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**SUBSURFACE EXPLORATION REPORT
INFILTRATION BASINS
I-95 BUSINESS / US 301 FROM NC 87 SOUTH TO NC 59
CUMBERLAND COUNTY, NORTH CAROLINA
WBS NO: 45849.1.FR1
TIP NO: W-5519
F.A. NO.: N/A**

S&ME Project No: 1305-15-073

Prepared for:



State of N.C. Department of Transportation
Division of Highways
Geotechnical Engineering Unit
1589 Mail Service Center
Raleigh, North Carolina 27699-1589

Prepared By:



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

July 27, 2015
S&ME, Inc. N.C. PE Firm License No. F-0176

July 27, 2015

State of N.C. Department of Transportation
Division of Highways
Geotechnical Engineering Unit
1589 Mail Service Center
Raleigh, North Carolina 27699-1589

Attention: Mr. Mohammed A. Mulla, P.E. CPM
Contract and Statewide Services Manager

Reference: Subsurface Exploration Report
Infiltration Basins
I-95 Business/US 301 from NC 87 South to NC 59
Cumberland County, North Carolina
WBS No: 45849.1.FR1
Tip No: W-5519
F.A. No: N/A
S&ME Project No: 1305-15-073

Dear Mr. Mulla:

S&ME, Inc. (S&ME) has completed the authorized subsurface exploration for the above referenced project. The purpose of our investigation was to explore subsurface conditions at the site and provide soil profile descriptions, elevation of the seasonal high groundwater table and in-situ saturated hydraulic conductivity testing. Our services were completed in general accordance with S&ME Proposal No.13-1500387 dated July 23, 2015. The North Carolina Department of Transportation (NCDOT) issued S&ME a verbal Notice to Proceed for our investigation July 16, 2015. This report presents the findings of the exploration. A hand auger boring location plan, soil profile descriptions, in-situ hydraulic conductivity test results, seasonal high water table elevations, are provided in the Appendix.

S&ME appreciates the opportunity to provide our professional services on this project. If you have any questions concerning information presented herein, please do not hesitate to contact us.

Respectfully submitted,

S&ME, Inc.



Not considered "FINAL" unless all signatures are completed.

Paul Masten, LSS
Soil Scientist
N.C. License Number 1329

Abner F. Riggs, Jr., PE
Senior Geotechnical Engineer
N.C. Registration Number 14155

PROJECT INFORMATION

On July 22, 2015, S&ME performed soil evaluations at 4 locations to assist NCDOT with design of stormwater best management practices (BMPs) associated with proposed roadway improvements to I-95 Business/US Highway 301 in Fayetteville, Cumberland County, North Carolina. NCDOT provided Mr. Abner Riggs, Jr., P.E. with S&ME coordinates for the test locations. All four of the test locations are located adjacent to existing roadways and are in the road median/shoulder with shallow, surface topsoil being the only fill observed.

Mr. Paul Masten, S&ME soil scientist, conducted an evaluation of the soils within the test areas identified by NCDOT. The soil scientist evaluation was conducted to evaluate the suitability of the soil properties relative to Stormwater Management permitted by the North Carolina Department of Environment and Natural Resources – Land Quality Section (NCDENR-LQS). S&ME visited the site on July 22, 2015 and performed the evaluation with hand auger borings at each test location to a depth of approximately 8 feet below the existing ground surface (bgs).

FIELD EXPLORATION

The soil scientist investigation was conducted to evaluate the seasonal high water table (SHWT) elevations and in-situ soil permeability rate (in-situ saturated hydraulic conductivity testing). S&ME personnel conducted four (4) in-situ saturated hydraulic conductivity (Ksat) tests on July 22, 2015 at field test locations identified by NCDOT.

Ksat measurements were performed with a compact constant-head permeameter. Hand augers were used to excavate soils for the SHWT evaluations and for the Ksat measurements.

SHWT AND KSAT TESTING RESULTS

Seasonal High Water Table (SHWT) Determination

The SHWT evaluations were performed by advancing hand auger borings to a depth of approximately 8 feet (bgs) at the proposed stormwater best management practice (BMP) areas. The locations of the SHWT evaluations were approximated in the field with a Trimble GeoXT handheld Global Positioning Unit on July 17, 2015. During the hand auger investigation, soils were evaluated by a Licensed Soil Scientist for evidence of SHWT influence. This evaluation involved observing the actual moisture content in the soil and observing the soil matrix and mottle colors. Depending on the soil texture, the soil color will indicate processes that are driven by seasonally high water table fluctuations, such as iron reduction and oxidation and organic matter staining.

SHWT evaluations are based on secondary evidence and not on direct groundwater level measurements. Groundwater levels fluctuate for numerous reasons and these findings do not indicate that groundwater levels have not or will not rise above the noted depths. The

attached roadway Plan Sheet No. 4, identifies the approximate SHWT test locations and Table 1 identifies the approximated SHWT depths.

Test locations IB-1 and IB-4 were located adjacent to the west of the southbound travel lanes of I-95 Business/US Highway 301. Test locations IB-2 and IB-3 were located east of the northbound travel lanes of I-95 Business/US Highway 301. Shallow topsoil surface fill was observed at each of the locations.

Test location IB-1 was located in the road median/shoulder on the west side of I-95 Business/US 301. Soils at IB-1 consisted of loamy sand topsoil (fill) from 0 to 3 inches underlain by four horizons of fine sand and loamy sand from 3 to 48 inches underlain by one horizon of sandy loam from 48 to 96 inches. The surface soil (fill) was identified with soil matrix Munsell colors of 10YR 3/2 (very dark grayish brown); the first subsurface horizon was 2.5Y 6/4 (light yellowish brown); the next subsurface horizon was 2.5Y 7/4 (pale yellow) with 10YR 5/6 (yellowish brown) and 2.5Y 6/3 (light yellowish brown) streaks; the next subsurface horizon was 2.5Y 6/4 (light yellowish brown); the next subsurface horizon was 2.5Y 6/6 (olive yellow); the next subsurface horizon was 10YR 5/6 (yellowish brown) with 2.5Y 6/3 (light yellowish brown) and 7.5YR 5/6 (strong brown) streaks. Evidence of a SHWT was observed not observed within 8 feet of the ground surface.

Test location IB-2 was located in the road median/shoulder on the east side of I-95 Business/US 301. Soils at IB-2 consisted of loamy sand topsoil (fill) from 0 to 4 inches underlain by fine sand from 4 to 33 inches and three horizons of sandy clay loam from 33 to 96 inches. The surface soil (fill) was identified with a soil matrix Munsell color of 10YR 3/2 (very dark grayish brown); the first subsurface horizon was 2.5Y 6/4 (light yellowish brown); the next horizon was 10YR 4/6 (yellowish brown); the next horizon was 7.5YR 5/8 (strong brown); the next horizon was 10YR 5/8 (yellowish brown) with 2.5YR 5/8 (red streaks). Evidence of a SHWT was not observed within 8 feet of the ground surface.

Test location IB-3 was located in the road median/shoulder on the east side of I-95 Business/US 301. Soils at IB-3 consisted of loamy sand topsoil (fill) from 0 to 5 inches. Soil beneath the fill consisted of fine sand from 5 to 37 inches, underlain by two horizons of sandy clay loam from 37 to 84 inches and sandy loam with plinthitic (dense, very hard) soil materials from 84 to 96 inches. The surface soil (fill) was identified with a soil matrix Munsell color of 10YR 3/2 (very dark grayish brown); the first subsurface horizon was 2.5Y 6/4 (light olive yellow); the next subsurface horizon was 10YR 4/6 (dark yellowish brown); the next two subsurface horizons were 10YR 5/8 (yellowish brown) with 10YR 6/2 (light brownish gray) redox depletions and 7/5YR 5/8 (strong brown) and 5YR 4/6 (red) redox concentrations. Evidence of a SHWT was observed at 43 inches below the ground surface.

Test location IB-4 was located in the road median/shoulder on the east side of I-95 Business/US 301. Soils at IB-4 consisted of loamy sand topsoil (fill) from 0 to 2 inches. Soil beneath the fill consisted of fine sand from 2 to 24 inches, underlain by two horizons

of sandy clay loam from 24 to 80 inches and sandy loam with plinthitic (dense, very hard) soil materials from 80 to 96 inches. The surface soil (fill) was identified with a soil matrix Munsell color of 10YR3/2 (very dark grayish brown); the first subsurface horizon was 2.5Y 6/4 (light olive yellow); the next subsurface horizon was 10YR 4/6 (dark yellowish brown); the next subsurface horizon was 10YR 5/6 (yellowish brown) with 10YR 6/2 (light brownish gray) redox depletions and 2.5YR 4/6 (red) redox concentrations; the next subsurface horizon was 7.5YR 5/8 (strong brown) with 10YR 6/2 (light brownish gray) redox depletions and 2.5YR 5/8 (red) redox depletions. Evidence of a SHWT was observed at 30 inches below the ground surface.

The ground surface elevations at the test locations were determined by S&ME personnel using a tripod level scope and measuring rod and the elevation of nearby benchmark (BM PK Nail B9534 on Linwood Road: Elevation 194.06 feet) provided to S&ME by NCDOT on July 20, 2015.

Table 1: Seasonal High Water Table Determinations

NCDOT I-95 Business/US Highway 301			
Test Location	Elevation Ground Surface (feet)	Seasonal High Water Table Depth (feet bgs)	Elevation Seasonal High Water Table (feet)
IB-1	192.1	> 8	< 184.1
IB-2	192.8	> 8	< 184.8
IB-3	192.9	3.6	189.3
IB-4	193.0	2.5	190.5

Please note that the seasonal high water table conditions encountered at IB-3 and IB-4 may represent perched water table conditions.

Constant Head Permeameter Saturated Hydraulic Conductivity Testing

S&ME performed the in-situ hydraulic conductivity (Ksat) testing by utilizing a compact constant head permeameter at each of the test locations. S&ME performed Ksat tests on July 22, 2015.

For the Ksat testing, a hand auger boring was advanced at each Test Location with a 2 inch diameter bucket. The water dissipating unit of the permeameter was lowered to the bottom of the hole and water was dispensed from the permeameter. The water was allowed to move through the unit until steady-state flow was achieved and then flow rates were recorded. The last three measurements were averaged to achieve the most representative value to express the saturated hydraulic conductivity. The soils at the test location depths were observed to consist of naturally occurring sand, sandy loam and sandy clay loam typical of the Sandhills region.

The Ksat rates were variable depending on location and ranged from 0.22 inches per hour (in/hr.) at IB-4 to 9.3 in/hr. at IB-3. Table 2 below summarizes the measured hydraulic conductivities and testing depths for the test locations.

Table 2: Calculated Hydraulic Conductivity Rates

TEST LOCATION	TESTING HORIZON	TESTING INTERVAL (inches bgs)	HYDRAULIC CONDUCTIVITY RATE (in/hr.)
IB-1	Bt1	48 to 54 inches	4.22 in/hr.
IB-2	Bt1/Bt2	39 to 45 inches	1.55 in/hr.
IB-3	E	20 to 26 inches	9.33 in/hr.
IB-4	Bt1	28 to 34 inches	0.22 in/hr.

The North Carolina Department of Environment and Natural Resources (NCDENR) Best Management Practices (BMP) Manual identifies a minimum infiltration rate of 0.52 inches per hour and a draw-down time of five days for stormwater runoff entering an infiltration system as well as a two-foot separation between the SHWT and the bottom of the infiltration device. However, NCDENR has issued draft Minimum Design Criteria (MDC) for stormwater treatment systems that identify a 72-hour draw down time to the bottom of an infiltration device, with no minimum infiltration rate and two-foot separation above SHWT with the option to reduce the separation to one foot if the applicant can show that the water table will return to its pre-storm elevation in five days or less. Although the MDC are still in draft form, they can be utilized at this time by following the Alternative Design Criteria provisions in 15A NCAC 2H .1008(h).

QUALIFICATIONS OF REPORT

This report has been prepared in accordance with generally accepted soil science and geotechnical engineering practice for specific application to this project. The findings contained in this report were based on the applicable standards of our profession at the time this report was prepared. No other warranty, expressed or implied, is made.

The findings submitted in this report are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the locations evaluated may not become evident until construction. If variations appear evident, then the findings contained in this report may need to be re-evaluated.

REFERENCE: W-5519

PROJECT: 45849

SEE SHEET 2A FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

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SHEET 1	TITLE SHEET
SHEET 2	LEGEND
SHEET 2A	PLAN SHEET LAYOUT
SHEET 3	SITE PLAN
SHEET 4-7	SOIL PROFILE DESCRIPTIONS
SHEET 8	SOIL PROFILE DESCRIPTIONS
	ABBREVIATION LEGEND
SHEET 9-12	IN-SITU CONSTANT HEAD CALCULATIONS

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 GEOTECHNICAL ENGINEERING UNIT

**ROADWAY
 SUBSURFACE INVESTIGATION**

COUNTY CUMBERLAND
 PROJECT DESCRIPTION I-95 BUSINESS /US301 FROM
 NC87 SOUTH TO NC59

INFILTRATION BASINS

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5519	1	12

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

P. MASTEN

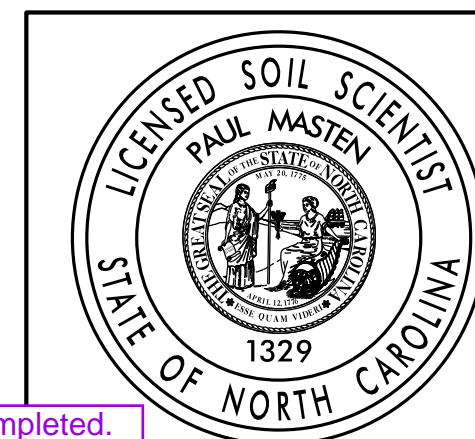
INVESTIGATED BY P. MASTEN

DRAWN BY B. RATTI

CHECKED BY A.F. RIGGS JR, P.E.

SUBMITTED BY S&ME, INC.

DATE JULY 2015



SIGNATURE

DATE

SIGNATURE

DATE

Not considered "FINAL" unless all signatures are completed.

09/08/1999

See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbols

STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS

CUMBERLAND COUNTY

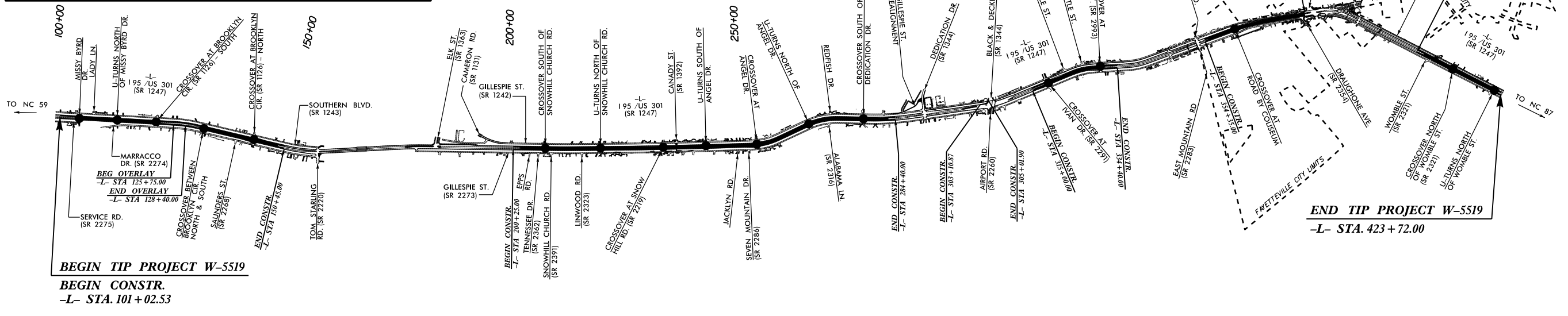
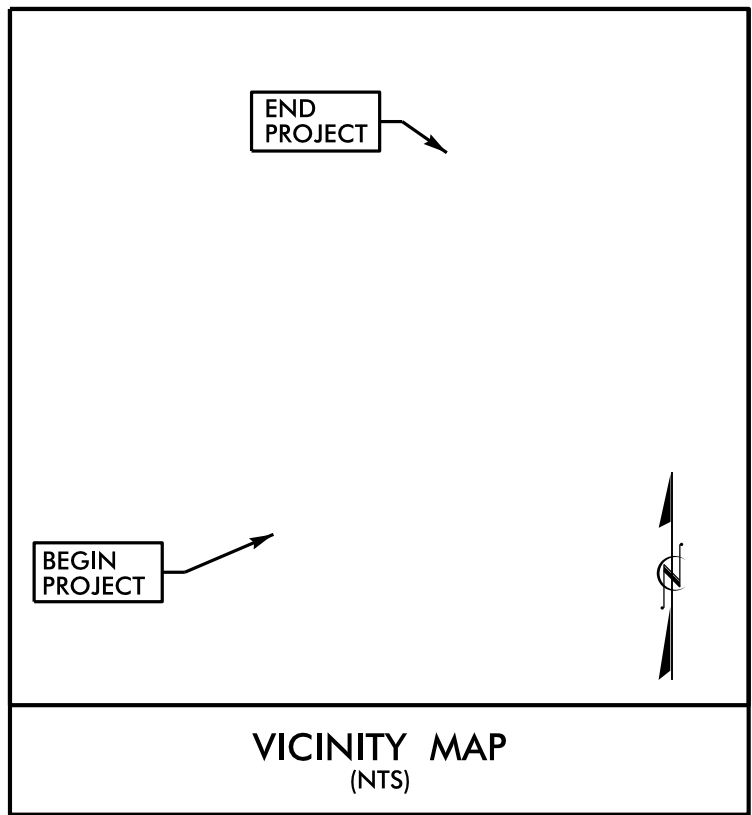
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N.C.	W-5519	2A	12
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
45849.1.FRI	HSIP-095-2(128)46	PE	
45849.2.FRI	HSIP-095-2(128)46	RW	
45849.3.FRI	HSIP-095-2(128)46	CONST	

**LOCATION: I-95 BUSINESS /US 301 FROM NC 87 SOUTH
TO NC 59**

**TYPE OF WORK: PAVING, GRADING, DRAINAGE,
PAVEMENT MARKINGS AND SIGNING**

TIP PROJECT: W-5519

CONTRACT: 45849

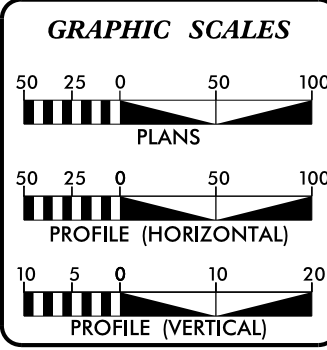


NCDOT CONTACT: SEAN MATUSZEWSKI
PROJECT ENGINEER - DIVISION DESIGN CONSTRUCTION

A PORTION OF THIS PROJECT IS WITHIN MUNICIPAL BOUNDARIES OF
THE CITY OF FAYETTEVILLE, N.C.

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS
ESTABLISHED BY METHOD II

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



DESIGN DATA

ADT 2015 =	26,160
ADT 2035 =	41,860
K =	10 %
D =	70 %
T =	9 % *
V =	60 MPH
* TTST = 9% DUAL N/A	
FUNC CLASS =	
PRINCIPAL ARTERIAL	
REGIONAL TIER	

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT W-5519 =	3.747 mi.
LENGTH STRUCTURE TIP PROJECT W-5519 =	0.000 mi.
TOTAL LENGTH TIP PROJECT W-5519 =	3.747 mi.

Prepared For NCDOT In the Office of:

moftatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
1919 781-4626 VOICE 1919 781-4869 FAX

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: MAY 29, 2015	TIM REID, P.E. PROJECT ENGINEER
LETTING DATE: NOV. 17, 2015	TRENT HUFFMAN, P.E. PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

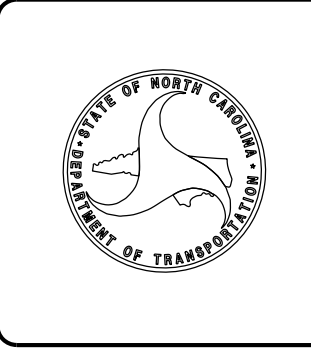
moftatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
1919 781-4626 VOICE 1919 781-4869 FAX

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

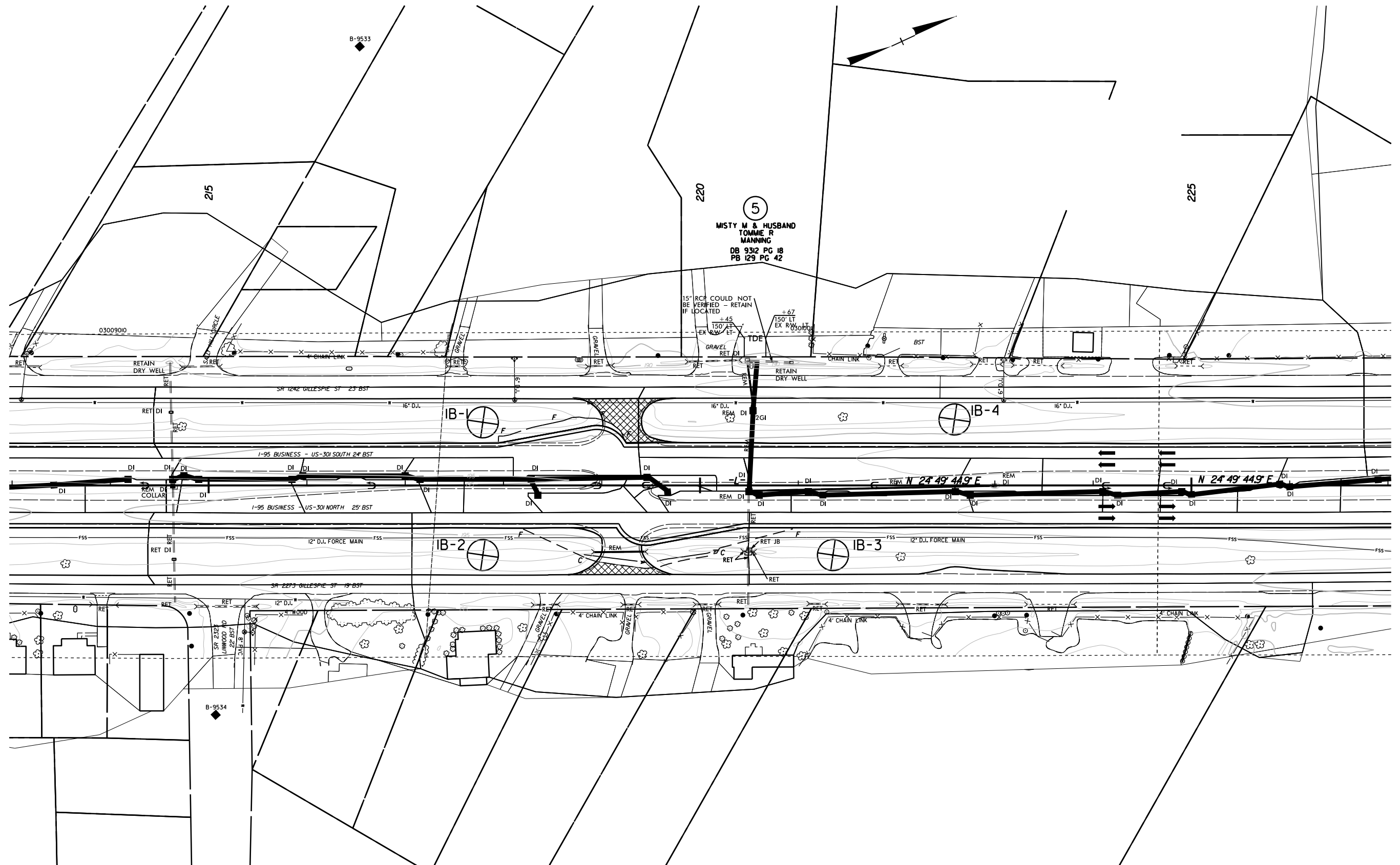
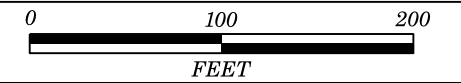
moftatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
1919 781-4626 VOICE 1919 781-4869 FAX

SIGNATURE: _____ P.E.



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DWGTH AT BRAITTI-13500

SITE PLAN



S&ME, INC.
SOIL PROFILE DESCRIPTIONS

SHEET 4

Client:	NCDOT	Date:	7-22-15
Project Name:	I-95 Business/US 301 INFLPND	Project No.:	W-5519
County:	Cumberland	State:	NC
Location:	STA 217+80 64 FT LT -L-	Site/Field No.:	IB-1
Soil Series:	Wagram		
Apparent Water Table:	>8 feet bgs	Seasonal High Water Table:	>8 feet bgs
Vegetation:	Grass	Slope:	1-2%
Hand Auger Boring Terminated at	8 feet bgs		

Horizon	Depth (ft)	Matrix	Mottles	Texture	Structure	Consistence	Notes
A	0 – 0.25	10YR 3/2		ls	gr	v fr	
E1	0.25 – 0.92	2.5Y 6/4		fs	sg	loose	
E/Bt	0.92 – 2.7	2.5Y 7/4	10YR 5/6 2.5Y 6/3	ls	gr	v fr	
E2	2.7 – 3.6	2.5Y 6/4		fs	sg	loose	
E3	3.6 – 4.0	2.5Y 6/6		fs	sg	loose	
Bt1	4.0 – 8.0	10YR 5/6	2.5Y 6/3 7.5YR 5/6	sl	msbk	ss, sp, fr	

COMMENTS:

DESCRIBED BY: Paul Masten DATE: 7-22-15

S&ME, INC.
SOIL PROFILE DESCRIPTIONS

SHEET 5

Client:	NCDOT	Date:	7-22-15
Project Name:	I-95 Business/US 301 INFLPND	Project No.:	W-5519
County:	Cumberland	State:	NC
Location:	STA 217+80 71 FT RT -L-	Site/Field No.:	IB-2
Soil Series:	Wagram		
Apparent Water Table:	>8 feet bgs	Seasonal High Water Table:	>8 feet bgs
Vegetation:	Grass	Slope:	Flat
Hand Auger Boring Terminated at	8 feet bgs		

Horizon	Depth (ft)	Matrix	Mottles	Texture	Structure	Consistence	Notes
A	0 – 0.33	10YR 3/2		ls	gr	fr	
E	0.33 – 2.8	2.5Y 6/4		fs	sg	loose	
Bt1	2.8 – 3.6	10YR 4/6		scl	wabk	ss, np, fr	
Bt2	3.6 – 6.6	7.5YR 5/8		scl	wsbk	ss, np, fr	
Bt3	6.6 – 8.0	10YR 5/8	2.5YR 5/8	scl	wsbk	ss, np, fr	

COMMENTS:

DESCRIBED BY: Paul Masten DATE: 7-22-15

S&ME, INC.
SOIL PROFILE DESCRIPTIONS

SHEET 6

Client:	NCDOT	Date:	7-22-15
Project Name:	I-95 Business/US 301 INFLPND	Project No.:	W-5519
County:	Cumberland	State:	NC
Location:	STA 221+35 71 FT RT -L-	Site/Field No.:	IB-3
Soil Series:	Wagram		
Apparent Water Table:	>8 feet bgs	Seasonal High Water Table:	3.6 feet bgs
Vegetation:	Grass	Slope:	Flat
Hand Auger Boring Terminated at	8 feet bgs		

Horizon	Depth (ft)	Matrix	Mottles	Texture	Structure	Consistence	Notes
A	0 – 0.42	10YR 3/2		ls	gr	v fr	
E	0.42 – 3.1	2.5Y 6/4		fs	sg	loose	
Bt1	3.1 – 3.6	10YR 4/6		scl	wsbk	fr	
Bt2	3.6 – 7.0	10YR 5/8	10YR 6/2 7.5YR 5/8	scl	mabk	firm	
Bx	7.0 – 8.0	10YR 5/8	10YR 6/2 5YR 4/6	sl	gr	v fr	Plinthitic soil materials observed

COMMENTS:

DESCRIBED BY: Paul Masten DATE: 7-22-15

S&ME, INC.
SOIL PROFILE DESCRIPTIONS

SHEET 7

Client:	NCDOT	Date:	7-22-15
Project Name:	I-95 Business/US 301 INFLPND	Project No.:	W-5519
County:	Cumberland	State:	NC
Location:	STA 222+59 67 FT LT -L-	Site/Field No.:	IB-4
Soil Series:	Wagram		
Apparent Water Table:	>8 feet bgs	Seasonal High Water Table:	2.5 feet bgs
Vegetation:	Grass	Slope:	Flat
Hand Auger Boring Terminated at	5.2 feet bgs		

Horizon	Depth (ft)	Matrix	Mottles	Texture	Structure	Consistence	Notes
A	0 – 0.17	10YR 3/2		ls	gr	v fr	
E	0.17 – 2.0	2.5Y 6/4		fs	sg	loose	
Bt1	2.0 – 2.5	10YR 4/6		scl	mabk	s, p, fr	
Bt2	2.5 – 6.7	10YR 5/6	10YR 6/2 2.5YR 4/6	scl	mabk	ss, sp, fr	
Bx	6.7 – 8.0	7.5YR 5/8	10YR 6/2 2.5YR 5/8	sl	gr	v fr	Plintihic soil materials observed

COMMENTS:

DESCRIBED BY: Paul Masten DATE: 7-22-15

S&ME Soil Profile Descriptions Abbreviation Legend – I-95 Business/US Highway 301
Project No. 45849.1.FR1

Texture

sandy loam	sl
loamy sand	ls
fine sand	fs
sandy clay loam	scl

Structure

weak, subangular blocky	wsbk
moderate, subangular blocky	msbk
moderate, angular blocky	mabk
granular	gr
single grain	sg

Consistence

very friable	v fr
friable	fr

Seasonal High Water Table SHWT

Munsell Colors

2.5YR4/6	red
2.5YR5/8	red
5YR4/6	yellowish red
2.5Y6/3	light yellowish brown
2.5Y6/4	light yellowish brown
2.5Y6/6	olive yellow
2.5Y7/4	pale yellow
7.5YR5/6	strong brown
7.5YR5/8	strong brown
10YR3/2	very dark grayish brown
10YR4/6	dark yellowish brown
10YR5/6	yellowish brown
10YR5/8	yellowish brown
10YR6/2	light brownish gray

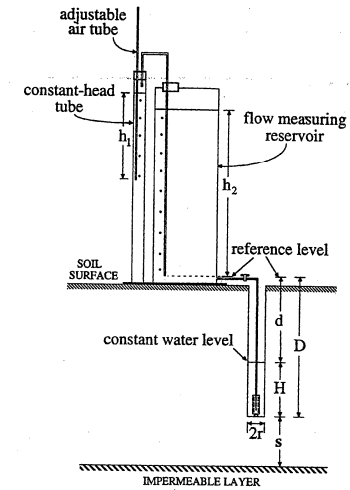
"IN-SITU" CONSTANT HEAD PERMEAMETER

Date: 7/22/2015
 Location: IB-1
 Horizon: Bt1
 Client: NCDOT
 Project Name: I-95 Business/US Highway 301
 Project #: W-5519
 Location: N 446900 E 2027201
 Elevation: 192.1 feet

Hole Depth:	4.50	Feet
Hole Radius (r):	0.08	Feet
Bubble Tube to Surface:	0.30	Feet
Reference Tube to Hole Bottom (D):	4.80	Feet
Water Depth in Hole (H):	0.50	Feet
CHT Tube(s) Setting (h ₁):	4.30	Feet

Chamber Used:	0.11	ft ²
---------------	------	-----------------

Initial Water in Hole:	0.13	Feet
Final Water in Hole:	0.50	Feet



$$K_{sat} = CQ / (2\pi H^2)$$

$$C = \sinh^{-1}(H/r) - [(r/H)^2 + 1]^{1/2} + r/H$$

\sinh^{-1} = inverse hyperbolic sin of a number

H = Height of water in hole (cm)

r = radius of hole (cm)

Q = Constant Flow Rate (Gal/day)

= Cross Sectional Area of Reservoir x Length of Drop in Water Column over Time

$$r = \frac{0.08}{12} \text{ ft}$$

$$H = \frac{0.50}{12} \text{ ft}$$

$$C = 1.68$$

$$Q = 59.03 \text{ Gallons/Day}$$

Time	Drop in Water Column	
	(ft)	(cm)
9	0.141	4.30
12	0.105	3.20
15	0.089	2.70
18	0.098	3.00
21	0.112	3.40
24	0.121	3.70
27	0.128	3.90
30	0.148	4.50
33	0.141	4.30
36	0.148	4.50
Avg.	0.145	

Time (min) = 3

$$\text{Cross Sectional Area} = 0.11 \text{ ft}^2$$

$$\text{Length of Drop in Water Column} = 69.82 \text{ ft/day}$$

$$K_{sat} = 63.14 \text{ Gallons/Day/ft}^2$$

$$\text{Cm/Hour} = 10.72$$

$$\text{Inches/Hour} = 4.22$$

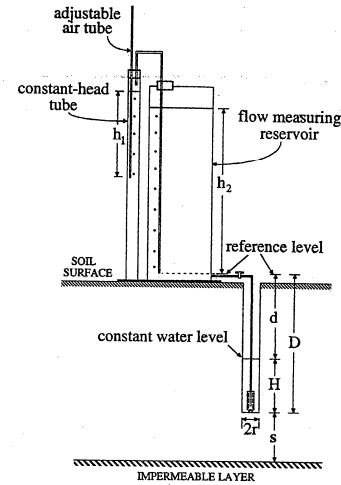
$$\text{Feet/Day} = 8.44$$

Note: Ksat calculations are based on average drop in Water Column (ft) after equilibrium is reached.

"IN-SITU" CONSTANT HEAD PERMEAMETER

Date: 7/22/2015
 Location: IB-2
 Horizon: Bt1/Bt2
 Client: NCDOT
 Project Name: I-95 Business/US Highway 301
 Project #: W-5519
 Location: N 446844 E 2027323
 Elevation: 192.8 feet

Hole Depth:	3.75	Feet
Hole Radius (r):	0.08	Feet
Bubble Tube to Surface:	0.30	Feet
Reference Tube to Hole Bottom (D):	4.05	Feet
Water Depth in Hole (H):	0.50	Feet
CHT Tube(s) Setting (h ₁):	3.55	Feet
Chamber Used: 0.11 Ft ²		
Initial Water in Hole:	0.33	Feet
Final Water in Hole:	0.50	Feet



$K_{sat} = CQ / (2\pi H^2)$

$C = \sinh^{-1} (H/r) - [(r/H)^2 + 1]^{1/2} + r/H$

\sinh^{-1} = inverse hyperbolic sin of a number

H = Height of water in hole (cm)

r = radius of hole (cm)

Q = Constant Flow Rate (Gal/day)

= Cross Sectional Area of Reservoir x Length of Drop in Water Column over Time

r = 0.08 ft
 H = 0.50 ft
 C = **1.68**
 Q = **21.75** Gallons/Day

Time	Drop in Water Column	
	(ft)	(cm)
12	0.033	1.00
15	0.000	1.10
18	0.000	1.00
21	0.039	1.20
24	0.036	1.10
27	0.043	1.30
30	0.046	1.40
33	0.046	1.40
36	0.056	1.70
39	0.059	1.80
Avg.	0.054	

Time (min) = **3**

Cross Sectional Area = **0.11** ft²
 Length of Drop in Water Column = **25.72** ft/day

K_{sat} = 23.26 Gallons/Day/ft²

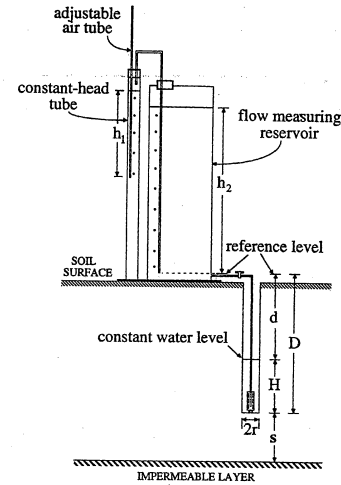
Cm/Hour = 3.95
Inches/Hour = 1.55
Feet/Day = 3.11

Note: K_{sat} calculations are based on average drop in Water Column (ft) after equilibrium is reached.

