.1	86.1	66.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.1563	0.9064	1.4533
	Diameter, in.	2.712	2.767	2.754
	Height, in.	5.697	5.686	5.640
Strain rate, %/min.		0.02	0.02	0.02
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		63.50	67.00	74.00
Fail. Stress, ksf		1.15	1.70	2.26
Total Pore Pr., ksf		8.91	9.23	10.17
Ult. Stress, ksf		1.40	2.04	2.49
Total Pore Pr., ksf		8.80	9.00	9.95
$\bar{\sigma}_1$ Failure, ksf		1.38	2.12	2.75
$\bar{\sigma}_3$ Failure, ksf		0.23	0.42	0.49

Type of Test:
CU with Pore Pressures

Sample Type: Intact Sample

Description: USCS: SANDY ELASTIC SILT (MH); AASHTO: A-7-5

LL= 76 **PL=** 42 **PI=** 34

Specific Gravity= 2.63

Remarks: The specimens failed in bulging. ASTM D4767.

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

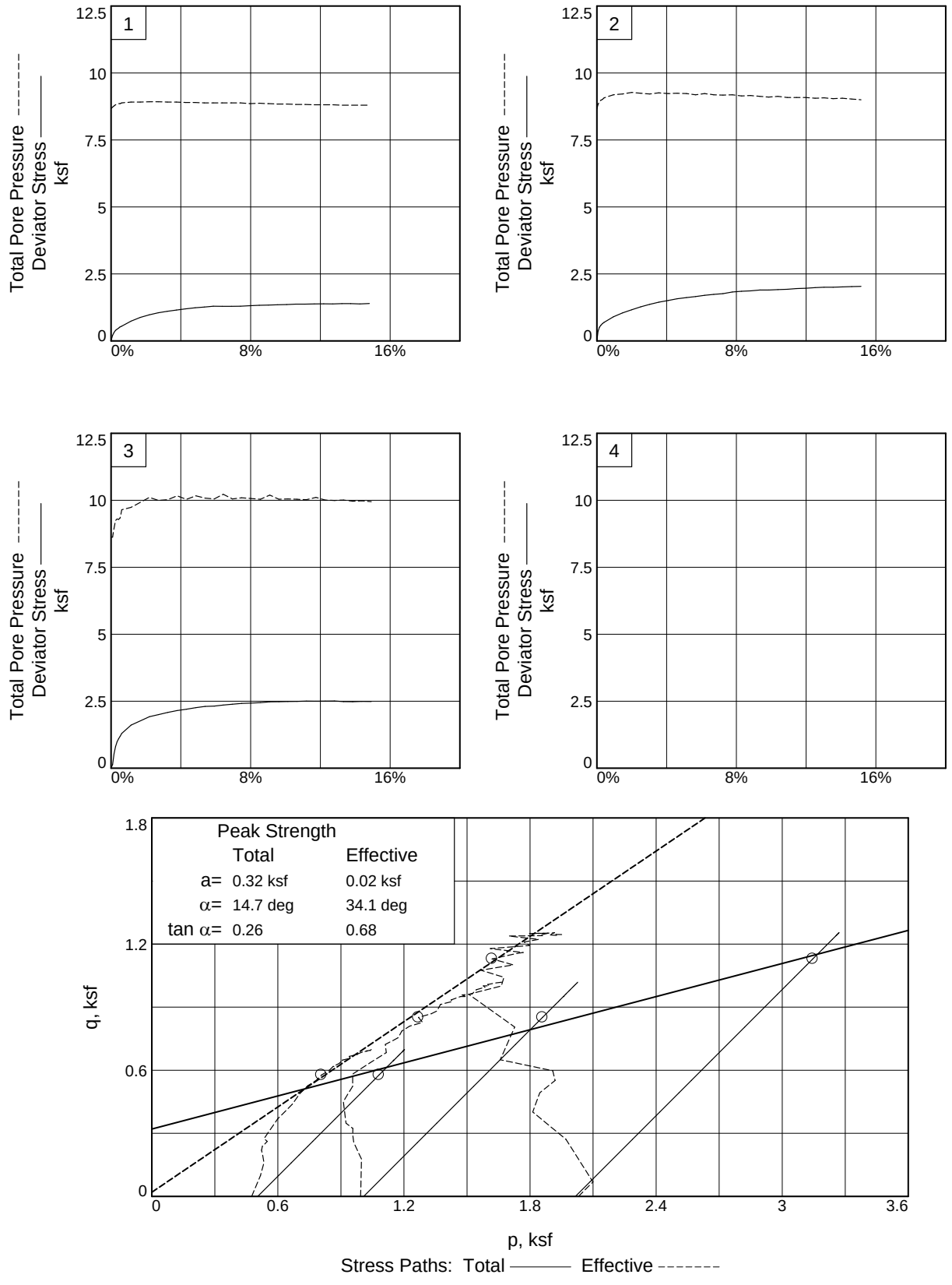
Location: B-16

Sample Number: Log 357 **Depth:** 11 - 13 ft

Proj. No.: 1461-14-046

TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14



Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-16 **Depth:** 11 - 13 ft **Sample Number:** Log 357

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Michael D. Kelso **Checked By:** NRR, 12/2/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 9:06 AM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-16
Depth: 11 - 13 ft **Sample Number:** Log 357
Description: USCS: SANDY ELASTIC SILT (MH); AASHTO: A-7-5
Remarks: The specimens failed in bulging. ASTM D4767.
Type of Sample: Intact Sample
Specific Gravity=2.63 **LL=**76 **PL=**42 **PI=**34
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	243.120			979.860
Moisture content: Dry soil+tare, gms.	166.710			686.030
Moisture content: Tare, gms.	6.810			17.740
Moisture, %	47.8	44.7	44.0	44.0
Moist specimen weight, gms.	972.10			
Diameter, in.	2.844	2.722	2.712	
Area, in.²	6.352	5.817	5.777	
Height, in.	5.735	5.705	5.697	
Net decrease in height, in.		0.030	0.008	
Net decrease in water volume, cc.			4.500	
Wet density, pcf	101.7	109.2	109.6	
Dry density, pcf	68.8	75.5	76.1	
Void ratio	1.3866	1.1743	1.1563	
Saturation, %	90.6	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 63.50 psi (9.14 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 1.15 ksf **at reading no.** 13
Ult. Stress = 1.40 ksf **at reading no.** 34

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	0.48	0.48	1.00	60.20	0.48	0.00
1	0.0048	8.000	8.0	0.1	0.20	0.42	0.62	1.48	60.60	0.52	0.10
2	0.0096	12.800	12.8	0.2	0.32	0.37	0.69	1.85	60.90	0.53	0.16
3	0.0145	15.800	15.8	0.3	0.39	0.33	0.72	2.19	61.20	0.53	0.20
4	0.0195	17.700	17.7	0.3	0.44	0.30	0.74	2.45	61.40	0.52	0.22
5	0.0245	19.200	19.2	0.4	0.48	0.29	0.76	2.65	61.50	0.53	0.24
6	0.0295	21.100	21.1	0.5	0.52	0.29	0.81	2.82	61.50	0.55	0.26
7	0.0347	22.200	22.2	0.6	0.55	0.26	0.81	3.12	61.70	0.53	0.27
8	0.0651	29.900	29.9	1.1	0.74	0.23	0.97	4.20	61.90	0.60	0.37
9	0.0952	35.800	35.8	1.7	0.88	0.23	1.11	4.81	61.90	0.67	0.44
10	0.1248	39.900	39.9	2.2	0.97	0.22	1.19	5.50	62.00	0.70	0.49
11	0.1542	43.400	43.4	2.7	1.05	0.22	1.27	5.87	62.00	0.74	0.53
12	0.1837	45.800	45.8	3.2	1.10	0.23	1.34	5.80	61.90	0.78	0.55
13	0.2136	48.100	48.1	3.7	1.15	0.23	1.38	6.01	61.90	0.81	0.58
14	0.2443	50.300	50.3	4.3	1.20	0.24	1.44	5.90	61.80	0.84	0.60
15	0.2748	52.100	52.1	4.8	1.24	0.24	1.48	6.05	61.80	0.86	0.62
16	0.3046	53.600	53.6	5.3	1.26	0.26	1.52	5.88	61.70	0.89	0.63
17	0.3338	55.200	55.2	5.9	1.30	0.26	1.55	6.00	61.70	0.91	0.65
18	0.3632	55.400	55.4	6.4	1.29	0.26	1.55	5.99	61.70	0.91	0.65
19	0.3927	55.600	55.6	6.9	1.29	0.26	1.55	5.98	61.70	0.90	0.65
20	0.4228	56.200	56.2	7.4	1.30	0.26	1.56	6.00	61.70	0.91	0.65
21	0.4535	57.300	57.3	8.0	1.31	0.29	1.60	5.56	61.50	0.95	0.66
22	0.4841	58.400	58.4	8.5	1.33	0.27	1.61	5.87	61.60	0.94	0.67
23	0.5143	59.100	59.1	9.0	1.34	0.29	1.63	5.65	61.50	0.96	0.67
24	0.5440	59.800	59.8	9.5	1.35	0.30	1.65	5.46	61.40	0.98	0.67
25	0.5736	60.500	60.5	10.1	1.36	0.30	1.66	5.48	61.40	0.98	0.68
26	0.6030	61.700	61.7	10.6	1.38	0.32	1.69	5.34	61.30	1.00	0.69
27	0.6335	62.000	62.0	11.1	1.37	0.32	1.69	5.34	61.30	1.00	0.69
28	0.6641	62.800	62.8	11.7	1.38	0.33	1.71	5.18	61.20	1.02	0.69
29	0.6944	63.300	63.3	12.2	1.39	0.33	1.72	5.18	61.20	1.02	0.69
30	0.7245	63.500	63.5	12.7	1.38	0.33	1.71	5.17	61.20	1.02	0.69
31	0.7538	64.400	64.4	13.2	1.39	0.35	1.74	5.03	61.10	1.04	0.70
32	0.7827	64.800	64.8	13.7	1.39	0.35	1.74	5.03	61.10	1.04	0.70
33	0.8130	64.700	64.7	14.3	1.38	0.35	1.73	5.00	61.10	1.04	0.69
34	0.8437	65.800	65.8	14.8	1.40	0.35	1.74	5.04	61.10	1.04	0.70

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	278.130			1061.620
Moisture content: Dry soil+tare, gms.	202.050			792.580
Moisture content: Tare, gms.	6.950			11.930
Moisture, %	39.0	36.1	34.5	34.5
Moist specimen weight, gms.	1074.60			
Diameter, in.	2.844	2.790	2.767	
Area, in.²	6.353	6.113	6.015	
Height, in.	5.744	5.721	5.686	
Net decrease in height, in.		0.022	0.036	
Net decrease in water volume, cc.			12.700	
Wet density, pcf	112.2	114.6	115.8	
Dry density, pcf	80.7	84.2	86.1	
Void ratio	1.0342	0.9496	0.9064	
Saturation, %	99.2	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 67.00 psi (9.65 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 1.01 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 1.70 ksf **at reading no.** 16
Ult. Stress = 2.04 ksf **at reading no.** 33

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	0.99	0.99	1.00	60.10	0.99	0.00
1	0.0039	14.800	14.8	0.1	0.35	0.82	1.17	1.43	61.30	1.00	0.18
2	0.0084	21.400	21.4	0.1	0.51	0.71	1.22	1.73	62.10	0.96	0.26
3	0.0134	24.600	24.6	0.2	0.59	0.66	1.25	1.89	62.40	0.96	0.29
4	0.0184	27.100	27.1	0.3	0.65	0.63	1.28	2.02	62.60	0.96	0.32
5	0.0236	29.200	29.2	0.4	0.70	0.58	1.27	2.21	63.00	0.92	0.35
6	0.0539	38.000	38.0	0.9	0.90	0.46	1.36	2.96	63.80	0.91	0.45
7	0.0839	44.400	44.4	1.5	1.05	0.43	1.48	3.42	64.00	0.96	0.52
8	0.1136	49.600	49.6	2.0	1.16	0.37	1.54	4.11	64.40	0.96	0.58
9	0.1429	54.500	54.5	2.5	1.27	0.40	1.68	4.15	64.20	1.04	0.64
10	0.1722	58.900	58.9	3.0	1.37	0.43	1.80	4.17	64.00	1.12	0.68
11	0.2020	62.600	62.6	3.6	1.45	0.39	1.83	4.72	64.30	1.11	0.72
12	0.2322	65.700	65.7	4.1	1.51	0.42	1.93	4.61	64.10	1.17	0.75
13	0.2620	68.900	68.9	4.6	1.57	0.40	1.98	4.90	64.20	1.19	0.79
14	0.2921	71.300	71.3	5.1	1.62	0.42	2.04	4.88	64.10	1.23	0.81
15	0.3219	73.300	73.3	5.7	1.66	0.46	2.12	4.59	63.80	1.29	0.83
16	0.3514	75.800	75.8	6.2	1.70	0.42	2.12	5.08	64.10	1.27	0.85
17	0.3811	77.800	77.8	6.7	1.74	0.46	2.20	4.77	63.80	1.33	0.87
18	0.4110	79.400	79.4	7.2	1.76	0.48	2.24	4.71	63.70	1.36	0.88
19	0.4417	82.700	82.7	7.8	1.83	0.46	2.29	4.96	63.80	1.37	0.91
20	0.4716	84.500	84.5	8.3	1.86	0.50	2.36	4.68	63.50	1.43	0.93
21	0.5014	85.600	85.6	8.8	1.87	0.49	2.36	4.82	63.60	1.42	0.93
22	0.5312	87.600	87.6	9.3	1.90	0.52	2.42	4.67	63.40	1.47	0.95
23	0.5605	88.100	88.1	9.9	1.90	0.55	2.45	4.47	63.20	1.50	0.95
24	0.5902	89.300	89.3	10.4	1.92	0.52	2.43	4.70	63.40	1.48	0.96

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
25	0.6206	90.300	90.3	10.9	1.93	0.56	2.49	4.43	63.10	1.52	0.96
26	0.6510	92.200	92.2	11.5	1.95	0.56	2.52	4.48	63.10	1.54	0.98
27	0.6812	93.300	93.3	12.0	1.97	0.56	2.53	4.50	63.10	1.54	0.98
28	0.7112	95.000	95.0	12.5	1.99	0.59	2.58	4.37	62.90	1.59	0.99
29	0.7407	96.200	96.2	13.0	2.00	0.58	2.58	4.48	63.00	1.58	1.00
30	0.7702	96.800	96.8	13.5	2.00	0.60	2.61	4.31	62.80	1.61	1.00
31	0.8002	98.000	98.0	14.1	2.02	0.59	2.61	4.41	62.90	1.60	1.01
32	0.8306	99.300	99.3	14.6	2.03	0.62	2.65	4.28	62.70	1.63	1.01
33	0.8610	100.300	100.3	15.1	2.04	0.65	2.69	4.14	62.50	1.67	1.02

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	172.630			890.540
Moisture content: Dry soil+tare, gms.	114.530			579.970
Moisture content: Tare, gms.	6.950			17.940
Moisture, %	54.0	56.4	55.3	55.3
Moist specimen weight, gms.	908.80			
Diameter, in.	2.843	2.751	2.754	
Area, in.²	6.347	5.942	5.956	
Height, in.	5.735	5.725	5.640	
Net decrease in height, in.		0.010	0.085	
Net decrease in water volume, cc.			7.000	
Wet density, pcf	95.1	103.4	103.9	
Dry density, pcf	61.8	66.1	66.9	
Void ratio	1.6585	1.4845	1.4533	
Saturation, %	85.6	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 74.00 psi (10.66 ksf)
Consolidation back pressure = 60.00 psi (8.64 ksf)
Consolidation effective confining stress = 2.02 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 2.26 ksf **at reading no.** 14
Ult. Stress = 2.49 ksf **at reading no.** 33

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.00	2.03	2.03	1.00	59.90	2.03	0.00
1	0.0049	5.700	5.7	0.1	0.14	2.03	2.17	1.07	59.90	2.10	0.07
2	0.0097	22.500	22.5	0.2	0.54	1.70	2.24	1.32	62.20	1.97	0.27
3	0.0145	33.300	33.3	0.3	0.80	1.41	2.21	1.57	64.20	1.81	0.40
4	0.0194	40.900	40.9	0.3	0.99	1.35	2.34	1.73	64.60	1.85	0.49
5	0.0244	45.800	45.8	0.4	1.10	1.37	2.47	1.81	64.50	1.92	0.55
6	0.0294	49.700	49.7	0.5	1.20	1.31	2.51	1.91	64.90	1.91	0.60
7	0.0345	54.100	54.1	0.6	1.30	1.01	2.31	2.29	67.00	1.66	0.65
8	0.0648	67.400	67.4	1.1	1.61	0.92	2.53	2.75	67.60	1.73	0.81
9	0.1242	81.300	81.3	2.2	1.92	0.55	2.47	4.51	70.20	1.51	0.96
10	0.1533	85.100	85.1	2.7	2.00	0.66	2.66	4.02	69.40	1.66	1.00
11	0.1832	89.100	89.1	3.2	2.08	0.63	2.72	4.29	69.60	1.68	1.04

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.2133	92.500	92.5	3.8	2.15	0.49	2.64	5.40	70.60	1.57	1.08
13	0.2438	95.200	95.2	4.3	2.20	0.62	2.82	4.56	69.70	1.72	1.10
14	0.2741	98.200	98.2	4.9	2.26	0.49	2.75	5.61	70.60	1.62	1.13
15	0.3040	100.900	100.9	5.4	2.31	0.58	2.88	5.01	70.00	1.73	1.15
16	0.3334	102.000	102.0	5.9	2.32	0.60	2.93	4.84	69.80	1.76	1.16
17	0.3627	104.200	104.2	6.4	2.36	0.43	2.79	6.46	71.00	1.61	1.18
18	0.3922	106.100	106.1	7.0	2.39	0.60	2.99	4.95	69.80	1.80	1.19
19	0.4225	108.200	108.2	7.5	2.42	0.56	2.98	5.31	70.10	1.77	1.21
20	0.4528	109.400	109.4	8.0	2.43	0.59	3.02	5.12	69.90	1.81	1.22
21	0.4832	110.600	110.6	8.6	2.44	0.62	3.06	4.95	69.70	1.84	1.22
22	0.5132	112.700	112.7	9.1	2.48	0.46	2.94	6.38	70.80	1.70	1.24
23	0.5426	113.500	113.5	9.6	2.48	0.62	3.10	5.01	69.70	1.86	1.24
24	0.5719	114.600	114.6	10.1	2.49	0.60	3.09	5.12	69.80	1.85	1.24
25	0.6013	115.500	115.5	10.7	2.49	0.62	3.11	5.03	69.70	1.87	1.25
26	0.6319	116.600	116.6	11.2	2.50	0.63	3.14	4.95	69.60	1.89	1.25
27	0.6624	117.200	117.2	11.7	2.50	0.55	3.05	5.57	70.20	1.80	1.25
28	0.6926	118.100	118.1	12.3	2.50	0.65	3.15	4.87	69.50	1.90	1.25
29	0.7225	119.000	119.0	12.8	2.51	0.66	3.17	4.79	69.40	1.92	1.25
30	0.7519	118.700	118.7	13.3	2.49	0.65	3.14	4.84	69.50	1.89	1.24
31	0.7812	119.200	119.2	13.9	2.48	0.69	3.17	4.59	69.20	1.93	1.24
32	0.8111	120.400	120.4	14.4	2.49	0.68	3.17	4.68	69.30	1.92	1.25
33	0.8416	121.100	121.1	14.9	2.49	0.71	3.20	4.53	69.10	1.95	1.25

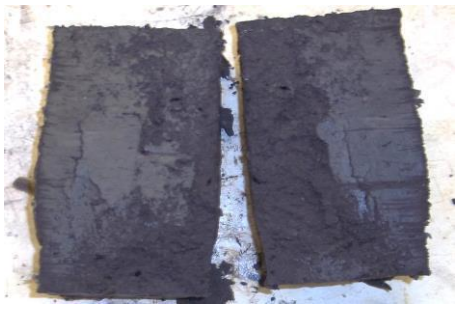
ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

Sample ID: B-16
Depth: 11 - 13 ft Log No.: 357

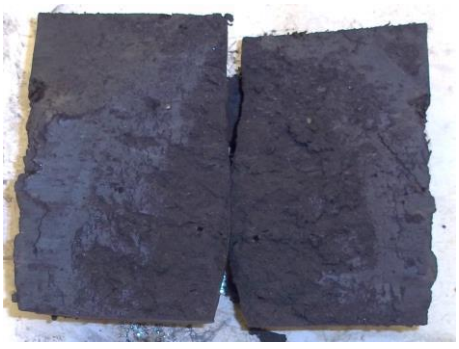
Failed Specimens

Specimen No.: 1
Effective Confining Pressure: 0.5 ksf
Notes: Specimen failed in bulging

Specimen No.: 2
Effective Confining Pressure: 1 ksf
Notes: Specimen failed in bulging


Specimen No.: 3
Effective Confining Pressure: 2 ksf
Notes: Specimen failed in bulging

Sheared By: Michael D. Kelso
Reviewed By: N. Randy Rainwater Date: 12/3/2014

Sieve Analysis of Soils

ASTM D422

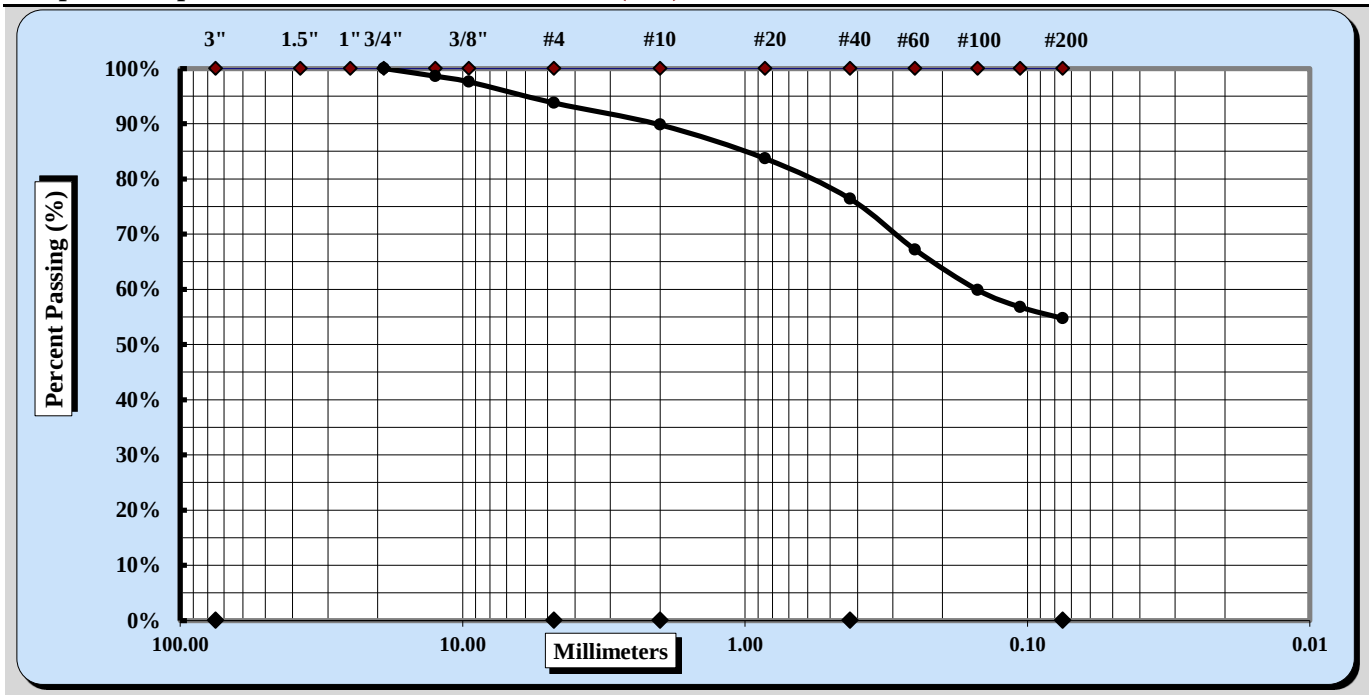
Quality Assurance

Sample Log No.:357

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/26/14-11/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Type: UD		
		Depth:	11 - 13 ft

Sample Description: SANDY ELASTIC SILT (MH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	4.0%	Fine Sand	21.7%
Gravel	6.2%	Medium Sand	13.4%	Silt & Clay	54.7%
Liquid Limit	76	Plastic Limit	42	Plastic Index	34

Coarse Sand	4.0%	Medium Sand	13.4%	Fine Sand	21.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

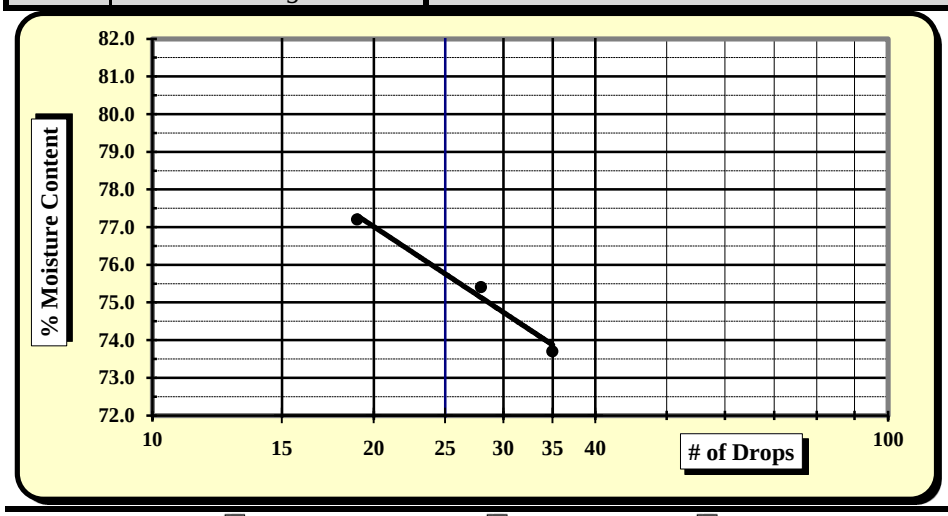
Log No.:357 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Sample No: UD		
		Depth: 11 - 13 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	4	20	11				33	36	
A	Tare Weight	15.51	15.54	15.50				21.25	21.04	
B	Wet Soil Weight + A	26.41	27.08	28.06				29.68	30.24	
C	Dry Soil Weight + A	21.66	22.12	22.73				27.21	27.52	
D	Water Weight (B-C)	4.75	4.96	5.33				2.47	2.72	
E	Dry Soil Weight (C-A)	6.15	6.58	7.23				5.96	6.48	
F	% Moisture (D/E)*100	77.2%	75.4%	73.7%				41.4%	42.0%	
N	# OF DROPS	19	28	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**41.7%**		



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 **76**
Plastic Limit **42**
Plastic Index **34**
USCS Group Symbol **MH**

Multipoint Method ☑
One-point Method ☐

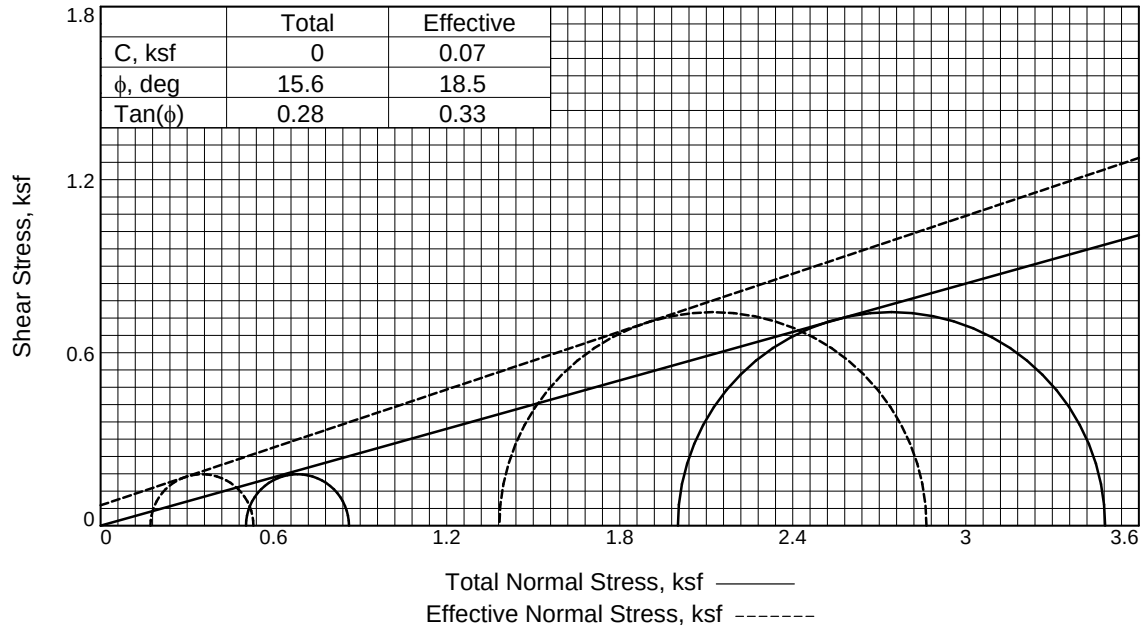
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASTHO Classification A-7-5**

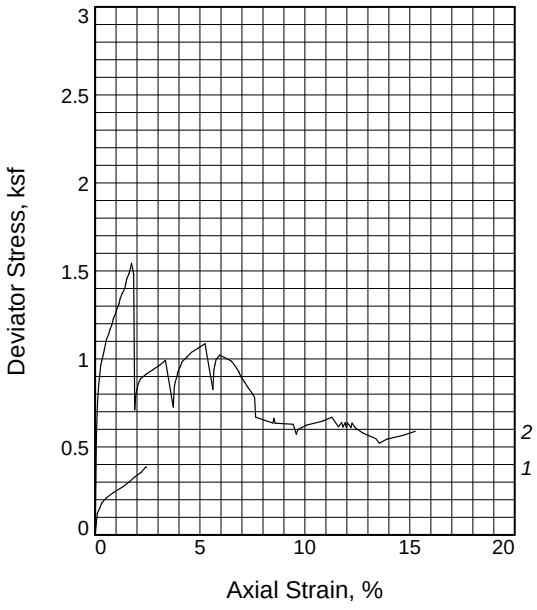
ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/25/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0	0.07
ϕ, deg	15.6	18.5
Tan(ϕ)	0.28	0.33



Sample No.		1	2
Initial	Water Content, %	9.5	9.4
	Dry Density, pcf	117.2	118.2
	Saturation, %	61.5	62.4
	Void Ratio	0.4117	0.3993
	Diameter, in.	2.821	2.820
	Height, in.	5.949	5.952
At Test	Water Content, %	14.8	14.7
	Dry Density, pcf	118.8	119.1
	Saturation, %	100.0	100.0
	Void Ratio	0.3922	0.3895
	Diameter, in.	2.817	2.828
	Height, in.	5.883	5.879
Strain rate, %/min.		0.08	0.08
Back Pressure, psi		85.50	93.30
Cell Pressure, psi		89.00	107.20
Fail. Stress, ksf		0.36	1.48
Total Pore Pr., ksf		12.64	14.05
Ult. Stress, ksf		0.39	0.59
Total Pore Pr., ksf		12.63	14.44
$\bar{\sigma}_1$ Failure, ksf		0.53	2.86
$\bar{\sigma}_3$ Failure, ksf		0.17	1.38

Type of Test:
CU with Pore Pressures

Sample Type: Intact Specimen

Description: USCS: SILTY SAND (SM); AASHTO: A-2-4

LL= NP **PI=** NP

Assumed Specific Gravity= 2.65

Remarks: Specimens failed in bulging. Specimen 1 shear was terminated early to attempt multistage, stage 2 data indicated failure had occured in stage 1. ASTM D4767

Figure 1

Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

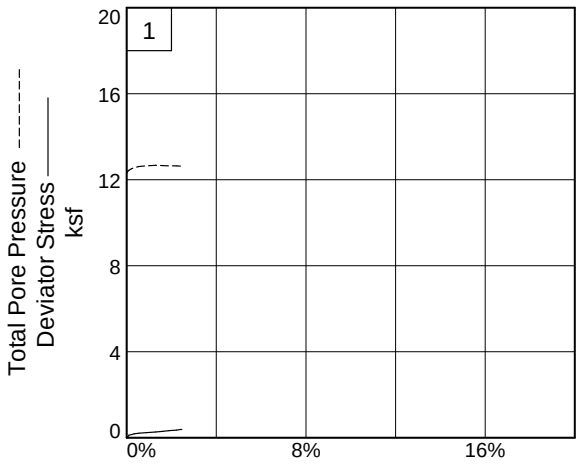
Location: B-17

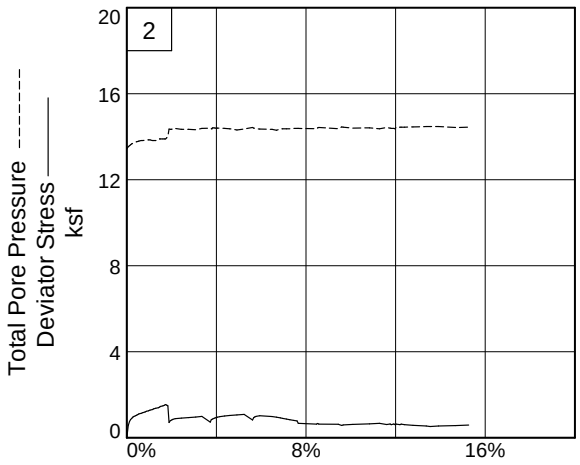
Sample Number: Log 358 **Depth:** 6 - 8 ft

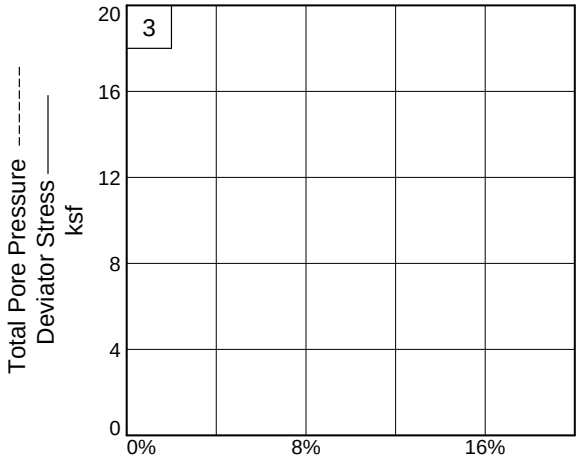
Proj. No.: 1461-14-046

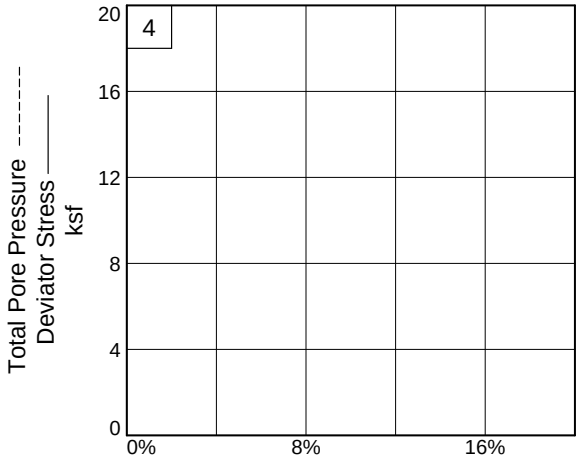
TRIAXIAL SHEAR TEST REPORT
S & ME, INC.
Louisville, TN

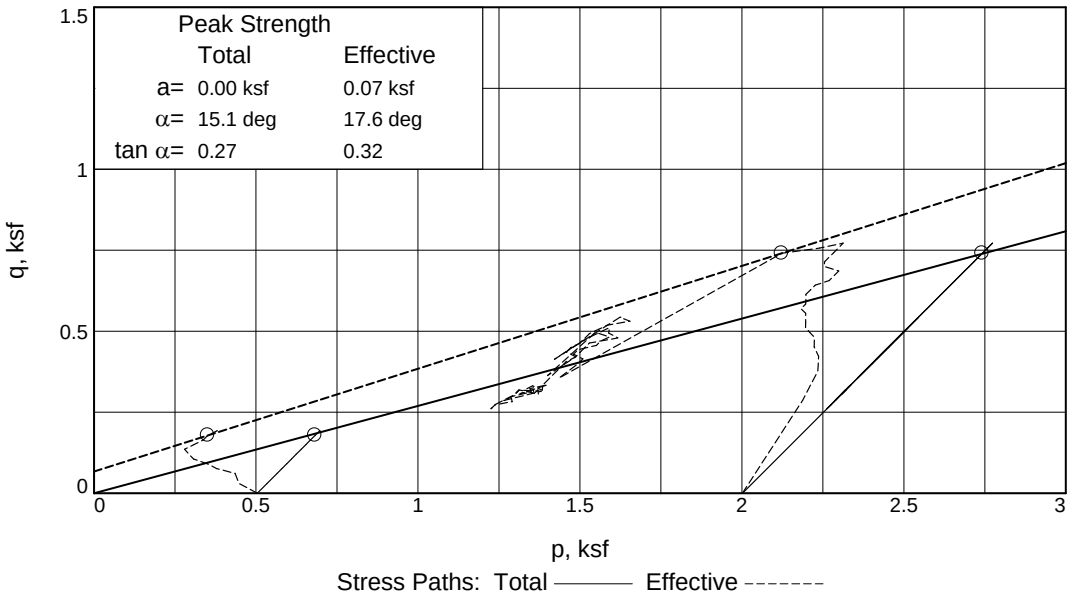
Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14











Client: HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-17 **Depth:** 6 - 8 ft **Sample Number:** Log 358

Project No.: 1461-14-046 **Figure** 2

S & ME, Inc.

