STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

November 21, 2017

WBS No:	44376.3.2
County:	Mecklenburg
Description:	Grading, Drainage, Paving, Utilities, and Culvert Extension on South Trade Street (SR-3448) from Marque Place to Chaphyn Lane.

Addendum No. 1
November 29, 2017 Letting

To: Prospective Bidders

Please note the following revision to the proposal for the above referenced project.

- **Removed - Master Item No. 2655000000-E – 5” Monolithic Concrete Island (Keyed In)**

- **Added – Master Item No. 2647000000-E – 5” Monolithic Concrete Island (Surface Mounted)**

Please note the following revision to the plans for the above referenced project.

- **ICT #1 lane closure restrictions shall be used in place of all mentioned lane closure restrictions on plan sheet TMP-4 under ``Construction Phasing” .**

- **On plan sheet S-1 under “Notes” line 25-28 shall be replaced with the following paragraph: “No separate payment will be made for any temporary sheeting, undercut, or unsuitable material replacement as required to construct the proposed Culvert or Culvert Wing Foundations. Payment is included in the cubic yard price for foundation excavation”.**

- **A typical section for –DRW1- has been added to plan sheet 2A-2. Please see the attached updated plan sheet.**

Please note the following clarification statement for the above referenced project.

- **To satisfy ICT #2 all “Structure Items” shall be complete.**

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
716 WEST MAIN STREET
ALBEMARLE, NC 28001

Telephone: (704) 983-4400
Fax: (704) 982-3146
Customer Service: 1-877-368-4968

Website: www.ncdot.gov

Location:
716 WEST MAIN STREET
ALBEMARLE, NC 28001

Please see the attached project reference material.

- **Geotechnical Engineering Report**

To submit an electronic bid package you must use Bid Express ®. The following link will direct you to Bid Express ®.
https://www.bidx.com/site/mybidx?action=ChangePassword&accounttype=new

If you have any questions, please contact me at (704) 983-4400.

Sincerely,

DocuSigned by:

7153CE23F21843F...

Donald Griffith
DDC Engineer

CC: Mr. Terry Burleson
Ms. Kellie Crump
Mr. Scott Cole, PE
File

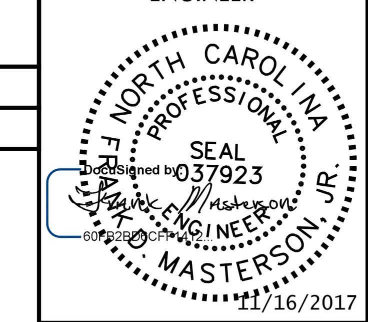
Kimley»Horn

200 S. TRYON ST. • CHARLOTTE, NC 28202

RIGHT-OF-WAY REV.

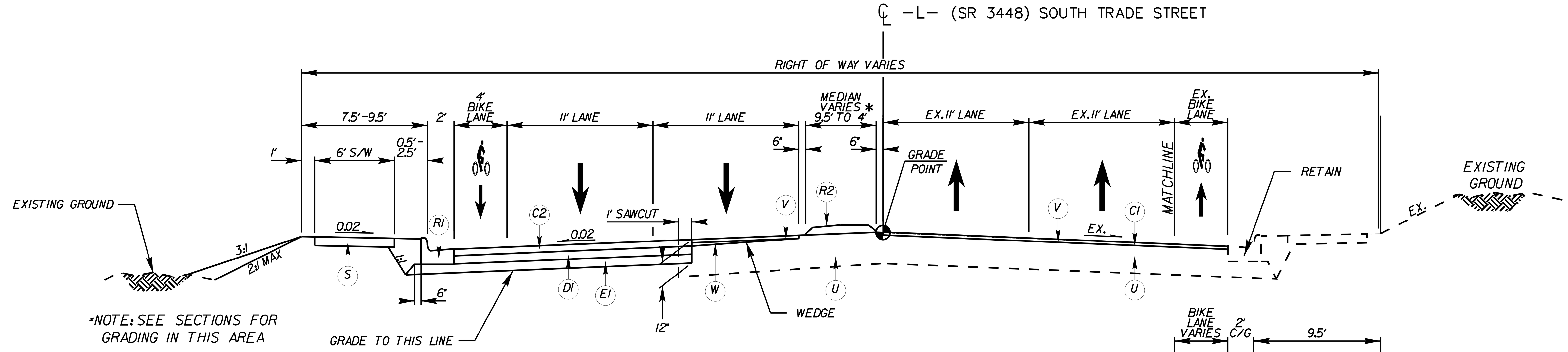
CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
44376.3.2	2A-2
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER



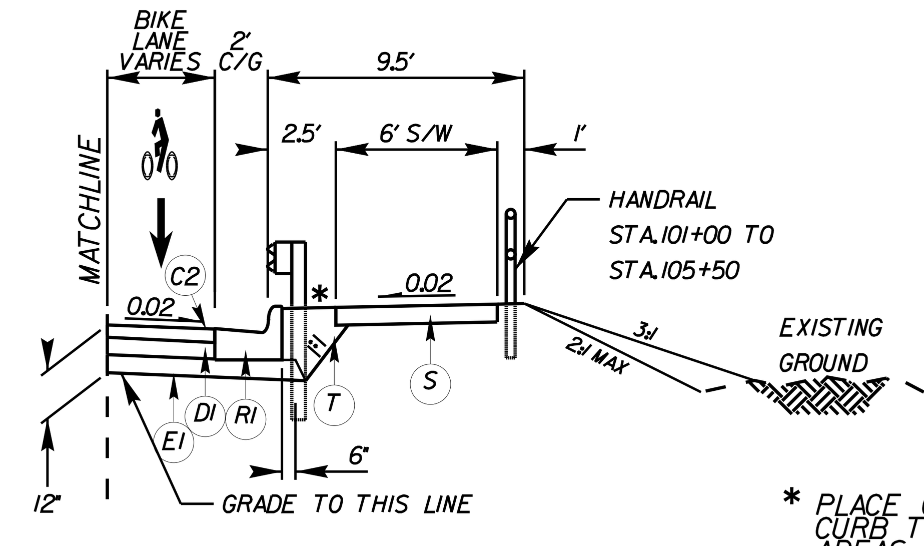
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS



TYPICAL SECTION NO. 4

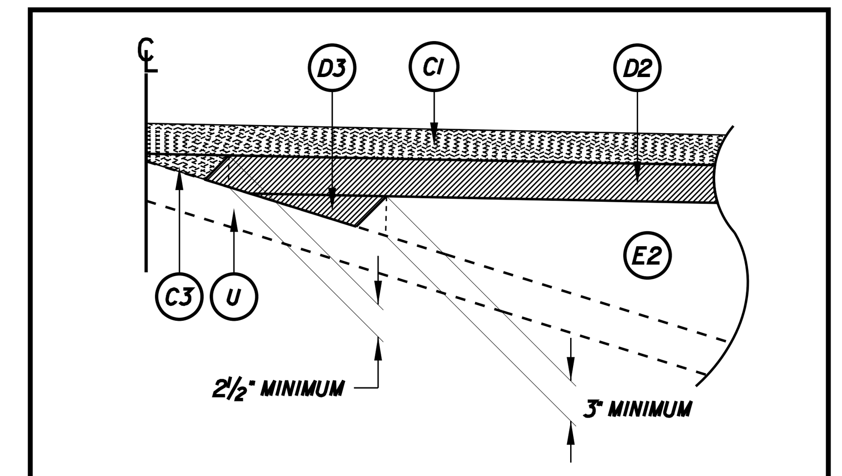
-L- STA.98+60.23 TO -L- STA.101+00.91



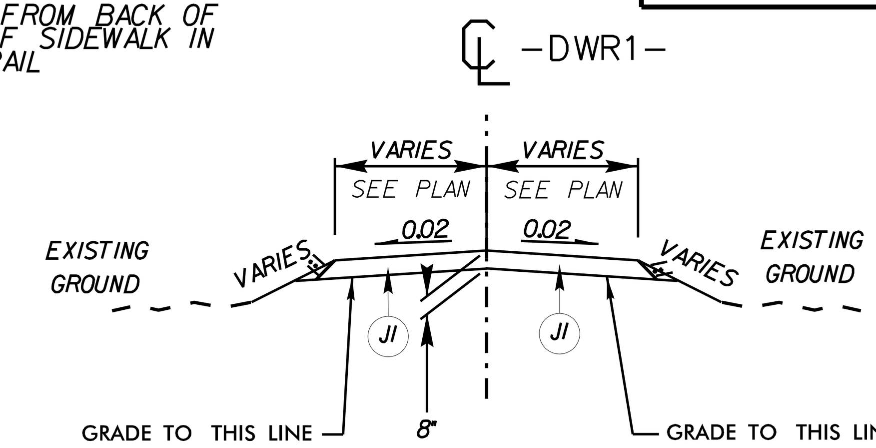
* PLACE CONCRETE FROM BACK OF CURB TO FRONT OF SIDEWALK IN AREAS OF GUARDRAIL

TYPICAL SECTION NO. 4A

-L- STA.100+69.64 TO -L- STA.101+00.91

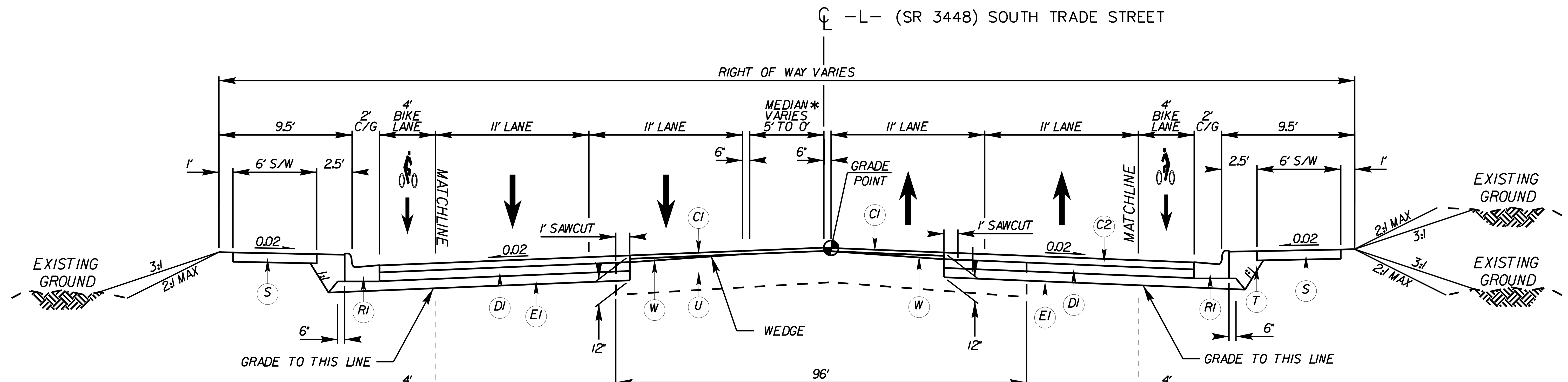


DETAIL SHOWING METHOD OF WEDGING



DRW1 TYPICAL SECTION

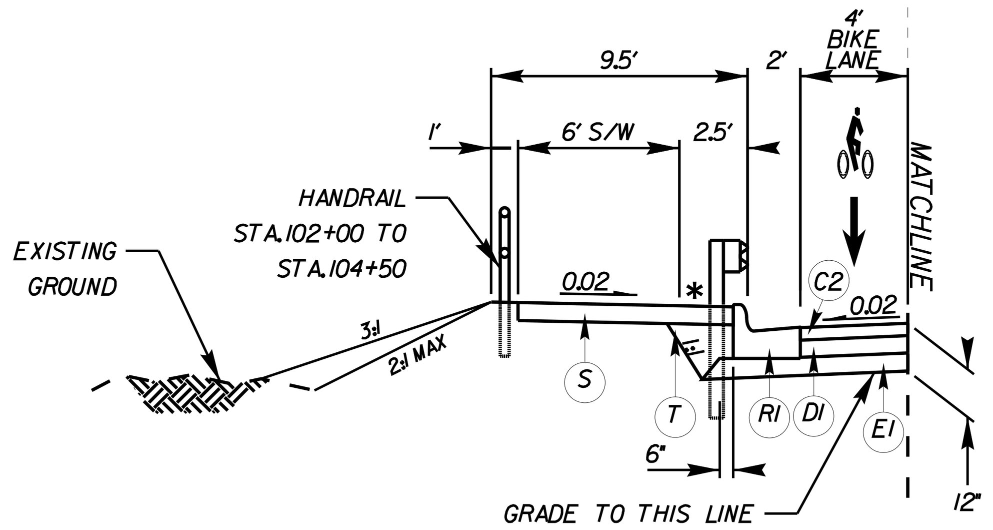
-DRW1- STA.10+08.21 TO -DRW1- STA.10+87.11



TYPICAL SECTION NO. 5

-L- STA.101+00.91 TO -L- STA.106+35.14

MEDIAN -L- STA.101+00.91 TO -L- STA.102+32.04



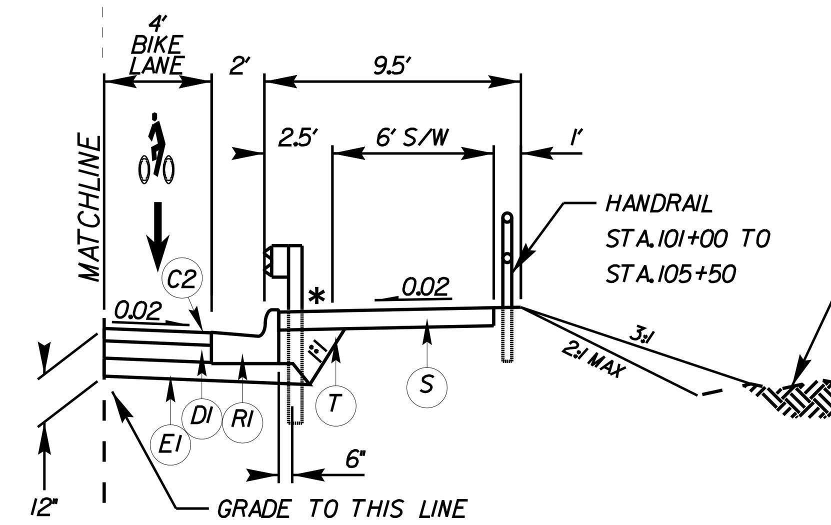
TYPICAL SECTION NO. 5A

CULVERT SECTION (LT)

-L- STA.100+87.68 TO -L- STA.104+75.01

PLACE FULL WIDTH SIDEWALK

STA.100+85.666 TO 104+77.01 (LT)



* PLACE CONCRETE FROM BACK OF CURB TO FRONT OF SIDEWALK IN AREAS OF GUARDRAIL

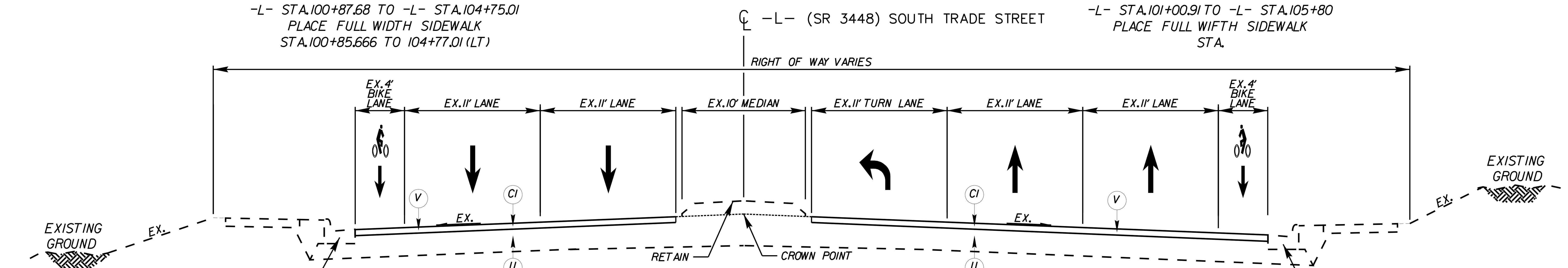
TYPICAL SECTION NO. 5B

CULVERT SECTION (RT)

-L- STA.101+00.91 TO -L- STA.105+80

PLACE FULL WIFTH SIDEWALK

STA.



TYPICAL SECTION NO. 6

-L- STA.106+35.14 TO -L- STA.109+15.00

NOTE:

1) CONSTRUCT 95' OF C&G FROM STA.106+35.14 TO CHAPHYN LANE TIE IN AT STA.107+15.48

PAVEMENT SCHEDULE

C1	PROPOSED APPROX 1.5" ASPHALT CONCRETE SURFACE COURSE TYPE S9.5C, AT AN AVERAGE RATE OF 168 LBS. PER SQ. YD.
C2	PROPOSED APPROX 3" ASPHALT CONCRETE SURFACE COURSE TYPE S9.5C, AT AN AVERAGE RATE OF 168 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
C3	PROPOSED VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5C, AT AN AVERAGE RATE OF 112 LBS. PER SQ. YD. PER 1" DEPTH. TO BE PLACED IN LAYERS NOT LESS THAN 1½" IN DEPTH OR GREATER THAN 2" IN DEPTH.
D1	PROPOSED APPROX. 4" ASPHALT CONCRETE INTERMEDIATE COURSE TYPE I19.0C, AT AN AVERAGE RATE OF 456 LBS. PER SQ. YD.
D2	PROPOSED VAR. DEPTH ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0C, AT AN AVERAGE RATE OF 114 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT LESS THAN 2.5" OR GREATER THAN 4" IN DEPTH.
D3	PROPOSED VAR. DEPTH ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE I19.0C, AT AN AVERAGE RATE OF 114 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT LESS THAN 2.5" OR GREATER THAN 4" IN DEPTH.
E1	PROPOSED APPROX. 6" ASPHALT CONCRETE BASE COURSE TYPE B25.0C, AT AN AVERAGE RATE OF 684 LBS. PER SQ. YD.
E2	PROP. APPROX. 3" ASPHALT CONCRETE BASE COURSE TYPE B25.0C, AT AN AVERAGE RATE OF 342 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
J1	PROPOSED 8" AGGREGATE BASE COURSE
R1	PROPOSED 2'-6" CONCRETE CURB & GUTTER
R2	PROPOSED MONOLITHIC CONCRETE ISLAND (SURFACE MOUNTED)
S	PROPOSED 4" CONCRETE SIDEWALK
T	EARTH MATERIAL
U	EXISTING PAVEMENT
V	MILLING EXISTING PAVEMENT (1.5")
W	VARIABLE DEPTH ASPHALT PAVEMENT

NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS OTHERWISE INDICATED

11/13/2017

Geotechnical Engineering Report
Proposed S Trade Street Widening
Matthews, North Carolina
S&ME Project No. 1351-13-123

Prepared For:

The Town of Matthews
1600 Tank Town Road
Matthews, North Carolina 28105

Prepared by:

S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273

November 25, 2013

November 25, 2013

The Town of Matthews
1600 Tank Town Road
Matthews, North Carolina 28105

Attention: Mr. Ralph Messera

Reference: Geotechnical Engineering Report
Proposed S. Trade Street Widening
Matthews, North Carolina
S&ME Project No. 1351-13-123
NC PE Firm License No. F-0176

Dear Mr. Messera:

S&ME, Inc. (S&ME) is pleased to present this geotechnical engineering report for the proposed roadway widening in Matthews, North Carolina. This exploration was performed in general accordance with our proposal No. 1351-26737-13 dated July 29, 2013. Authorization to proceed with this study was provided by the execution of S&ME's Agreement for Services Form AS-071.

The purpose of the geotechnical study was to determine the general subsurface conditions along the proposed and existing roadway alignment and to evaluate those conditions with regard to the design and construction of the proposed roadway widening. This report presents our findings together with our conclusions, recommendations and construction considerations for the proposed roadway widening.

S&ME appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report or if we may be of further assistance, please contact us.

Very truly yours,

S&ME, Inc.

Luis A. Campos, P.E.
Project Engineer
N.C. Registration No. 37845

Stewart S. Laney, P.E.
Project Engineer

Senior Reviewed By: Kristen H. Hill, P.E., P.G.
Senior Engineer

LAC/SSL/KHH/cps

S/1351/Project/2013/13-123

Copies Submitted: (3)

TABLE OF CONTENTS

APPENDIX

1. INTRODUCTION

1.1 Project and Site Description

Project information is based on e-mail correspondence between Ben Taylor of Kimley-Horn and Associates, Inc. (KHA) and Duane Bents of S&ME between July 15 and 25, 2013. It is also based on subsequent e-mail correspondence between Mr. Taylor and Luis Campos of S&ME between September 18 and October 15, 2013. Included in the e-mail correspondence were a draft site plan (*Modified Plan – No Culvert*) prepared by Kimley-Horn and dated June 11, 2013, as well as current and assumed traffic loading information for the subject roadways.

We understand that the Town of Matthews plans to widen portions of S. Trade Street and Fullwood Lane in Matthews, North Carolina. The approximate areas where widening will occur are highlighted in the Site Vicinity Map (Figure 1) in the Appendix. The S. Trade Street widening will extend from approximately 1,000 feet north of its intersection with Fullwood Lane to 300 feet south of its intersection with Chaphyn Lane and will total about 3,000 feet in length. S. Trade Street is planned to be widened from a 2-lane to a 4-lane roadway in this area with the widening occurring generally to the east side of the current alignment. The Fullwood Lane widening is planned to begin at its intersection with S. Trade Street and extend west approximately 1,200 feet. Fullwood Lane is planned to be widened from a 2-lane to a 4-lane roadway with the widening occurring generally to the north side of the current alignment.

E-mail correspondences with Kimley-Horn indicate that the NCDOT 2012 Annual Average Daily Traffic (AADT) along Trade Street is 21,000 vehicles and that the NCDOT 2012 AADT along Fullwood Lane is 13,000 vehicles. Kimley-Horn recommended that 2 percent truck traffic be assumed for the subject roadways.

Based on our site reconnaissance, a majority of the widening areas are grass covered and relatively level. Final grade information has not been provided; however, based on existing grades, we anticipate that less than 5 feet of cut and fill will be required to achieve design grades.

1.2 Purpose and Scope

The purpose of this geotechnical study was to explore the subsurface conditions along the subject alignments and develop geotechnical recommendations for the design and construction of the project.

S&ME has completed the following scope of geotechnical services for this project:

- Visited the site to observe site surface conditions and marked test locations.
- Contacted North Carolina 811 to mark the locations of underground utilities in the exploration areas.
- Coordinated with Town of Matthews and NCDOT personnel to schedule field testing.

- Subcontracted traffic control for work performed in the existing roadways.
- Mobilized a power drilling rig mounted on a truck carrier and crew to the site.
- Cored the existing asphalt roadway surface at ten (10) locations.
- Performed nineteen (19) Kessler Dynamic Cone Penetrometer (DCP) tests.
- Drilled ten (10) soil test borings at the site.
- Performed nine (9) hand auger borings with DCP testing.
- Collected four (4) bulk samples of auger cuttings.
- Attempted groundwater level measurements in the boreholes.
- Backfilled the boreholes with soil cuttings, installed a hole closure device near the ground surface in each borehole, and patched existing asphalt pavement with cold patch asphalt.
- Performed laboratory testing consisting of grain-size distribution, Atterberg Limits, moisture content, standard Proctor compaction, and California Bearing Ratio (CBR) tests.
- Performed geotechnical analysis and prepared this geotechnical engineering report.

2. EXPLORATION PROCEDURES

2.1 Field Testing

In order to explore the subsurface conditions along the subject roadway alignments, ten soil test borings, nine hand auger borings with DCP testing, and nineteen Kessler DCP tests were performed. The approximate test locations are shown on the Test Location Plan (Figures 2, 3, and 4) in the Appendix. The test locations were selected by S&ME and located in the field by a staff professional from our office using the provided plans and existing site features as references for measuring distances and approximating right angles. Some test locations were offset to avoid underground and overhead utilities. Field testing was performed between September 6 and 25, 2013.

Water level measurements were attempted at the termination of drilling activities in all borings and after a waiting period of at least 24 hours in borings not performed in the existing roadways. All boreholes were backfilled with soil cuttings and cold-mix asphalt patch, where applicable, after the water level measurements were attempted.

2.1.1 Kessler DCP Testing

The subgrade soils beneath the existing pavements and along the proposed widening areas were first evaluated by performing Kessler DCP tests. The Kessler DCP tests were performed at the ten asphalt core locations as well as the nine hand auger boring locations. The Kessler DCP tests were performed beginning at the bottom of the asphalt in borings performed in the roadway and from the existing ground surface in hand auger borings performed along the proposed widening areas. Kessler DCP tests were performed in general accordance with ASTM D-6951. The penetration rate of the Kessler DCP can be used to estimate in-situ California Bearing Ratio (CBR) and shear strength of near surface soils. The results of the Kessler DCP tests are attached on the Kessler DCP Test Results sheets in the Appendix.

2.1.2 Soil Test Borings

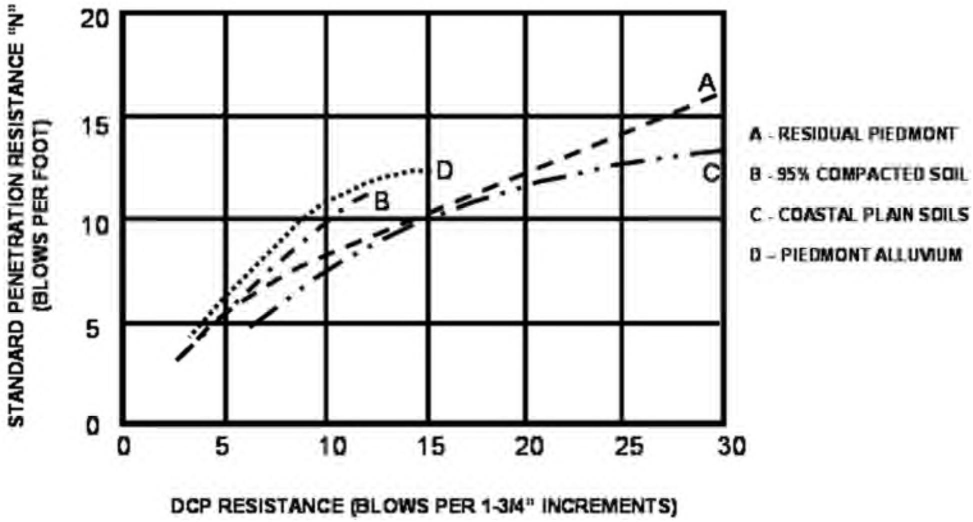
Eight soil test borings (Borings B-1, B-2, B-3, B-4, B-7, B-8, B-12, and B-13) were drilled along the existing S. Trade Street and two soil test borings (Borings B-16 and B-18) were drilled along the existing Fullwood Lane. The borings were drilled to depths ranging from 6 to 10 feet below the existing roadway surface.

A truck-mounted CME-45B drill rig was used to advance the borings with hollow-stem, continuous flight augers. Standard Penetration Test (SPT) split spoon sampling was performed at designated intervals in the soil test borings in general accordance with ASTM D 1586 to provide an index for estimating soil strength and relative density or consistency. The drill rig used to drill the borings is equipped with a hydraulic automatic hammer for Standard Penetration tests. In conjunction with the SPT testing, samples were obtained for soil classification purposes. Representative portions of each soil sample were placed in glass jars and taken to our laboratory.