"IN-SITU" CONSTANT HEAD PERMEAMETER

Date: 7/22/2015
 Location: IB-3
 Horizon: E
 Client: NCDOT
 Project Name: I-95 Business/US Highway 301
 Project #: W-5519
 Location: N 447167 E 2027473
 Elevation: 192.9 feet

Hole Depth:	2.17	Feet
Hole Radius (r):	0.08	Feet
Bubble Tube to Surface:	0.30	Feet
Reference Tube to Hole Bottom (D):	2.47	Feet
Water Depth in Hole (H):	0.50	Feet
CHT Tube(s) Setting (h ₁):	1.97	Feet
Chamber Used: 0.11 Ft ²		
Initial Water in Hole:	0.33	Feet
Final Water in Hole:	0.50	Feet



0.02
0.11

$K_{sat} = CQ / (2\pi H^2)$

$C = \sinh^{-1}(H/r) - [(r/H)^2 + 1]^{1/2} + r/H$

\sinh^{-1} = inverse hyperbolic sin of a number

H = Height of water in hole (cm)

r = radius of hole (cm)

Q = Constant Flow Rate (Gal/day)

= Cross Sectional Area of Reservoir x Length of Drop in Water Column over Time

r = 0.08 ft
 H = 0.50 ft
 C = **1.68**
 Q = **130.48** Gallons/Day

Time	Drop in Water Column	
	(ft)	(cm)
21	0.102	3.10
22	0.000	3.30
23	0.000	3.30
24	0.108	3.30
25	0.102	3.10
26	0.102	3.10
27	0.108	3.30
28	0.108	3.30
29	0.108	3.30
30	0.105	3.20
Avg.	0.107	

Time (min) = **1**

Cross Sectional Area = **0.11** ft²
 Length of Drop in Water Column = **154.33** ft/day

K_{sat} = 139.57 Gallons/Day/ft²

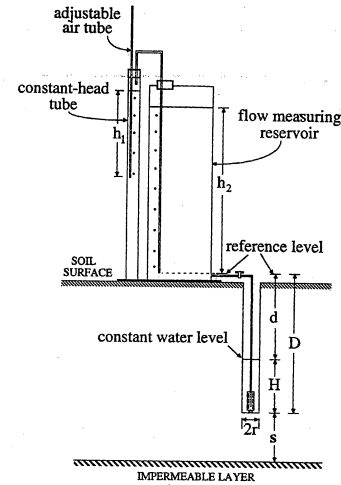
Cm/Hour = 23.70
Inches/Hour = 9.33
Feet/Day = 18.66

Note: K_{sat} calculations are based on average drop in Water Column (ft) after equilibrium is reached.

"IN-SITU" CONSTANT HEAD PERMEAMETER

Date: 7/22/2015
 Location: IB-4
 Horizon: Bt1
 Client: NCDOT
 Project Name: I-95 Business/US Highway 301
 Project #: W-5519
 Location: N 447337 E 2027400
 Elevation: 193.0 feet

Hole Depth:	2.83	Feet
Hole Radius (r):	0.08	Feet
Bubble Tube to Surface:	0.30	Feet
Reference Tube to Hole Bottom (D):	3.13	Feet
Water Depth in Hole (H):	0.50	Feet
CHT Tube(s) Setting (h ₁):	2.63	Feet
Chamber Used: 0.11 Ft ²		
Initial Water in Hole:	0.42	Feet
Final Water in Hole:	0.50	Feet



0.02
0.11

$K_{sat} = CQ / (2\pi H^2)$

$C = \sinh^{-1} (H/r) - [(r/H)^2 + 1]^{1/2} + r/H$

\sinh^{-1} = inverse hyperbolic sin of a number

H = Height of water in hole (cm)

r = radius of hole (cm)

Q = Constant Flow Rate (Gal/day)

= Cross Sectional Area of Reservoir x Length of Drop in Water Column over Time

r = 0.08 ft
 H = 0.50 ft
 C = **1.68**
 Q = **3.11** Gallons/Day

Time	Drop in Water Column	
	(ft)	(cm)
3	0.098	3.00
6	0.000	0.40
9	0.000	0.20
12	0.007	0.20
15	0.010	0.30
18	0.007	0.20
21	0.010	0.30
24	0.007	0.20
27	0.007	0.20
30	0.010	0.30
Avg.	0.008	

Time (min) = **3**

Cross Sectional Area = **0.11** ft²
 Length of Drop in Water Column = **3.67** ft/day

K_{sat} = 3.32 Gallons/Day/ft²

Cm/Hour = 0.56
Inches/Hour = 0.22
Feet/Day = 0.44

Note: K_{sat} calculations are based on average drop in Water Column (ft) after equilibrium is reached.

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5519	1	46

CONTENTS

LINE	STATION	PLAN	PROFILE	XSECT
-L-	105+00 TO 120+00	4	-	-
-L-	132+00 TO 147+00	5	-	-
-L-	205+00 TO 220+00	6	-	-
-L-	222+00 TO 237+00	7	-	-
-L-	239+00 TO 254+00	8	-	-
-L-	262+00 TO 277+00	9	-	15
-L-	279+00 TO 294+00	10	-	-
-L-	316+00 TO 331+00	11	-	-
-L-	356+00 TO 371+00	12	-	-
-L-	393+00 TO 407+00	13	-	-
-SRI-	10+00 TO 21+00	10	14	-

**ROADWAY
SUBSURFACE INVESTIGATION**

COUNTY CUMBERLAND
PROJECT DESCRIPTION I-95 BUSINESS /US 301 FROM
NC 87 SOUTH TO NC 59

INVENTORY

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

REFERENCE:

PROJECT:

PERSONNEL

A. S. PAUL

T. E. EVANS

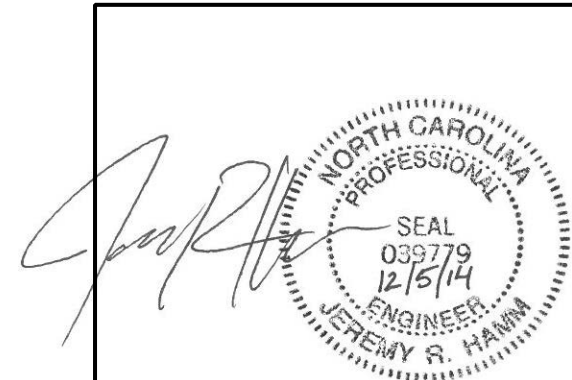
INVESTIGATED BY A. S. PAUL

DRAWN BY ASP & TEE

CHECKED BY J. R. HAMM

SUBMITTED BY FALCON

DATE DECEMBER 2014



SIGNATURE _____ DATE _____

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

SOIL DESCRIPTION

SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR 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		
	A-1	A-1-b	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7		
GROUP CLASS.	A-1-a	A-1-b	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7		
SYMBOL	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]	[Symbol]
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 35 MX	40 MX 35 MX	41 MN 35 MX	42 MN 35 MX	43 MN 35 MX	36 MN 36 MN	37 MN 36 MN	38 MN 36 MN	39 MN 36 MN	40 MN 36 MN	41 MN 36 MN	42 MN 36 MN	43 MN 36 MN		
MATERIAL PASSING #40 LL PI	-	-	40 MX 10 MX	41 MN 10 MX	42 MN 10 MX	43 MN 10 MX	44 MN 10 MX	45 MN 10 MX	46 MN 10 MX	47 MN 10 MX	48 MN 10 MX	49 MN 10 MX	50 MN 10 MX	51 MN 10 MX	52 MN 10 MX		
GROUP INDEX	0	0	0	1 MX	2 MX	3 MX	4 MX	8 MX	12 MX	16 MX	20 MX						
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE				
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 RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)
GENERALLY GRANULAR MATERIAL (NON-COHESSIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
BOULDER (BLDR.)						
COBBLE (COB.)						
GRAVEL (GR.)						
COARSE SAND (CS. SD.)						
FINE SAND (F SD.)						
SILT (SL.)						
CLAY (CL.)						
GRAIN SIZE	305 IN.	75 IN.	2.0 IN.	0.25 IN.	0.075 IN.	0.005 IN.

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

NON PLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
SLIGHTLY PLASTIC	0-5	VERY LOW
MODERATELY PLASTIC	6-15	SLIGHT
HIGHLY PLASTIC	16-25	MEDIUM
	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). 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.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LL < 31
MODERATELY COMPRESSIBLE LL = 31 - 50
HIGHLY COMPRESSIBLE LL > 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
- Perched water, saturated zone, or water bearing strata
- Spring or seep

MISCELLANEOUS SYMBOLS

ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION

ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT

INFERRED SOIL BOUNDARY

INFERRED ROCK LINE

ALLUVIAL SOIL BOUNDARY

DIP & DIP DIRECTION OF ROCK STRUCTURES

SLOPE INDICATOR INSTALLATION

CONE PENETROMETER TEST

SOUNDING ROD

TEST BORING WITH CORE

SPT N-VALUE

RECOMMENDATION SYMBOLS

UNDERCUT EXCAVATION

SHALLOW UNDERCUT

UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE

UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK

UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

- DRILL UNITS:
 - CME-45C
 - CME-55
 - CME-550
 - VANE SHEAR TEST
 - PORTABLE HOIST
- ADVANCING TOOLS:
 - CLAY BITS
 - 6" CONTINUOUS FLIGHT AUGER
 - 8" HOLLOW AUGERS
 - HARD FACED FINGER BITS
 - TUNG-CARBIDE INSERTS
 - CASING W/ ADVANCER
 - TRICONE * STEEL TEETH
 - TRICONE * TUNG-CARB.
 - CORE BIT
- HAMMER TYPE:
 - AUTOMATIC MANUAL
- CORE SIZE:
 - B
 - H
 - N
- HAND TOOLS:
 - POST HOLE DIGGER
 - HAND AUGER
 - SOUNDING ROD
 - VANE SHEAR TEST
 - KESSLER DCP

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED, 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 YIELD 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 (IV 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, WOULD YIELD SPT N VALUES > 100 BPF*
- VERY SEVERE (IV SEV.)** - ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD 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 GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
- SOFT** - CAN BE GROUDED 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 FINGER NAIL.

FRACTURE SPACING

TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FOOT	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET

INDURATION

- 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, SUCH 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 (ROD)** - 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 (SROD)** - 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 MARKS:

BORING ELEVATIONS RETRIEVED FROM *.TIN* FILES

ELEVATION: FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLED

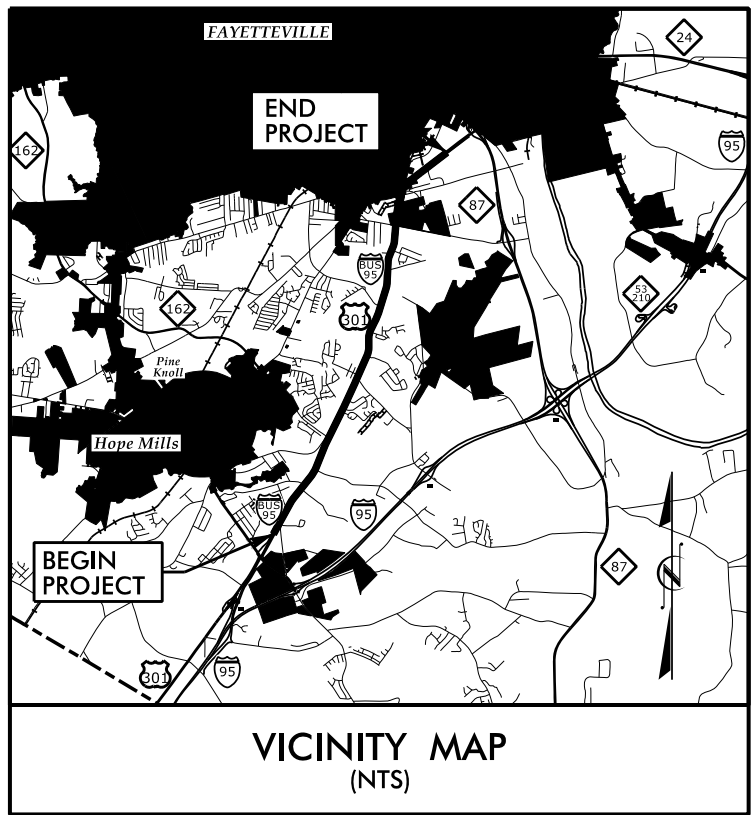
09/28/14

See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbols

STATE OF NORTH CAROLINA DIVISION OF HIGHWAYS CUMBERLAND COUNTY

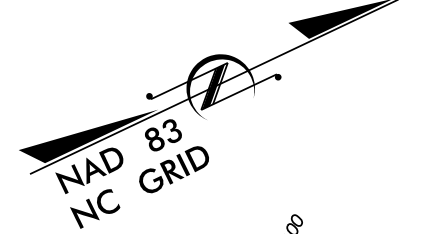
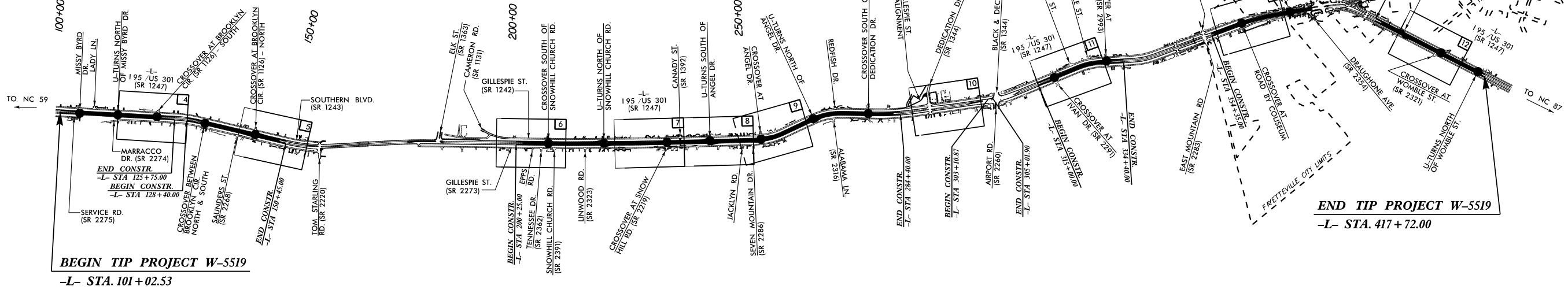
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5519	2A	46
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
45849.1.FR1	HSIP-095-2(128)46	PE	
45849.2.FR1	HSIP-095-2(128)46	R/W	
45849.3.FR1	HSIP-095-2(128)46	CONST	

TIP PROJECT: W-5519



LOCATION: I-95 BUSINESS /US 301 FROM NC 87 SOUTH TO NC 59

TYPE OF WORK: PAVING, GRADING, DRAINAGE, PAVEMENT MARKINGS AND SIGNING



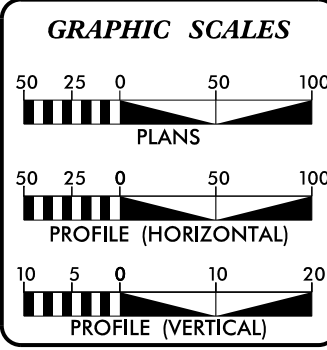
NCDOT CONTACT: SEAN MATUSZEWSKI
PROJECT ENGINEER - DIVISION DESIGN CONSTRUCTION

A PORTION OF THIS PROJECT IS WITHIN MUNICIPAL BOUNDARIES OF THE CITY OF FAYETTEVILLE, N.C.

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD II

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

CONTRACT:



DESIGN DATA

ADT 2015 =	26,160
ADT 2035 =	41,860
K =	10 %
D =	70 %
T =	9 % *
V =	60 MPH

* TTST = 9% DUAL N/A
FUNC CLASS =
PRINCIPAL ARTERIAL
REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT W-5519 =	3.814 mi.
LENGTH STRUCTURE TIP PROJECT W-5519 =	0.000 mi.
TOTAL LENGTH TIP PROJECT W-5519 =	3.814 mi.

Prepared for NCDOT in the Office of:

moffatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4869 FAX

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
NOV. 24, 2014

LETTING DATE:
NOV. 17, 2015

TIM REID, P.E.
PROJECT ENGINEER

TRENT HUFFMAN, P.E.
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

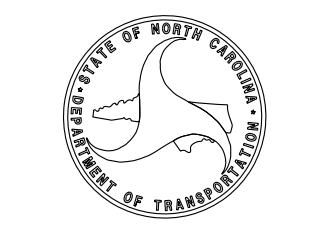
moffatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4869 FAX

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

moffatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4869 FAX

SIGNATURE: _____ P.E.



\$\$\$\$\$ SYSTEM \$\$\$\$\$\$
\$\$\$\$\$ DN \$\$\$\$\$\$
\$\$\$\$\$ USERNAME \$\$\$\$\$\$



Roadway Subsurface Investigation Report - Inventory

I-95 Business / US-301 from NC 87 South to NC 59
Cumberland County, North Carolina
TIP: W-5519
Falcon Project No.: G14025.00

Prepared for:
Moffatt and Nichol
1616 East Millbrook Road, Suite 160
Raleigh, NC 27608

Submitted by:
Falcon Engineering, Inc.
1210 Trinity Road, Suite 110
Raleigh, North Carolina 27607
(919) 871-0800
www.falconengineers.com

December 5, 2014

PREFACE

This roadway subsurface investigation was conducted between September 30 and October 10, 2014 in general accordance with our Proposal to Provide Geotechnical Engineering Services, dated March 5, 2014. The recommendations provided in this report are based solely on our site reconnaissance, hand auger borings, laboratory test data, engineering evaluation of these data, and generally accepted soil engineering practices and principles.

A total of thirty-four (34) hand auger borings were performed for the new intersection improvements and service road alignment. Representative soil samples, collected from hand auger cuttings, were selected for laboratory testing to verify visual field classifications. In addition, one (1) bulk sample was collected for additional laboratory testing for use in our geotechnical engineering analyses.

Falcon appreciates the opportunity to have provided our geotechnical engineering services for the above referenced project. If you have any questions concerning the contents of this report or need additional information, please do not hesitate to contact our office.

FALCON ENGINEERING, INC.

Report Prepared By:

Report Reviewed By:

Allan Paul, PE
Geotechnical Engineer

Jeremy R. Hamm, PE
Geotechnical Department Manager



TIP: W-5519
COUNTY: Cumberland
DESCRIPTION: I-95 Business / US-301 from NC 87 South to NC 59
SUBJECT: Roadway Subsurface Investigation – Inventory

PROJECT DESCRIPTION

This project consists of various intersection improvements along several miles of I-95 Business in Cumberland County, North Carolina. Many of the intersection improvements will include new pavements for turn lanes and turn outs, while some intersections will only include removal of existing pavements. Site grading for construction of new pavements will be minimal and generally include less than 3 feet of cut and/or fill, with the majority of pavements to be constructed near existing site grades.

The following alignments, totaling approximately 30,200 feet (5.72 miles) were explicitly investigated.

<u>Alignment</u>	<u>Station</u>
-L- (I-95 Business)	101+02.53 – 125+75.00
	128+40.00 – 150+45.00
	200+25.00 – 284+40.00
	315+00.00 – 334+40.00
	354+35.00 – 374+66.00
	391+15.00 – 417+72.00
-SR1- (Dedication Lane)	14+00.00 – 21+57.71

Site plans and boring logs along these alignments are included in this report.

AREAS OF SPECIAL GEOTECHNICAL INTEREST

The following sections contain cohesive and/or highly plastic soils which have the potential to cause embankment/subgrade and or slope stability problems during construction:

<u>Station</u>	<u>Offset</u>
113+60 -L-	Right
139+00 -L-	Center
262+00 -L-	Center
266+00 -L-	Right

Groundwater was measured within the following area within 6 feet of existing grade and may cause groundwater related stability problems during construction:

<u>Station</u>	<u>Offset</u>
262+00 -L-	Center



PHYSIOGRAPHY AND GEOLOGY

The project site is in the western portion of the Coastal Plain Physiographic Province of North Carolina. According to the *Geologic Map of North Carolina* (1985), the site is underlain by the Black Creek Formation (Kb) and the Cape Fear Formation (Kc) of the Cretaceous age. The Black Creek Formation is noted to contain gray to black, lignitic clay with thin beds and laminae of fine-grained micaceous sand and thick lenses of cross-bedded sand. Glauconitic, fossiliferous clayey sandy lenses are present in the upper portions. The Cape Fear formation is noted to contain sandstone and sandy mudstone yellowish gray to bluish gray, mottled red to yellowish orange, indurated, graded and laterally continuous sand bedding, and blocky clay with faint cross-bedding.

The majority of new pavement construction New fills on the order of up to 3 feet are proposed along both left and right sides of the project within the right-of-way and for the relocation of Dedication Drive (-SR1-).

Existing site topography is relatively flat with moderate grade changes near low lying areas; typical of the coastal plains especially in flood plains. Predominantly wide and shallow drainage swales parallel existing roadway alignments, and carry roadway drainage toward various drainage features and natural creeks/swamps

SOIL PROPERTIES

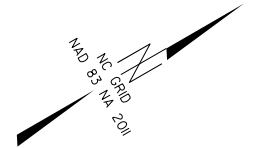
The typical soils encountered along the project include existing roadway embankments and coastal plains deposits.

Roadway Embankment soils were encountered at the ground surface or beneath existing pavements in and adjacent to existing roadways and consisted of moist, slightly silty sand (A-1-b) and silty/clayey sand (A-2-4 and A-2-6).

Coastal Plain soils were encountered at the ground surface and underneath roadway embankment. These soils consist of dry to saturated, sand (A-3), silty/clayey sands (A-2-4, A-2-6, A-2-7) and sandy clays (A-6,A-7).

GROUNDWATER PROPERTIES

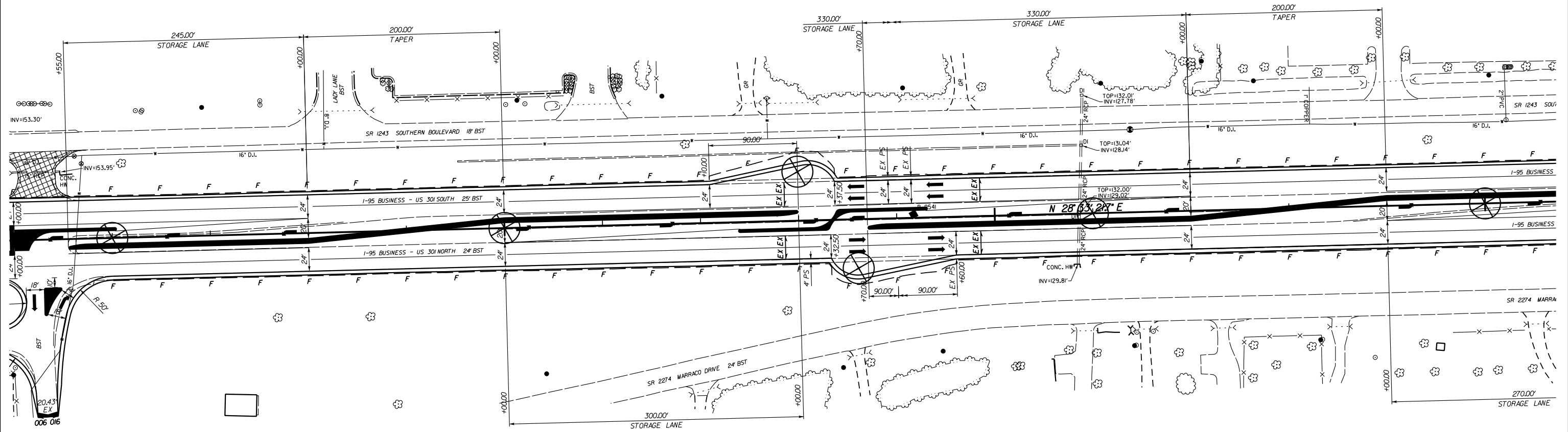
Groundwater levels were measured at the time of boring completion, and in some cases after a waiting period of at least 24 hours. Hand auger borings drilled within and in close proximity to existing roadways were backfilled immediately after completion due to safety considerations. Groundwater was observed at shallow depths near low lying areas and should be anticipated to be within 6 feet of finished roadway grades near Station 260+00 to 263+00 -L-. Detailed groundwater measurements are included in the attached boring logs.



110


115

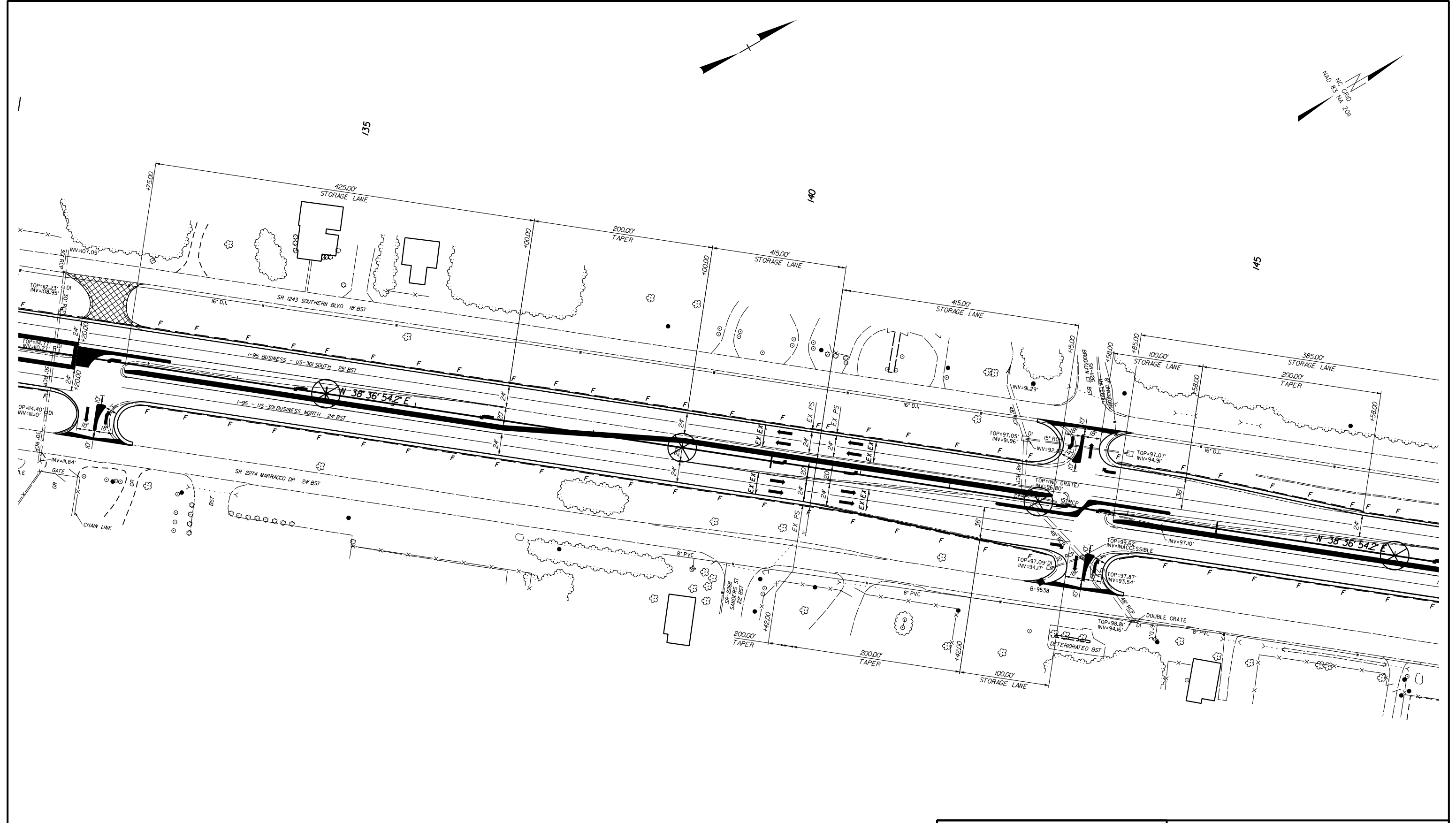
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NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.

	FALCON ENGINEERING, INC. 1210 TRINITY ROAD, SUITE 110 RALEIGH, NC 27607	SITE PLAN I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 99 CUMBERLAND COUNTY, NORTH CAROLINA WBS: , TIP: W-5519 FALCON PROJECT NO.: G14025.00
	PHONE: 919.871.0800 FAX: 919.871.0803	



NOTES:

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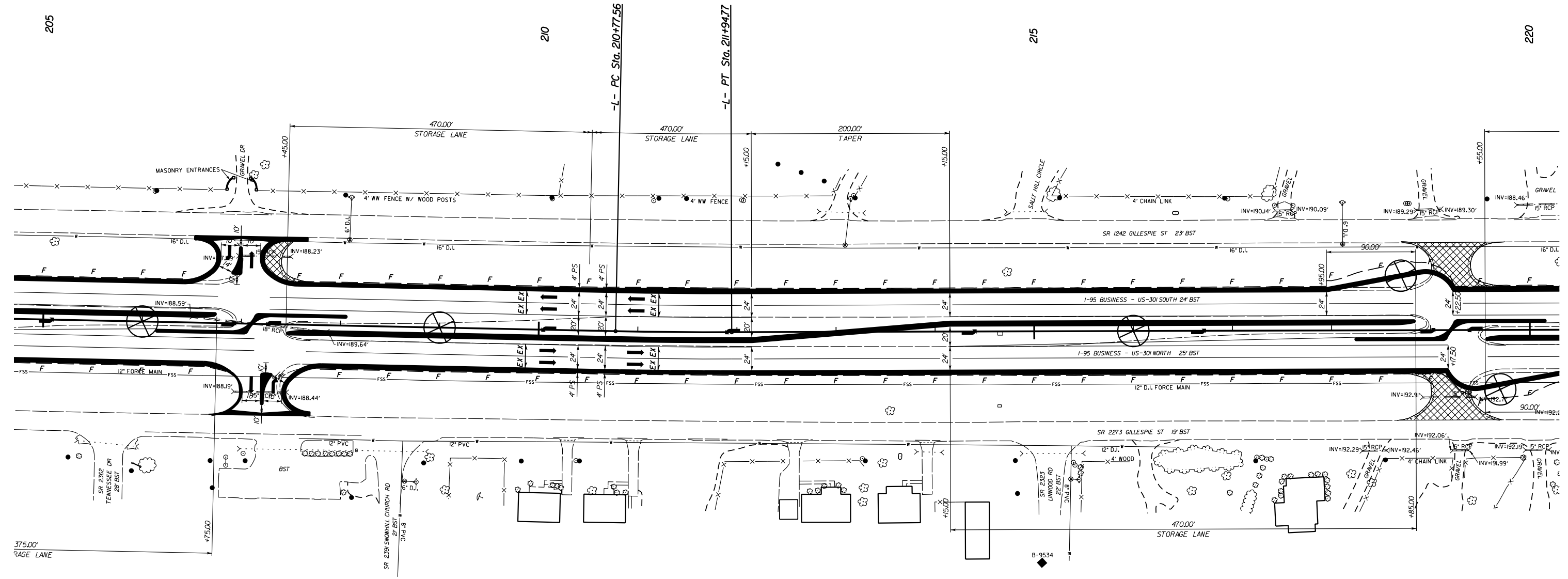
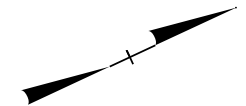


FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 RALEIGH, NC 27607
 PHONE: 919.871.0800
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SITE PLAN

I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00

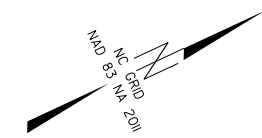
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 PI Sta 211+36.17
 $\Delta = 120^\circ 34.9' (LT)$
 $D = 108' 45.3''$
 $L = 117.20'$
 $T = 58.60'$
 $R = 5,000.00'$



NOTES:
 • PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.

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 I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
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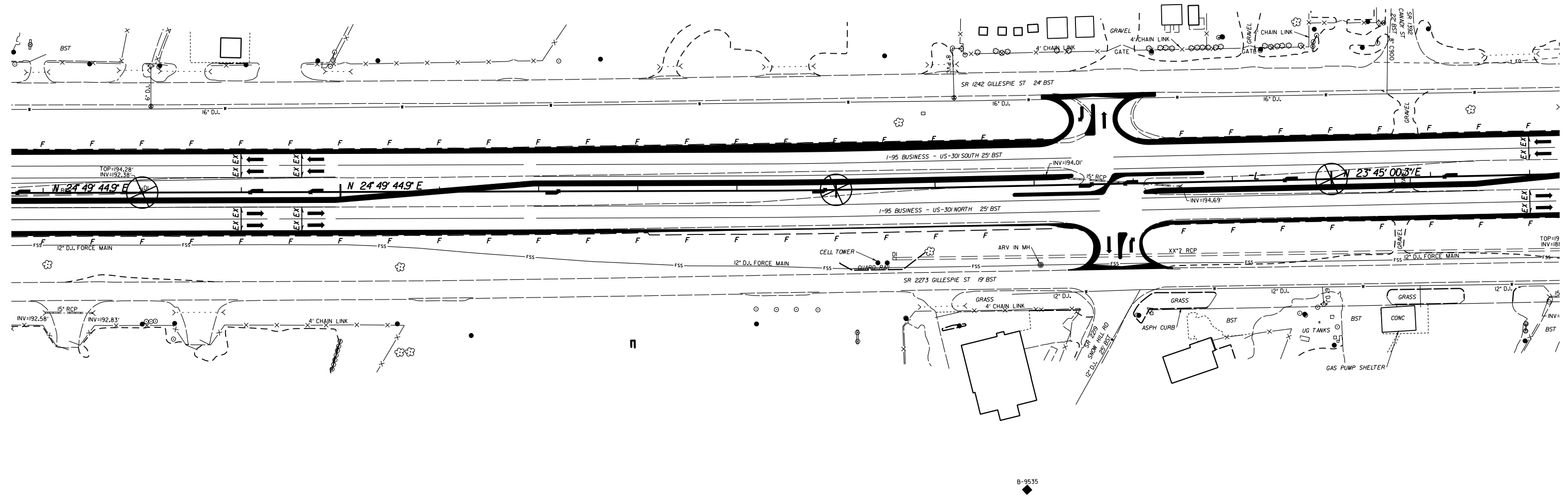


225

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235

B-9536



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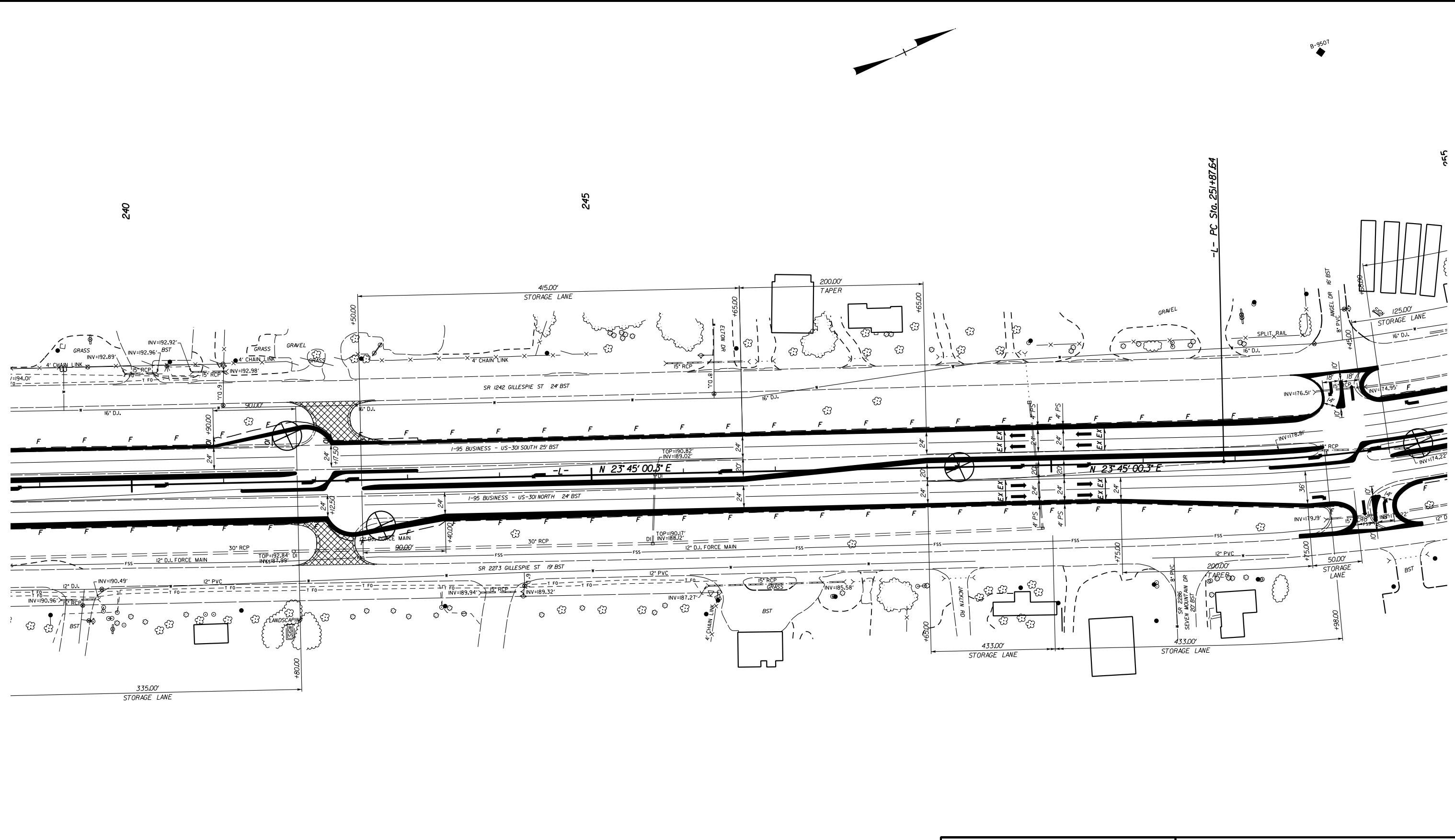
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NOTES:

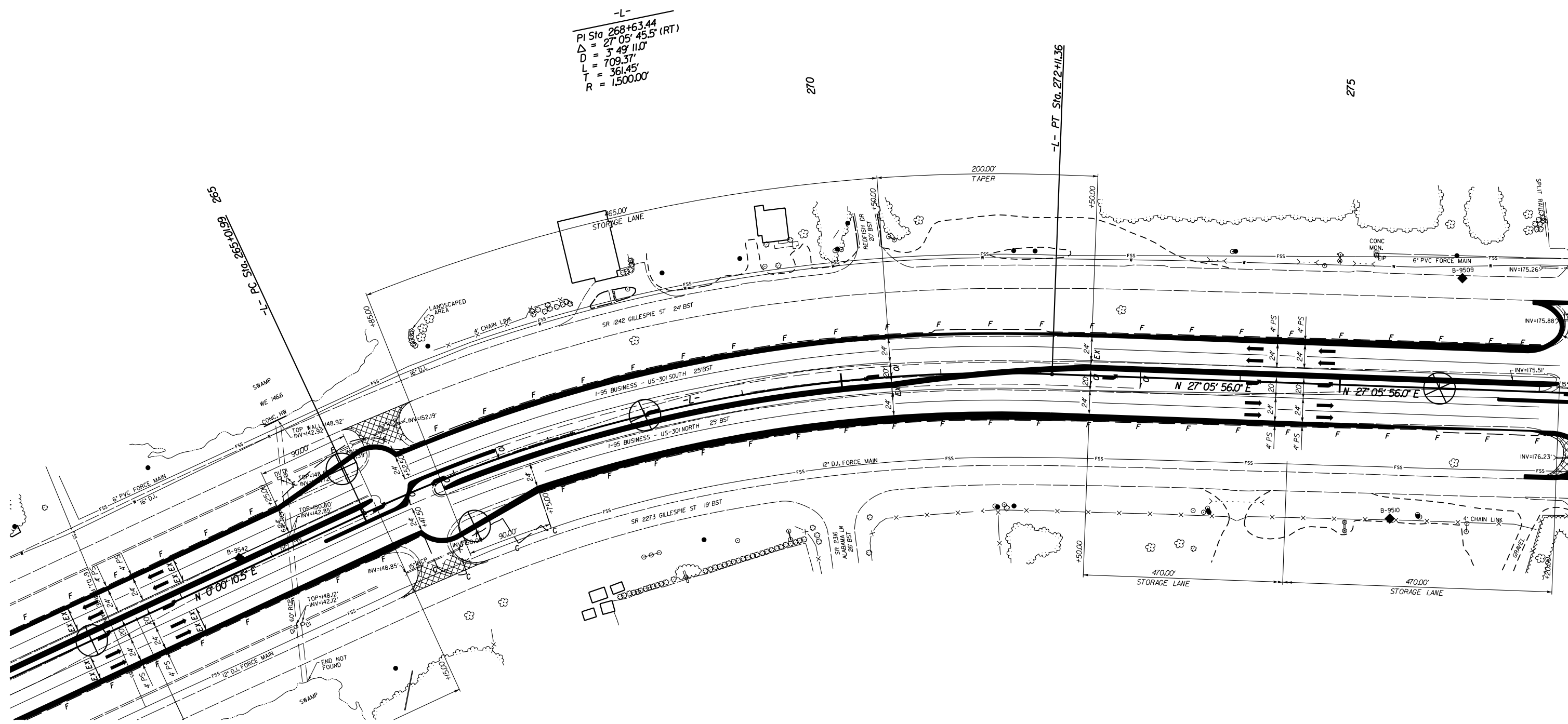
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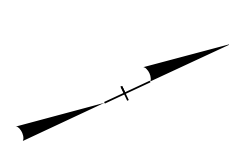
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SITE PLAN

I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00



-L-
 PI Sta 268+63.44
 $\Delta = 27^{\circ} 05' 45.5''$ (RT)
 $D = 3^{\circ} 49' 11.0''$
 $L = 709.37'$
 $T = 361.45'$
 $R = 1,500.00'$



NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.