Tested By: Jacob Folsom **Checked By:** NRR, 12/2/14

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

TRIAXIAL COMPRESSION TEST 12/2/2014

CU with Pore Pressures 2:39 PM

Date:
Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project No.: 1461-14-046
Location: B-17
Depth: 6 - 8 ft **Sample Number:** Log 358
Description: USCS: SILTY SAND (SM); AASHTO: A-2-4
Remarks: Specimens failed in bulging. Specimen 1 shear was terminated early to attempt multistage, stage 2 data indicated failure had occured in stage 1. ASTM D4767
Type of Sample: Intact Specimen
Assumed Specific Gravity=2.65 **LL=**NP **PI=**NP
Test Method: ASTM D 4767 Method B

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	109.550			114.800
Moisture content: Dry soil+tare, gms.	100.000			100.000
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	9.5	15.2	14.8	14.8
Moist specimen weight, gms.	1253.00			
Diameter, in.	2.821	2.813	2.817	
Area, in.²	6.250	6.215	6.233	
Height, in.	5.949	5.949	5.883	
Net decrease in height, in.		0.000	0.066	
Net decrease in water volume, cc.			5.000	
Wet density, pcf	128.4	135.8	136.4	
Dry density, pcf	117.2	117.8	118.8	
Void ratio	0.4117	0.4038	0.3922	
Saturation, %	61.5	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 89.00 psi (12.82 ksf)
Consolidation back pressure = 85.50 psi (12.31 ksf)
Consolidation effective confining stress = 0.50 ksf
Strain rate, %/min. = 0.08
Fail. Stress = 0.36 ksf **at reading no.** 10
Ult. Stress = 0.39 ksf **at reading no.** 12

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1620	38.200	0.0	0.0	0.00	0.50	0.50	1.00	85.50	0.50	0.00
1	0.1650	40.800	2.6	0.1	0.06	0.42	0.48	1.14	86.10	0.45	0.03
2	0.1680	43.500	5.3	0.1	0.12	0.37	0.50	1.33	86.40	0.44	0.06
3	0.1750	44.800	6.6	0.2	0.15	0.30	0.45	1.50	86.90	0.38	0.08
4	0.1810	46.100	7.9	0.3	0.18	0.26	0.44	1.70	87.20	0.35	0.09
5	0.1940	47.400	9.2	0.5	0.21	0.20	0.41	2.05	87.60	0.31	0.11
6	0.2130	48.700	10.5	0.9	0.24	0.17	0.41	2.39	87.80	0.29	0.12
7	0.2380	50.100	11.9	1.3	0.27	0.14	0.42	2.88	88.00	0.28	0.14
8	0.2570	51.400	13.2	1.6	0.30	0.16	0.46	2.89	87.90	0.31	0.15
9	0.2730	52.700	14.5	1.9	0.33	0.17	0.50	2.90	87.80	0.34	0.16
10	0.2920	54.000	15.8	2.2	0.36	0.17	0.53	3.07	87.80	0.35	0.18
11	0.3040	55.300	17.1	2.4	0.39	0.19	0.57	3.06	87.70	0.38	0.19
12	0.3070	55.300	17.1	2.5	0.39	0.19	0.57	3.06	87.70	0.38	0.19

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	109.400			114.700
Moisture content: Dry soil+tare, gms.	100.000			100.000
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	9.4	15.2	14.7	14.7
Moist specimen weight, gms.	1262.10			
Diameter, in.	2.820	2.824	2.828	
Area, in.²	6.246	6.264	6.279	
Height, in.	5.952	5.952	5.879	
Net decrease in height, in.		0.000	0.073	
Net decrease in water volume, cc.			6.000	
Wet density, pcf	129.3	135.8	136.6	
Dry density, pcf	118.2	117.9	119.1	
Void ratio	0.3993	0.4033	0.3895	
Saturation, %	62.4	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 107.20 psi (15.44 ksf)

Consolidation back pressure = 93.30 psi (13.44 ksf)

Consolidation effective confining stress = 2.00 ksf

Strain rate, %/min. = 0.08

Fail. Stress = 1.48 ksf **at reading no.** 27

Ult. Stress = 0.59 ksf **at reading no.** 85

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1040	42.200	0.0	0.0	0.00	2.00	2.00	1.00	93.30	2.00	0.00
1	0.1080	67.200	25.0	0.1	0.57	1.90	2.47	1.30	94.00	2.19	0.29
2	0.1110	75.100	32.9	0.1	0.75	1.86	2.61	1.41	94.30	2.23	0.38
3	0.1140	79.100	36.9	0.2	0.84	1.81	2.66	1.47	94.60	2.24	0.42
4	0.1170	81.700	39.5	0.2	0.90	1.77	2.68	1.51	94.90	2.22	0.45
5	0.1200	84.300	42.1	0.3	0.96	1.74	2.71	1.55	95.10	2.22	0.48
6	0.1230	85.600	43.4	0.3	0.99	1.71	2.71	1.58	95.30	2.21	0.50
7	0.1270	87.000	44.8	0.4	1.02	1.68	2.71	1.61	95.50	2.20	0.51

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
8	0.1300	88.300	46.1	0.4	1.05	1.67	2.72	1.63	95.60	2.20	0.53
9	0.1330	89.600	47.4	0.5	1.08	1.66	2.74	1.65	95.70	2.20	0.54
10	0.1360	90.900	48.7	0.5	1.11	1.64	2.75	1.68	95.80	2.20	0.56
11	0.1420	92.200	50.0	0.6	1.14	1.61	2.75	1.71	96.00	2.18	0.57
12	0.1460	93.500	51.3	0.7	1.17	1.61	2.78	1.72	96.00	2.20	0.58
13	0.1520	94.900	52.7	0.8	1.20	1.60	2.80	1.75	96.10	2.20	0.60
14	0.1550	96.200	54.0	0.9	1.23	1.58	2.81	1.78	96.20	2.20	0.61
15	0.1610	97.500	55.3	1.0	1.26	1.58	2.84	1.79	96.20	2.21	0.63
16	0.1650	98.800	56.6	1.0	1.28	1.58	2.87	1.81	96.20	2.23	0.64
17	0.1710	100.100	57.9	1.1	1.31	1.61	2.93	1.81	96.00	2.27	0.66
18	0.1740	101.400	59.2	1.2	1.34	1.61	2.95	1.83	96.00	2.28	0.67
19	0.1800	102.800	60.6	1.3	1.37	1.61	2.98	1.85	96.00	2.30	0.69
20	0.1870	104.100	61.9	1.4	1.40	1.56	2.95	1.90	96.40	2.25	0.70
21	0.1900	105.400	63.2	1.5	1.43	1.54	2.97	1.93	96.50	2.25	0.71
22	0.1930	106.700	64.5	1.5	1.46	1.54	3.00	1.95	96.50	2.27	0.73
23	0.1990	108.000	65.8	1.6	1.48	1.54	3.03	1.96	96.50	2.28	0.74
24	0.2030	109.400	67.2	1.7	1.52	1.54	3.06	1.98	96.50	2.30	0.76
25	0.2060	110.700	68.5	1.7	1.54	1.54	3.08	2.00	96.50	2.31	0.77
26	0.2090	109.400	67.2	1.8	1.51	1.48	3.00	2.02	96.90	2.24	0.76
27	0.2120	108.000	65.8	1.8	1.48	1.38	2.86	2.07	97.60	2.12	0.74
28	0.2150	73.800	31.6	1.9	0.71	1.08	1.79	1.66	99.70	1.44	0.36
29	0.2180	77.700	35.5	1.9	0.80	1.09	1.89	1.73	99.60	1.49	0.40
30	0.2220	79.100	36.9	2.0	0.83	1.09	1.92	1.76	99.60	1.51	0.41
31	0.2250	80.400	38.2	2.1	0.86	1.05	1.91	1.82	99.90	1.48	0.43
32	0.2310	81.700	39.5	2.2	0.89	1.05	1.94	1.84	99.90	1.49	0.44
33	0.2470	83.000	40.8	2.4	0.91	1.09	2.01	1.83	99.60	1.55	0.46
34	0.2660	84.300	42.1	2.8	0.94	1.09	2.03	1.86	99.60	1.56	0.47
35	0.2850	85.600	43.4	3.1	0.96	1.11	2.07	1.87	99.50	1.59	0.48
36	0.3010	87.000	44.8	3.4	0.99	1.05	2.04	1.94	99.90	1.55	0.50
37	0.3230	75.100	32.9	3.7	0.73	1.04	1.76	1.70	100.00	1.40	0.36
38	0.3260	80.400	38.2	3.8	0.84	1.07	1.91	1.79	99.80	1.49	0.42
39	0.3290	81.700	39.5	3.8	0.87	1.02	1.89	1.85	100.10	1.46	0.44
40	0.3330	83.000	40.8	3.9	0.90	1.02	1.92	1.88	100.10	1.47	0.45
41	0.3360	84.300	42.1	3.9	0.93	1.04	1.96	1.89	100.00	1.50	0.46
42	0.3420	85.600	43.4	4.0	0.96	1.04	1.99	1.92	100.00	1.51	0.48
43	0.3480	87.000	44.8	4.2	0.98	1.04	2.02	1.95	100.00	1.53	0.49
44	0.3610	88.300	46.1	4.4	1.01	1.05	2.06	1.96	99.90	1.56	0.51
45	0.3740	89.600	47.4	4.6	1.04	1.07	2.10	1.97	99.80	1.58	0.52
46	0.3930	90.900	48.7	4.9	1.06	1.12	2.19	1.95	99.40	1.65	0.53
47	0.4120	92.200	50.0	5.2	1.09	1.08	2.17	2.01	99.70	1.62	0.54
48	0.4340	80.400	38.2	5.6	0.83	1.01	1.83	1.82	100.20	1.42	0.41
49	0.4370	85.600	43.4	5.7	0.94	1.04	1.98	1.91	100.00	1.51	0.47
50	0.4400	87.000	44.8	5.7	0.97	1.05	2.02	1.92	99.90	1.54	0.48
51	0.4430	88.300	46.1	5.8	1.00	1.07	2.06	1.93	99.80	1.56	0.50
52	0.4530	89.600	47.4	5.9	1.02	1.08	2.10	1.95	99.70	1.59	0.51
53	0.4850	88.300	46.1	6.5	0.99	1.09	2.08	1.90	99.60	1.59	0.49
54	0.4970	87.000	44.8	6.7	0.96	1.14	2.10	1.84	99.30	1.62	0.48

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
55	0.5070	85.600	43.4	6.9	0.93	1.07	1.99	1.87	99.80	1.53	0.46
56	0.5130	84.300	42.1	7.0	0.90	1.07	1.96	1.84	99.80	1.51	0.45
57	0.5230	83.000	40.8	7.1	0.87	1.07	1.93	1.82	99.80	1.50	0.43
58	0.5320	81.700	39.5	7.3	0.84	1.07	1.91	1.79	99.80	1.49	0.42
59	0.5420	80.400	38.2	7.5	0.81	1.05	1.86	1.77	99.90	1.46	0.41
60	0.5510	79.100	36.9	7.6	0.78	1.05	1.83	1.74	99.90	1.44	0.39
61	0.5540	73.800	31.6	7.7	0.67	1.05	1.72	1.64	99.90	1.39	0.33
62	0.6020	72.500	30.3	8.5	0.64	1.07	1.70	1.60	99.80	1.38	0.32
63	0.6050	73.800	31.6	8.5	0.66	1.02	1.69	1.65	100.10	1.35	0.33
64	0.6080	72.500	30.3	8.6	0.64	1.01	1.64	1.63	100.20	1.33	0.32
65	0.6590	72.500	30.3	9.4	0.63	1.07	1.69	1.59	99.80	1.38	0.31
66	0.6680	69.800	27.6	9.6	0.57	0.98	1.55	1.58	100.40	1.27	0.29
67	0.6720	71.100	28.9	9.7	0.60	0.99	1.59	1.60	100.30	1.29	0.30
68	0.6970	72.500	30.3	10.1	0.62	1.04	1.66	1.60	100.00	1.35	0.31
69	0.7410	73.800	31.6	10.8	0.65	1.02	1.67	1.63	100.10	1.35	0.32
70	0.7670	75.100	32.9	11.3	0.67	1.07	1.74	1.63	99.80	1.40	0.33
71	0.7860	72.500	30.3	11.6	0.61	1.01	1.62	1.61	100.20	1.32	0.31
72	0.7950	73.800	31.6	11.8	0.64	1.04	1.68	1.62	100.00	1.36	0.32
73	0.7980	72.500	30.3	11.8	0.61	1.05	1.66	1.58	99.90	1.36	0.31
74	0.8050	73.800	31.6	11.9	0.64	1.05	1.69	1.61	99.90	1.37	0.32
75	0.8080	72.500	30.3	12.0	0.61	1.07	1.68	1.57	99.80	1.37	0.31
76	0.8110	73.800	31.6	12.0	0.64	0.99	1.63	1.64	100.30	1.31	0.32
77	0.8210	72.500	30.3	12.2	0.61	0.99	1.60	1.61	100.30	1.30	0.31
78	0.8240	73.800	31.6	12.2	0.64	0.99	1.63	1.64	100.30	1.31	0.32
79	0.8330	72.500	30.3	12.4	0.61	0.99	1.60	1.61	100.30	1.30	0.30
80	0.8550	71.100	28.9	12.8	0.58	0.98	1.56	1.59	100.40	1.27	0.29
81	0.8900	69.800	27.6	13.4	0.55	0.96	1.51	1.57	100.50	1.24	0.27
82	0.9000	68.500	26.3	13.5	0.52	0.96	1.49	1.54	100.50	1.23	0.26
83	0.9220	69.800	27.6	13.9	0.54	0.96	1.51	1.56	100.50	1.24	0.27
84	0.9660	71.100	28.9	14.7	0.57	1.01	1.57	1.56	100.20	1.29	0.28
85	1.0010	72.500	30.3	15.3	0.59	0.99	1.58	1.59	100.30	1.29	0.29

ASTM D 4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST FOR COHESIVE SOILS

Project No.: 1461-14-046
Project Name: I-77 Widening Design/Build Preparation On-Call

Sample ID: B-17
Depth: 6 - 8 ft Log No.: 358

Failed Specimens

Specimen No.: 2
Effective Confining Pressure: 2 ksf
Notes: The specimen failed in bulging. Specimen 1 (0.5 ksf) was similar in appearance and failiure mode.

Sheared By: Jacob J. Folsom
Reviewed By: N. Randy Rainwater Date: 12/4/2014

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:358

Sieve Analysis of Soils

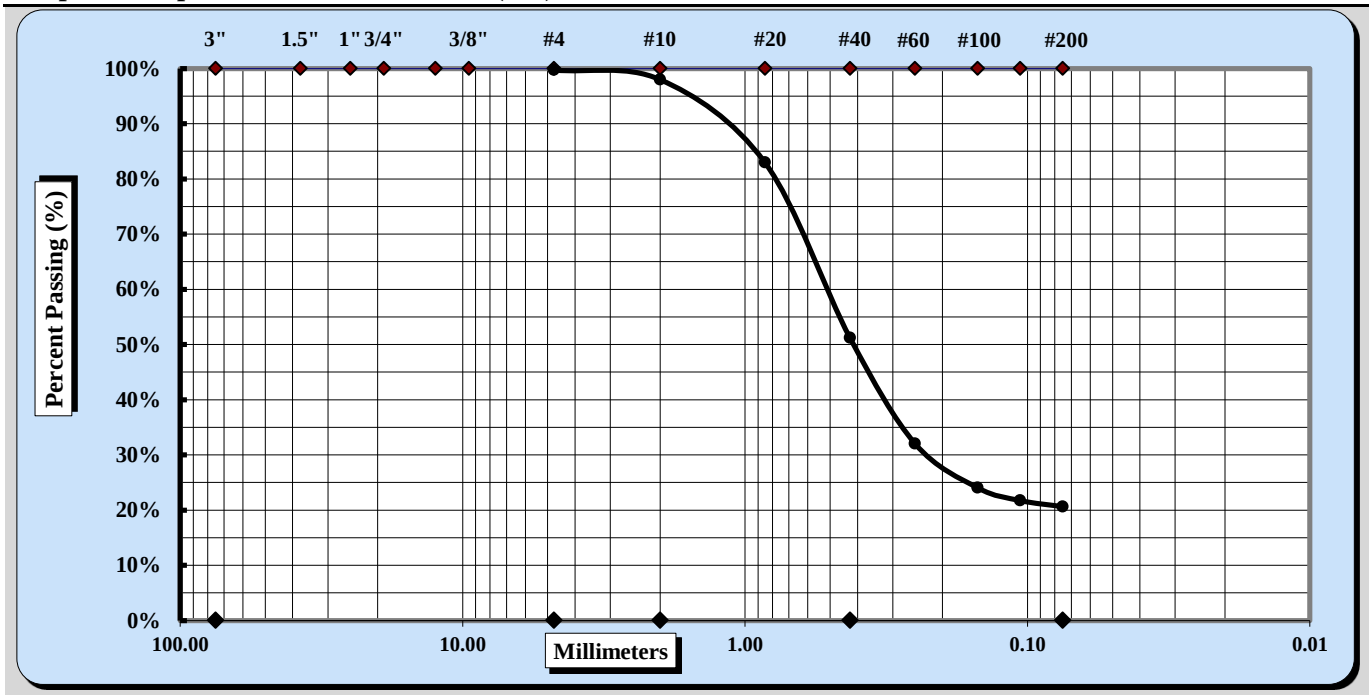
ASTM D422

Quality Assurance

S&ME, Inc., 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**1461-14-046**	Report Date:	11/26/14
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/25/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-17	Type: UD	Depth:	6 - 8 ft

Sample Description: SILTY SAND (SM) **A-2-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	1.7%	Fine Sand	30.6%
Gravel	0.3%	Medium Sand	46.8%	Silt & Clay	20.6%
Liquid Limit	NP	Plastic Limit	NP	Plastic Index	NP

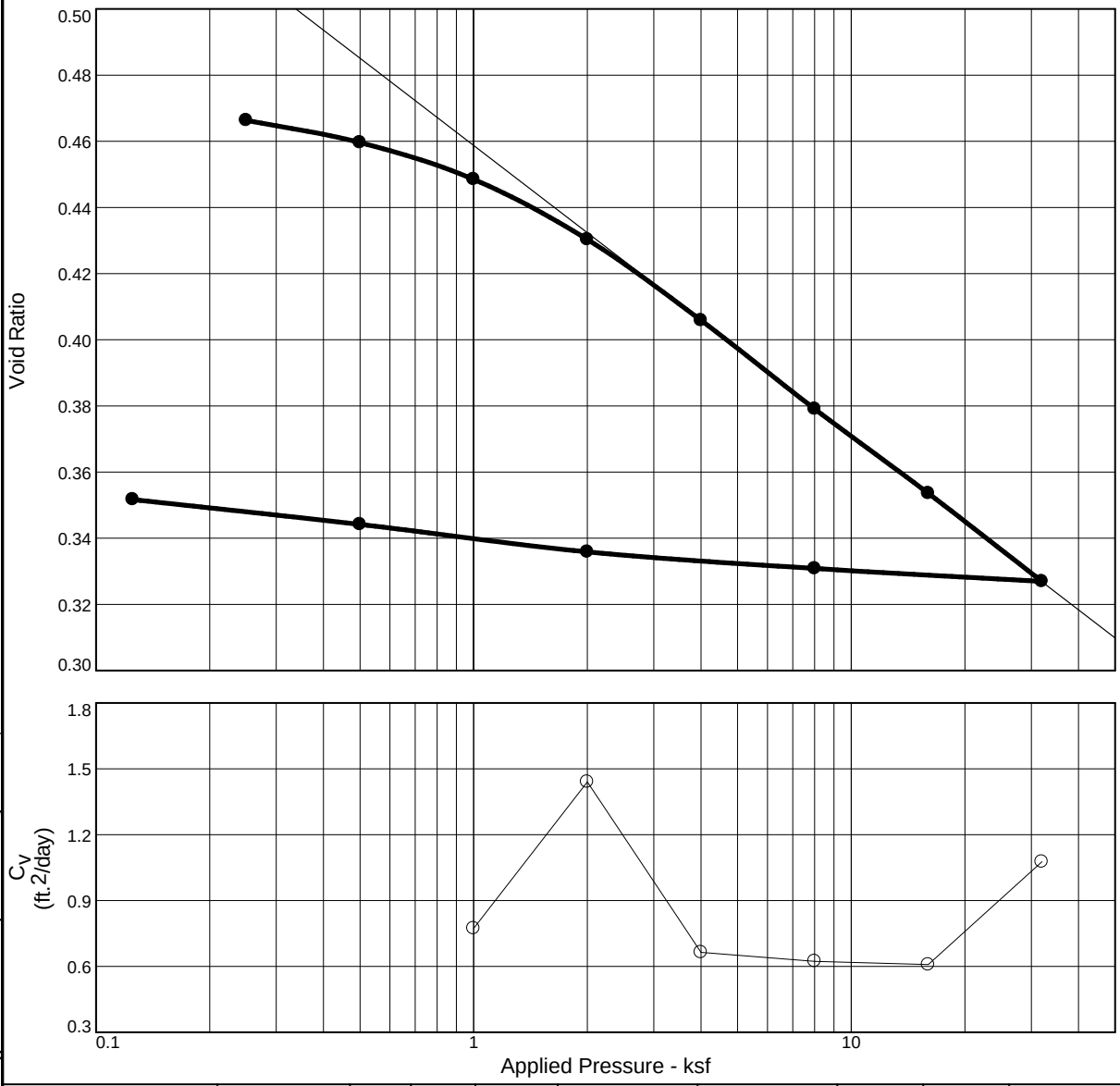
Coarse Sand	1.7%	Medium Sand	46.8%	Fine Sand	30.6%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D4318, D422, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

CONSOLIDATION TEST REPORT ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.		P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
67.6 %	12.0 %	114.2	30	14	2.65		1.45	0.09	0.01	0.472

MATERIAL DESCRIPTION	USCS	AASHTO
USCS: CLAYEY SAND (SC); AASHTO: A-2-6	SC	A-2-6

Project No. 146114046 **Client:** HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-14 **Depth:** 23 - 25 ft **Sample Number:** Log 355

S & ME, INC.

Louisville, TN

Remarks:

Trimmed with a cutting ring, inundated in seat load.

Figure 1

The designer is responsible for interpreting test data as provided by S&ME, Inc.

Checked By: NRR, 12/2/14

CONSOLIDATION TEST DATA

12/2/2014

Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project Number: 146114046
Location: B-14
Depth: 23 - 25 ft **Sample Number:** Log 355
Material Description: USCS: CLAYEY SAND (SC); AASHTO: A-2-6
Liquid Limit: 30 **Plasticity Index:** 14
USCS: SC **AASHTO:** A-2-6
Figure No.: 1
Testing Remarks: Trimmed with a cutting ring, inundated in seat load.
Tested by: D. Baker, M. Kelso **Checked by:** NRR, 12/2/14

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	210.77 g.	Spec. Gr. =	2.65	Wet w+t =	160.64 g.
Dry w+t =	188.84 g.	Est. Ht. Solids =	0.638 in.	Dry w+t =	142.88 g.
Tare Wt. =	6.79 g.	Init. V.R. =	0.472	Tare Wt. =	6.82 g.
Moisture =	12.0 %	Init. Sat. =	67.6 %	Moisture =	13.1 %

UNIT WEIGHT		TEST START			
Height =	0.940 in.	Height =	0.940 in.	Dry Wt. =	136.06* g.
Diameter =	2.500 in.	Diameter =	2.500 in.		
Weight =	154.98 g.				
Dry Dens. =	114.2 pcf				

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000		0.00000			0.472	
0.25	0.00400	0.00020	0.00380			0.466	0.4 Comprs.
0.50	0.00880	0.00070	0.00810			0.460	0.9 Comprs.
1.00	0.01630	0.00110	0.01520	0.773		0.448	1.6 Comprs.
2.00	0.02840	0.00160	0.02680	1.440		0.430	2.9 Comprs.
4.00	0.04460	0.00220	0.04240	0.664		0.406	4.5 Comprs.
8.00	0.06280	0.00330	0.05950	0.623		0.379	6.3 Comprs.
16.00	0.08040	0.00460	0.07580	0.608		0.354	8.1 Comprs.
32.00	0.09940	0.00660	0.09280	1.077	0.001	0.327	9.9 Comprs.
8.00	0.09440	0.00410	0.09030			0.331	9.6 Comprs.
2.00	0.09000	0.00290	0.08710			0.336	9.3 Comprs.
0.50	0.08420	0.00240	0.08180			0.344	8.7 Comprs.
0.13	0.07900	0.00200	0.07700			0.352	8.2 Comprs.
0.00	0.07900	0.00200	0.07700				

Compression index (C_C), ksf = 0.09 **Preconsolidation pressure (P_p), ksf =** 1.45 **Void ratio at P_p (e_m) =** 0.440

Pressure: 0.25 ksf		TEST READINGS			Load No. 1
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	60	0.00330
2	.10	0.00210	12	120	0.00340
3	.25	0.00240	13	240	0.00350
4	.5	0.00250	14	480	0.00380
5	1	0.00270	15	1440	0.00400
6	2	0.00280			
7	4	0.00290			
8	8	0.00300			
9	15	0.00310			
10	30	0.00320			

Void Ratio = 0.466 **Compression =** 0.4%

Pressure: 0.50 ksf		TEST READINGS			Load No. 2
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00400	11	60	0.00840
2	.10	0.00690	12	120	0.00850
3	.25	0.00710	13	240	0.00850
4	.5	0.00730	14	480	0.00860
5	1	0.00750	15	1440	0.00880
6	2	0.00770			
7	4	0.00780			
8	8	0.00790			
9	15	0.00810			
10	30	0.00830			

Void Ratio = 0.460 **Compression =** 0.9%

Pressure: 1.00 ksf		TEST READINGS			Load No. 3
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00880	11	60	0.01570
2	.10	0.01350	12	120	0.01570
3	.25	0.01400	13	240	0.01580
4	.5	0.01420	14	480	0.01590
5	1	0.01440	15	1440	0.01620
6	2	0.01470	16	2703	0.01630
7	4	0.01490			
8	8	0.01510			
9	15	0.01530			
10	30	0.01550			

Void Ratio = 0.448 **Compression =** 1.6%

D_0 = 0.0123 **D_{90} =** 0.0136 **D_{100} =** 0.0138 **C_V at 2.36 min. =** 0.773 ft.^{2}/day

Pressure: 2.00 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01630	11	60	0.02770
2	.10	0.02450	12	120	0.02770
3	.25	0.02530	13	240	0.02790
4	.5	0.02570	14	480	0.02810
5	1	0.02610	15	1440	0.02840
6	2	0.02630			
7	4	0.02680			
8	8	0.02700			
9	15	0.02720			
10	30	0.02750			

Void Ratio = 0.430 **Compression =** 2.9%
D_0 = 0.0224 **D_{90} =** 0.0246 **D_{100} =** 0.0248 **C_v at 1.24 min. =** 1.440 ft.^{2}/day

Pressure: 4.00 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02840	11	60	0.04380
2	.10	0.04010	12	120	0.04400
3	.25	0.04100	13	240	0.04420
4	.5	0.04140	14	480	0.04440
5	1	0.04190	15	1325	0.04460
6	2	0.04230			
7	4	0.04280			
8	8	0.04310			
9	15	0.04350			
10	30	0.04370			

Void Ratio = 0.406 **Compression =** 4.5%
D_0 = 0.0377 **D_{90} =** 0.0403 **D_{100} =** 0.0406 **C_v at 2.62 min. =** 0.664 ft.^{2}/day

Pressure: 8.00 ksf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.04460	11	60	0.06210
2	.10	0.05790	12	120	0.06230
3	.25	0.05890	13	240	0.06250
4	.5	0.05940	14	480	0.06280
5	1	0.05990	15	779	0.06280
6	2	0.06050			
7	4	0.06110			
8	8	0.06140			
9	15	0.06170			
10	30	0.06200			

Void Ratio = 0.379 **Compression =** 6.3%
D_0 = 0.0543 **D_{90} =** 0.0574 **D_{100} =** 0.0578 **C_v at 2.69 min. =** 0.623 ft.^{2}/day

Pressure: 16.00 ksf		TEST READINGS			Load No. 7
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.06280	11	60	0.07960
2	.10	0.07510	12	120	0.07970
3	.25	0.07590	13	240	0.08000
4	.5	0.07650	14	480	0.08020
5	1	0.07720	15	651	0.08040
6	2	0.07790			
7	4	0.07840			
8	8	0.07880			
9	15	0.07900			
10	30	0.07930			

Void Ratio = 0.354 **Compression =** 8.1%

D_0 = 0.0700 **D_{90} =** 0.0735 **D_{100} =** 0.0739 **C_v at 2.65 min. =** 0.608 ft.^{2}/day

Pressure: 32.00 ksf		TEST READINGS			Load No. 8
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.08040	11	60	0.09840
2	.10	0.09200	12	120	0.09870
3	.25	0.09340	13	240	0.09890
4	.5	0.09430	14	480	0.09910
5	1	0.09530	15	780	0.09940
6	2	0.09620			
7	4	0.09700			
8	8	0.09740			
9	15	0.09790			
10	30	0.09810			

Void Ratio = 0.327 **Compression =** 9.9%

D_0 = 0.0833 **D_{50} =** 0.0872 **D_{100} =** 0.0911 **C_v at 0.33 min. =** 1.077 ft.^{2}/day **C_α =** 0.001

Pressure: 8.00 ksf		TEST READINGS			Load No. 9
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.09940	11	60	0.09450
2	.10	0.09500	12	120	0.09440
3	.25	0.09490	13	240	0.09440
4	.5	0.09480	14	480	0.09440
5	1	0.09470			
6	2	0.09460			
7	4	0.09450			
8	8	0.09450			
9	15	0.09450			
10	30	0.09450			

Void Ratio = 0.331 **Compression =** 9.6%

Pressure: 2.00 ksf			TEST READINGS			Load No. 10
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	
1	0	0.09440	11	60	0.09000	
2	.10	0.09210	12	120	0.09000	
3	.25	0.09180	13	240	0.09000	
4	.5	0.09160	14	258	0.09000	
5	1	0.09120				
6	2	0.09090				
7	4	0.09050				
8	8	0.09020				
9	15	0.09010				
10	30	0.09000				

Void Ratio = 0.336 **Compression =** 9.3%

Pressure: 0.50 ksf			TEST READINGS			Load No. 11
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	
1	0	0.09000	11	60	0.08460	
2	.10	0.08830	12	120	0.08450	
3	.25	0.08800	13	240	0.08440	
4	.5	0.08780	14	480	0.08430	
5	1	0.08750	15	1202	0.08420	
6	2	0.08700				
7	4	0.08640				
8	8	0.08580				
9	15	0.08530				
10	30	0.08490				

Void Ratio = 0.344 **Compression =** 8.7%

Pressure: 0.13 ksf			TEST READINGS			Load No. 12
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	
1	0	0.08420	11	60	0.08010	
2	.10	0.08370	12	120	0.07980	
3	.25	0.08350	13	240	0.07960	
4	.5	0.08330	14	480	0.07920	
5	1	0.08310	15	1440	0.07900	
6	2	0.08290				
7	4	0.08240				
8	8	0.08190				
9	15	0.08130				
10	30	0.08060				

Void Ratio = 0.352 **Compression =** 8.2%

Sieve Analysis of Soils

ASTM D422

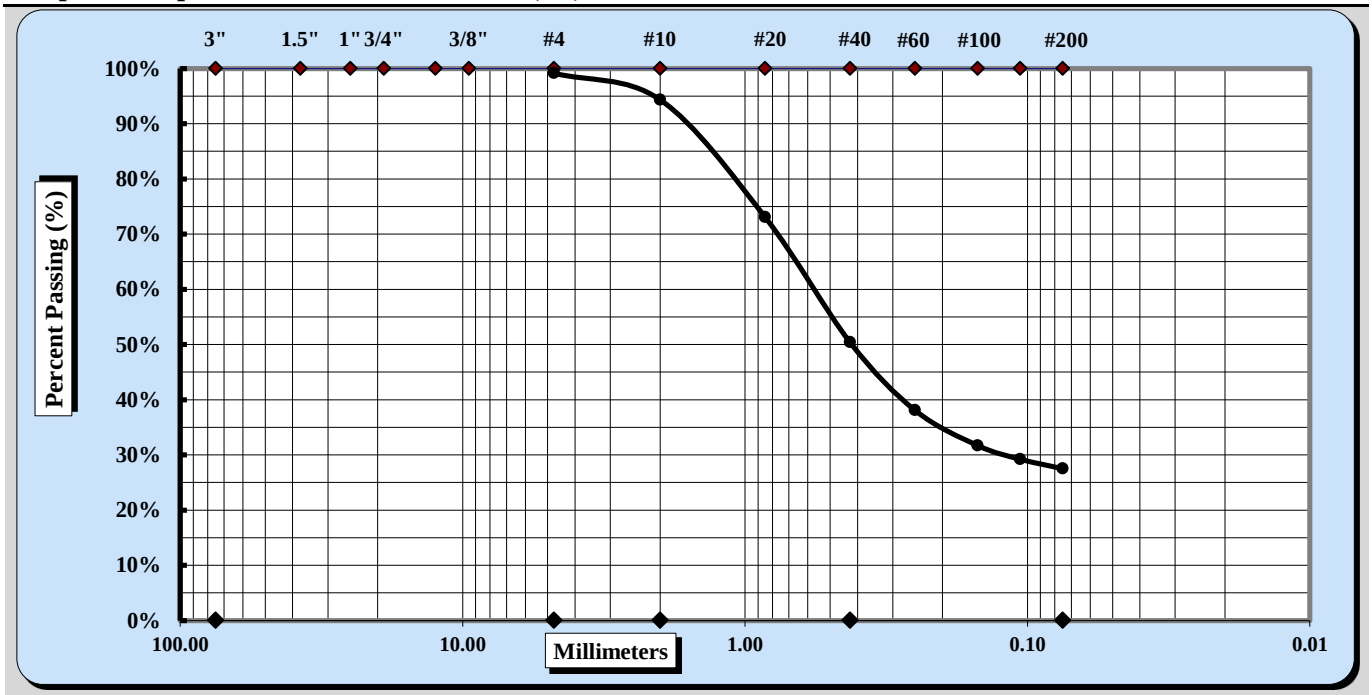
Quality Assurance

Sample Log No.:355

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/5/14 - 11/6/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: UD		
		Depth:	23 - 25 ft