2.1.3 Hand Auger Borings with DCP Testing

Six Hand Auger Borings with DCP tests (Borings B-5, B-6, B-9, B-10, B-11, and B-14) were performed along the proposed widening areas east of S. Trade Street and three Hand Auger Borings with DCP tests (Borings B-15, B-17, and B-19) were performed along the proposed widening areas north of Fullwood Lane. The hand auger borings were extended to depths of 10 feet below the existing ground surface. The DCP tests were generally performed at 2-foot intervals, beginning at the ground surface.

The DCP test procedure is as follows: The cone point of the penetrometer is first seated 2 inches into the bearing materials to assure that the point is completely embedded. Then the cone point is driven an additional 1-3/4 inches using a 15-pound weight falling 20 inches. The penetrometer reading is the number of blows required to drive the cone point 1-3/4 inches. The cone point may be driven a second and third increment of 1-3/4 inches each and the penetrometer readings are recorded. The average penetrometer reading is similar to the Standard Penetration Resistance “N-value” as defined by ASTM D 1586. When properly evaluated, the penetrometer test results provide an index for estimating soil strength and relative density/consistency. The following figure (from ASTM Special Technical Publication #399, 1966) presents generally accepted correlations between average DCP resistance and the SPT N-value, although site specific correlations may be developed.



The results of the hand auger boring and DCP tests are summarized on the attached "Hand Auger / DCP Sounding Records." Relative densities and consistencies presented on the logs are inferred from the appropriate correlations in the previous figure.

2.2 Laboratory Testing

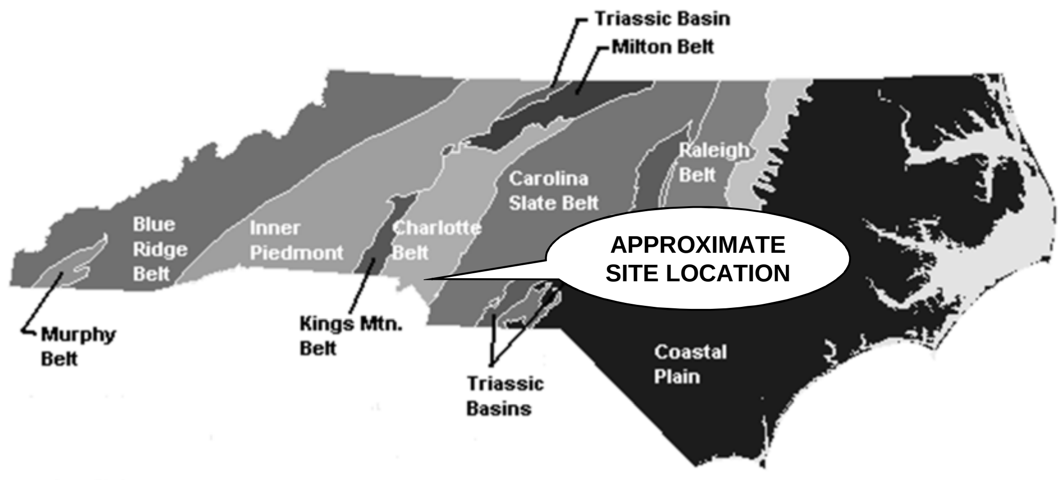
Once the samples were received in our laboratory, a staff professional visually examined each sample in general accordance with the American Association of State Highway and Transportation Officials (AASHTO) system to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams and apparent geological origin. The results of the classifications, as well as the field test results, are presented on the individual boring logs included in the Appendix. Similar materials were grouped into strata on the logs. The strata contact lines represent approximate boundaries between the soil and rock types; the actual transition between the soil and rock types in the field may be gradual in both the horizontal and vertical directions.

Laboratory testing consisting of grain-size distribution, Atterberg Limits, and moisture content tests were performed on representative soil samples to confirm visual soil classifications and estimate the engineering properties of the soils tested. Additional laboratory testing included two standard Proctor and CBR tests on representative bulk soil samples. A brief description of the laboratory test procedures, as well as results of the laboratory testing can be found on the Summary of Laboratory Testing Sheet and test results sheets in the Appendix.

3. AREA GEOLOGY AND SUBSURFACE CONDITIONS

3.1 Physiography and Area Geology

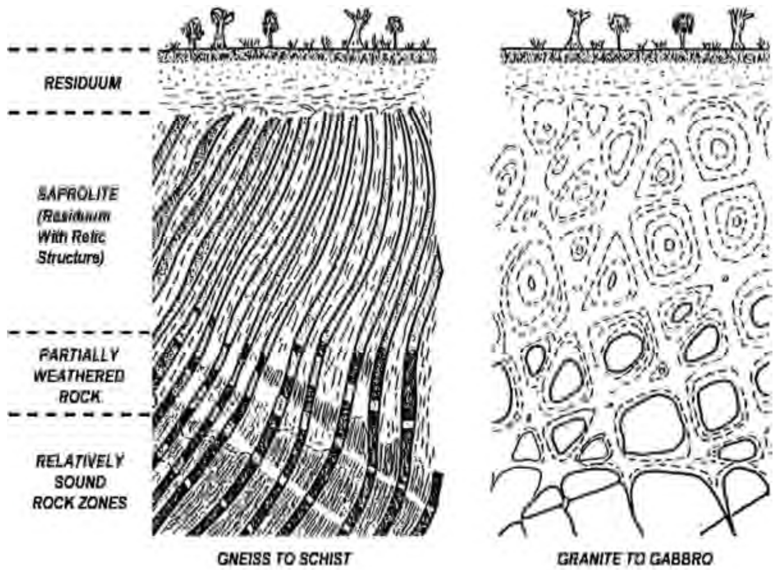
The site is located within the Charlotte Belt section of the Piedmont Physiographic Province of North Carolina as shown in the following figure. The Piedmont Province generally consists of well-rounded hills and ridges, which are dissected by a well-developed system of draws and streams. The Piedmont Province is predominantly underlain by metamorphic rock (formed by heat, pressure and/or chemical action) and igneous rock (formed directly from molten material), which were initially formed during the Precambrian and Paleozoic eras. The volcanic and sedimentary rocks deposited in the Piedmont Province during the Precambrian eras were the host for the metamorphism and were changed to gneiss and schist. The more recent Paleozoic era had periods of igneous emplacement, with at least several episodes of regional metamorphism resulting in the majority of the rock types seen today.



Physiographic Provinces of North Carolina

The topography and relief of the Piedmont Province have developed from differential weathering of the igneous and metamorphic rock. Because of the continued chemical and physical weathering, the rocks in the Piedmont Province are now generally covered with a mantle of soil that has weathered in place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically finer grained and has higher clay content near the surface because of the advanced weathering. Similarly, the soils typically become coarser grained with increasing depth because of decreased weathering. As the degree of weathering decreases, the residual soils generally retain the overall appearance, texture, gradation and foliations of the parent rock.

The boundary between soil and rock in the Piedmont is not sharply defined. A transitional zone termed "Partially Weathered Rock" or "Weathered Rock" is normally found overlying the parent bedrock. Partially Weathered Rock (PWR) and Weathered Rock (WR) are defined for engineering purposes as residual material with Standard Penetration Resistances (N-values) exceeding 100 blows per foot. The transition between hard/dense residual soils and WR occurs at irregular depths due to variations in degree of weathering. A depiction of typical weathering profiles in the Piedmont Province is presented in the following figure:



Typical Piedmont Weathering Profiles (After Sowers/Richardson, 1983)

Groundwater is typically present in the residual soils and within fractures in the WR or underlying bedrock in the Piedmont. On upland ridges in the Piedmont, groundwater may or may not be present in the residual soils above the WR and bedrock. Alluvial soils, which have been transported and deposited by water, are typically found in floodplains and are generally saturated to within a few feet of the ground surface. Fluctuations in groundwater levels are typical in residual soils and WR in the Piedmont, depending on variations in precipitation, evaporation, and surface water runoff. Seasonal high groundwater levels are expected to occur during the typically wetter months of the year (November through April).

3.2 Subsurface Conditions

Generalized subsurface conditions for the two major areas of the project are described below. For more detailed soil descriptions, stratifications and water levels at a particular test location, the respective boring or hand auger log should be reviewed.

Groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, water may be encountered during construction operations at depths or elevations different than indicated in this study.

3.2.1 S. Trade Street Alignment (Borings B-1 through B-14)

Subsurface conditions as indicated by the soil test and hand auger borings (B-1 through B-14) generally consist of asphalt pavement in the existing roadways and surficial topsoil in the proposed widening areas, underlain by roadway embankment fill, residual soils, weathered rock, and auger refusal material to the boring termination depths.

Surface Materials: Borings B-1 through B-4, B-7, B-8, B-12, and B-13 encountered between 7 and 8-½ inches of asphalt pavement underlain by 4-½ to 13 inches of ABC Stone. Borings B-5, B-6, B-9, B-10, B-11, and B-14 encountered 1 to 3 inches of topsoil at the ground surface.

Roadway Embankment Fill Soils: Roadway embankment fill soils were encountered beneath the existing pavement in Borings B-3, B-4, B-7, B-8, B-12, and B-13 to depths of 3 to 5.5 feet. Roadway embankment fill soils were encountered beneath the surficial topsoil in Borings B-5, B-9, B-10, B-11, and B-14 to depths of 2 to 8 feet. The roadway embankment fill beneath the existing roadway consisted of medium stiff to very stiff silty clay and clay (AASHTO classifications A-7-5 and A-7-6) and medium dense silty gravel (A-1-b). The roadway embankment fill beneath the proposed widening area consisted of soft to stiff silty clay and clay (A-7-5 and A-7-6), medium stiff sandy clay (A-6), medium stiff sandy silt (A-4), and loose silty sand (A-2-4). SPT N-values in the roadway embankment soils ranged from 7 to 20 blows per foot (bpf). Average DCP resistance values in the roadway embankment soils ranged from 3 to 15 blows per 1-¾ inch increment (bpi).

Residual Soils: Residual soils were encountered beneath the surficial materials or roadway embankment fill soils in each of the borings, with the exception of Boring B-2. Residual soils were encountered in Boring B-2 beneath WR. The residual soils generally consisted of stiff silty clay (A-7-5), stiff sandy clay (A-6), stiff to very stiff sandy silt (A-4), and loose to very dense silty sand (A-2-4). SPT N-values ranged from 9 to 54 bpf in the residual soils. Average DCP resistance values in the residual soils ranged from 12 to greater than 25 bpi. Each of the borings, except Boring B-2, was terminated in residual soils.

Weathered Rock: Weathered Rock was first encountered in Boring B-1 just beneath the existing pavement to a depth of approximately 5.5 feet. Weathered Rock was first encountered in Boring B-2 at a depth of approximately 3 feet to the termination depth. The weathered rock parent material was metamorphosed quartz diorite.

Auger Refusal: Boring B-2 was terminated at a depth of 6 feet upon encountering auger refusal. Auger refusal material is defined as material that could not be penetrated with the drill rig equipment used on the project. Auger refusal material may consist of large boulders, rock ledges, lenses, seams or the top of parent bedrock. Core drilling techniques would be required to evaluate the character and continuity of the auger refusal; however, rock coring was beyond the scope of this study.

Groundwater: Groundwater level measurements were attempted in the borings at the completion of drilling or augering. Groundwater was not encountered in any of the boreholes. The borings in the existing roadway were backfilled after drilling; therefore subsequent water level measurements could not be attempted. The hand auger borings were left open for a 1-day waiting period. Water was not encountered in any of the hand auger borings after the waiting period.

3.2.2 Fullwood Lane Alignment (Borings B-15 through B-19)

Subsurface conditions as indicated by the soil test and hand auger borings (B-15 through B-19) generally consist of asphalt pavement in the existing roadways and surficial topsoil in the proposed widening areas, underlain by roadway embankment fill and residual soils to the boring termination depths.

Surface Materials: Borings B-16 and B-18 encountered 5-½ and 6 inches of asphalt pavement underlain by 9 and 5-½ inches of ABC Stone, respectively. Borings B-15, B-17, and B-19 encountered 1 to 2 inches of topsoil at the ground surface.

Roadway Embankment Fill Soils: Beneath the surficial materials, roadway embankment fill soils were encountered in Borings B-15, B-16, and B-18 to depths of 1, 9 and 5.5 feet respectively. The roadway embankment fill beneath the existing roadway (Borings B-16 and B-18) consisted of stiff to very stiff silty clay (A-7-5). The roadway embankment fill beneath the proposed widening area (Boring B-15) consisted of medium stiff silty clay (A-7-5). SPT N-values in the roadway embankment soils ranged from 13 to 18 bpf. An average DCP resistance value of 8 bpi was encountered in the roadway embankment soils.

Residual Soils: Residual soils were encountered beneath the surficial materials or roadway embankment fill soils in each of the borings. The residual soils generally consisted of soft to stiff silt (A-5), very stiff to stiff sandy silt (A-4), and loose to medium dense silty sand (A-2-4). SPT N-values in the residual soils ranged from 14 to 18 bpf. Average DCP resistance values in the residual soils ranged from 3 to greater than 25 bpi. Each of the borings was terminated in residual soils.

Groundwater: Groundwater level measurements were attempted in the borings at the completion of drilling or augering. Groundwater was not encountered in any of the boreholes. The borings in the existing roadway were backfilled after drilling; therefore subsequent water level measurements could not be attempted. The hand auger borings were left open for a 1-day waiting period. Water was not encountered in any of the hand auger borings after the waiting period.

3.3 Existing Pavement Conditions

As previously discussed, a portion of S. Trade Street will be widened to the east and a portion of Fullwood Lane will be widened to the north. The existing pavements in these areas were visually evaluated by an S&ME project engineer. The Federal Highway Administration (FHWA) Distress Identification Manual (Publication No. FHWA-RD-03-031) was used for reference.

The existing pavement surface near the test locations along S. Trade Street and Fullwood Lane generally had little pavement distress; however some low- to moderate-severity fatigue cracking (Distress Types ACP1) was observed. Overall, these sections of pavement are in good condition.

The existing pavements along S. Trade Street and Fullwood Lane were cored and the resulting cores were visually inspected. The following table presents our findings:

Table 1: Summary of Existing Pavement Sections

	Roadway Boring	Asphalt Thickness (inches)	Asphalt Surface and Intermediate (inches)	Asphalt Base (inches)	ABC Stone Thickness (inches)	Subbase / Subgrade Material Type
S. Trade Street	B-1	8 ½	6 ½	2	8	WR
	B-2	7 ½	6	1 ½	5 ½	A-2-4
	B-3	7	5	2	7	A-7-6
	B-4	8 ¾	6 ½	1 ¾	6 ½	A-7-5
	B-7	8 ½	6 ¾	1 ¾	12	A-7-5
	B-8	7 ¾	6	1 ¾	13	A-7-5
	B-12	8 ¼	6	2 ¼	4 ½	A-7-5
	B-13	7 ¼	5 ½	1 ¼	9 ½	A-1-b
Fullwood Lane	B-16	5 ½	5 ½	0	9	A-7-5
	B-18	6	6	0	5 ½	A-7-5

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Earthwork

4.1.1 Site Preparation

All topsoil, rootmat, vegetation, trash, debris and other unsuitable materials should be stripped to a minimum of 10 feet outside the proposed new roadway embankment and pavement areas. Based on the borings in the proposed widening areas, we anticipate an average stripping depth of 3 inches to remove the surficial materials. Deeper stripping depths should be anticipated near any trees in order to remove the rootmat and localized stumps.

Any existing underground utilities, structures, or obstructions in the proposed construction areas should be properly excavated, removed, abandoned, or re-routed to facilitate the proposed grading. The resulting excavations should be properly backfilled as described later in this report.

4.1.2 Expansive Soils

Results of the soil test borings and our visual observations of the split-spoon and hand auger samples recovered indicate highly plastic clay soils (A-7-5 and A-7-6) exist at the site. Plastic soils can undergo change in volume (shrink/swell) with changes in their moisture content. The presence of the high-plasticity material can adversely affect the performance of the proposed new pavement systems. These materials should be carefully evaluated when encountered at/beneath pavement subgrade. An evaluation by the geotechnical engineer's representative should be performed during construction to help reduce the potential of plastic materials from underlying the pavements.

In order to reduce the risk of damage of the pavement systems, we recommend that adequate separation be provided between highly plastic clays (A-7-5 and A-7-6 soils) and subgrades. These materials may remain in place provided they are stable under proofrolling and are separated from design pavement subgrades by a minimum of 2 feet. Separation material should consist of newly placed structural fill soils. Unstable highly plastic soils should be undercut and replaced with structural fill.

Based on the soil test borings, existing grades, and anticipated grades, we anticipate undercutting of the high plasticity clay will be required in the vicinity of Borings B-3 through B-5, B-7 through B-9, B-11, B-12, B-15, and B-16 to provide the recommended separation. These areas are also shown on the Anticipated Undercut/ Stabilization Areas figures (Figure 5, 6, and 7) in the Appendix.

As an alternative to undercutting, chemical stabilization may be considered. In addition to creating a stable subgrade and reducing the design pavement section as discussed in Section 4.2.2, chemical stabilization of the subgrade soils can reduce the plasticity characteristics of the subgrade soils thereby eliminating the need for undercutting. Additional laboratory testing will be required to determine cement/lime application rates.

4.1.3 Proofrolling of Subgrade Soils

After stripping of the surficial materials is completed, the exposed subgrade soils in areas to receive fill or at the subgrade elevation in cut areas should be proofrolled with a loaded dump truck or similar pneumatic tired vehicle (minimum loaded weight of 20 tons) to help identify unstable areas requiring repair. Proofrolling near the creeks should be performed at the discretion of the geotechnical engineer to minimize disturbance of already unstable soils. The proofrolling procedures should consist of four complete passes of the exposed areas, with two of the passes being in a direction perpendicular to the preceding ones. Any areas which deflect, rut or pump excessively during proofrolling or fail to "tighten up" after successive passes should be undercut to suitable soils and replaced with compacted fill.

4.1.4 Subgrade Repair after Exposure

The on-site silts and clays in the project area are fairly low-strength, sensitive to moisture, and can degrade quickly if exposed to water. Because of this, the exposed subgrade soil may deteriorate when exposed to construction activity and changes such as freezing, erosion, softening from ponded rainwater, and rutting from construction traffic. Chemical stabilization will reduce the severity of deterioration.

We recommend that exposed subgrade surfaces in the pavement areas that have deteriorated be properly repaired by scarifying and re-compacting immediately prior to continued construction. It should be noted that the level of difficulty and cost of developing a stable subgrade will depend upon the weather conditions before and during construction as well as the time available to stabilize the subgrade. If subgrade preparation operations must be performed during wet weather conditions, undercutting deteriorated soil and replacing it with compacted crushed stone, rather than soil fill, may be preferable.

We recommend that the grading subcontractor smooth-roll exposed subgrades at the end of each work day, limit construction traffic to defined areas, and protect exposed subgrade soils during construction. This is essential for construction during the typically wetter, cooler months of November through March. If subgrades are rough-graded and not immediately covered by pavement base course materials, the grading subcontractor should cover the exposed subgrades with a sacrificial layer of crushed stone, leave the subgrades approximately 1 foot high, or be prepared to repair/stabilize the subgrades at a later date as a part of the original scope of work.

4.1.5 Excavations

Based on the results of the soil test borings, we anticipate that the majority of the general excavation for this site will be in existing roadway embankment fill soils and residual soils. Generally, these soils can be excavated using backhoes, trackhoes, front-end loaders, bull dozers and other types of typical earthmoving equipment.

Results from the soil test borings indicate that weathered rock is present in Boring B-1 just below the pavement system and in Boring B-2 at a depth of approximately 5.5 feet. Additionally, auger refusal material was encountered in Boring B-2 at a depth of 6 feet. Although we anticipate relatively shallow excavation depths for this project, we anticipate that weathered rock and rock may be encountered during site grading operations and excavation for the installation of the roadway and utilities in the southern portion of the project. It should be noted that the depth to and thickness of weathered rock and rock lenses or seams, can vary dramatically in short distances and between boring locations; therefore, weathered rock or bedrock may be encountered during construction at locations or depths, between boring locations, not encountered during this exploration.

It has been our experience in this geological area that materials having Standard Penetration Resistances of less than 50 blows per 0.4 foot can generally be excavated using pans and scrapers by first loosening with a single tooth ripper attached to a suitable sized dozer, such as a Caterpillar D-8 or D-9. Excavation of the weathered rock is typically much more difficult in confined excavations. Jackhammering is anticipated to be required for materials having Standard Penetration Resistances in excess of 50 blows per 0.2 foot, or at or near the level that auger refusal is encountered.

For temporary excavations, shoring and bracing or flattening (laying back) of the slopes should be performed to obtain a safe working environment. Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed responsible for construction site safety.

4.1.6 Cut and Fill Slopes

Final project slopes should be designed at 3 horizontal to 1 vertical or flatter. The tops and bases of all slopes should be located a minimum of 5 feet from pavement limits. The fill slopes should be adequately compacted, as outlined below, and all slopes should be seeded and maintained after construction.

If roadway embankment fill slopes are 10 feet in height or greater, they may require additional preparation of the subgrade soils to provide an adequate factor of safety against global instability. We request the opportunity to review grading plans, once available, to determine if detailed slope stability analysis is required.

4.1.7 Fill Placement

Structural fill placed within the pavement areas at the site should consist of a low plasticity soil that is free of organic material or debris. Structural fill soils should generally classify as A-1, A-2, A-3, A-4, A-5 or A-6 in accordance with AASHTO. While some of these materials were encountered near the ground surface at the site, highly plastic (A-7-5 and A-7-6) materials were also encountered near the existing ground surface. These materials can be used as structural fill, however, should not be placed within 2 feet of pavement subgrades. It should be noted that mixing with low plasticity soils may be required to achieve the required compaction criteria. In areas to be treated with lime stabilization, plastic soils can be placed up to subgrade.

Structural fill should be placed in 8- to 10-inch thick loose lifts at moisture contents within three percent of the optimum moisture content of the material as determined by AASHTO T-99 (Standard Proctor). Each lift of fill should be uniformly compacted to a dry density of at least 95 percent of the maximum dry density of the material determined according to AASHTO T-99 (Standard Proctor), with the upper 8 inches of fill compacted to at least 100 percent. Sliver fills should be benched into existing slopes steeper than 4:1 (H:V) measured at right angles to the roadway.

The geotechnical engineer's representative should perform in-place field density tests to evaluate the compaction of the structural fill and backfill placed at the site. We recommend a testing frequency of one test per lift per 5,000 square feet of fill area in pavements. Also, at least one field density test should be performed for each lift of backfill per every 100 linear feet of utility trench in structural areas.

4.2 Chemical Stabilization

As previously discussed, undercutting should be anticipated to remove plastic soils along a majority of the alignment. As an alternative to undercutting, chemical stabilization may be considered. Depending on the soil conditions, both lime and cement stabilization can provide benefits such as providing a more stable working platform for construction equipment and improving performance and long-term structural strength of the pavement subgrades. Lime stabilization and cement stabilization involve mixing the stabilizing agent with the upper 8 inches and 7 inches, respectively, of existing subgrade soils.

4.2.1 Cement Stabilization

According to the Federal Highway Administration (FHWA), cement stabilization is suitable for materials with a fines content of less than 35% and a PI less than 20, which are typically materials classifying as A-1, A-2 and A-3. These materials were present at subgrade along the alignment between Stations 4+00 and 11+00. Cement stabilization can also be performed on materials classifying as A-4, A-5, A-6, A-7-5, and A-7-6; however, higher cement dosages are typically required. If the soil's PI exceeds 30, mixing the cement with the soil can become difficult.

Cement stabilized subgrades are normally required to provide a minimum unconfined compressive strength of 200 psi and a maximum of 400 psi. Typically, the quantity of cement required to achieve this minimum unconfined compressive strength is in the range of 4 to 10 percent by weight.

4.2.2 Lime Stabilization

Lime stabilization creates a chemical reaction with clay minerals to reduce the swell potential of clays and helps dry the soil to aid in achieving compaction levels. Lime stabilization is suitable on materials classifying as A-4, A-5, A-6, A-7-5 and A-7-6. These materials were present at subgrade along the S. Trade Street alignment roughly between Stations 108+00 and 114+00, 116+00 and 122+00, as well as 124+00 and 128+00. These materials were present at subgrade along the Fullwood Lane alignment roughly between Stations 600+00 and 605+00.

Typically, lime stabilized subgrades should provide a minimum unconfined compressive strength on the order of 60 psi. Typically, the quantity of lime required to achieve this minimum unconfined compressive strength is in the range of 3.5 to 6.5 percent by weight. Additionally, a mellowing period of 1 to 4 days should be allowed between creating the lime/soil mixture and placement/compaction of the lime-stabilized soils.

4.2.3 Stabilization Recommendations

It is our opinion that the majority of the on-site soils appear more suitable for lime stabilization. This information should be used for preliminary estimate purposes only and should be verified and modified as additional test data becomes available during construction. Typically, contractors bidding the project are required to submit mix designs for review to verify that the proposed percent lime mixed with the on-site soils achieves the minimum unconfined compressive strength. We would be happy to assist with mix designs if soil stabilization is selected.

4.3 Pavements

4.3.1 General

S&ME has utilized the "AASHTO Guide of Pavement Structures," dated 1993 and the "NCDOT 2012 HMA/QMS Manual", as guidance for the analysis and design process and for selection of subgrade soil support values, structural coefficient for pavement layers, and selection of recommended pavement components. The recommendations presented herein assume that the production and placement of the aggregate base course and bituminous concrete meet the requirements of the current NCDOT "Standard Specifications for Roads and Structures."

Kimley-Horn indicated that the NCDOT 2012 Annual Average Daily Traffic (AADT) along Trade Street is 21,000 vehicles and the AADT along Fullwood Lane is 13,000 vehicles, with 2 percent truck traffic. S&ME has assumed a 3 percent growth rate over the pavement design life, and that 80 percent of the ESALs are in the design lane due to the 4-lane configuration. Based on information obtained from the Kessler DCP and CBR testing, we have conservatively assumed soaked CBR values of 5 and 8 for widening and existing portions, respectively, of S. Trade Street. Also, we have conservatively assumed soaked CBR values of 4 and 7 for widening and existing portions, respectively, of Fullwood Lane.

The existing pavement section was analyzed based on existing material thicknesses. An effective Structural Number for the existing pavement sections was determined using AASHTO guidelines and our engineering judgment. Based on the existing pavement surface condition, a reduction in the structural coefficient from 0.44 to 0.30 was taken for the upper 4 inches of pavement to determine the effective Structural Number. The effective Structural Number was then used in the overlay design.

Per the 1993 AASHTO guide, the overlay areas should be designed for a 10-year design life. The new alignment (widening) areas have been designed for a 20-year design life. The following tables reflect the appropriate design lives.

We recommend that special care be given to providing adequate drainage away from pavement areas to reduce infiltration of surface water to the base course and subgrade materials in these areas. If the subgrade soils are allowed to become saturated during the life of the pavement section, there may be a strength reduction of the materials that could result in a reduced life of the pavement section. All water should be routed away from the pavements via ditches to maintain drainage. Pavement areas should be proofrolled prior to placing structural fill and/or base course. Proofrolling procedures are outlined in previous sections of this report.

4.3.2 S. Trade Street Design

Existing Pavement Section - As previously mentioned, the existing pavement of S. Trade Street is in relatively good condition. Evidence of pavement distress was negligible. Asphalt Cement ranged from approximately 7 to 8-½ inches thick. Approximately 4-½ to 13 inches of ABC Stone was underlying the asphalt cement.

Serviceability Index and Regional Factor - A terminal serviceability index of P_t=2.5 and initial serviceability index of P_o=4.2 were used for the pavement design analysis in conjunction with a regional factor of 1, a reliability of 85%, and a standard deviation of 0.47 were used in the pavement design calculations.