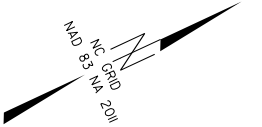
FALCON ENGINEERING

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 1210 TRINITY ROAD, SUITE 110
 RALEIGH, NC 27607

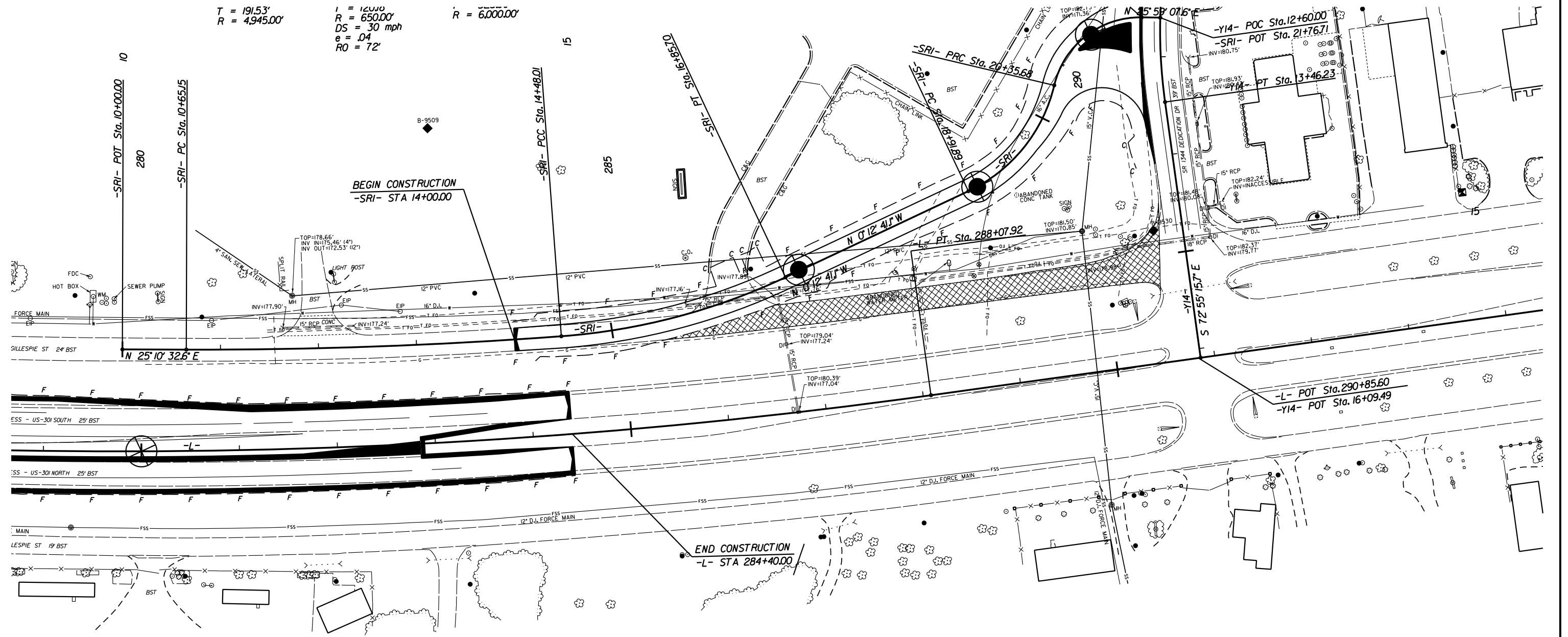
PHONE: 919.871.0800
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SITE PLAN

I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00



$T = 191.53'$
 $R = 4,945.00'$
 $I = 12.000$
 $R = 650.00'$
 $DS = 30 \text{ mph}$
 $e = .04$
 $RO = 72'$
 $R = 6,000.00'$



NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.



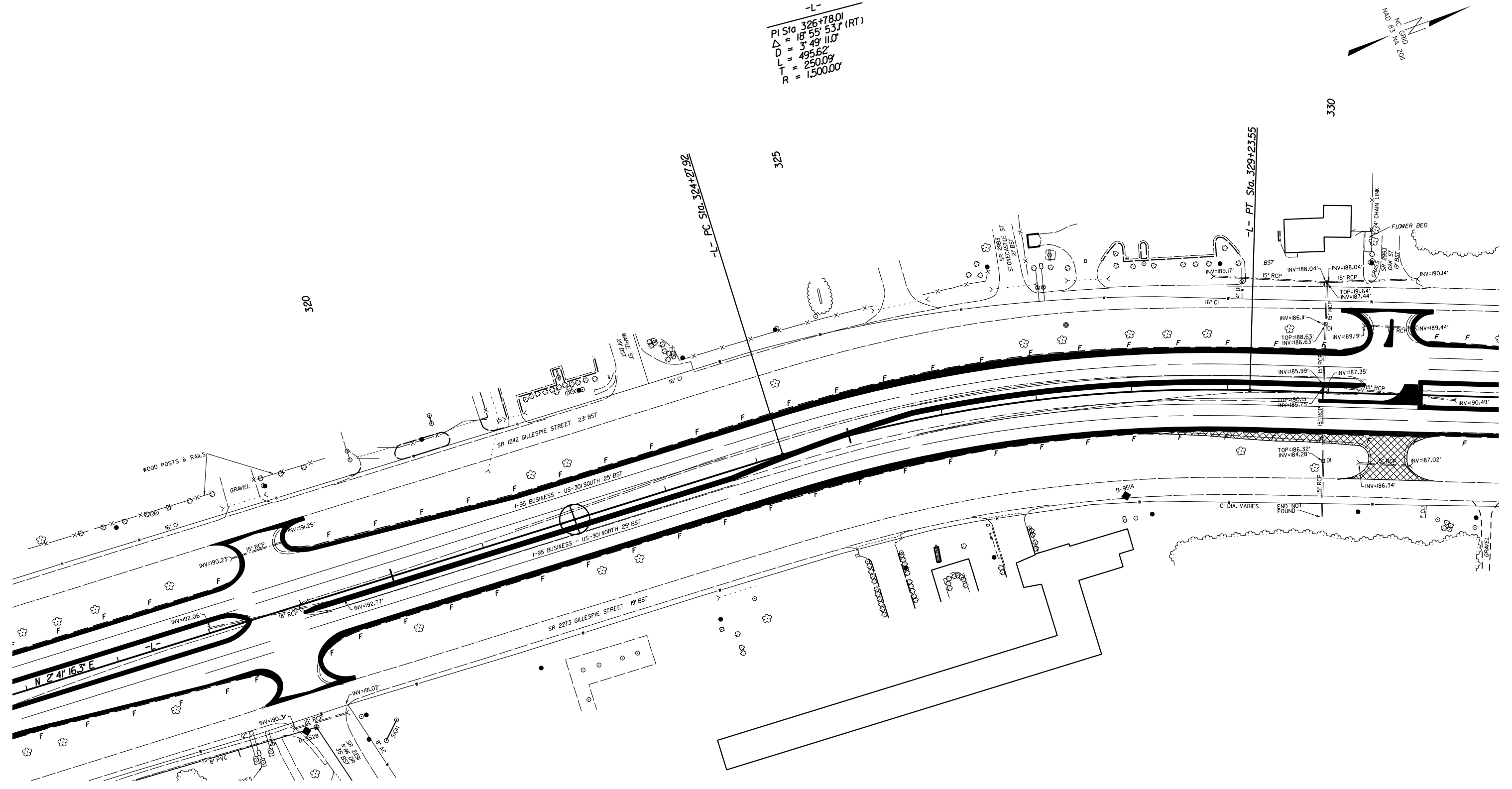
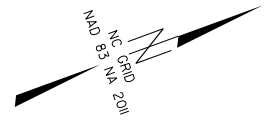
FALCON ENGINEERING, INC.
 1210 TRINITY ROAD, SUITE 110
 RALEIGH, NC 27607
 PHONE: 919.871.0800
 FAX: 919.871.0803

SITE PLAN

I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00

K = 1,500.00

-L-
 PI Sta 326+78.01
 $\Delta = 18^{\circ} 55' 53"$ (RT)
 D = 3' 49' 11.0"
 L = 495.62'
 T = 250.09'
 R = 1,500.00'

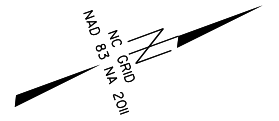


NOTES:
 • PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.

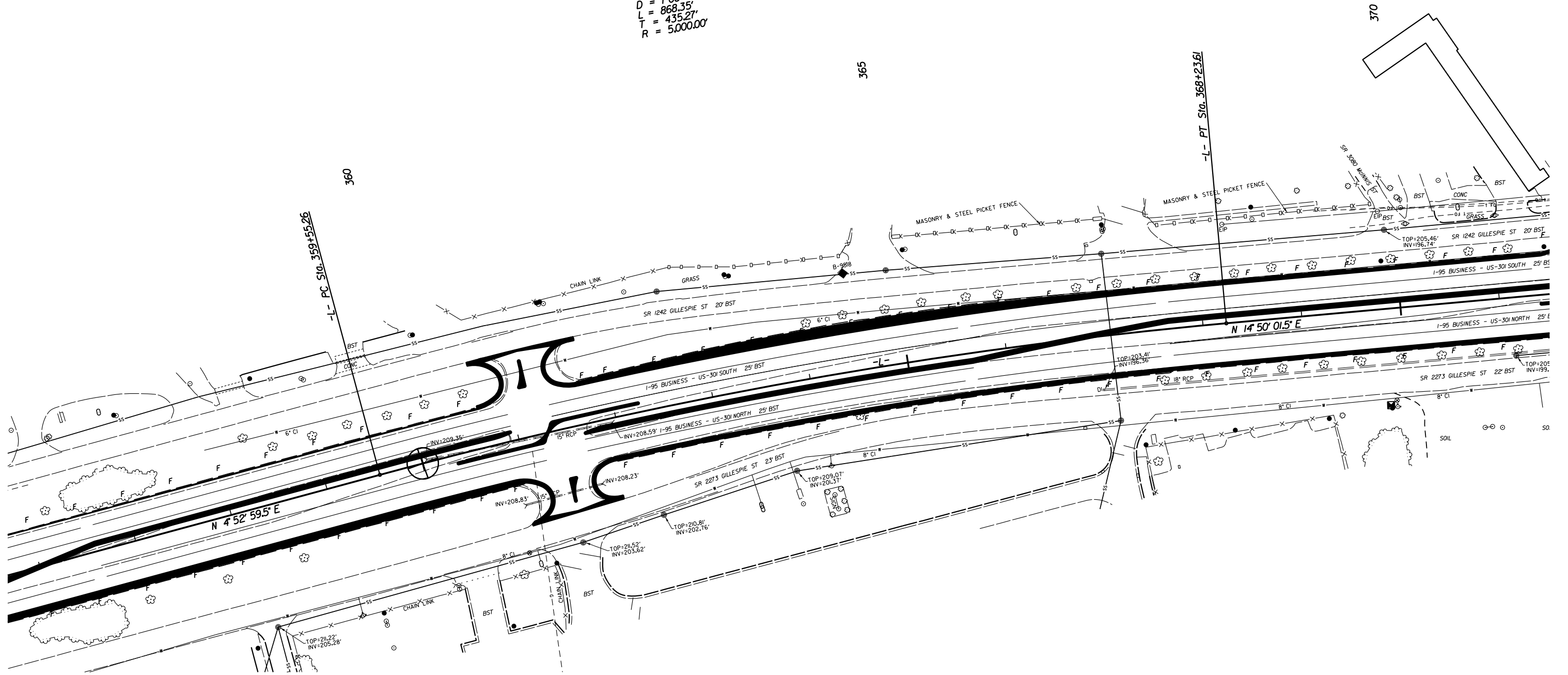


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SITE PLAN
 I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00



-L-
 PI Sta 363+90.53
 $\Delta = 9^{\circ} 57' 02.0''$ (RT)
 $D = 108' 45.3''$
 $L = 868.35'$
 $T = 435.27'$
 $R = 5,000.00'$

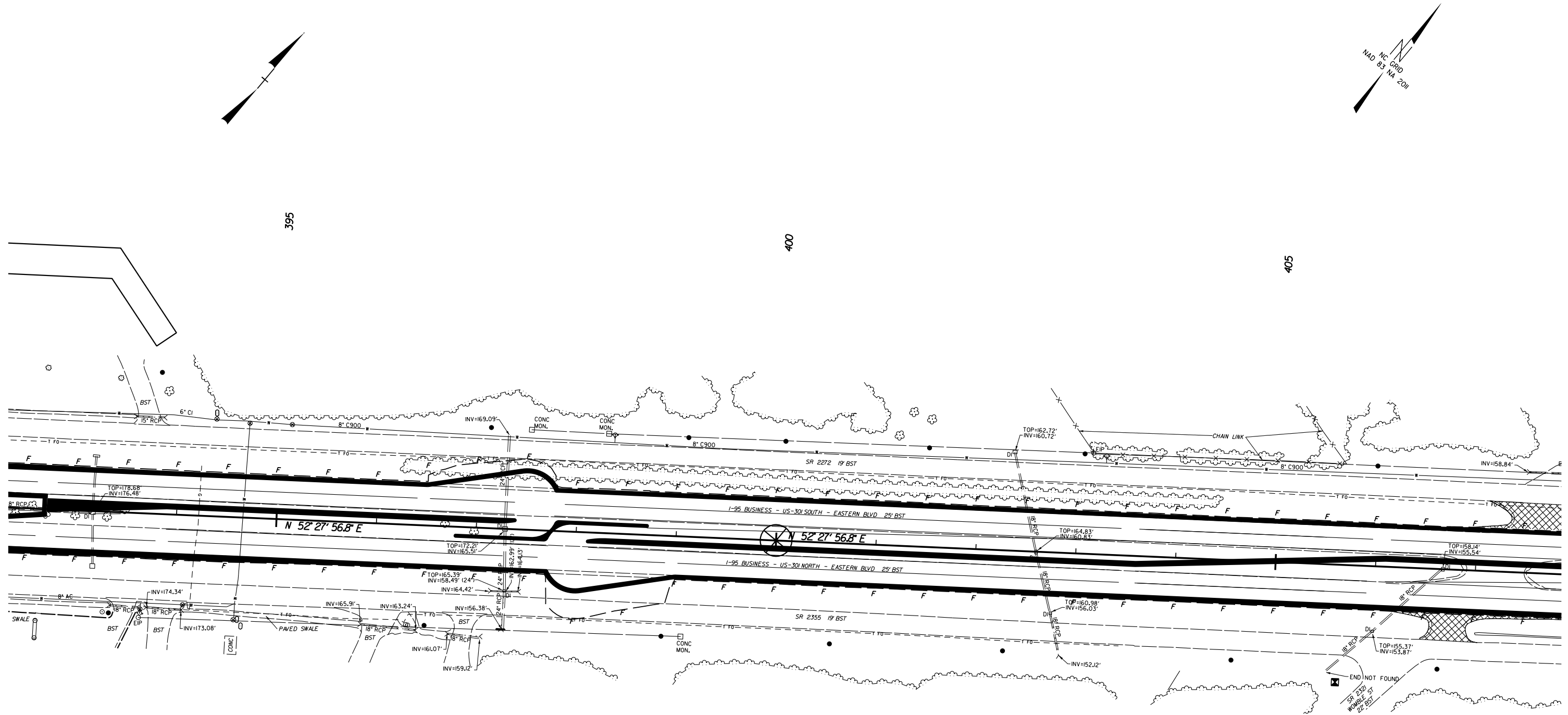


NOTES:

- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.

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SITE PLAN
 I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00



NOTES:

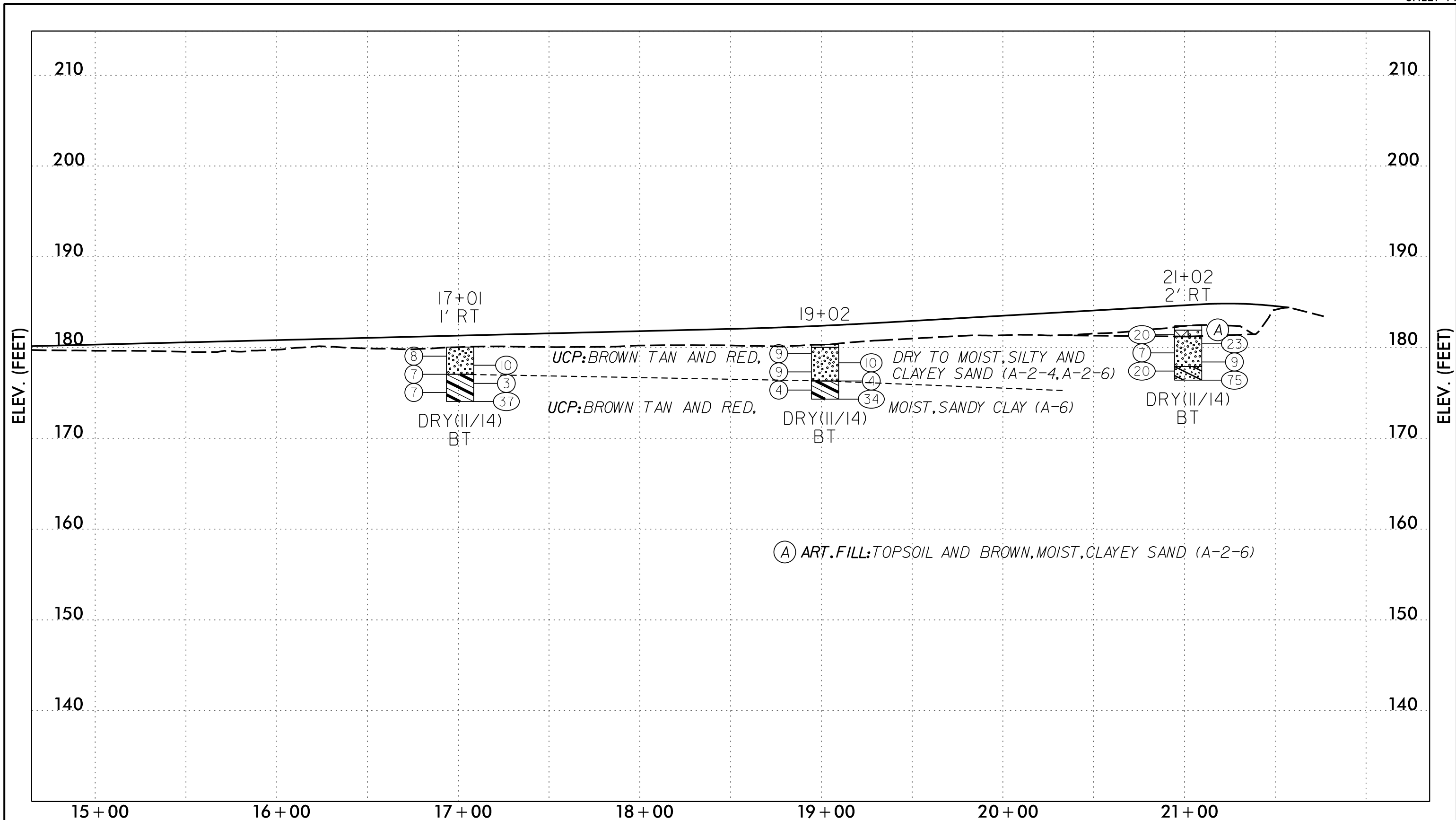
- PLANS ADOPTED FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER 2014.



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SITE PLAN

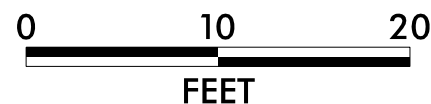
I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
 CUMBERLAND COUNTY, NORTH CAROLINA
 WBS: , TIP: W-5519
 FALCON PROJECT NO.: G14025.00



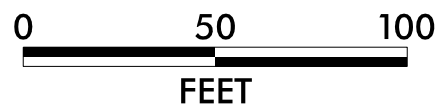
NOTES:

- GROUNDLINE PROFILE OF -SR1- TAKEN FROM ELECTRONIC FILES RECEIVED FROM MOFFATT AND NICHOL, DATED NOVEMBER, 2014.
- INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

VERTICAL SCALE



HORIZONTAL SCALE

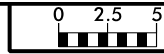


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SUBSURFACE PROFILE ALONG -SR1-

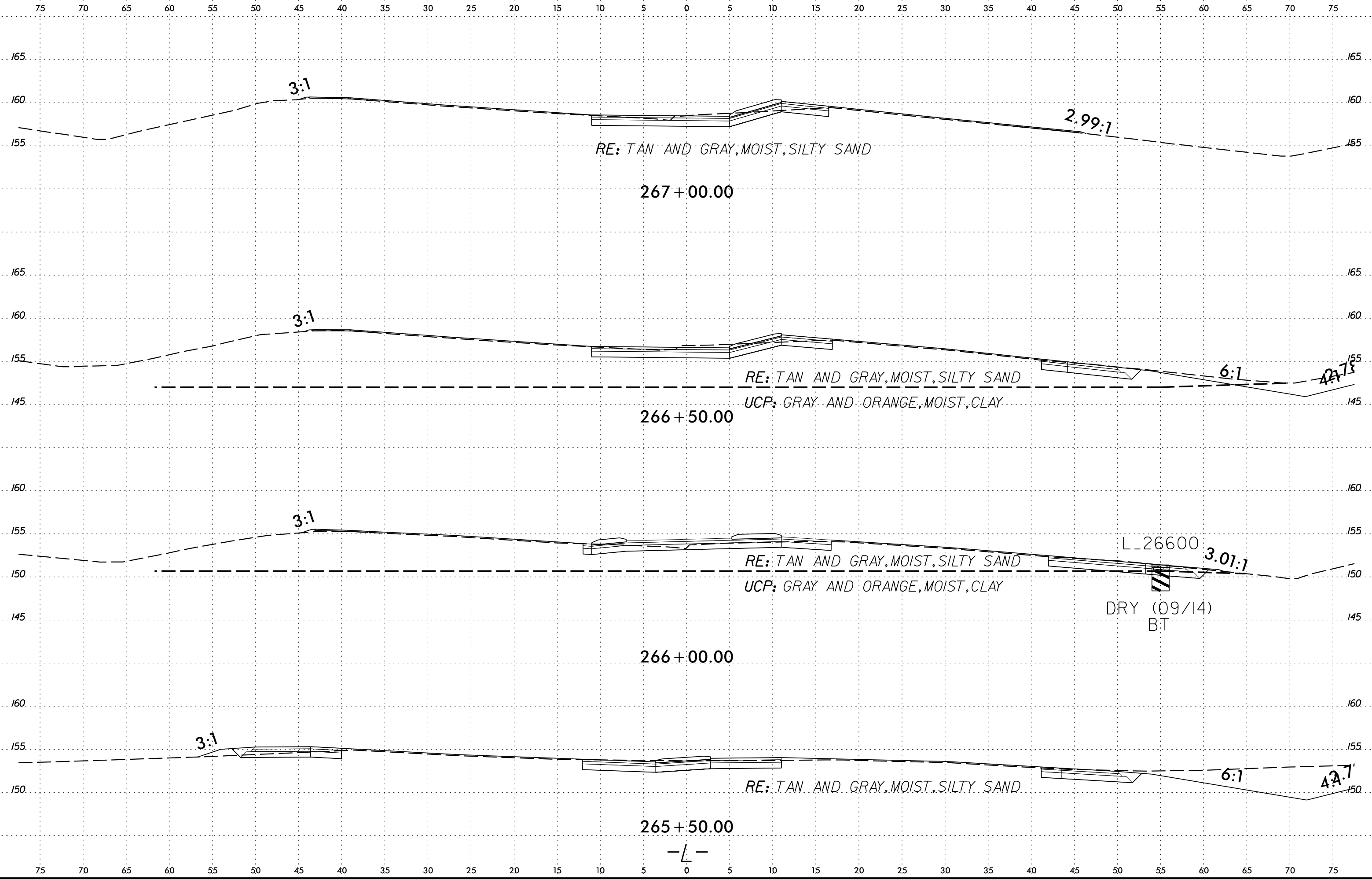
I-95 BUSINESS /US-301 FROM NC 87 SOUTH TO NC 59
CUMBERLAND COUNTY, NORTH CAROLINA
WBS: , TIP: W-5519
FALCON PROJECT NO.: G14025.00

8/23/99



PROJ. REFERENCE NO.
W-5519

SHEET NO.
15



SECTION CUTLINE

—L—



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_11600	STATION 116+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 132.6 ft	TOTAL DEPTH 3.0 ft	NORTHING 437,995	EASTING 2,022,389
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
135																
														132.6	GROUND SURFACE	0.0
														131.4	TOPSOIL (2")	1.2
														129.6	ROADWAY EMBANKMENT GRAY AND BROWN, SILTY SAND (A-2-4)	3.0
130															UNDIVIDED COASTAL PLAIN GRAY, SILTY SAND (A-2-4)	
															Boring Terminated at Elevation 129.6 ft	

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_12000	STATION 120+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 124.7 ft	TOTAL DEPTH 3.0 ft	NORTHING 438,346	EASTING 2,022,581
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
125																
														124.7	GROUND SURFACE	0.0
														124.5	TOPSOIL (2")	0.2
														121.7	ROADWAY EMBANKMENT GRAY AND TAN, SILTY SAND (A-2-4)	3.0
															Boring Terminated at Elevation 121.7 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_13500	STATION 135+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 111.5 ft	TOTAL DEPTH 3.0 ft	NORTHING 439,602	EASTING 2,023,393
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
115														
													GROUND SURFACE	0.0
													TOPSOIL (3")	0.0
													ROADWAY EMBANKMENT	3.0
													ORANGE, SAND (A-1-b) W/ SILT	
													Boring Terminated at Elevation 108.5 ft	

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_13900	STATION 139+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 104.0 ft	TOTAL DEPTH 3.0 ft	NORTHING 439,914	EASTING 2,023,643
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
105														
													GROUND SURFACE	0.0
													TOPSOIL (5")	0.0
													ROADWAY EMBANKMENT	2.0
													DARK TAN, SILTY SAND (A-2-4)	3.0
													UNDIVIDED COASTAL PLAIN	
													GRAY AND WHITE, CLAY (A-7-6)	
													Boring Terminated at Elevation 101.0 ft	

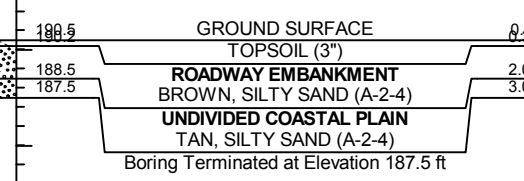
NCDOT BORE DOUBLE W5519.GPJ NC_DOT.GDT 12/5/14



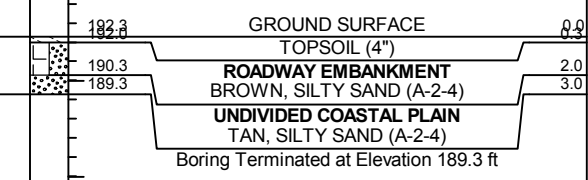
NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_20600		STATION 206+00		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 190.5 ft		TOTAL DEPTH 3.0 ft		NORTHING 445,809		EASTING 2,026,753										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 10/01/14		COMP. DATE 10/01/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195																
190																



WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_20900		STATION 209+00		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 192.3 ft		TOTAL DEPTH 3.0 ft		NORTHING 446,078		EASTING 2,026,885										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 10/01/14		COMP. DATE 10/01/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195																
190																



NCDOT BORE DOUBLE W5519.GPJ NC_DOT.GDT 12/5/14



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_21600	STATION 216+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 193.8 ft	TOTAL DEPTH 3.0 ft	NORTHING 446,711	EASTING 2,027,184
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
195															
														193.8	GROUND SURFACE 0.0
														191.9	TOPSOIL (4") 1.9
														190.8	ROADWAY EMBANKMENT BROWN, SILTY SAND (A-2-4) 3.0
															UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)
															Boring Terminated at Elevation 190.8 ft

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_21870	STATION 218+70	OFFSET 55 ft LT	ALIGNMENT -L-
COLLAR ELEV. 194.0 ft	TOTAL DEPTH 3.0 ft	NORTHING 446,979	EASTING 2,027,247
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	LOG G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
195															
														194.0	GROUND SURFACE 0.0
														193.2	TOPSOIL (9") 0.8
														191.0	UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4) 3.0
															Boring Terminated at Elevation 191.0 ft



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_21970	STATION 219+70	OFFSET 60 ft RT	ALIGNMENT -L-
COLLAR ELEV. 193.6 ft	TOTAL DEPTH 3.0 ft	NORTHING 447,021	EASTING 2,027,394
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195																
														193.6	GROUND SURFACE	0.0
														191.9	TOPSOIL (4")	1.7
														190.6	ROADWAY EMBANKMENT BROWN, SILTY SAND (A-2-4)	3.0
															UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)	
															Boring Terminated at Elevation 190.6 ft	

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_22300	STATION 223+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 194.1 ft	TOTAL DEPTH 3.0 ft	NORTHING 447,346	EASTING 2,027,478
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/01/14	COMP. DATE 10/01/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195																
														194.1	GROUND SURFACE	0.0
														193.6	TOPSOIL (6")	0.5
														192.4	UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)	1.7
														191.1	UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)	3.0
															Boring Terminated at Elevation 191.1 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_23000		STATION 230+00		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 195.6 ft		TOTAL DEPTH 3.0 ft		NORTHING 447,982		EASTING 2,027,771										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 10/01/14		COMP. DATE 10/01/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
195																

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_23500		STATION 235+00		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 195.5 ft		TOTAL DEPTH 3.0 ft		NORTHING 448,439		EASTING 2,027,973										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 10/01/14		COMP. DATE 10/01/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200																
195																

NCDOT BORE DOUBLE W5519.GPJ NC_DOT.GDT 12/5/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_24170		STATION 241+70		OFFSET 50 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 195.0 ft		TOTAL DEPTH 3.0 ft		NORTHING 449,073		EASTING 2,028,197										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 10/01/14		COMP. DATE 10/01/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195															195.0 GROUND SURFACE 0.0	
															194.7 TOPSOIL (3") 0.3	
															193.0 UNDIVIDED COASTAL PLAIN 2.0	
															192.0 TAN AND GRAY, SILTY SAND (A-2-4) 3.0	
															TAN, SILTY SAND (A-2-4)	
															Boring Terminated at Elevation 192.0 ft	

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_24270		STATION 242+70		OFFSET 50 ft RT		ALIGNMENT -L-										
COLLAR ELEV. 195.2 ft		TOTAL DEPTH 3.0 ft		NORTHING 449,122		EASTING 2,028,333										
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A												
DRILLER PAUL, A.		START DATE 09/30/14		COMP. DATE 09/30/14		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
200															195.2 GROUND SURFACE 0.0	
															193.5 TOPSOIL (1") 1.7	
															192.2 UNDIVIDED COASTAL PLAIN 3.0	
															TAN, SILTY SAND (A-2-4)	
															TAN, CLAYEY SAND (A-2-4)	
															Boring Terminated at Elevation 192.2 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A		TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.	
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59					GROUND WTR (ft)
BORING NO. L_24900	STATION 249+00	OFFSET CL	ALIGNMENT -L-	0 HR.	Dry
COLLAR ELEV. 185.5 ft	TOTAL DEPTH 3.0 ft	NORTHING 449,721	EASTING 2,028,536	24 HR.	Dry
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A	
DRILLER PAUL, A.		START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
190																
185														185.5	GROUND SURFACE	0.0
														183.5	TOPSOIL (2")	2.0
														182.5	UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)	3.0
															BROWN, SILTY SAND (A-2-4)	
															Boring Terminated at Elevation 182.5 ft	