Sample Description: CLAYEY SAND (SC) **A-2-6**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 4	Coarse Sand	4.8%	Fine Sand	22.9%
Gravel	0.9%	Medium Sand	43.9%	Silt & Clay	27.5%
Liquid Limit	30	Plastic Limit	16	Plastic Index	14

Coarse Sand	4.8%	Medium Sand	43.9%	Fine Sand	22.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

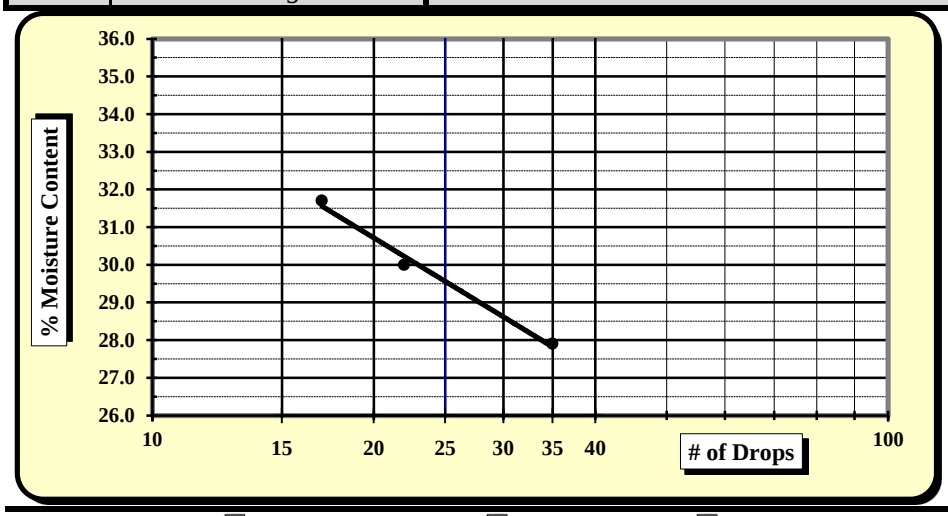
Log No.:355 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/21/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: UD		
		Depth: 23 - 25 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	17	24	23				1	5	
A	Tare Weight	15.57	15.51	15.50				15.42	15.48	
B	Wet Soil Weight + A	28.54	29.58	30.45				25.07	24.97	
C	Dry Soil Weight + A	25.42	26.33	27.19				23.73	23.66	
D	Water Weight (B-C)	3.12	3.25	3.26				1.34	1.31	
E	Dry Soil Weight (C-A)	9.85	10.82	11.69				8.31	8.18	
F	% Moisture (D/E)*100	31.7%	30.0%	27.9%				16.1%	16.0%	
N	# OF DROPS	17	22	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**16.1%**		



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	**30**
Plastic Limit	**16**
Plastic Index	**14**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

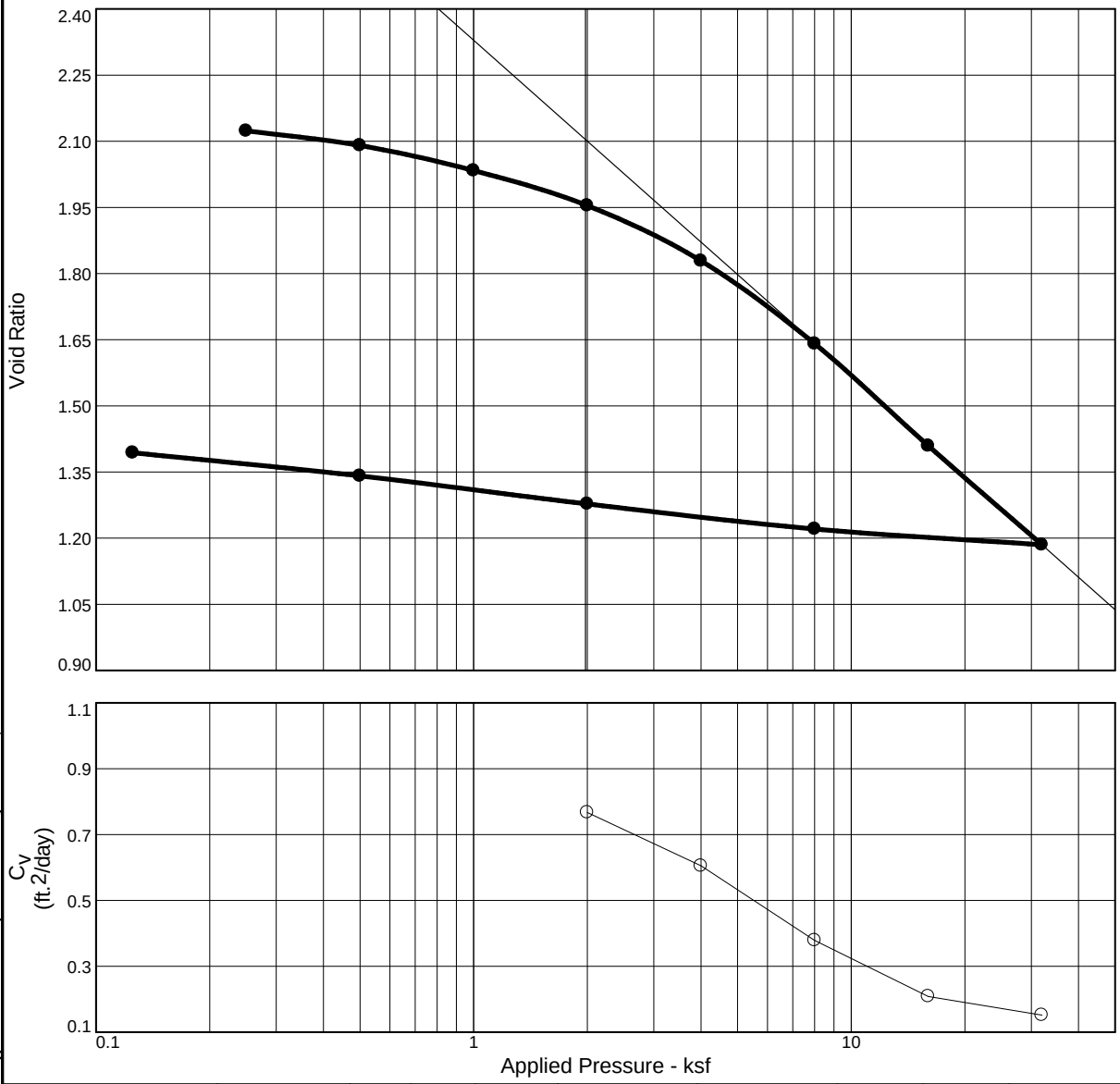
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-2-6**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/21/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

CONSOLIDATION TEST REPORT ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.		P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
65.2 %	55.6 %	56.4	31	10	2.52		3.50	0.76	0.09	2.150

MATERIAL DESCRIPTION	USCS	AASHTO
USCS: CLAYEY SAND (SC); AASHTO: A-4	SC	A-4

Project No. 146114046 **Client:** HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-14 **Depth:** 28 - 30 ft **Sample Number:** Log 356

S & ME, INC.

Louisville, TN

Remarks:

Trimmed with a cutting ring, indundated in seat load.

Figure 1

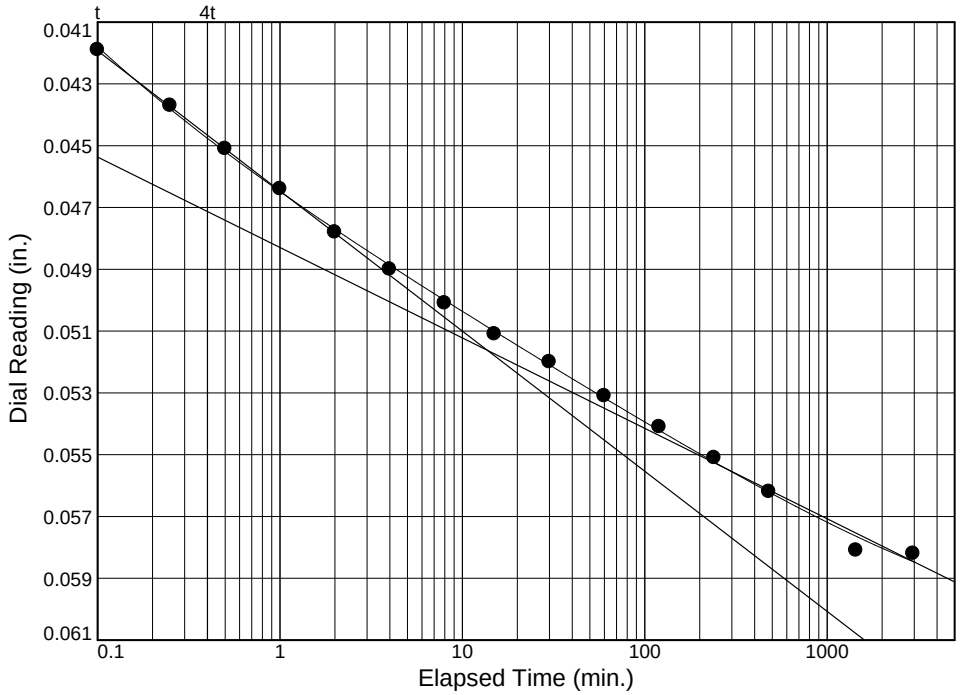
The designer is responsible for interpreting test data as provided by S&ME, Inc.

Checked By: NRR, 12/2/14

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

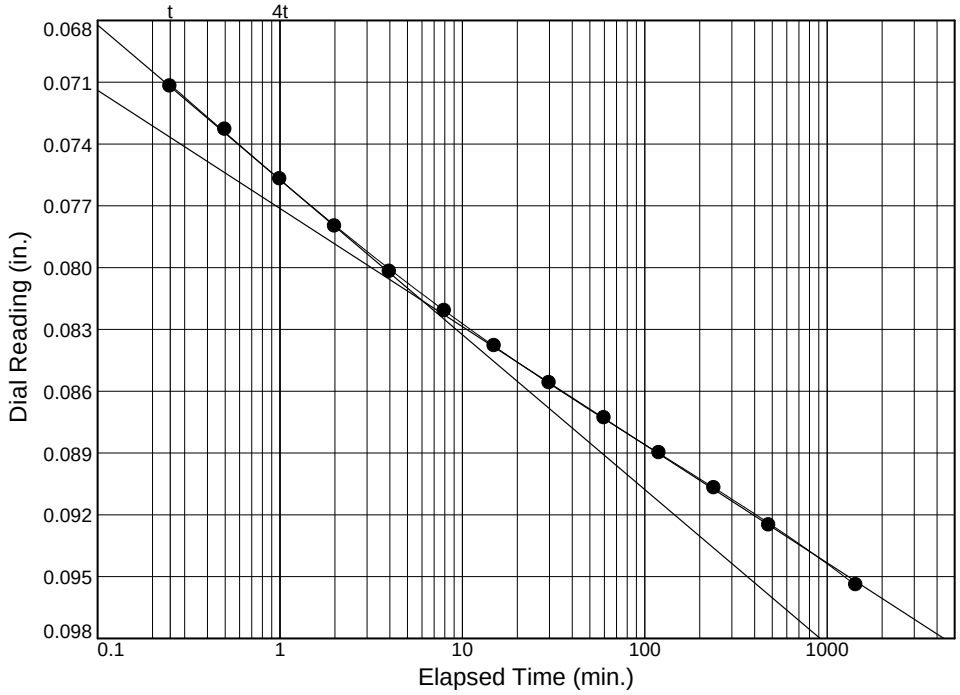
Location: B-14 Depth: 28 - 30 ft Sample Number: Log 356



Load No.= 4
Load= 2.00 ksf
D_0 = 0.0388
D_{50} = 0.0452
D_{100} = 0.0516
T_{50} = 0.51 min.

C_v @ T_{50}
0.767 ft.^{2}/day

C_α = 0.003



Load No.= 5
Load= 4.00 ksf
D_0 = 0.0665
D_{50} = 0.0741
D_{100} = 0.0816
T_{50} = 0.60 min.

C_v @ T_{50}
0.605 ft.^{2}/day

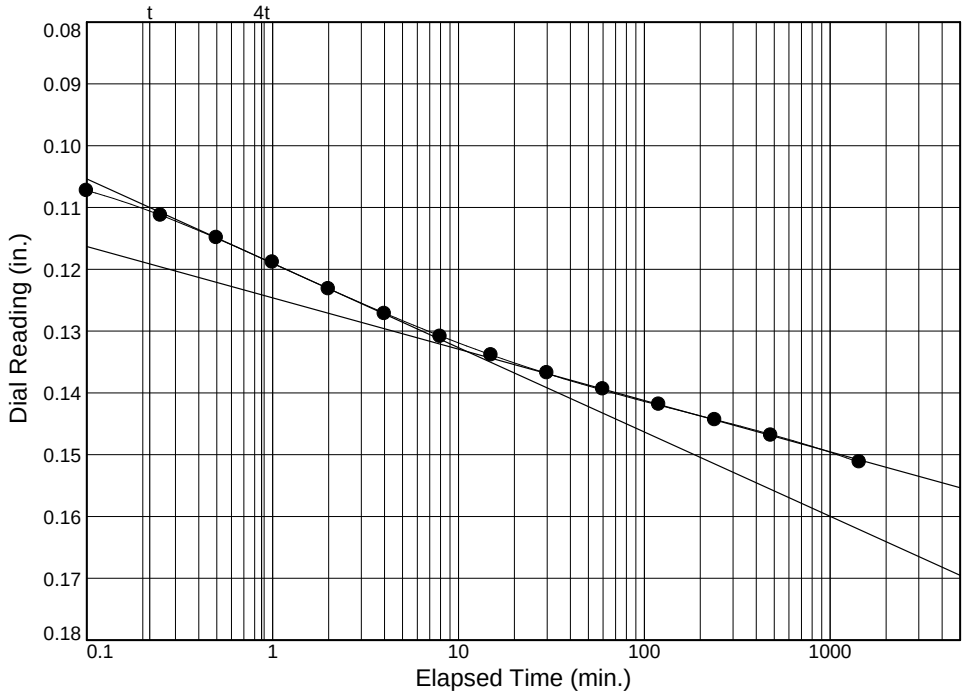
C_α = 0.006

Figure 2

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

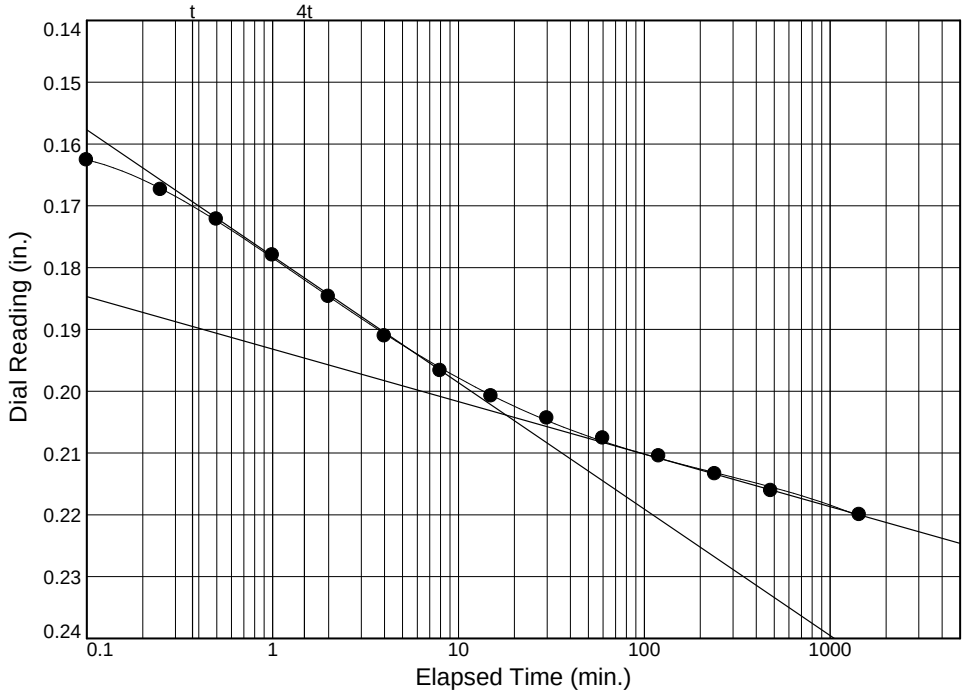
Location: B-14 Depth: 28 - 30 ft Sample Number: Log 356



Load No.= 6
Load= 8.00 ksf
D_0 = 0.1029
D_{50} = 0.1181
D_{100} = 0.1333
T_{50} = 0.86 min.

C_v @ T_{50}
0.379 ft.^{2}/day

C_α = 0.009



Load No.= 7
Load= 16.00 ksf
D_0 = 0.1581
D_{50} = 0.1810
D_{100} = 0.2039
T_{50} = 1.33 min.

C_v @ T_{50}
0.208 ft.^{2}/day

C_α = 0.009

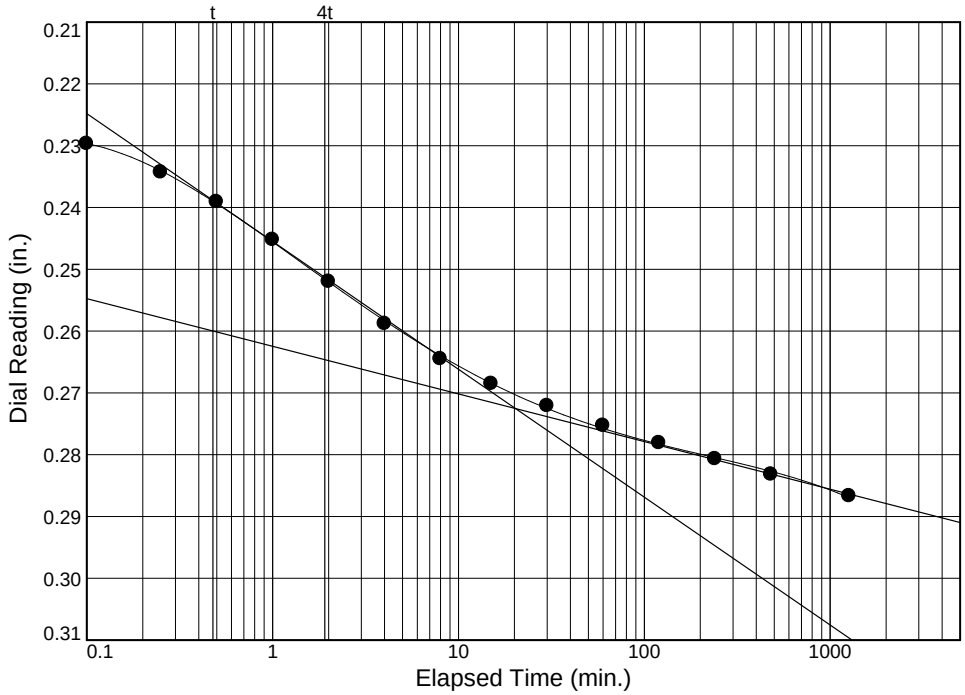
Figure 3

S & ME, Inc.

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

Location: B-14 Depth: 28 - 30 ft Sample Number: Log 356



Load No.= 8
Load= 32.00 ksf
D_0 = 0.2263
D_{50} = 0.2494
D_{100} = 0.2725
T_{50} = 1.51 min.

C_v @ T_{50}
0.152 ft.^{2}/day

C_α = 0.008

Figure 4

CONSOLIDATION TEST DATA

12/3/2014

Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project Number: 146114046
Location: B-14
Depth: 28 - 30 ft **Sample Number:** Log 356
Material Description: USCS: CLAYEY SAND (SC); AASHTO: A-4
Liquid Limit: 31 **Plasticity Index:** 10
USCS: SC **AASHTO:** A-4
Figure No.: 1
Testing Remarks: Trimmed with a cutting ring, indundated in seat load.
Tested by: DB & MDK **Checked by:** NRR, 12/2/14

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	189.87 g.	Spec. Gr. =	2.52	Wet w+t =	578.63 g.
Dry w+t =	124.44 g.	Est. Ht. Solids =	0.297 in.	Dry w+t =	544.95 g.
Tare Wt. =	6.81 g.	Init. V.R. =	2.150	Tare Wt. =	484.74 g.
Moisture =	55.6 %	Init. Sat. =	65.2 %	Moisture =	55.9 %
UNIT WEIGHT		**TEST START**		Dry Wt. =	60.21* g.
Height =	0.936 in.	Height =	0.936 in.		
Diameter =	2.500 in.	Diameter =	2.500 in.		
Weight =	105.82 g.				
Dry Dens. =	56.4 pcf				

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000		0.00000			2.150	
0.25	0.00820	0.00040	0.00780			2.124	0.8 Comprs.
0.50	0.01880	0.00110	0.01770			2.090	1.9 Comprs.
1.00	0.03650	0.00190	0.03460			2.034	3.7 Comprs.
2.00	0.06080	0.00260	0.05820	0.767	0.003	1.954	6.2 Comprs.
4.00	0.09900	0.00360	0.09540	0.605	0.006	1.829	10.2 Comprs.
8.00	0.15610	0.00490	0.15120	0.379	0.009	1.641	16.2 Comprs.
16.00	0.22660	0.00660	0.22000	0.208	0.009	1.409	23.5 Comprs.
32.00	0.29590	0.00920	0.28670	0.152	0.008	1.185	30.6 Comprs.
8.00	0.28220	0.00610	0.27610			1.221	29.5 Comprs.
2.00	0.26340	0.00420	0.25920			1.278	27.7 Comprs.
0.50	0.24340	0.00310	0.24030			1.341	25.7 Comprs.
0.13	0.22700	0.00230	0.22470			1.394	24.0 Comprs.

Compression index (C_c), ksf = 0.76 **Preconsolidation pressure (P_p), ksf =** 3.50 **Void ratio at P_p (e_m) =** 1.858

Pressure: 0.25 ksf		TEST READINGS			Load No. 1
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	60	0.00740
2	.10	0.00350	12	120	0.00770
3	.25	0.00420	13	240	0.00790
4	.5	0.00470	14	480	0.00820
5	1	0.00510	15	1200	0.00820
6	2	0.00560			
7	4	0.00600			
8	8	0.00640			
9	15	0.00670			
10	30	0.00700			

Void Ratio = 2.124 **Compression =** 0.8%

Pressure: 0.50 ksf		TEST READINGS			Load No. 2
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00820	11	60	0.01660
2	.10	0.01180	12	120	0.01710
3	.25	0.01250	13	240	0.01760
4	.5	0.01320	14	480	0.01800
5	1	0.01370	15	1440	0.01880
6	2	0.01430			
7	4	0.01480			
8	8	0.01530			
9	15	0.01580			
10	30	0.01620			

Void Ratio = 2.090 **Compression =** 1.9%

Pressure: 1.00 ksf		TEST READINGS			Load No. 3
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01880	11	60	0.03330
2	.10	0.02620	12	120	0.03390
3	.25	0.02730	13	240	0.03460
4	.5	0.02810	14	480	0.03530
5	1	0.02900	15	1440	0.03650
6	2	0.02980			
7	4	0.03060			
8	8	0.03130			
9	15	0.03190			
10	30	0.03260			

Void Ratio = 2.034 **Compression =** 3.7%

Pressure: 2.00 ksf | **TEST READINGS** | **Load No. 4**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03650	11	60	0.05570
2	.10	0.04450	12	120	0.05670
3	.25	0.04630	13	240	0.05770
4	.5	0.04770	14	480	0.05880
5	1	0.04900	15	1440	0.06070
6	2	0.05040	16	2966	0.06080
7	4	0.05160			
8	8	0.05270			
9	15	0.05370			
10	30	0.05460			

Void Ratio = 1.954 **Compression =** 6.2%

D_0 = 0.0388 D_{50} = 0.0452 D_{100} = 0.0516 C_v **at 0.51 min. =** 0.767 ft.^{2}/day C_α = 0.003

Pressure: 4.00 ksf | **TEST READINGS** | **Load No. 5**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.06080	11	120	0.09260
2	.25	0.07480	12	240	0.09430
3	.5	0.07690	13	480	0.09610
4	1	0.07930	14	1440	0.09900
5	2	0.08160			
6	4	0.08380			
7	8	0.08570			
8	15	0.08740			
9	30	0.08920			
10	60	0.09090			

Void Ratio = 1.829 **Compression =** 10.2%

D_0 = 0.0665 D_{50} = 0.0741 D_{100} = 0.0816 C_v **at 0.60 min. =** 0.605 ft.^{2}/day C_α = 0.006

Pressure: 8.00 ksf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.09900	11	60	0.14430
2	.10	0.11220	12	120	0.14680
3	.25	0.11620	13	240	0.14930
4	.5	0.11980	14	480	0.15180
5	1	0.12380	15	1440	0.15610
6	2	0.12810			
7	4	0.13210			
8	8	0.13580			
9	15	0.13880			
10	30	0.14170			

Void Ratio = 1.641 **Compression =** 16.2%

D_0 = 0.1029 D_{50} = 0.1181 D_{100} = 0.1333 C_v **at 0.86 min. =** 0.379 ft.^{2}/day C_α = 0.009

Pressure: 16.00 ksf — **TEST READINGS** — **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.15610	11	60	0.21420
2	.10	0.16920	12	120	0.21710
3	.25	0.17400	13	240	0.22000
4	.5	0.17880	14	480	0.22270
5	1	0.18460	15	1440	0.22660
6	2	0.19130			
7	4	0.19770			
8	8	0.20330			
9	15	0.20740			
10	30	0.21100			

Void Ratio = 1.409 **Compression =** 23.5%

D_0 = 0.1581 D_{50} = 0.1810 D_{100} = 0.2039 C_v **at 1.33 min. =** 0.208 ft.^{2}/day C_α = 0.009

Pressure: 32.00 ksf — **TEST READINGS** — **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.22660	11	60	0.28450
2	.10	0.23890	12	120	0.28730
3	.25	0.24350	13	240	0.28990
4	.5	0.24830	14	480	0.29240
5	1	0.25440	15	1264	0.29590
6	2	0.26120			
7	4	0.26800			
8	8	0.27370			
9	15	0.27770			
10	30	0.28130			

Void Ratio = 1.185 **Compression =** 30.6%

D_0 = 0.2263 D_{50} = 0.2494 D_{100} = 0.2725 C_v **at 1.51 min. =** 0.152 ft.^{2}/day C_α = 0.008

Pressure: 8.00 ksf — **TEST READINGS** — **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.29590	11	60	0.28380
2	.10	0.28920	12	120	0.28340
3	.25	0.28790	13	240	0.28300
4	.5	0.28730	14	480	0.28260
5	1	0.28670	15	1440	0.28220
6	2	0.28610			
7	4	0.28550			
8	8	0.28500			
9	15	0.28460			
10	30	0.28420			

Void Ratio = 1.221 **Compression =** 29.5%

Pressure: 2.00 ksf		TEST READINGS			Load No. 10
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.28220	11	60	0.26810
2	.10	0.27790	12	120	0.26700
3	.25	0.27690	13	240	0.26610
4	.5	0.27610	14	480	0.26490
5	1	0.27520	15	1440	0.26340
6	2	0.27400			
7	4	0.27260			
8	8	0.27120			
9	15	0.27010			
10	30	0.26900			

Void Ratio = 1.278 **Compression =** 27.7%

Pressure: 0.50 ksf		TEST READINGS			Load No. 11
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.26340	11	60	0.25160
2	.10	0.26140	12	120	0.25010
3	.25	0.26040	13	240	0.24850
4	.5	0.26040	14	480	0.24660
5	1	0.25970	15	1440	0.24340
6	2	0.25880			
7	4	0.25760			
8	8	0.25610			
9	15	0.25460			
10	30	0.25300			

Void Ratio = 1.341 **Compression =** 25.7%

Pressure: 0.13 ksf		TEST READINGS			Load No. 12
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.24340	11	60	0.23500
2	.10	0.24060	12	120	0.23380
3	.25	0.24040	13	240	0.23250
4	.5	0.24010	14	480	0.23080
5	1	0.23980	15	1440	0.22700
6	2	0.23930			
7	4	0.23870			
8	8	0.23790			
9	15	0.23710			
10	30	0.23610			

Void Ratio = 1.394 **Compression =** 24.0%

Form No: TR-D422-WH-1Ga
Revision No. 0
Revision Date: 07/14/08

Sample Log No.:356

Sieve Analysis of Soils

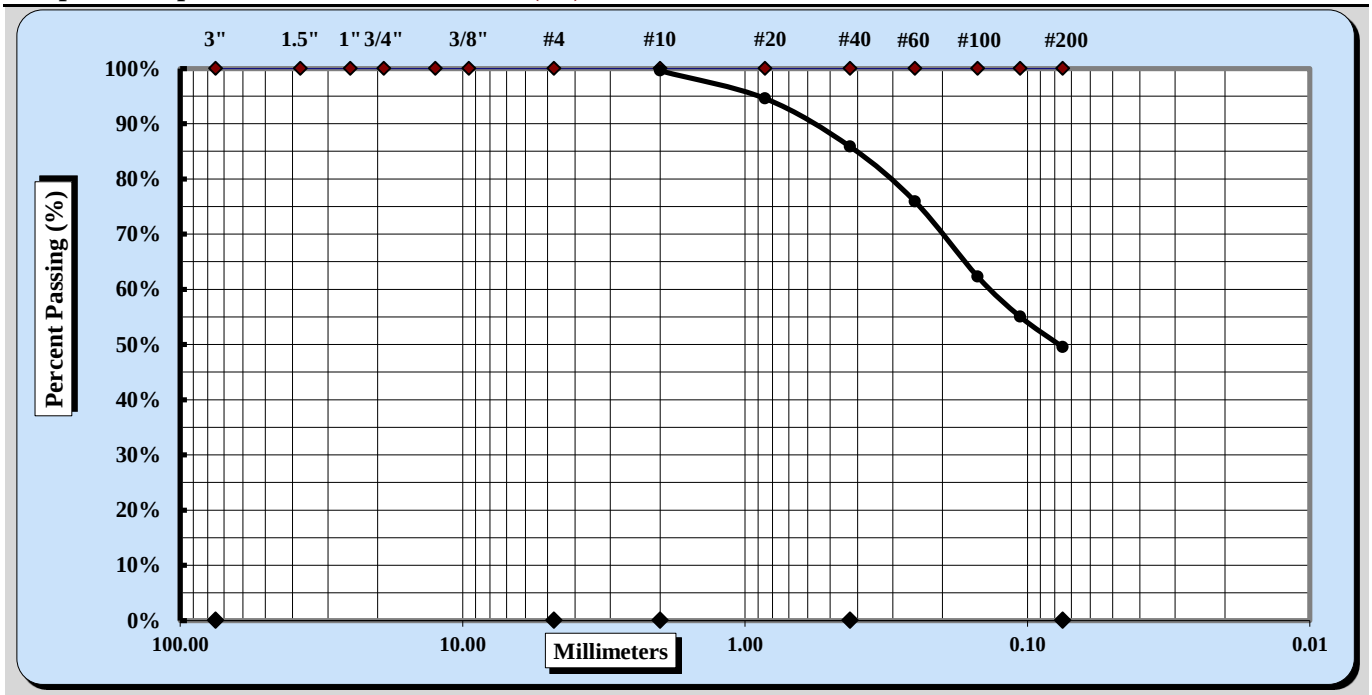
ASTM D422

Quality Assurance

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/25/14 - 11/26/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Type: UD		
		Depth:	28 - 30 ft

Sample Description: CLAYEY SAND (SC) **A-4**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	No. 10	Coarse Sand	0.4%	Fine Sand	36.3%
Gravel	0.0%	Medium Sand	13.7%	Silt & Clay	49.5%
Liquid Limit	31	Plastic Limit	21	Plastic Index	10

Coarse Sand	0.4%	Medium Sand	13.7%	Fine Sand	36.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

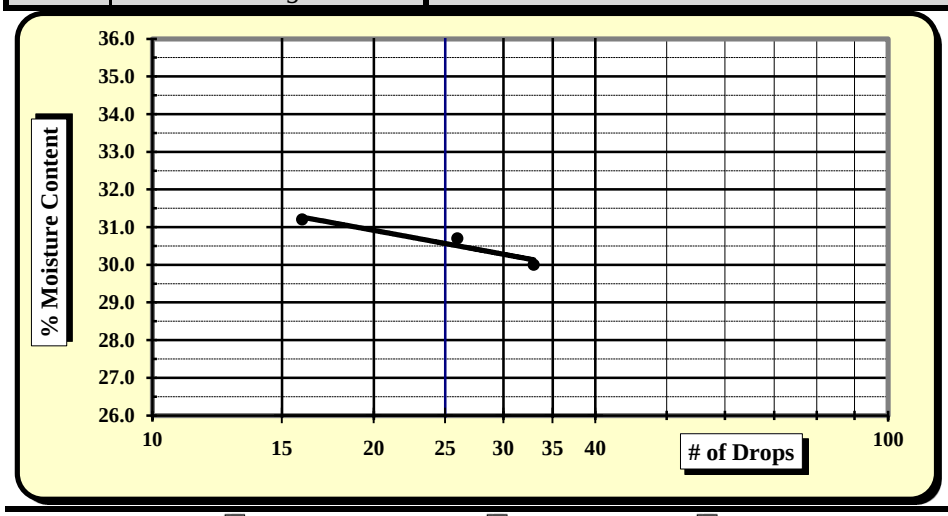
Log No.:356 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/21/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-14	Sample No: UD		
		Depth: 28 - 30 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	18	22				7	11	
A	Tare Weight	15.52	15.50	15.47				15.48	15.50	
B	Wet Soil Weight + A	32.80	33.37	34.92				25.82	24.81	
C	Dry Soil Weight + A	28.69	29.17	30.43				24.00	23.17	
D	Water Weight (B-C)	4.11	4.20	4.49				1.82	1.64	
E	Dry Soil Weight (C-A)	13.17	13.67	14.96				8.52	7.67	
F	% Moisture (D/E)*100	31.2%	30.7%	30.0%				21.4%	21.4%	
N	# OF DROPS	16	26	33				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**21.4%**		



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	**31**
Plastic Limit	**21**
Plastic Index	**10**
USCS Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

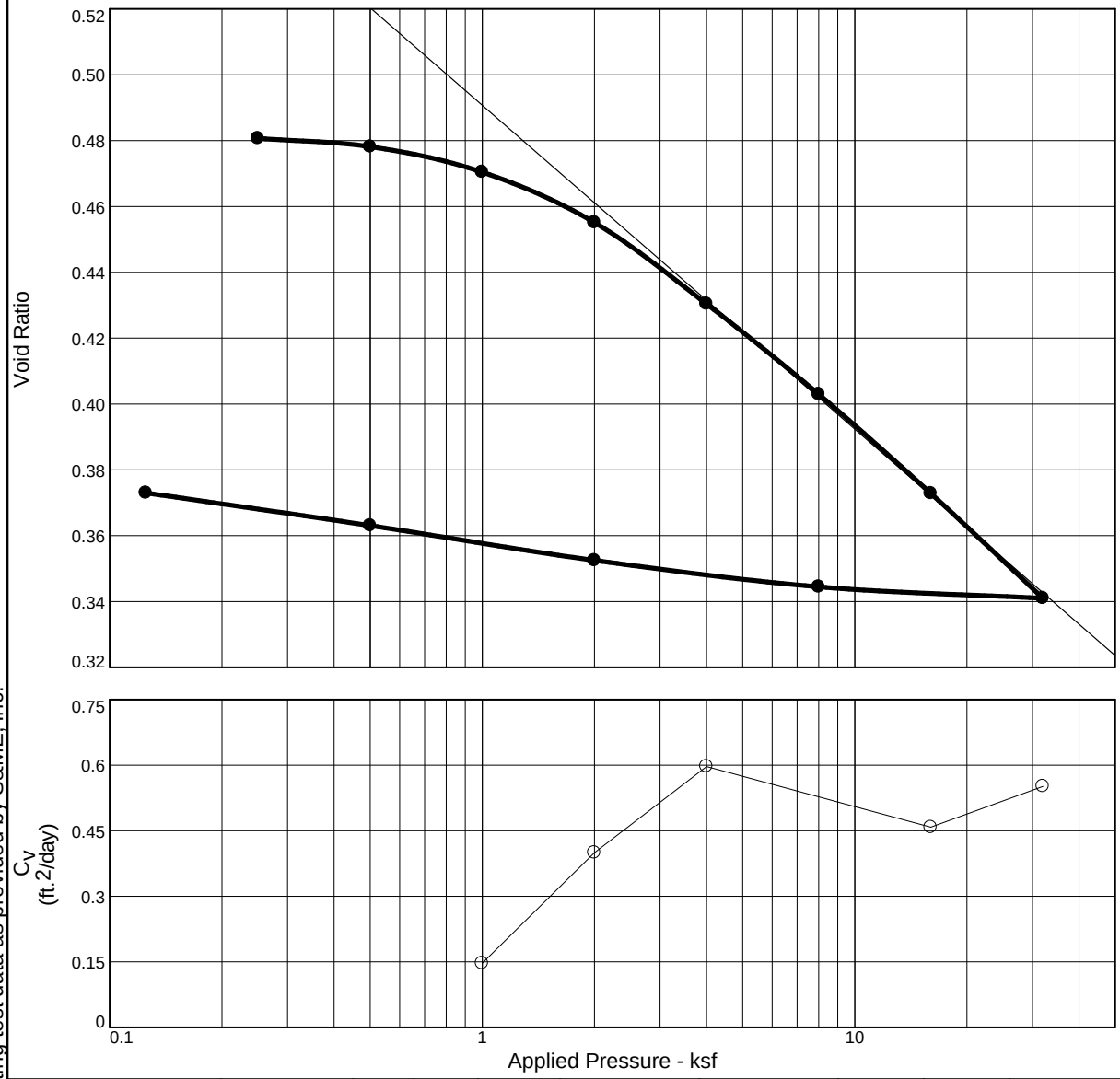
Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASHTO Classification A-4**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/21/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

CONSOLIDATION TEST REPORT ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.		P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
73.2 %	13.3 %	111.9	76	34	2.63		1.46	0.10	0.01	0.480

MATERIAL DESCRIPTION	USCS	AASHTO
USCS: SANDY ELASTIC SILT (MH); AASHTO: A-7-5	MH	A-7-5

Project No. 146114046 **Client:** HDR, Inc.