Design of Pavement Section Overlay and New Construction - Based on the traffic loading information, we estimate 1,350,000 ESALs over a 10-year pavement lifespan (overlay areas) and 2,540,000 ESALs over a 20-year pavement lifespan (new construction areas). The recommended pavement section was established based on the above stated design parameters and a CBR value of 8 for overlay areas and a CBR of 5 for the new construction alignment. Based on the estimated CBR values and anticipated traffic volumes, we recommend the following pavement sections:

Table 2: Summary of Pavement Sections for S. Trade Street

Pavement Area	AC Surface Course (Type S 9.5B)	AC Intermediate Course (Type I 19.0B)	AC Base Course (Type B 25.0B)	Lime Stabilized Subgrade
Overlay	1.5	---	---	---
New Construction without Lime	3.0	4.0	4.0	---
New Construction with Lime	3.0	4.0	---	8.0

Milling depths up to 1.5 inches can be performed without adversely affecting the overlay design.

4.3.3 Fullwood Lane Design

Existing Pavement Section - As previously mentioned, the existing pavement of Fullwood Lane is in relatively good condition. Evidence of pavement distress was negligible. Asphalt Cement ranged from approximately 5-½ to 6 inches thick. Approximately 5-½ to 9 inches of ABC Stone was underlying the asphalt cement.

Serviceability Index and Regional Factor - A terminal serviceability index of P_t=2.5 and initial serviceability index of P_o=4.2 were used for the pavement design analysis in conjunction with a regional factor of 1, a reliability of 85%, and a standard deviation of 0.47 were used in the pavement design calculations.

Design of Pavement Section Overlay and New Construction - Based on the traffic loading information, we estimate 840,000 ESALs over a 10-year pavement lifespan (overlay areas) and 1,570,000 ESALs over a 20-year pavement lifespan (new construction areas). The recommended pavement section was established based on the above stated design parameters and a CBR value of 7 for overlay areas and a CBR of 4 for the new construction alignment. Based on the estimated CBR values and anticipated traffic volumes, we recommend the following pavement sections:

Table 3: Summary of Pavement Sections for Fullwood Lane

Pavement Area	AC Surface Course (Type S 9.5B)	AC Intermediate Course (Type I 19.0B)	AC Base Course (Type B 25.0B)	Lime Stabilized Subgrade
Overlay	1.5	---	---	---
New Construction without Lime	3.0	4.0	4.0	---
New Construction with Lime	3.0	4.0	---	8.0

Milling depths up to 1.5 inches can be performed without adversely affecting the overlay design.

4.3.4 Overlay Recommendations

Prior to any construction activity, we recommend that the existing pavement sections to be overlaid be proofrolled under the observation of a geotechnical engineer to identify unstable pavement sections that were not visually observed. Any unstable sections should be removed and replaced. We also recommend that sections that show cracking be milled and leveled, and/or filled with liquidized joint sealer prior to the overlay.

Vertical faces of pavements, curbs, gutters, drainage gratings, manholes, and any other non-asphalt contact surfaces should be sprayed or painted with a prime coat and a tack coat as in accordance with the current edition of the North Carolina Department of Transportation's "Standard Specifications for Roads and Structures." Asphalt coatings on vertical surfaces should be protected from dust and dirt; it is best to apply them immediately prior to pavement construction. When the pavement has been prepared, placing the overlay should proceed without delay.

Longitudinal cracking is a common issue at the joint between new and existing pavement systems. A pavement reinforcement system such as the Glasgrid® System could be utilized directly beneath the overlaid portion of the existing pavement system and the asphalt surface course of the new pavement system to aid in the prevention of longitudinal cracking.

5. LIMITATIONS OF REPORT

The test locations given in this report should be considered accurate only to the degree implied by the methods used to determine them. The boring logs represent our interpretation of the subsurface conditions based on the field logs, and visual examinations of samples by a staff professional or technician, in addition to tests of the field samples. The lines designating the interfaces between various strata may be gradual.

The generalized subsurface strata and profiles described in this report are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized. They have been developed by interpretations of widely-spaced borings. Therefore, actual subsurface conditions may vary from those given between test locations.

Water levels have been measured or inferred in the borings at the times and under the conditions stated on the exploration logs in this report. Changes in the groundwater conditions may occur due to variations in rainfall, evaporation, construction activity, surface water runoff, and other site specific factors.

Our geotechnical services include storing the samples collected and making them available for inspection for 90 days. The samples are then discarded unless our client requests otherwise.

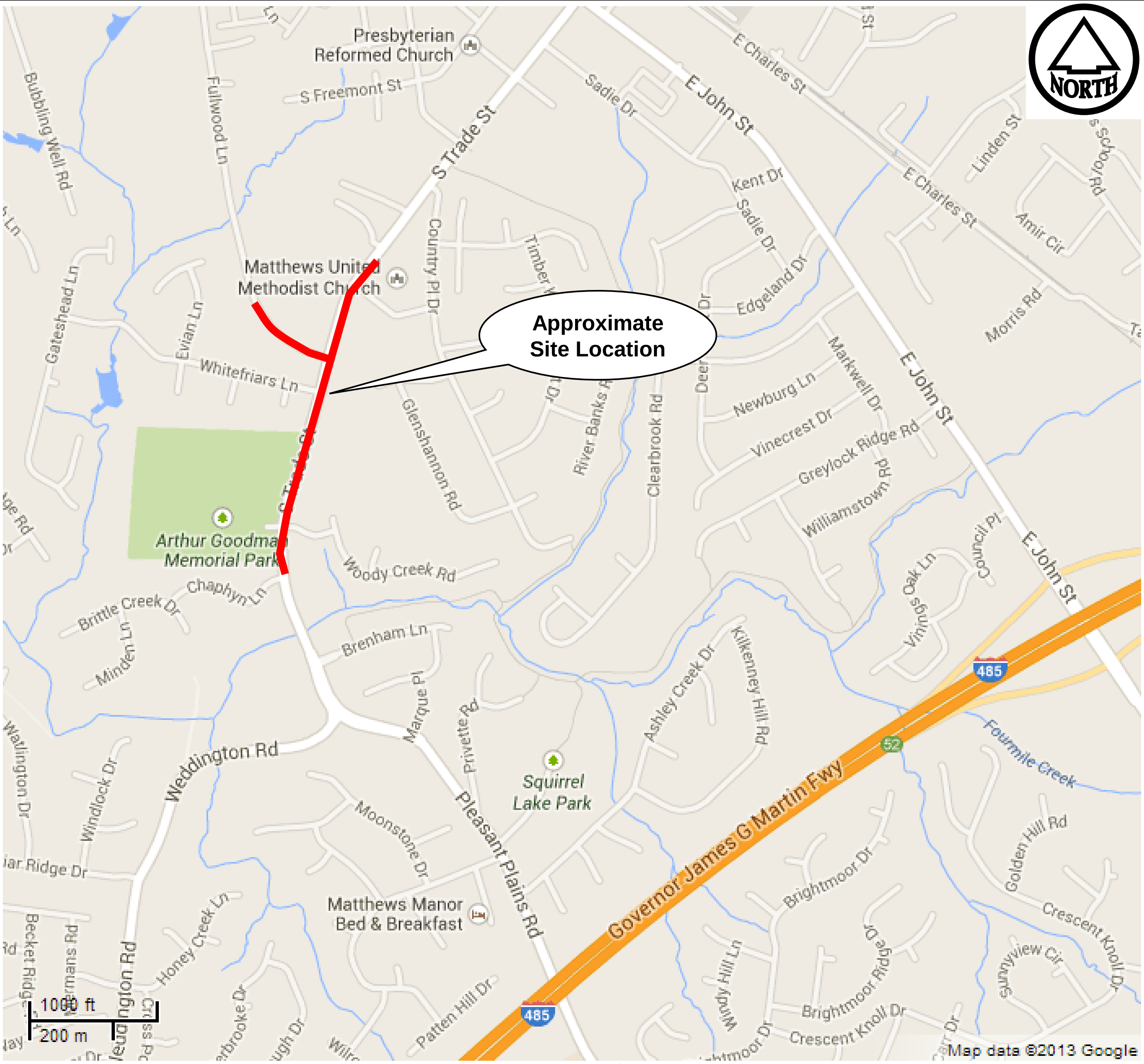
The assessment of site environmental conditions and the determination of contaminants in the soil, rock, surface water or groundwater of the site were beyond the scope of this geotechnical study.

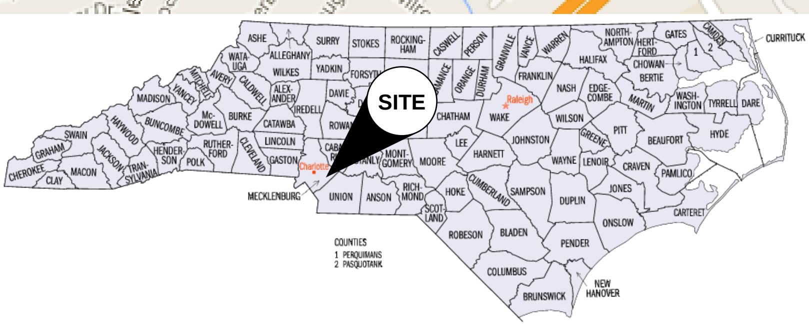
The recommendations provided in this report are based on our understanding of the project information given in this report and on our interpretation of the surface and subsurface data collected. We have made our recommendations based on our experience with similar subsurface conditions and similar projects. The recommendations apply to the specific project discussed in this report; therefore, any changes in the project information should be provided to us so we may review our conclusions and recommendations and make any appropriate modifications.

S&ME should be retained for a general review of the design drawings and specifications to verify that geotechnical recommendations are properly interpreted and implemented.

Regardless of the thoroughness of a geotechnical study, there is always a possibility that subsurface conditions will be different from those at boring locations, that conditions will not be as anticipated by the designers or contractors, or that the construction process will alter soil conditions. Therefore, qualified geotechnical personnel should observe construction to confirm that the conditions indicated by the geotechnical borings actually exist. We recommend the owner retain S&ME for this service since we are already familiar with the project, the subsurface conditions at the site, and the intent of the recommendations and design.

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





SCALE: AS SHOWN

DRAWN BY: LAC

CHECKED BY: KHH

DATE: 11/25/2013

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

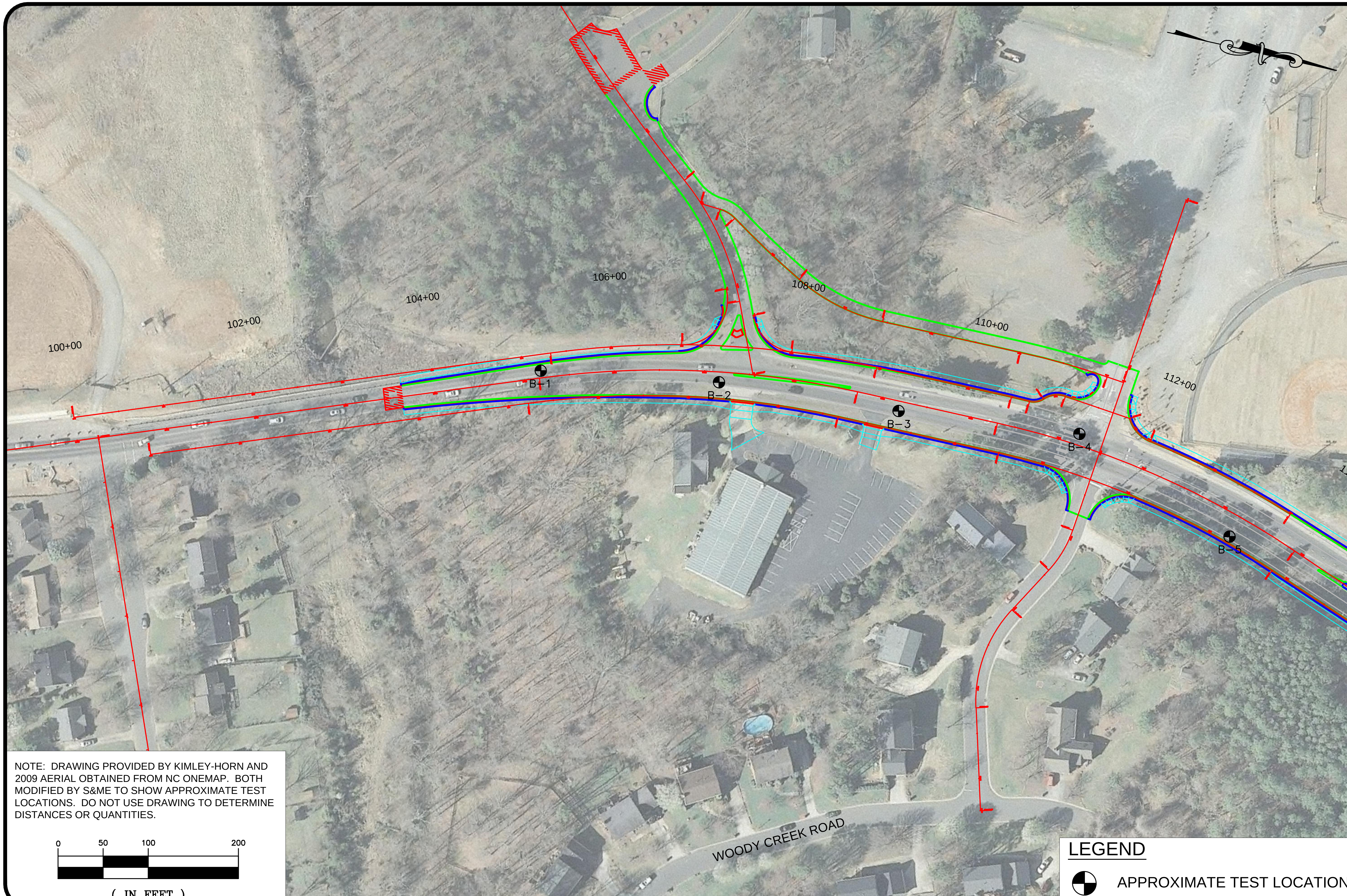
SITE VICINITY MAP

S. TRADE STREET WIDENING

S. TRADE STREET AND FULLWOOD LANE
MATTHEWS, NORTH CAROLINA

PROJECT NO.: 1351-13-123

FIGURE NO. 1



NOTE: DRAWING PROVIDED BY KIMLEY-HORN AND 2009 AERIAL OBTAINED FROM NC ONEMAP. BOTH MODIFIED BY S&ME TO SHOW APPROXIMATE TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.

0 50 100 200

(IN FEET)

LEGEND

APPROXIMATE TEST LOCATION

DATE:	11/25/2013
DRAWN BY:	LAC
CHECKED BY:	SSL
SCALE:	1" = 100'
PROJECT NO.	1351-13-123
ENGINEERING LICENSE NO:	F-0176

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TEST LOCATION PLAN

S. TRADE STREET WIDENING

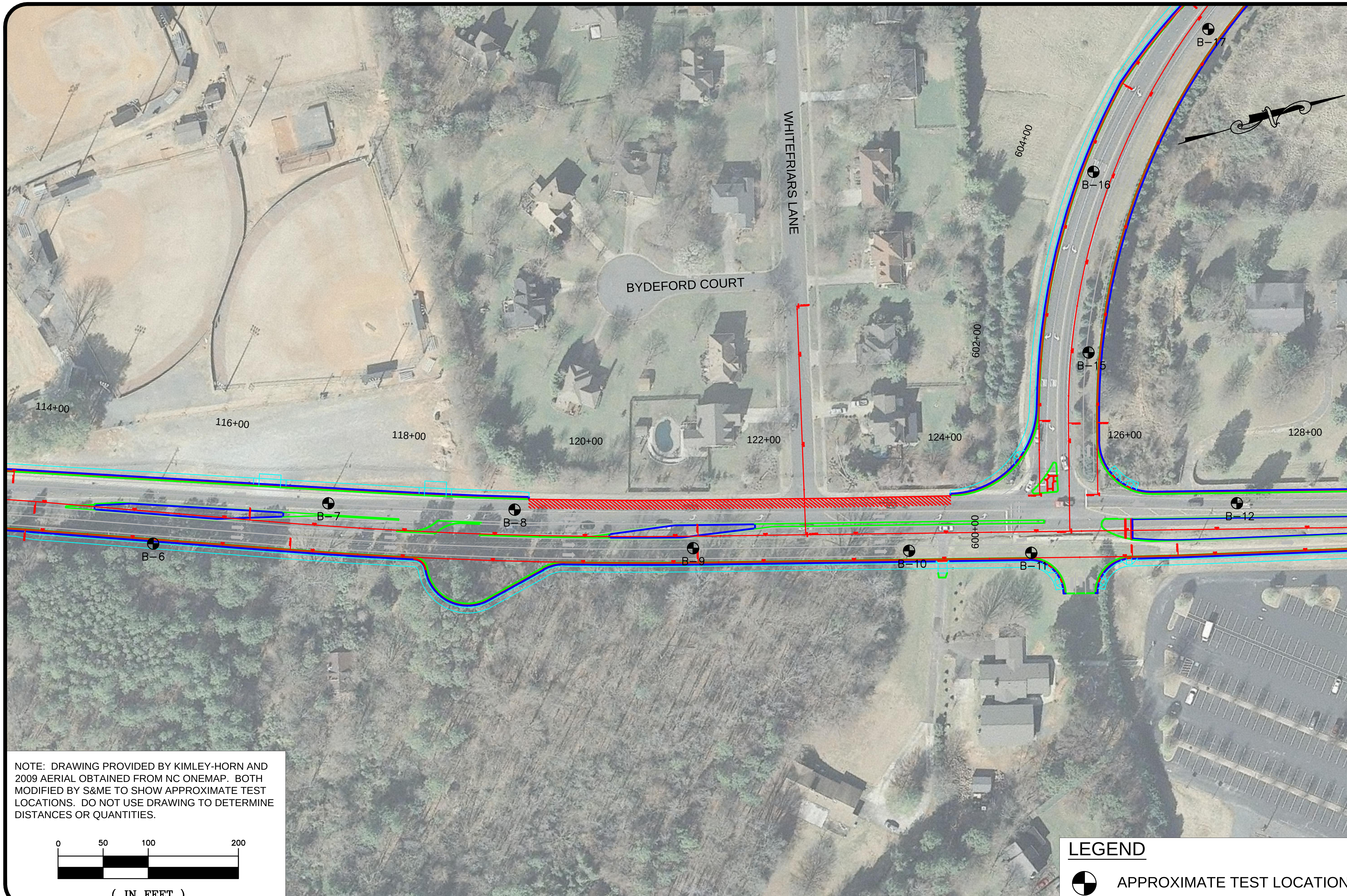
S. TRADE STREET AND FULLWOOD LANE

MATTHEWS, NORTH CAROLINA

FIGURE NO.

2

Drawing path:



NOTE: DRAWING PROVIDED BY KIMLEY-HORN AND 2009 AERIAL OBTAINED FROM NC ONEMAP. BOTH MODIFIED BY S&ME TO SHOW APPROXIMATE TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.

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LEGEND

APPROXIMATE TEST LOCATION

DATE: 11/25/2013
DRAWN BY: LAC
CHECKED BY: SSL
SCALE: 1" = 100'
PROJECT NO. 1351-13-123
ENGINEERING LICENSE NO: F-0176

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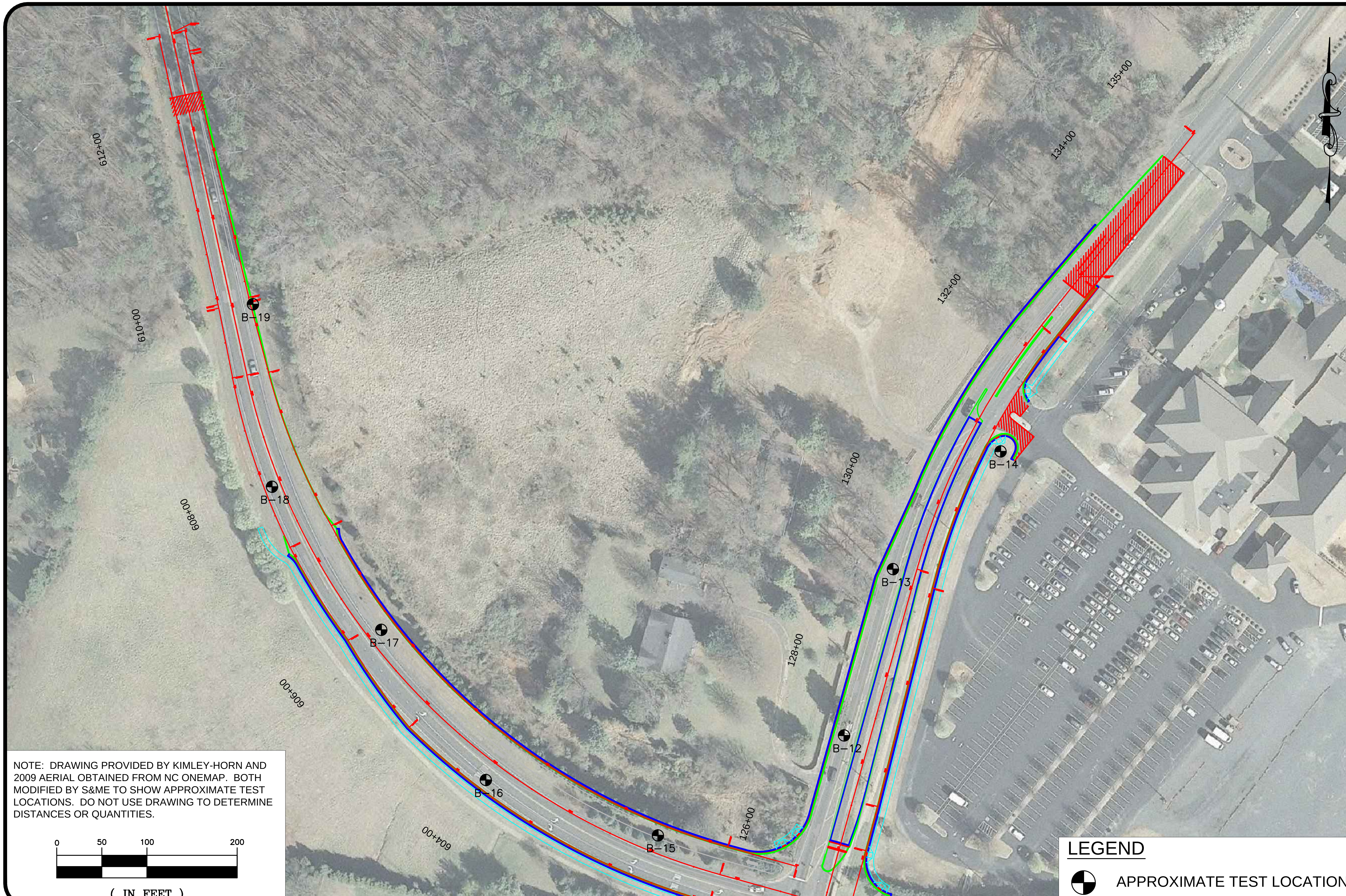
TEST LOCATION PLAN

S. TRADE STREET WIDENING
S. TRADE STREET AND FULLWOOD LANE
MATTHEWS, NORTH CAROLINA

FIGURE NO.
3

Drawing path:



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LEGEND

APPROXIMATE TEST LOCATION

SCALE: 1" = 100'

DATE: 11/25/2013

PROJECT NO. 1351-13-123

DRAWN BY: LAC

ENGINEERING LICENSE NO: F-0176

CHECKED BY: SSL

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TEST LOCATION PLAN

S. TRADE STREET WIDENING

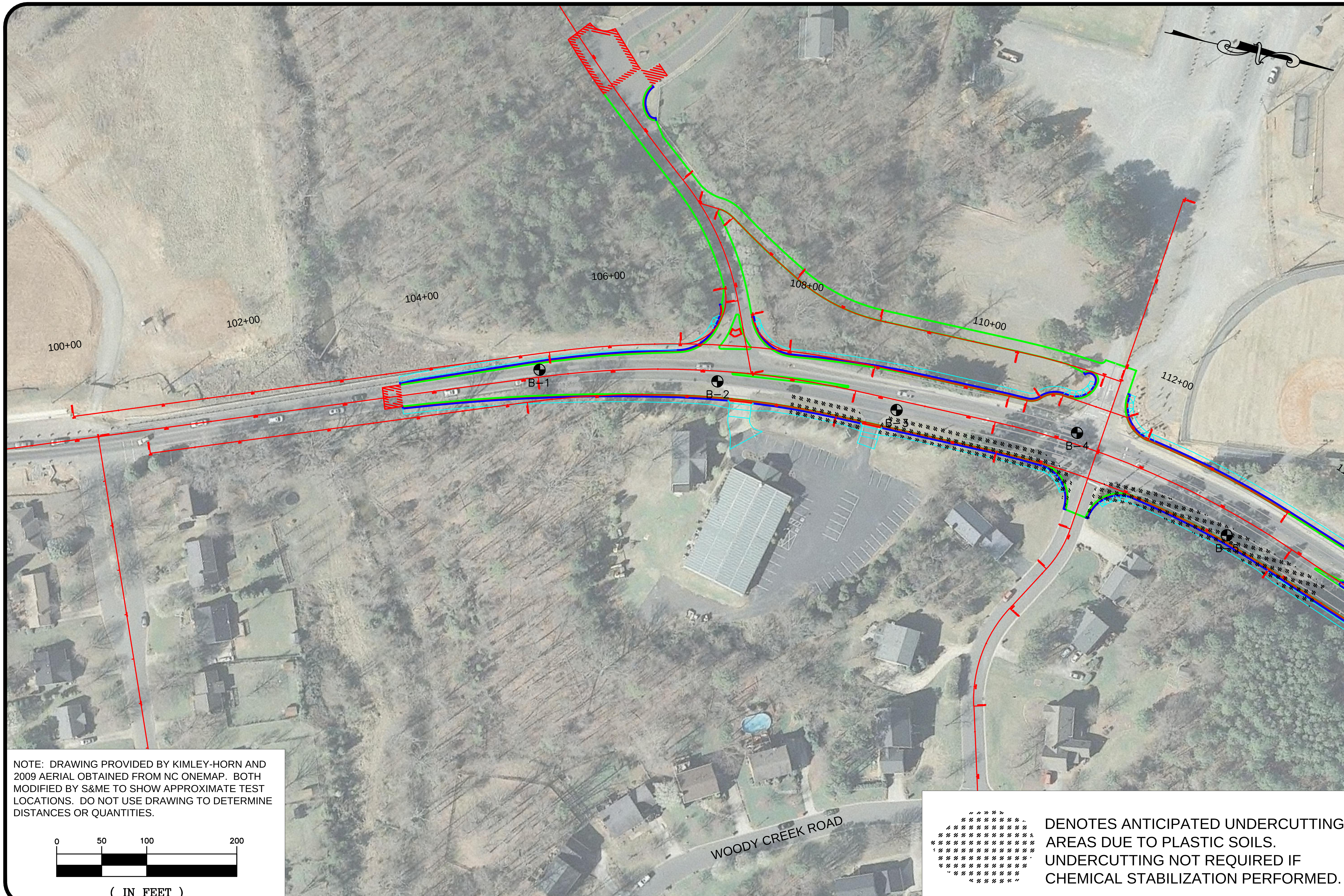
S. TRADE STREET AND FULLWOOD LANE

MATTHEWS, NORTH CAROLINA

FIGURE NO.