WBS N/A		TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.	
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59					GROUND WTR (ft)
BORING NO. L_25400	STATION 254+00	OFFSET CL	ALIGNMENT -L-	0 HR.	Dry
COLLAR ELEV. 176.2 ft	TOTAL DEPTH 3.0 ft	NORTHING 450,184	EASTING 2,028,724	24 HR.	Dry
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A	
DRILLER PAUL, A.		START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
180																
175														176.2	GROUND SURFACE	0.0
														174.8	TOPSOIL (2")	1.4
														173.7	ROADWAY EMBANKMENT GRAY AND RED, SILTY SAND (A-2-4)	2.5
														173.2	YELLOW, SILTY SAND (A-2-4) RED, SILTY SAND (A-2-4)	3.0
															Boring Terminated at Elevation 173.2 ft	



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_26200	STATION 262+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 151.5 ft	TOTAL DEPTH 3.0 ft	NORTHING 450,979	EASTING 2,028,779
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
155															
150															

GROUND SURFACE 151.5

TOPSOIL (2") 149.7

ROADWAY EMBANKMENT 148.5

GRAY AND TAN, SILTY SAND (A-2-4)

UNDIVIDED COASTAL PLAIN TAN AND GRAY, CLAY (A-7-6)

Boring Terminated at Elevation 148.5 ft

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_26500	STATION 265+00	OFFSET 50 ft LT	ALIGNMENT -L-
COLLAR ELEV. 152.3 ft	TOTAL DEPTH 3.0 ft	NORTHING 451,279	EASTING 2,028,729
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
155															
150															

GROUND SURFACE 152.3

TOPSOIL (3") 150.8

ROADWAY EMBANKMENT 149.3

GRAY AND TAN, SILTY SAND (A-2-4)

TAN AND ORANGE, SILTY SAND (A-2-4)

Boring Terminated at Elevation 149.3 ft



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_26600	STATION 266+00	OFFSET 55 ft RT	ALIGNMENT -L-
COLLAR ELEV. 152.7 ft	TOTAL DEPTH 3.0 ft	NORTHING 451,375	EASTING 2,028,837
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
155														
													GROUND SURFACE	0.0
													TOPSOIL (3")	0.7
150													ROADWAY EMBANKMENT	
													TAN AND GRAY, SILTY SAND (A-2-4)	
													UNDIVIDED COASTAL PLAIN	
													GRAY AND ORANGE, CLAY (A-7-6)	
													Boring Terminated at Elevation 149.7 ft	

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_26800	STATION 268+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 161.8 ft	TOTAL DEPTH 3.0 ft	NORTHING 451,577	EASTING 2,028,809
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				
165														
													GROUND SURFACE	0.0
													TOPSOIL (3")	0.7
160													ROADWAY EMBANKMENT	
													TAN AND GRAY, SILTY SAND (A-2-4)	
													Boring Terminated by Auger Refusal at Elevation 158.8 ft on RCP	



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_27600	STATION 276+00	OFFSET CL	ALIGNMENT -L-	0 HR. Dry												
COLLAR ELEV. 177.5 ft	TOTAL DEPTH 3.0 ft	NORTHING 452,310	EASTING 2,029,121	24 HR. Dry												
DRILL RIG/HAMMER EFF./DATE N/A			DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A												
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
180																
															177.5	GROUND SURFACE
																TOPSOIL (3")
															174.5	UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)
175																Boring Terminated at Elevation 174.5 ft

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.										
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)									
BORING NO. L_28000	STATION 280+00	OFFSET CL	ALIGNMENT -L-	0 HR. Dry												
COLLAR ELEV. 181.0 ft	TOTAL DEPTH 3.0 ft	NORTHING 452,668	EASTING 2,029,299	24 HR. Dry												
DRILL RIG/HAMMER EFF./DATE N/A			DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 09/30/14	COMP. DATE 09/30/14	SURFACE WATER DEPTH N/A												
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
185																
															181.0	GROUND SURFACE
																TOPSOIL (3")
											S-5	9%		179.0	ROADWAY EMBANKMENT ORANGE AND GRAY, SILTY SAND (A-2-4)	
														178.0	UNDIVIDED COASTAL PLAIN YELLOW, SILTY SAND (A-2-4)	
																Boring Terminated at Elevation 178.0 ft



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.									
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)								
BORING NO. L_32200		STATION 322+00		OFFSET CL		ALIGNMENT -L-									
COLLAR ELEV. 195.5 ft		TOTAL DEPTH 3.0 ft		NORTHING 456,732		EASTING 2,030,208									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 09/30/14		COMP. DATE 09/30/14		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
200															
195														185.5	GROUND SURFACE
															TOPSOIL (2")
														192.5	ROADWAY EMBANKMENT TAN, SILTY SAND (A-2-4)
															Boring Terminated at Elevation 192.5 ft

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.									
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)								
BORING NO. L_36000		STATION 360+00		OFFSET CL		ALIGNMENT -L-									
COLLAR ELEV. 210.4 ft		TOTAL DEPTH 3.0 ft		NORTHING 460,446		EASTING 2,030,858									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 10/08/14		COMP. DATE 10/08/14		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
215															
210														210.4	GROUND SURFACE
															ROADWAY EMBANKMENT TAN, SILTY SAND (A-2-4)
														207.4	Boring Terminated at Elevation 207.4 ft

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. L_40000	STATION 400+00	OFFSET CL	ALIGNMENT -L-
COLLAR ELEV. 169.4 ft	TOTAL DEPTH 3.0 ft	NORTHING 463,758	EASTING 2,032,733
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 10/08/14	COMP. DATE 10/08/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
170															
														168.4	GROUND SURFACE
														166.4	ROADWAY EMBANKMENT BROWN, SILTY SAND (A-2-4)
														166.4	ROADWAY EMBANKMENT YELLOW TAN AND ORANGE, CLAYEY SAND (A-2-6)
															Boring Terminated at Elevation 166.4 ft

WBS N/A	TIP W-5519	COUNTY CUMBERLAND	GEOLOGIST PAUL, A.
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59			GROUND WTR (ft)
BORING NO. SR1_1701	STATION 17+01	OFFSET 1 ft RT	ALIGNMENT -SR1-
COLLAR ELEV. 180.3 ft	TOTAL DEPTH 6.0 ft	NORTHING 453,354	EASTING 2,029,414
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger	HAMMER TYPE N/A
DRILLER PAUL, A.	START DATE 11/21/14	COMP. DATE 11/21/14	SURFACE WATER DEPTH N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
185															
180	180.3	0.0												180.3	GROUND SURFACE
	179.3	1.0	N/A	4	4										UNDIVIDED COASTAL PLAIN TAN, SILTY SAND (A-2-4)
	178.3	2.0	N/A	5	5										
	177.3	3.0	N/A	3	4									177.3	BROWN AND RED, SANDY CLAY (A-6)
	176.3	4.0	N/A	1	2										
175	175.3	5.0	N/A	3	4									174.3	Boring Terminated at Elevation 174.3 ft
			N/A	18	19										



NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.									
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)								
BORING NO. SR1_1902		STATION 19+02		OFFSET CL		ALIGNMENT -SR1-									
COLLAR ELEV. 180.6 ft		TOTAL DEPTH 6.0 ft		NORTHING 453,555		EASTING 2,029,415									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 11/21/14		COMP. DATE 11/21/14		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
185															
180	180.6	0.0	N/A	4	5									8% TOPSOIL (3")	0.0
	179.6	1.0	N/A	5	5									UNDIVIDED COASTAL PLAIN	
	178.6	2.0	N/A	4	5									BROWN/RED, SILTY SAND (A-2-4)	4.0
	177.6	3.0	N/A	2	2									BROWN, SANDY CLAY (A-6)	6.0
	176.6	4.0	N/A	2	2										
	175.6	5.0	N/A	17	17										

Boring Terminated at Elevation 174.6 ft

Other Samples:
CBR-1 (1.0 - 2.0)

WBS N/A		TIP W-5519		COUNTY CUMBERLAND		GEOLOGIST PAUL, A.									
SITE DESCRIPTION I-95 BUSINESS / US-301 FROM NC 87 SOUTH TO NC 59							GROUND WTR (ft)								
BORING NO. SR1_2102		STATION 21+02		OFFSET 2 ft RT		ALIGNMENT -SR1-									
COLLAR ELEV. 182.7 ft		TOTAL DEPTH 6.0 ft		NORTHING 453,725		EASTING 453,725									
DRILL RIG/HAMMER EFF./DATE N/A		DRILL METHOD Hand Auger		HAMMER TYPE N/A											
DRILLER PAUL, A.		START DATE 11/21/14		COMP. DATE 11/21/14		SURFACE WATER DEPTH N/A									
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	L O G	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
185															
	182.7	0.0	N/A	10	10									GROUND SURFACE	0.0
	181.7	1.0	N/A	11	12									TOPSOIL (6")	0.9
	180.7	2.0	N/A	3	4									ARTIFICIAL FILL	1.2
	179.7	3.0	N/A	4	5									BROWN, CLAYEY SAND (A-2-6)	
	178.7	4.0	N/A	10	10									UNDIVIDED COASTAL PLAIN	4.5
	177.7	5.0	N/A	37	38									TAN AND GRAY, SILTY SAND (A-2-4)	6.0
														BROWN, CLAYEY SAND (A-2-6)	
															Boring Terminated at Elevation 176.7 ft

DCP TEST DATA

File Name: W-5519

Project: G14025.00

Location: L_11360

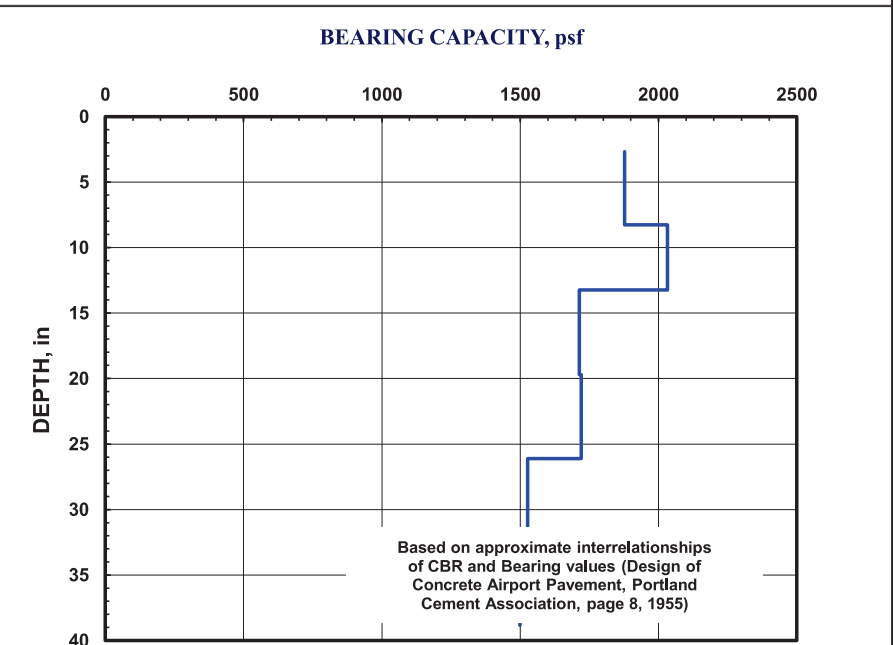
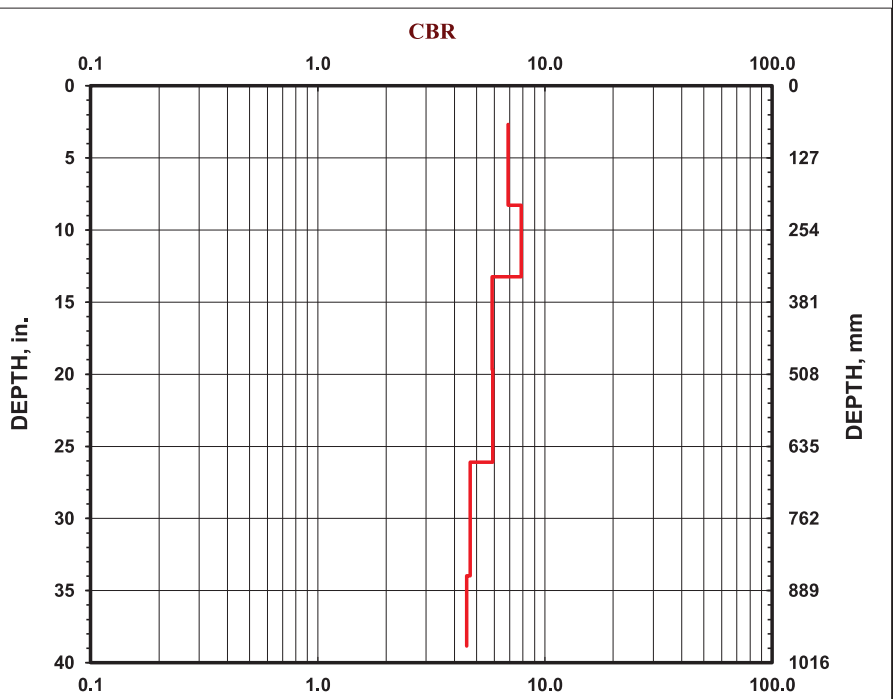
Date: 30-Sep-14

Soil Type(s): A-2-4

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	68	1
5	210	1
5	336	1
5	500	1
5	663	1
5	863	1
3	987	1
		1
		1
		1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Location: L_12000

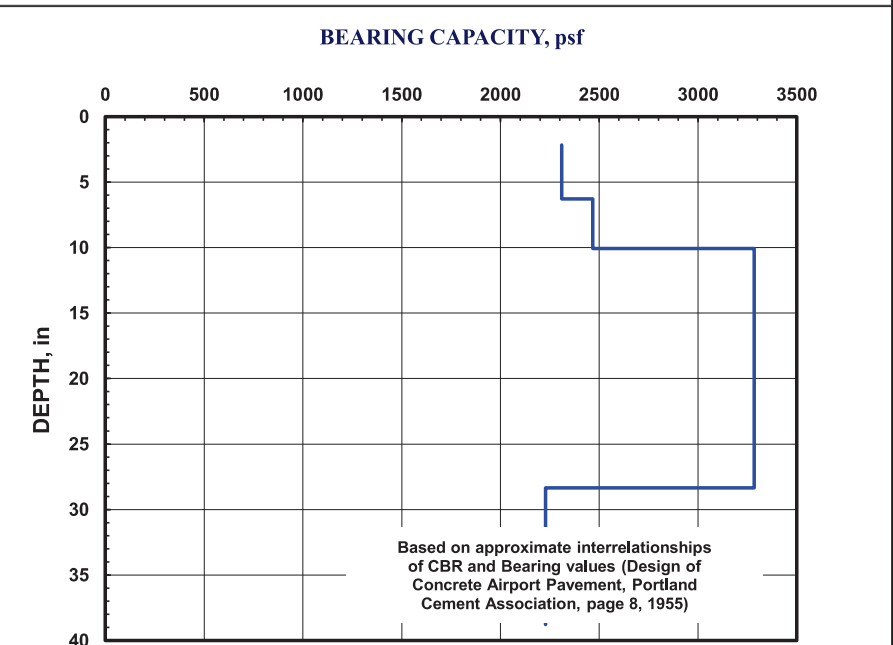
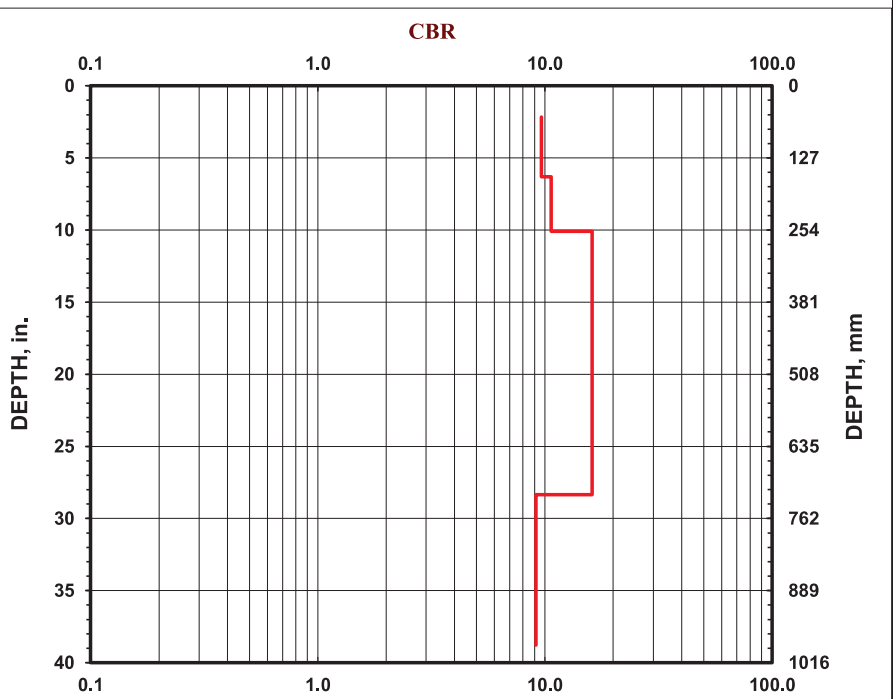
Date: 30-Sep-14

Soil Type(s): A-2-4

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	55	1
5	160	1
5	256	1
35	720	1
12	985	1
		1
		1
		1
		1
		1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Date: 30-Sep-14

Location: L_13900

Soil Type(s): A-2-4

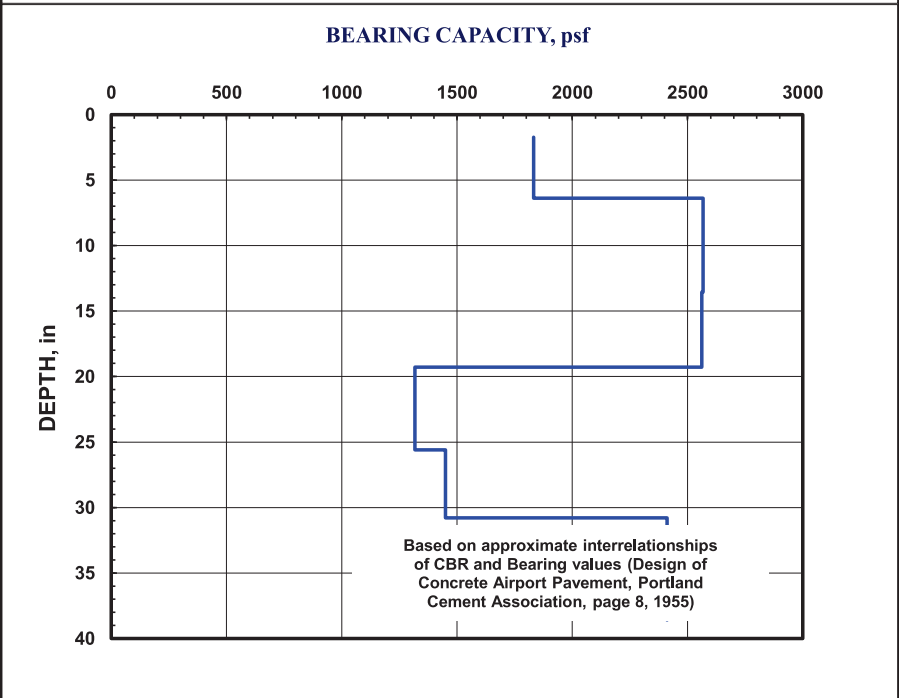
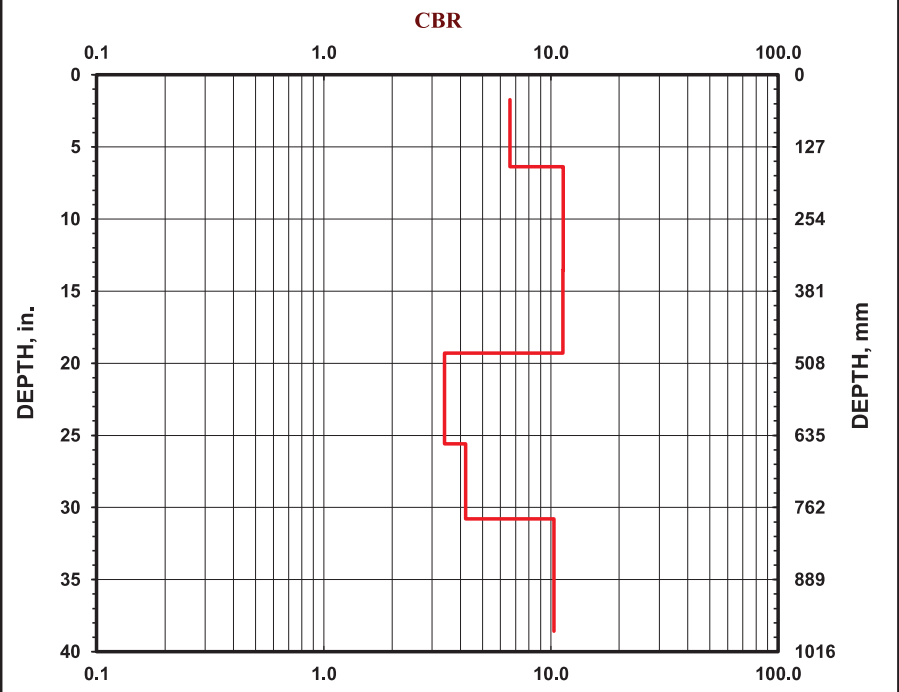
Hammer

- 10.1 lbs.
 17.6 lbs.
 Both hammers used

Soil Type

- CH
 CL
 All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	44	1
4	162	1
10	344	1
8	490	1
3	650	1
3	782	1
10	980	1
		1
		1
		1
		1
		1
		1
		1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Date: 30-Sep-14

Location: L_14700

Soil Type(s): A-2-4

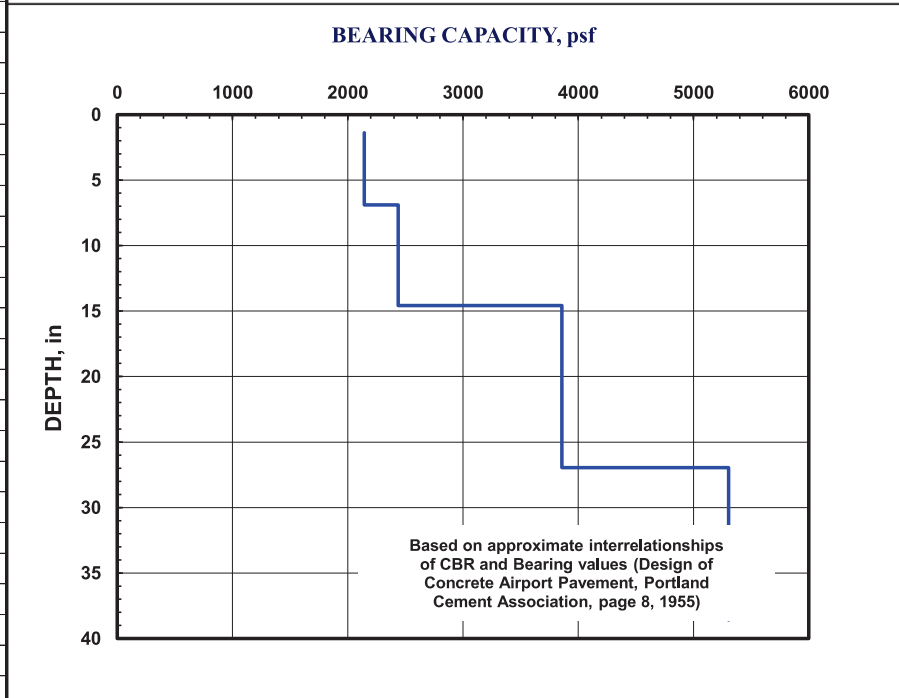
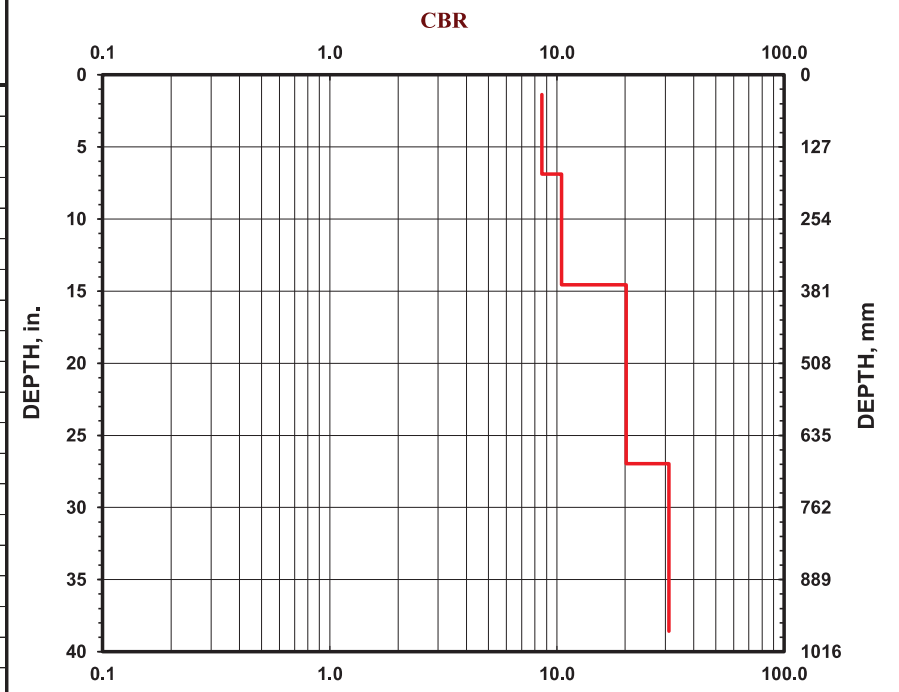
Hammer

- 10.1 lbs.
 17.6 lbs.
 Both hammers used

Soil Type

- CH
 CL
 All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	35	1
6	175	1
10	370	1
29	685	1
40	980	1
		1
		1
		1
		1
		1
		1
		1
		1
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		1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Date: 30-Sep-14

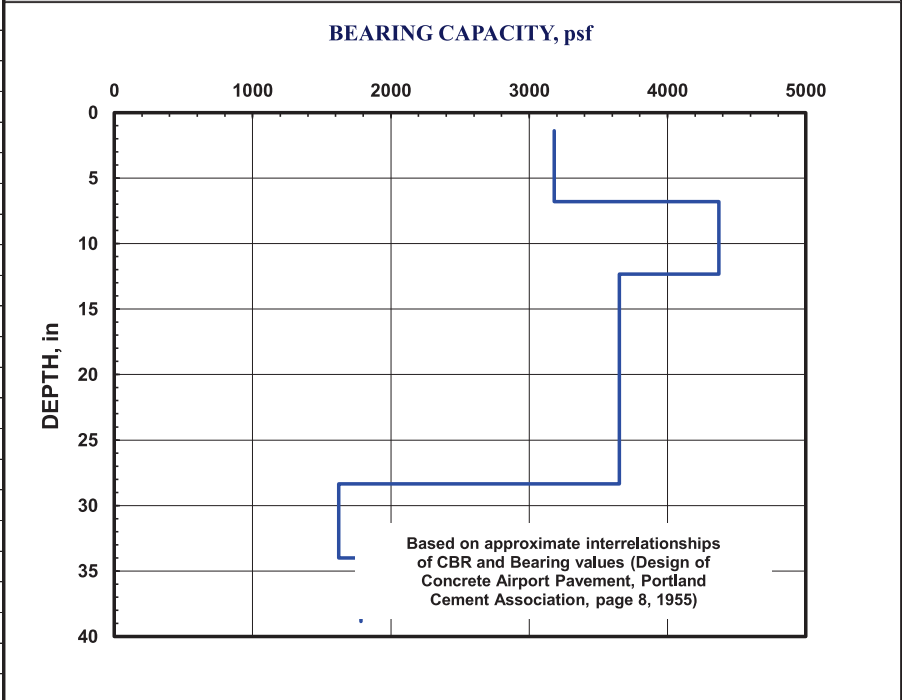
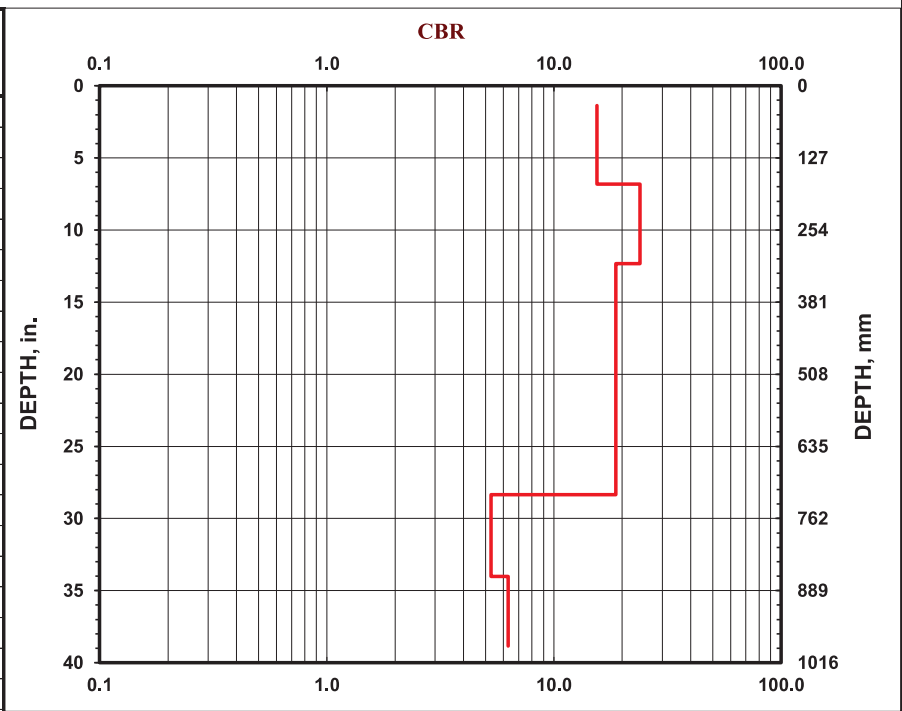
Location: L_20900

Soil Type(s): Type in the soil type

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	35	1
10	173	1
15	313	1
35	720	1
4	864	1
4	987	1
		1
		1
		1
		1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Date: 30-Sep-14

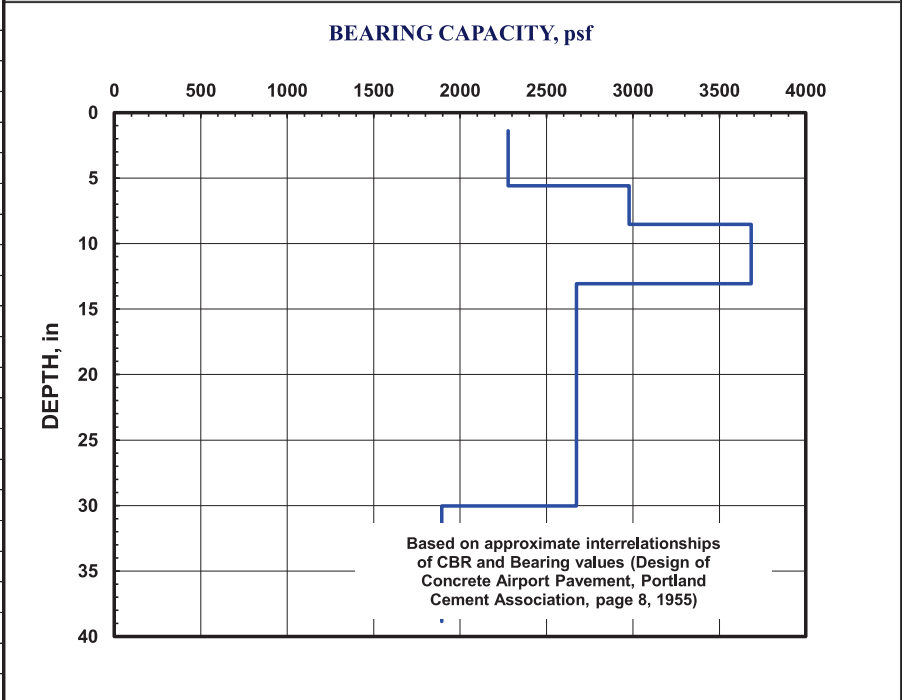
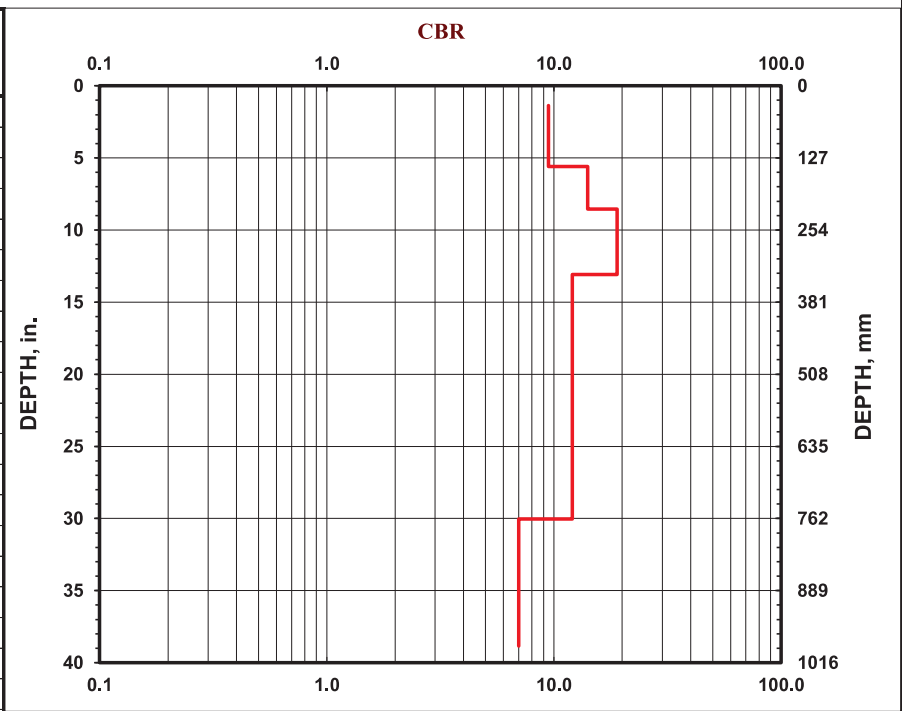
Location: L_21870

Soil Type(s): A-2-4

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	35	1
5	142	1
5	217	1
10	332	1
25	763	1
8	987	1
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DCP TEST DATA

File Name: W-5519

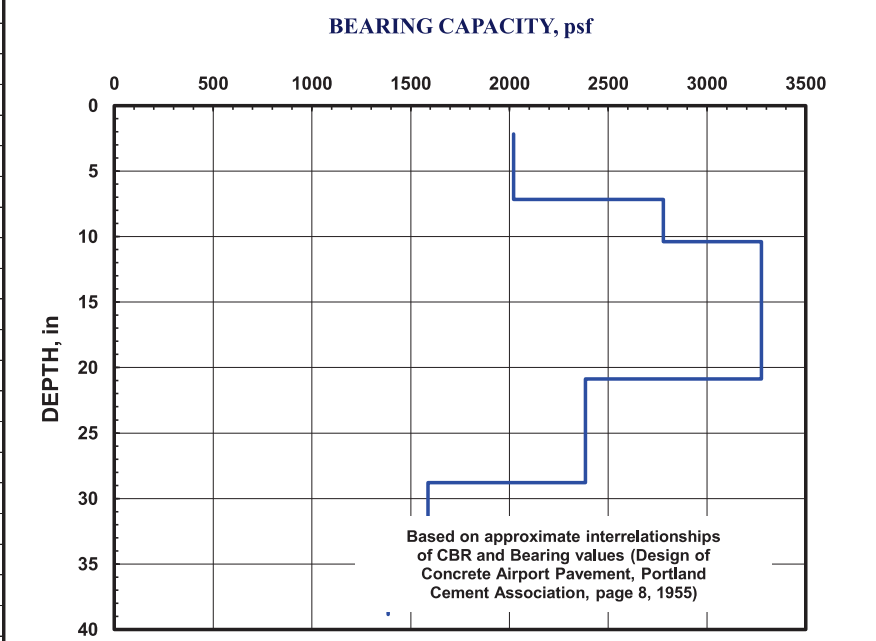
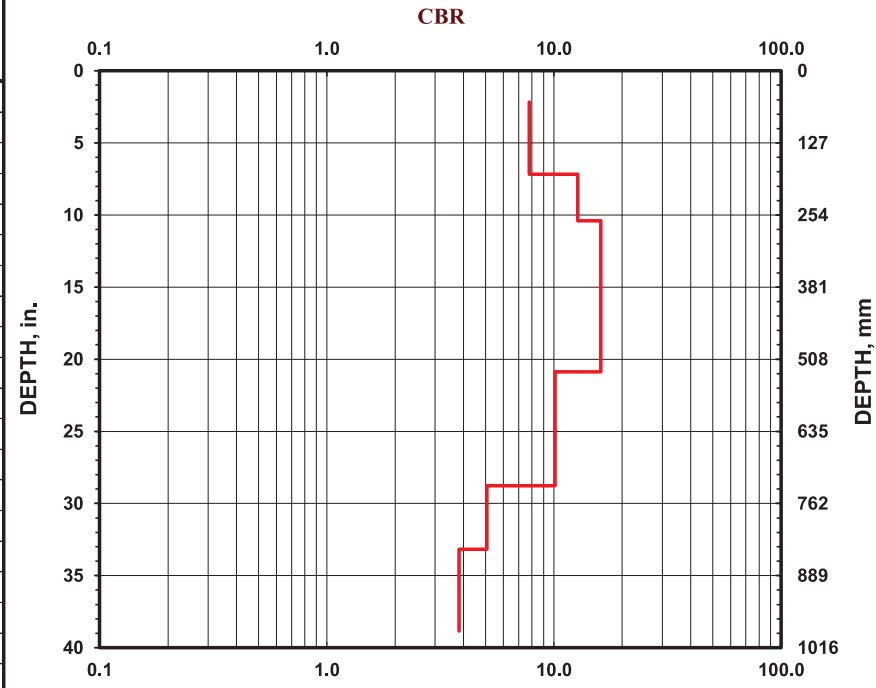
Project: G14025.00
 Location: R-15