Project: I-77 Widening Design/Build Preparation On-Call

Location: B-16 **Depth:** 11 - 13 ft **Sample Number:** Log 357

S & ME, INC.

Louisville, TN

Remarks:

Trimmed with a cutting ring, inundated in seat load.

Figure 1

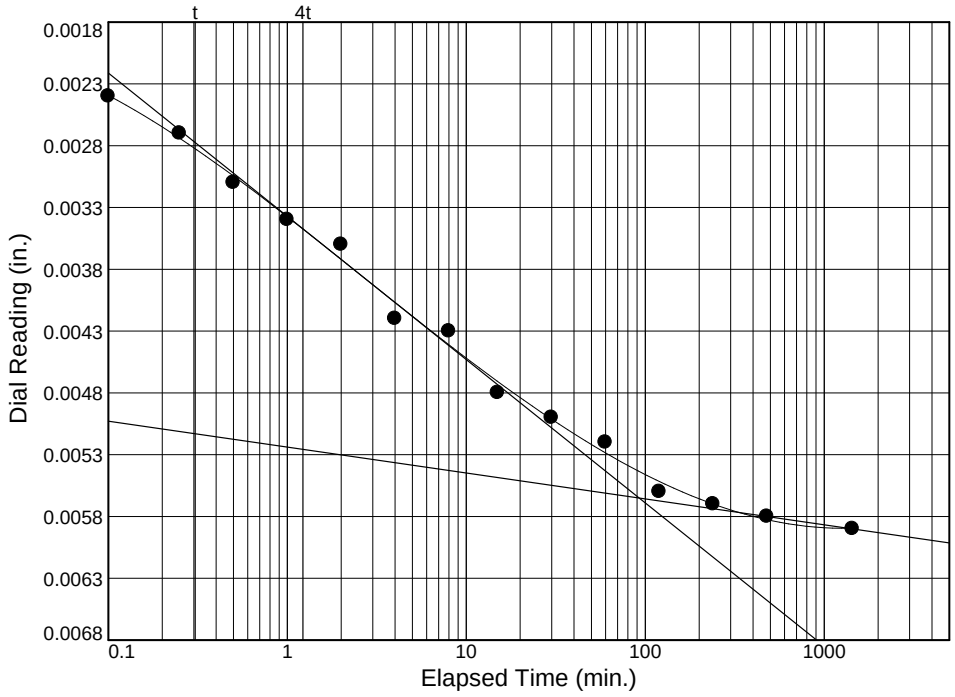
The designer is responsible for interpreting test data as provided by S&ME, Inc.

Checked By: NRR, 12/2/14

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

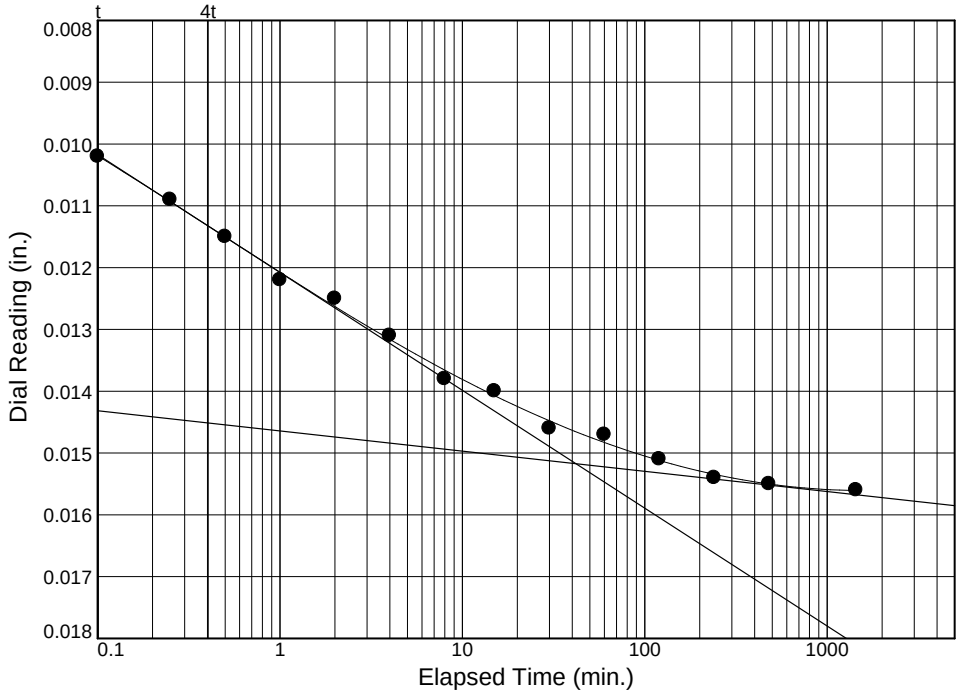
Location: B-16 Depth: 11 - 13 ft Sample Number: Log 357



Load No.= 3
Load= 1.00 ksf
D_0 = 0.0022
D_{50} = 0.0039
D_{100} = 0.0057
T_{50} = 2.93 min.

C_v @ T_{50}
0.147 ft.^{2}/day

C_α = 0.000



Load No.= 4
Load= 2.00 ksf
D_0 = 0.0091
D_{50} = 0.0121
D_{100} = 0.0152
T_{50} = 1.06 min.

C_v @ T_{50}
0.400 ft.^{2}/day

C_α = 0.000

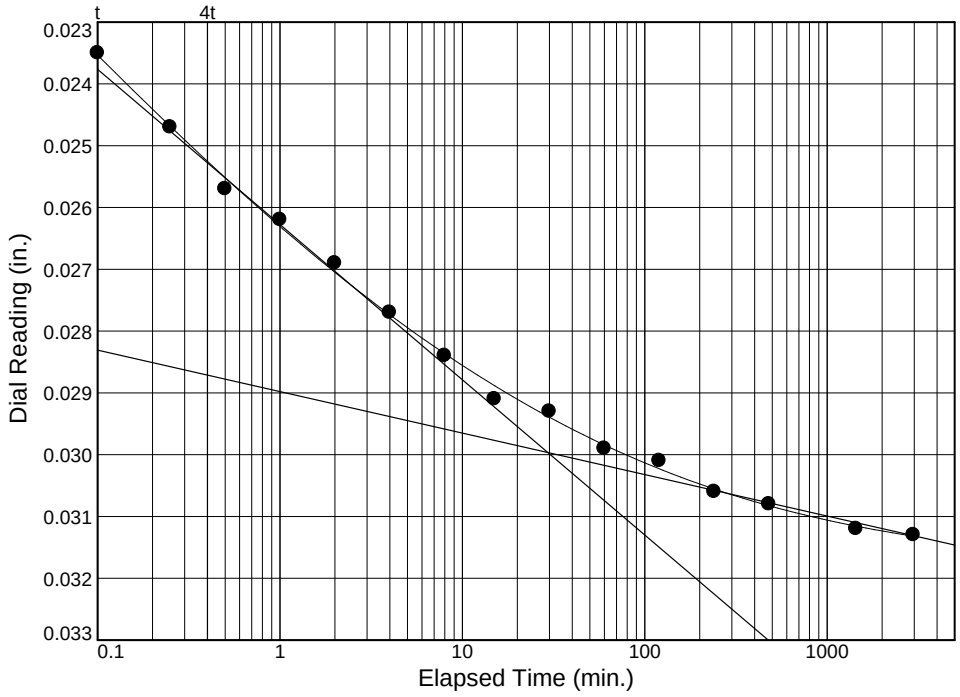
Figure 2

S & ME, Inc.

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

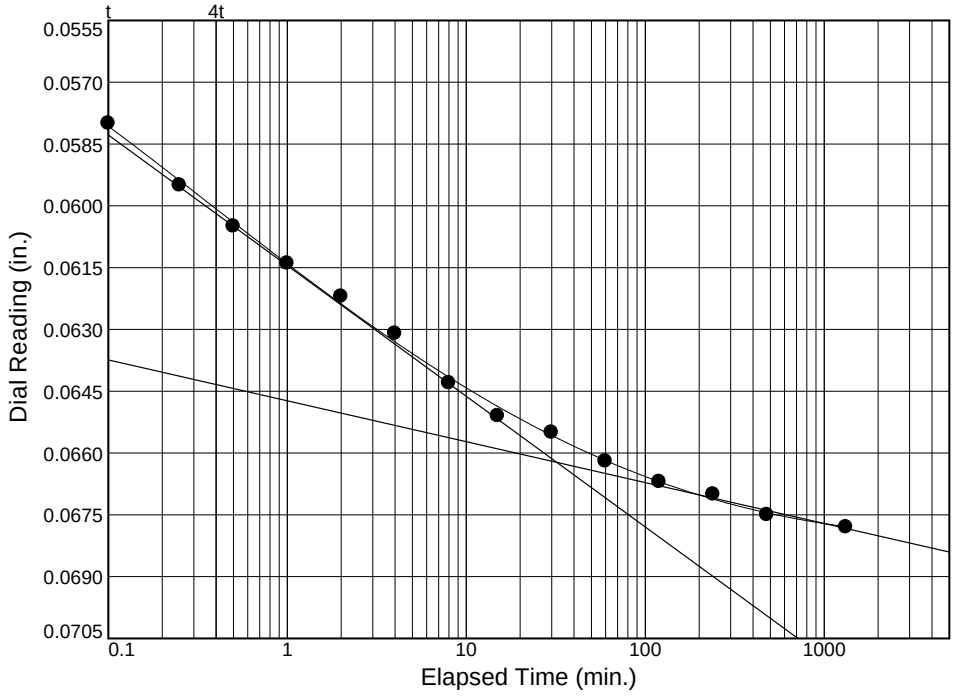
Location: B-16 Depth: 11 - 13 ft Sample Number: Log 357



Load No.= 5
Load= 4.00 ksf
D_0 = 0.0218
D_{50} = 0.0259
D_{100} = 0.0300
T_{50} = 0.69 min.

C_v @ T_{50}
0.597 ft.^{2}/day

C_α = 0.001



Load No.= 7
Load= 16.00 ksf
D_0 = 0.0561
D_{50} = 0.0611
D_{100} = 0.0662
T_{50} = 0.83 min.

C_v @ T_{50}
0.458 ft.^{2}/day

C_α = 0.001

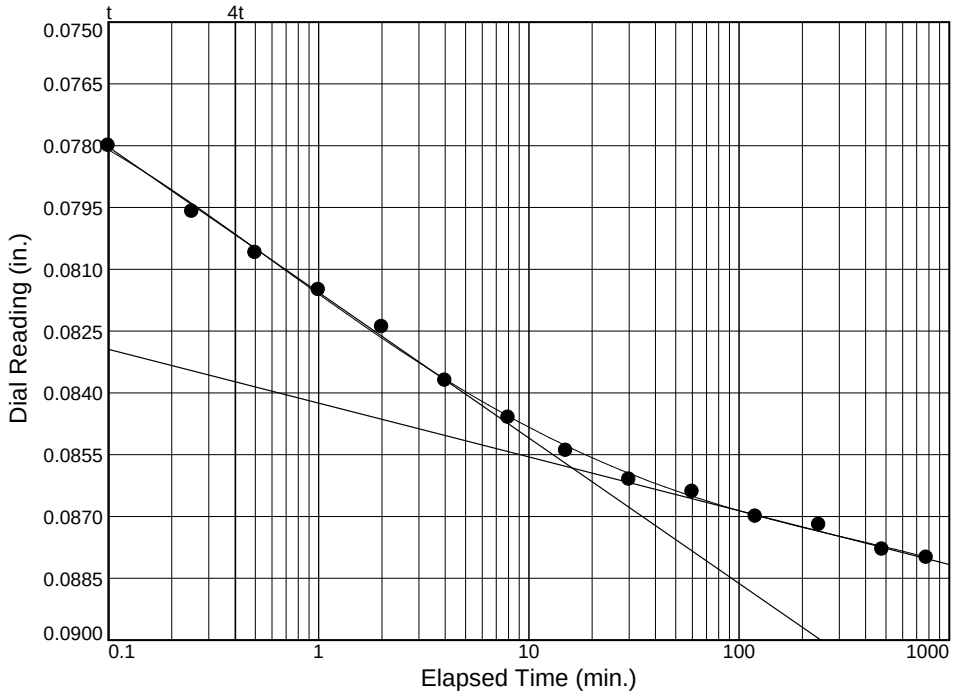
Figure 3

S & ME, Inc.

Dial Reading vs. Time

Project No.: 146114046
Project: I-77 Widening Design/Build Preparation On-Call

Location: B-16 Depth: 11 - 13 ft Sample Number: Log 357



Load No.= 8

Load= 32.00 ksf

D_0 = 0.0761

D_{50} = 0.0809

D_{100} = 0.0858

T_{50} = 0.66 min.

C_v @ T_{50}
0.551 ft.^{2}/day

C_α = 0.001

Figure 4

CONSOLIDATION TEST DATA

12/2/2014

Client: HDR, Inc.
Project: I-77 Widening Design/Build Preparation On-Call
Project Number: 146114046
Location: B-16
Depth: 11 - 13 ft **Sample Number:** Log 357
Material Description: USCS: SANDY ELASTIC SILT (MH); AASHTO: A-7-5
Liquid Limit: 76 **Plasticity Index:** 34
USCS: MH **AASHTO:** A-7-5
Figure No.: 1
Testing Remarks: Trimmed with a cutting ring, inundated in seat load.
Tested by: DB & MDK **Checked by:** NRR, 12/2/14

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	246.79 g.	Spec. Gr. =	2.63	Wet w+t =	681.56 g.
Dry w+t =	218.52 g.	Est. Ht. Solids =	0.634 in.	Dry w+t =	663.81 g.
Tare Wt. =	6.72 g.	Init. V.R. =	0.480	Tare Wt. =	529.64 g.
Moisture =	13.3 %	Init. Sat. =	73.2 %	Moisture =	13.2 %
UNIT WEIGHT		TEST START		Dry Wt. =	134.17* g.
Height =	0.939 in.	Height =	0.939 in.		
Diameter =	2.500 in.	Diameter =	2.500 in.		
Weight =	153.41 g.				
Dry Dens. =	111.9 pcf				

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000		0.00000			0.480	
0.25	0.00010	0.00070	-0.00060			0.481	0.1 Swell
0.50	0.00260	0.00160	0.00100			0.478	0.1 Comprs.
1.00	0.00830	0.00240	0.00590	0.147	0.000	0.470	0.6 Comprs.
2.00	0.01880	0.00320	0.01560	0.400	0.000	0.455	1.7 Comprs.
4.00	0.03520	0.00390	0.03130	0.597	0.001	0.430	3.3 Comprs.
8.00	0.05390	0.00520	0.04870			0.403	5.2 Comprs.
16.00	0.07470	0.00690	0.06780	0.458	0.001	0.373	7.2 Comprs.
32.00	0.09720	0.00920	0.08800	0.551	0.001	0.341	9.4 Comprs.
8.00	0.09300	0.00720	0.08580			0.344	9.1 Comprs.
2.00	0.08670	0.00600	0.08070			0.353	8.6 Comprs.
0.50	0.07850	0.00450	0.07400			0.363	7.9 Comprs.
0.13	0.07070	0.00300	0.06770			0.373	7.2 Comprs.

Compression index (C_c), ksf = 0.10 **Preconsolidation pressure (P_p), ksf =** 1.46 **Void ratio at P_p (e_m) =** 0.463

Pressure: 0.25 ksf	TEST READINGS	Load No. 1

No.	Elapsed Time	Dial Reading
1	0	0.00000
2	.10	0.00010
3	.25	0.00010
4	.5	0.00010
5	1	0.00010
6	2	0.00010
7	4	0.00010

Void Ratio = 0.481 **Swell =** 0.1%

Pressure: 0.50 ksf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00010	11	60	0.00220
2	.10	0.00110	12	120	0.00240
3	.25	0.00110	13	240	0.00260
4	.5	0.00120	14	480	0.00260
5	1	0.00130			
6	2	0.00160			
7	4	0.00180			
8	8	0.00190			
9	15	0.00190			
10	30	0.00200			

Void Ratio = 0.478 **Compression =** 0.1%

Pressure: 1.00 ksf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00260	11	60	0.00760
2	.10	0.00480	12	120	0.00800
3	.25	0.00510	13	240	0.00810
4	.5	0.00550	14	480	0.00820
5	1	0.00580	15	1440	0.00830
6	2	0.00600			
7	4	0.00660			
8	8	0.00670			
9	15	0.00720			
10	30	0.00740			

Void Ratio = 0.470 **Compression =** 0.6%

D_0 = 0.0022 **D_{50} =** 0.0039 **D_{100} =** 0.0057 **C_v at 2.93 min. =** 0.147 ft.^{2}/day **C_α =** 0.000

Pressure: 2.00 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00830	11	60	0.01790
2	.10	0.01340	12	120	0.01830
3	.25	0.01410	13	240	0.01860
4	.5	0.01470	14	480	0.01870
5	1	0.01540	15	1440	0.01880
6	2	0.01570			
7	4	0.01630			
8	8	0.01700			
9	15	0.01720			
10	30	0.01780			

Void Ratio = 0.455 **Compression =** 1.7%

D_0 = 0.0091 **D_{50} =** 0.0121 **D_{100} =** 0.0152 **C_v at 1.06 min. =** 0.400 ft.^{2}/day **C_α =** 0.000

Pressure: 4.00 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01880	11	60	0.03380
2	.10	0.02740	12	120	0.03400
3	.25	0.02860	13	240	0.03450
4	.5	0.02960	14	480	0.03470
5	1	0.03010	15	1440	0.03510
6	2	0.03080	16	2972	0.03520
7	4	0.03160			
8	8	0.03230			
9	15	0.03300			
10	30	0.03320			

Void Ratio = 0.430 **Compression =** 3.3%

D_0 = 0.0218 **D_{50} =** 0.0259 **D_{100} =** 0.0300 **C_v at 0.69 min. =** 0.597 ft.^{2}/day **C_α =** 0.001

Pressure: 8.00 ksf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03520	11	60	0.05230
2	.10	0.05000	12	120	0.05290
3	.25	0.05000	13	240	0.05310
4	.5	0.05000	14	480	0.05380
5	1	0.05040	15	1200	0.05390
6	2	0.05060			
7	4	0.05080			
8	8	0.05140			
9	15	0.05160			
10	30	0.05220			

Void Ratio = 0.403 **Compression =** 5.2%

Pressure: 16.00 ksf **TEST READINGS** **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.05390	11	60	0.07310
2	.10	0.06490	12	120	0.07360
3	.25	0.06640	13	240	0.07390
4	.5	0.06740	14	480	0.07440
5	1	0.06830	15	1322	0.07470
6	2	0.06910			
7	4	0.07000			
8	8	0.07120			
9	15	0.07200			
10	30	0.07240			

Void Ratio = 0.373 **Compression =** 7.2%

D_0 = 0.0561 **D_{50} =** 0.0611 **D_{100} =** 0.0662 **C_v at 0.83 min. =** 0.458 ft.^{2}/day **C_α =** 0.001

Pressure: 32.00 ksf **TEST READINGS** **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.07470	11	60	0.09560
2	.10	0.08720	12	120	0.09620
3	.25	0.08880	13	240	0.09640
4	.5	0.08980	14	480	0.09700
5	1	0.09070	15	779	0.09720
6	2	0.09160			
7	4	0.09290			
8	8	0.09380			
9	15	0.09460			
10	30	0.09530			

Void Ratio = 0.341 **Compression =** 9.4%

D_0 = 0.0761 **D_{50} =** 0.0809 **D_{100} =** 0.0858 **C_v at 0.66 min. =** 0.551 ft.^{2}/day **C_α =** 0.001

Pressure: 8.00 ksf **TEST READINGS** **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.09720	11	60	0.09300
2	.10	0.09330	12	120	0.09300
3	.25	0.09320	13	240	0.09300
4	.5	0.09310	14	480	0.09300
5	1	0.09310			
6	2	0.09310			
7	4	0.09310			
8	8	0.09310			
9	15	0.09310			
10	30	0.09300			

Void Ratio = 0.344 **Compression =** 9.1%

Pressure: 2.00 ksf		TEST READINGS			Load No. 10
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.09300	11	60	0.08730
2	.10	0.09010	12	120	0.08730
3	.25	0.08990	13	240	0.08690
4	.5	0.08970	14	480	0.08680
5	1	0.08910	15	761	0.08670
6	2	0.08880			
7	4	0.08820			
8	8	0.08770			
9	15	0.08750			
10	30	0.08740			

Void Ratio = 0.353 **Compression =** 8.6%

Pressure: 0.50 ksf		TEST READINGS			Load No. 11
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.08670	11	60	0.07960
2	.10	0.08510	12	120	0.07940
3	.25	0.08490	13	240	0.07920
4	.5	0.08440	14	480	0.07870
5	1	0.08420	15	1338	0.07850
6	2	0.08350			
7	4	0.08280			
8	8	0.08190			
9	15	0.08110			
10	30	0.08030			

Void Ratio = 0.363 **Compression =** 7.9%

Pressure: 0.13 ksf		TEST READINGS			Load No. 12
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.07850	11	60	0.07310
2	.10	0.07640	12	120	0.07230
3	.25	0.07640	13	240	0.07160
4	.5	0.07630	14	480	0.07140
5	1	0.07630	15	1440	0.07070
6	2	0.07620			
7	4	0.07570			
8	8	0.07540			
9	15	0.07470			
10	30	0.07390			

Void Ratio = 0.373 **Compression =** 7.2%

Sieve Analysis of Soils

ASTM D422

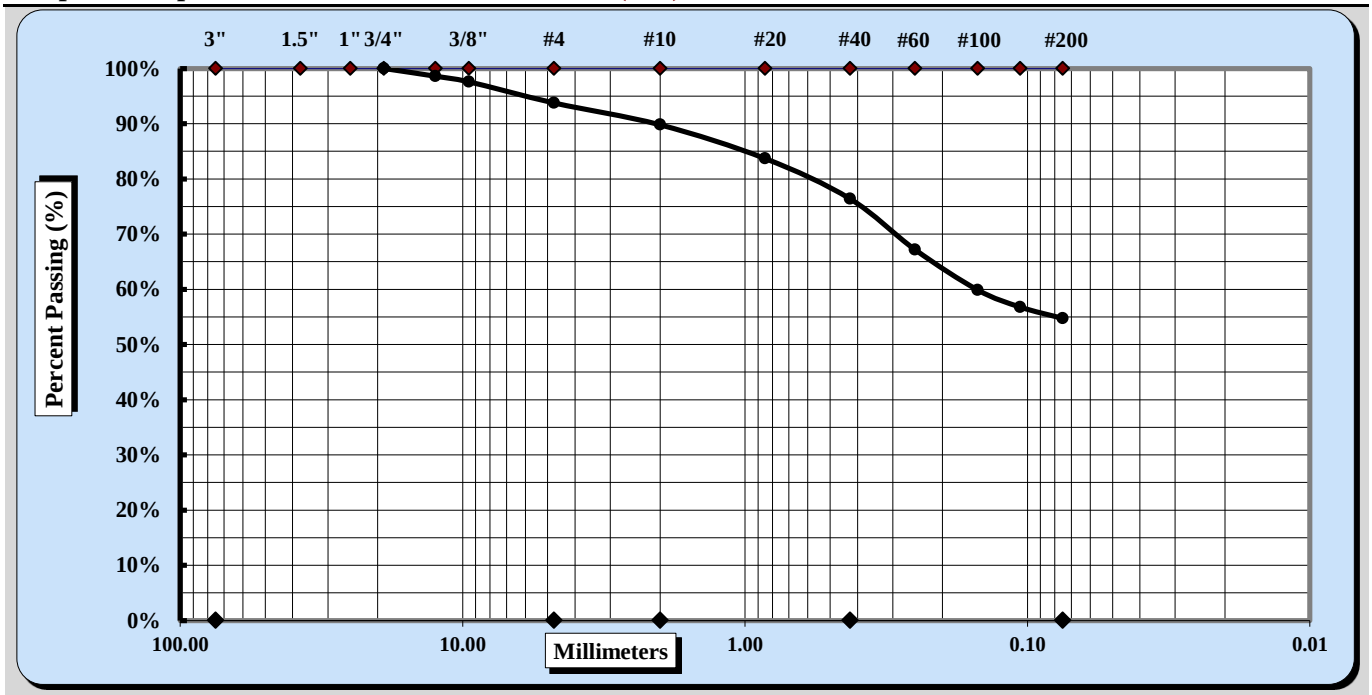
Quality Assurance

Sample Log No.:357

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s):	11/26/14-11/28/14
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Type: UD		
		Depth:	11 - 13 ft

Sample Description: SANDY ELASTIC SILT (MH) **A-7-5**



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/4"	Coarse Sand	4.0%	Fine Sand	21.7%
Gravel	6.2%	Medium Sand	13.4%	Silt & Clay	54.7%
Liquid Limit	76	Plastic Limit	42	Plastic Index	34

Coarse Sand	4.0%	Medium Sand	13.4%	Fine Sand	21.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒

Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: ASTM D422, D4318, D2487; AASHTO M145

N. Randy Rainwater		Project Engineer	12/1/2014
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D4318-T89-90
Revision No. 0
Revision Date: 11/20/07

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

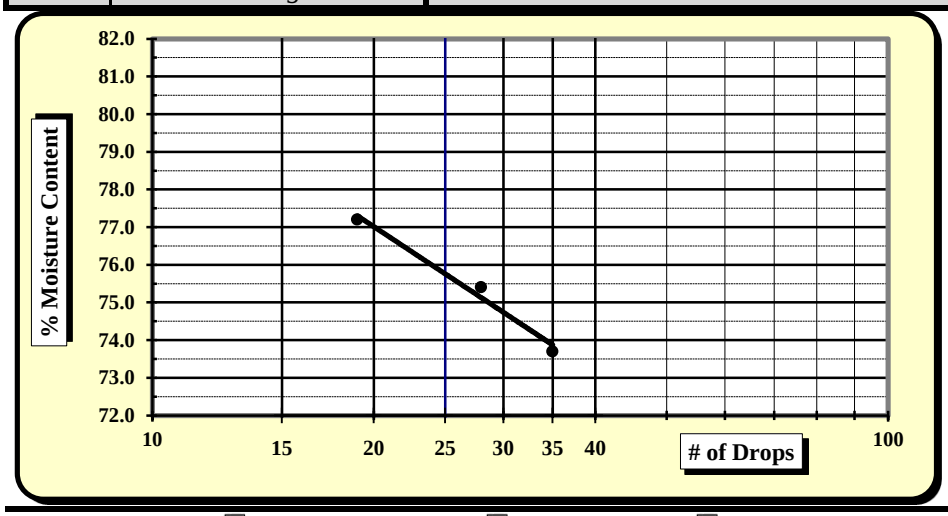
Log No.:357 | *ASTM D4318* ☒ | *AASHTO T 89* ☐ | *AASHTO T 90* ☐ | *Quality Assurance*

S&ME, Inc., 1413 Topside Road, Louisville, TN 37777

Project #:	**1461-14-046**	Report Date:	11/30/2014
Project Name:	I-77 Widening Design/Build Preparation On-Call	Test Date(s)	11/25/2014
Client Name:	HDR, Inc.		
Client Address:	North Charleston, SC		
Boring No.: B-16	Sample No: UD		
		Depth: 11 - 13 ft	

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	18435	3/17/2014	Grooving tool	26803	9/4/2014
LL Apparatus	18414	8/12/2014	No. 40 Sieve	26797	9/4/2014
Oven	12872	8/15/2014			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	4	20	11				33	36	
A	Tare Weight	15.51	15.54	15.50				21.25	21.04	
B	Wet Soil Weight + A	26.41	27.08	28.06				29.68	30.24	
C	Dry Soil Weight + A	21.66	22.12	22.73				27.21	27.52	
D	Water Weight (B-C)	4.75	4.96	5.33				2.47	2.72	
E	Dry Soil Weight (C-A)	6.15	6.58	7.23				5.96	6.48	
F	% Moisture (D/E)*100	77.2%	75.4%	73.7%				41.4%	42.0%	
N	# OF DROPS	19	28	35				*All Moisture Contents determined by ASTM D2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**41.7%**		



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 **76**
Plastic Limit **42**
Plastic Index **34**
USCS Group Symbol **MH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *USCS Group Symbol is for minus No. 40 portion*

Notes / Deviations / References: **AASTHO Classification A-7-5**

ASTM D4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Derek Baker	11/25/2014	N. Randy Rainwater	12/1/2014
Technician Name	*Date*	*Technical Responsibility*	*Date*

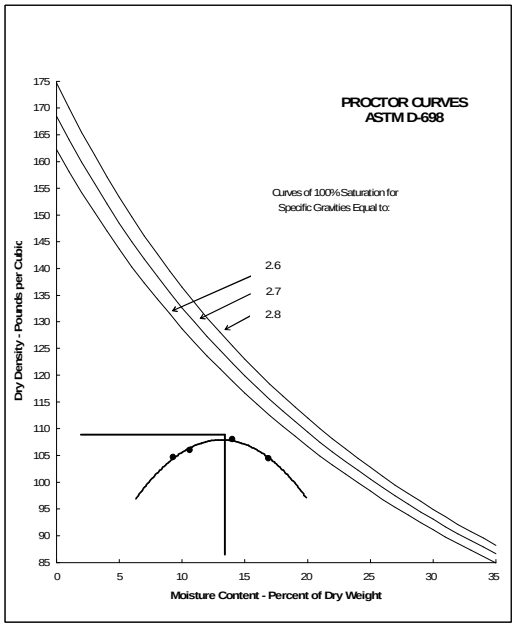
LABORATORY COMPACTION TESTING OF SOIL

LABORATORY COMPACTION TESTING

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.

Two alternate procedures are used for determining a moisture-density relationship for soils and granular materials. The determination of which procedure is more appropriate for the specific soils on a site is made by the geotechnical engineer after examination of the recovered bulk samples and considering local practice.

Each approach involves compaction of loose soils into a standard size mold using a specified compactive effort, then weighing back the unit weight of the soil and recording the moisture content.



Typical moisture- density curve indicates maximum dry density and optimum moisture content. Also shown are zero air voids curves for assumed specific gravity values.

Soil is compacted in the mold in three layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. Separate soils are used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure is 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.

Compaction Tests of Soils Using Standard Effort

Test procedures generally follow those described by ASTM D 698, "*Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 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 5.5 lbf rammer dropped from a height of 12 inches, producing a compactive effort of 12,400 lbf/ft^3. ASTM D 698 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 3 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 3 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 ¾ inch sieve.
- Soil in 3 layers with 56 blows per layer

Compaction Tests of Soils Using Modified Effort

The compactive effort will be greater when using a heavier roller on the site. To attempt to reproduce the effort applied by heavy rollers, a modified procedure applies a greater compactive effort in the laboratory. Test procedures generally follow 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

Correction for Oversize Material

Compaction testing performed using either ASTM D698 or D1557 place limits on the maximum particle size that can be used in the tests. Oversize materials are sieved out of the samples prior to performing moisture-density tests.

Where samples contain greater than 5 percent by weight exceeding the maximum size fraction, unit weight and moisture contents of all data points obtained in Proctor tests using either Standard or Modified effort must be corrected using the procedures outlined in ASTM D 4718, *"Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles."* Where this correction is made test data and report text so states.

S&ME

LABORATORY CONSOLIDATION TESTING

OEDOMETER (CONSOLIDATION) TESTING

The data from the consolidation test are used to estimate the magnitude and rate of both total and differential settlement of a structure or earthfill. In this test method a saturated soil specimen is restrained laterally by a steel mold and loaded axially with total stress increments. As the specimen consolidates, measurements are made of the change in specimen height and plotted vs. time to determine the relationship between the effective stress and void ratio or strain, and the time rate at which consolidation occurs.

Procedures for determining the magnitude and rate of consolidation of laterally restrained soil generally follow those described in ASTM D 2435-04, *"Standard Test Method for One-Dimensional Consolidation of Soils."*

Sample Preparation and Seating

Undisturbed samples intended for use in consolidation testing are handled as Group C or D samples as described in ASTM D 4220. Extruded samples are each trimmed to a disc 2.5 inches in diameter and 1.0 inches thick as described in Section 9. Each disc is confined in a stainless steel ring and sandwiched between two porous stone plates. After application of a seating load of 100 lb/ft^2 to confine the specimen, the ring is placed in an oedometer and the sample immersed in water to full saturation.

Loading Schedule

Prepared specimens are loaded to the desired stress in accordance with the standard loading schedule described in Section 11.4.1 - 250, 500, 1000, 2000, 4000, 8000, etc. lbf/ft^2 – continuing at a load increment ratio determined by doubling the preceding increment until a maximum load equal to or greater than four times the preconsolidation stress is attained. Exceptions to the loading schedule of Section 11.4.1, or use of an alternate schedule as provided in Section 11.4.3, are noted in the report, if applicable.