4

Drawing path:



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0 50 100 200

(IN FEET)

DENOTES ANTICIPATED UNDERCUTTING AREAS DUE TO PLASTIC SOILS. UNDERCUTTING NOT REQUIRED IF CHEMICAL STABILIZATION PERFORMED.

SCALE: 1" = 100'	DATE: 11/25/2013
PROJECT NO. 1351-13-123	DRAWN BY: LAC
ENGINEERING LICENSE NO: F-0176	CHECKED BY: SSL

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ANTICIPATED UNDERCUT/STABILIZATION AREAS

S. TRADE STREET WIDENING

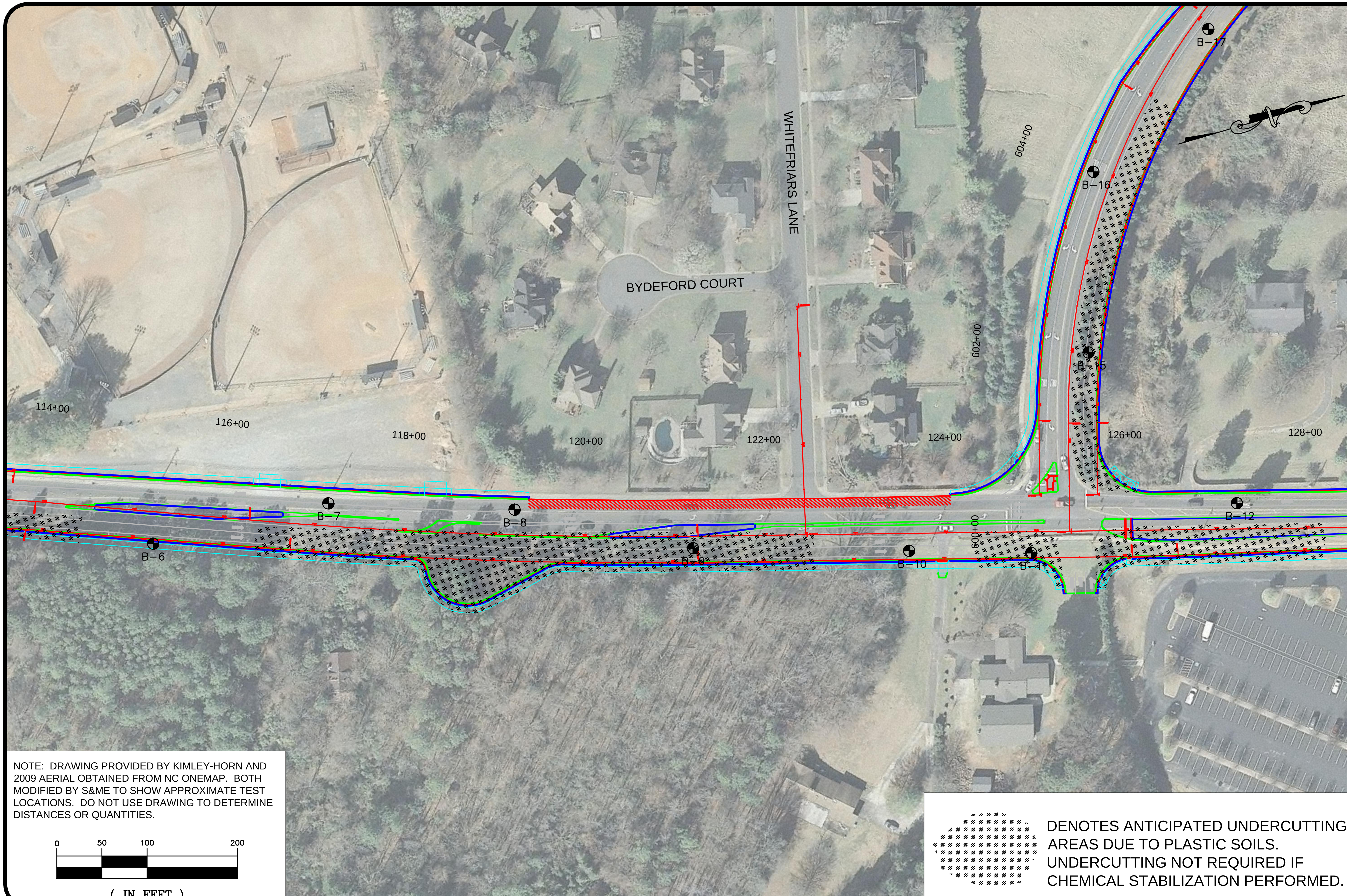
S. TRADE STREET AND FULLWOOD LANE

MATTHEWS, NORTH CAROLINA

FIGURE NO.

5

Drawing path:



NOTE: DRAWING PROVIDED BY KIMLEY-HORN AND 2009 AERIAL OBTAINED FROM NC ONEMAP. BOTH MODIFIED BY S&ME TO SHOW APPROXIMATE TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.

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(IN FEET)

DENOTES ANTICIPATED UNDERCUTTING AREAS DUE TO PLASTIC SOILS. UNDERCUTTING NOT REQUIRED IF CHEMICAL STABILIZATION PERFORMED.

SCALE: 1" = 100'

DATE: 11/25/2013

PROJECT NO. 1351-13-123

DRAWN BY: LAC

ENGINEERING LICENSE NO: F-0176

CHECKED BY: SSL

S&ME

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ANTICIPATED UNDERCUT/STABILIZATION AREAS

S. TRADE STREET WIDENING

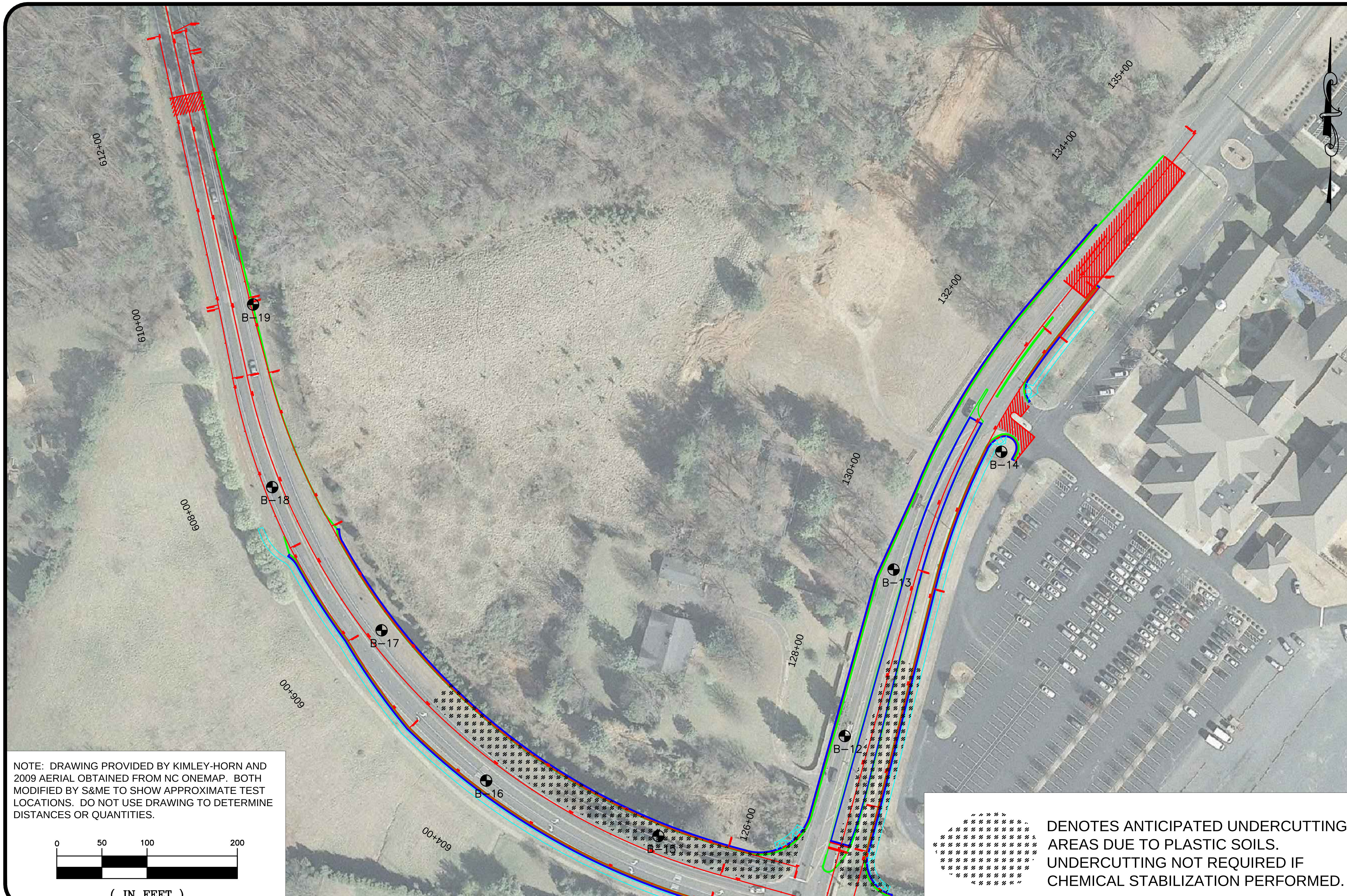
S. TRADE STREET AND FULLWOOD LANE

MATTHEWS, NORTH CAROLINA

FIGURE NO.

6

Drawing path:



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(IN FEET)

DENOTES ANTICIPATED UNDERCUTTING AREAS DUE TO PLASTIC SOILS. UNDERCUTTING NOT REQUIRED IF CHEMICAL STABILIZATION PERFORMED.

SCALE: 1" = 100'	DATE: 11/25/2013
PROJECT NO. 1351-13-123	DRAWN BY: LAC
ENGINEERING LICENSE NO: F-0176	CHECKED BY: SSL

S&ME

WWW.SMEINC.COM

ANTICIPATED UNDERCUT/STABILIZATION AREAS

S. TRADE STREET WIDENING

S. TRADE STREET AND FULLWOOD LANE

MATTHEWS, NORTH CAROLINA

FIGURE NO.

7

Drawing path:

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2, A-3	A-4, A-5, A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
LIQUID LIMIT	6 MX		NP	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.50
	MEDIUM STIFF	4 TO 8	0.5 TO 1.0
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE						
MM	305	75	2.0	0.25	0.05	0.005
IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL - LIQUID LIMIT; PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL - PLASTIC LIMIT		
OM - OPTIMUM MOISTURE; SL - SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	6-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 31
MODERATELY COMPRESSIBLE	LIQUID LIMIT EQUAL TO 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT DPT DMT VST PMT TEST BORING
- AUGER BORING
- CORE BORING
- MW MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING W/ CORE
- SPT N-VALUE
- REF SPT REFUSAL

ABBREVIATIONS

AR - AUGER REFUSAL	MED. - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA. - MICACEOUS	WEA. - WEATHERED
CL. - CLAY	MOD. - MODERATELY	γ - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	γ_d - DRY UNIT WEIGHT
CSE. - COARSE	ORG. - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP. - SAPROLITIC	S - BULK
e - VOID RATIO	SD. - SAND, SANDY	SS - SPLIT SPOON
F - FINE	SL. - SILT, SILTY	ST - SHELBY TUBE
FOSS. - FOSSILIFEROUS	SLI. - SLIGHTLY	RS - ROCK
FRAC. - FRACTURED, FRACTURES	TCR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAGS. - FRAGMENTS	w - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HI. - HIGHLY	V - VERY	

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
☐ MOBILE B-__	☐ CLAY BITS	☒ AUTOMATIC ☐ MANUAL
☐ BK-51	☐ 6" CONTINUOUS FLIGHT AUGER	CORE SIZE:
☐ CME-45C	☐ 8" HOLLOW AUGERS	☐ -B____
☐ CME-550	☐ HARD FACED FINGER BITS	☐ -N____
☐ PORTABLE HOIST	☐ TUNG.-CARBIDE INSERTS	☐ -H____
☒ CME-45B	☐ CASING ☐ W/ ADVANCER	HAND TOOLS:
☐ ____	☐ TRICONE ____ STEEL TEETH	☐ POST HOLE DIGGER
	☐ TRICONE ____ TUNG.-CARB.	☐ HAND AUGER
	☐ CORE BIT	☐ SOUNDING ROD
	☒ 3-1/4" H.S.A.	☐ VANE SHEAR TEST
		☐ ____

REVISED 09/23/09

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK:

ELEVATION: FT.

NOTES:

REVISED 09/23/09

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts

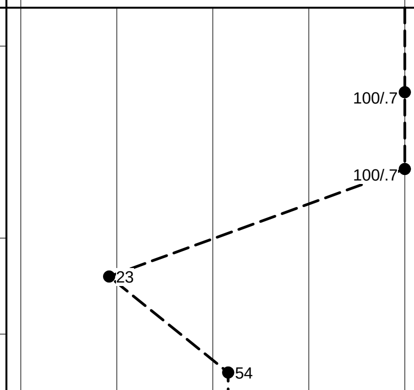
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)	**GROUND WTR (ft)**

BORING NO. B-1	**STATION** 105+19	**OFFSET** 8 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 496,856	**EASTING** 1,482,583	**24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic

DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	ELEV. (ft)	DEPTH (ft)
										GROUND SURFACE		0.0
										Asphalt (8-1/2") over ABC Stone (8")		1.4
		1.0	19	50	50/.2	100/.7		D		**WEATHERED ROCK** (metamorphosed quartz diorite)		
		3.5	57	43/.2		100/.7		D				5.5
		6.0	10	11	12	23		D		**RESIDUAL** Very Stiff, Brown Tan Orange, Sandy SILT (A-4)		8.0
		8.5	6	18	36	54		D		**RESIDUAL** Very Dense, Orange Tan White, Silty Fine to Coarse SAND (A-2-4), trace of mica		10.0
										Boring Terminated at Depth 10.0 ft		



NCDOT BORE SINGLE 13-123 S TRADE STREET WIDENING NCDOT.GPJ NC_DOT.GDT 11/25/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts

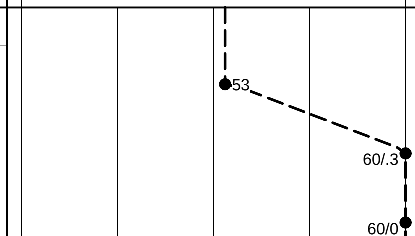
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)

BORING NO. B-2	**STATION** 107+17	**OFFSET** 12 ft RT	**ALIGNMENT** -L-	**GROUND WTR (ft)** **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 6.0 ft	**NORTHING** 497,051	**EASTING** 1,482,552	**24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic

DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
										GROUND SURFACE — 0.0
										Asphalt (7-1/2") over ABC Stone (5-1/2") — 1.1
		1.0	6	19	34	53				**RESIDUAL** Very Dense, Brown Tan Gray, Silty Fine to Coarse SAND (A-2-4) — 3.0
		3.5	60/.3			60/.3				**WEATHERED ROCK** (metamorphosed quartz diorite)
		5.6	60/0			60/0				6.0
										Boring Terminated by Auger Refusal at Depth 6.0 ft on crystalline rock (metamorphosed quartz diorite)



NCDOT BORE SINGLE 13-123 S TRADE STREET WIDENING NCDOT.GPJ NC_DOT.GDT 11/25/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)			**GROUND WTR (ft)**
BORING NO. B-3	**STATION** 109+20	**OFFSET** 11 ft RT	**ALIGNMENT** -L-
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 497,252	**EASTING** 1,482,539
DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic	
DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft): 0 HR. Dry; 24 HR. FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										GROUND SURFACE 0.0
										Asphalt (7") over ABC Stone (7") 1.2
		1.0	2	3	4	7				**ROADWAY EMBANKMENT** Medium Stiff, Red Orange Tan, CLAY (A-7-6)
		3.5	3	4	4	8				5.5
		6.0	18	21	19	40				**RESIDUAL** Dense, Brown Tan Gray, Silty Fine to Coarse SAND (A-2-4)
		8.5	10	18	20	38				10.0
										Boring Terminated at Depth 10.0 ft

NCDOT BORE SINGLE 13-123 S TRADE STREET WIDENING NCDOT.GPJ NC_DOT.GDT 11/25/13

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts

SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)

BORING NO. B-4	**STATION** 111+20	**OFFSET** 12 ft LT	**ALIGNMENT** -L-	**GROUND WTR (ft)** **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 497,453	**EASTING** 1,482,520	**24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic

DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A

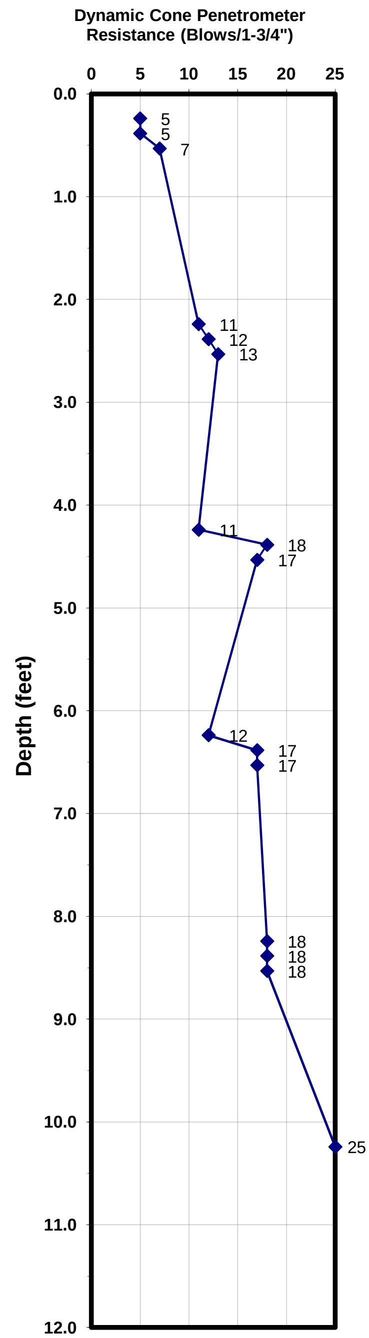
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
										GROUND SURFACE 0.0
										Asphalt (8-1/4") over ABC Stone (6-1/2") 1.2
		1.0	2	3	5	8				**ROADWAY EMBANKMENT** Medium Stiff, Orange Brown, Silty CLAY (A-7-5) 4.0
		3.5	3	3	6	9				**RESIDUAL** Stiff, Tan Gray, Sandy SILT (A-4)
		6.0	3	5	7	12				
		8.5	5	6	7	13				10.0
										Boring Terminated at Depth 10.0 ft

PROJECT:	S. Trade Street Widening Matthews, North Carolina **S&ME Project No. 1351-13-123**	**BORING LOG: B-5**
DATE PERFORMED: **9/24/2013** PERFORMED BY: **JRW / MIK** NORTHING: **497640** EASTING: **1482594**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/24/2013** STATION: **113+20**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.3	**Topsoil / Rootmat** (3 inches)
0.3 - 1.5	**ROADWAY EMBANKMENT** Soft, Red Brown, Silty Clay (A-7-5), trace roots (moist)
1.5 - 3.5	**RESIDUAL** Stiff, Orange Brown Tan, Silty Clay (A-7-5), trace mica, trace roots (moist)
3.5 - 10	**RESIDUAL** Stiff, Orange Brown Tan, Sandy Silt (A-4) (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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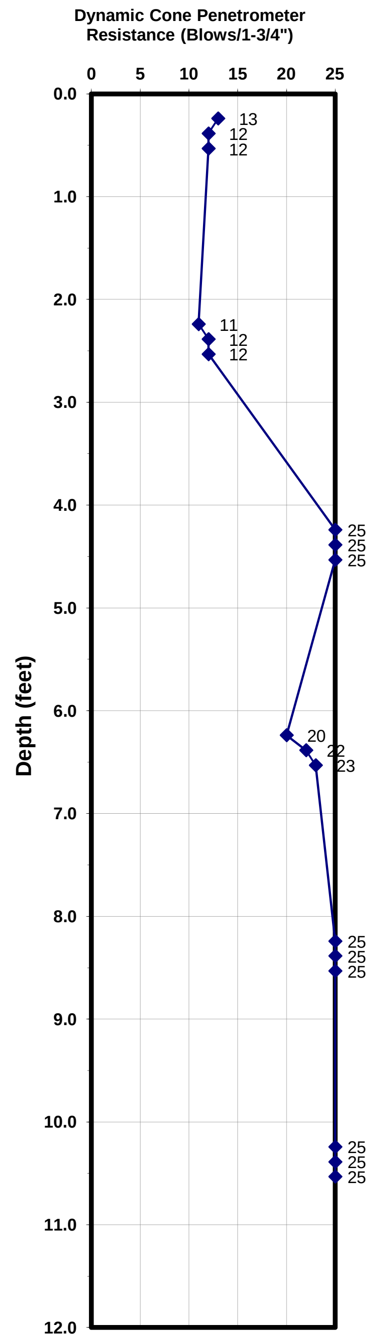
PROJECT:	S. Trade Street Widening Matthews, North Carolina S&ME Project No. 1351-13-123	BORING LOG: **B-6**
DATE PERFORMED: **9/24/2013** PERFORMED BY: **JRW / MIK** NORTHING: **497826** EASTING: **1482675**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/24/2013** STATION: **115+24**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.2	**Topsoil / Rootmat** (2 inches)
0.2 - 2.5	**RESIDUAL** Loose, Brown, Silty Fine Sand (A-2-4), trace mica (moist)
2.5 - 10	**RESIDUAL** Stiff, Brown Orange Tan, Sandy Clay (A-6) (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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SHEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)			
BORING NO. B-7	**STATION** 117+14	**OFFSET** 25 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 498,025	**EASTING** 1,482,687
DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic	
DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG
		1.0	4	9	11	20			
		3.5	6	9	11	20			
		6.0	4	6	8	14			
		8.5	4	5	6	11			

SOIL AND ROCK DESCRIPTION	DEPTH (ft)
GROUND SURFACE	0.0
Asphalt (8-1/2") over ABC Stone (12")	1.7
ROADWAY EMBANKMENT Very Stiff, Orange Tan, Silty CLAY (A-7-5), trace of mica	3.0
RESIDUAL Very Stiff to Stiff, Orange Tan, Sandy SILT (A-4), trace of mica	10.0
Boring Terminated at Depth 10.0 ft	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

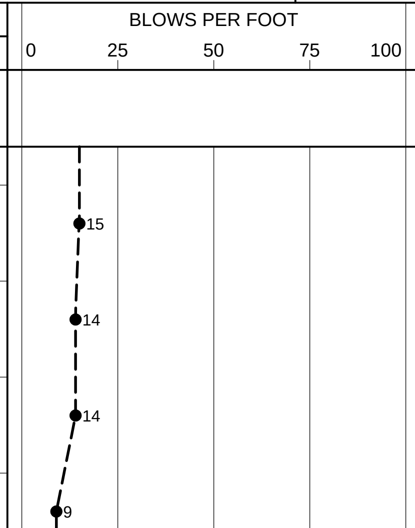
SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts

SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)

BORING NO. B-8	**STATION** 119+21	**OFFSET** 28 ft LT	**ALIGNMENT** -L-	**GROUND WTR (ft)** **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 498,221	**EASTING** 1,482,751	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CME 45-B		**DRILL METHOD** 3-1/4" H.S.A.		**HAMMER TYPE** Automatic
DRILLER S. Goodwin	**START DATE** 09/20/13	**COMP. DATE** 09/20/13	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
										GROUND SURFACE	0.0
										Asphalt (7-3/4") over ABC Stone (13")	
		1.0	12	8	7	15					1.7
										ROADWAY EMBANKMENT Stiff, Orange Tan, Silty CLAY (A-7-5)	
		3.5	3	6	8	14					5.5
		6.0	5	7	7	14				**RESIDUAL** Stiff, Orange Tan, Sandy SILT (A-4), trace of mica	
		8.5	3	4	5	9					10.0
										Boring Terminated at Depth 10.0 ft	