Date: 30-Sep-14
 Soil Type(s): A-2-4

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	55	1
5	182	1
5	264	1
20	530	1
10	731	1
3	843	1
3	987	1
		1
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DCP TEST DATA

File Name: W-5519

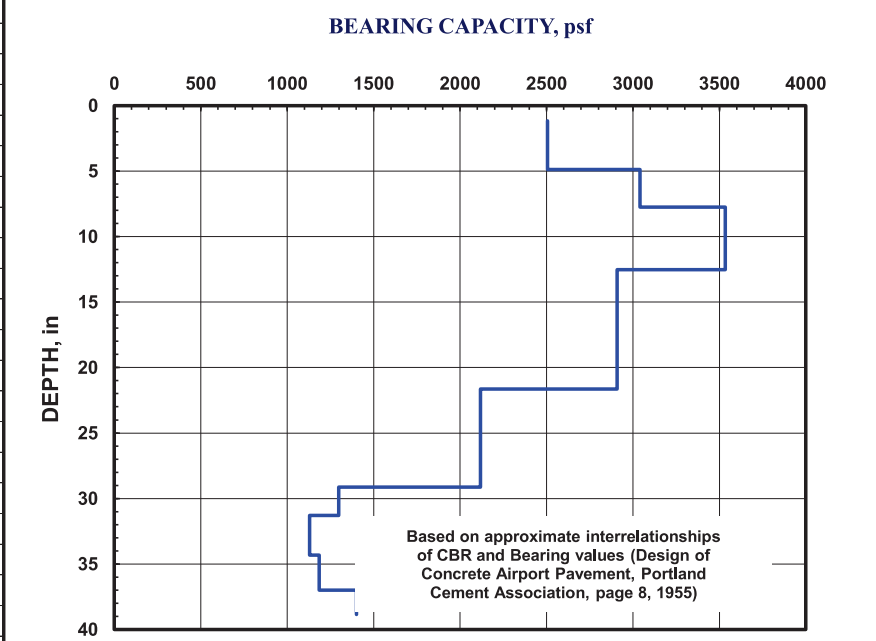
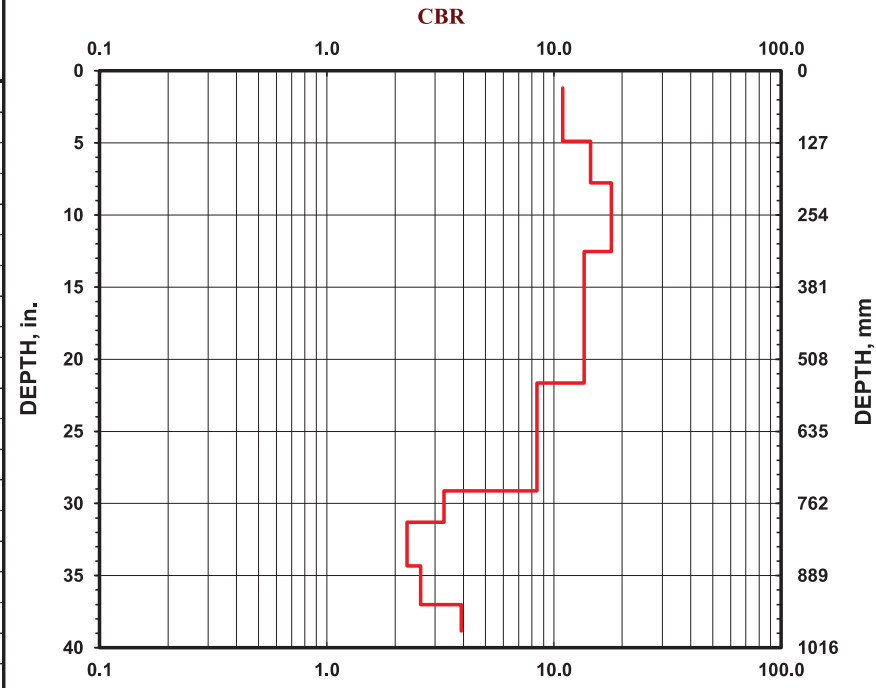
Project: G14025.00
 Location: L_23000

Date: 30-Sep-14
 Soil Type(s): A-2-4

- Hammer
- 10.1 lbs.
 - 17.6 lbs.
 - Both hammers used

- Soil Type
- CH
 - CL
 - All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	30	1
5	124	1
5	197	1
10	318	1
15	550	1
8	740	1
1	795	1
1	872	1
1	940	1
1	987	1
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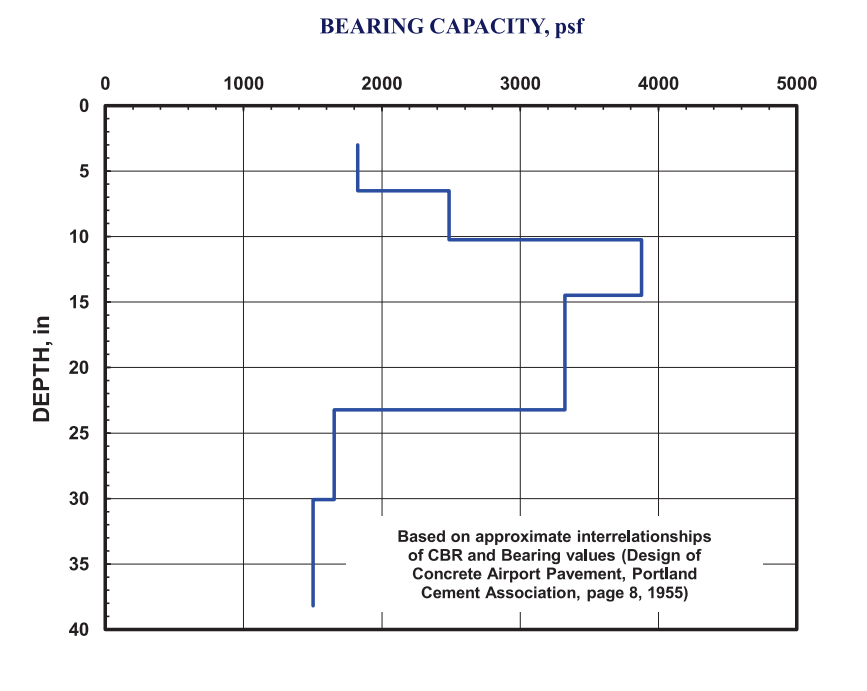
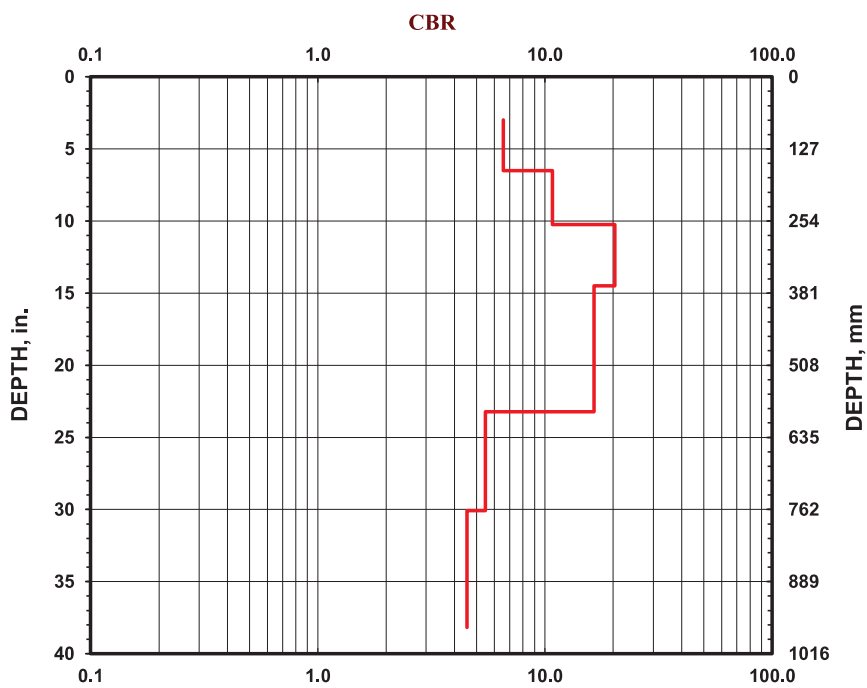
DCP TEST DATA

File Name: W-5519

Project: G14025.00 Date: 30-Sep-14
 Location: L_26200 Soil Type(s): A-2-4

Hammer: 10.1 lbs., 17.6 lbs., Both hammers used
 Soil Type: CH, CL, All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	76	1
3	165	1
5	260	1
10	368	1
17	590	1
5	764	1
5	970	1
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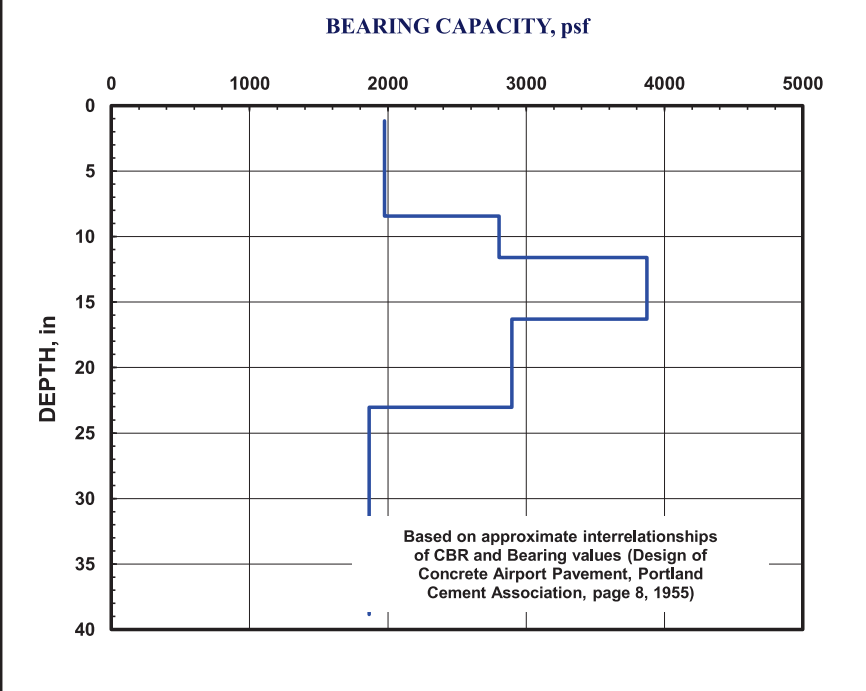
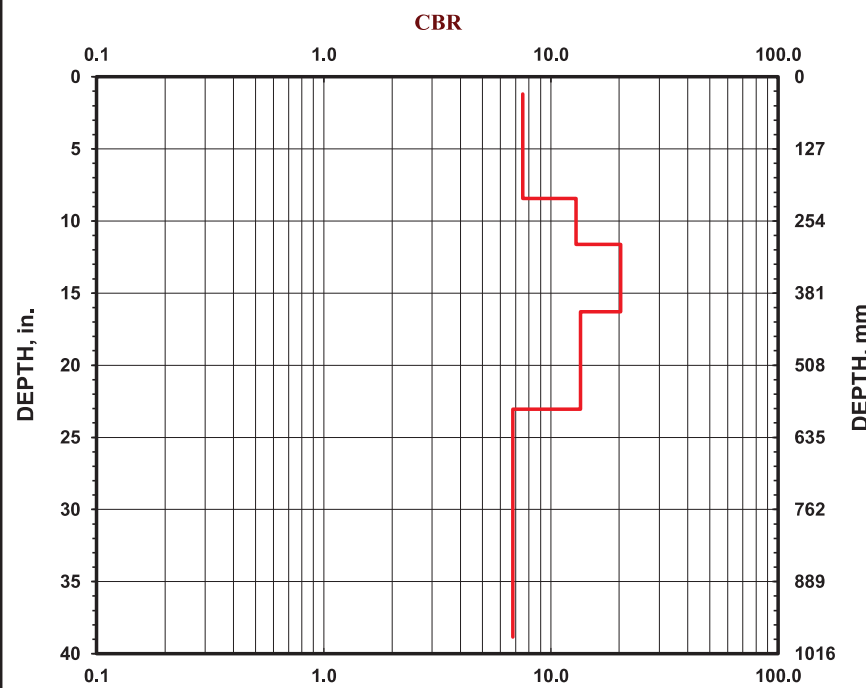
DCP TEST DATA

File Name: W-5519

Project: G14025.00 Date: 30-Sep-14
 Location: L_26800 Soil Type(s): A-2-4

Hammer: 10.1 lbs., 17.6 lbs., Both hammers used
 Soil Type: CH, CL, All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	30	1
7	214	1
5	295	1
11	414	1
11	585	1
14	987	1
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DCP TEST DATA

File Name: W-5519

Project: G14025.00

Date: 30-Sep-14

Location: L_40000

Soil Type(s): A-2-4

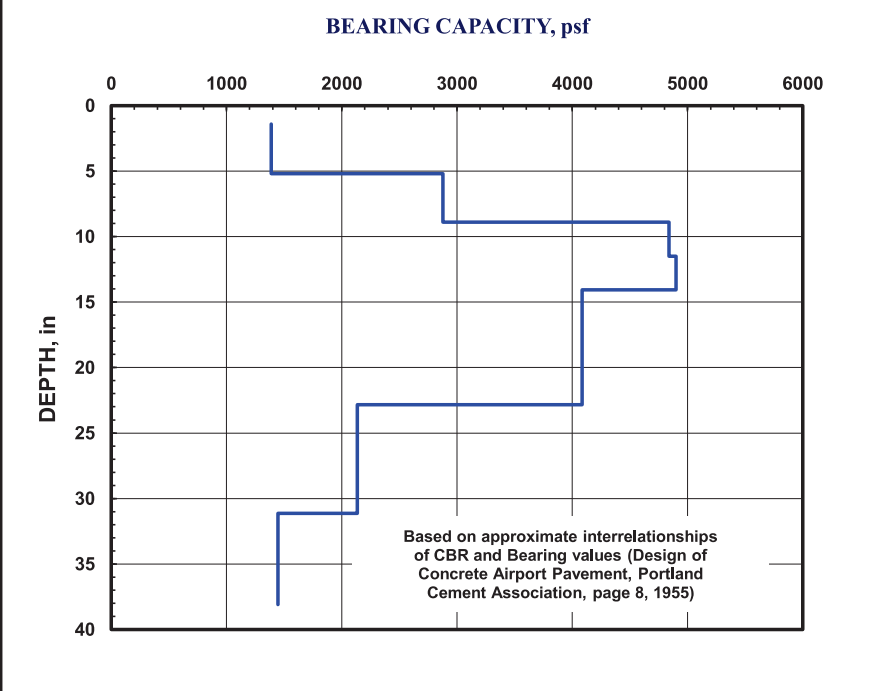
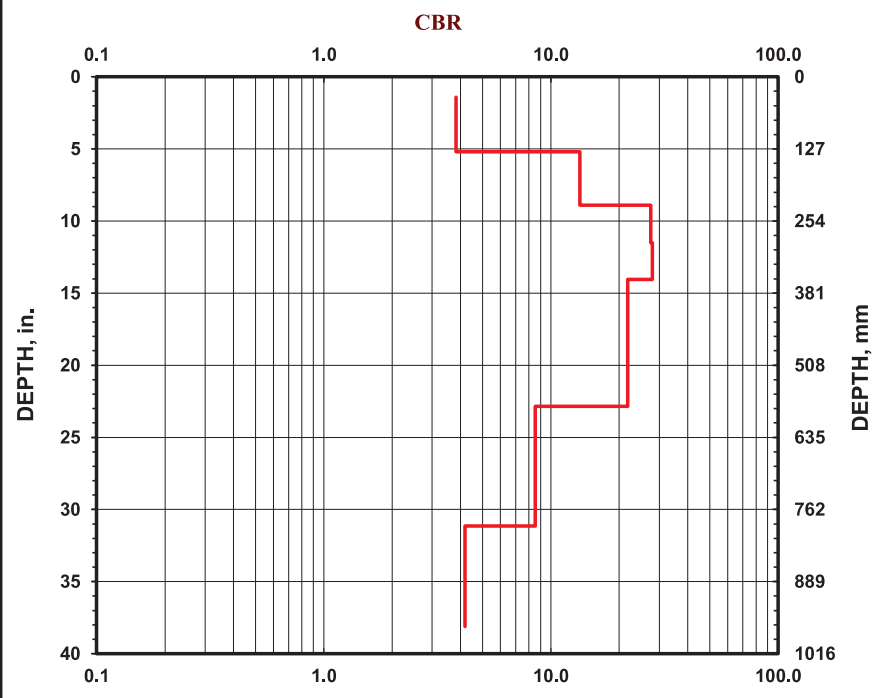
Hammer

- 10.1 lbs.
- 17.6 lbs.
- Both hammers used

Soil Type

- CH
- CL
- All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	36	1
2	132	1
6	226	1
8	292	1
8	357	1
22	580	1
9	791	1
4	968	1
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AASHTO SOIL CLASSIFICATION AND GRADATION SHEET

I-95 BUSINESS / US 301 FROM NC 87 SOUTH TO NC 59

TIP: W-5519

CUMBERLAND COUNTY, NORTH CAROLINA

FALCON ENGINEERING, INC. PROJECT NO: G14025.00

BORING		SAMPLE	TOTAL SAMPLE			Atterberg Limit Test Results			Natural Moisture Content	Organic Content	Corrected CBR @ 0.1"	Optimum Water Content	Max. Dry Density
AASHTO Classification			PERCENT PASSING			LL	PL	PI	%	%		%	PCF
STATION	OFFSET (FEET)	DEPTH (FEET)	#10	#40	#200								
L_11360		S-1	99	66	35	51	26	25	21.7	-	-	-	-
113+60	50' RT	2.2-3.0											
L_13900		S-2	99	78	63	53	25	28	25.4	-	-	-	-
139+00	CL	2.0-3.0											
L_23000		S-3	100	68	24	17	11	6	9.5	-	-	-	-
230+00	CL	1.4-3.0											
L_26200		S-4	99	79	57	57	26	31	27.6	-	-	-	-
262+00	CL	1.8-3.0											
L_28000		S-5	99	68	15	16	0	NP	9.3	-	-	-	-
280+00	CL	0.3-2.0											
SR_1902		BS-1	100	81	18	15	0	NP	7.9	-	21.0	11.3	120.0
19+00	CL	0.3-3.0											

SIGNATURE



105-03-0803

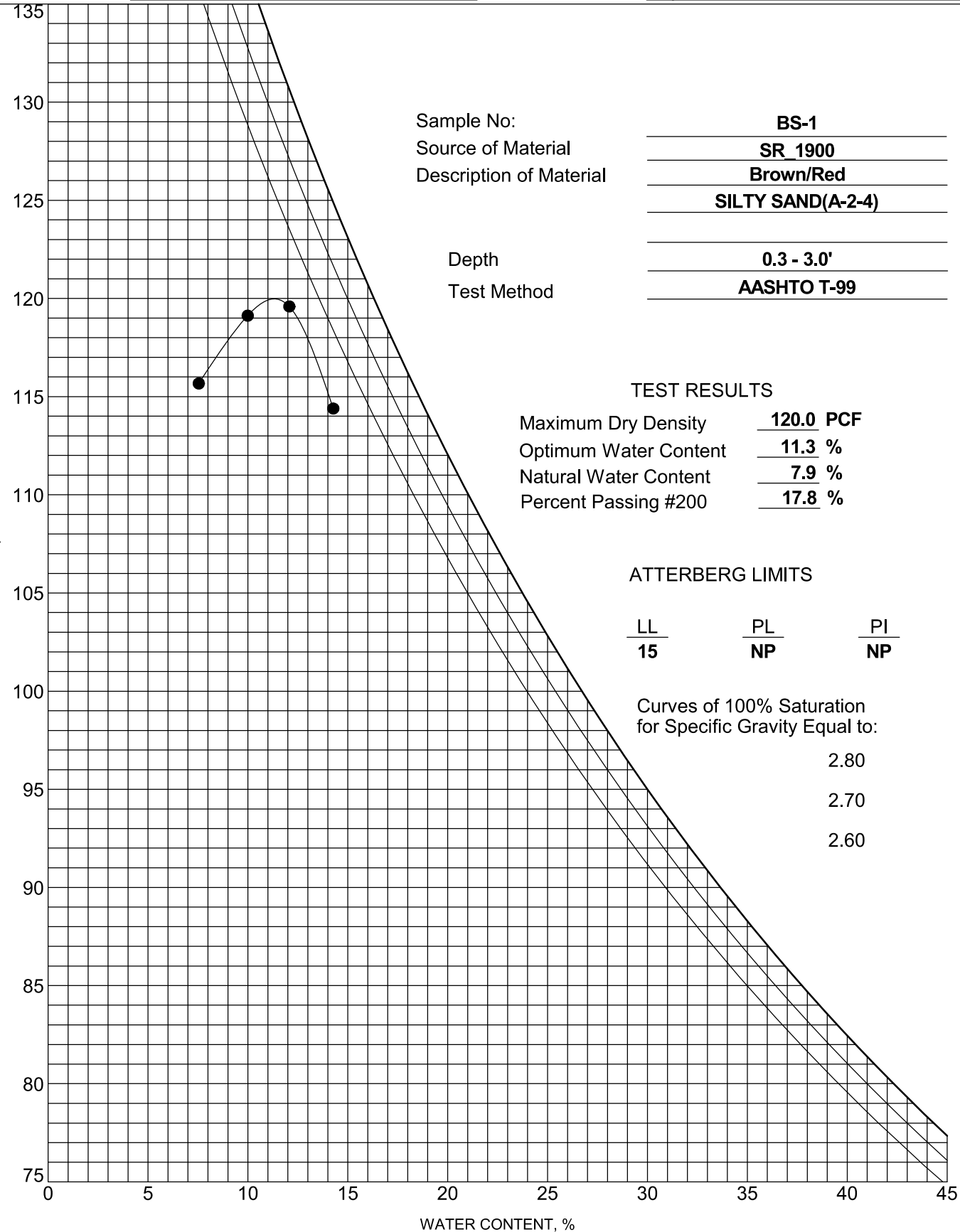
Notes: LL = Liquid limit
 PL = Plastic limit
 PI = Plasticity index = LL - PL



Falcon Engineering, Inc.
 1210 Trinity Rd., Suite 110
 Raleigh, NC 27607
 Telephone: (919) 871-0800
 Fax: (919) 871-0803

MOISTURE-DENSITY RELATIONSHIP

CLIENT Moffat & Nichol PROJECT NAME W5519 I-95 Business Intersection Improvements
 PROJECT NUMBER G14025.00 PROJECT LOCATION Fayetteville, NC



Sample No: BS-1
 Source of Material: SR_1900
 Description of Material: Brown/Red SILTY SAND(A-2-4)
 Depth: 0.3 - 3.0'
 Test Method: AASHTO T-99

TEST RESULTS

Maximum Dry Density 120.0 PCF
 Optimum Water Content 11.3 %
 Natural Water Content 7.9 %
 Percent Passing #200 17.8 %

ATTERBERG LIMITS

LL 15 PL NP PI NP

Curves of 100% Saturation
 for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION - GINT STD US LAB.GDT - 10/10/14 09:19 - T:\PROJECTS\2014\G14025.00 W-5519 I-95 BUSINESS INTERSECTION IMPROVEMENTS\LAB\G14025.00 GINT.GPJ

FALCON ENGINEERING

1210 TRINITY RD., SUITE 110, RALEIGH, NC 27607

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

AASHTO T-193 \ ASTM D-1883

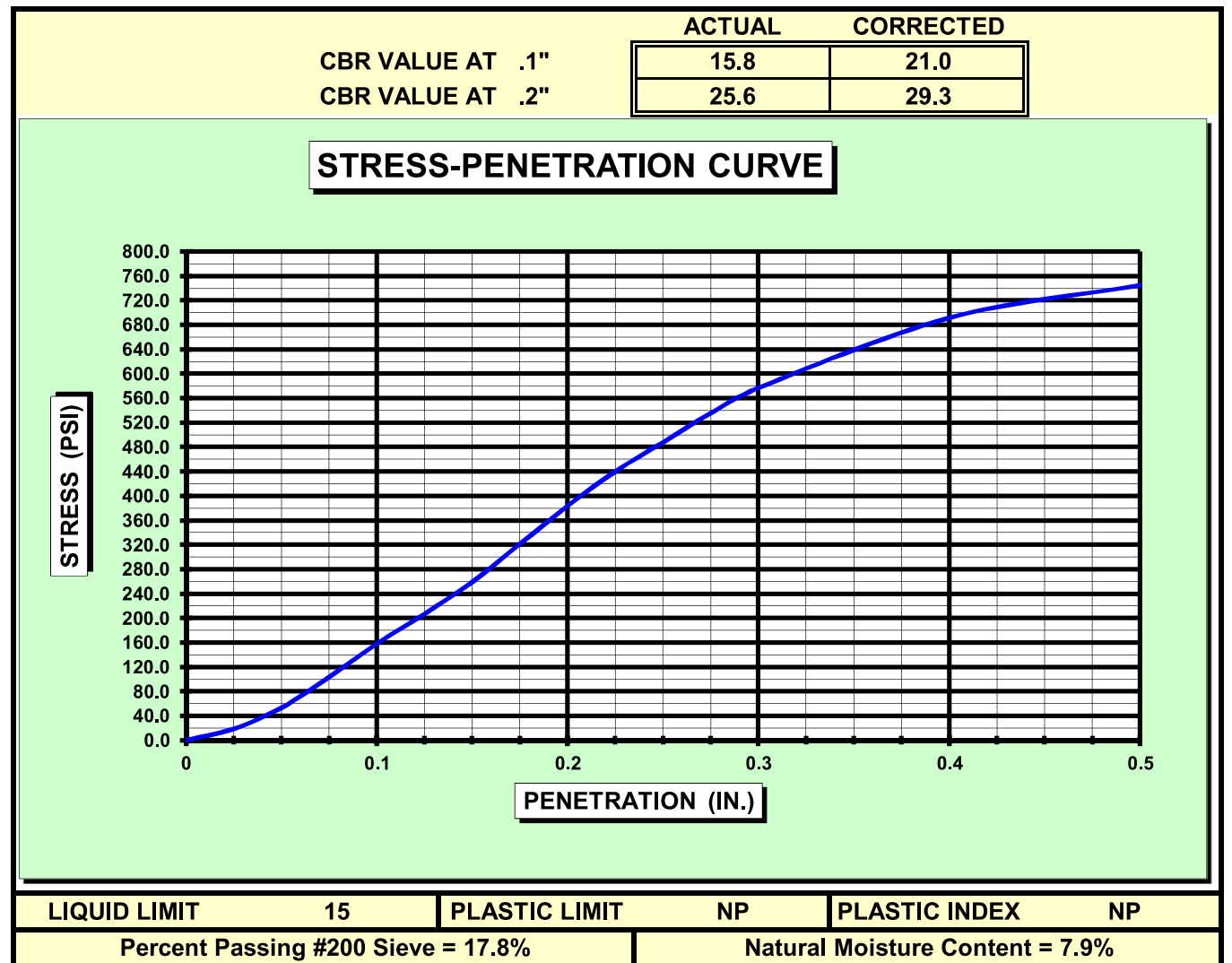
PROJECT #: G14025.00 DATE: 10/13/2014

PROJECT NAME: W5519 I-95 Business Intersection Improvements

BORING: SR_1900 SAMPLE: BS-1 DEPTH: 0.3-3.0

SOIL DESCRIPTION: Brown/Red SILTY SAND (A-2-4)

COMPACTION METHOD	AASHTO T-99	SOAK	96 HRS.
MAXIMUM DRY DENSITY	120.0 PCF	STRAIN RATE	.05 IN / MIN.
OPTIMUM MOISTURE CONTENT	11.3%	LOAD CELL	2500lb
TEST DATA		SURCHARGE WEIGHT	
DRY DENSITY	116.8 PCF	SURCHARGE PER SQUARE FOOT	51 lbs/sq.ft.
MOISTURE CONTENT	11.3%	FINAL MOISTURE CONTENT	N/A
PERCENT COMPACTION	97.3%	SWELL	-0.02%





STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

PAT MCCRORY
GOVERNOR

ANTHONY J. TATA
SECRETARY

November 7, 2014

MEMORANDUM TO: Judith Corley-Lay, P.E., Ph.D.
State Pavement Management Engineer

Glen W. Mumford, P.E.
State Roadway Design Engineer

FROM: J. L. Pilipchuk, P.E., L.G.
State Geotechnical Engineer

DS
MAM DocuSigned by:
John Pilipchuk
52C44B94B8BE444...

STATE PROJECT: 45849.1.FR1 (W-5519) – DDC
F. A. PROJECT: HSIP-095-2(128) 46
COUNTY: Cumberland
DESCRIPTION: I-95 Business / US 301 from NC 87 South to NC 59

SUBJECT: Geotechnical Recommendations for Pavement Design

The proposed work consists of converting the existing left turn lanes to directional crossovers.

Soil Type: The predominant soil types on the project consist of undivided Coastal Plain soils silty sand (A-2-4) and fine sand (A-3).

Anticipated borrow will likely consist of sandy soils. The design soil type is silty sand (A-2-4) and fine sand (A-3).

The length of this project is 3.814 miles

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT
1589 MAIL SERVICE CENTER
RALEIGH NC 27699-1589

TELEPHONE: 919-707-6850
FAX: 919-250-4237
WEBSITE: WWW.NCDOT.GOV

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC

DESIGN AND CONSTRUCTION RECOMMENDATIONS

I. Subgrade Stability

A. Aggregate Subgrade

Recommend a quantity of 500 cubic yards of shallow undercut to be included in the project contract as a contingency item.

B. Geotextile for Soil Stabilization

Recommend 1,500 square yards of Geotextile for Soil Stabilization to be included in the project contract as a contingency item.

C. Class IV Subgrade Stabilization

Recommend 1,000 tons of Class IV Subgrade Stabilization material to be included in the project contract as a contingency item.

II. Miscellaneous

A. Proof Rolling

It is recommended that proof rolling not performed on this project.

JLP/JBB

ATTACHMENT 1:	Core Evaluation Sheet	4
ATTACHMENT 2:	Core Photographs	7
ATTACHMENT 3:	Dynamic Cone Penetrometer Tests	24



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL ENGINEERING UNIT

Summary of Quantities

WBS Number: 45849.1.FR1

County: Cumberland

Project Engineer: _____

TIP Number: W-5519

Field Office: Central

Project Geologist: J. B. Barfield

Description: I-95 Business/US 301 from NC 87 South to NC 59

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units / %
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. A	Contingency	N/A	N/A	1,500	SY
Total Quantity of Geotextile for Soil Stabilization =							1,500	SY
1099500000-E	Shallow Undercut	505 - Aggregate Subgrade	I. A	Contingency	N/A	N/A	500	CY
Total Quantity of Shallow Undercut =							500	CY
1099700000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	I. A	Contingency	N/A	N/A	1,000	TON
Total Quantity of Class IV Subgrade Stabilization =							1,000	TON

PAVEMENT CORES FOR
45849.1.FR1.1.1, W-5519, Cumberland County

ATTACHMENT 1

LINE	STATION	ABC	LAYER THICKNESS (in)	LAYERS	REMARKS
-L-	106+00 SB LTL 10 1/2" Asphalt	-	4	S	3 lifts
			2 1/2	I	1 lift, moderate severity stripping
			4	B	1 lift
-L-	113+50 NB OSS 11 1/2" Asphalt	-	5 3/4	S	4 lifts, lifts 3 and 4 have sandy matrix
			4 3/4	B	1 lift, delaminated from surface, moderate severity stripping, missing 1" of base material
-L-	113+50 NB OSL 11 1/4" Asphalt 6 1/2" Concrete	-	2 3/4	S	2 lifts, tack coat top of lift 2
			8 1/2	SD	1 lift, rounded agg., bottom up crack, horizontal break, high severity bleeding, tack coat top of sand layer, missing 1 1/4" of material
			6 1/2	C	1 lift, bottom up crack, sub-rounded limestone agg., matrix is highly weathered, traces of grout
-L-	113+50 NB ISL 14" Asphalt	-	3 1/4	S	2 lifts, low severity stripping lift 2
			7 1/4	SD	1 lift, rounded agg., bottom up crack, 2 horizontal breaks, high severity bleeding, tack coat top of sand layer, last 9 1/2" of core in pieces, missing 4 1/2" of material
-L-	113+50 SB OSS 10 1/4" Asphalt	-	6 1/2	S	5 lifts, lift 5 has sandy matrix, low severity stripping at contact of lifts 2 and 3
			3 3/4	B	1 lift
-L-	113+50 SB OSL 11 1/4" Asphalt	-	9	S	6 lifts, lift 5 has sandy matrix
			2 1/4	B	1 lift, low severity stripping
-L-	113+00 SB ISS 12" Asphalt	-	10	S	8 lifts, lift 6 and 7 have sandy matrix, low severity stripping
			2	I	1 lift, low to moderate severity stripping
-L-	121+50 NB LTL 8" Asphalt	-	5 1/2	S	4 lifts, yellow line top of lifts 1 and 2, low severity stripping, low severity bleeding lift 3 and 4
			2 1/2	I	1 lift, low severity stripping
-L-	133+00 SB LTL 11 1/4" Asphalt	-	5	S	3 lifts, low severity stripping at contact of lifts 2 and 3
			6 1/4	B	1 lift, moderate severity stripping top 2 inches
-L-	142+50 NB LTL 7" Asphalt	-	4	S	3 lifts, low severity stripping at contact of lifts 2 and 3
			3	I	1 lift, high severity stripping and few missing agg. from bottom 1 inch
-L-	144+50 SB LTL 8 1/2" Asphalt	-	5	S	4 lifts
			3 1/2	I	1 lift, moderate severity stripping
-L-	206+50 NB LTL 8" Asphalt	-	4 1/4	S	3 lifts, low severity stripping
			3 3/4	I	1 lift, low severity stripping bottom 1 inch
-L-	208+00 SB LTL 8" Asphalt	-	4	S	3 lifts, lift 1 has low severity bleeding, yellow line top of lift 3, all lifts have low severity stripping at lift contacts
			4	I	1 lift, low severity stripping
-L-	218+50 NB LTL 12 1/2" Asphalt	-	4 1/2	S	3 lifts
			8	B	1 lift, last 1" broken with few missing agg.
-L-	220+25 SB LTL 9 1/4" Asphalt	-	4	S	3 lifts
			3/4	I	1 lift
			4 1/2	B	1 lift
-L-	232+00 NB LTL 7 1/2" Asphalt	-	4 1/4	S	3 lifts, lift 3 has yellow line, lifts 2 and 3 have moderate severity stripping at lift contact
			3 1/4	I	1 lift

PAVEMENT CORES FOR
45849.1.FR1.1.1, W-5519, Cumberland County

ATTACHMENT 1

LINE	STATION	ABC	LAYER THICKNESS (IN)	LAYERS	REMARKS
-L-	233+75 SB LTL 7 3/4" Asphalt	-	4	S	3 lifts, low severity stripping at contacts of all lifts, yellow line between lift 2 and 3
			3 3/4	I	1 lift, low severity stripping
-L-	241+50 SB OSS 10 1/2" Asphalt	-	6 1/4	S	4 lifts, low severity stripping lifts 3 and 4
			4 1/4	B	1 lift, low severity stripping bottom 1 inch
-L-	241+50 SB OSL 12 3/4" Asphalt 7 1/2" Concrete	-	7 3/4	S	5 lifts, lifts 3-5 have sandy matrix and low severity stripping
			3	I	1 lift, low severity stripping
			2	SD	1 lift, sand asphalt, horizontal crack, moderate severity stripping
-L-	241+50 SB ISS 11 1/2" Asphalt	-	7 1/2	S	5 lifts, lifts 2 and 3 and lifts 4 and 5 are delaminated, lifts 3-5 have sandy matrix
			4	B	1 lift, low severity stripping
-L-	243+00 NB OSS 11" Asphalt	-	7 1/4	S	5 lifts, lifts 3-5 have sandy matrix, low severity bleeding, and moderate severity stripping
			2 3/4	B	1 lift, moderate severity stripping, missing few agg., missing 1 inch of material
-L-	243+00 NB OSL 11 1/4" Asphalt	-	7 3/4	S	5 lifts, lifts 3-5 have sandy matrix and moderate severity stripping, lift 5 has white line
			3 1/2	I	1 lift, low severity stripping
-L-	243+00 NB ISL 11 1/4" Asphalt	-	8 3/4	S	6 lifts, lifts 3-5 have sandy matrix, low severity bleeding, and moderate severity stripping
			2 1/2	I	1 lift, low severity stripping
-L-	252+25 NB LTL 9 1/4" Asphalt	-	3 3/4	S	2 lifts
			5 1/2	B	1 lift, low severity stripping
-L-	254+00 SB LTL 6 1/4" Asphalt	-	3 1/2	S	3 lifts, lift 2 has low severity stripping
			2 3/4	I	1 lift, low severity stripping
-L-	264+75 NB LTL 9" Asphalt	-	5	S	3 lifts, low severity stripping lifts 2 and 3
			4	I	1 lift, low severity stripping bottom 1 inch
-L-	266+00 SB LTL 10" Asphalt	-	3 1/4	S	2 lifts, low severity stripping at contact between lifts 1 and 2
			2	I	1 lift, low severity stripping
			4 3/4	B	1 lift, some elongated and sub-rounded agg.
-L-	276+75 NB LTL 7 3/4" Asphalt	-	4 1/2	S	3 lifts
			3 1/4	I	1 lift, moderate severity stripping last 1 inch
-L-	278+25 SB LTL 7 1/2" Asphalt	-	4	S	3 lifts, lift 3 has sandy matrix, lifts 2 and 3 delaminated
			3 1/2	B	1 lift, low severity stripping
-L-	320+00 SB LTL 7 3/4" Asphalt	-	5 1/4	s	3 lifts, lift 2 has low severity stripping
			2 1/2	B	1 lift
-L-	329+75 NB LTL 8" Asphalt	-	5	S	4 lifts
			3	I	1 lift, low severity stripping bottom 1 inch
-L-	360+50 NB LTL 8 " Asphalt	-	2 1/4	S	2 lifts, low severity stripping lift 2, yellow line top of lift 1
			5 3/4	B	1 lift, low severity stripping
-L-	362+30 SB LTL 7" Asphalt	-	1 1/2	S	1 lift
			5 1/2	B	1 lift, sub-rounded and elongated agg., bottom 1" broken
-L-	368+65 SB OSS 7" Asphalt	-	4	S	3 lifts, low severity stripping lift 1
			3	B	1 lift, sandy matrix, round to sub-rounded agg.