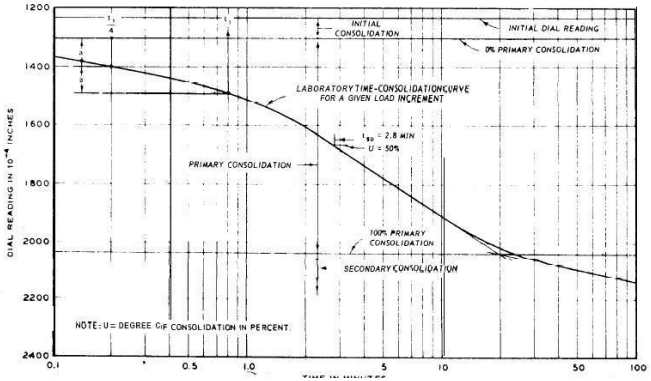
An unload-reload cycle can be imposed to better define the recompression curve in overconsolidated clays. The unload-reload cycle is imposed beginning at the first increment of load that exceeds the preconsolidation stress. Load increments on unload-reload cycles always span at least two decrements of pressure. Each decrement of load is equal to one-fourth of the preceding load when unloading.

The time sequence of readings for each load increment duration follows either Test Method "A" or "B" described in Section 11.5 and indicated on the attached test reports. Deformation of the sample is measured at each time interval using a micrometer dial gage. Measurements continue until sufficient readings are taken to confirm that primary consolidation is complete at each load increment.

Evaluation of secondary compression may be required for some samples. Where this is required longer duration times may be required for load increments above the preconsolidation stress. The laboratory report will describe any non-standard load increment durations.

Data Reduction and Plotting

Time deformation properties are plotted for each load increment using either the log time or square root of time methods described in Section 12.3 and the *coefficient of consolidation* C_v computed. Load deformation properties are plotted in terms of either void ratio at 100 percent consolidation for each loading increment vs. applied load or in terms of percentage strain (of initial sample height) vs. applied load plotted on log scale.



Time-consolidation curve at incremental load – log time method (from USACOE 1102-

The graphical representation of the sample under load was corrected for sample disturbance using the procedures recommended by the Norwegian Geotechnical Institute using the estimated effective vertical stress and the estimated preconsolidation stress.

Interpreted Values

The *preconsolidation stress* p_c of the specimen is estimated from the plot using the Casagrande construction described in Section 12.4.6, using the straight line portion of the virgin compression curve and the point of maximum curvature of the consolidation curve. The overconsolidation ratio (OCR) of the specimen is estimated by comparing the preconsolidation stress to the estimated vertical effective stress acting at the sample depth.

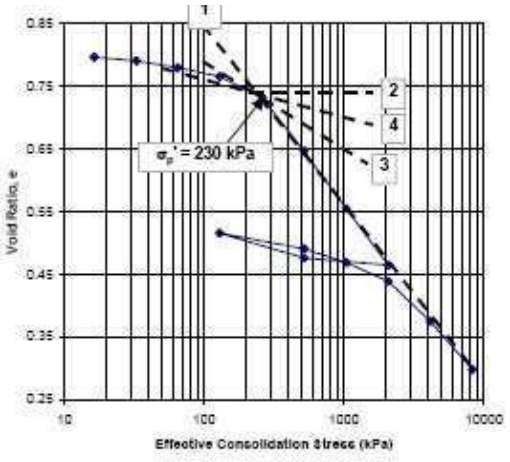


Illustration of Casagrande method to evaluate preconsolidation stress.(FHWA-IF-02-034)

The *compression index* C_c is estimated from the straight line portion of the semilog consolidation curve, above the preconsolidation stress.

The *percent initial consolidation* is determined for each load increment by comparing dial gage deflection immediately upon placement of the load increment (d_0) to the dial gage deflection at 100 percent consolidation for that increment (d_{100}). Percent initial consolidation is typically plotted arithmetically vs. load increment on a log plot.

The slope of the secondary branch of the settlement vs. time curve ($C\alpha$) is related to creep or secondary compression. Typically this trend is considered to be linear vs. the log of time. The secondary compression coefficient was estimated by comparing the deformation at two time intervals at least one log cycle apart.

ASSESSMENT OF UNDISTURBED SAMPLE QUALITY

Nominally undisturbed specimens obtained using thin-walled tube samplers will become disturbed as a result of drilling, sampling, sample extrusion, and trimming. These processes change the effective stress condition in the soil sample. In most cases by the time extrusion of the sample has been completed, significant stress relief has occurred. The specimen is at a higher void ratio than the in-situ condition. A laboratory strength test performed on the specimen would likely have lower strength and a higher compressibility relative to the same soil at the in-situ void ratio.

Use of Consolidation Test Data

The strain to reach the in-situ effective stress (σ'_{vo}) will be greater for the disturbed sample when compared to an undisturbed specimen. The preconsolidation stress is difficult to determine due to rounding of the consolidation curve, generally leading to an under estimation of the reconsolidation stress. The recompression curve for the disturbed sample will have a steeper slope than that of an undisturbed specimen, while the apparent virgin compression curve will likely be flatter.

Assessment of Sample Quality Using Oedometer Test Data – after LaCasse et al (1985)

Range of OCR	Depth Interval (m)	V. Good Test if ε_r < %	Acceptable Test if < ε_r <	Likely Disturbed if ε_r > %
1 – 1.2	0 – 10 10 – 50	3 2	3 – 5 2 - 4	5 4
1.2 – 1.5	0 – 10 10 - 50	2 1	2 - 4 1 - 3	4 3
1.5 - 2	0 – 10 10 – 50	1.5 1.0	1.5-3.5 1 – 2.5	3.5 2.5
2 - 3	0 – 10 10 – 50	1.0 0.75	1 – 3 0.75 - 2	3 2
3 - 8	0 – 10 10 – 50	0.5 0.5	0.5 – 1 0.5 - 1	1 2

Sample disturbance can be estimated in the laboratory where oedometer or triaxial testing is performed, using the procedure by Lacasse et. al. (1985) as a guide. This assessment is based on estimated overconsolidation of the sample before removal, and the degree of strain required for the sample to withstand the in-situ vertical effective stress during initial loading in the oedometer or during the consolidation phase in the triaxial cell.

Since the loading of the sample up to the preconsolidation stress is "elastic," the response of the soil to application of load should be relatively stiff at applied stresses below the preconsolidation stress. So, as the amount of strain required to reach the initial effective stress in the ground increases, this reflects increased likelihood that the sample is actually disturbed.

Sample quality is judged to be "very good", "acceptable", or "likely to be disturbed" depending on the estimated OCR and strain ε exhibited at σ'_{vo}, according to the table shown above. For slightly overconsolidated soils (OCR 2-3), samples could be judged to be "acceptable" if the strain is less than 3 percent when the sample reaches the preconsolidation stress in the oedometer and "very good" if the strain is less than 1 percent.

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ELECTRO-CHEMICAL CLASSIFICATION TESTS

ELECTRO-CHEMICAL CLASSIFICATION TESTS

Electro chemical classification tests provide the engineer or geologist with quantitative information related to the aggressiveness of the soil conditions and the potential for deterioration of a foundation material. Electro chemical tests include (1) pH; (2) resistivity; (3) sulfate ion content; and (4) chloride ion content.

Soil pH Testing

Soil pH measures the activity of hydrogen ions in a water solution. The pH scale ranges from 0 (very acidic) to 14 (very alkaline or basic). Test methods follow those given by AASHTO T-289-91(2004), *"Determining pH for Soil for Use in Corrosion Testing."*

Moist samples are sieved and pulverized as described in Section 6.2. A 30mg sample is then suspended in distilled water for one hour. A pH meter is first standardized against a buffer solution of known pH, then the probe immersed in the suspended solution and the pH reading recorded. If the pH of the soil is below 4.5 the soil is reported as aggressive.

Field Resistivity Testing

Apparent resistivity of the soil is measured at selected locations by measuring the voltage potential between four equally spaced, in-line direct current electrodes in the Wenner Electrode Arrangement as described in ASTM D 6431, *"Standard Guide for Using the Direct Current Resistivity Method for Subsurface Investigation."* Using the measured voltages, resistivity is estimated using the approach described in "*A Method of Measuring Earth Resistivity*", U. S. Bureau of Standards Bulletin No. 258, by Dr. F. Wenner, in which the average resistivity of the soil to a depth of "A" is given by:

r = 191.5 x AE/I, where:

r = Average resistivity of soil, ohm-cm
A = Distance between electrodes, cm
E = Measured Voltage, Volts
I = Current, Amperes

Measurements employ a set of four electrodes in a linear array. Measurements at a single location are typically made in two orientations at right angles to one another. The location and orientation of each traverse is indicated in the report or on the boring location plan in the Appendix.

Successive measurements are made by varying the electrode spacing at horizontal intervals of 5, 10, 15, and 20 feet unless otherwise indicated in the report. The depth of measurement is considered roughly equivalent to the electrode spacing

Laboratory Minimum Soil Resistivity

This method is used to determine the soil corrosivity and identify conditions under which corrosion of metals in the soil may be reduced. Test methods follow those described in AASHTO T-288-91(2004), "*Determining Minimum Laboratory Soil Resistivity.*"

Tests are performed on about 1500 grams of air dried material obtained by splitting or quartering recovered samples. Testing is performed on material passing the No. 10 sieve size. Prepared samples are placed in a standard soil box and finger compacted. Resistance of the sample between the electrodes is measured with either an alternating current resistivity meter or a 12-V direct current resistivity meter.

After each test, the sample is removed from the box and moisture content adjusted by addition of distilled water to the soil. The sample is replaced in the box with finger compaction and the test repeated. Testing is preformed on successively higher moisture contents until a minimum resistivity value is recorded, which is reported as the resistivity. The minimum soil resistivity can occur at any soil moisture content.

Soil Corrosivity Versus Resistivity

Soil Corrosivity	Soil Resistivity (ohm-cm)
Very corrosive	0 to 2,000
Corrosive	2,000 to 5,000
Moderately corrosive	5,000 to 10,000
Mildly corrosive	10,000 to 25,000
Relatively less corrosive	25,000 to 50,000
Progressively non-corrosive	50,000 to 100,000

Laboratory Sulfate Ion Content Test

External sulfate can occur when concrete is in contact with sulfate containing water e.g. seawater, swamp water, ground water or sewage water. The often massive formation of gypsum and ettringite formed during the external sulfate attack may cause concrete to crack and scale.

Water soluble sulfate ion content is determined using either Method A or B as described by AASHTO T-290-95(2003), *"Determining Water-Soluble Sulfate Ion Content in Soil*." Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Gravimetric Method, determines sulfate content by precipitation of barium sulfate from a heated solution of the soil and chemical reagents. Method B, the Turbidimetric Method, relies on a photoelectric colorimeter to determine the turbidity of a barium sulfate suspension after chemical reagents are added. Laboratory test data sheets will indicate the method used.

Laboratory Chloride Ion Content Test

Water soluble chloride ion content is determined using either Method A or B as described by AASHTO T-291-94(2004), *"Determining Water-Soluble chloride Ion Content in Soil*." Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Mohr Titration Method, determines chloride ion content using silver nitrate in a suspended solution of the soil and distilled water. A reaction between a potassium chromate indicator solution and the silver nitrate produces a red-silver chromate precipitate.

Method B utilizes a pH/mV meter with chloride ion selective electrodes. When inserted into the suspension the meter records the activity of the chloride ions. These readings are compared to a set of calibration curves to determine the ion content in mg/kg.

Interpretation of Soil Corrosive Potential

Tests to characterize the aggressiveness of a soil environment are important for design applications that include metallic elements, especially for ground anchors comprised of high strength steel and for metallic reinforcements in mechanically stabilized earth walls.

If results from these tests indicate chloride ion content greater than 100 ppm or sulfate ion content greater than 200 ppm, then the soil should be considered as **aggressive**. If the pH of the soil is below 4.5 or the resistivity is less than 1000 ohms/cm, the soil is reported as **aggressive**.

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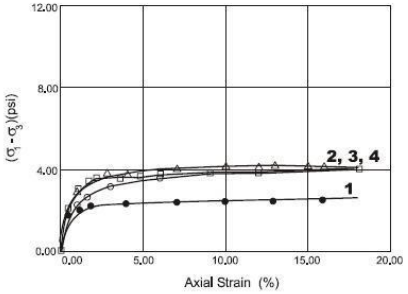
LABORATORY SHEAR STRENGTH TESTING

UU or "Q" Triaxial Shear Tests of Undisturbed Samples

Undrained strength tests performed using the UU or "Q" test method are described by ASTM D 2850, "*Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils."* This test is typically limited to cohesive soils having a permeability slower than 10^{-3} cm/sec, preserved as Group C samples as defined in ASTM D 4220.

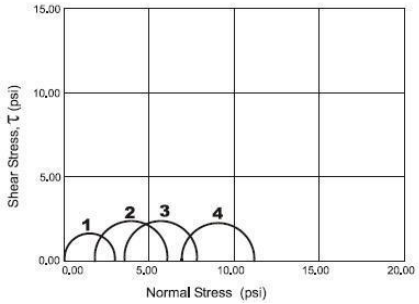
The UU test employs rapid application of both confining and axial stresses without permitting drainage of pore water. This condition simulates rapid loading of the soil during construction before sufficient time is allowed for the soil to consolidate. UU tests are performed on samples at their "as-received" moisture content, so that results may be applied to "construction conditions" in embankment stability analyses.

The extruded sample was encased in a rubber membrane and sealed to the specimen base and cap with rubber O-rings to prevent drainage of the specimen. In most cases UD samples are tested without trimming except for cutting the end surfaces plane and perpendicular to the longitudinal axis of the specimen.



The UU test is performed with the drain valve of the triaxial cell closed during all phases of the test and before the sample has a chance to consolidate (S<100 percent). The chamber is pressurized to the desired confining pressure and the sample allowed to stabilize at least 10 minutes before application of axial load. The sample is loaded axially by compressing the top platen into the sample at a constant rate of approximately one percent strain per minute.

Deformation of the sample and the applied stress is recorded electronically using LVDT strain gages. Failure of the specimens during the tests is defined as the maximum principal stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurs first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, and Mohr Circle plots at various increments of confining stress.



CU or "R" Triaxial Shear Tests of Undisturbed Samples

Shear tests performed using the CU or "R" test method are described by ASTM D 4767, *"Standard Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils*." This test is typically applicable to Group C samples as defined in ASTM D 4220.

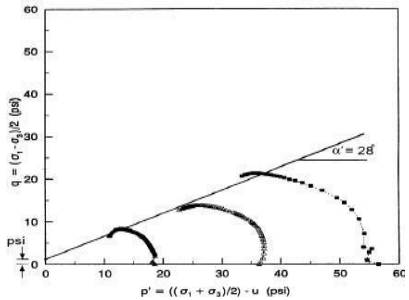
Samples tested using the R test method are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation. The measured shear strength can be applied to field conditions where soils that have been fully consolidated under one set of stresses are subjected to a change in stress without time for further consolidation to take place.

Measured pore pressures induced by the change in stress can be used to compute effective stress shear strength, which may be applied to field conditions in which full drainage can occur or to conditions in which pore pressures induced by loading can be estimated.

R test samples are prepared as generally described in Section 6 of ASTM D 4767. Each extruded sample is encased in a rubber membrane and sealed with rubber O-rings to prevent drainage of the specimen. UD samples are typically tested without trimming except for cutting end surfaces plane and perpendicular to the long axis of the specimen. Samples are saturated by back pressuring the pore water to drive the air in the void spaces into solution, after the system was saturated by applying a vacuum to the specimen and dry drainage system as described in section 8.2.

With the drainage valves of the triaxial cell closed, the cell pressure is increased with back pressure constant to confine the specimen. After attaining the desired confining pressure, the drainage ports are opened and the sample fully consolidated to equilibrium before applying axial load.

p-q plot of test results



The fully consolidated sample is loaded axially by compressing the top platen at a constant rate of one percent strain per minute, with drainage ports again closed. Sample deformation and applied stress is recorded electronically using LVDT strain gages and induced pore pressures measured using a stiff electronic pressure transducer.

Failure of the specimens during the tests is defined as the point of maximum effective stress obliquity, the maximum stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurs first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, induced pore pressure vs. applied strain, p'-q' diagram, and Mohr Circle plots at various increments of confining stress.

Triaxial Shear Tests of Remolded Samples

Specimens are prepared in a standard mold by compacting them at predetermined moisture contents to the dry density values prescribed by the geotechnical engineer. Compacted samples are then removed from the mold and the ends of each specimen carved by hand and trimmed as necessary to provide a surface perpendicular to the long axis.

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LABORATORY SHEAR STRENGTH TESTING (continued)

Unconfined Compressive Strength Tests of Undisturbed Cohesive Samples

The unconfined compressive strength of relatively undisturbed cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil*." Relatively undisturbed Group C samples of cohesive soils are extruded from the sampler and examined as described above.

Representative portions of each sample are split from the extruded material and prepared using the procedures described in Section 6.2 of ASTM D 2166. The ends of the specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

The prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length is attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formula in sections 8.2 and 8.3 of ASTM D 2166.

Unconfined Compressive Strength Tests of Remolded Cohesive Samples

The unconfined compressive strength of remolded cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.*" Specimens are prepared either from cohesive soils recovered from split spoon samples obtained as described in ASTM D 1586 and preserved as Group B samples, or from portions of failed undisturbed samples tested in unconfined compression.

Representative portions of remolded samples are prepared using the procedures described in Section 6.3 of ASTM D 2166. The ends of each specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

The prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length is attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formulae in sections 8.2 and 8.3 of ASTM D 2166.

Unconfined Compressive Strength Tests of Compacted Cohesive Samples

The unconfined compressive strength of compacted cohesive soils is determined generally following the procedures described by ASTM D 2166, "*Standard Test Method for Unconfined Compressive Strength of Cohesive Soil."*

Specimens are prepared in a standard mold by compacting them at predetermined moisture contents to the dry density values prescribed by the geotechnical engineer. Compacted samples are then removed from the mold and specimens prepared using the procedures described in Section 6.4 of ASTM D 2166. The ends of each specimen are carved by hand and trimmed as necessary to provide a surface perpendicular to the specimen's long axis, but the ends are not capped.

Each prepared sample is placed in a compressive testing machine and the specimen compressed in the platen at a rate of 1 to 2 percent strain per minute. Deformation and loading of the sample are recorded at regular intervals until the load values began to decrease with increasing axial strain, or a total strain of 15 percent of the original sample length was attained.

Sample stress is corrected at each load increment for the change in cross sectional area produced by deformation of the sample using the formulae in sections 8.2 and 8.3 of ASTM D 2166.

Direct Simple Shear Testing of Undisturbed Samples

Shear tests are performed using the single shearing method described by ASTM D 3080, *"Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions*." This test is typically applicable to both coarse-grained and fine-grained soils preserved as Group C samples as defined in ASTM D 4220, or on remolded or recompacted samples.

Samples are tested by placing the specimen in a direct shear device and consolidating it under a predetermined normal load. The specimen is then sheared along a horizontal plane in the middle of the specimen. Shearing is performed at a slow rate (at least 50 times the estimated time for 50 percent consolidation of the sample) to limit buildup of pore pressures along the failure plane. Since drainage paths in the specimen are short, excess pore pressures are dissipated and the test is considered a drained test.

Failure of the specimens during the tests is defined as the point of maximum stress attained (peak stress) and at 15 to 20 percent strain (residual stress). Test output includes a plot of deviator stress vs. applied strain for various load increments and Mohr Circle plots at various increments of confining stress.

Pocket Penetrometer Tests

A pocket penetrometer is a spring operated device used to roughly estimate compressive strength for classification purposes of selected samples. The device is operated by pushing a 0.25-inch (6.4mm) diameter loading piston into the material being measured, up to a calibration groove machined on the piston 0.25 inches from the end. Strength in tons per sq. ft. or kg per sq. cm. to a maximum of 4.5 is obtained by noting the position of an indicating ring on the scale.

Pocket penetrometers are not individually calibrated. Calibration is on the basis of correlation studies relating the effective spring compression to unconfined compressive strength values determined by other methods.

Pocket Torvane Shear Tests

Pocket torvane devices are simple spring loaded hand-held blades used to estimate consistency of cohesive soills by correlation of torsion of the spring mechanism to compressive strength determined by other methods. Performed on cohesive materials, undisturbed samples, and intact chunks or disturbed samples. Test results are to be regarded with caution. Pocket torvane tests are used mainly for consistency classification and as guide for assigning shear tests.

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APPENDIX III-C

Appendix III–C – Unconfined Compressive Strength of Rock Cores
Summary of Laboratory Test Results – Rock Core Samples
Photo Log of Rock Core Test Specimens
Rock Core End Condition Assessment

Summary of Laboratory Test Data

I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME Project No. 1461-14-046

Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
B-9	99.3	RC-1	99.6-101.6	83%	40%	Moderately hard to hard Soft to hard	Fairly continuous	Poor	Severe to slight	1	100.5	2,925
		RC-2	101.6-106.6	90%	44%	Soft to hard	Continuous	Poor	Severe to moderate	1	104	---
		RC-3	106.6-111.6	82%	38%	Soft to very hard	Fairly continuous	Poor	Severe to slight	1	107.9	20,773
		RC-4	111.6-116.6	59%	30%	Moderately hard to very hard	Competent	Poor	Moderately severe to very slight	N/A	N/A	---
		RC-5	116.6-121.6	98%	70%	Hard to very hard	Continuous	Fair	Slight to very slight	1	117.1	16,435
B-10	94	RC-1	94-94.5	100%	75%	Hard to very hard	Continuous	Fair	Very slight to fresh	N/A	N/A	---
		RC-2	94.5-99.5	97%	81%	Moderately soft to moderately hard	Continuous	Good	Slight to fresh	1	97.1	446
		RC-3	99.5-104.5	94%	43%	Moderately hard to hard	Continuous	Poor	Moderately severe to fresh	1	103.4	4,232
		RC-4	104.5-109	95%	68%	Moderately hard to hard	Continuous	Fair	Moderate to fresh	2	104.9, 105.4	6,551/ 18,872
		RC-5	109-114	92%	60%	Hard to very hard	Continuous	Fair	Slight to fresh	N/A	N/A	---
B-11	56.9	RC-1	86-91.2	100%	100%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	2	87.6, 88.8	23,445/ 21,801
		RC-2	91.2-96.4	98%	88%	Moderately hard to very hard	Continuous	Good	Slight to fresh	1	92.7	22,478
		RC-3	96.4-101.5	100%	100%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	1	98.7	11,952
		RC-4	101.5-105.9	98%	74%	Moderately hard to hard	Continuous	Fair	Slight to fresh	N/A	N/A	---
B-12	82.5	RC-1	80.5-82.5	73%	26%	Moderately soft to moderately hard	Fairly continuous	Poor	Severe to very slight	1	81.4	---

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME project No. 1461-14-046

Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
		RC-2	82.5-87.5	100%	87%	Moderately hard to moderately soft	Continuous	Good	Moderate to very slight	2	83.6, 86.5	3,038/ 1,150
		RC-3	87.5-92.5	94%	53%	Soft to moderately hard	Continuous	Fair	Moderately severe to slight	1	88.3	1,030
		RC-4	92.5-97.5	98%	84%	Moderately hard to hard	Continuous	Good	Slight to fresh	1	96.1	1,798
		RC-5	97.5-102.5	99%	83%	Moderately hard	Continuous	Good	Slight to fresh	N/A	N/A	---
B-13	94.7	RC-1	94.7-96.5	89%	73%	Hard	Fairly continuous	Fair	Very slight to fresh	1	95.1	---
		RC-2	96.5-101.5	90%	60%	Moderately hard to hard	Continuous	Fair	Severe to fresh	1	99	4,803
		RC-3	101.5-105.7	78%	45%	Soft to hard	Fairly continuous	Poor	Moderate to very slight	1	103.4	7,323
		RC-4	105.7-107	106%	78%	Moderately hard to very hard	Continuous	Good	Slight to very slight	N/A	N/A	---
		RC-5	107-112	98%	92%	Moderately hard to very hard	Continuous	Excellent	Very slight to fresh	2	107.2, 110.6	5,918/ 5,788
		RC-6	112-117	80%	41%	Moderately hard to hard	Fairly continuous	Poor	Moderately severe to very slight	N/A	N/A	---
		RC-7	117-120.5	29%	0%	Moderately hard to hard	Incompetent	Very poor	Severe to very slight	N/A	N/A	---
		RC-8	120.5-122	100%	75%	Moderately hard to hard	Continuous	Good	Moderate to very slight	N/A	N/A	---
B-14	89.7	RC-1	89.7-91.4	90%	0%	Moderately hard	Continuous	Very poor	Severe to moderate	N/A	N/A	---
		RC-2	91.4-96.4	90%	27%	Moderately soft to moderately hard	Continuous	Poor	Moderately severe to slight	1	95.8	7,030
		RC-3	96.4-101.4	93%	64%	Moderately soft to moderately hard	Continuous	Fair	Severe to fresh	2	97.6, 99.6	5,112/ 8,086

Summary of Laboratory Test Data
I-77 Widening Design/Build Preparation
Richland County, South Carolina
S&ME project No. 1461-14-046

Table 9 – Rock Strength Data

Boring	Refusal	Run	Interval	Rec	RQD	Hardness	Continuity	Rock Quality	Weathering	# of Samples	Approx. Depth (s)	PSI
		RC-3	89.7-91.4	90%	0%	Moderately hard	Continuous	Fair	Severe to fresh	2	97.6, 99.6	5,112/ 8,086
		RC-4	101-4-106.4	92%	76%	Soft to moderately hard	Continuous	Good	Severe to very slight	1	102.1	5,197
		RC-5	106.4-110.6	90%	48%	Moderately soft to moderately hard	Continuous	Poor	Severe to very slight	1	109.3	5,710

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-1	B-9	100.5	4.31	1.84	E	2.66	164.2	40	7,780	2,925	2.4
RC-3	B-9	107.9	3.73	1.85	C	2.69	202.1	94	55,880	20,773	0.2
RC-5	B-9	117.1	4.01	1.85	C	2.69	185.0	87	44,210	16,435	0.2

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

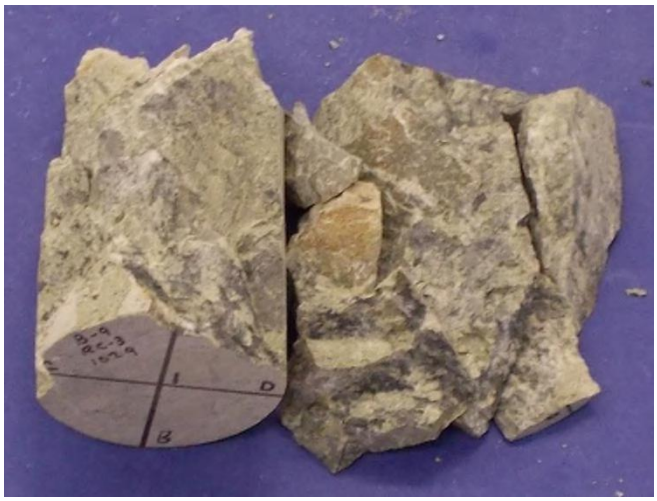
C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

S&ME
1413 Topside Road
Louisville, TN 37777

1	**Specimen ID**	B-9, RC-1 (100.5')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-9, RC-3 (107.9')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

S&ME
1413 Topside Road
Louisville, TN 37777

3	**Specimen ID**	B-9, RC-5 (117.1')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

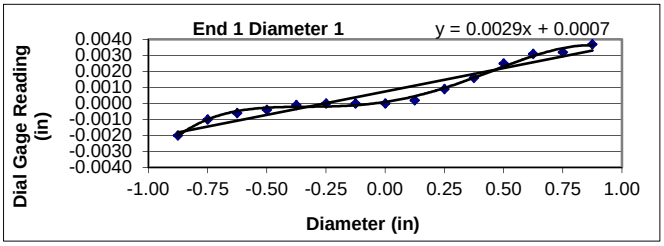
Project:	I-77 Widening	**Diameter (in):**	1.84	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.31	**Tested by:**	TJW
Boring Id:	B-9	**Unit Weight (pcf):**	164.2	**Reviewed by:**	JBB
Sample No.:	RC-1	**Moisture Content (%):**	2.4		
Depth (ft):	100.5				

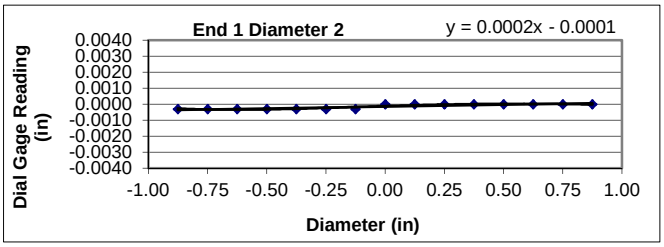
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

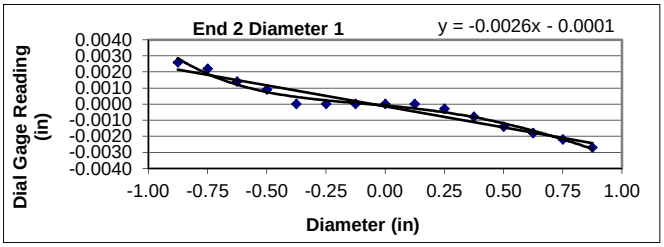
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0020	-0.0003	0.0026	0.0023
- 6/8	-0.0010	-0.0003	0.0022	0.0019
- 5/8	-0.0006	-0.0003	0.0014	0.0015
- 4/8	-0.0004	-0.0003	0.0009	0.0010
- 3/8	-0.0001	-0.0003	0.0000	0.0008
- 2/8	0.0000	-0.0003	0.0000	0.0008
- 1/8	0.0000	-0.0003	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0002	0.0000	0.0000	-0.0002
2/8	0.0009	0.0000	-0.0003	-0.0003
3/8	0.0016	0.0000	-0.0008	-0.0003
4/8	0.0025	0.0000	-0.0014	-0.0009
5/8	0.0031	0.0000	-0.0018	-0.0013
6/8	0.0032	0.0000	-0.0022	-0.0019
7/8	0.0037	0.0000	-0.0027	-0.0025

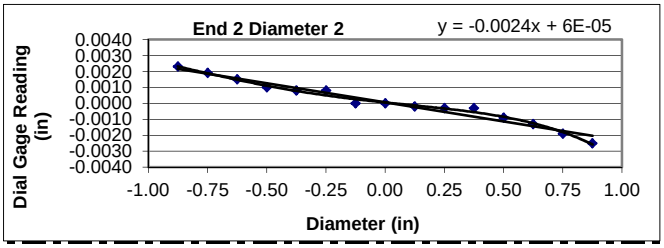




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00292
	Angle of Best Fit Line:	0.16747
End 2:	Slope of Best Fit Line:	-0.00262
	Angle of Best Fit Line:	-0.15011
	Max Angular Difference:	**0.32**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00024
	Angle of Best Fit Line:	0.01375
End 2:	Slope of Best Fit Line:	-0.00239
	Angle of Best Fit Line:	-0.13702
	Max Angular Difference:	**0.15**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0057	0.0031	**YES**
End 1 Diam 2	0.0003	0.0002	**YES**
End 2 Diam 1	0.0053	0.0029	**YES**
End 2 Diam 2	0.0048	0.0026	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

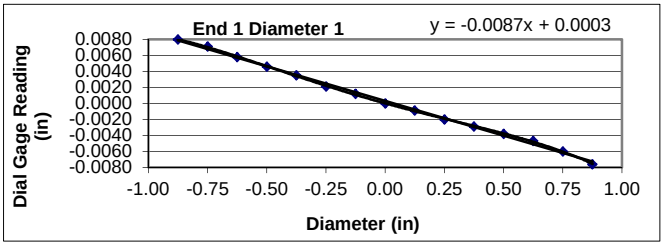
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	3.73	**Tested by:**	TJW
Boring Id:	B-9	**Unit Weight (pcf):**	202.1	**Reviewed by:**	JBB
Sample No.:	RC-3	**Moisture Content (%):**	0.2		
Depth (ft):	107.9				

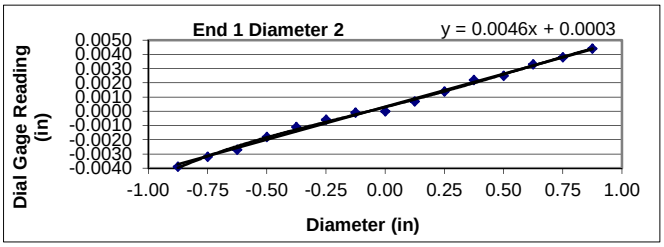
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

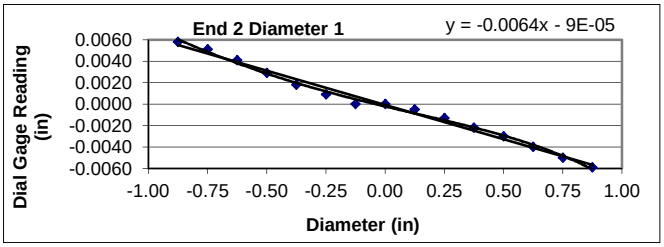
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0080	-0.0039	0.0058	-0.0028
- 6/8	0.0071	-0.0032	0.0051	-0.0021
- 5/8	0.0058	-0.0027	0.0041	-0.0015
- 4/8	0.0046	-0.0018	0.0029	-0.0008
- 3/8	0.0035	-0.0011	0.0018	0.0000
- 2/8	0.0021	-0.0006	0.0009	0.0000
- 1/8	0.0012	-0.0001	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0009	0.0007	-0.0005	0.0010
2/8	-0.0020	0.0014	-0.0013	0.0010
3/8	-0.0029	0.0022	-0.0022	0.0010
4/8	-0.0038	0.0025	-0.0030	0.0021
5/8	-0.0047	0.0033	-0.0040	0.0030
6/8	-0.0060	0.0038	-0.0050	0.0035
7/8	-0.0076	0.0044	-0.0059	0.0040

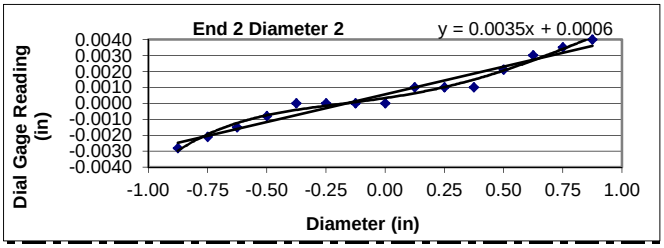




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00867
	Angle of Best Fit Line:	-0.49667
End 2:	Slope of Best Fit Line:	-0.00639
	Angle of Best Fit Line:	-0.36587
	Max Angular Difference:	**-0.13**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00463
	Angle of Best Fit Line:	0.26520
End 2:	Slope of Best Fit Line:	0.00347
	Angle of Best Fit Line:	0.19857
	Max Angular Difference:	**0.07**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0156	0.0084	**NO**
End 1 Diam 2	0.0083	0.0045	**NO**
End 2 Diam 1	0.0117	0.0063	**NO**
End 2 Diam 2	0.0068	0.0037	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

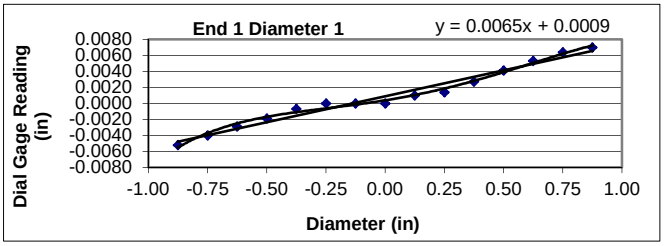
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.01	**Tested by:**	TJW
Boring Id:	B-9	**Unit Weight (pcf):**	185.0	**Reviewed by:**	JBB
Sample No.:	RC-5	**Moisture Content (%):**	0.2		
Depth (ft):	117.1				