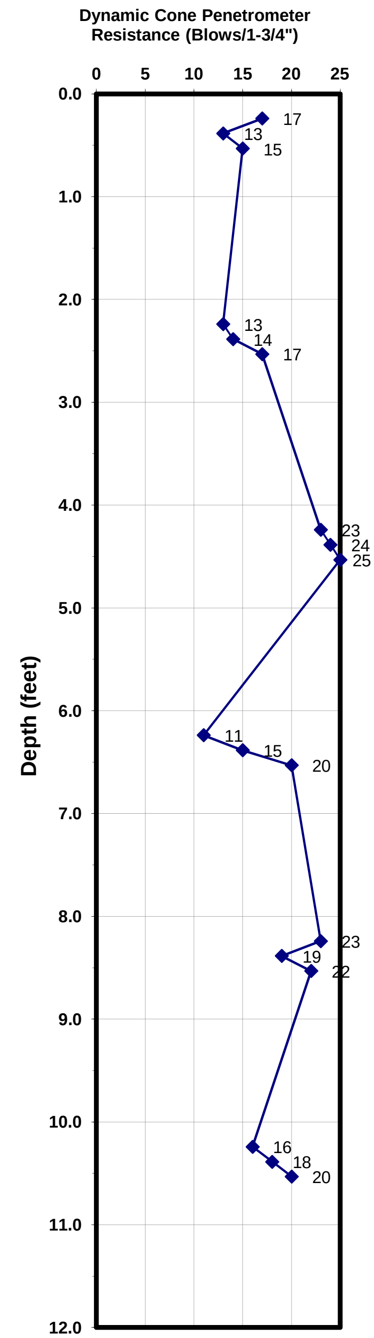


PROJECT:	S. Trade Street Widening Matthews, North Carolina S&ME Project No. 1351-13-123	BORING LOG: B-9
DATE PERFORMED: **9/24/2013** PERFORMED BY: **JRW / MIK** NORTHING: **498398** EASTING: **1482848**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/24/2013** STATION: **121+20**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.1	**Topsoil / Rootmat** (1 inch)
0.1 - 3.5	**ROADWAY EMBANKMENT** Stiff, Red Brown, Clay (A-7-6), trace roots (moist)
3.5 - 6.5	**RESIDUAL** Stiff, Red Brown, Silty Clay (A-7-5), trace mica (moist)
6.5 - 10	**RESIDUAL** Stiff, Orange Brown Tan, Sandy Silt (A-4) (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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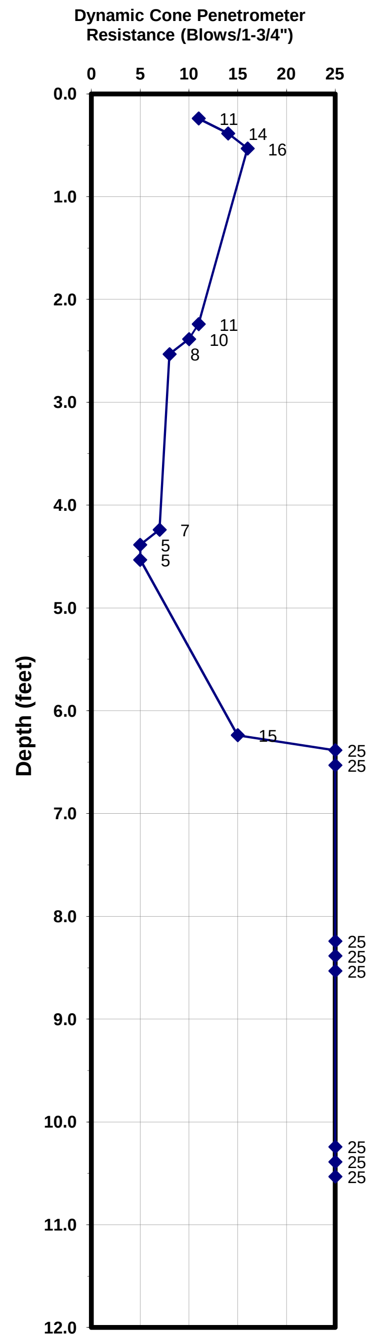
PROJECT:	S. Trade Street Widening Matthews, North Carolina **S&ME Project No. 1351-13-123**	**BORING LOG: B-10**
DATE PERFORMED: **9/25/2013** PERFORMED BY: **JRW / MIK** NORTHING: **498627** EASTING: **1482918**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/25/2013** STATION: **123+59**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.2	**Topsoil / Rootmat** (2 inches)
0.2 - 5.5	**ROADWAY EMBANKMENT** Loose, Tan Brown, Silty Fine Sand (A-2-4), trace mica, trace gravel (moist)
5.5 - 10	**RESIDUAL** Medium Dense, Tan Brown, Silty Fine Sand (A-2-4), trace mica (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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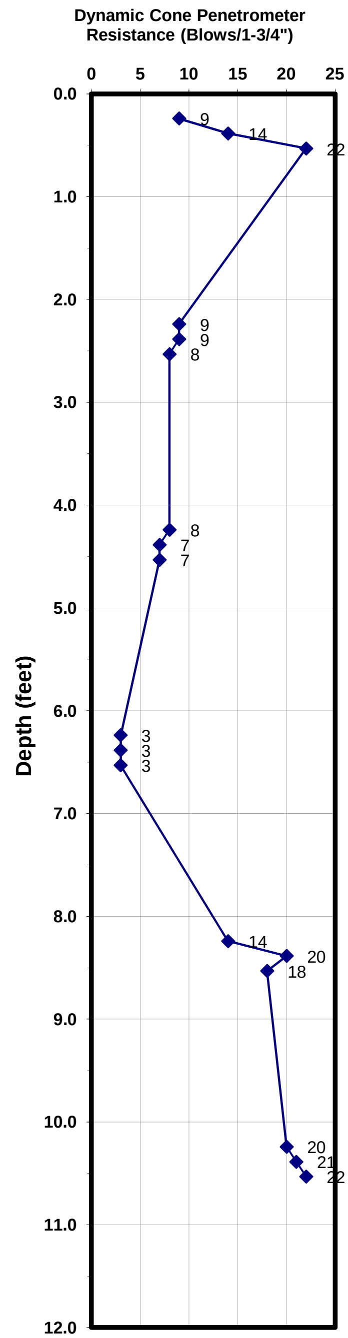
PROJECT:	**S. Trade Street Widening** **Matthews, North Carolina** **S&ME Project No. 1351-13-123**	**BORING LOG: B-11**
DATE PERFORMED: **9/25/2013** PERFORMED BY: **JRW / MIK** NORTHING: **498756** EASTING: **1482958**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/25/2013** STATION: **124+94**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.1	**Topsoil / Rootmat** (1 inch)
0.1 - 1.0	**ROADWAY EMBANKMENT** Stiff, Orange Brown, Clay (A-7-6), trace mica, trace roots (moist)
1.0 - 5.5	**ROADWAY EMBANKMENT** Medium Stiff, Orange Brown Tan, Sandy Silt (A-4), trace mica (moist)
5.5 - 8.0	**ROADWAY EMBANKMENT** Soft, Red Brown, Clay (A-7-6) (moist)
8.0 - 10	**RESIDUAL** Stiff, Tan Brown, Sandy Silt (A-4), trace mica (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)			**GROUND WTR (ft)**
BORING NO. B-12	**STATION** 127+23	**OFFSET** 28 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 498,990	**EASTING** 1,482,969
DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic	
DRILLER T. Lanham	**START DATE** 09/06/13	**COMP. DATE** 09/06/13	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	FIAD

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG
		1.0	3	5	7	12			
		3.5	3	5	6	11			
		6.0	5	6	8	14			
		8.5	5	5	6	11			

SOIL AND ROCK DESCRIPTION

ELEV. (ft)	Description	DEPTH (ft)
	GROUND SURFACE	0.0
	Asphalt (8-1/2") over ABC Stone (4-1/2")	1.1
	ROADWAY EMBANKMENT Stiff, Orange, Silty CLAY (A-7-5)	3.0
	RESIDUAL Stiff, Orange Brown Tan, Sandy SILT (A-4), trace of mica	10.0
	Boring Terminated at Depth 10.0 ft	

SHEET

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)			**GROUND WTR (ft)**
BORING NO. B-13	**STATION** 129+15	**OFFSET** 26 ft LT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 499,175	**EASTING** 1,483,023 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic	
DRILLER T. Lanham	**START DATE** 09/06/13	**COMP. DATE** 09/06/13	**SURFACE WATER DEPTH** N/A

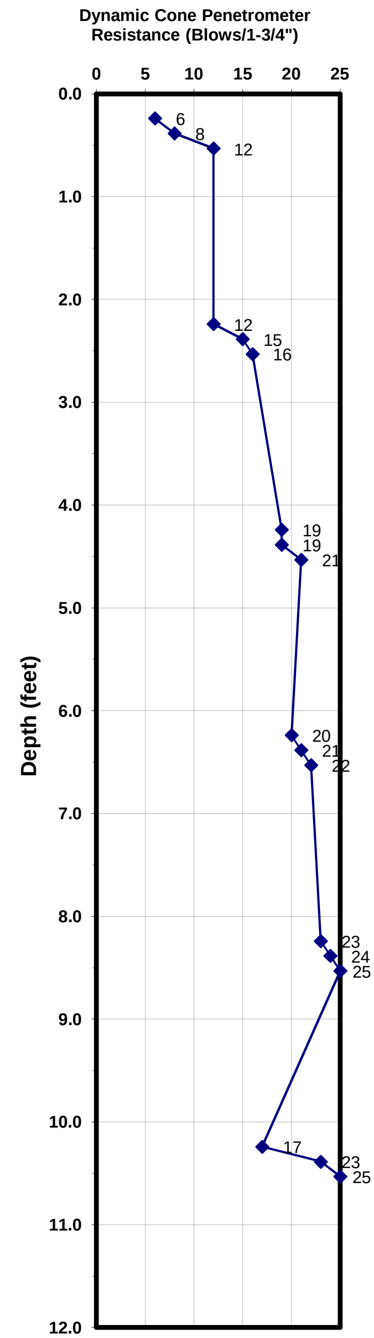
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
										GROUND SURFACE — 0.0
										Asphalt (7-1/4") over ABC Stone (9-1/2") — 1.4
		1.0	6	5	6	11				**ROADWAY EMBANKMENT** Medium Dense, Brown, Silty GRAVEL (A-1-b) — 3.0
		3.5	4	5	6	11				**RESIDUAL** Stiff, Orange Brown Tan, Sandy SILT (A-4), trace of mica
		6.0	3	5	6	11				
		8.5	4	5	6	11				— 10.0
										Boring Terminated at Depth 10.0 ft

PROJECT:	S. Trade Street Widening Matthews, North Carolina **S&ME Project No. 1351-13-123**	**BORING LOG: B-14**
DATE PERFORMED: **9/24/2013** PERFORMED BY: **JRW / MIK** NORTHING: EASTING:	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/24/2013** STATION: **130+82**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.1	**Topsoil / Rootmat** (1 inch)
0.1 - 1.0	**ROADWAY EMBANKMENT** Medium Stiff, Brown Orange, Sandy Clay (A-6), trace roots (moist)
1.0 - 2.0	**ROADWAY EMBANKMENT** Medium Stiff, Red Brown, Silty Clay (A-7-5), trace roots (moist)
2.0 - 4.0	**RESIDUAL** Stiff, Red Brown, Silty Clay (A-7-5) (moist)
4.0 - 10	**RESIDUAL** Stiff, Red Brown, Sandy Silt (A-4), trace mica (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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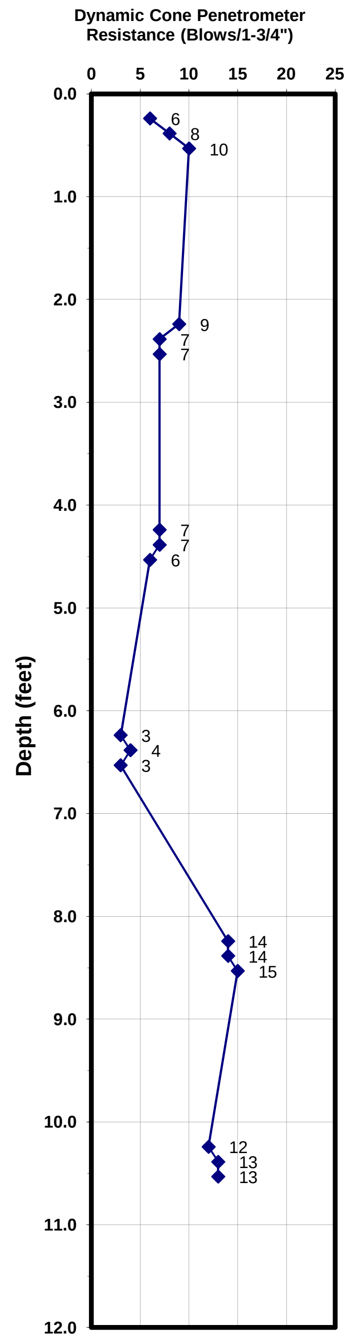
PROJECT:	S. Trade Street Widening Matthews, North Carolina **S&ME Project No. 1351-13-123**	**BORING LOG: B-15**
DATE PERFORMED: **9/25/2013** PERFORMED BY: **JRW / MIK** NORTHING: **498880** EASTING: **1482763**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/25/2013** STATION: **602+00**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.1	**Topsoil / Rootmat** (1 inch)
0.1 - 1.0	**ROADWAY EMBANKMENT** Medium Stiff, Red Brown, Silty Clay (A-7-5) (moist)
1.0 - 7.5	**RESIDUAL** Medium Stiff to Soft, Tan Brown, Silt (A-5), trace mica (moist)
7.5 - 10	**RESIDUAL** Stiff, Tan Brown, Silt (A-5), trace mica (moist)

Hand auger terminated at 10 feet
No groundwater encountered



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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts
SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)			**GROUND WTR (ft)**
BORING NO. B-16	**STATION** 603+96	**OFFSET** 21 ft LT	**ALIGNMENT** -Y1- / **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 498,941	**EASTING** 1,482,572 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CME 45-B	**DRILL METHOD** 3-1/4" H.S.A.	**HAMMER TYPE** Automatic	
DRILLER T. Lanham	**START DATE** 09/06/13	**COMP. DATE** 09/06/13	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG
		1.0	4	5	8	13			
		3.5	4	5	8	13			
		6.0	5	7	9	16			
		8.5	6	6	9	15			

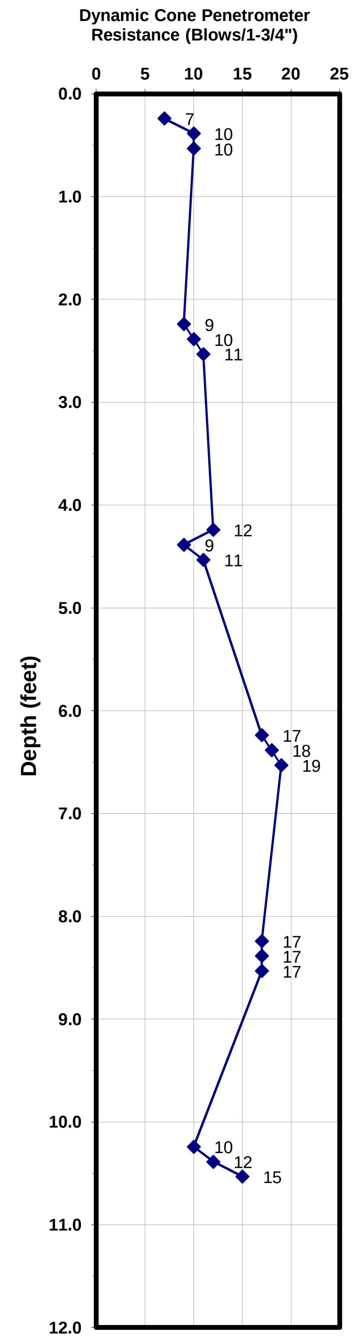
SOIL AND ROCK DESCRIPTION

ELEV. (ft)	Description	DEPTH (ft)
	GROUND SURFACE	0.0
	Asphalt (5-1/2") over ABC Stone (9")	1.2
	ROADWAY EMBANKMENT Stiff to Very Stiff, Red Brown Orange, Silty CLAY (A-7-5), trace of mica	9.0
	RESIDUAL Stiff, Orange Tan, SILT (A-5), trace of mica	10.0
	Boring Terminated at Depth 10.0 ft	

PROJECT:	S. Trade Street Widening Matthews, North Carolina S&ME Project No. 1351-13-123	**BORING LOG:** **B-17**
DATE PERFORMED: **9/25/2013** PERFORMED BY: **JRW / MIK** NORTHING: **499108** EASTING: **1482456**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/25/2013** STATION: **605+96**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.2	**Topsoil / Rootmat** (2 inches)
0.2 - 10	**RESIDUAL** Medium Stiff to Stiff, Tan Brown, Silt (A-5) trace mica (moist)
	Hand auger terminated at 10 feet No groundwater encountered



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NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS N/A	**TIP** N/A	**COUNTY** Mecklenburg	**GEOLOGIST** M. Keatts

SITE DESCRIPTION S Trade Street Widening (S&ME Project 1351-13-123)

BORING NO. B-18	**STATION** 607+95	**OFFSET** 10 ft LT	**ALIGNMENT** -Y1-	**GROUND WTR (ft)** **0 HR.** Dry
COLLAR ELEV. N/A	**TOTAL DEPTH** 10.0 ft	**NORTHING** 499,266	**EASTING** 1,482,335	**24 HR.** FIAD

DRILL RIG/HAMMER EFF./DATE CME 45-B | **DRILL METHOD** 3-1/4" H.S.A. | **HAMMER TYPE** Automatic

DRILLER T. Lanham | **START DATE** 09/06/13 | **COMP. DATE** 09/06/13 | **SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT (0 25 50 75 100)	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										GROUND SURFACE — 0.0
										Asphalt (6") over ABC Stone (5-1/2") — 1.0
		1.0	4	7	10	17				**ROADWAY EMBANKMENT** Very Stiff, Tan Orange, Silty CLAY (A-7-5)
		3.5	6	8	10	18				
										5.5
		6.0	6	8	10	18				**RESIDUAL** Very Stiff to Stiff, Tan Orange, Sandy SILT (A-4), trace of mica
		8.5	7	7	7	14				10.0
										Boring Terminated at Depth 10.0 ft

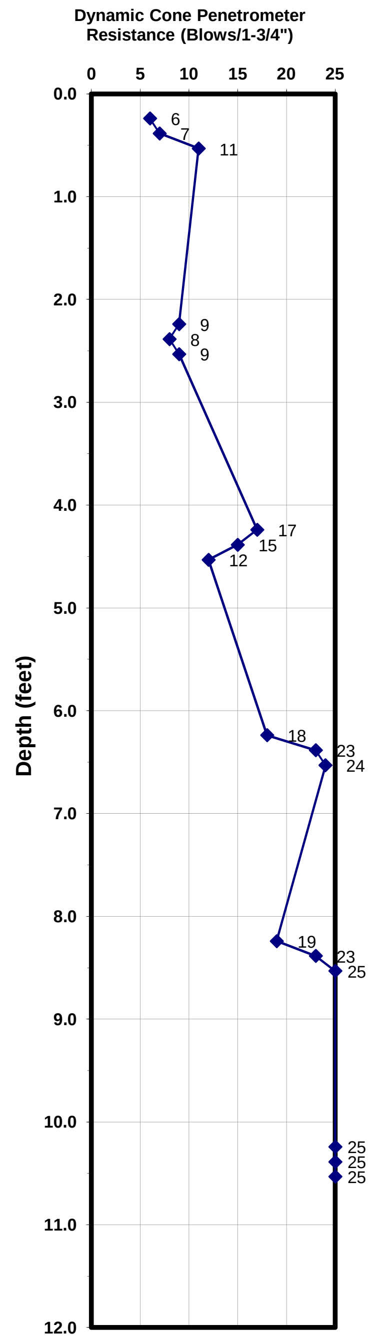
PROJECT:	S. Trade Street Widening Matthews, North Carolina S&ME Project No. 1351-13-123	BORING LOG: **B-19**

DATE PERFORMED: **9/25/2013** PERFORMED BY: **JRW / MIK** NORTHING: **499468** EASTING: **1482314**	ELEVATION: **Not Measured** BORING DEPTH: **10 Feet** WATER LEVEL: **Dry on 9/25/2013** STATION: **609+96**	NOTES: **Dynamic Cone Penetrometer Testing performed in general accordance with ASTM STP-399.** **Northing and Easting interpolated from provided drawing and should be considered approximate.**

HAND AUGER / DYNAMIC CONE PENETROMETER SOUNDING RECORD

DEPTH (FEET)	DESCRIPTION
0 - 0.2	**Topsoil / Rootmat** (2 inches)
0.2 - 10	**RESIDUAL** Loose to Medium Dense, Tan Brown, Silty Fine Sand (A-2-4), trace mica (moist)

Hand auger terminated at 10 feet
No groundwater encountered



S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

9751 Southern Pine Boulevard
Charlotte, North Carolina 28723
Phone: (704) 523-4726 • Fax: (704) 525-3953

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-1 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 8

Test Data

No. of Blows	Cummulative Penetration (mm)
1	5
5	13
5	19
5	25
5	31
5	38
5	44
5	50
5	54
5	60
5	67
5	72
5	80
5	93
2	100
2	108
2	122
2	135
2	160
2	185
2	218
1	239
1	257
2	267
1	271
1	274
5	288
5	300
5	313
5	327
5	340
5	351
5	362
5	370
5	379
5	385
5	390
5	395
5	400
30	429
25	451
30	472

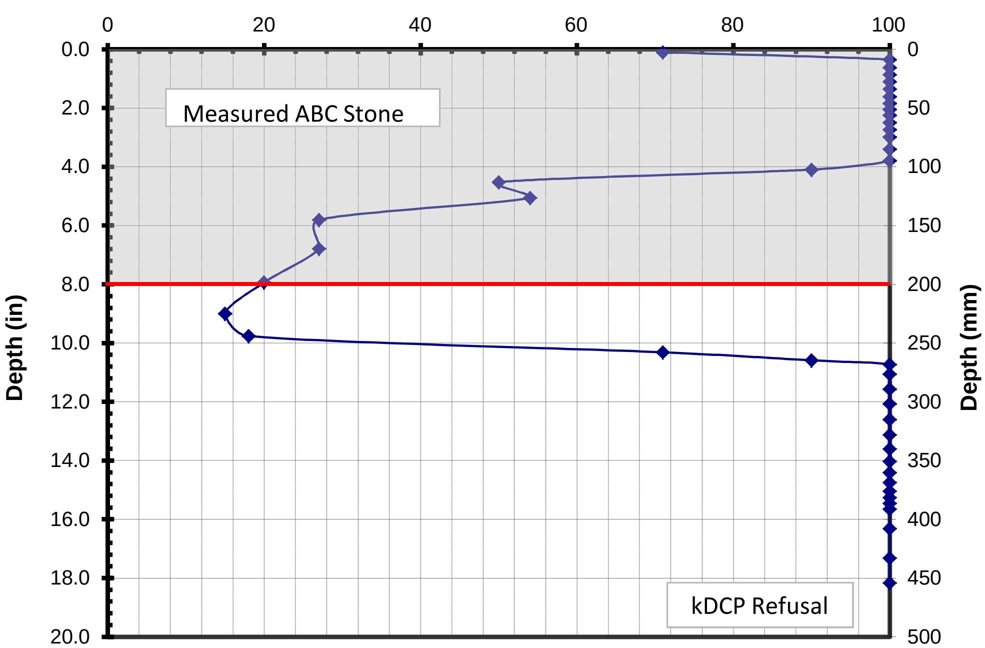
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	21	# Values	21
Average CBR	83	Average CBR	90
Weighted Average	64	Weighted Average	86
Max CBR	100	Max CBR	100
Min CBR	20	Min CBR	15

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-2 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 5.5

Test Data

No. of Blows	Cummulative Penetration (mm)
1	1
1	7
1	15
5	22
5	25
5	32
5	42
5	51
5	60
5	72
5	84
5	87
5	90
5	94
5	102
5	110
5	116
5	125
5	143
3	158
3	179
3	204
3	229
3	255
3	282
3	307
3	336
3	369
3	396
3	422
3	446
3	467
1	472
3	477
33	504

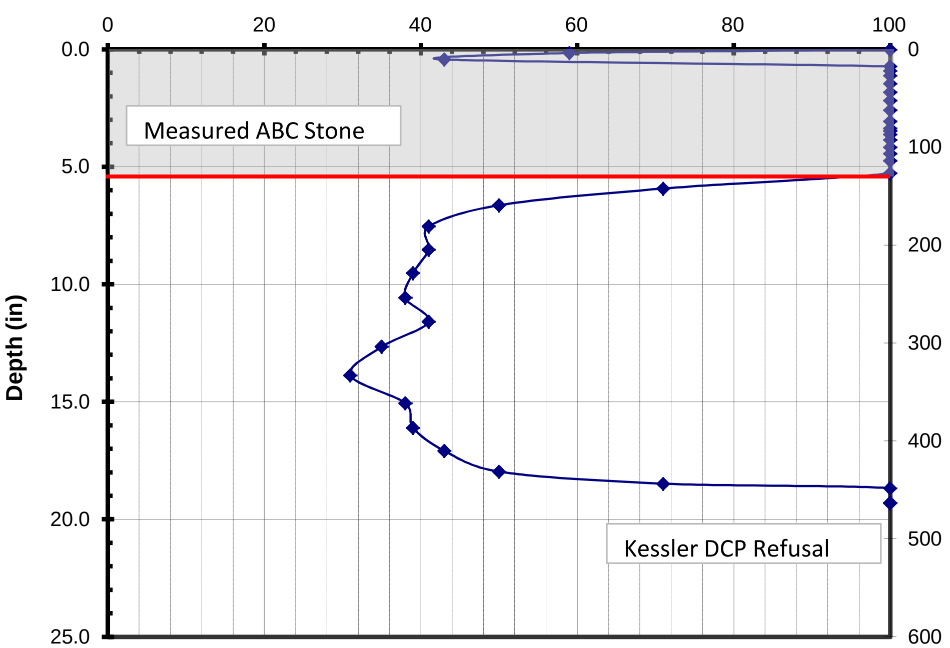
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	19	# Values	16
Average CBR	95	Average CBR	52
Weighted Average	95	Weighted Average	47
Max CBR	100	Max CBR	100
Min CBR	43	Min CBR	31

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-3 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 7

Test Data

No. of Blows	Cummulative Penetration (mm)
1	4
5	10
5	19
5	25
5	33
5	38
4	44
5	50
15	61
5	67
5	75
5	84
5	91
5	99
5	106
5	113
5	128
5	150
4	175
4	237
4	323
4	414
4	489
4	559
4	624
4	700
4	763

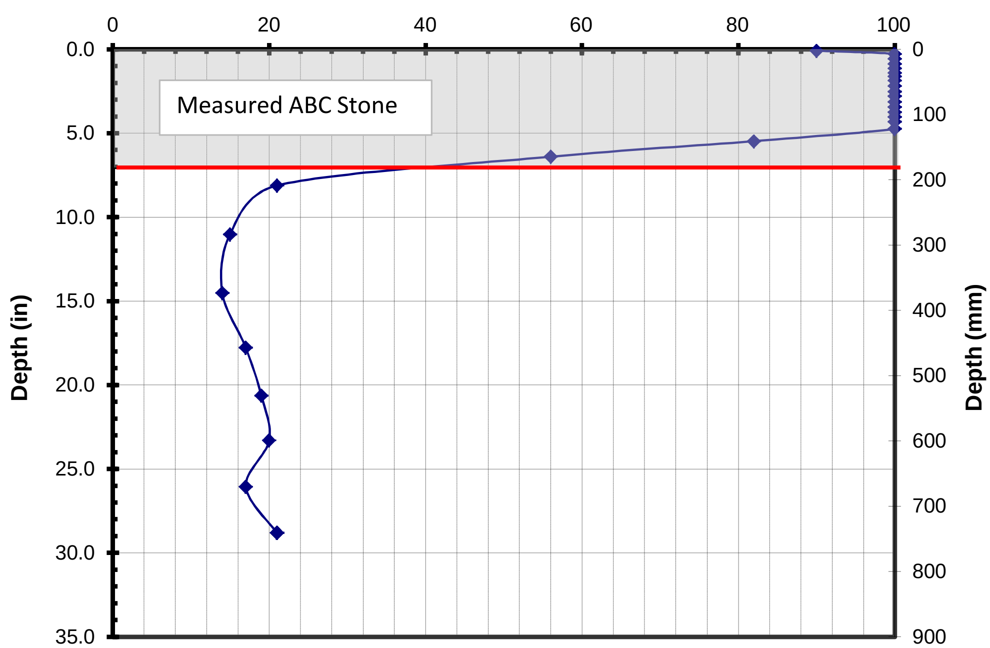
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	19	# Values	8
Average CBR	96	Average CBR	18
Weighted Average	91	Weighted Average	18
Max CBR	100	Max CBR	21
Min CBR	56	Min CBR	14

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-4 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 6.5

Test Data

No. of Blows	Cummulative Penetration (mm)
1	4
5	9
72	91
5	100
5	110
5	120
5	131
5	147
5	160
5	174
1	180
1	190
1	202
1	223
1	256
1	287
1	309
1	328
1	346
2	372
2	395
2	414
2	434
2	457
2	483
2	510
2	540
2	569
2	599
2	625
2	652
2	676
2	700
2	722
2	740
1	750

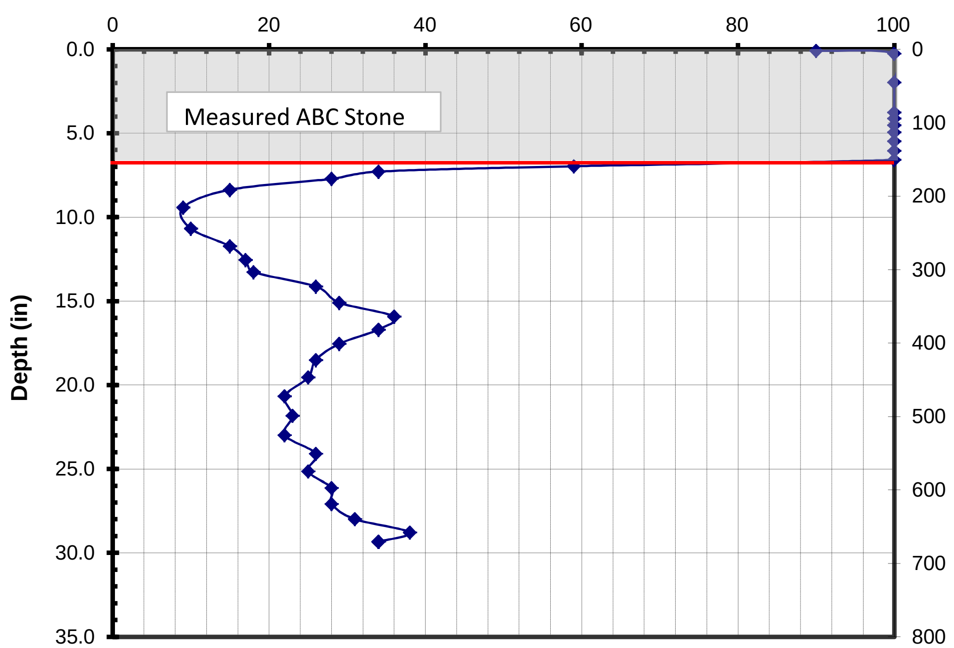
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	9	# Values	27
Average CBR	99	Average CBR	29
Weighted Average	100	Weighted Average	26
Max CBR	100	Max CBR	100
Min CBR	90	Min CBR	9