PAVEMENT CORES FOR
45849.1.FR1.1.1, W-5519, Cumberland County

ATTACHMENT 1

LINE	STATION	ABC	LAYER THICKNESS (IN)	LAYERS	REMARKS
-L-	368+65 SB OSL 13" Asphalt 6" Concrete	-	4 1/4	S	4 lifts, lifts 2-4 have sandy matrix, low severity stripping
			5 1/4	I	3 lifts, sub-rounded agg.
			1 1/4	S	1 lift, 1 1/2" of surface missing, high severity stripping
			6	C	concrete not recovered
-L-	368+65 SB ISL 11 1/2" Asphalt	-	5	S	4 lifts
			6 1/2	I	2 lifts, sub-rounded agg.
-L-	368+65 NB OSS 7" Asphalt	-	3 1/4	S	2 lifts, lift 2 has sandy matrix and moderate severity stripping
			3 3/4	B	1 lift, moderate severity stripping
-L-	368+65 NB OSL 8 3/4" Asphalt	-	4	S	2 lifts, lift 2 has sandy matrix, low severity stripping, moderately weathered
			4 3/4	I	2 lifts, 4 3/4" bottom-up crack
-L-	368+65 NB ISL 9 1/4" Asphalt	-	6	S	3 lifts, lift 2 has sandy matrix and low severity stripping
			3 1/4	I	2 lifts, very low severity stripping
-L-	371+50 NB LTL 12" Asphalt	-	8	S	5 lifts, lifts 3-5 have sandy matrix and low severity stripping, contact of lift 2 and 3 has low severity stripping, delamination between lift 4 and 5
			4	I	1 lift, moderate severity stripping
-L-	375+75 NB LTL 8" Asphalt	-	2 1/2	S	2 lifts
			5 1/2	B	1 lift with rounded to sub-rounded quartz agg.
-L-	416+00 NB OSS 13 1/2" Asphalt	-	9 1/2	S	7 lifts, lifts 4 and 5 delaminated, lifts 4-7 have sandy matrix with moderate weathering
			4	B	1 lift, low severity stripping
-L-	416+00 NB OSL 14 3/4" Asphalt	-	8 1/2	S	lifts are indistinguishable, top 4 1/2" has elongated agg., bottom 4" has sandy matrix with sub-rounded agg. and moderate stripping
			2	SD	1 lift
			1 3/4	S	1 lift, high AC content, low severity stripping
			2 1/2	B	1 lift, moderate severity stripping
-L-	416+00 NB ISL 15" Asphalt	-	8	S	7 lifts, lifts 4-7 have sandy matrix
			2 1/4	SD	1 lift
			2 1/4	S	2 lifts
			2 1/2	I	1 lift
-L-	416+00 SB OSS 13" Asphalt	-	9 3/4	S	8 lifts, lifts 4-8 have sandy matrix and subrounded quartz agg.
			3 1/4	B	1 lift, sandy matrix, over 1 1/2" large sub-rounded quartz agg.

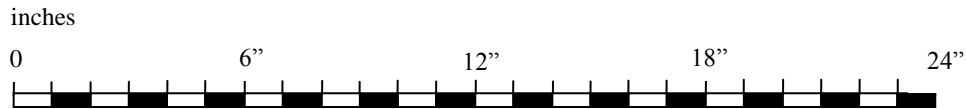
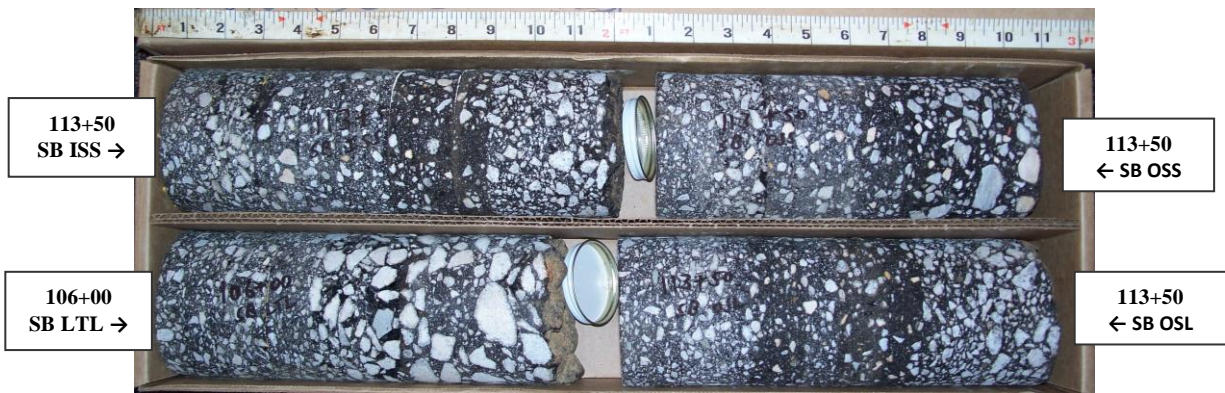
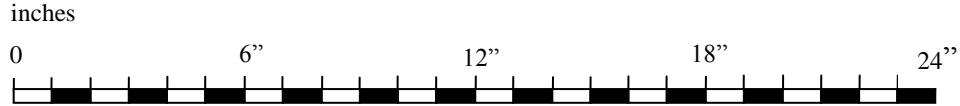
PAVEMENT CORES FOR
45849.1.FR1.1.1, W-5519, Cumberland County

ATTACHMENT 1

LINE	STATION	ABC	LAYER THICKNESS (IN)	LAYERS	REMARKS
-L-	416+00 SB OSL 14" Asphalt	-	8 1/4	S	6 lifts, lifts 4-6 have sandy matrix, sub-rounded quartz agg.
			1	SD	1 lift
			2 1/4	S	2 lifts
			2 1/2	I	1 lift, low severity stripping
-L-	416+00 SB ISL 14 1/2" Asphalt	-	8 3/4	S	6 lifts, lifts 4-6 have sandy matrix, low severity stripping
			1 3/4	SD	1 lift
			4	I	1 lift, low severity stripping

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<i>Site Description:</i> I-95 Business/US 301 from NC 87 to NC 59			
<i>Driller:</i> Ron Toothman & Willie Trapp		<i>Core Size:</i> 4 - inch	<i>Drill Machine:</i> Mobile B-55
<i>Geologist / Engineer:</i> Paul Weaver			



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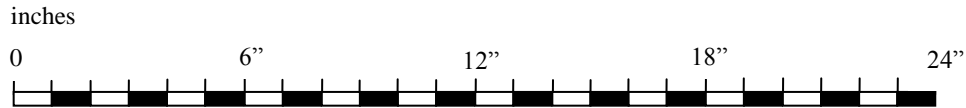
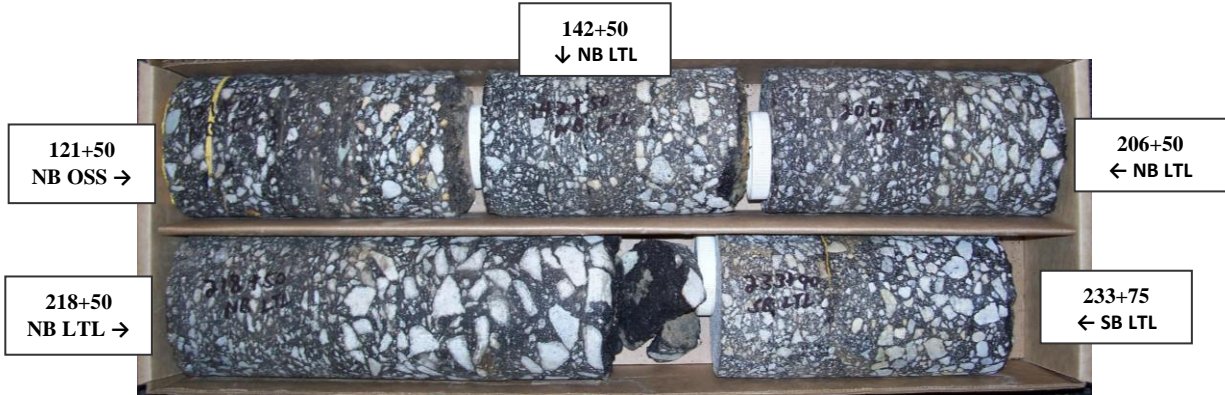
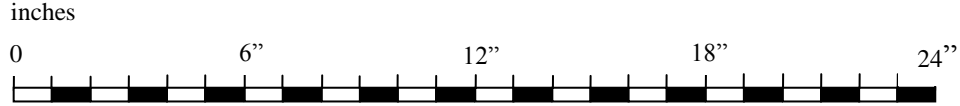
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Geologist / Engineer: Paul Weaver



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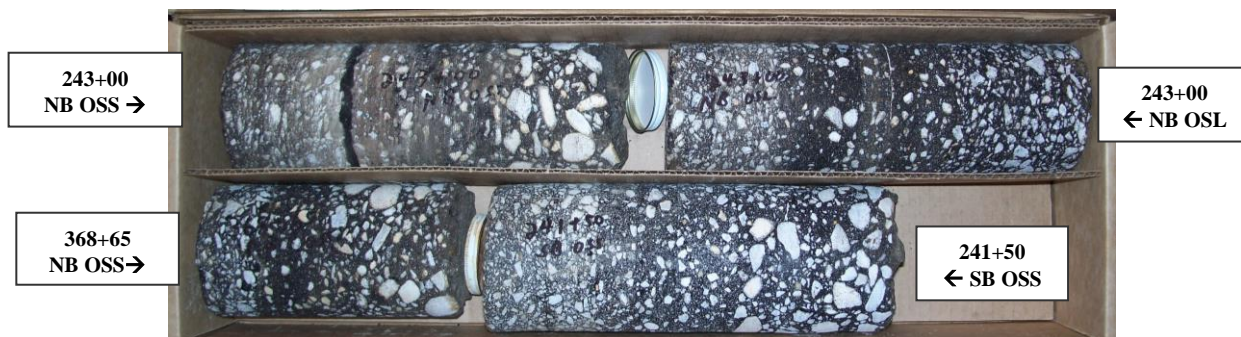
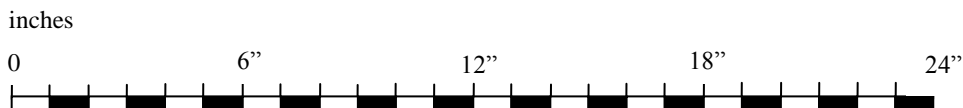
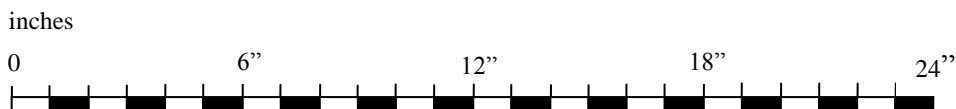
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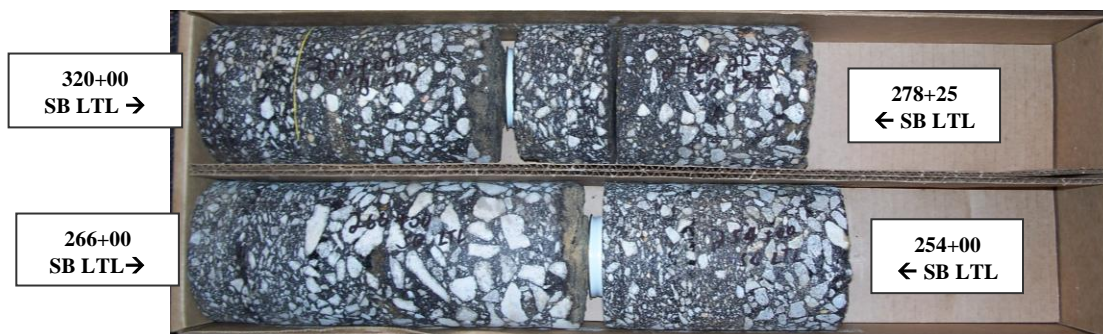
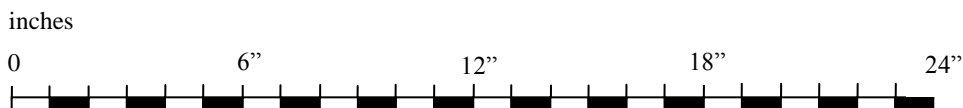
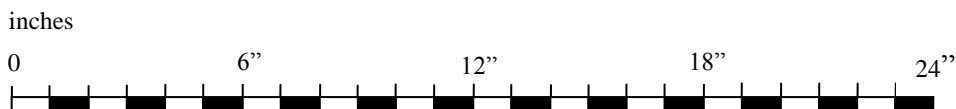
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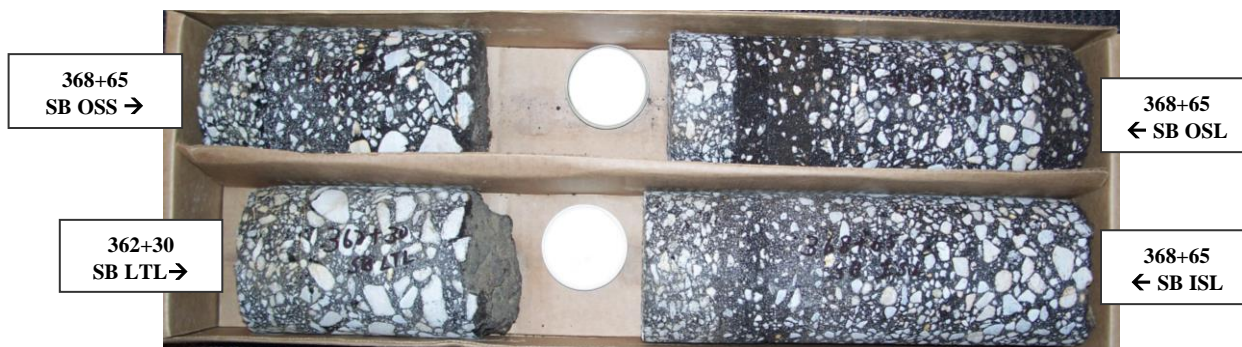
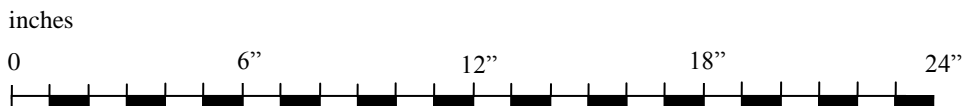
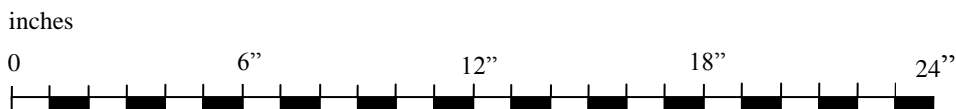
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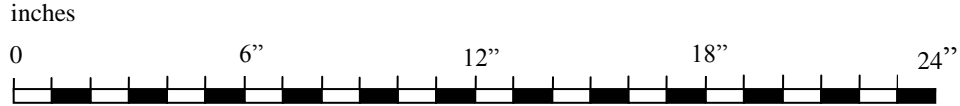
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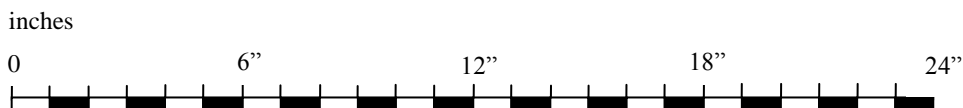
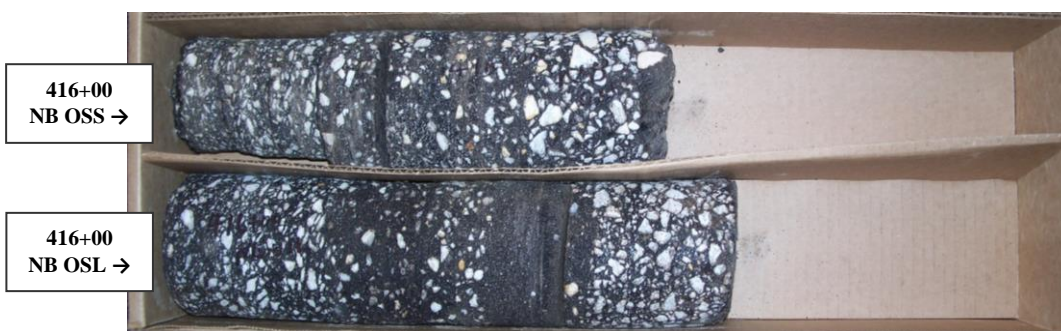
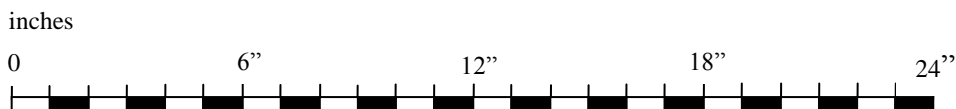
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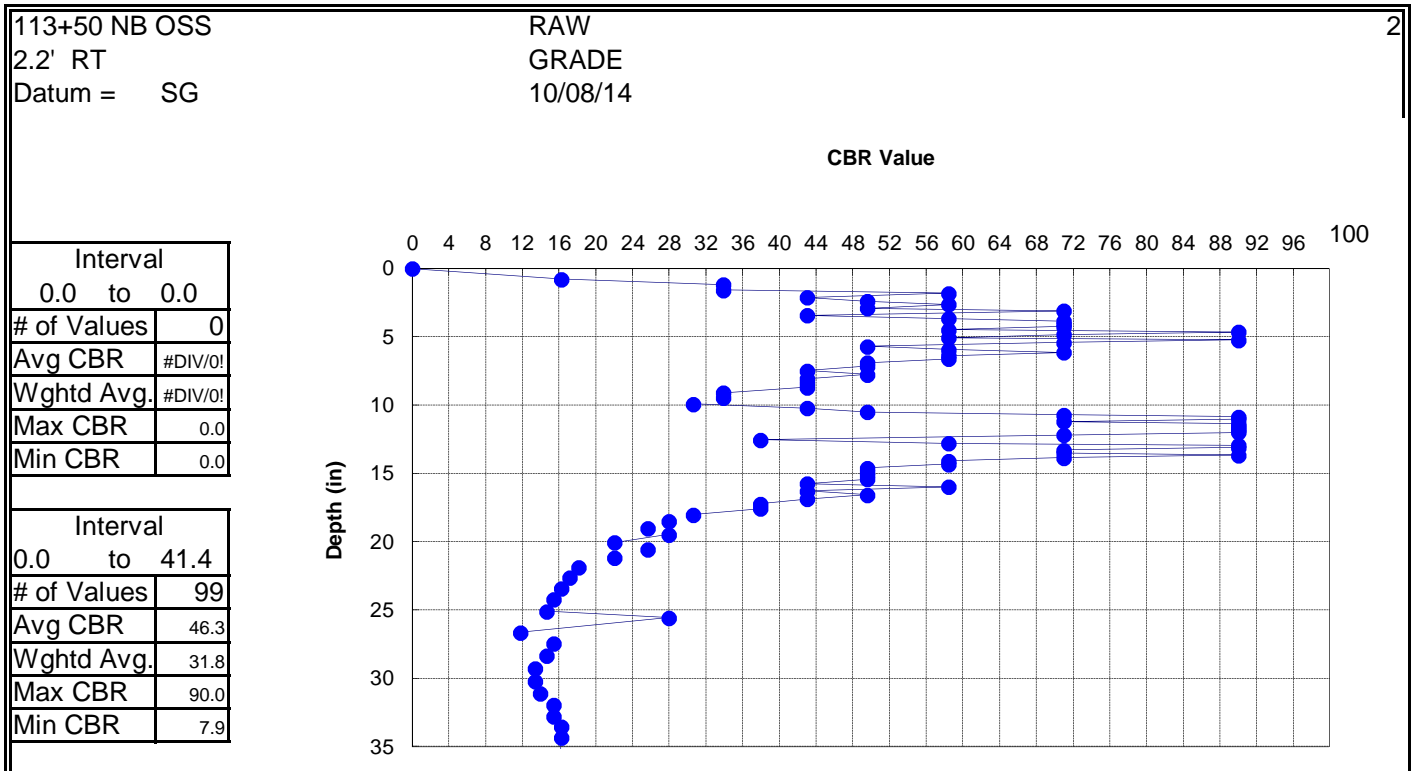
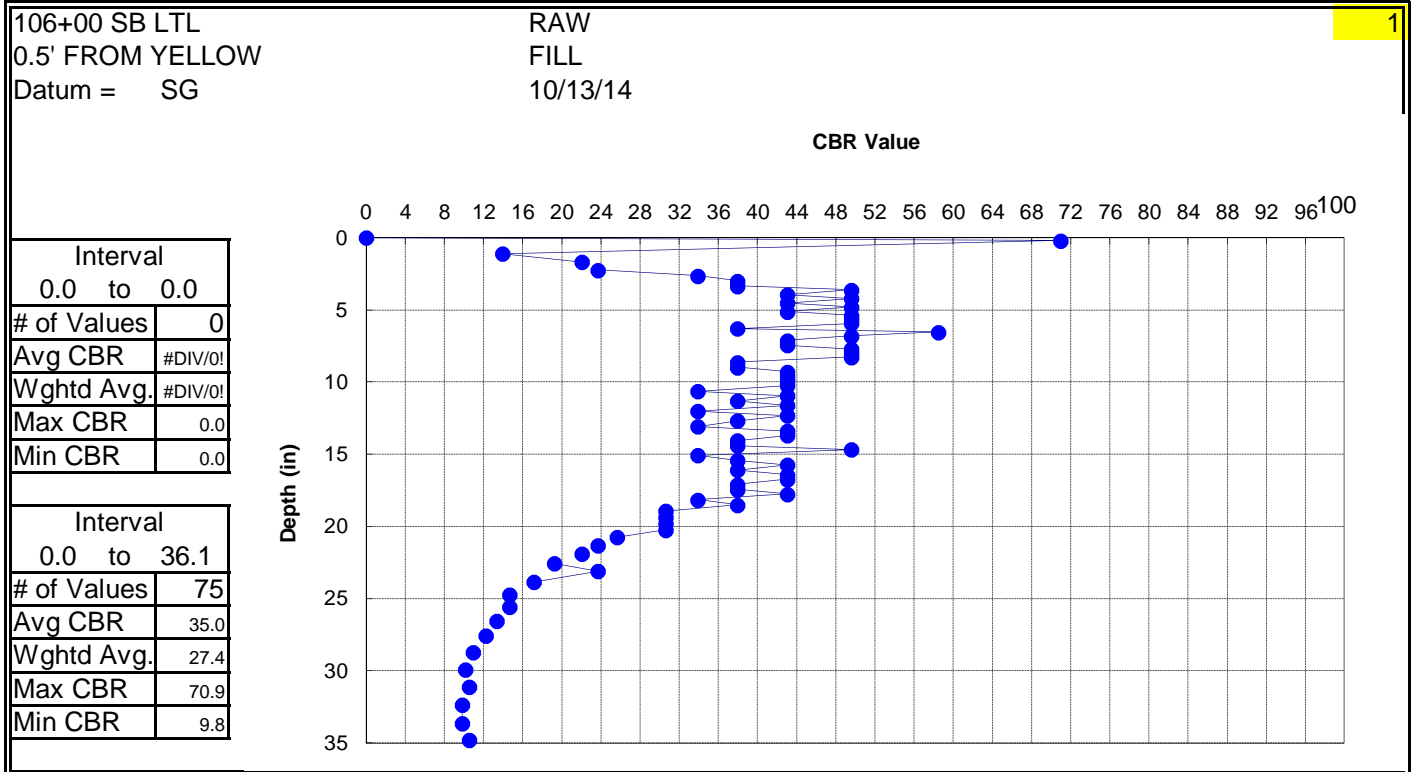
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GEOTECHS	TRIGON

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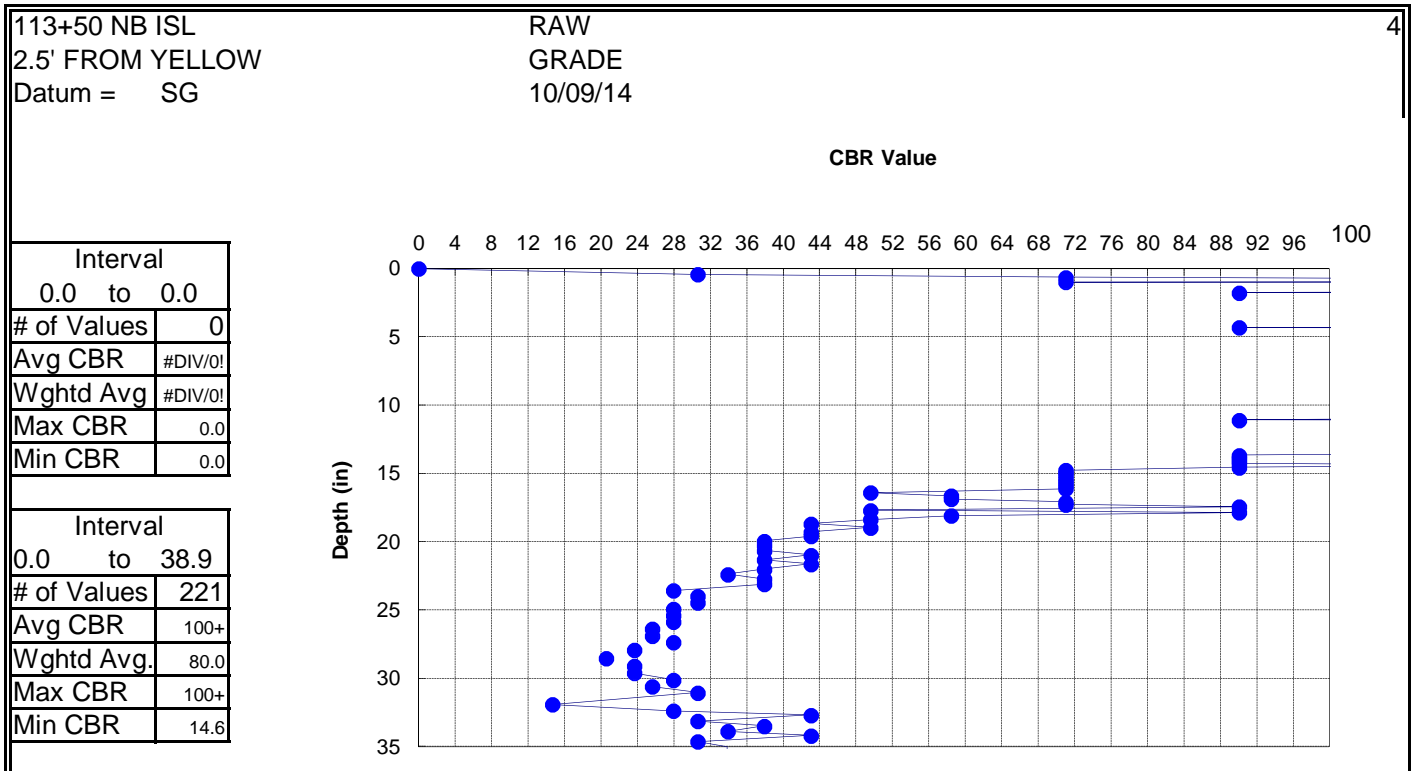
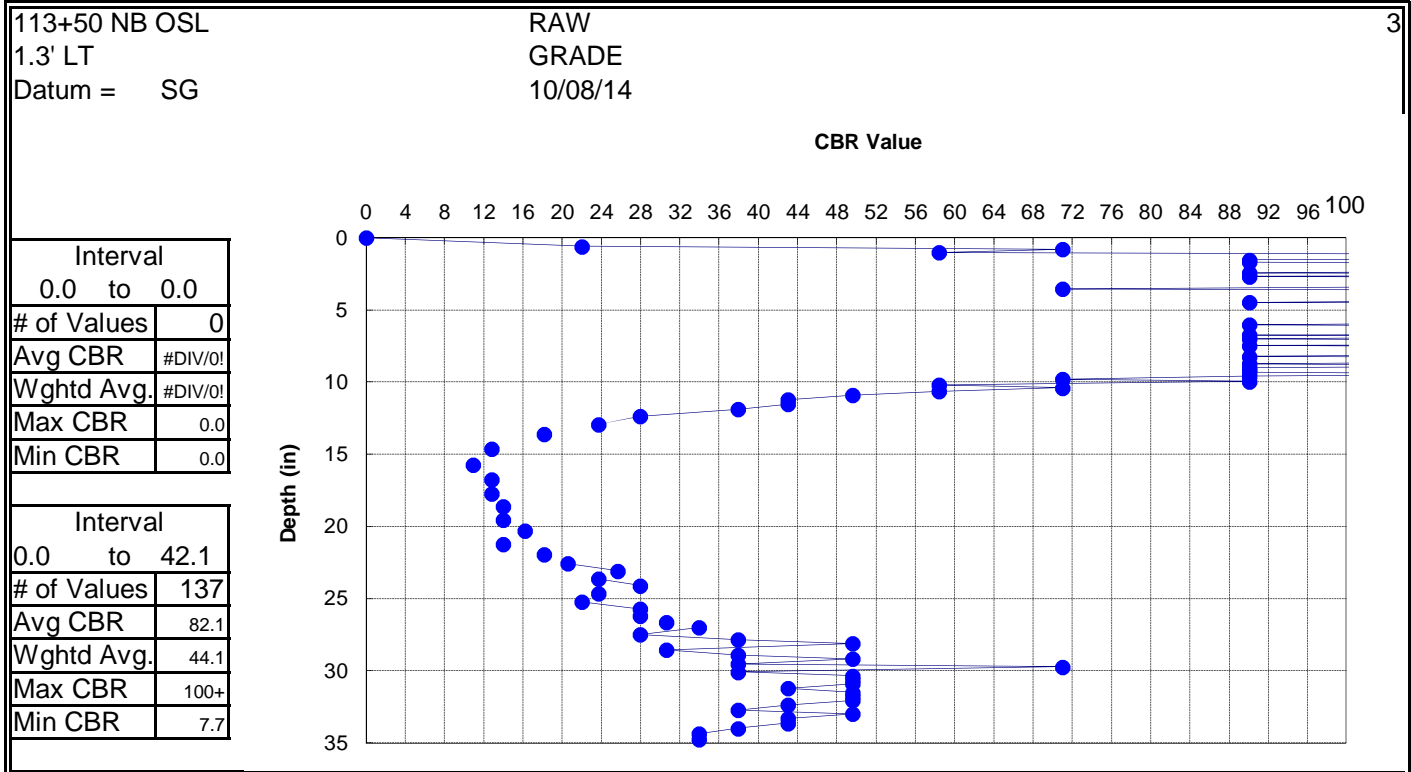