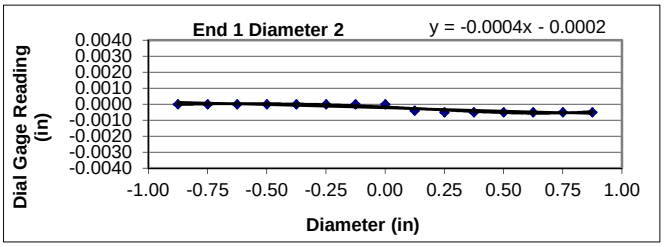
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

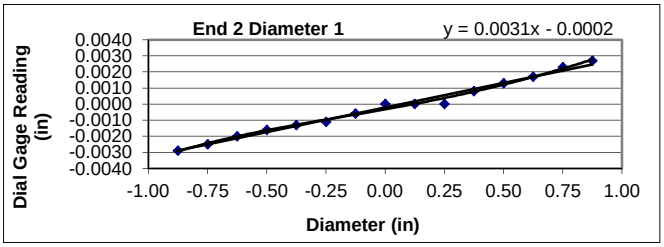
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0052	0.0000	-0.0029	0.0035
- 6/8	-0.0040	0.0000	-0.0025	0.0027
- 5/8	-0.0029	0.0000	-0.0020	0.0020
- 4/8	-0.0019	0.0000	-0.0016	0.0014
- 3/8	-0.0007	0.0000	-0.0013	0.0012
- 2/8	0.0000	0.0000	-0.0011	0.0008
- 1/8	0.0000	0.0000	-0.0006	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0010	-0.0004	0.0000	-0.0001
2/8	0.0014	-0.0005	0.0000	-0.0003
3/8	0.0027	-0.0005	0.0008	-0.0012
4/8	0.0041	-0.0005	0.0013	-0.0015
5/8	0.0053	-0.0005	0.0017	-0.0017
6/8	0.0064	-0.0005	0.0023	-0.0023
7/8	0.0070	-0.0005	0.0027	-0.0028

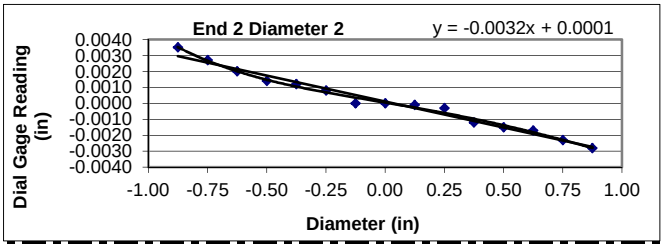




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00648
	Angle of Best Fit Line:	0.37128
End 2:	Slope of Best Fit Line:	0.00306
	Angle of Best Fit Line:	0.17549
	Max Angular Difference:	**0.20**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00040
	Angle of Best Fit Line:	-0.02275
End 2:	Slope of Best Fit Line:	-0.00325
	Angle of Best Fit Line:	-0.18613
	Max Angular Difference:	**0.16**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0122	0.0066	**NO**
End 1 Diam 2	0.0005	0.0003	**YES**
End 2 Diam 1	0.0056	0.0030	**YES**
End 2 Diam 2	0.0063	0.0034	**YES**

Perpendicularity Tolerance Met? **NO**

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-2	B-10	97.1	4.39	1.94	B	2.96	171.6	15	1,320	446	1.6
RC-3	B-10	103.4	4.44	1.96	B	3.02	167.0	49	12,780	4,232	1.1
RC-4a	B-10	104.9	4.37	1.97	C	3.05	164.5	64	19,980	6,551	1.4
RC-4b	B-10	105.4	4.41	1.97	D	3.05	178.6	79	57,560	18,872	0.4

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

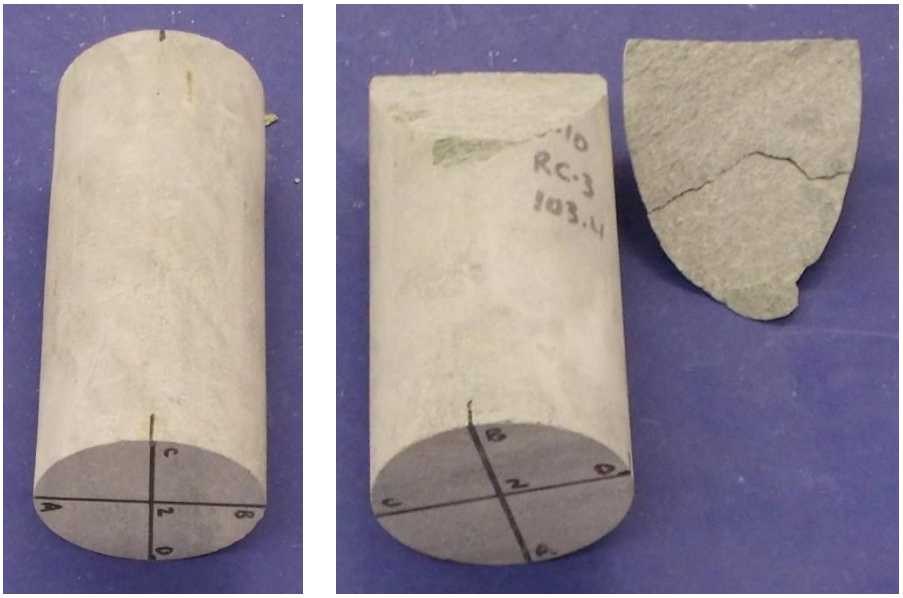
C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

S&ME
1413 Topside Road
Louisville, TN 37777

1	**Specimen ID**	B-10, RC-2 (97.1')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-10, RC-3 (103.4')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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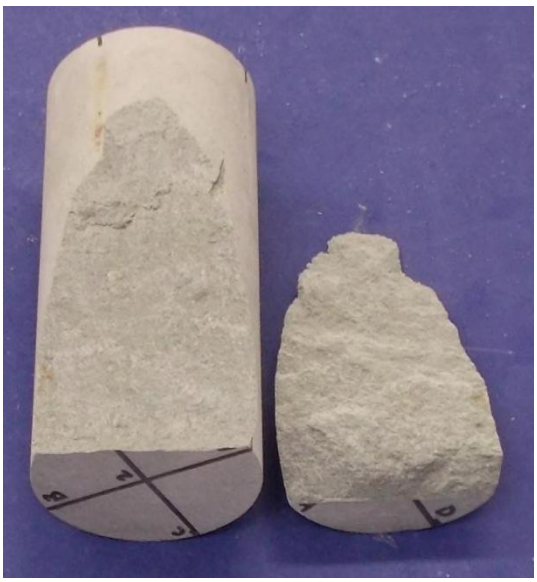
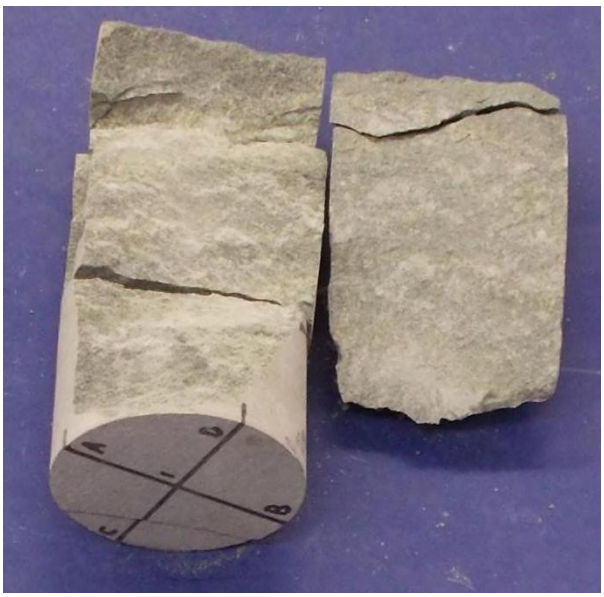
Louisville, TN 37777



3	**Specimen ID**	B-10, RC-4a (104.9')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



4	**Specimen ID**	B-10, RC-4b (105.4')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

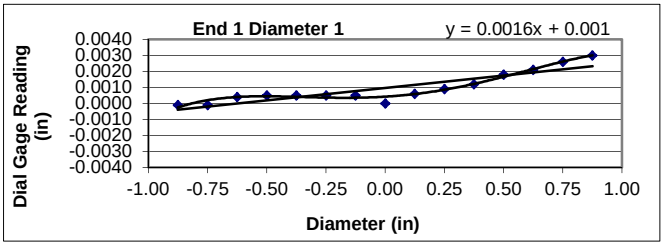
Project:	I-77 Widening	**Diameter (in):**	1.94	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.39	**Tested by:**	TJW
Boring Id:	B-10	**Unit Weight (pcf):**	171.6	**Reviewed by:**	JBB
Sample No.:	RC-2	**Moisture Content (%):**	1.6		
Depth (ft):	97.1				

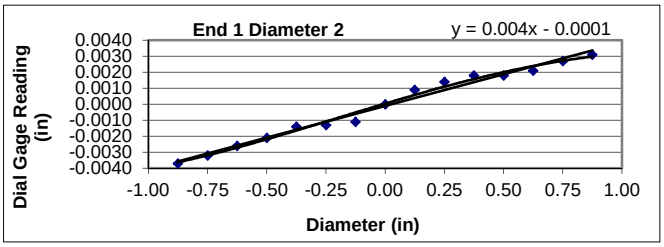
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

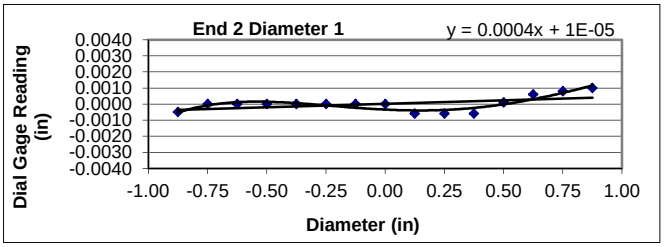
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0001	-0.0037	-0.0005	0.0000
- 6/8	-0.0001	-0.0032	0.0000	0.0000
- 5/8	0.0004	-0.0026	0.0000	0.0000
- 4/8	0.0005	-0.0021	0.0000	0.0000
- 3/8	0.0005	-0.0014	0.0000	0.0000
- 2/8	0.0005	-0.0013	0.0000	0.0000
- 1/8	0.0005	-0.0011	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0006	0.0009	-0.0006	-0.0002
2/8	0.0009	0.0014	-0.0006	-0.0002
3/8	0.0012	0.0018	-0.0006	-0.0002
4/8	0.0018	0.0018	0.0001	-0.0003
5/8	0.0021	0.0021	0.0006	-0.0003
6/8	0.0026	0.0027	0.0008	-0.0003
7/8	0.0030	0.0031	0.0010	-0.0003

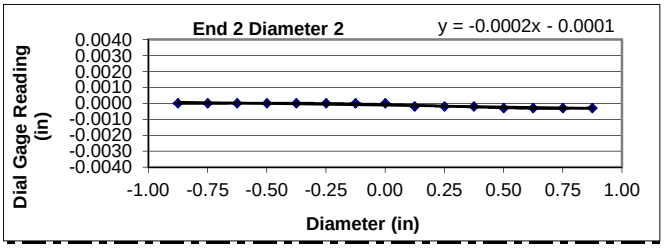




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00156
	Angle of Best Fit Line:	0.08938
End 2:	Slope of Best Fit Line:	0.00043
	Angle of Best Fit Line:	0.02472
	Max Angular Difference:	**0.06**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00397
	Angle of Best Fit Line:	0.22771
End 2:	Slope of Best Fit Line:	-0.00022
	Angle of Best Fit Line:	-0.01277
	Max Angular Difference:	**0.24**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0031	0.0016	**Yes**
End 1 Diam 2	0.0068	0.0035	**YES**
End 2 Diam 1	0.0016	0.0008	**YES**
End 2 Diam 2	0.0003	0.0002	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

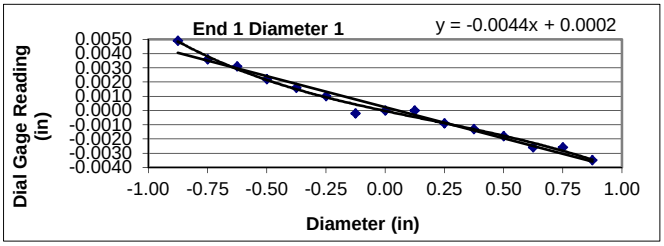
Project:	I-77 Widening	**Diameter (in):**	1.96	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.44	**Tested by:**	TJW
Boring Id:	B-10	**Unit Weight (pcf):**	167.0	**Reviewed by:**	JBB
Sample No.:	RC-3	**Moisture Content (%):**	1.1		
Depth (ft):	103.4				

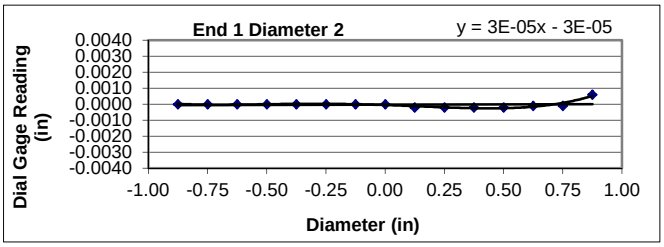
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

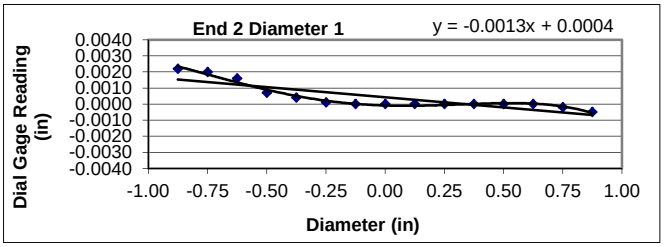
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0049	0.0000	0.0022	-0.0027
- 6/8	0.0036	0.0000	0.0020	-0.0022
- 5/8	0.0031	0.0000	0.0016	-0.0019
- 4/8	0.0022	0.0000	0.0007	-0.0016
- 3/8	0.0016	0.0000	0.0004	-0.0013
- 2/8	0.0010	0.0000	0.0001	-0.0007
- 1/8	-0.0002	0.0000	0.0000	-0.0001
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0002	0.0000	0.0000
2/8	-0.0009	-0.0002	0.0000	0.0006
3/8	-0.0013	-0.0002	0.0000	0.0012
4/8	-0.0018	-0.0002	0.0000	0.0024
5/8	-0.0026	-0.0001	0.0000	0.0027
6/8	-0.0026	-0.0001	-0.0002	0.0034
7/8	-0.0035	0.0006	-0.0005	0.0037

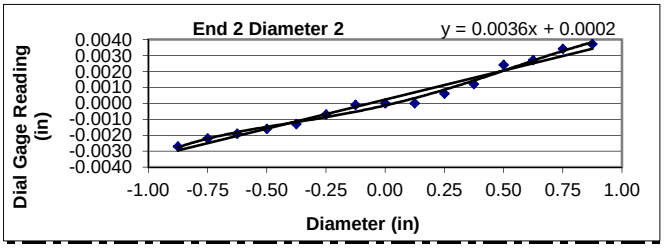




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00437
	Angle of Best Fit Line:	-0.25014
End 2:	Slope of Best Fit Line:	-0.00127
	Angle of Best Fit Line:	-0.07252
	Max Angular Difference:	**-0.18**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00003
	Angle of Best Fit Line:	0.00180
End 2:	Slope of Best Fit Line:	0.00365
	Angle of Best Fit Line:	0.20888
	Max Angular Difference:	**-0.21**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0084	0.0043	**YES**
End 1 Diam 2	0.0008	0.0004	**YES**
End 2 Diam 1	0.0027	0.0014	**YES**
End 2 Diam 2	0.0064	0.0033	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

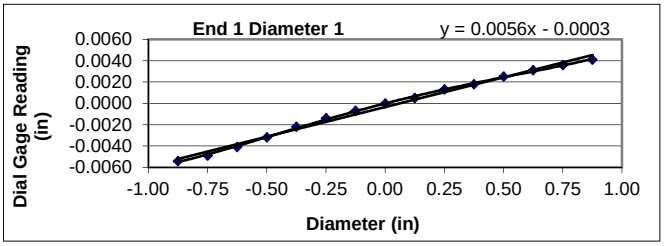
Project:	I-77 Widening	**Diameter (in):**	1.97	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.37	**Tested by:**	TJW
Boring Id:	B-10	**Unit Weight (pcf):**	164.5	**Reviewed by:**	JBB
Sample No.:	RC-4a	**Moisture Content (%):**	1.4		
Depth (ft):	104.9				

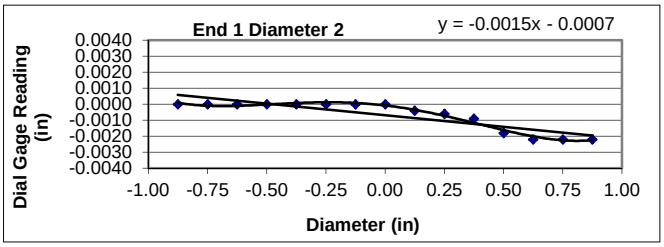
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

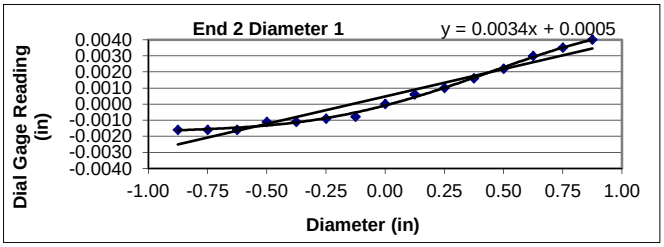
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0054	0.0000	-0.0016	0.0013
- 6/8	-0.0049	0.0000	-0.0016	0.0010
- 5/8	-0.0041	0.0000	-0.0016	0.0005
- 4/8	-0.0032	0.0000	-0.0011	0.0000
- 3/8	-0.0022	0.0000	-0.0011	0.0000
- 2/8	-0.0014	0.0000	-0.0009	0.0000
- 1/8	-0.0007	0.0000	-0.0008	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0005	-0.0004	0.0006	0.0000
2/8	0.0013	-0.0006	0.0010	0.0000
3/8	0.0018	-0.0009	0.0016	0.0000
4/8	0.0025	-0.0018	0.0022	0.0000
5/8	0.0031	-0.0022	0.0030	0.0000
6/8	0.0036	-0.0022	0.0035	0.0000
7/8	0.0041	-0.0022	0.0040	0.0000

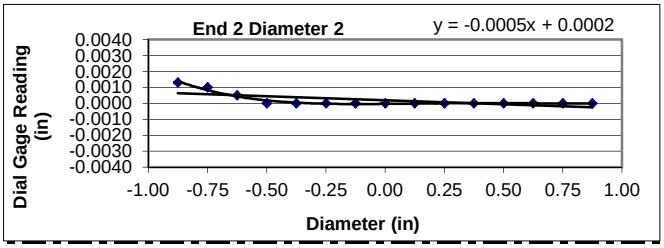




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00557
	Angle of Best Fit Line:	0.31906
End 2:	Slope of Best Fit Line:	0.00341
	Angle of Best Fit Line:	0.19530
	Max Angular Difference:	**0.12**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00146
	Angle of Best Fit Line:	-0.08365
End 2:	Slope of Best Fit Line:	-0.00050
	Angle of Best Fit Line:	-0.02881
	Max Angular Difference:	**-0.05**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0095	0.0048	**NO**
End 1 Diam 2	0.0022	0.0011	**YES**
End 2 Diam 1	0.0056	0.0028	**YES**
End 2 Diam 2	0.0013	0.0007	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

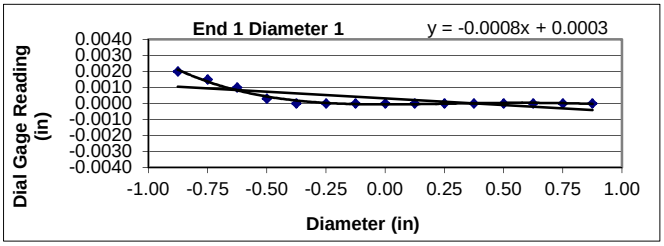
Project:	I-77 Widening	**Diameter (in):**	1.97	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.41	**Tested by:**	TJW
Boring Id:	B-10	**Unit Weight (pcf):**	178.6	**Reviewed by:**	JBB
Sample No.:	RC-4b	**Moisture Content (%):**	0.4		
Depth (ft):	105.4				

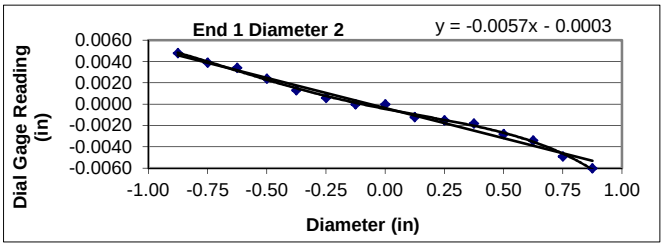
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

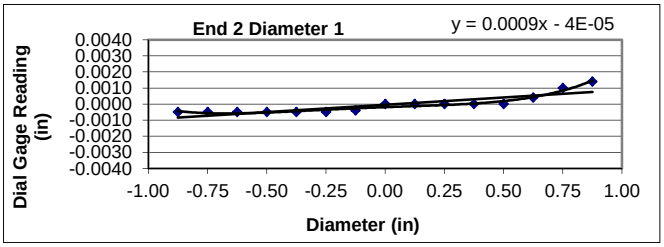
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0020	0.0048	-0.0005	0.0000
- 6/8	0.0015	0.0039	-0.0005	0.0000
- 5/8	0.0010	0.0034	-0.0005	0.0000
- 4/8	0.0003	0.0024	-0.0005	0.0000
- 3/8	0.0000	0.0013	-0.0005	0.0000
- 2/8	0.0000	0.0006	-0.0005	0.0000
- 1/8	0.0000	0.0000	-0.0004	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0012	0.0000	0.0002
2/8	0.0000	-0.0015	0.0000	0.0010
3/8	0.0000	-0.0018	0.0000	0.0017
4/8	0.0000	-0.0028	0.0000	0.0020
5/8	0.0000	-0.0034	0.0004	0.0029
6/8	0.0000	-0.0049	0.0010	0.0030
7/8	0.0000	-0.0060	0.0014	0.0035

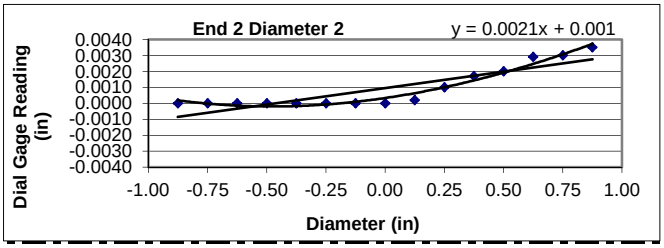




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00083
	Angle of Best Fit Line:	-0.04780
End 2:	Slope of Best Fit Line:	0.00091
	Angle of Best Fit Line:	0.05189
	Max Angular Difference:	**-0.10**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00565
	Angle of Best Fit Line:	-0.32397
End 2:	Slope of Best Fit Line:	0.00207
	Angle of Best Fit Line:	0.11836
	Max Angular Difference:	**-0.44**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0020	0.0010	**YES**
End 1 Diam 2	0.0108	0.0055	**NO**
End 2 Diam 1	0.0019	0.0010	**YES**
End 2 Diam 2	0.0035	0.0018	**YES**

Perpendicularity Tolerance Met? **NO**

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-1a	B-11	87.6	4.12	1.86	D	2.72	185.2	87	63,770	23,445	0.1
RC-1b	B-11	88.8	4.11	1.86	C	2.72	185.6	83	59,300	21,801	0.1
RC-2	B-11	92.7	4.12	1.86	A	2.72	184.1	100	61,140	22,478	0.2
RC-3	B-11	98.7	4.17	1.86	C	2.72	184.7	86	32,510	11,952	0.1

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

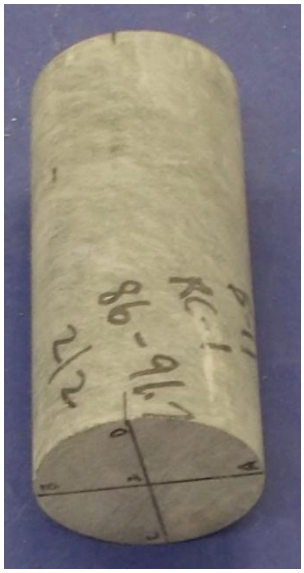
C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

S&ME
1413 Topside Road
Louisville, TN 37777

1	**Specimen ID**	B-11, RC-1a (87.6')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-11, RC-1b (88.8')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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Louisville, TN 37777

3	**Specimen ID**	B-11, RC-2 (92.7')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

4	**Specimen ID**	B-11, RC-3 (98.7')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

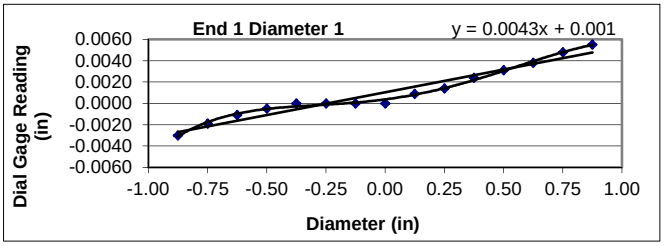
Project:	I-77 Widening	**Diameter (in):**	1.86	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.12	**Tested by:**	TJW
Boring Id:	B-11	**Unit Weight (pcf):**	185.2	**Reviewed by:**	JBB
Sample No.:	RC-1a	**Moisture Content (%):**	0.1		
Depth (ft):	87.6				

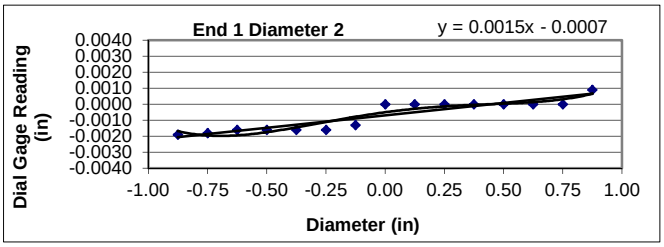
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

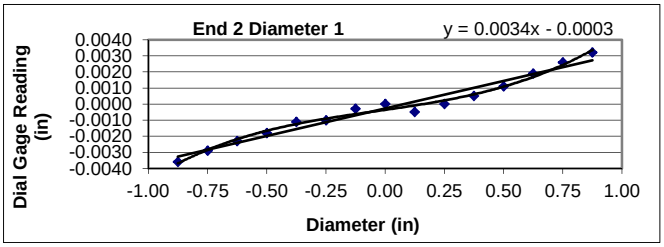
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0030	-0.0019	-0.0036	0.0027
- 6/8	-0.0019	-0.0018	-0.0029	0.0021
- 5/8	-0.0011	-0.0016	-0.0023	0.0015
- 4/8	-0.0005	-0.0016	-0.0018	0.0012
- 3/8	0.0000	-0.0016	-0.0011	0.0006
- 2/8	0.0000	-0.0016	-0.0010	0.0000
- 1/8	0.0000	-0.0013	-0.0003	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0009	0.0000	-0.0005	-0.0011
2/8	0.0014	0.0000	0.0000	-0.0011
3/8	0.0024	0.0000	0.0005	-0.0014
4/8	0.0031	0.0000	0.0011	-0.0018
5/8	0.0038	0.0000	0.0019	-0.0021
6/8	0.0048	0.0000	0.0026	-0.0024
7/8	0.0055	0.0009	0.0032	-0.0026

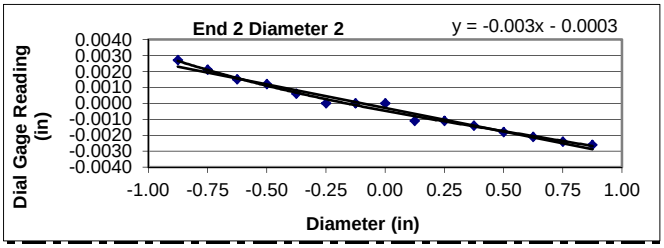




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00427
	Angle of Best Fit Line:	0.24473
End 2:	Slope of Best Fit Line:	0.00342
	Angle of Best Fit Line:	0.19612
	Max Angular Difference:	**0.05**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00155
	Angle of Best Fit Line:	0.08856
End 2:	Slope of Best Fit Line:	-0.00295
	Angle of Best Fit Line:	-0.16927
	Max Angular Difference:	**0.26**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0085	0.0046	**NO**
End 1 Diam 2	0.0028	0.0015	**YES**
End 2 Diam 1	0.0068	0.0037	**YES**
End 2 Diam 2	0.0053	0.0028	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

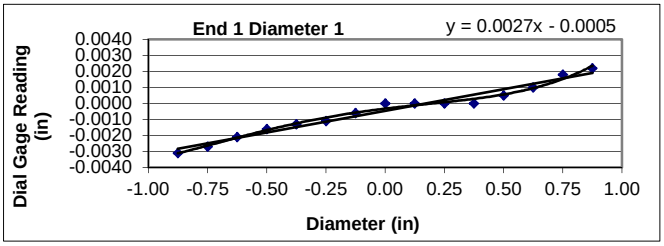
Project:	I-77 Widening	**Diameter (in):**	1.86	**Date:**	11/12/2014
Project No.:	1461-14-046	**Length (in):**	4.11	**Tested by:**	TJW
Boring Id:	B-11	**Unit Weight (pcf):**	185.6	**Reviewed by:**	JBB
Sample No.:	RC-1b	**Moisture Content (%):**	0.1		
Depth (ft):	88.8				

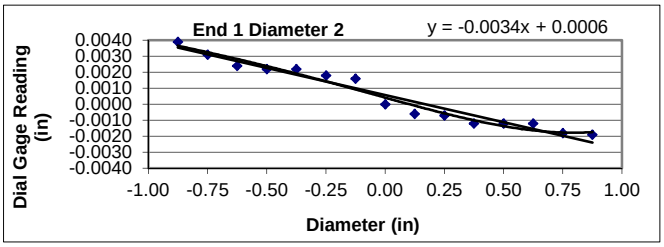
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

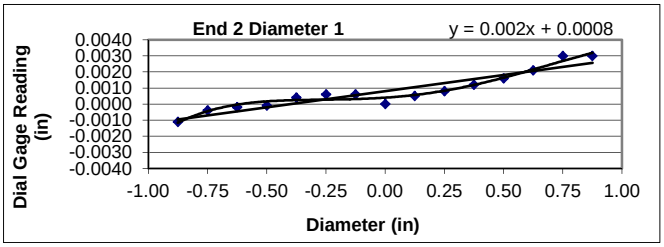
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0031	0.0039	-0.0011	0.0045
- 6/8	-0.0027	0.0031	-0.0004	0.0030
- 5/8	-0.0021	0.0024	-0.0002	0.0024
- 4/8	-0.0016	0.0022	-0.0001	0.0010
- 3/8	-0.0013	0.0022	0.0004	0.0002
- 2/8	-0.0011	0.0018	0.0006	0.0000
- 1/8	-0.0006	0.0016	0.0006	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0006	0.0005	-0.0011
2/8	0.0000	-0.0007	0.0008	-0.0021
3/8	0.0000	-0.0012	0.0012	-0.0027
4/8	0.0005	-0.0012	0.0016	-0.0030
5/8	0.0010	-0.0012	0.0021	-0.0038
6/8	0.0018	-0.0018	0.0030	-0.0046
7/8	0.0022	-0.0019	0.0030	-0.0052

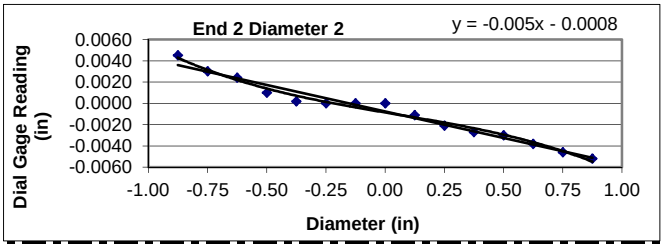




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00271
	Angle of Best Fit Line:	0.15503
End 2:	Slope of Best Fit Line:	0.00200
	Angle of Best Fit Line:	0.11476
	Max Angular Difference:	**0.04**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00340
	Angle of Best Fit Line:	-0.19481
End 2:	Slope of Best Fit Line:	-0.00499
	Angle of Best Fit Line:	-0.28566
	Max Angular Difference:	**0.09**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0053	0.0028	**YES**
End 1 Diam 2	0.0058	0.0031	**YES**
End 2 Diam 1	0.0041	0.0022	**YES**
End 2 Diam 2	0.0097	0.0052	**NO**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

1413 Topside Road, Louisville, TN 37777

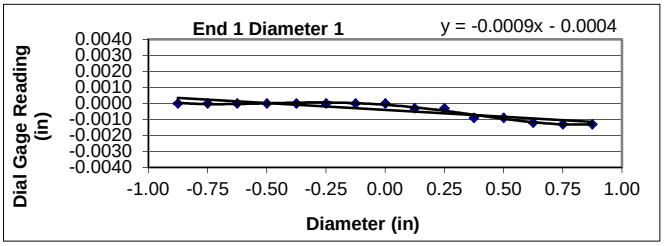
Project:	I-77 Widening	**Diameter (in):**	1.86	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.12	**Tested by:**	TJW
Boring Id:	B-11	**Unit Weight (pcf):**	184.1	**Reviewed by:**	JBB
Sample No.:	RC-2	**Moisture Content (%):**	0.2		
Depth (ft):	92.7				

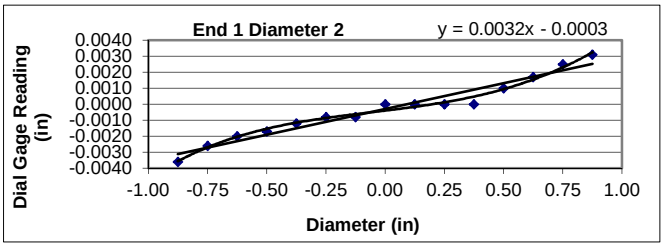
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

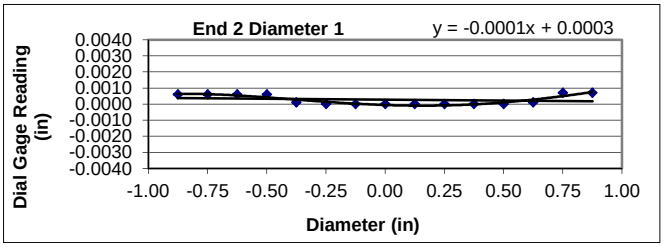
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0000	-0.0036	0.0006	0.0000
- 6/8	0.0000	-0.0026	0.0006	0.0000
- 5/8	0.0000	-0.0020	0.0006	0.0000
- 4/8	0.0000	-0.0017	0.0006	0.0000
- 3/8	0.0000	-0.0012	0.0001	0.0000
- 2/8	0.0000	-0.0008	0.0000	0.0000
- 1/8	0.0000	-0.0008	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0003	0.0000	0.0000	-0.0012
2/8	-0.0003	0.0000	0.0000	-0.0012
3/8	-0.0009	0.0000	0.0000	-0.0012
4/8	-0.0009	0.0010	0.0000	-0.0010
5/8	-0.0012	0.0017	0.0001	-0.0010
6/8	-0.0013	0.0025	0.0007	-0.0010
7/8	-0.0013	0.0031	0.0007	-0.0007