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-5
Thickness of Stone (in): 0
Date: 9/20/2013
Personnel: MIK

Measured Asphalt Thickness (in): 0.0"

CBR - DCP Correlation for Soil Subgrade

- (selected) North Carolina Department of Transportation (Shin, et al
- U.S. Army Corps of Engineers (Webster, et al 1992)
- Piedmont Residual Soils (Coonse 1999)

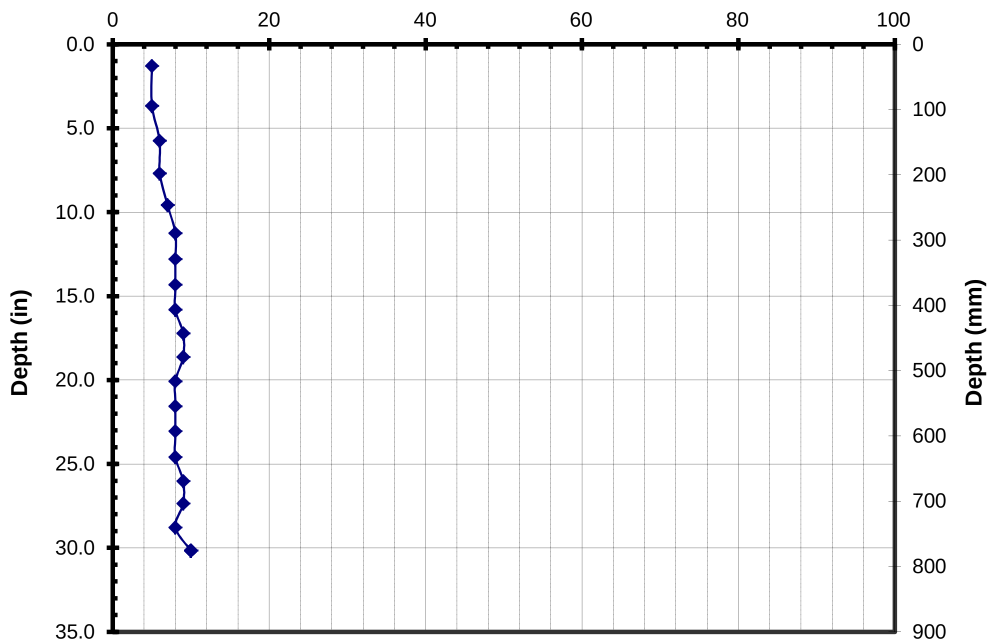
Test Data

No. of Blows	Cummulative Penetration (mm)
1	65
1	121
1	171
1	220
1	266
1	306
1	344
1	383
1	420
1	455
1	491
1	529
1	566
1	605
1	644
1	678
1	712
1	750
1	782

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	19
Average CBR	n/a	Average CBR	8
Weighted Average	n/a	Weighted Average	7
Max CBR	n/a	Max CBR	10
Min CBR	n/a	Min CBR	5

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-6 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data	
No. of Blows	Cummulative Penetration (mm)
1	26
1	48
1	66
1	85
1	103
1	120
1	136
1	153
1	168
1	187
1	209
1	230
1	254
1	278
1	304
1	331
1	358
1	387
1	415
1	445
1	475
1	505
1	537
1	566
1	598
1	630
1	661
1	692
1	720
1	748
1	776
1	807
1	833

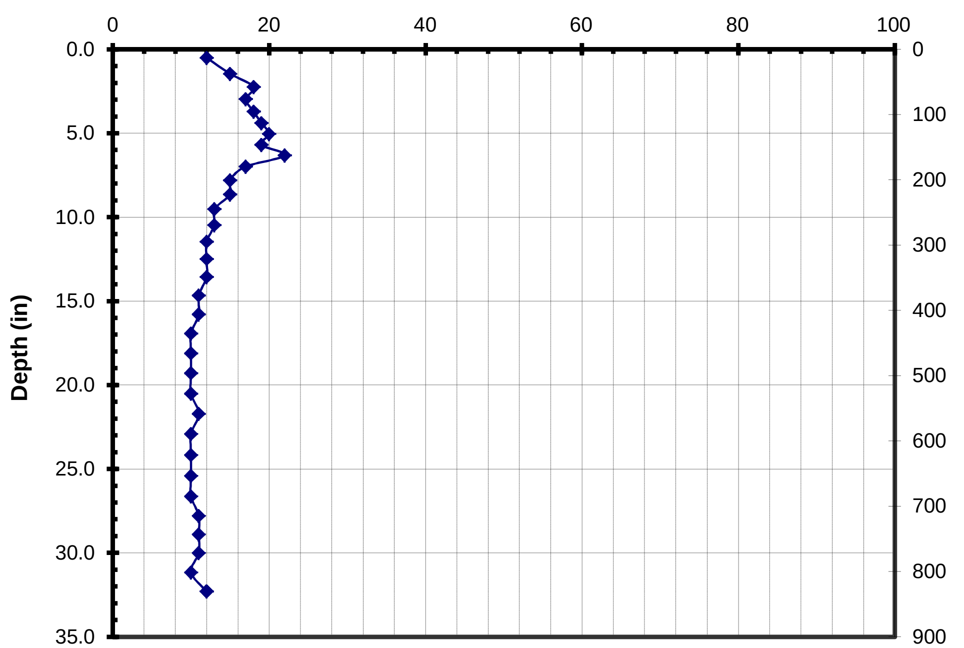
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	33
Average CBR	n/a	Average CBR	13
Weighted Average	n/a	Weighted Average	13
Max CBR	n/a	Max CBR	22
Min CBR	n/a	Min CBR	10

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-7 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 12

Test Data

No. of Blows	Cummulative Penetration (mm)
1	10
1	15
1	19
5	26
5	33
5	41
5	48
82	120
5	129
5	136
5	147
5	158
5	172
5	185
3	233
3	268
3	299
3	327
3	355
3	382
3	411
3	438
3	465
3	492
3	518
3	544
3	568
3	593
3	618
3	645
3	663
3	687
3	714
3	742

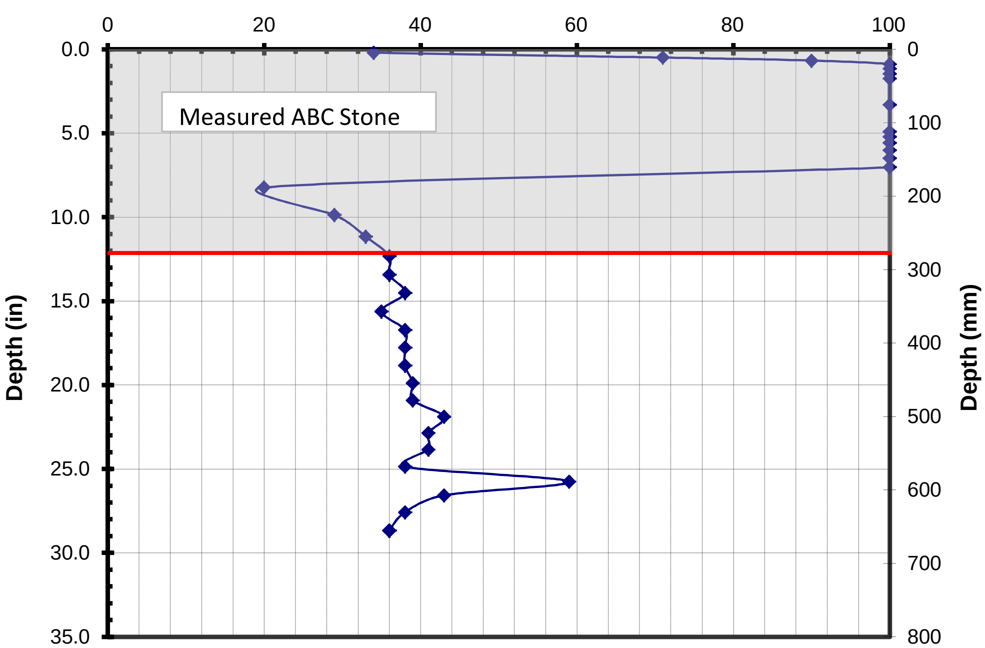
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	17	# Values	17
Average CBR	81	Average CBR	40
Weighted Average	69	Weighted Average	39
Max CBR	100	Max CBR	59
Min CBR	20	Min CBR	35

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-8 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 13

Test Data

No. of Blows	Cummulative Penetration (mm)
1	5
5	15
5	26
5	32
63	110
5	123
5	136
5	152
3	164
1	170
1	178
1	189
1	203
1	220
1	235
1	248
1	261
2	287
2	310
2	332
2	354
2	375
2	397
2	418
2	439
2	460
2	480
2	500
2	519
2	540
2	561
2	581
2	602
2	623
2	644
2	664
2	685
2	706
2	727
2	748
2	769

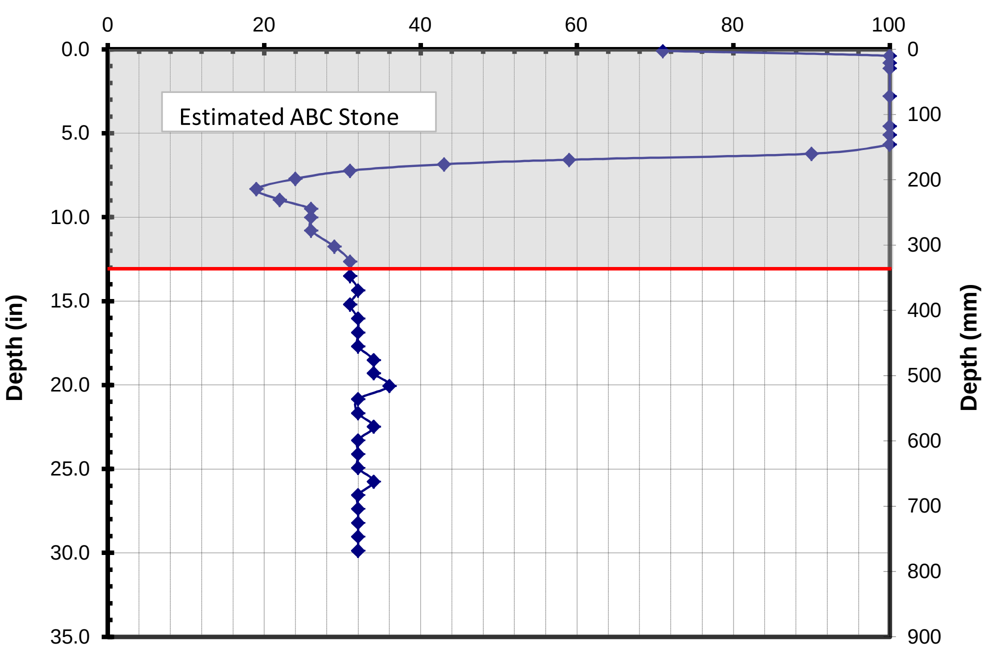
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	20	# Values	21
Average CBR	60	Average CBR	32
Weighted Average	63	Weighted Average	32
Max CBR	100	Max CBR	36
Min CBR	19	Min CBR	31

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-9 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	30
1	60
1	91
1	128
1	162
1	183
1	203
1	223
1	241
1	258
1	275
1	292
1	310
1	327
1	347
1	364
1	380
1	396
1	415
1	434
1	458
1	482
1	506
1	528
1	555
1	581
1	608
1	634
1	661
1	683
1	704
1	727
1	746
1	766
1	783
1	802
1	820
1	840
1	860

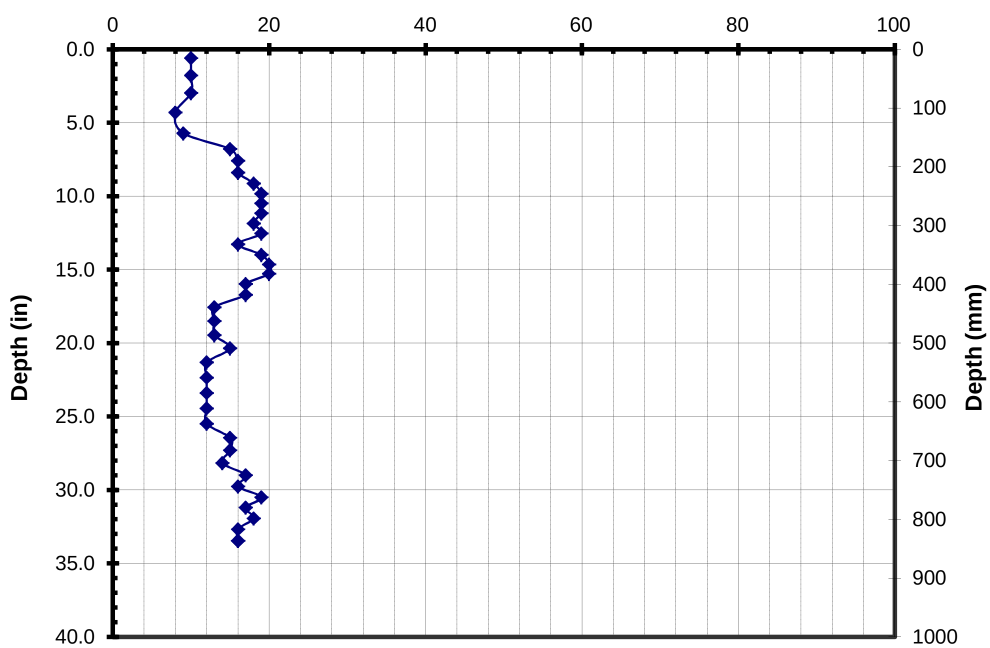
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	39
Average CBR	n/a	Average CBR	15
Weighted Average	n/a	Weighted Average	14
Max CBR	n/a	Max CBR	20
Min CBR	n/a	Min CBR	8

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-10 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	23
1	33
1	40
1	46
1	50
1	57
1	72
1	88
1	106
1	129
1	157
1	183
1	211
1	234
1	253
1	270
1	287
1	307
1	329
1	352
1	377
1	403
1	431
1	457
1	483
1	507
1	530
1	556
1	581
1	603
1	623
3	641
2	657
2	670
5	740
2	757
3	775
2	791
2	803
2	818
1	830
1	840

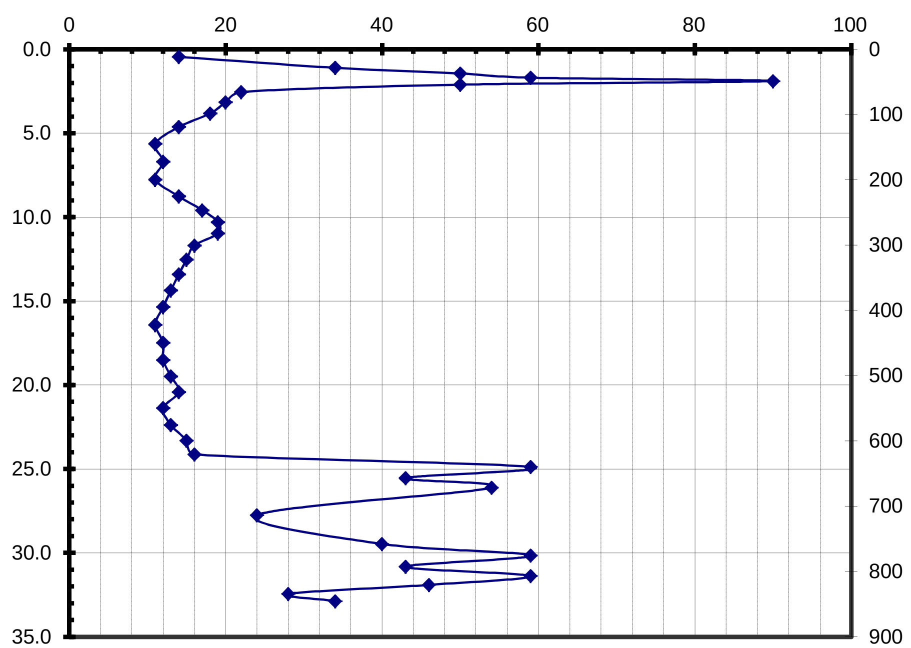
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	42
Average CBR	n/a	Average CBR	27
Weighted Average	n/a	Weighted Average	22
Max CBR	n/a	Max CBR	90
Min CBR	n/a	Min CBR	11

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-11 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	38
1	62
1	78
1	90
1	100
1	110
1	122
1	137
1	153
1	171
1	189
1	206
1	224
1	241
1	256
1	266
1	282
1	295
1	309
1	321
1	335
1	350
1	363
1	377
1	390
1	405
1	417
1	430
1	441
1	454
1	471
1	486
1	506
1	529
1	554
1	579
1	614
1	656
1	702
1	758
1	813
1	892

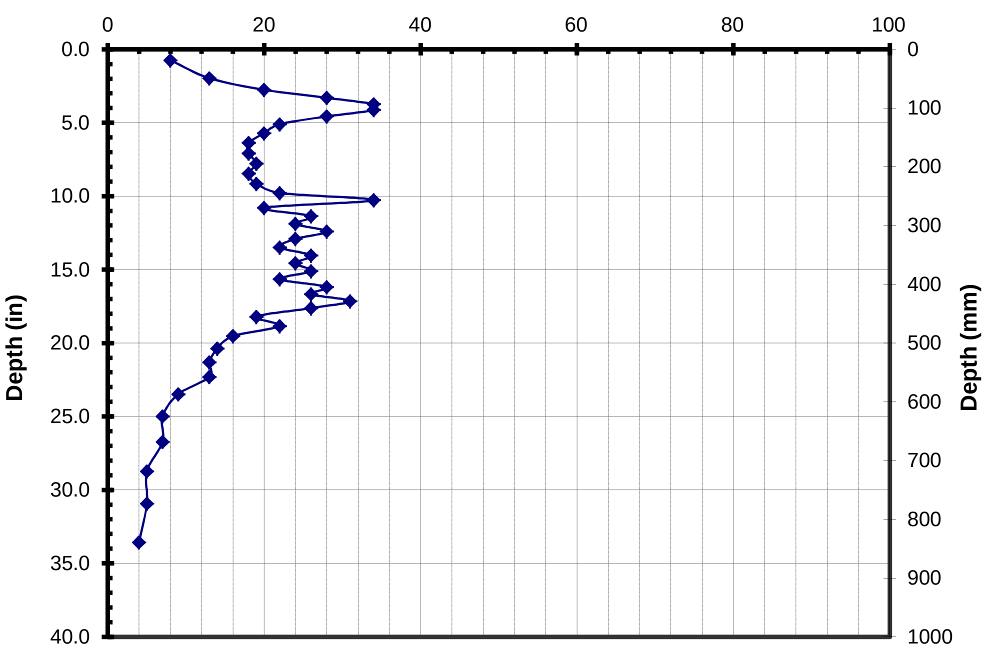
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	42
Average CBR	n/a	Average CBR	20
Weighted Average	n/a	Weighted Average	15
Max CBR	n/a	Max CBR	34
Min CBR	n/a	Min CBR	4

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-12 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 4

Test Data

No. of Blows	Cummulative Penetration (mm)
1	7
2	12
5	17
5	22
5	28
5	33
5	39
5	45
5	48
5	55
5	69
5	90
4	113
1	122
1	142
1	172
1	200
1	223
1	246
1	266
1	286
1	302
1	320
1	336
1	352
1	369
1	400
2	432
1	463
1	493
1	521
1	555
1	588
1	626
1	659
1	694
1	729

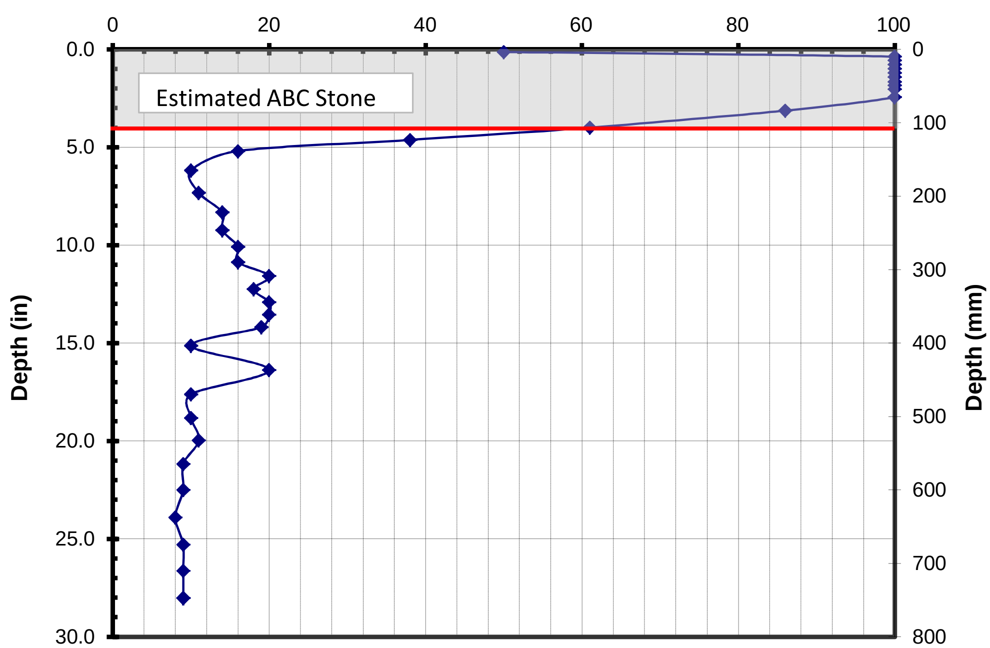
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	13	# Values	24
Average CBR	92	Average CBR	14
Weighted Average	86	Weighted Average	13
Max CBR	100	Max CBR	38
Min CBR	50	Min CBR	8

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-13 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 7.25

Test Data

No. of Blows	Cummulative Penetration (mm)
1	11
1	17
1	20
1	26
1	29
3	42
5	50
5	60
5	66
5	76
5	83
5	89
5	96
5	101
5	106
5	113
5	120
5	128
5	133
5	140

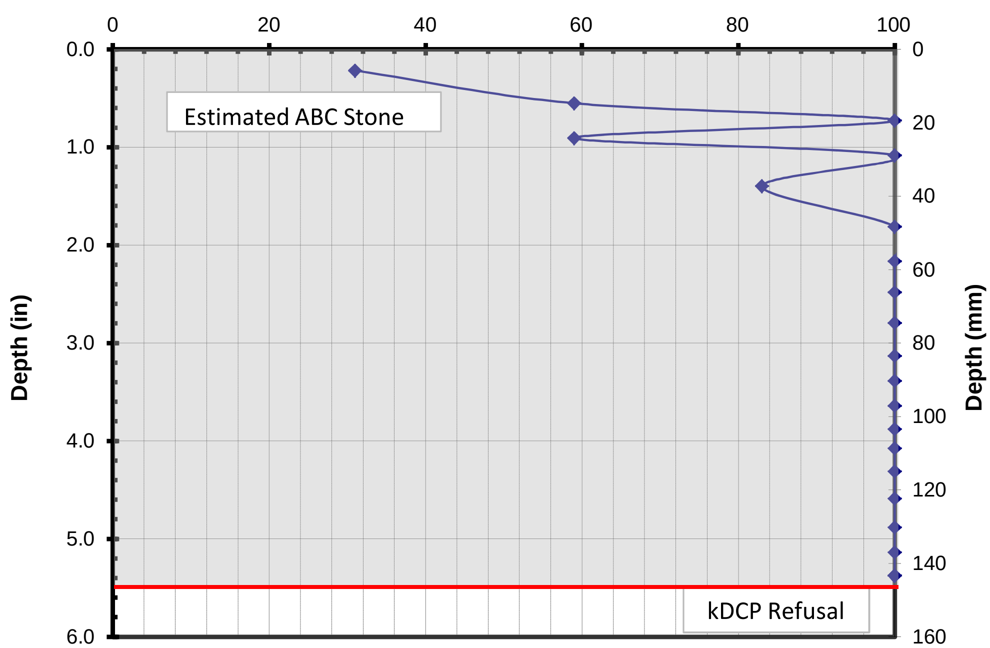
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	20	# Values	n/a
Average CBR	92	Average CBR	n/a
Weighted Average	89	Weighted Average	n/a
Max CBR	100	Max CBR	n/a
Min CBR	31	Min CBR	n/a

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-14 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	50
1	83
1	113
1	136
1	152
1	165
1	181
1	193
1	203
1	213
1	228
1	247
1	264
1	278
1	292
1	304
1	315
1	329
1	343
1	360
1	378
1	390
1	408
1	428
1	444
1	463
1	485
1	503
1	522
1	542
1	560
1	580
1	605
1	625
1	645
1	689
1	706
1	725
1	743
1	761
1	773
2	810

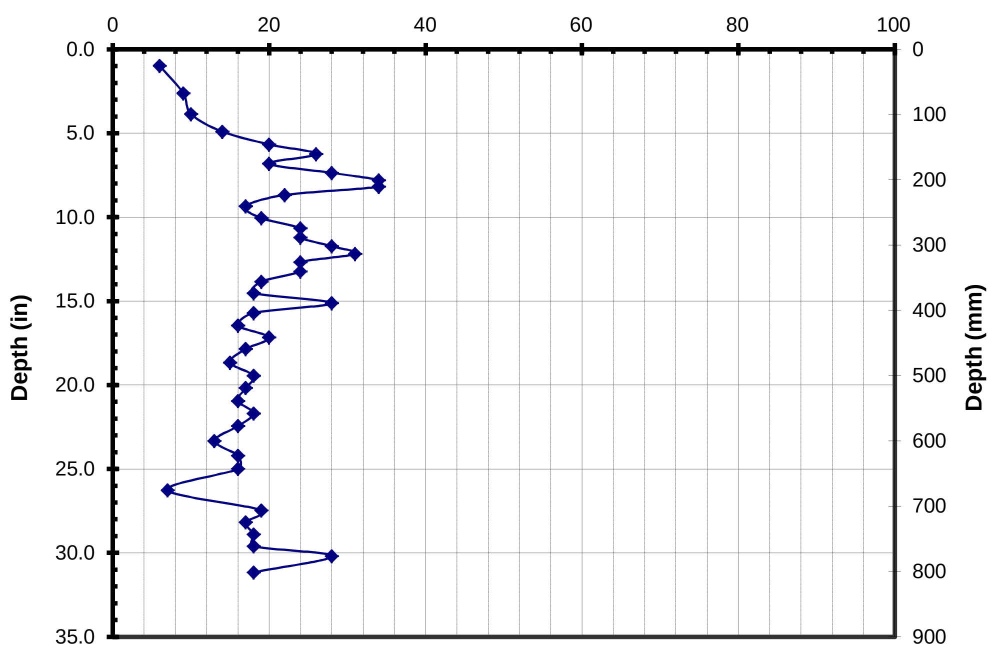
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al 1989)
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	42
Average CBR	n/a	Average CBR	20
Weighted Average	n/a	Weighted Average	17
Max CBR	n/a	Max CBR	34
Min CBR	n/a	Min CBR	6