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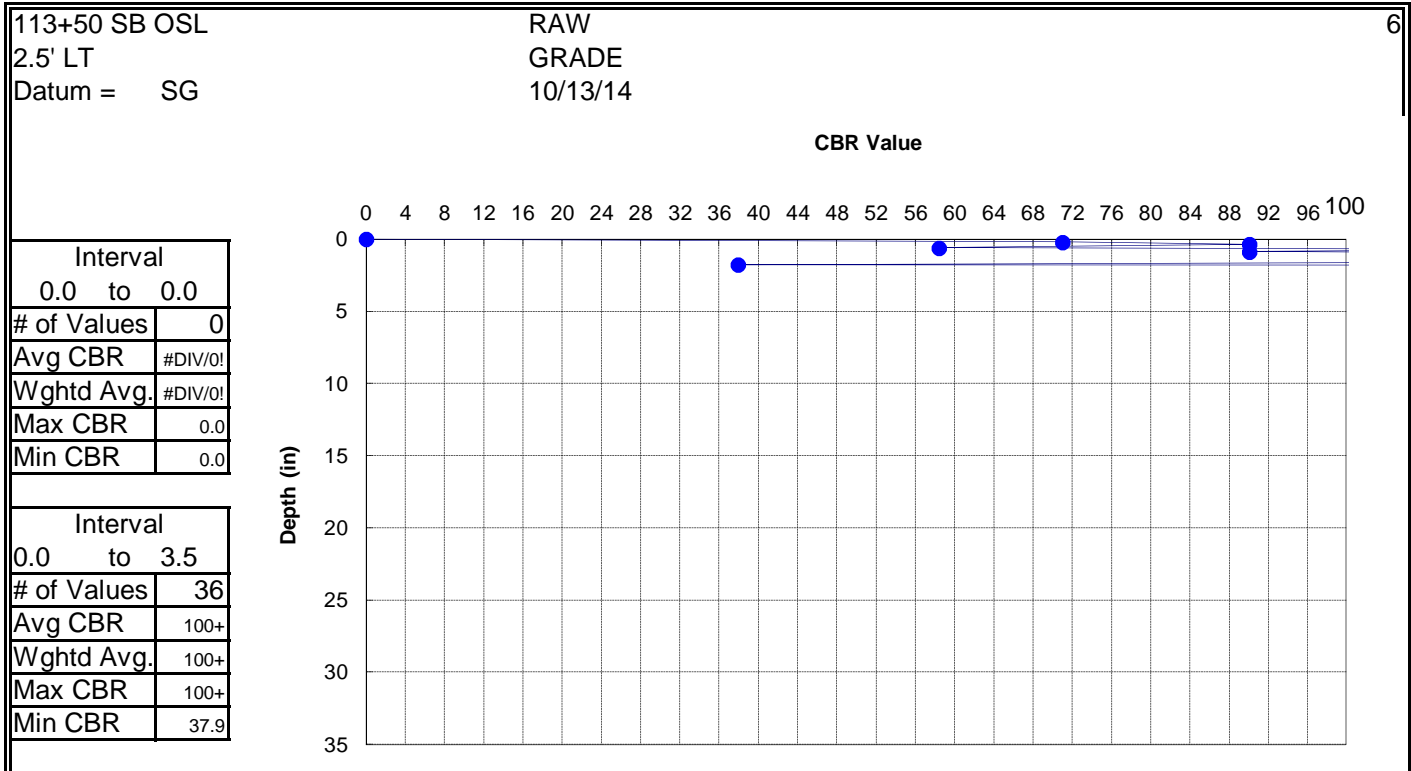
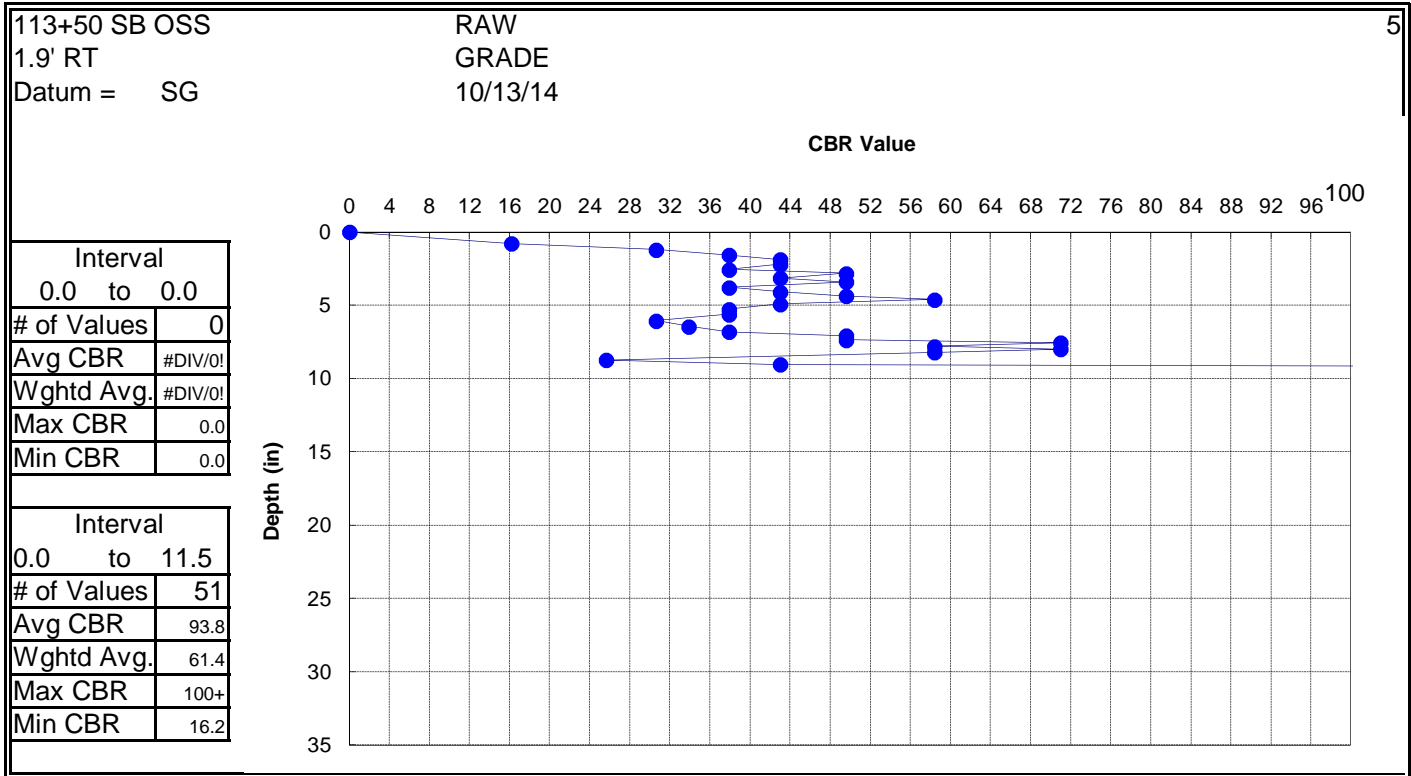


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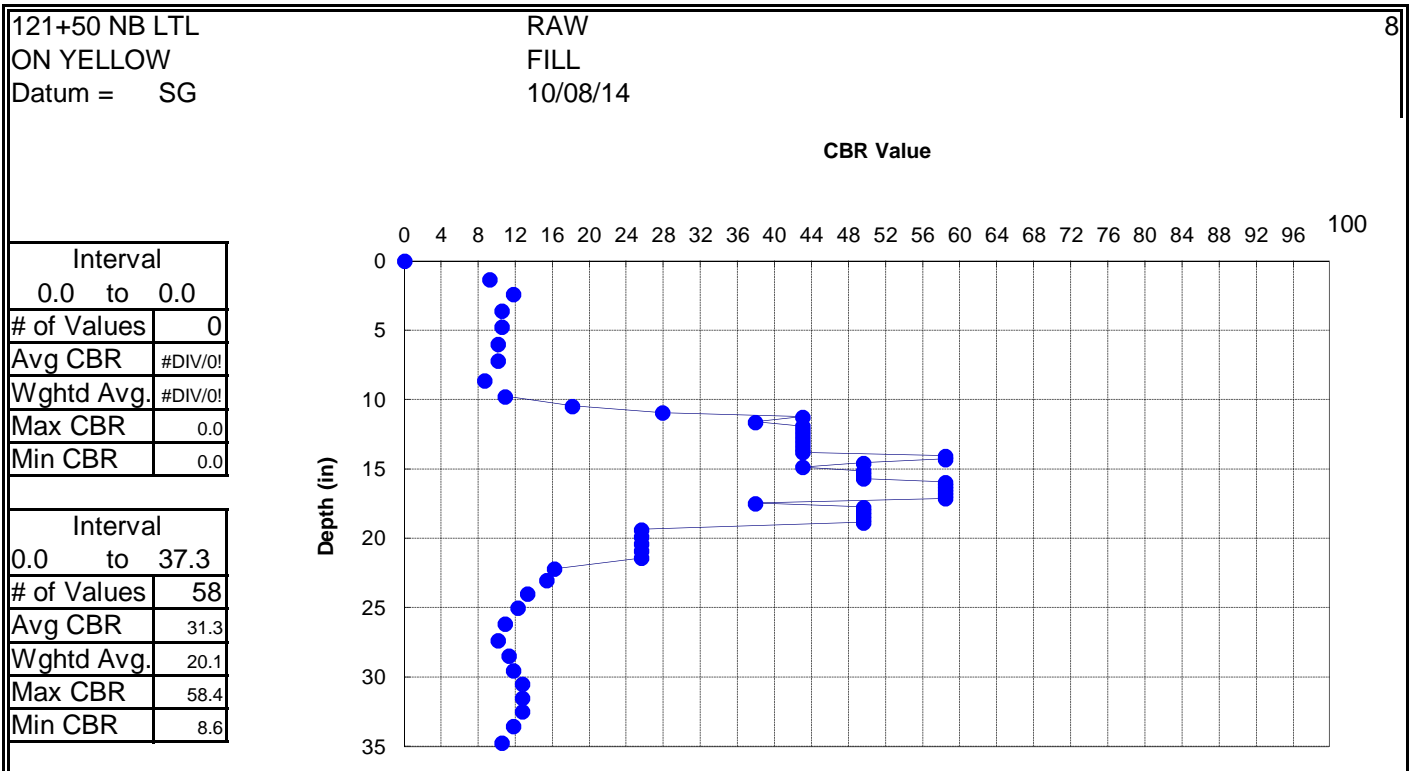
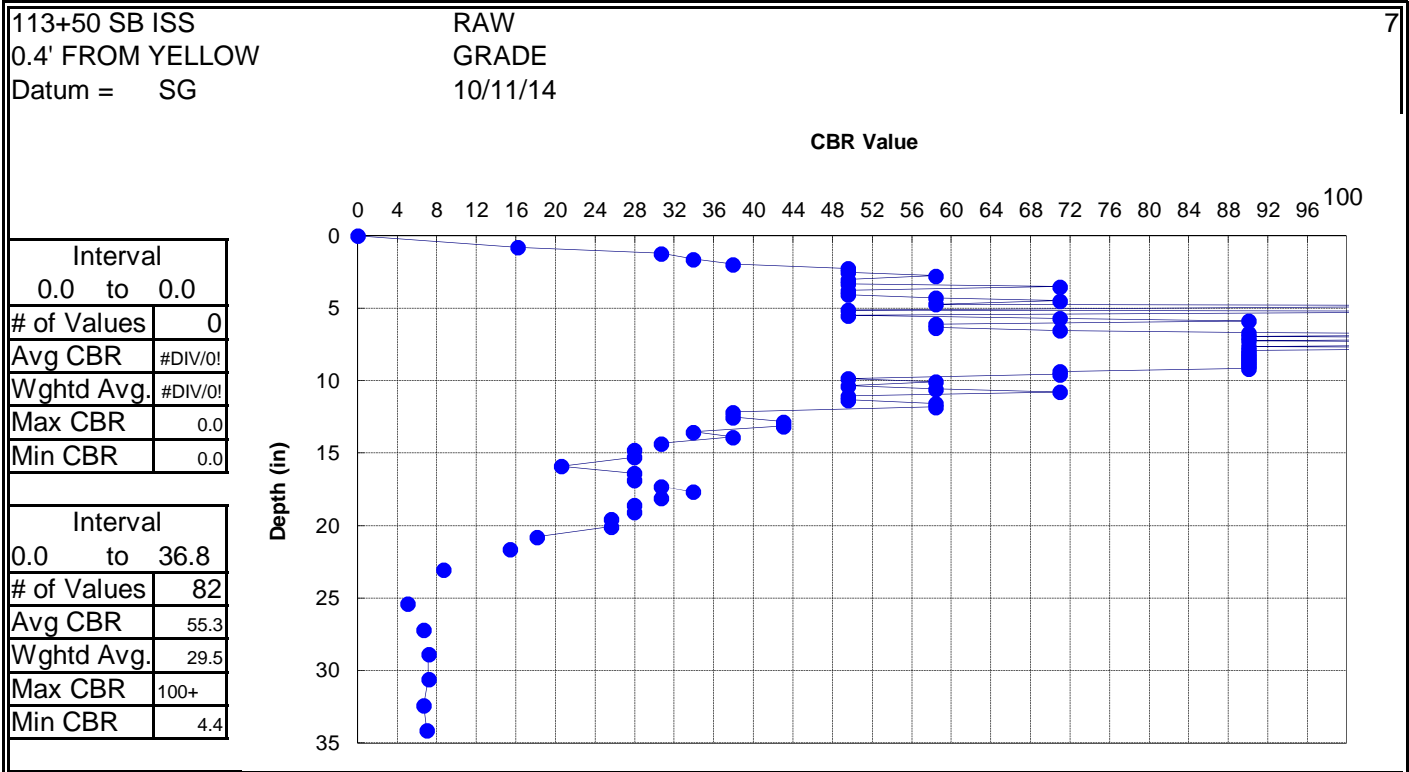


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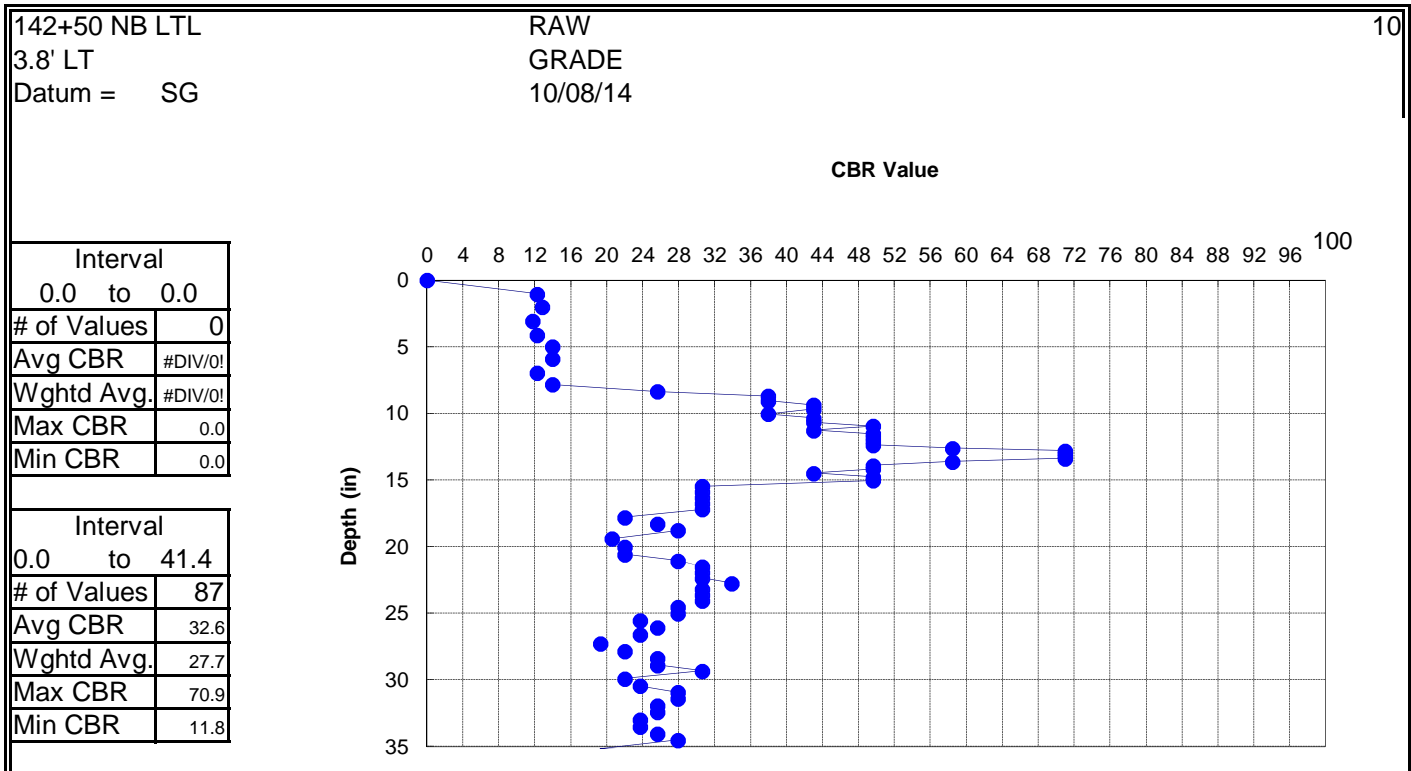
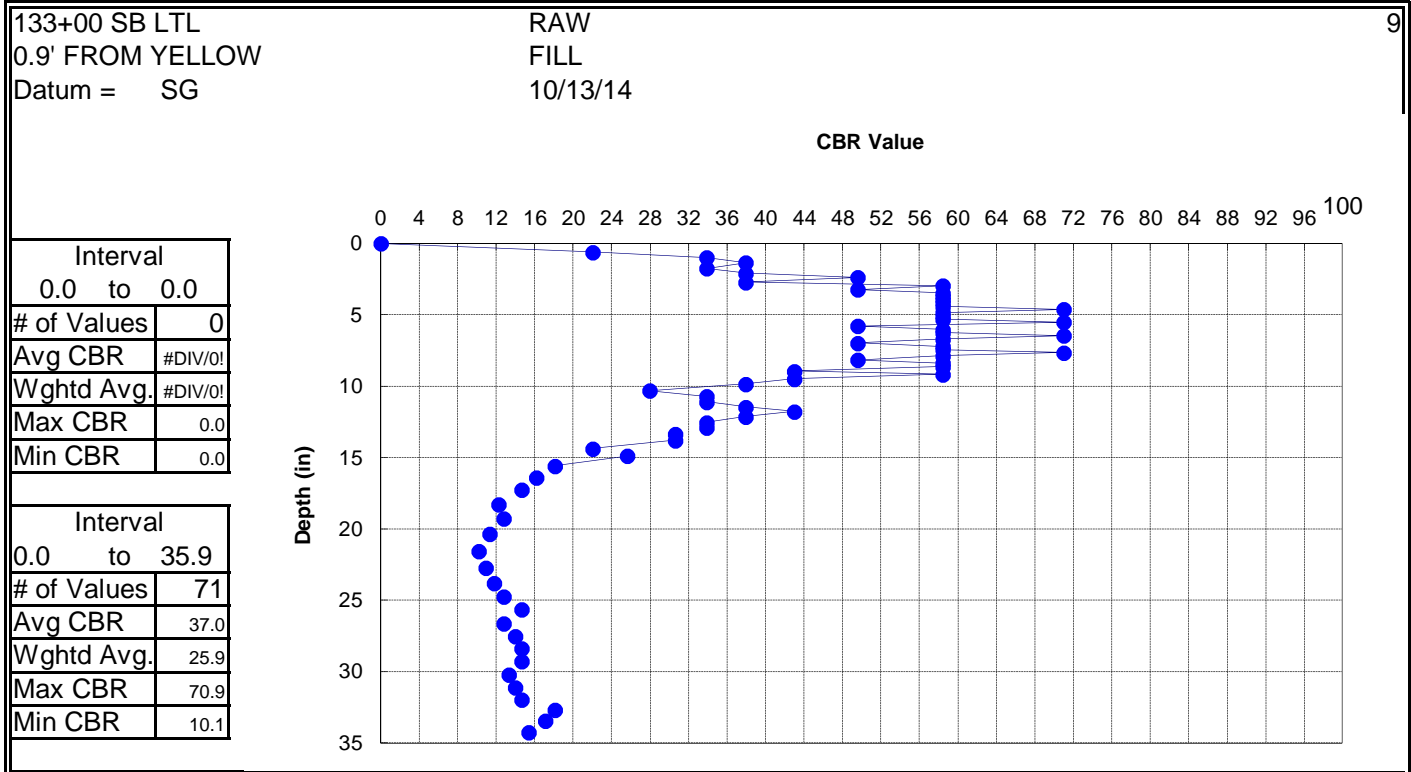


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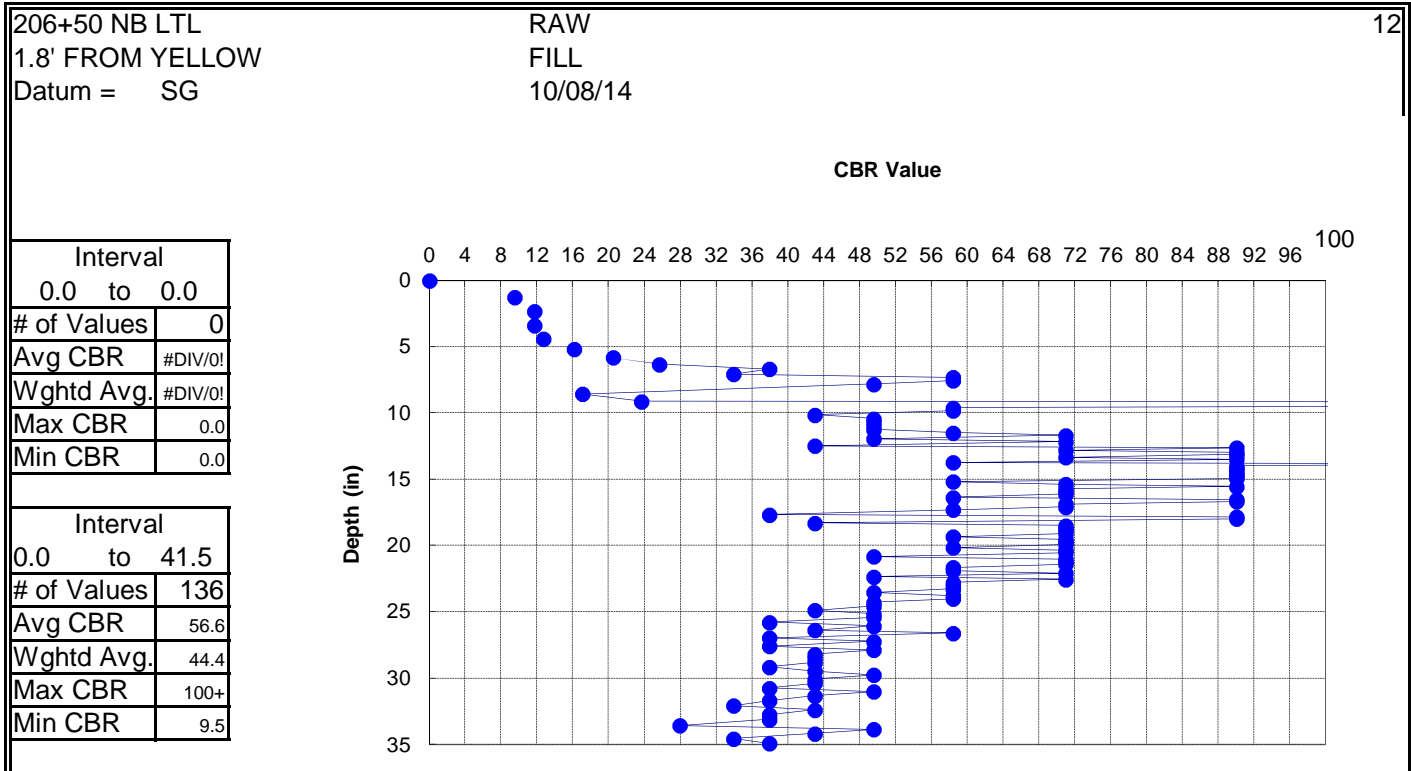
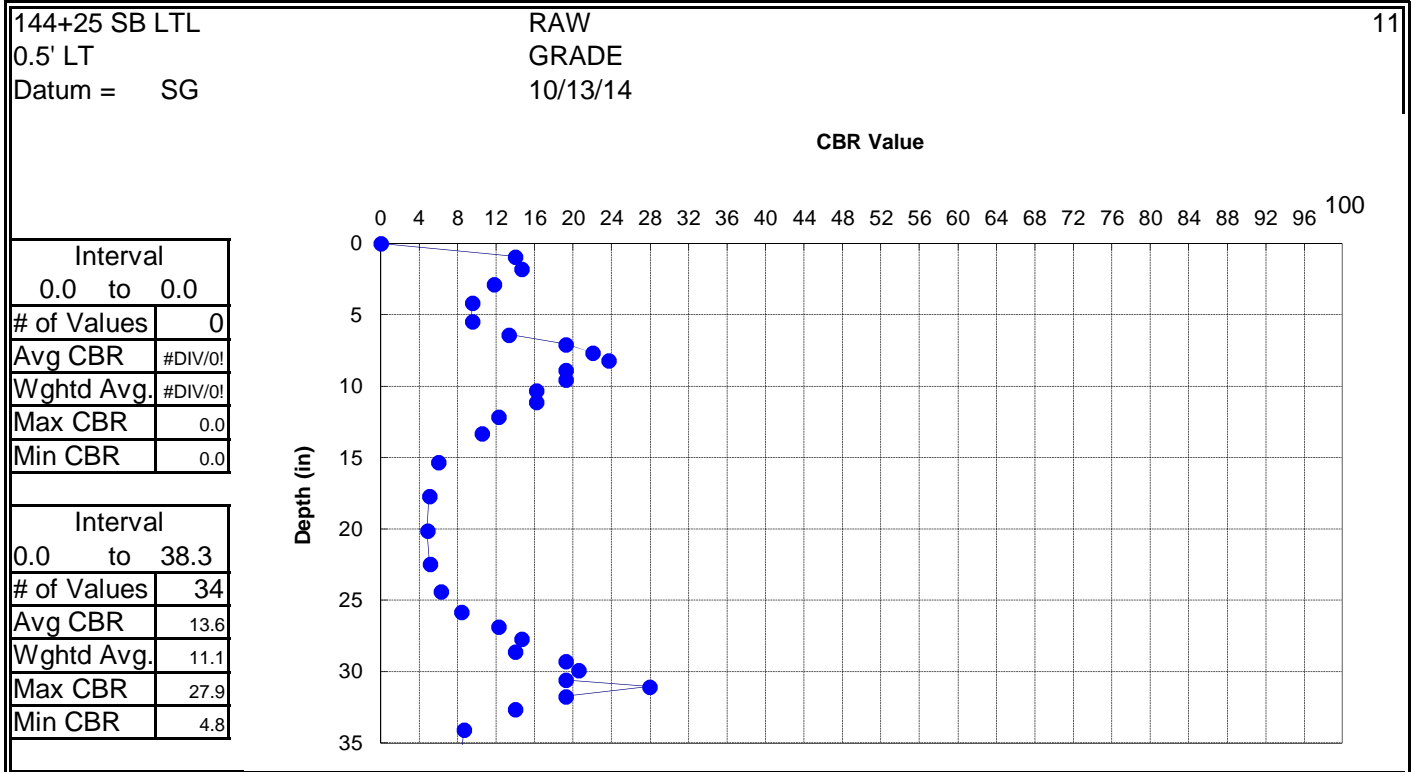


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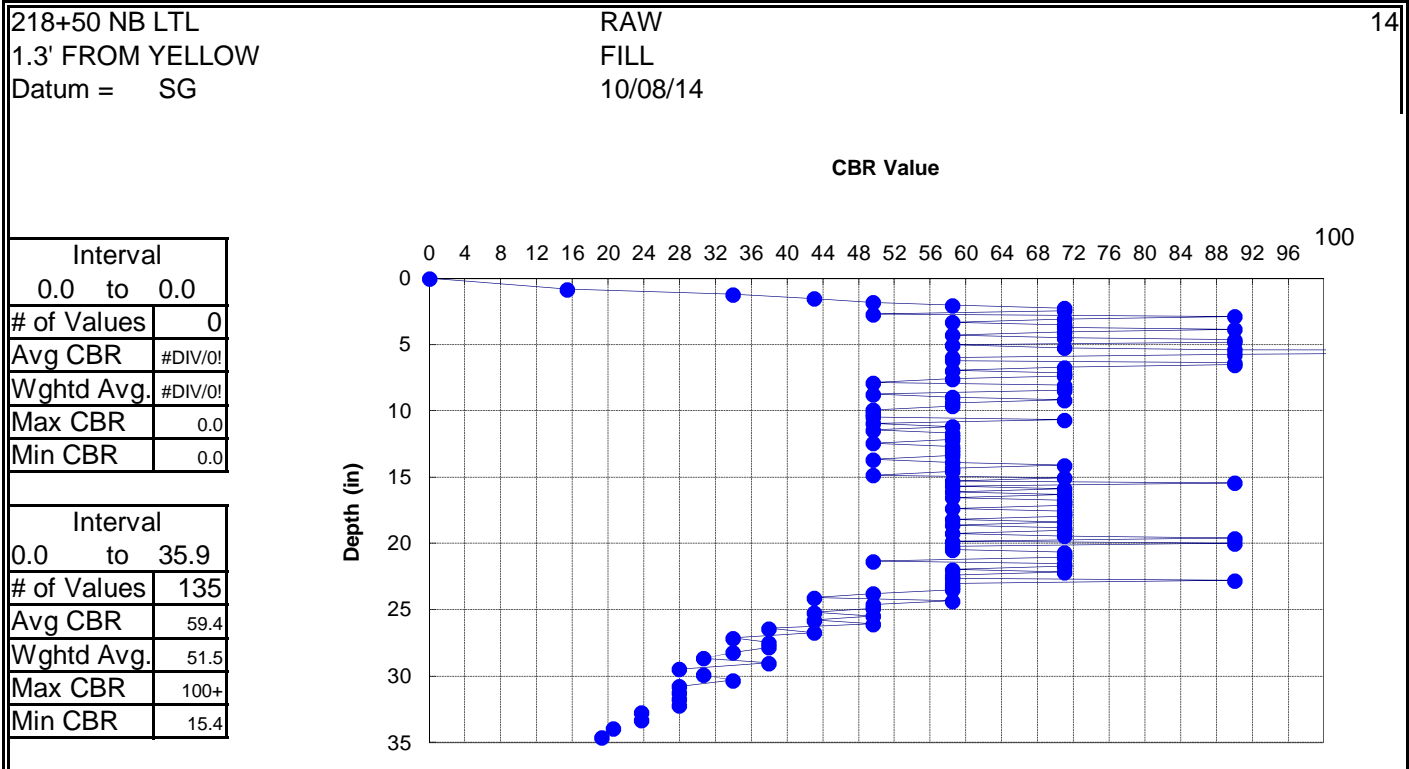
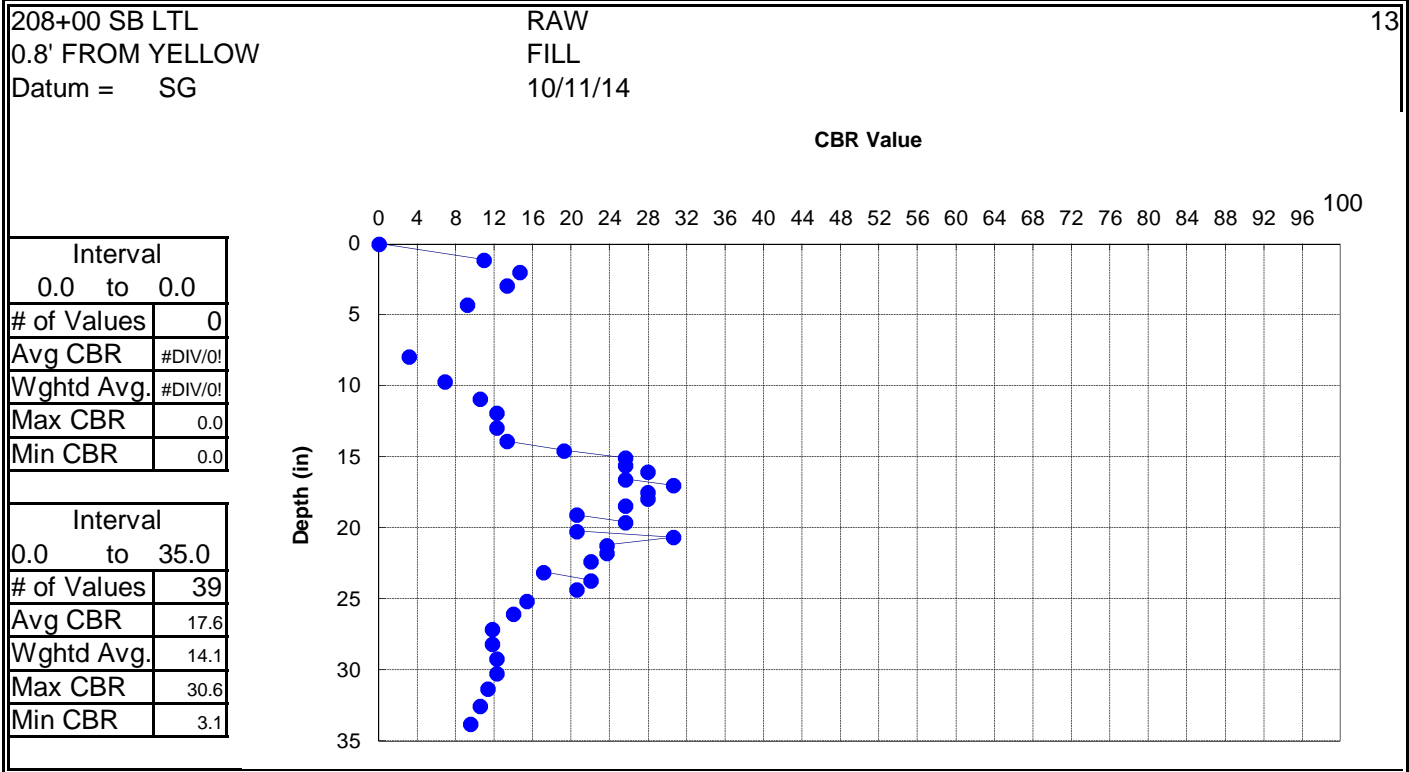


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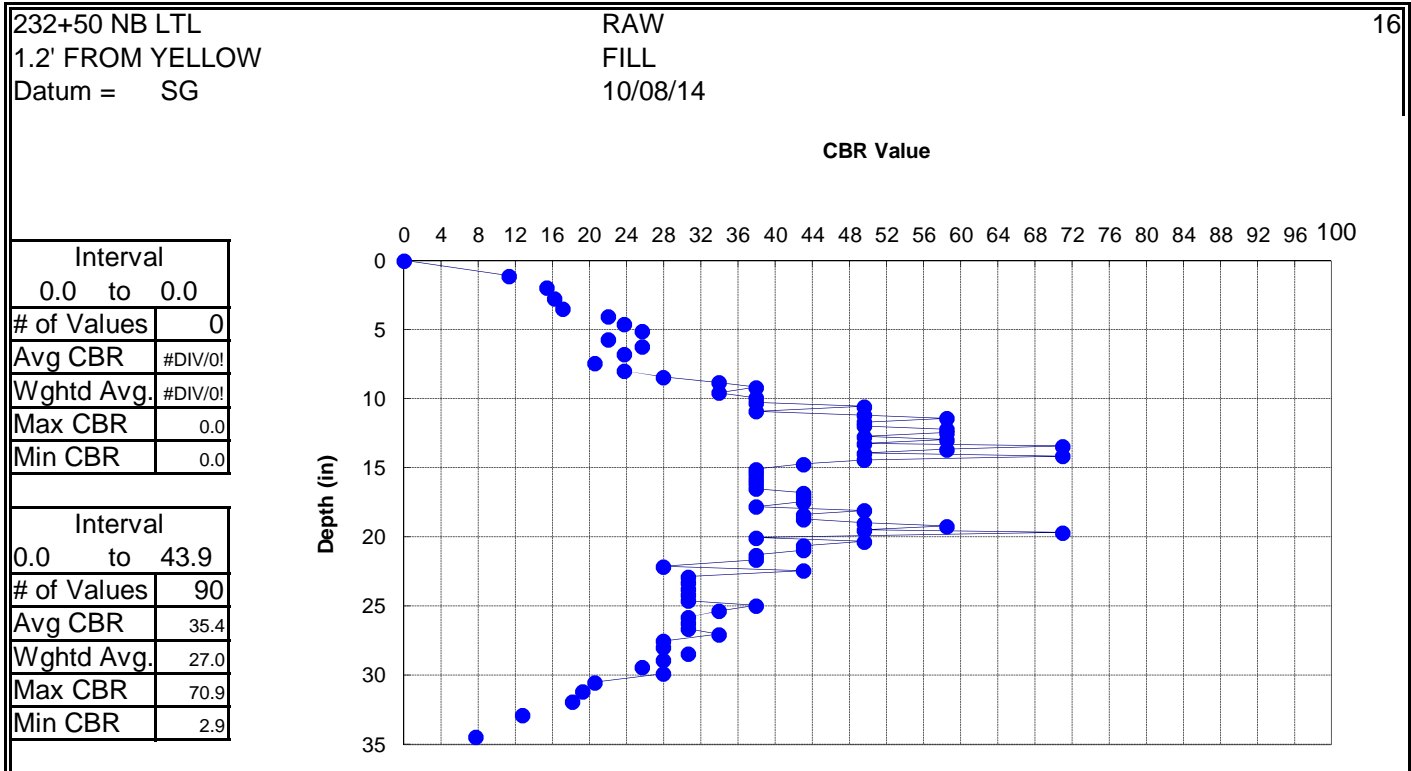
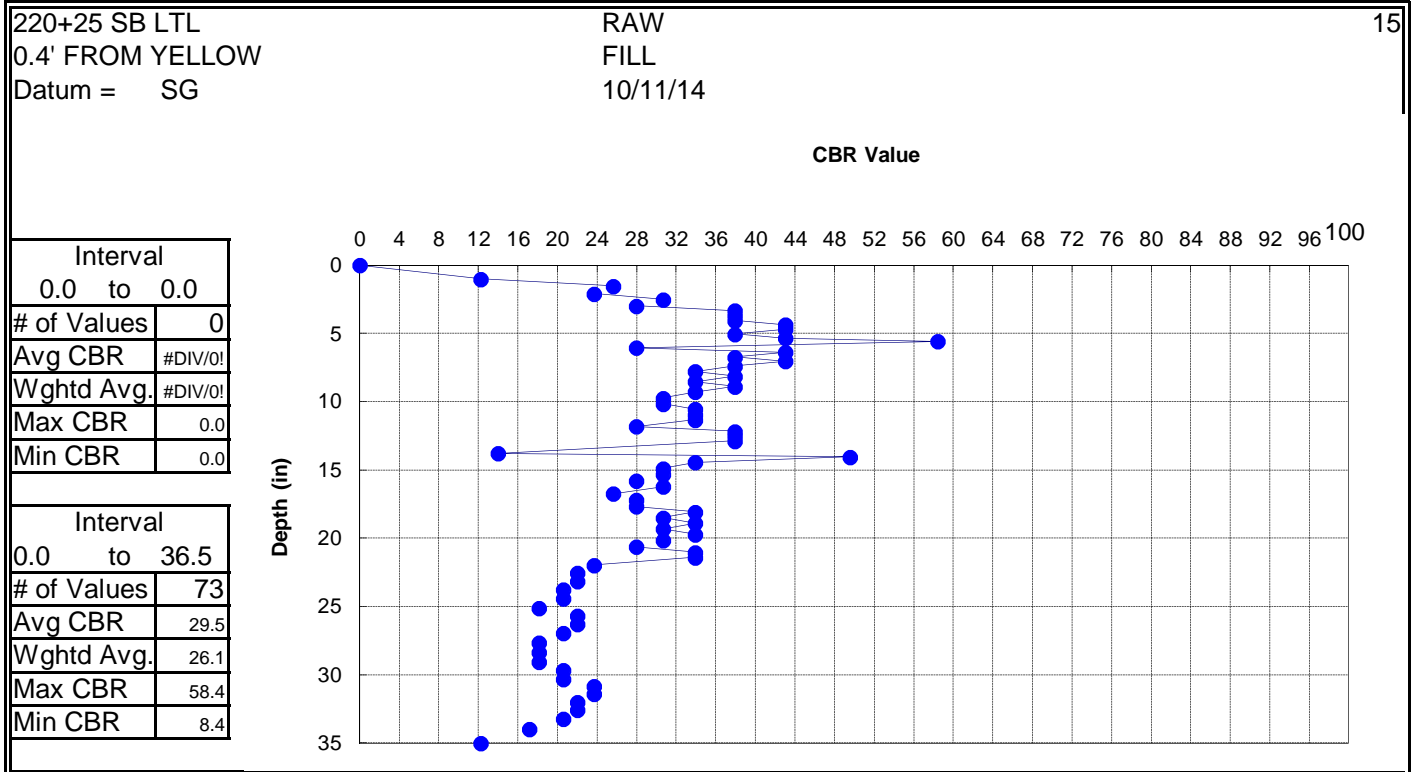