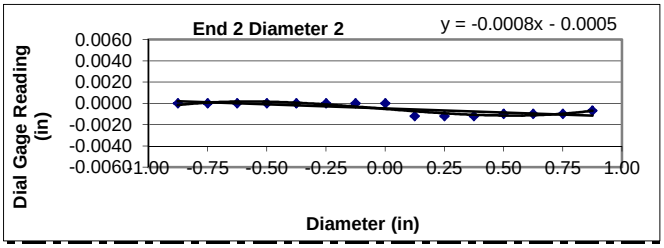




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00086
	Angle of Best Fit Line:	-0.04927
End 2:	Slope of Best Fit Line:	-0.00011
	Angle of Best Fit Line:	-0.00638
	Max Angular Difference:	**-0.04**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00322
	Angle of Best Fit Line:	0.18466
End 2:	Slope of Best Fit Line:	-0.00077
	Angle of Best Fit Line:	-0.04436
	Max Angular Difference:	**0.23**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0013	0.0007	**YES**
End 1 Diam 2	0.0067	0.0036	**YES**
End 2 Diam 1	0.0007	0.0004	**YES**
End 2 Diam 2	0.0012	0.0006	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

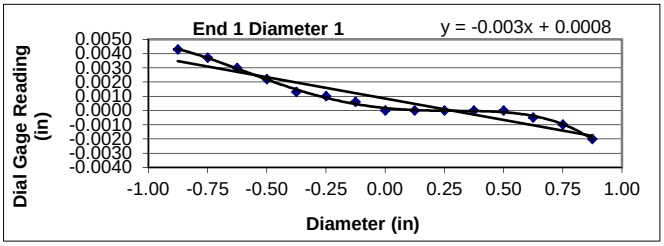
Project:	I-77 Widening	**Diameter (in):**	1.86	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.17	**Tested by:**	TJW
Boring Id:	B-11	**Unit Weight (pcf):**	184.7	**Reviewed by:**	JBB
Sample No.:	RC-3	**Moisture Content (%):**	0.1		
Depth (ft):	98.7				

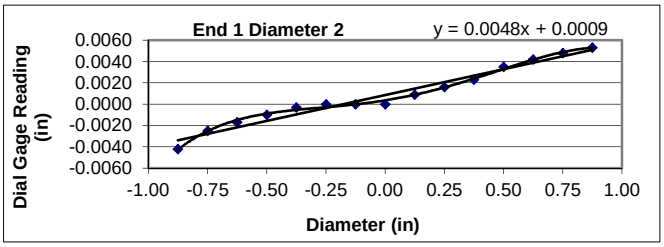
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

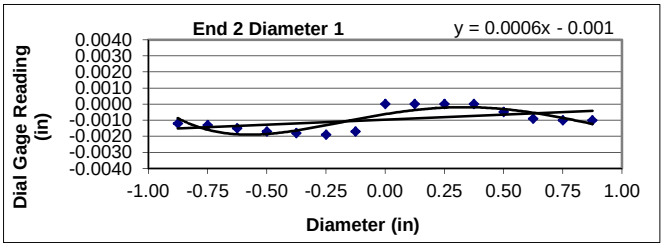
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0043	-0.0042	-0.0012	-0.0039
- 6/8	0.0037	-0.0025	-0.0013	-0.0034
- 5/8	0.0030	-0.0017	-0.0015	-0.0026
- 4/8	0.0022	-0.0010	-0.0017	-0.0016
- 3/8	0.0013	-0.0003	-0.0018	-0.0014
- 2/8	0.0010	0.0000	-0.0019	-0.0009
- 1/8	0.0006	0.0000	-0.0017	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0009	0.0000	0.0000
2/8	0.0000	0.0016	0.0000	0.0000
3/8	0.0000	0.0023	0.0000	0.0000
4/8	0.0000	0.0035	-0.0005	0.0011
5/8	-0.0005	0.0042	-0.0009	0.0011
6/8	-0.0010	0.0048	-0.0010	0.0017
7/8	-0.0020	0.0053	-0.0010	0.0024

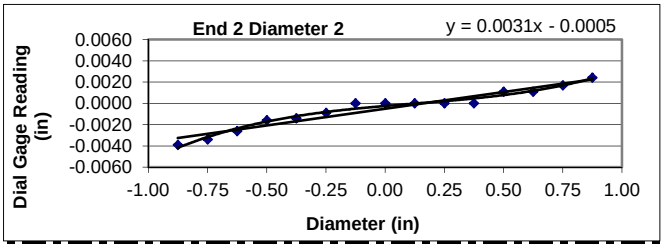




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00300
	Angle of Best Fit Line:	-0.17205
End 2:	Slope of Best Fit Line:	0.00063
	Angle of Best Fit Line:	0.03585
	Max Angular Difference:	**-0.21**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00485
	Angle of Best Fit Line:	0.27780
End 2:	Slope of Best Fit Line:	0.00314
	Angle of Best Fit Line:	0.18007
	Max Angular Difference:	**0.10**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0063	0.0034	**YES**
End 1 Diam 2	0.0095	0.0051	**NO**
End 2 Diam 1	0.0019	0.0010	**YES**
End 2 Diam 2	0.0063	0.0034	**YES**

Perpendicularity Tolerance Met? **NO**

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-2a	B-12	83.6	4.15	1.92	B	2.90	145.8	41	8,810	3,038	4.5
RC-2b	B-12	86.5	4.07	1.93	B	2.93	144.9	24	3,370	1,150	4.6
RC-3	B-12	88.3	4.32	1.94	E	2.96	151.9	27	3,050	1,030	5.2
RC-4	B-12	96.1	4.35	1.96	A	3.02	141.7	33	5,430	1,798	2.7

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

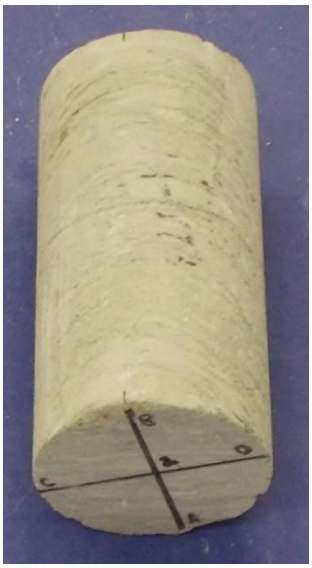
C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

S&ME
1413 Topside Road
Louisville, TN 37777

1	**Specimen ID**	B-12, RC-2a (83.6')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-12, RC-2b (86.5')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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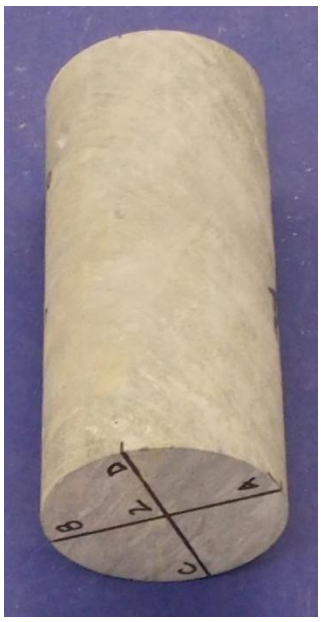
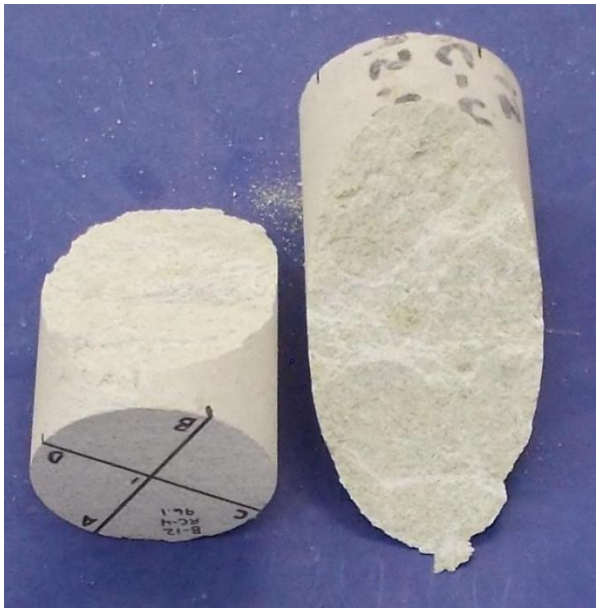
Louisville, TN 37777



3	**Specimen ID**	B-12, RC-3 (88.3')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



4	**Specimen ID**	B-12, RC-4 (96.1')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

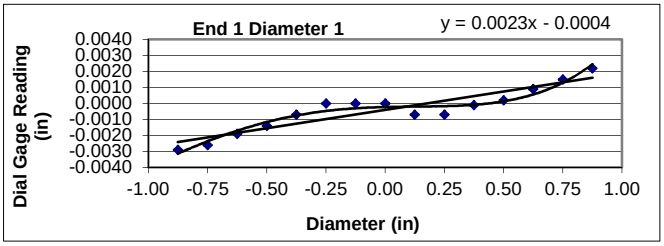
Project:	I-77 Widening	**Diameter (in):**	1.92	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.15	**Tested by:**	TJW
Boring Id:	B-12	**Unit Weight (pcf):**	145.8	**Reviewed by:**	JBB
Sample No.:	RC-2a	**Moisture Content (%):**	4.5		
Depth (ft):	83.6				

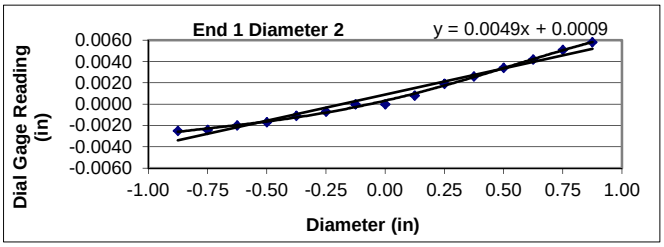
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

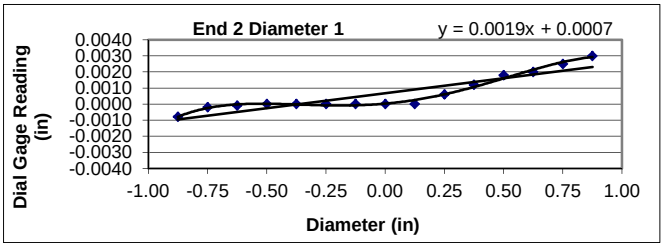
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0029	-0.0025	-0.0008	0.0000
- 6/8	-0.0026	-0.0024	-0.0002	0.0000
- 5/8	-0.0019	-0.0020	-0.0001	0.0000
- 4/8	-0.0014	-0.0017	0.0000	0.0000
- 3/8	-0.0007	-0.0011	0.0000	0.0000
- 2/8	0.0000	-0.0007	0.0000	0.0000
- 1/8	0.0000	0.0000	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0007	0.0008	0.0000	0.0001
2/8	-0.0007	0.0019	0.0006	0.0008
3/8	-0.0001	0.0026	0.0012	0.0013
4/8	0.0002	0.0034	0.0018	0.0020
5/8	0.0009	0.0042	0.0020	0.0024
6/8	0.0015	0.0051	0.0025	0.0028
7/8	0.0022	0.0058	0.0030	0.0033

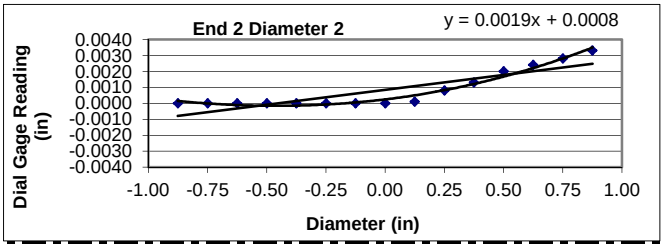




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00230
	Angle of Best Fit Line:	0.13162
End 2:	Slope of Best Fit Line:	0.00187
	Angle of Best Fit Line:	0.10690
	Max Angular Difference:	**0.02**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00490
	Angle of Best Fit Line:	0.28091
End 2:	Slope of Best Fit Line:	0.00187
	Angle of Best Fit Line:	0.10722
	Max Angular Difference:	**0.17**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0051	0.0027	**YES**
End 1 Diam 2	0.0083	0.0043	**YES**
End 2 Diam 1	0.0038	0.0020	**YES**
End 2 Diam 2	0.0033	0.0017	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

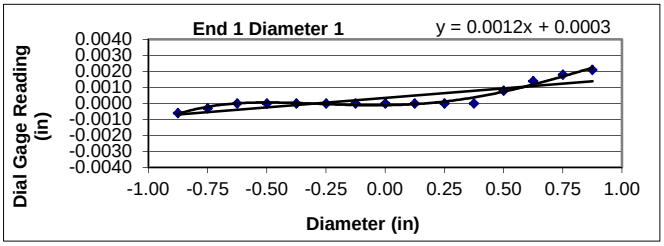
Project:	I-77 Widening	**Diameter (in):**	1.93	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.07	**Tested by:**	TJW
Boring Id:	B-12	**Unit Weight (pcf):**	144.9	**Reviewed by:**	JBB
Sample No.:	RC-2b	**Moisture Content (%):**	4.6		
Depth (ft):	86.5				

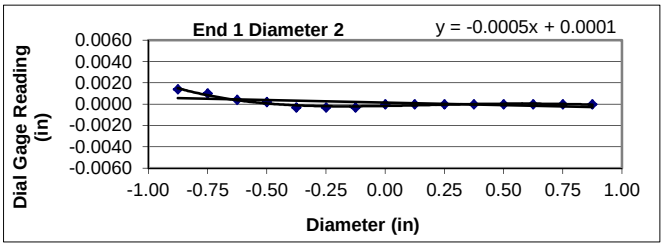
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

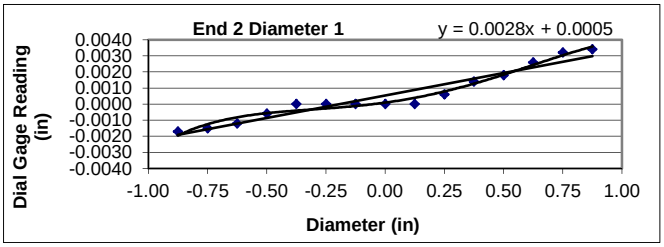
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0006	0.0014	-0.0017	0.0047
- 6/8	-0.0003	0.0010	-0.0015	0.0039
- 5/8	0.0000	0.0004	-0.0012	0.0034
- 4/8	0.0000	0.0002	-0.0006	0.0028
- 3/8	0.0000	-0.0003	0.0000	0.0019
- 2/8	0.0000	-0.0003	0.0000	0.0014
- 1/8	0.0000	-0.0003	0.0000	0.0007
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0000	-0.0006
2/8	0.0000	0.0000	0.0006	-0.0008
3/8	0.0000	0.0000	0.0014	-0.0013
4/8	0.0008	0.0000	0.0018	-0.0016
5/8	0.0014	0.0000	0.0026	-0.0019
6/8	0.0018	0.0000	0.0032	-0.0020
7/8	0.0021	0.0000	0.0034	-0.0027

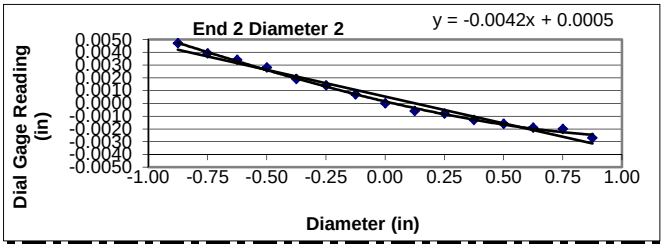




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00119
	Angle of Best Fit Line:	0.06826
End 2:	Slope of Best Fit Line:	0.00280
	Angle of Best Fit Line:	0.16026
	Max Angular Difference:	**-0.09**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00048
	Angle of Best Fit Line:	-0.02750
End 2:	Slope of Best Fit Line:	-0.00419
	Angle of Best Fit Line:	-0.23999
	Max Angular Difference:	**0.21**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0027	0.0014	**YES**
End 1 Diam 2	0.0017	0.0009	**YES**
End 2 Diam 1	0.0051	0.0026	**YES**
End 2 Diam 2	0.0074	0.0038	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

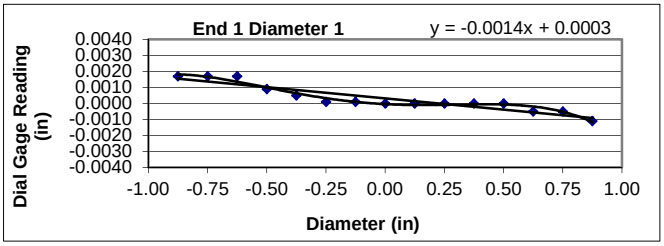
Project:	I-77 Widening	**Diameter (in):**	1.94	**Date:**	11/19/2014
Project No.:	1461-14-046	**Length (in):**	4.32	**Tested by:**	TJW
Boring Id:	B-12	**Unit Weight (pcf):**	151.9	**Reviewed by:**	JBB
Sample No.:	RC-3	**Moisture Content (%):**	5.2		
Depth (ft):	88.3				

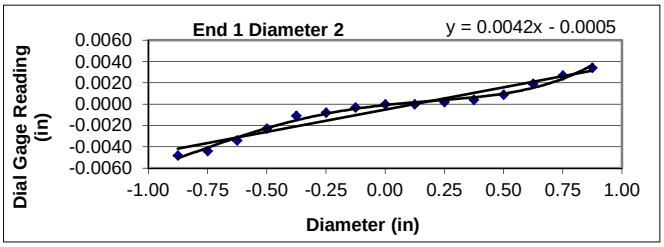
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

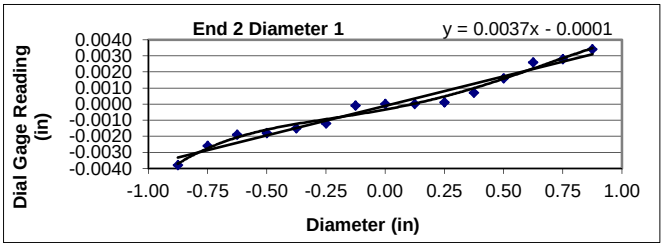
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0017	-0.0048	-0.0038	0.0001
- 6/8	0.0017	-0.0044	-0.0026	0.0001
- 5/8	0.0017	-0.0034	-0.0019	0.0001
- 4/8	0.0009	-0.0023	-0.0018	0.0001
- 3/8	0.0005	-0.0011	-0.0015	0.0001
- 2/8	0.0001	-0.0008	-0.0012	0.0001
- 1/8	0.0001	-0.0003	-0.0001	0.0001
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0000	0.0000
2/8	0.0000	0.0002	0.0001	0.0001
3/8	0.0000	0.0004	0.0007	0.0002
4/8	0.0000	0.0009	0.0016	0.0008
5/8	-0.0005	0.0019	0.0026	0.0010
6/8	-0.0005	0.0027	0.0028	0.0013
7/8	-0.0011	0.0034	0.0034	0.0013

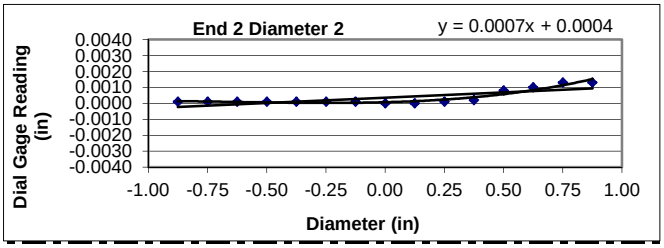




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00141
	Angle of Best Fit Line:	-0.08054
End 2:	Slope of Best Fit Line:	0.00366
	Angle of Best Fit Line:	0.20987
	Max Angular Difference:	**-0.29**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00417
	Angle of Best Fit Line:	0.23917
End 2:	Slope of Best Fit Line:	0.00066
	Angle of Best Fit Line:	0.03782
	Max Angular Difference:	**0.20**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0028	0.0014	**YES**
End 1 Diam 2	0.0082	0.0042	**YES**
End 2 Diam 1	0.0072	0.0037	**YES**
End 2 Diam 2	0.0013	0.0007	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

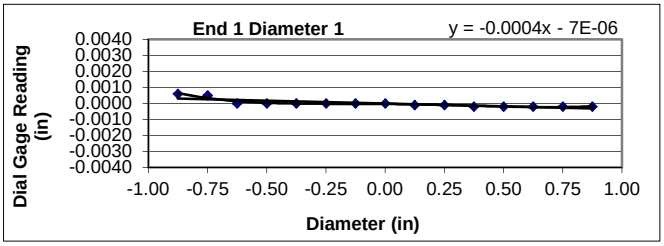
Project:	I-77 Widening	**Diameter (in):**	1.96	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.35	**Tested by:**	TJW
Boring Id:	B-12	**Unit Weight (pcf):**	141.7	**Reviewed by:**	JBB
Sample No.:	RC-4	**Moisture Content (%):**	2.7		
Depth (ft):	96.1				

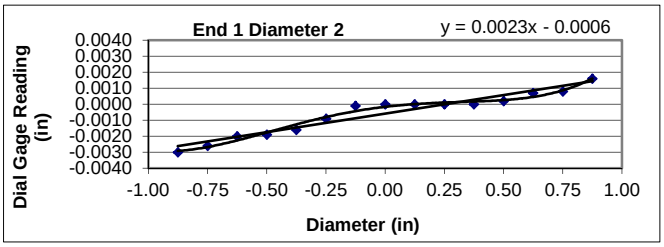
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

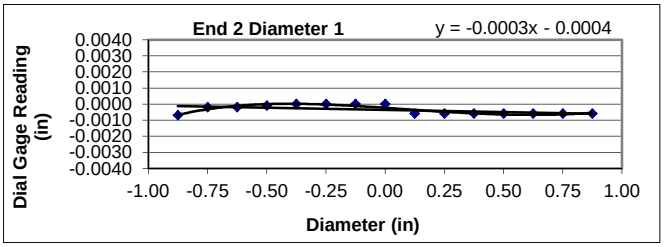
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0006	-0.0030	-0.0007	-0.0040
- 6/8	0.0005	-0.0026	-0.0002	-0.0033
- 5/8	0.0000	-0.0020	-0.0002	-0.0028
- 4/8	0.0000	-0.0019	-0.0001	-0.0020
- 3/8	0.0000	-0.0016	0.0000	-0.0015
- 2/8	0.0000	-0.0009	0.0000	-0.0004
- 1/8	0.0000	-0.0001	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0001	0.0000	-0.0006	-0.0005
2/8	-0.0001	0.0000	-0.0006	-0.0005
3/8	-0.0002	0.0000	-0.0006	0.0001
4/8	-0.0002	0.0002	-0.0006	0.0008
5/8	-0.0002	0.0007	-0.0006	0.0012
6/8	-0.0002	0.0008	-0.0006	0.0019
7/8	-0.0002	0.0016	-0.0006	0.0028

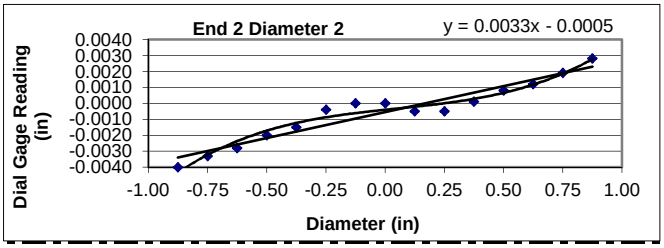




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00036
	Angle of Best Fit Line:	-0.02046
End 2:	Slope of Best Fit Line:	-0.00027
	Angle of Best Fit Line:	-0.01522
	Max Angular Difference:	**-0.01**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00232
	Angle of Best Fit Line:	0.13293
End 2:	Slope of Best Fit Line:	0.00326
	Angle of Best Fit Line:	0.18678
	Max Angular Difference:	**-0.05**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0008	0.0004	**YES**
End 1 Diam 2	0.0046	0.0023	**YES**
End 2 Diam 1	0.0007	0.0004	**YES**
End 2 Diam 2	0.0068	0.0035	**YES**

Perpendicularity Tolerance Met? **YES**

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-1	B-13	95.1	4.11	1.86	D	2.72	167.1	77	18,940	6,963	0.6
RC-2	B-13	99.0	4.10	1.85	C	2.69	164.0	69	12,920	4,803	1.0
RC-3	B-13	103.4	4.08	1.85	C	2.69	174.5	90	19,700	7,323	0.3
RC-5a	B-13	107.2	4.10	1.85	B	2.69	165.2	74	15,920	5,918	0.9
RC-5b	B-13	110.6	4.07	1.85	D	2.69	170.7	69	15,570	5,788	0.6

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

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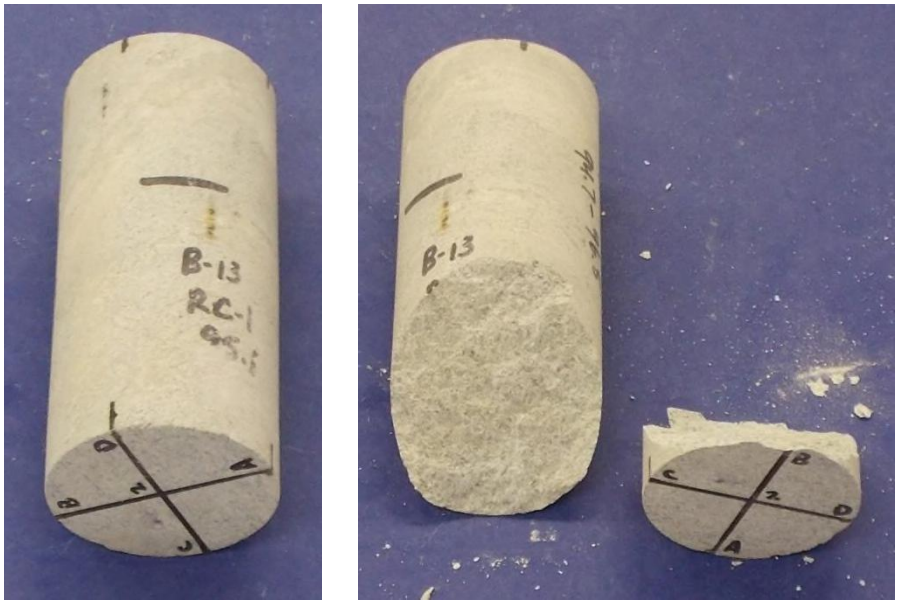
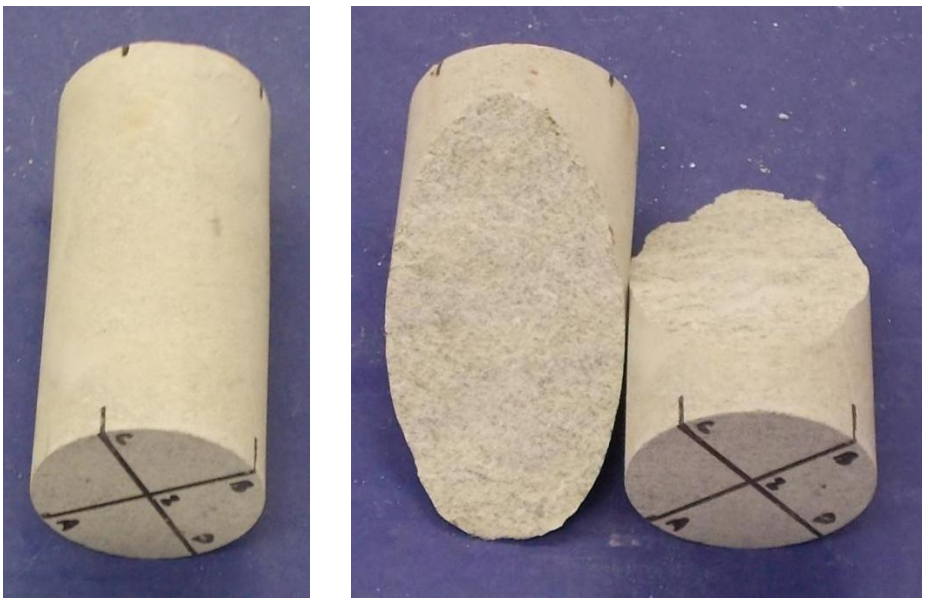
Louisville, TN 37777



1	**Specimen ID**	B-13, RC-1 (95.1')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-13, RC-2 (99.0')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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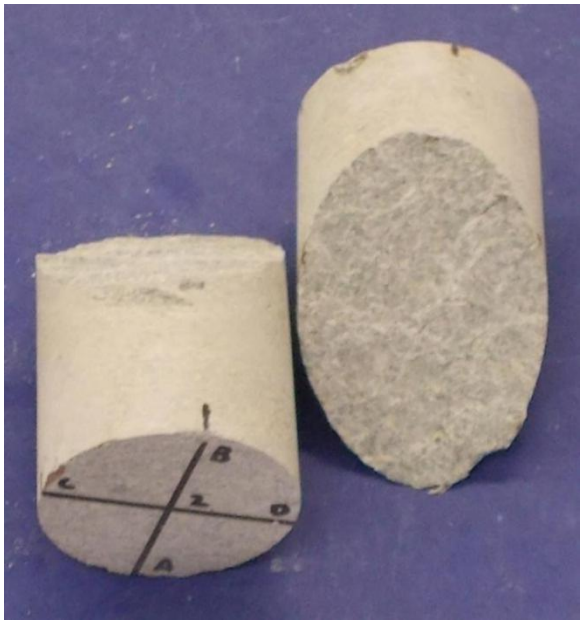
1413 Topside Road
Louisville, TN 37777

3	**Specimen ID**	B-13, RC-3 (103.4')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



4	**Specimen ID**	B-13, RC-5a (107.2')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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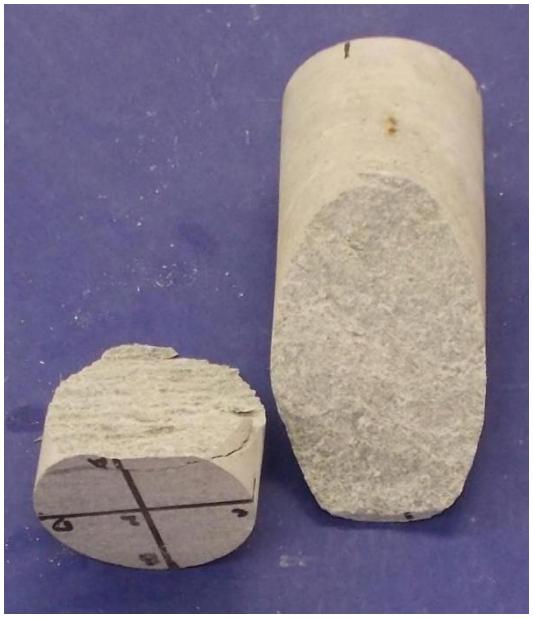
Louisville, TN 37777



5	**Specimen ID**	B-13, RC-5b (110.6')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

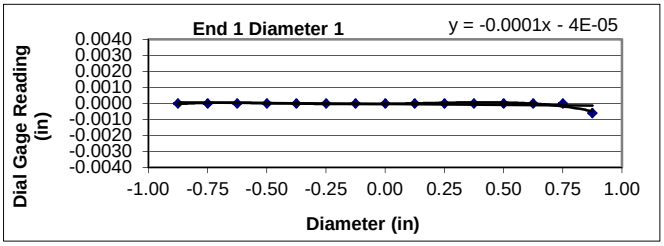
Project:	I-77 Widening	**Diameter (in):**	1.86	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.11	**Tested by:**	TJW
Boring Id:	B-13	**Unit Weight (pcf):**	167.1	**Reviewed by:**	JBB
Sample No.:	RC-1	**Moisture Content (%):**	0.6		
Depth (ft):	95.1				

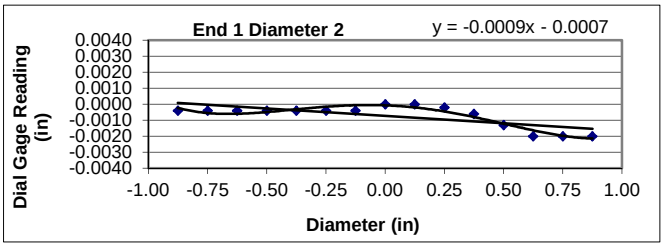
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

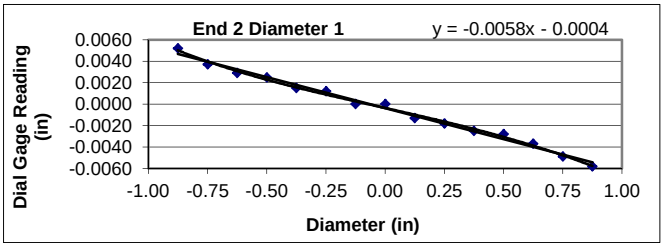
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0000	-0.0004	0.0052	0.0029
- 6/8	0.0000	-0.0004	0.0037	0.0029
- 5/8	0.0000	-0.0004	0.0029	0.0027
- 4/8	0.0000	-0.0004	0.0025	0.0023
- 3/8	0.0000	-0.0004	0.0015	0.0018
- 2/8	0.0000	-0.0004	0.0012	0.0010
- 1/8	0.0000	-0.0004	0.0000	0.0005
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	-0.0013	0.0000
2/8	0.0000	-0.0002	-0.0018	0.0000
3/8	0.0000	-0.0006	-0.0025	-0.0002
4/8	0.0000	-0.0013	-0.0028	-0.0002
5/8	0.0000	-0.0020	-0.0037	-0.0004
6/8	0.0000	-0.0020	-0.0049	-0.0009
7/8	-0.0006	-0.0020	-0.0058	-0.0012

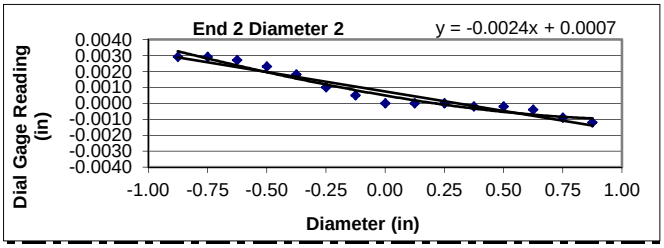




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00012
	Angle of Best Fit Line:	-0.00688
End 2:	Slope of Best Fit Line:	-0.00577
	Angle of Best Fit Line:	-0.33084
	Max Angular Difference:	**0.32**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00092
	Angle of Best Fit Line:	-0.05271
End 2:	Slope of Best Fit Line:	-0.00244
	Angle of Best Fit Line:	-0.13997
	Max Angular Difference:	**0.09**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0006	0.0003	**YES**
End 1 Diam 2	0.0020	0.0011	**YES**
End 2 Diam 1	0.0110	0.0059	**NO**
End 2 Diam 2	0.0041	0.0022	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

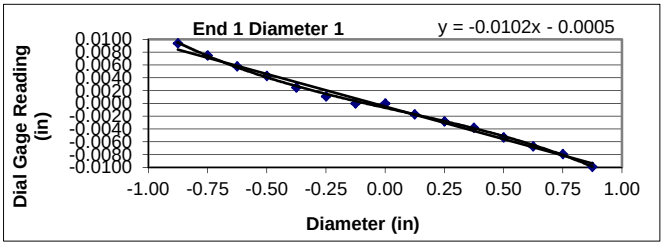
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.10	**Tested by:**	TJW
Boring Id:	B-13	**Unit Weight (pcf):**	164.0	**Reviewed by:**	JBB
Sample No.:	RC-2	**Moisture Content (%):**	1.0		
Depth (ft):	99.0				

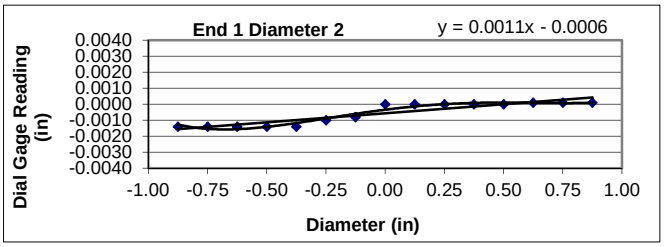
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