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-15 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

No. of Blows	Cummulative Penetration (mm)
1	100
1	139
1	174
1	217
1	256
1	285
1	319
1	347
1	373
1	391
1	409
1	443
1	474
1	503
1	538
1	582
1	632
1	691
1	735
1	773
1	807
1	839

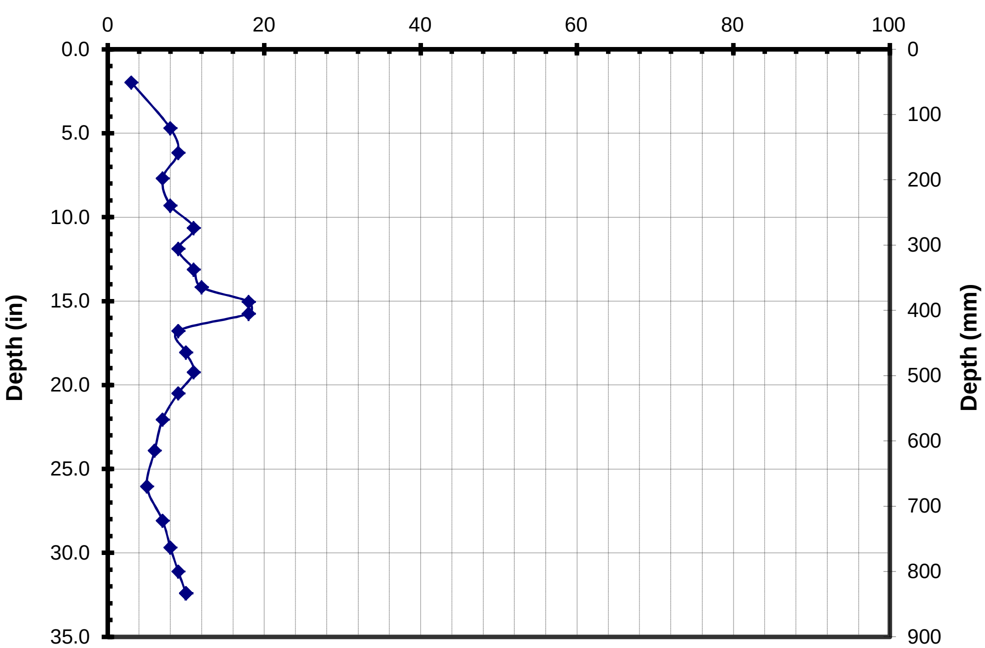
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	22
Average CBR	n/a	Average CBR	9
Weighted Average	n/a	Weighted Average	8
Max CBR	n/a	Max CBR	18
Min CBR	n/a	Min CBR	3

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-16 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 9

Test Data

No. of Blows	Cummulative Penetration (mm)
1	5
1	9
5	17
5	27
5	37
5	47
5	57
5	65
5	75
5	82
5	91
5	100
5	108
5	118
5	128
5	138
5	154
5	167
5	181
5	194
5	207
5	223
5	247
2	269
1	286
1	308
1	337
1	378
1	408
1	440
1	468
1	498
1	530
1	555
1	573
1	589
3	631
3	672
3	718
3	768
1	783
1	800

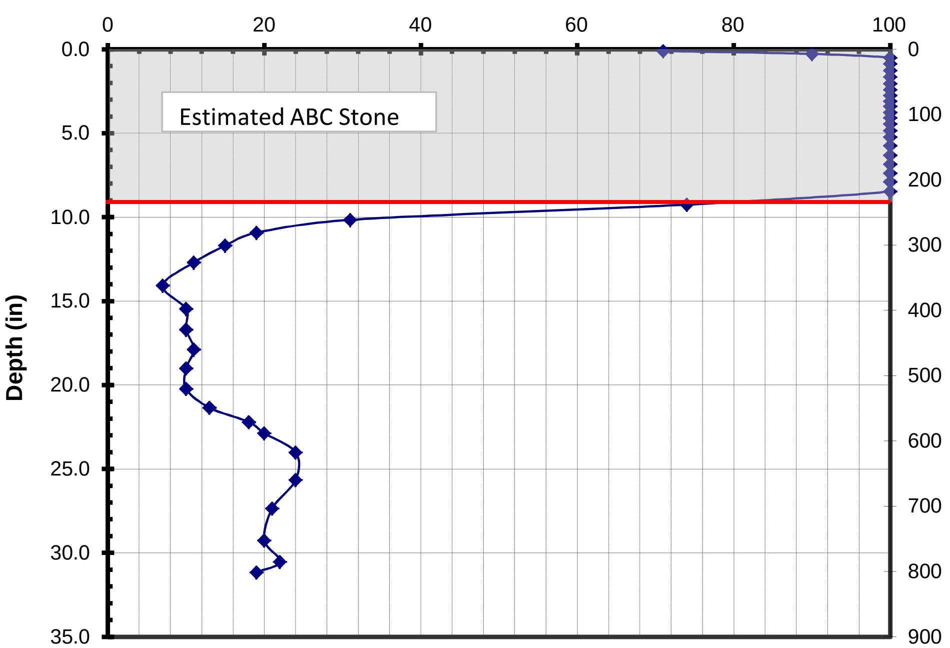
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	22	# Values	20
Average CBR	98	Average CBR	19
Weighted Average	99	Weighted Average	19
Max CBR	100	Max CBR	74
Min CBR	71	Min CBR	7

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-17 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data	
No. of Blows	Cummulative Penetration (mm)
1	34
1	73
1	106
1	140
1	172
1	199
1	224
1	246
1	269
1	294
1	320
1	348
1	376
1	404
1	431
1	458
1	484
1	511
1	538
1	563
1	589
1	615
1	642
1	668
1	693
1	718
1	745
1	771
1	798
1	823
1	849
1	874

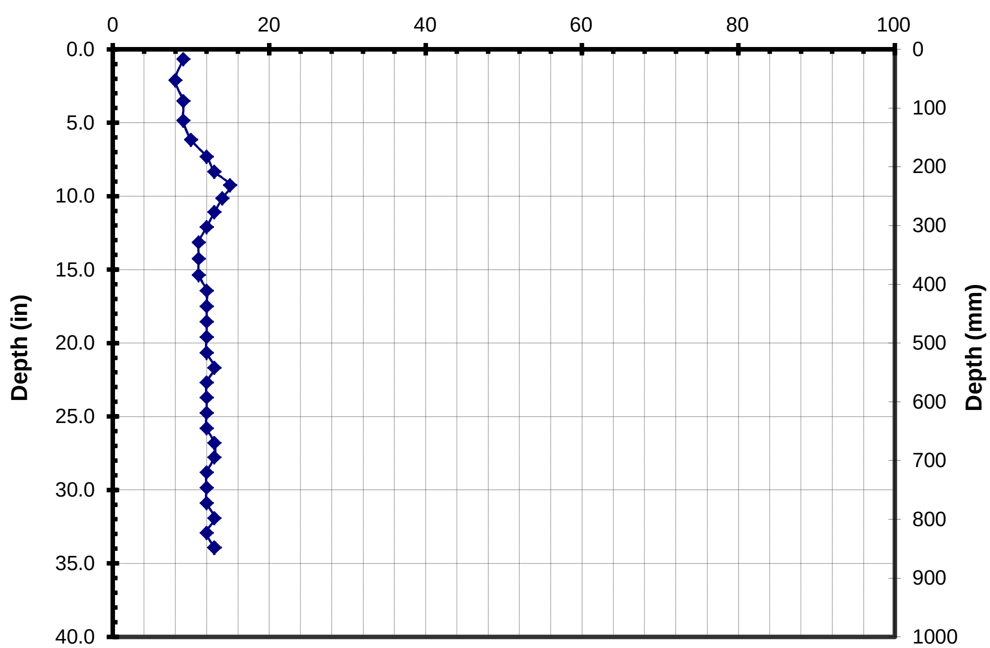
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	32
Average CBR	n/a	Average CBR	12
Weighted Average	n/a	Weighted Average	12
Max CBR	n/a	Max CBR	15
Min CBR	n/a	Min CBR	8

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-18 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 8

Test Data

No. of Blows	Cummulative Penetration (mm)
1	11
1	19
1	24
3	36
2	43
3	52
5	65
5	76
5	88
5	99
5	110
5	120
5	131
5	141
5	151
5	161
5	172
5	187
5	206
3	240
3	290
3	334
3	372
3	410
3	447
3	480
3	512
3	541
3	565
3	591
3	615
3	640
3	663
3	688
3	710
3	731
3	753
1	761

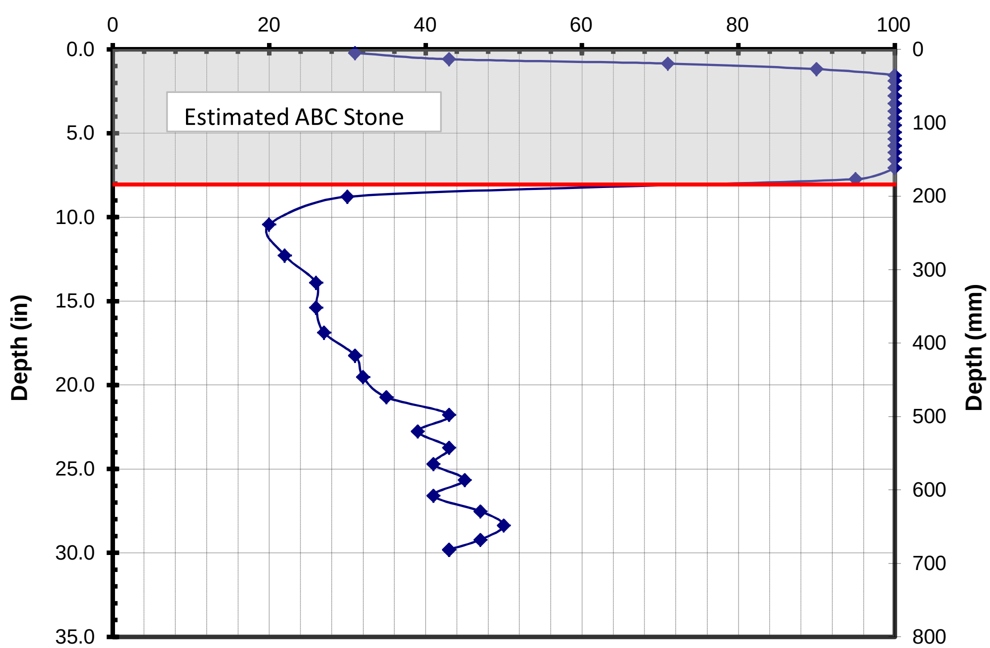
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	19	# Values	19
Average CBR	91	Average CBR	36
Weighted Average	92	Weighted Average	34
Max CBR	100	Max CBR	50
Min CBR	31	Min CBR	20

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

KESSLER DCP TEST RESULTS

Project Name: S Trade Street Widening
S&ME Project No.: 1351-13-123

Test Location: B-19 **Date:** 9/20/2013 **Personnel:** MIK
Thickness of Stone (in): 0

Test Data

No. of Blows	Cummulative Penetration (mm)
1	61
1	109
1	142
1	175
1	211
1	255
1	297
1	334
1	366
1	402
1	434
1	465
1	498
1	533
1	565
1	600
1	638
1	678
1	714
1	748
1	780
1	811
1	841
1	866
1	893
1	917

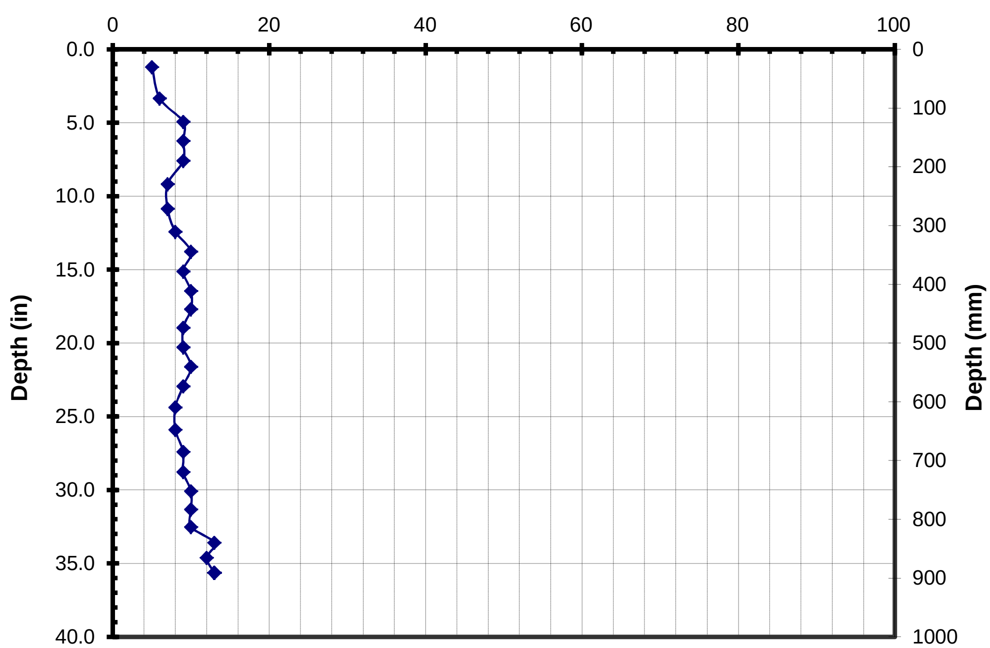
CBR - DCP Correlation for Soil Subgrade

- (●) North Carolina Department of Transportation (Shin, et al
- ( ) U.S. Army Corps of Engineers (Webster, et al 1992)
- ( ) Piedmont Residual Soils (Coonse 1999)

Test Summary

Stone		Soil Subgrade	
# Values	n/a	# Values	26
Average CBR	n/a	Average CBR	9
Weighted Average	n/a	Weighted Average	9
Max CBR	n/a	Max CBR	13
Min CBR	n/a	Min CBR	5

Estimated Field CBR Value*



* Stone Field CBR estimated using published NCDOT relationship.
Subgrade Field CBR estimated using relationship indicated above.

Laboratory Testing Procedures

S. Trade Street Widening
Matthews, North Carolina
S&ME Project No. 1351-13-123

Moisture Content

The moisture content is the percentage of water in a soil sample determined by dividing the weight of water in a given mass of soil by the weight of the solid particles. The moisture content can exceed 100 percent if there is more water than solid particles by weight in a soil sample. This test was conducted in general accordance with AASHTO T-265.

Soil Plasticity Tests (Atterberg Limits Tests)

A representative soil sample was selected for Atterberg Limits testing to determine the plasticity characteristics of the soil. The Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid and the Plastic Limit is the moisture content at which the soil begins to lose its plasticity. These tests were conducted in accordance with AASHTO T-89 and T-90.

Grain Size Distribution Tests

The grain size distribution testing was performed to determine the particle size and distribution of the soil sample. To perform the test, the sample was dried and weighed, and for non-hydrometer analysis, washed over a No. 200 mesh sieve. The dried sample was then passed through a standard set of nested sieves to determine the grain size distribution of the soil particles coarser than the No. 200 sieve. The grain size distribution of soils coarser than a No. 200 sieve was determined by passing the samples through a set of nested sieves. This test was conducted in general accordance with AASHTO T-88.

Laboratory Testing Procedures

S. Trade Street Widening
Matthews, North Carolina
S&ME Project No. 1351-13-123

Standard Proctor Compaction Test

Laboratory compaction testing was conducted on a bulk sample obtained from the cuttings of a soil test boring. To perform the compaction test, the soil was compacted at several different moisture contents with a standard compactive effort in accordance with the Standard Proctor compaction test procedure (AASHTO T-99) to determine compaction characteristics including maximum dry density and optimum moisture content.

California Bearing Ratio

The CBR test is a measure of the bearing properties of a soil sample compacted in the laboratory at a given dry density and moisture condition. A bulk sample was compacted to a specified density in accordance with the Standard Proctor compaction test procedure. The compacted soil sample was saturated for a period of 96 hours and then a 1.95-inch diameter piston was pushed into the compacted sample. During the penetration test, the load on the piston and the corresponding deflection of the soil were recorded. The test results were then plotted graphically and corrected for curve non-linearity. The corrected unit load at 0.1 inch penetration was divided by 100 to give the CBR value as a percentage. The CBR testing was conducted in general accordance with AASHTO T-193.

SUMMARY OF LABORATORY TEST DATA

Boring No.	Sample Depth (ft)	Sample Number *	AASHTO Classification	Natural Moisture Content (%)	% Finer No. 200	Atterberg Limits			Proctor Data		CBR (%)
						LL	PL	PI	Max. Dry Density (pcf)	Opt. Moisture Content (%)	
B-5	0.5 - 10	BAG-1	A-7-5	29.8	85.8	53	36	17	91.2	27.2	6.7
B-7	1 - 2.5	SS-1	A-7-5	17.8	78.6	51	30	21			
B-11	0.5 - 1	S-1	A-7-6	21.6	74.1	44	27	17			
B-17	0.5 - 3	BAG-1	A-5	18.2	69.2	46	39	7	97.9	21.6	5.0

Note: Graphic Presentations of Results of Proctor, Grain Size, and other tests follow this summary

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

Job Name: S. Trade Street Widening
Job Location: Matthews, North Carolina
Job Number: 1351-13-123

* SS = Split Spoon Sample (ASTM D-1586)
S = Hand Auger Sample
BAG= Bulk Sample

Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

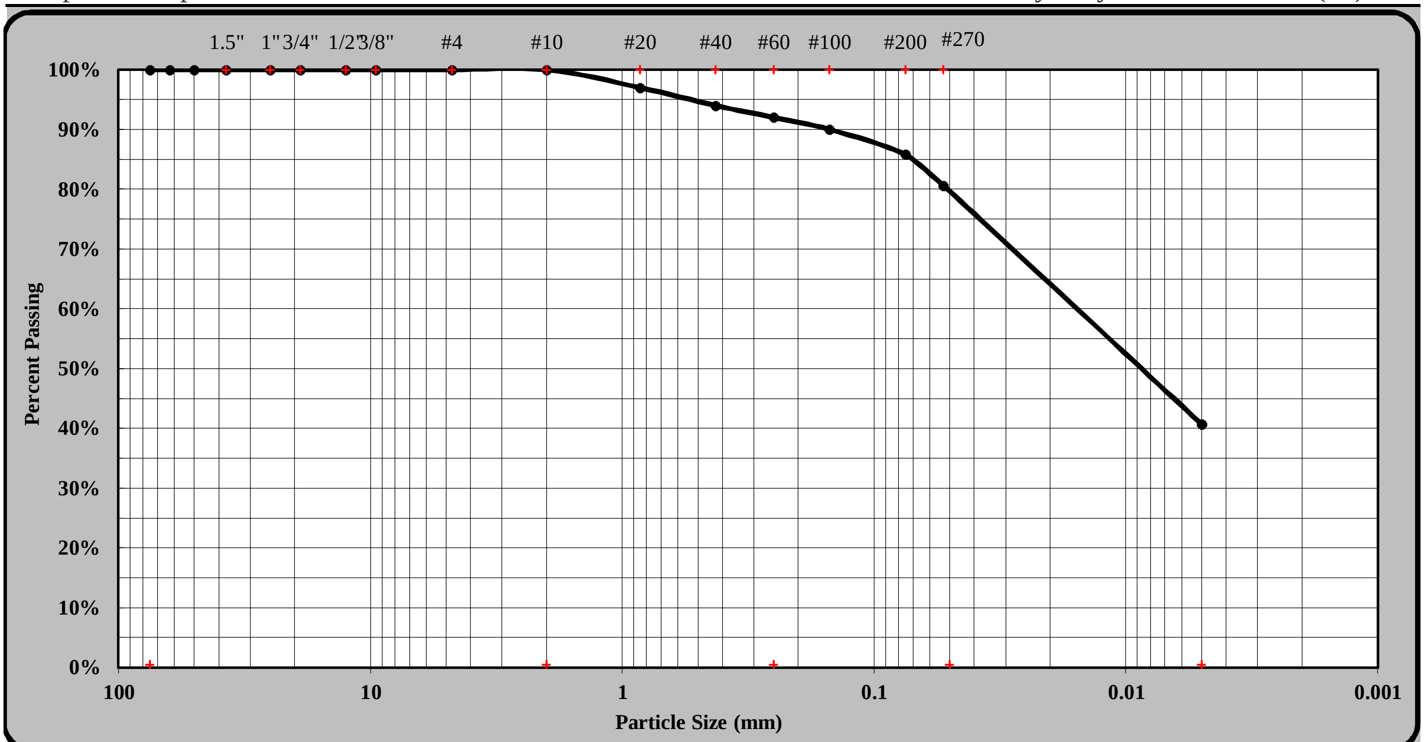
Particle Size Analysis of Soils

AASHTO T88 as Modified by NCDOT

S&ME *Quality Assurance*

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	1351-13-123	Report Date:	10/18/13
Project Name:	S. Trade Street Widening	Test Date(s):	10/14 - 10/18/13
State Project #:	F.A. Project No:	TIP NO:	
Client Name:			
Address:			
Boring #: B-5	Sample #: BAG-1	Sample Date:	9/24/13
Location: Site Borehole	Offset: N/A	Depth (ft):	0.5 - 10 ft.
Sample Description:	Brown Coarse to Fine Sandy Silty CLAY	A-7-5	(18)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#10	Coarse Sand	8%	Silt	40%
Gravel		Fine Sand	11%	Clay	41%
Apparent Relative Density	ND	Moisture Content	29.8%	% Passing #200	85.8%
Liquid Limit	53	Plastic Limit	36	Plastic Index	17

Soil Mortar (-#10 Sieve)

Coarse Sand	8%	Fine Sand	11%	Silt	40%	Clay	41%

Description of Sand & Gravel Particles:		Rounded	☐	Angular	☐
Hard & Durable	☐	Soft	☐	Weathered & Friable	☐

References / Comments / Deviations: ND=Not Determined.

Mal Krajan, ET	104-01-0703	Laboratory Manager	________
Technician Name	*Certification No.*	*Position*	*Date*
Mal Krajan, ET	________________	Laboratory Manager	________
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

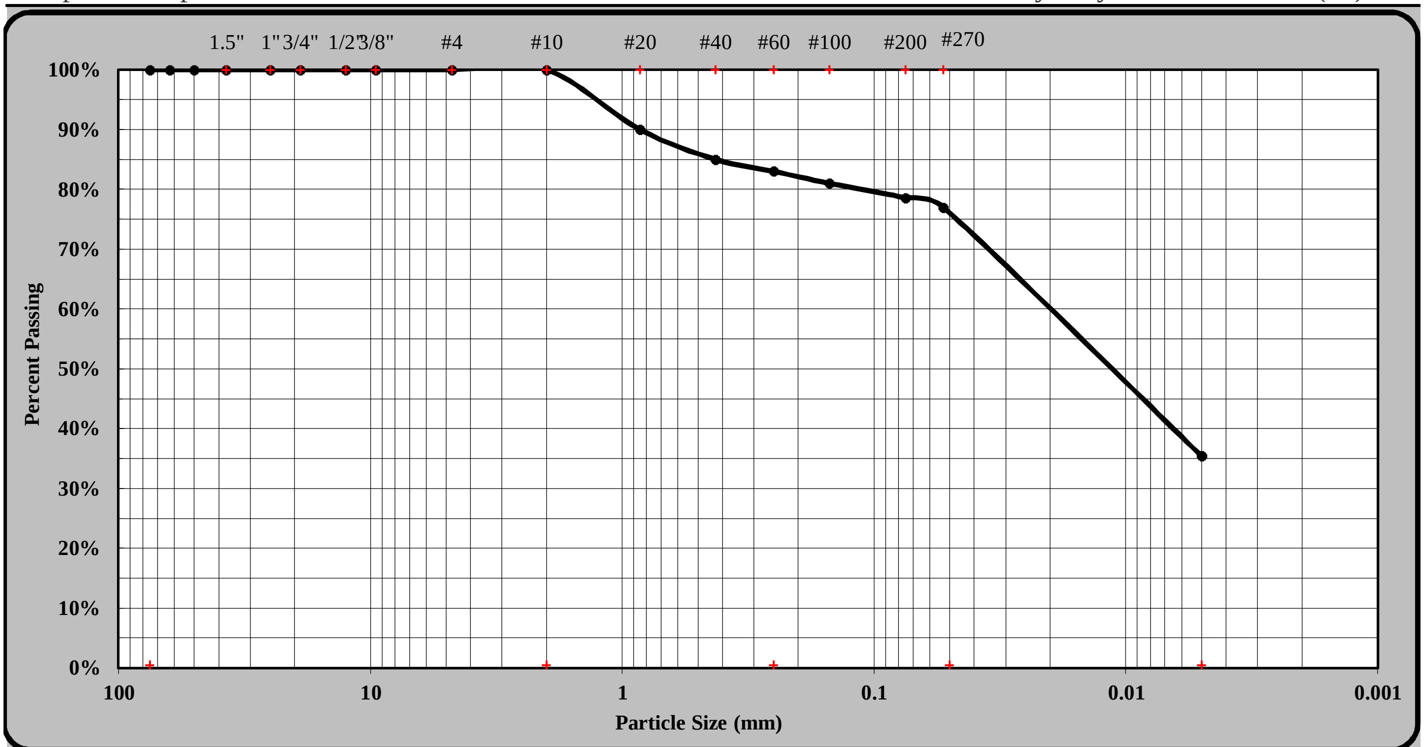
Particle Size Analysis of Soils

AASHTO T88 as Modified by NCDOT

S&ME
Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	1351-13-123			Report Date:	10/18/13
Project Name:	S. Trade Street Widening			Test Date(s):	10/14 - 10/18/13
State Project #:		F.A. Project No:		TIP NO:	
Client Name:					
Address:					
Boring #:	B-7	Sample #:	SS-1	Sample Date:	9/25/13
Location:	Site Borehole	Offset:	N/A	Depth (ft):	1 - 2.5 ft.
Sample Description:			Brown Fine to Coarse Sandy Silty CLAY	A-7-5	(18)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#10	Coarse Sand	17%	Silt	42%
Gravel		Fine Sand	6%	Clay	35%
Apparent Relative Density	ND	Moisture Content	17.8%	% Passing #200	78.6%
Liquid Limit	51	Plastic Limit	30	Plastic Index	21

Soil Mortar (-#10 Sieve)

Coarse Sand	17%	Fine Sand	6%	Silt	42%	Clay	35%

Description of Sand & Gravel Particles:		Rounded	☐	Angular	☐
Hard & Durable	☐	Soft	☐	Weathered & Friable	☐

References / Comments / Deviations: ND=Not Determined.

Mal Krajan, ET	104-01-0703	Laboratory Manager	________
Technician Name	*Certification No.*	*Position*	*Date*
Mal Krajan, ET	____________________	Laboratory Manager	________
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

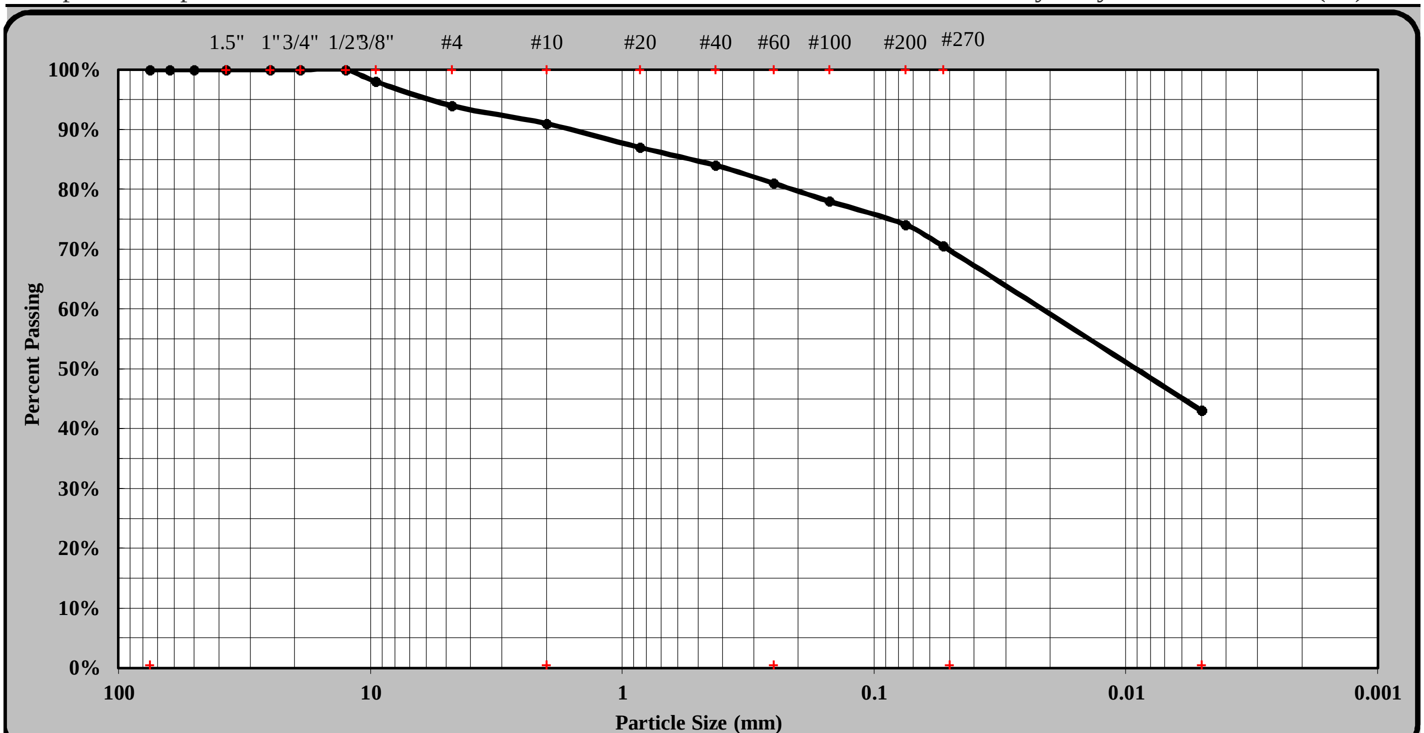
Particle Size Analysis of Soils

AASHTO T88 as Modified by NCDOT

S&ME
Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	1351-13-123			Report Date:	10/18/13
Project Name:	S. Trade Street Widening			Test Date(s):	10/14 - 10/18/13
State Project #:		F.A. Project No:		TIP NO:	
Client Name:					
Address:					
Boring #:	B-11	Sample #:	S-1	Sample Date:	9/25/13
Location:	Site Borehole	Offset:	N/A	Depth (ft):	0.5 - 1 ft.
Sample Description:			Red-Brown Coarse to Fine Sandy Silty CLAY	A-7-6	(13)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	1/2"	Coarse Sand	10%	Silt	28%
Gravel	9%	Fine Sand	11%	Clay	43%
Apparent Relative Density	ND	Moisture Content	21.6%	% Passing #200	74.1%
Liquid Limit	44	Plastic Limit	27	Plastic Index	17

Soil Mortar (-#10 Sieve)

Coarse Sand	11%	Fine Sand	12%	Silt	30%	Clay	47%

Description of Sand & Gravel Particles:		Rounded	☐	Angular	☐
Hard & Durable	☐	Soft	☐	Weathered & Friable	☐

References / Comments / Deviations: ND=Not Determined.

Mal Krajan, ET	104-01-0703	Laboratory Manager	________
Technician Name	*Certification No.*	*Position*	*Date*
Mal Krajan, ET	________________	Laboratory Manager	________
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-T88
Revision No. 0
Revision Date: 12/20/09

Particle Size Analysis of Soils

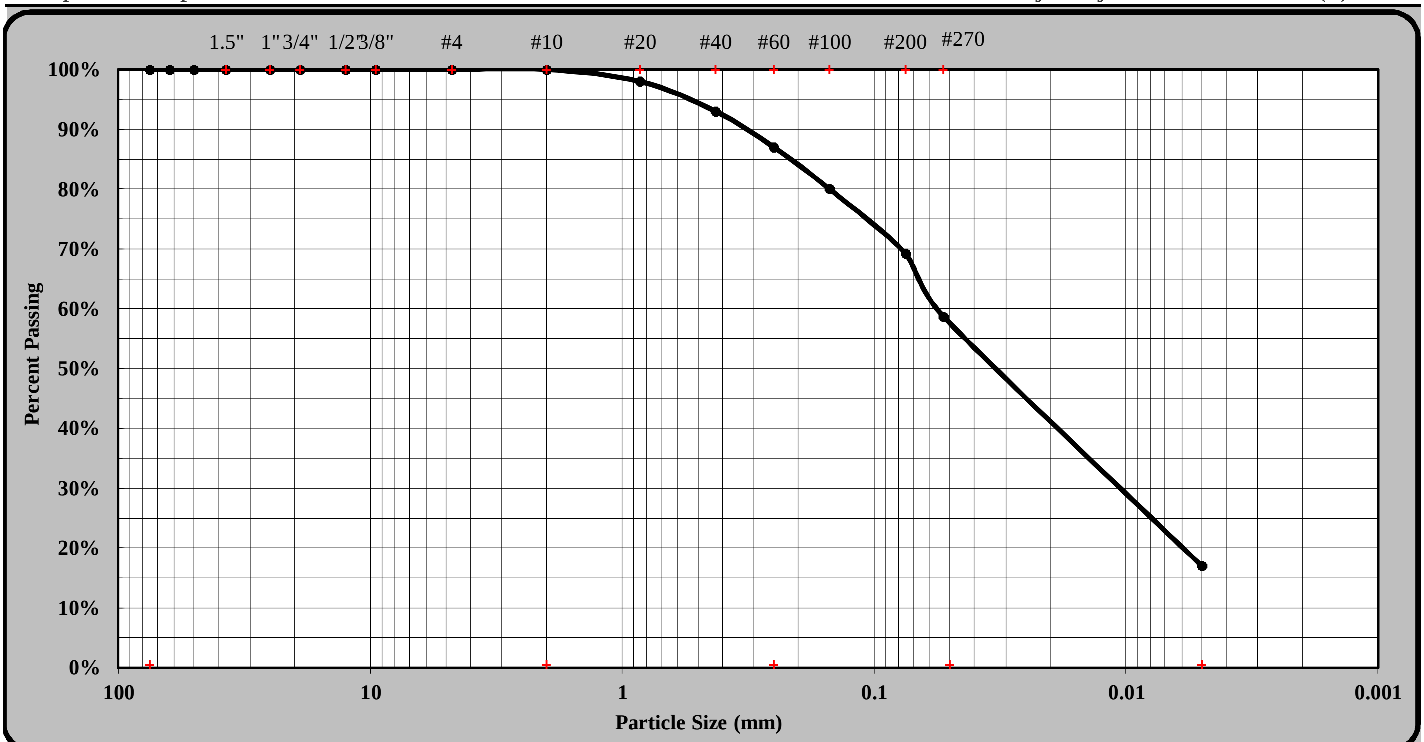
AASHTO T88 as Modified by NCDOT

S&ME
Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

S&ME Project #:	1351-13-123	Report Date:	10/18/13
Project Name:	S. Trade Street Widening	Test Date(s):	10/14 - 10/18/13
State Project #:	F.A. Project No:	TIP NO:	
Client Name:			
Address:			

Boring #:	B-17	Sample #:	BAG-1	Sample Date:	9/25/13
Location:	Site Borehole	Offset:	N/A	Depth (ft):	0.5 - 3 ft.
Sample Description:			Brown Coarse to Fine Sandy Silty CLAY	A-5	(6)



As Defined by NCDOT		Fine Sand	< 0.25 mm and > 0.05 mm
Gravel	< 75 mm and > 2.00 mm	Silt	< 0.05 and > 0.005 mm
Coarse Sand	< 2.00 mm and >0.25 mm	Clay	< 0.005 mm

Maximum Particle Size	#10	Coarse Sand	13%	Silt	42%
Gravel		Fine Sand	28%	Clay	17%
Apparent Relative Density	ND	Moisture Content	18.2%	% Passing #200	69.2%
Liquid Limit	46	Plastic Limit	39	Plastic Index	7

Soil Mortar (-#10 Sieve)

Coarse Sand	13%	Fine Sand	28%	Silt	42%	Clay	17%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐
Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

References / Comments / Deviations: ND=Not Determined.

Mal Krajan, ET	104-01-0703	Laboratory Manager	________
Technician Name	*Certification No.*	*Position*	*Date*
Mal Krajan, ET	____________________	Laboratory Manager	________
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-T99-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

S&ME Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

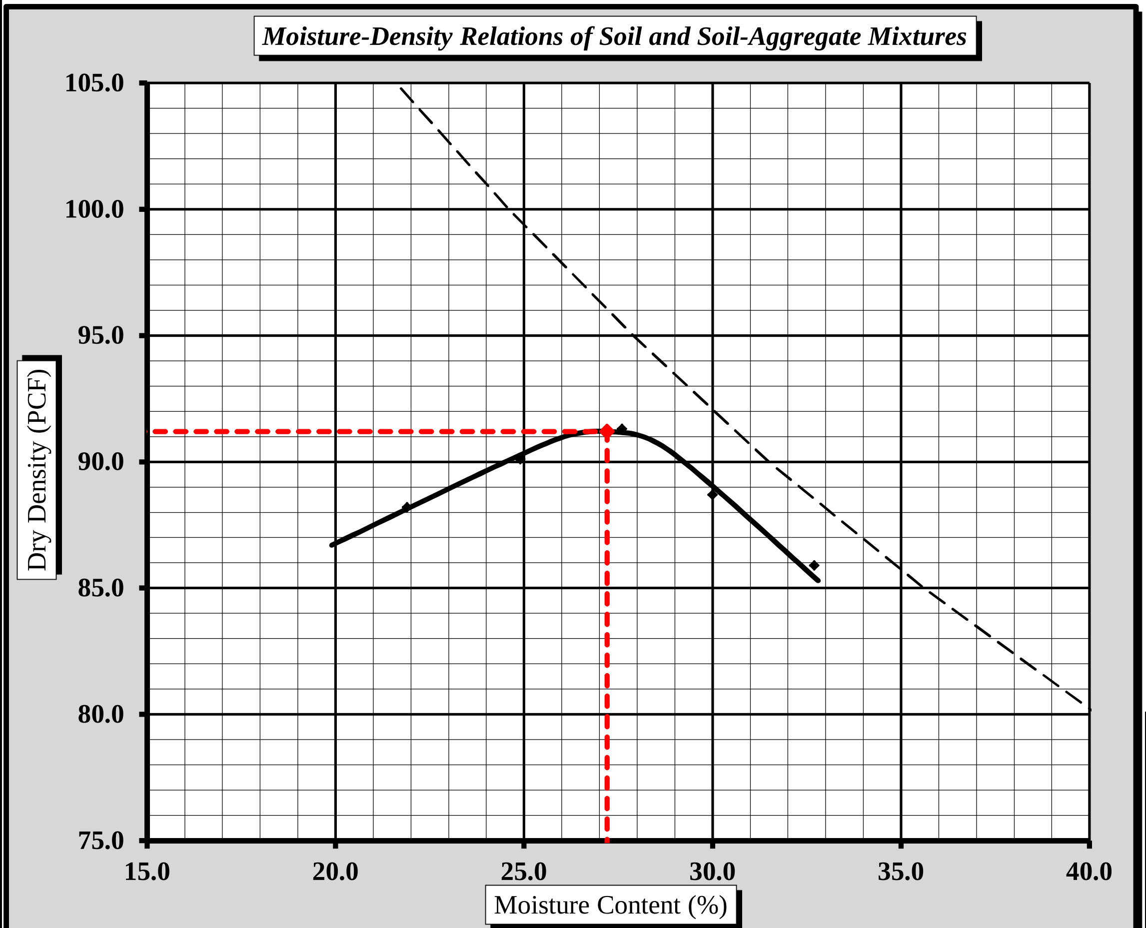
S&ME Project #:	1351-13-123	Report Date:	10/16/13
Project Name:	S. Trade Street Widening	Test Date(s):	10/11 - 10/13/13
Client Name:			
Client Address:			

Boring #:	B-5	Sample #:	BAG-1	Sample Date:	9/24/2013
Location:	Site-Borehole	Offset:	N/A	Depth:	0.5 - 10 ft.

Sample Description: Brown Fine to Coarse Sandy Silty CLAY (A-7-5) (18)

Maximum Dry Density 91.2 PCF. Optimum Moisture Content 27.2%

AASHTO T99 - - Method A



Soil Properties	
Natural Moisture Content	29.8%
Assumed Specific Gravity	2.650
Liquid Limit	53
Plastic Limit	36
Plastic Index	17

% Passing	
3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	100.0%
#40	94.0%
#60	92.0%
#200	85.8%

Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

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

References / Comments / Deviations:

AASHTO T88: Particle Size Analysis of Soils
AASHTO T265: Laboratory Determination of Moisture Content of Soils
AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Mal Krajan, ET	104-01-0703	Laboratory Manager	
Technical Responsibility	*Certification #*	*Position*	*Date*

Form No. TR-D1833-T193-3
Revision No. 0
Revision Date: 2/6/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

S&ME

Quality Assurance

S&ME, Inc.Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	**1351-13-123**	Report Date:	10/19/13
Project Name:	S. Trade Street Widening	Test Date(s)	10/11 - 10/19/13
Client Name:			
Client Address:			

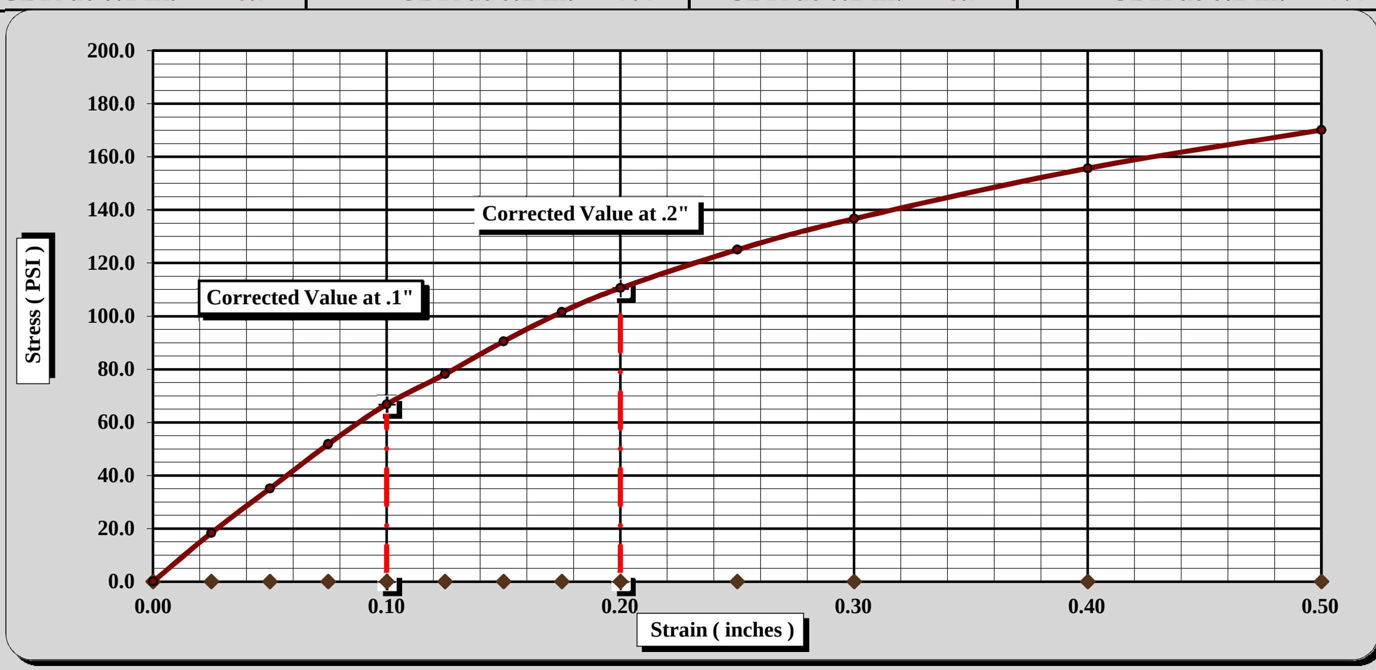
Boring #: B-5	Sample #: BAG-1	Sample Date: 9/24/13
Location:	Offset: N/A	Depth (ft): 0.5 - 10 ft.

Sample Description: Brown Coarse to Fine Sandy Silty CLAY (A-7-5) (18)

AASHTO T99 ***Method A*** Maximum Dry Density: **91.2** **PCF** Optimum Moisture Content: **27.2%**

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.	**6.7**	**CBR at 0.2 in.**	**7.4**	**CBR at 0.1 in.**	**6.7**	**CBR at 0.2 in.**	**7.4**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold.

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	60	Final Dry Density (PCF)	84.9
Initial Dry Density (PCF)	91.0	Average Final Moisture Content	32.0%
Moisture Content of the Compacted Specimen	27.1%	Moisture Content (top 1" after soaking)	35.2%
Percent Compaction	99.8%	Percent Swell	3.2%

Soak Time:	96-hr	Surcharge Weight	30.4	Surcharge Wt. per sq. Ft.	154.9
Liquid Limit	53	Plastic Index	17		

Notes/Deviations/References:

Test specimen compacted to 100% at opt. moisture.

Mal Krajan, ET	104-01-0703	Laboratory Manager	
Technical Responsibility	*Certification #*	*Position*	*Date*

Form No. TR-T99-2
Revision No. : 0
Revision Date: 11/21/07

Moisture - Density Report

S&ME

Quality Assurance

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

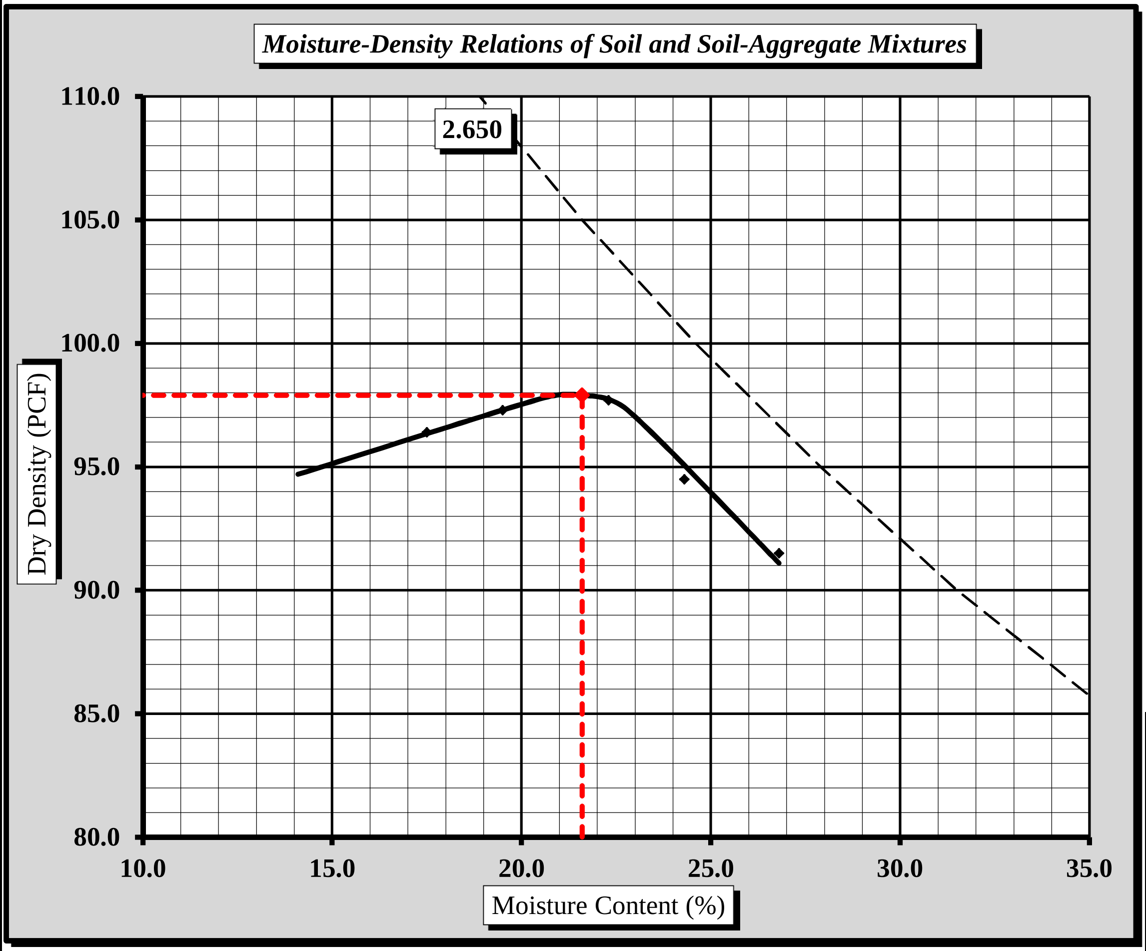
S&ME Project #:	**1351-13-123**	Report Date:	10/18/13
Project Name:	S. Trade Street Widening	Test Date(s):	10/11 - 10/13/13
Client Name:			
Client Address:			

Boring #:	B-17	Sample #:	BAG-1	Sample Date:	9/25/2013
Location:	Site-Borehole	Offset:	N/A	Depth:	0.5 - 3 ft.

Sample Description: Brown Coarse to Fine Sandy Silty CLAY (A-5) (6)

Maximum Dry Density 97.9 PCF. **Optimum Moisture Content 21.6%**

AASHTO T99 - - Method A



Soil Properties

Natural Moisture Content	**18.2%**
Assumed Specific Gravity	**2.650**
Liquid Limit	**46**
Plastic Limit	**39**
Plastic Index	**7**

% Passing

3/4"	100.0%
3/8"	100.0%
#4	100.0%
#10	100.0%
#40	93.0%
#60	87.0%
#200	58.7%

Oversize Fraction

Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

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

References / Comments / Deviations:

AASHTO T88: Particle Size Analysis of Soils
AASHTO T265: Laboratory Determination of Moisture Content of Soils
AASHTO T 99: Moisture-Density Relations of Soil Using a 5.5 Lb. Rammer and a 12" Drop

Mal Krajan, ET	104-01-0703	Laboratory Manager	
Technical Responsibility	*Certification #*	*Position*	*Date*

Form No. TR-D1833-T193-3
Revision No. 0
Revision Date: 2/6/08

CBR (California Bearing Ratio) of Laboratory Compacted Soil

AASHTO T 193

Quality Assurance

S&ME, Inc.Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	**1351-13-123**	Report Date:	10/19/13
Project Name:	S. Trade Street Widening	Test Date(s)	10/11 - 10/19/13
Client Name:			
Client Address:			

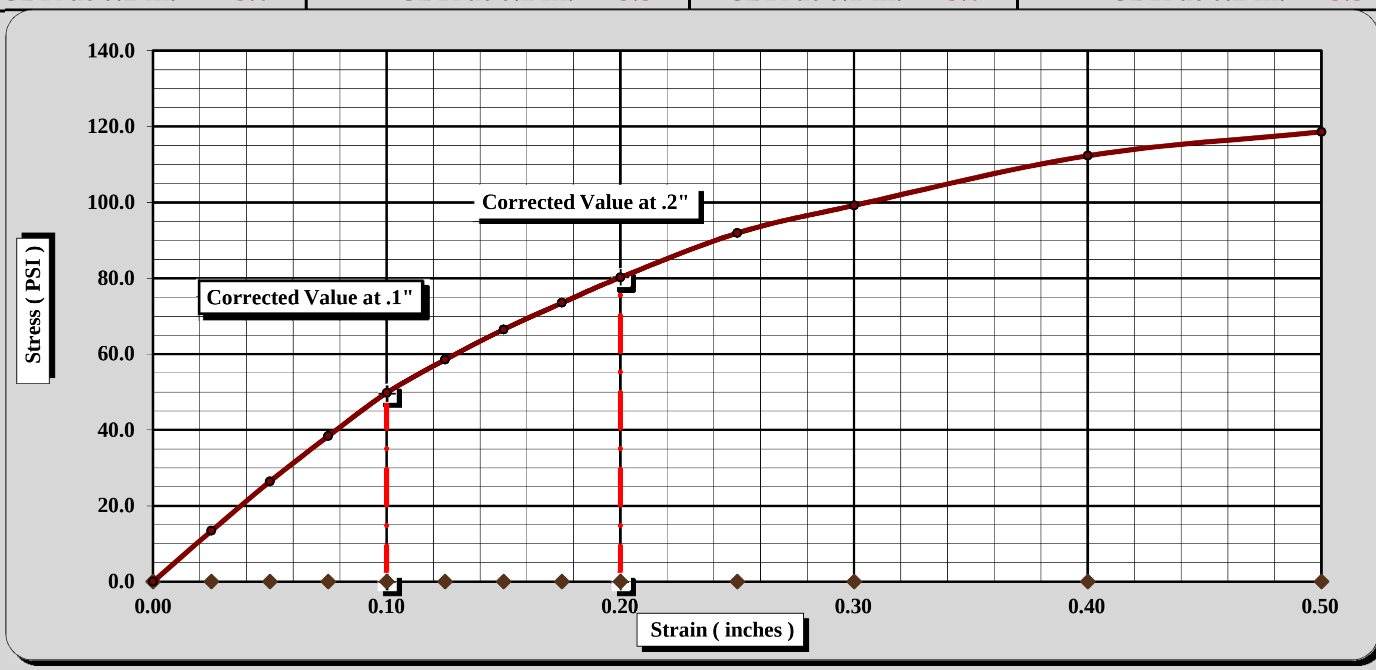
Boring #:	B-17	Sample #:	BAG-1	Sample Date:	9/25/13
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	0.5 - 3 ft.

Sample Description: Brown Coarse to Fine Sandy Silty CLAY (A-5) (6)

AASHTO T99 ***Method A*** Maximum Dry Density: **97.9** **PCF** Optimum Moisture Content: **21.6%**

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.	**5.0**	**CBR at 0.2 in.**	**5.3**	**CBR at 0.1 in.**	**5.0**	**CBR at 0.2 in.**	**5.3**



CBR Sample Preparation: *Performed on the fine fraction*

Grading was in accordance with the above method and compacted using the 6" diameter CBR mold.

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	60	Final Dry Density (PCF)	94.2
Initial Dry Density (PCF)	97.9	Average Final Moisture Content	25.9%
Moisture Content of the Compacted Specimen	21.8%	Moisture Content (top 1" after soaking)	28.6%
Percent Compaction	100.0%	Percent Swell	0.6%

Soak Time:	96-hr	Surcharge Weight	30.4	Surcharge Wt. per sq. Ft.	154.9
Liquid Limit	46	Plastic Index	7		

Notes/Deviations/References:

Test specimen compacted to 100% at opt. moisture.

Mal Krajan, ET	104-01-0703	Laboratory Manager	
Technical Responsibility	*Certification #*	*Position*	*Date*