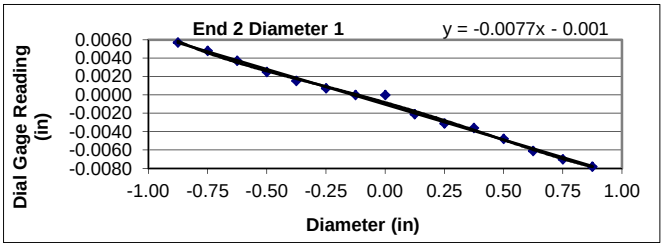
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0094	-0.0014	0.0057	0.0005
- 6/8	0.0075	-0.0014	0.0048	0.0005
- 5/8	0.0058	-0.0014	0.0037	0.0005
- 4/8	0.0043	-0.0014	0.0025	0.0005
- 3/8	0.0025	-0.0014	0.0015	0.0005
- 2/8	0.0011	-0.0010	0.0007	0.0005
- 1/8	0.0000	-0.0008	0.0000	0.0005
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0017	0.0000	-0.0021	0.0000
2/8	-0.0028	0.0000	-0.0031	0.0000
3/8	-0.0038	0.0000	-0.0036	0.0005
4/8	-0.0053	0.0000	-0.0048	0.0008
5/8	-0.0067	0.0001	-0.0061	0.0010
6/8	-0.0079	0.0001	-0.0070	0.0015
7/8	-0.0099	0.0001	-0.0078	0.0020

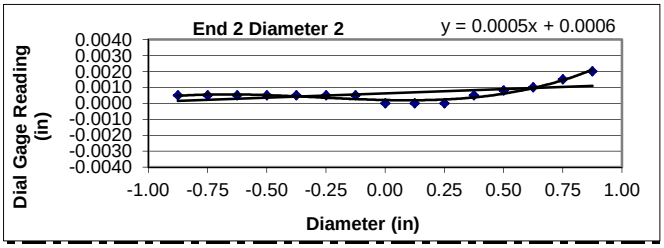




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.01019
	Angle of Best Fit Line:	-0.58409
End 2:	Slope of Best Fit Line:	-0.00767
	Angle of Best Fit Line:	-0.43954
	Max Angular Difference:	**-0.14**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00113
	Angle of Best Fit Line:	0.06483
End 2:	Slope of Best Fit Line:	0.00053
	Angle of Best Fit Line:	0.03061
	Max Angular Difference:	**0.03**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0193	0.0104	**NO**
End 1 Diam 2	0.0015	0.0008	**YES**
End 2 Diam 1	0.0135	0.0073	**NO**
End 2 Diam 2	0.0020	0.0011	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

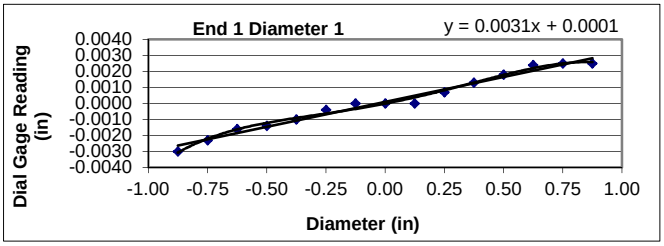
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.08	**Tested by:**	TJW
Boring Id:	B-13	**Unit Weight (pcf):**	174.5	**Reviewed by:**	JBB
Sample No.:	RC-3	**Moisture Content (%):**	0.3		
Depth (ft):	103.4				

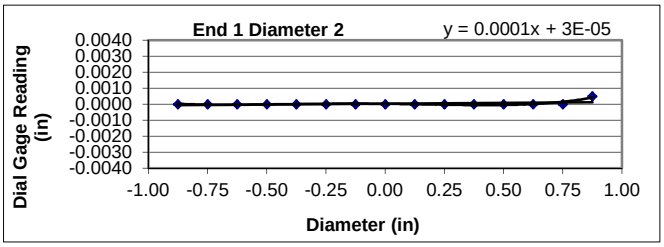
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

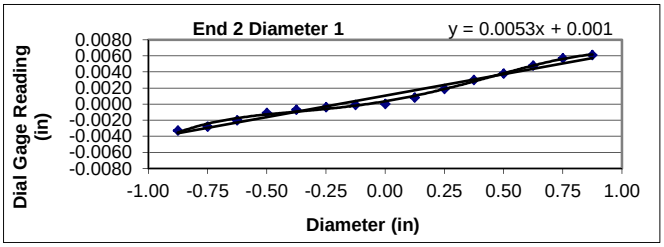
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0030	0.0000	-0.0033	0.0016
- 6/8	-0.0023	0.0000	-0.0028	0.0016
- 5/8	-0.0016	0.0000	-0.0020	0.0009
- 4/8	-0.0014	0.0000	-0.0011	0.0004
- 3/8	-0.0010	0.0000	-0.0007	0.0003
- 2/8	-0.0004	0.0000	-0.0004	0.0000
- 1/8	0.0000	0.0000	-0.0001	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	0.0008	-0.0012
2/8	0.0007	0.0000	0.0019	-0.0012
3/8	0.0013	0.0000	0.0030	-0.0012
4/8	0.0018	0.0000	0.0038	-0.0012
5/8	0.0024	0.0000	0.0048	-0.0013
6/8	0.0025	0.0000	0.0057	-0.0024
7/8	0.0025	0.0005	0.0061	-0.0030

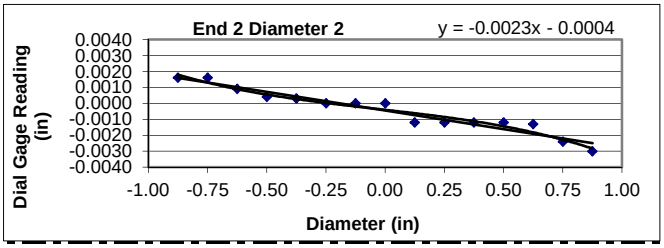




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00312
	Angle of Best Fit Line:	0.17876
End 2:	Slope of Best Fit Line:	0.00534
	Angle of Best Fit Line:	0.30612
	Max Angular Difference:	**-0.13**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00010
	Angle of Best Fit Line:	0.00573
End 2:	Slope of Best Fit Line:	-0.00233
	Angle of Best Fit Line:	-0.13374
	Max Angular Difference:	**0.14**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0055	0.0030	**YES**
End 1 Diam 2	0.0005	0.0003	**YES**
End 2 Diam 1	0.0094	0.0051	**NO**
End 2 Diam 2	0.0046	0.0025	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

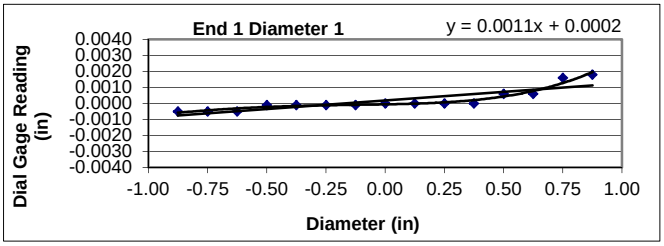
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.10	**Tested by:**	TJW
Boring Id:	B-13	**Unit Weight (pcf):**	165.2	**Reviewed by:**	JBB
Sample No.:	RC-5a	**Moisture Content (%):**	0.9		
Depth (ft):	107.2				

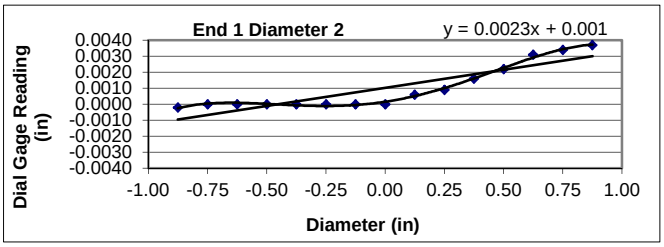
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

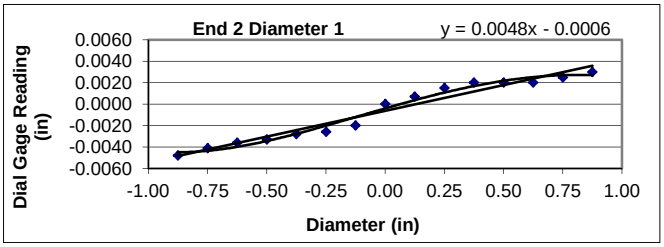
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0005	-0.0002	-0.0048	-0.0020
- 6/8	-0.0005	0.0000	-0.0041	-0.0016
- 5/8	-0.0005	0.0000	-0.0036	-0.0012
- 4/8	-0.0001	0.0000	-0.0033	-0.0005
- 3/8	-0.0001	0.0000	-0.0028	-0.0003
- 2/8	-0.0001	0.0000	-0.0026	-0.0003
- 1/8	-0.0001	0.0000	-0.0020	-0.0003
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0006	0.0007	0.0000
2/8	0.0000	0.0009	0.0015	0.0000
3/8	0.0000	0.0016	0.0020	0.0002
4/8	0.0006	0.0022	0.0020	0.0007
5/8	0.0006	0.0031	0.0020	0.0008
6/8	0.0016	0.0034	0.0025	0.0015
7/8	0.0018	0.0037	0.0030	0.0017

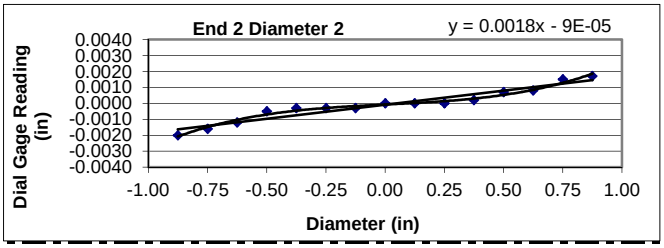




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00107
	Angle of Best Fit Line:	0.06155
End 2:	Slope of Best Fit Line:	0.00482
	Angle of Best Fit Line:	0.27617
	Max Angular Difference:	**-0.21**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00226
	Angle of Best Fit Line:	0.12965
End 2:	Slope of Best Fit Line:	0.00176
	Angle of Best Fit Line:	0.10100
	Max Angular Difference:	**0.03**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0023	0.0012	**YES**
End 1 Diam 2	0.0039	0.0021	**YES**
End 2 Diam 1	0.0078	0.0042	**YES**
End 2 Diam 2	0.0037	0.0020	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

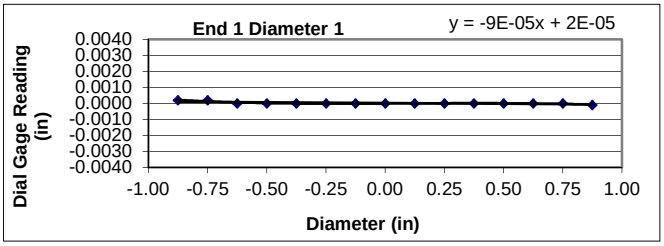
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.07	**Tested by:**	TJW
Boring Id:	B-13	**Unit Weight (pcf):**	170.7	**Reviewed by:**	JBB
Sample No.:	RC-5b	**Moisture Content (%):**	0.6		
Depth (ft):	110.6				

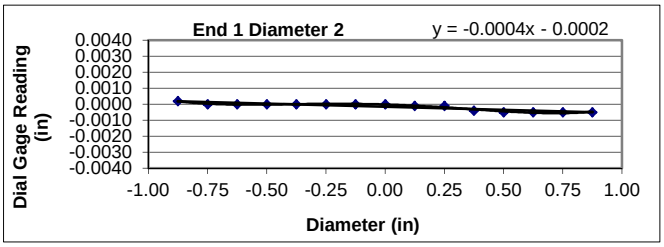
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

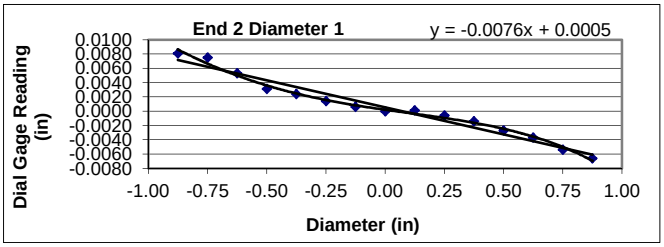
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0002	0.0002	0.0081	0.0098
- 6/8	0.0002	0.0000	0.0075	0.0088
- 5/8	0.0000	0.0000	0.0053	0.0072
- 4/8	0.0000	0.0000	0.0031	0.0056
- 3/8	0.0000	0.0000	0.0024	0.0038
- 2/8	0.0000	0.0000	0.0014	0.0020
- 1/8	0.0000	0.0000	0.0006	0.0005
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0001	0.0001	0.0000
2/8	0.0000	-0.0001	-0.0006	-0.0014
3/8	0.0000	-0.0004	-0.0014	-0.0029
4/8	0.0000	-0.0005	-0.0027	-0.0046
5/8	0.0000	-0.0005	-0.0037	-0.0057
6/8	0.0000	-0.0005	-0.0054	-0.0070
7/8	-0.0001	-0.0005	-0.0066	-0.0090

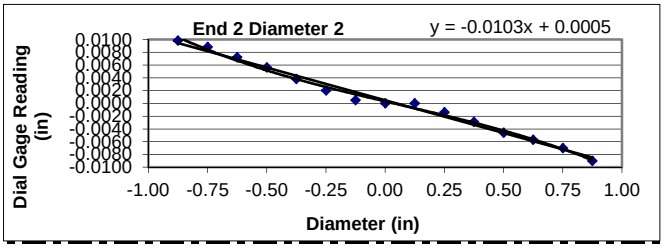




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00009
	Angle of Best Fit Line:	-0.00540
End 2:	Slope of Best Fit Line:	-0.00755
	Angle of Best Fit Line:	-0.43283
	Max Angular Difference:	**0.43**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00040
	Angle of Best Fit Line:	-0.02275
End 2:	Slope of Best Fit Line:	-0.01026
	Angle of Best Fit Line:	-0.58785
	Max Angular Difference:	**0.57**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0003	0.0002	**YES**
End 1 Diam 2	0.0007	0.0004	**YES**
End 2 Diam 1	0.0147	0.0079	**NO**
End 2 Diam 2	0.0188	0.0102	**NO**

Perpendicularity Tolerance Met? **NO**

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: I-77 Widening Design/Build Preparation
Project Number: 1461-14-046

Report Date: November 21, 2014
Reviewed By: Jason B. Burgess

Sample No.	Sample Id	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
RC-2	B-14	95.8	4.06	1.85	D	2.69	164.9	74	18,910	7,030	0.7
RC-3a	B-14	97.6	4.04	1.85	C	2.69	170.4	74	13,750	5,112	0.8
RC-3b	B-14	99.6	3.95	1.85	D	2.69	171.0	77	21,750	8,086	0.8
RC-4	B-14	102.1	4.03	1.85	D	2.69	165.8	68	13,980	5,197	0.8
RC-5	B-14	109.3	3.97	1.85	B	2.69	166.3	77	15,360	5,710	1.1

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.

SHAPE KEY

ASTM D4543-08 *Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance* Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-08 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

C Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-08 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

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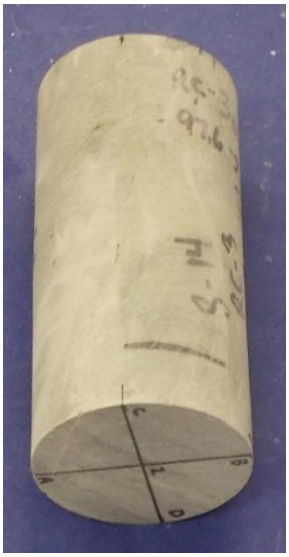
1	**Specimen ID**	B-14, RC-2 (95.8')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)



2	**Specimen ID**	B-14, RC-3a (97.6')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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3	**Specimen ID**	B-14, RC-3b (99.6')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

4	**Specimen ID**	B-14, RC-4 (102.1')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

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5	**Specimen ID**	B-14, RC-5 (109.3')
	Remarks	Unconfined Compression of Rock Specimen Before/After Test (ASTM D7012, Method C)

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

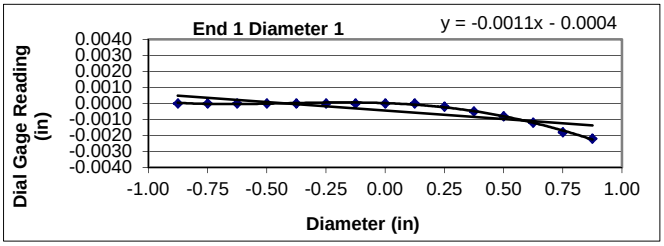
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.06	**Tested by:**	TJW
Boring Id:	B-14	**Unit Weight (pcf):**	164.9	**Reviewed by:**	JBB
Sample No.:	RC-2	**Moisture Content (%):**	0.7		
Depth (ft):	95.8				

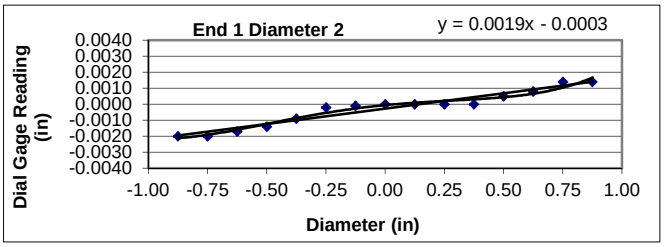
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

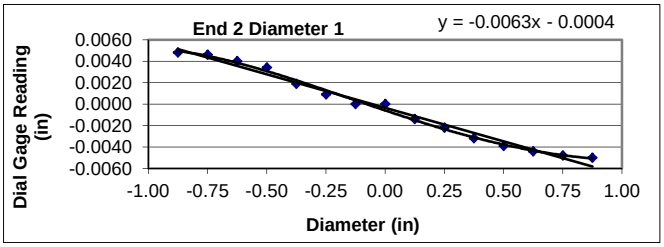
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0000	-0.0020	0.0048	0.0024
- 6/8	0.0000	-0.0020	0.0046	0.0020
- 5/8	0.0000	-0.0017	0.0040	0.0019
- 4/8	0.0000	-0.0014	0.0034	0.0015
- 3/8	0.0000	-0.0009	0.0019	0.0010
- 2/8	0.0000	-0.0002	0.0009	0.0010
- 1/8	0.0000	-0.0001	0.0000	0.0007
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	-0.0014	-0.0009
2/8	-0.0002	0.0000	-0.0022	-0.0012
3/8	-0.0005	0.0000	-0.0032	-0.0018
4/8	-0.0008	0.0005	-0.0039	-0.0022
5/8	-0.0012	0.0008	-0.0044	-0.0023
6/8	-0.0018	0.0014	-0.0048	-0.0028
7/8	-0.0022	0.0014	-0.0050	-0.0030

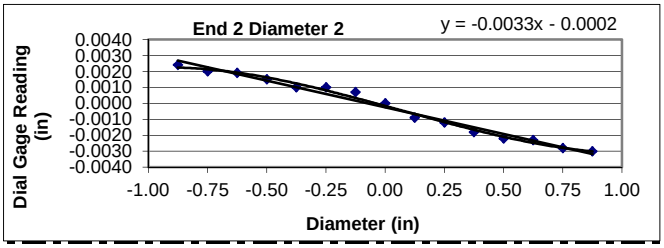




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00107
	Angle of Best Fit Line:	-0.06106
End 2:	Slope of Best Fit Line:	-0.00626
	Angle of Best Fit Line:	-0.35867
	Max Angular Difference:	**0.30**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00193
	Angle of Best Fit Line:	0.11050
End 2:	Slope of Best Fit Line:	-0.00334
	Angle of Best Fit Line:	-0.19120
	Max Angular Difference:	**0.30**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0022	0.0012	**YES**
End 1 Diam 2	0.0034	0.0018	**YES**
End 2 Diam 1	0.0098	0.0053	**NO**
End 2 Diam 2	0.0054	0.0029	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

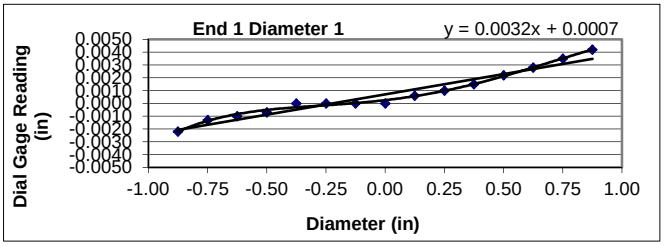
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.04	**Tested by:**	TJW
Boring Id:	B-14	**Unit Weight (pcf):**	170.4	**Reviewed by:**	JBB
Sample No.:	RC-3a	**Moisture Content (%):**	0.8		
Depth (ft):	97.6				

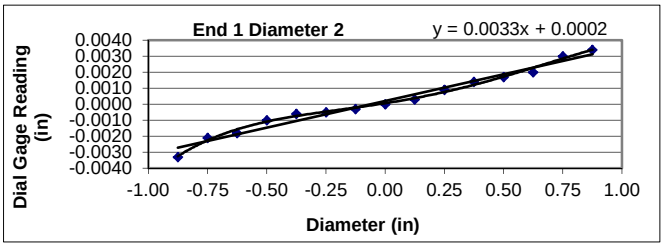
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

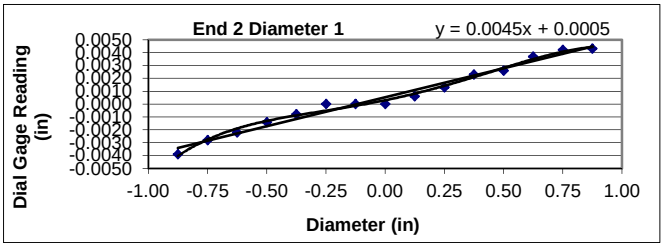
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0022	-0.0033	-0.0039	-0.0008
- 6/8	-0.0013	-0.0021	-0.0028	-0.0005
- 5/8	-0.0010	-0.0018	-0.0022	-0.0005
- 4/8	-0.0007	-0.0010	-0.0014	0.0000
- 3/8	0.0000	-0.0006	-0.0008	0.0000
- 2/8	0.0000	-0.0005	0.0000	0.0000
- 1/8	0.0000	-0.0003	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0006	0.0003	0.0006	0.0000
2/8	0.0010	0.0009	0.0013	0.0000
3/8	0.0015	0.0014	0.0023	0.0000
4/8	0.0022	0.0017	0.0026	0.0000
5/8	0.0028	0.0020	0.0037	0.0000
6/8	0.0035	0.0030	0.0042	0.0004
7/8	0.0042	0.0034	0.0043	0.0010

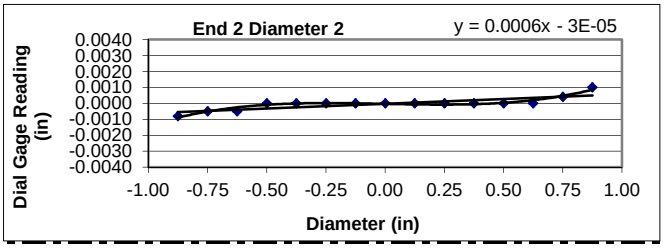




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00318
	Angle of Best Fit Line:	0.18220
End 2:	Slope of Best Fit Line:	0.00450
	Angle of Best Fit Line:	0.25767
	Max Angular Difference:	**-0.08**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00333
	Angle of Best Fit Line:	0.19104
End 2:	Slope of Best Fit Line:	0.00059
	Angle of Best Fit Line:	0.03356
	Max Angular Difference:	**0.16**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0064	0.0035	**YES**
End 1 Diam 2	0.0067	0.0036	**YES**
End 2 Diam 1	0.0082	0.0044	**NO**
End 2 Diam 2	0.0018	0.0010	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

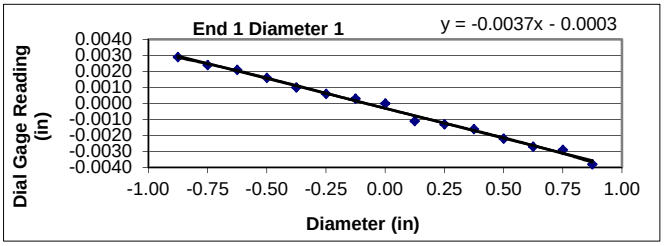
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	3.95	**Tested by:**	TJW
Boring Id:	B-14	**Unit Weight (pcf):**	171.0	**Reviewed by:**	JBB
Sample No.:	RC-3b	**Moisture Content (%):**	0.8		
Depth (ft):	99.6				

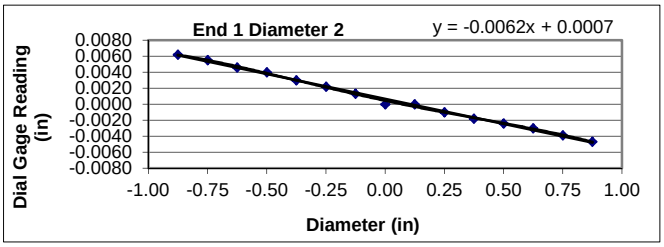
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

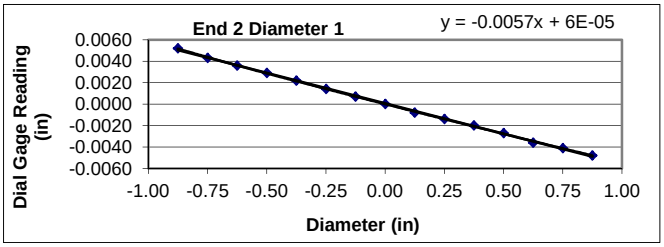
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0029	0.0062	0.0052	0.0027
- 6/8	0.0024	0.0055	0.0043	0.0022
- 5/8	0.0021	0.0046	0.0036	0.0018
- 4/8	0.0016	0.0040	0.0029	0.0016
- 3/8	0.0010	0.0030	0.0022	0.0013
- 2/8	0.0006	0.0022	0.0014	0.0012
- 1/8	0.0003	0.0013	0.0007	0.0004
0	0.0000	0.0000	0.0000	0.0000
1/8	-0.0011	0.0000	-0.0008	0.0000
2/8	-0.0013	-0.0010	-0.0014	0.0000
3/8	-0.0016	-0.0018	-0.0020	0.0000
4/8	-0.0022	-0.0024	-0.0027	0.0000
5/8	-0.0027	-0.0030	-0.0036	0.0000
6/8	-0.0029	-0.0039	-0.0041	0.0000
7/8	-0.0038	-0.0047	-0.0048	0.0000

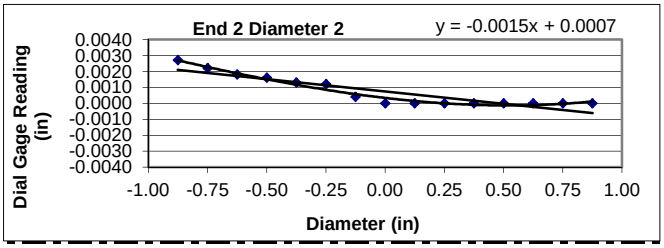




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00374
	Angle of Best Fit Line:	-0.21429
End 2:	Slope of Best Fit Line:	-0.00567
	Angle of Best Fit Line:	-0.32495
	Max Angular Difference:	**0.11**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00624
	Angle of Best Fit Line:	-0.35753
End 2:	Slope of Best Fit Line:	-0.00155
	Angle of Best Fit Line:	-0.08873
	Max Angular Difference:	**-0.27**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0067	0.0036	**YES**
End 1 Diam 2	0.0109	0.0059	**NO**
End 2 Diam 1	0.0100	0.0054	**NO**
End 2 Diam 2	0.0027	0.0015	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

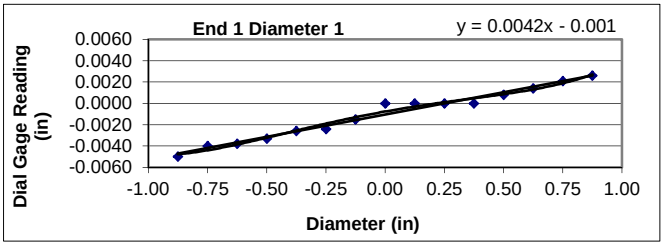
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	4.03	**Tested by:**	TJW
Boring Id:	B-14	**Unit Weight (pcf):**	165.8	**Reviewed by:**	JBB
Sample No.:	RC-4	**Moisture Content (%):**	0.8		
Depth (ft):	102.1				

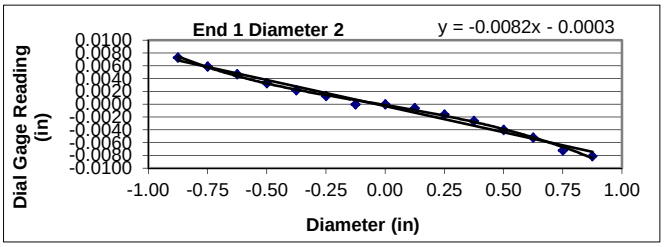
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

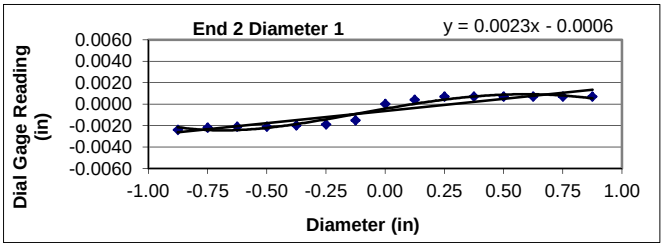
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0050	0.0073	-0.0024	0.0002
- 6/8	-0.0040	0.0059	-0.0022	0.0002
- 5/8	-0.0038	0.0047	-0.0021	0.0002
- 4/8	-0.0033	0.0033	-0.0021	-0.0001
- 3/8	-0.0026	0.0022	-0.0020	-0.0001
- 2/8	-0.0024	0.0013	-0.0019	-0.0001
- 1/8	-0.0015	0.0000	-0.0015	-0.0001
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	-0.0006	0.0004	0.0000
2/8	0.0000	-0.0016	0.0007	0.0000
3/8	0.0000	-0.0026	0.0007	0.0000
4/8	0.0008	-0.0040	0.0007	0.0000
5/8	0.0014	-0.0052	0.0007	0.0000
6/8	0.0021	-0.0072	0.0007	0.0000
7/8	0.0026	-0.0081	0.0007	0.0000

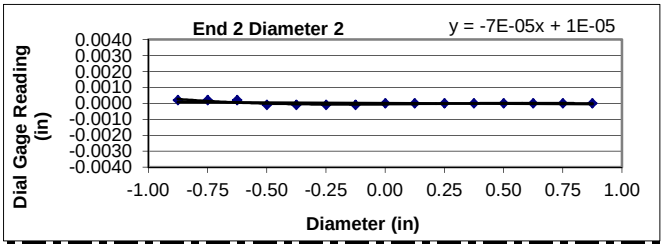




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00418
	Angle of Best Fit Line:	0.23950
End 2:	Slope of Best Fit Line:	0.00227
	Angle of Best Fit Line:	0.13014
	Max Angular Difference:	**0.11**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00817
	Angle of Best Fit Line:	-0.46802
End 2:	Slope of Best Fit Line:	-0.00007
	Angle of Best Fit Line:	-0.00426
	Max Angular Difference:	**-0.46**

Parallelsim Tolerance Met? **NO**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0076	0.0041	**YES**
End 1 Diam 2	0.0154	0.0083	**NO**
End 2 Diam 1	0.0031	0.0017	**YES**
End 2 Diam 2	0.0003	0.0002	**YES**

Perpendicularity Tolerance Met? **NO**

PREPARING ROCK CORES AS CYLINDRICAL TEST SPECIMENS AND VERIFY CONFORMANCE OF DIMENSIONAL AND SHAPE TOLERANCES

(ASTM D4543)

S&ME

1413 Topside Road, Louisville, TN 37777

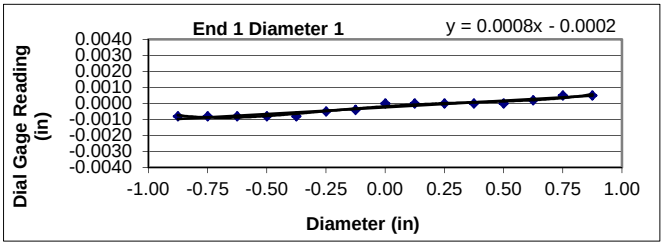
Project:	I-77 Widening	**Diameter (in):**	1.85	**Date:**	11/13/2014
Project No.:	1461-14-046	**Length (in):**	3.97	**Tested by:**	TJW
Boring Id:	B-14	**Unit Weight (pcf):**	166.3	**Reviewed by:**	JBB
Sample No.:	RC-5	**Moisture Content (%):**	1.1		
Depth (ft):	109.3				

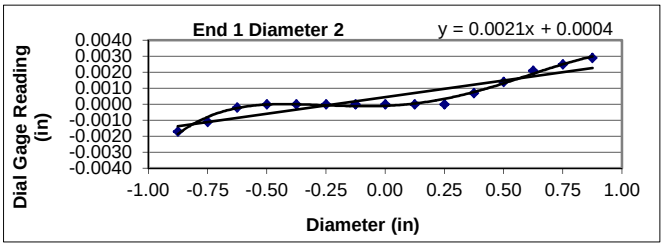
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **NO** Straightness Tolerance Met? **NO**

End Flatness and Parallelism Readings (Procedure FP1)

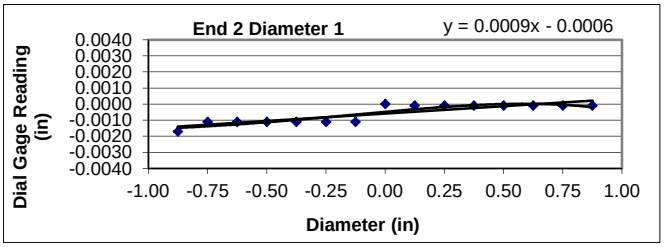
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0008	-0.0017	-0.0017	-0.0025
- 6/8	-0.0008	-0.0011	-0.0011	-0.0020
- 5/8	-0.0008	-0.0002	-0.0011	-0.0018
- 4/8	-0.0008	0.0000	-0.0011	-0.0013
- 3/8	-0.0008	0.0000	-0.0011	-0.0010
- 2/8	-0.0005	0.0000	-0.0011	-0.0005
- 1/8	-0.0004	0.0000	-0.0011	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0000	-0.0001	0.0000
2/8	0.0000	0.0000	-0.0001	0.0004
3/8	0.0000	0.0007	-0.0001	0.0008
4/8	0.0000	0.0014	-0.0001	0.0012
5/8	0.0002	0.0021	-0.0001	0.0016
6/8	0.0005	0.0025	-0.0001	0.0023
7/8	0.0005	0.0029	-0.0001	0.0026

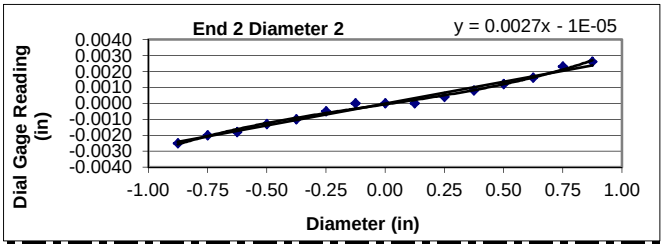




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00083
	Angle of Best Fit Line:	0.04731
End 2:	Slope of Best Fit Line:	0.00092
	Angle of Best Fit Line:	0.05271
	Max Angular Difference:	**-0.01**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00209
	Angle of Best Fit Line:	0.11950
End 2:	Slope of Best Fit Line:	0.00273
	Angle of Best Fit Line:	0.15666
	Max Angular Difference:	**-0.04**

Parallelsim Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0013	0.0007	**YES**
End 1 Diam 2	0.0046	0.0025	**YES**
End 2 Diam 1	0.0017	0.0009	**YES**
End 2 Diam 2	0.0051	0.0028	**YES**

Perpendicularity Tolerance Met? **YES**