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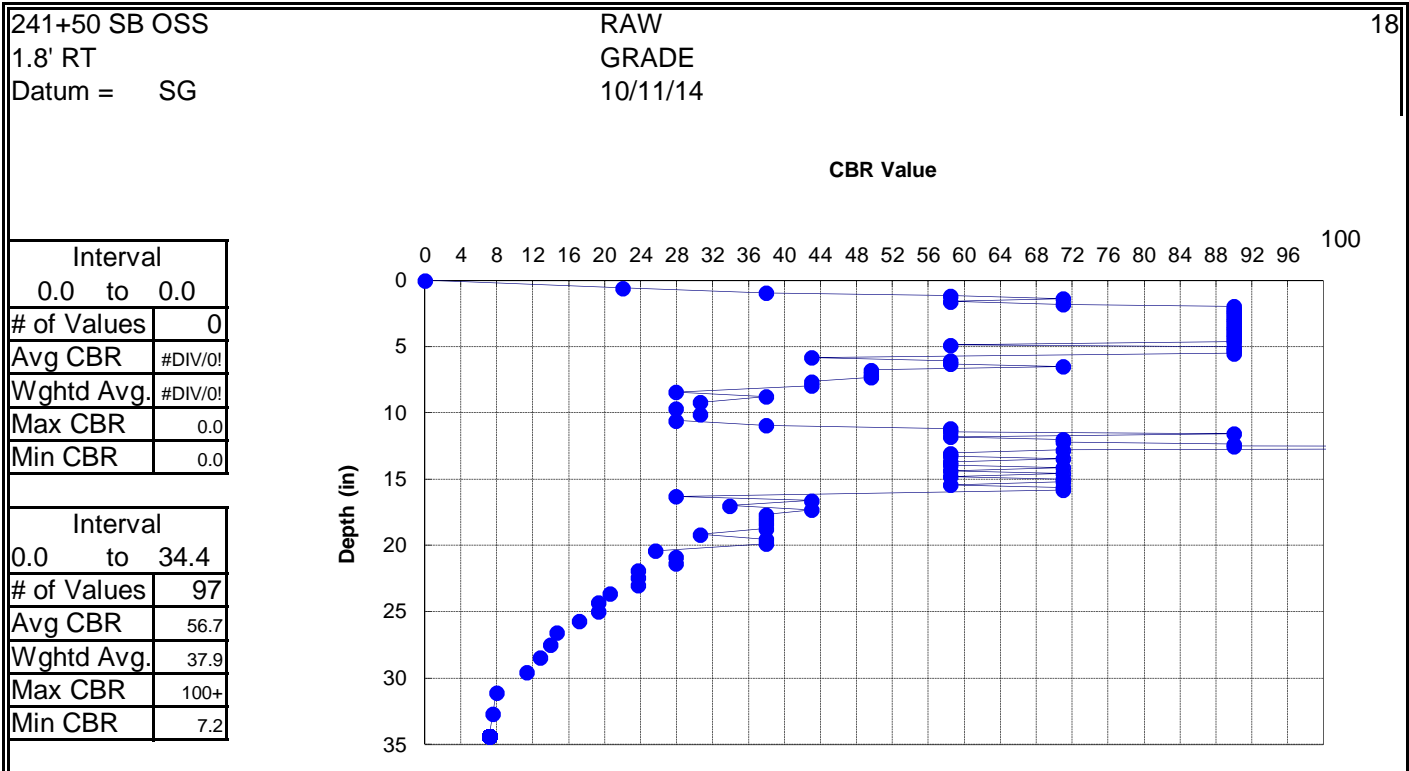
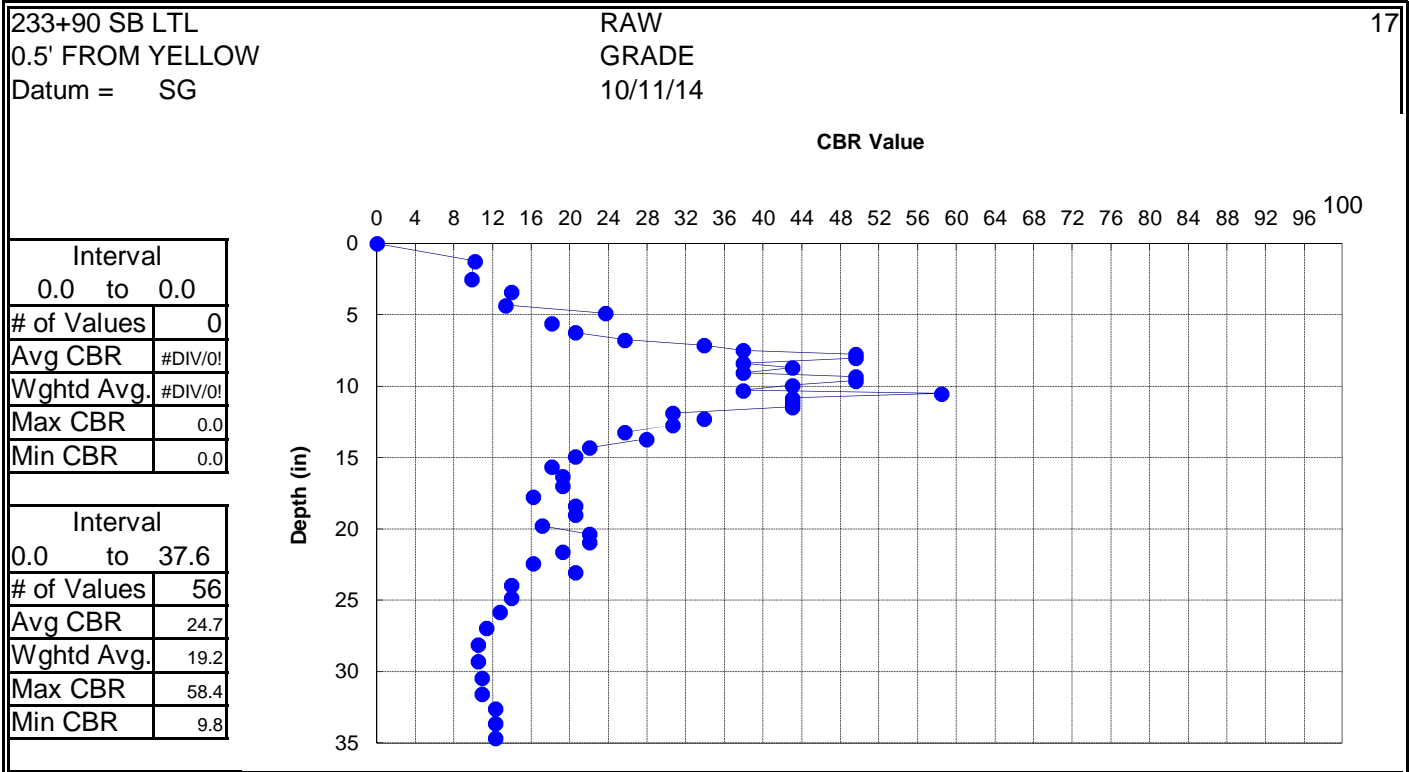


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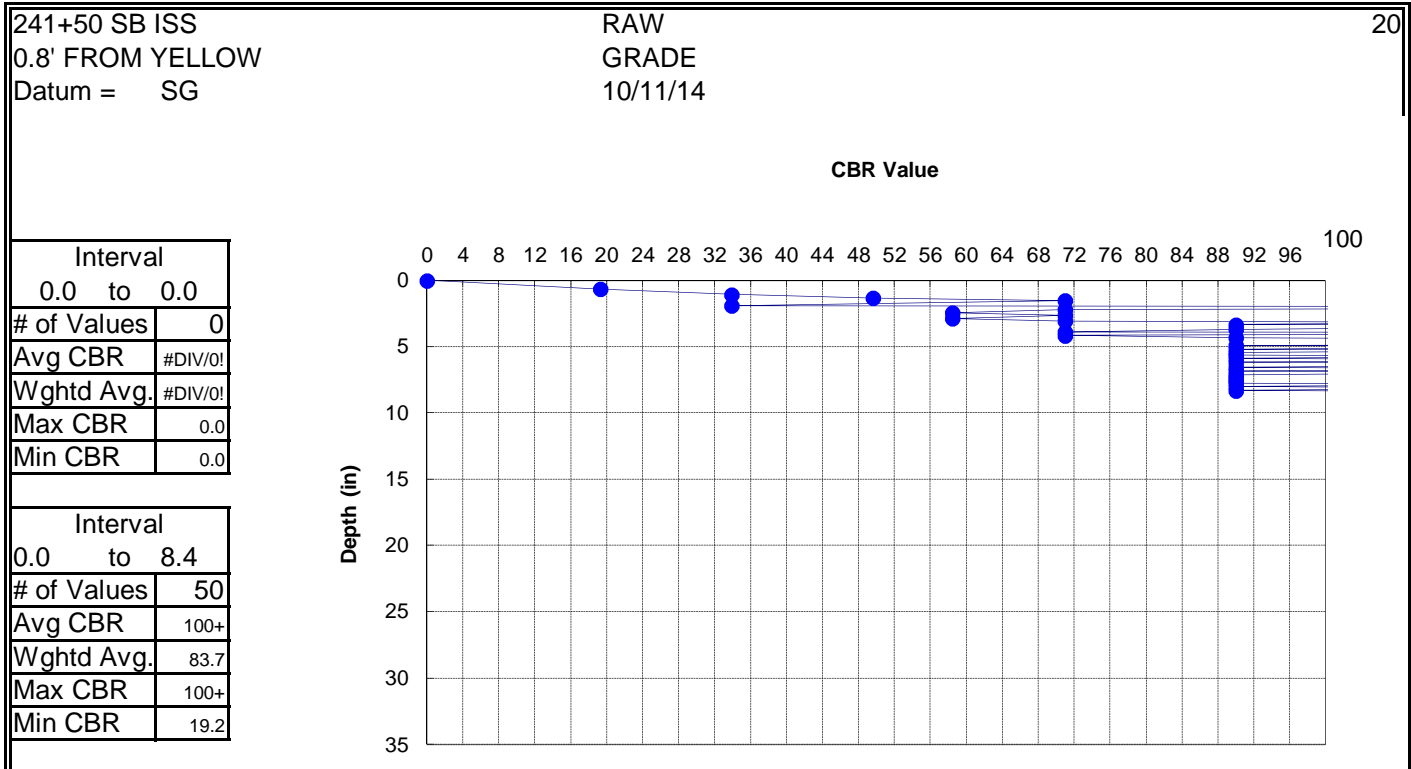
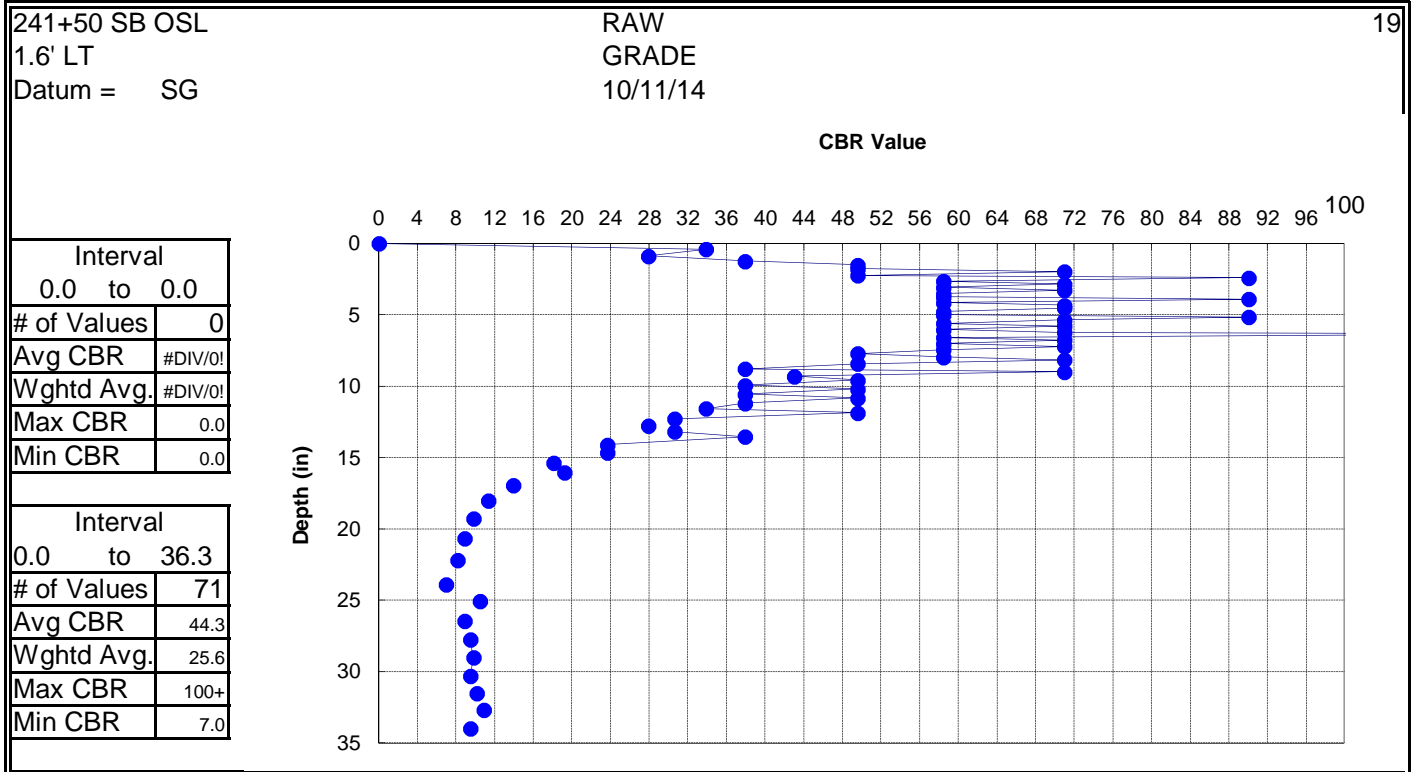


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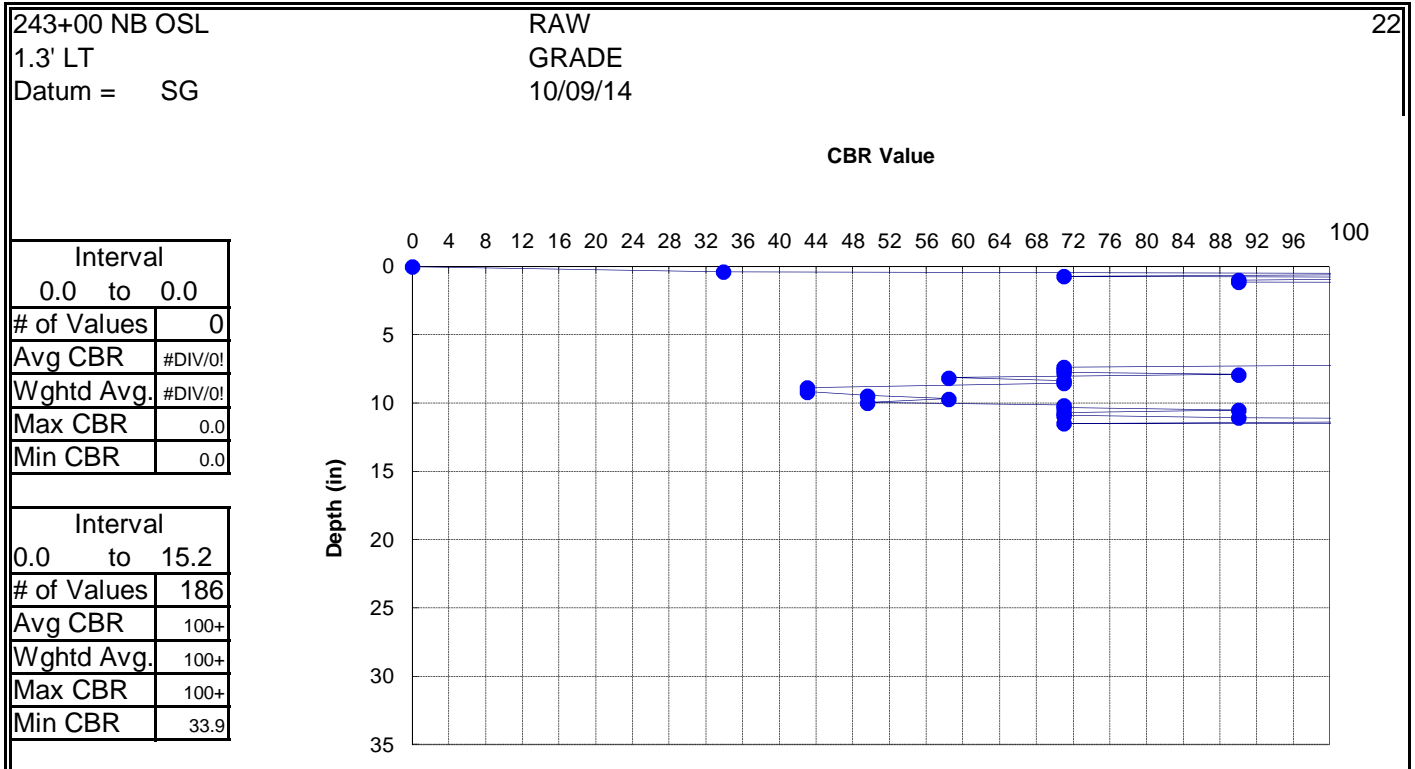
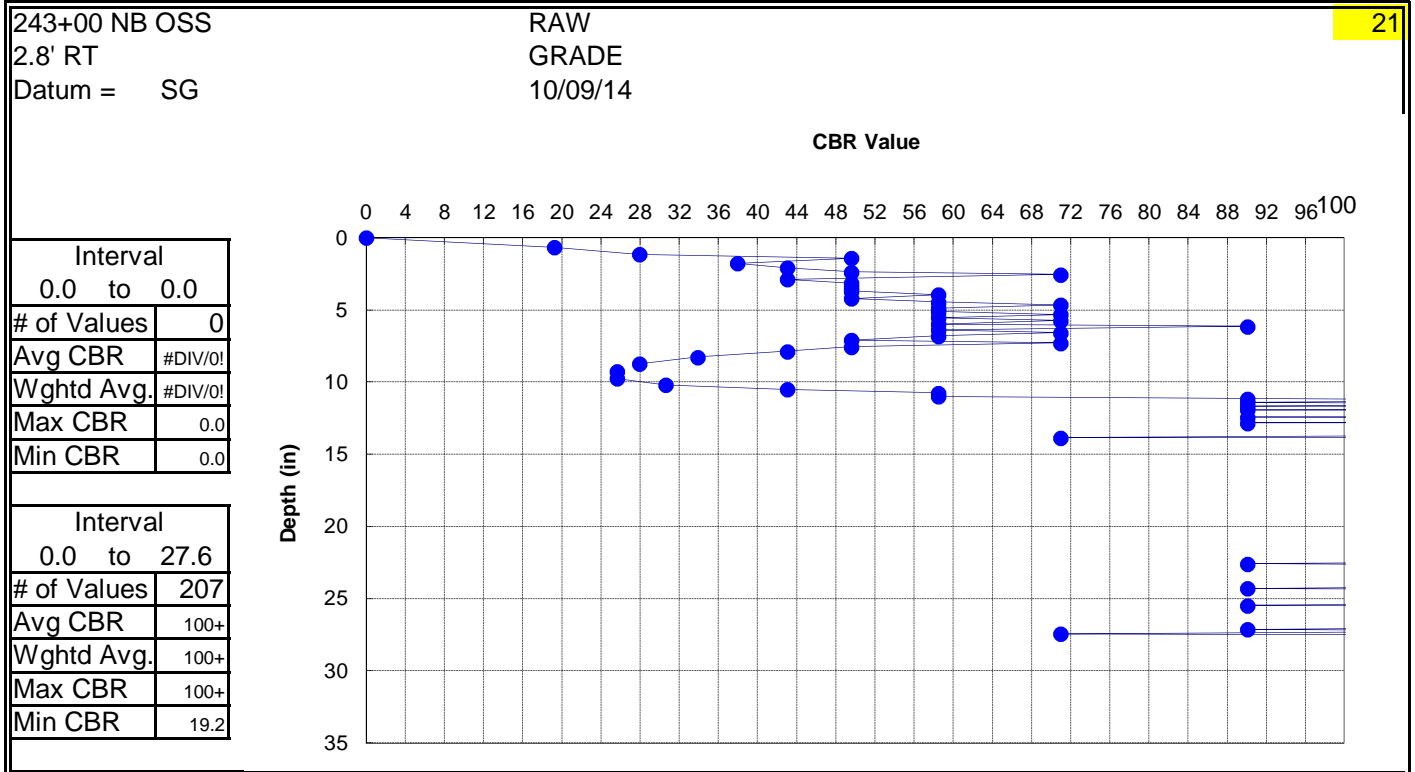


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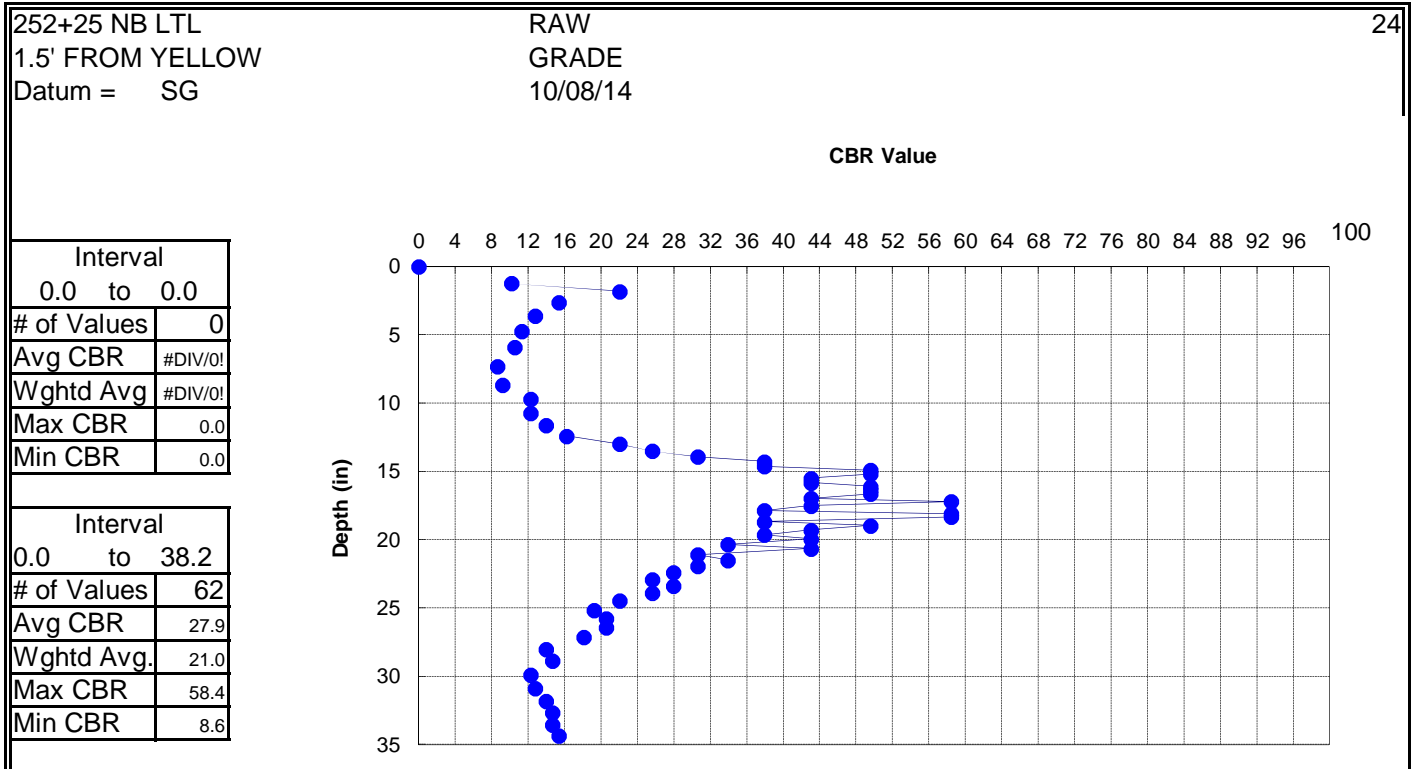
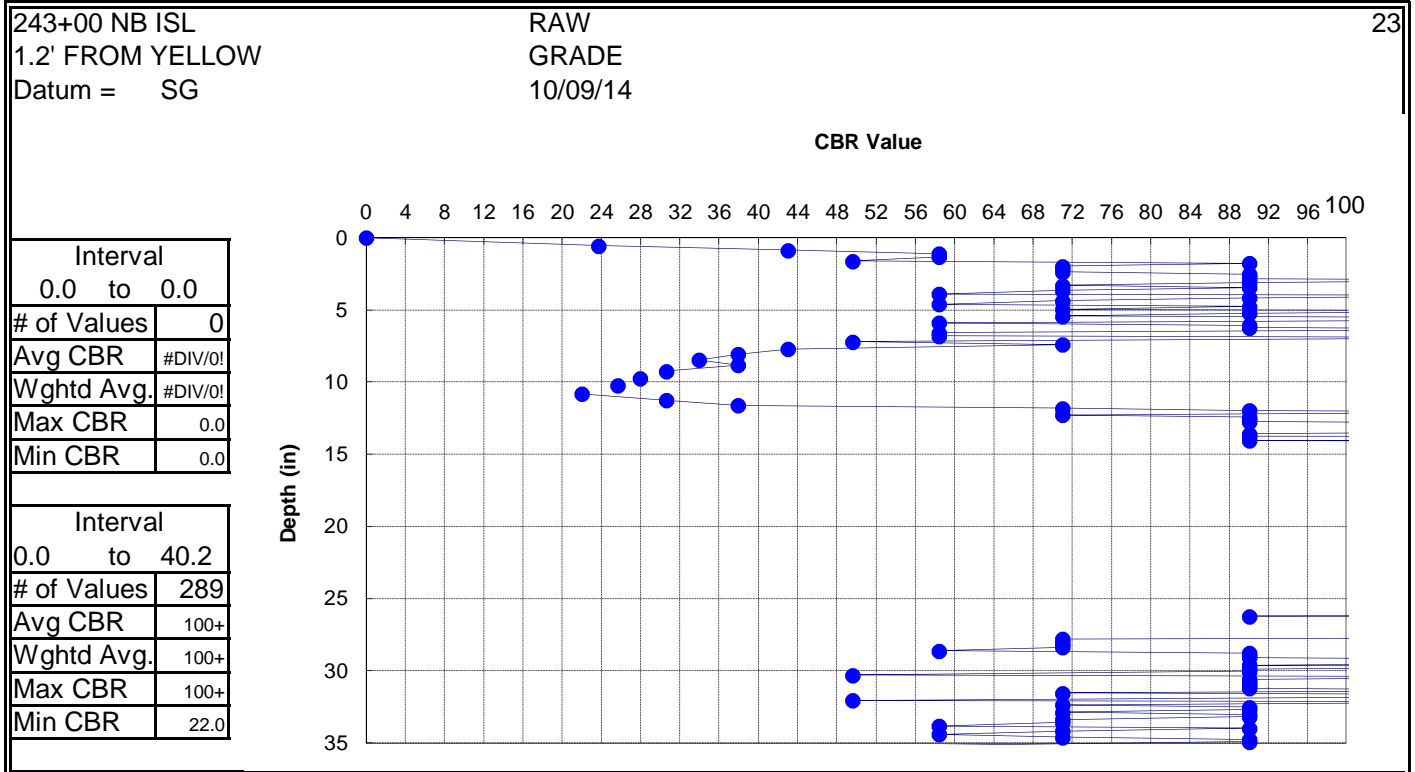


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GEOTECHS	TRIGON

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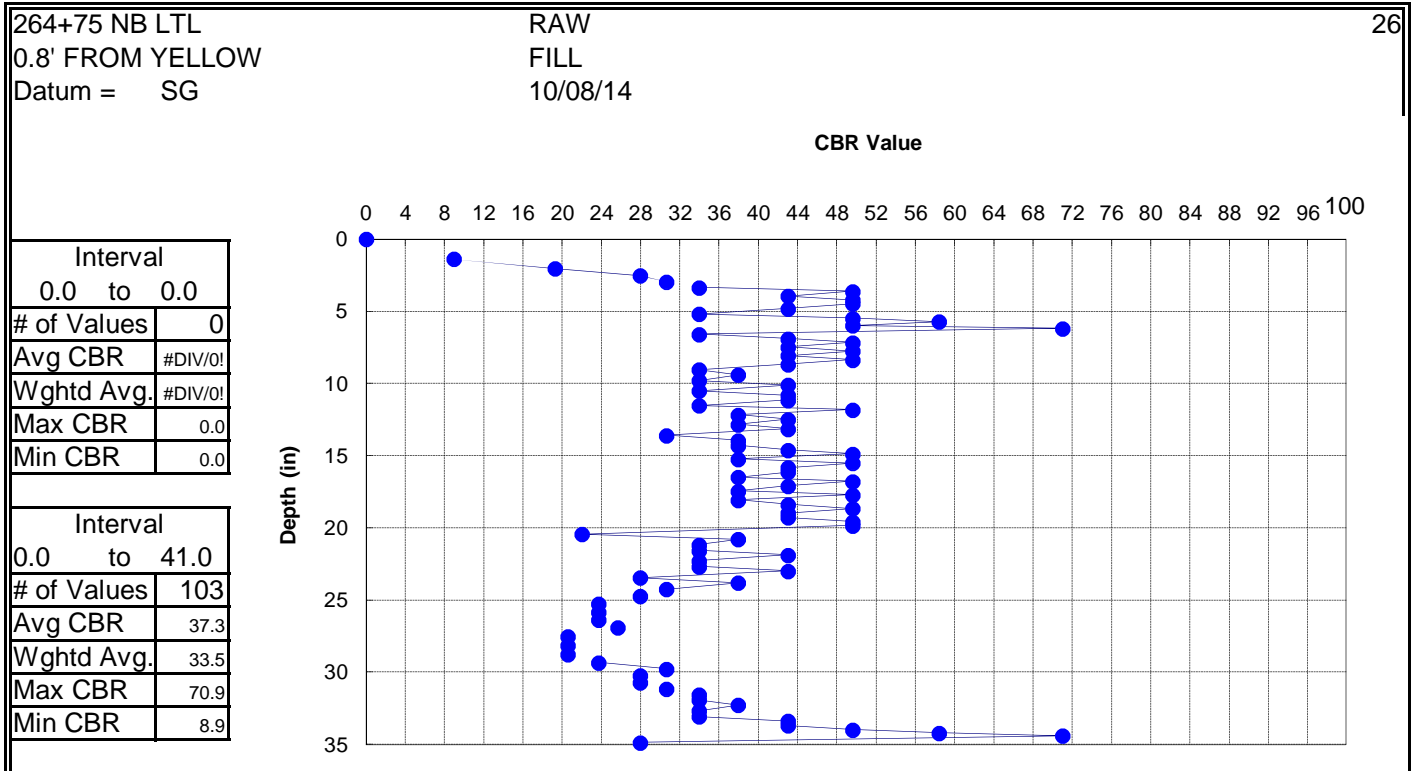
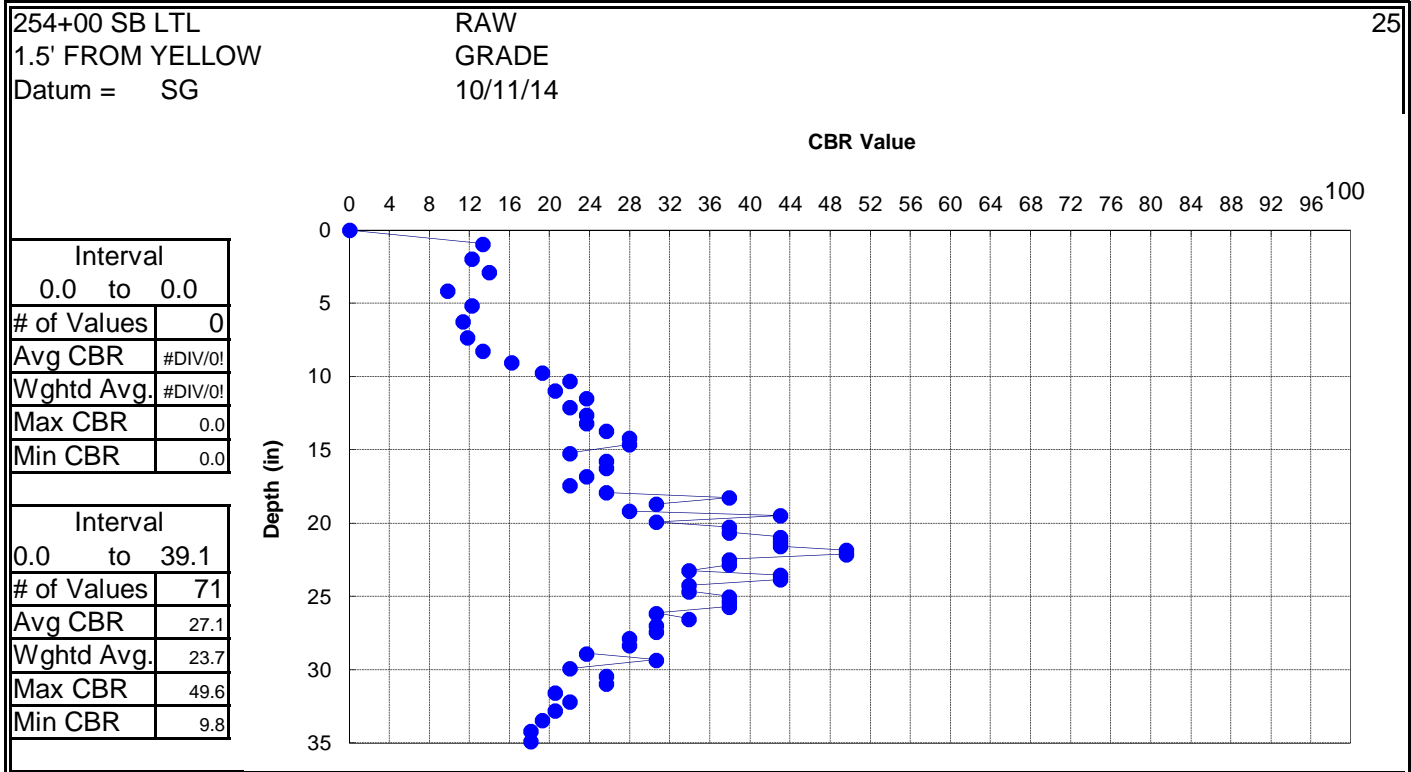


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GEOTECHS	TRIGON

FILE	W-5519_CONEPEN2
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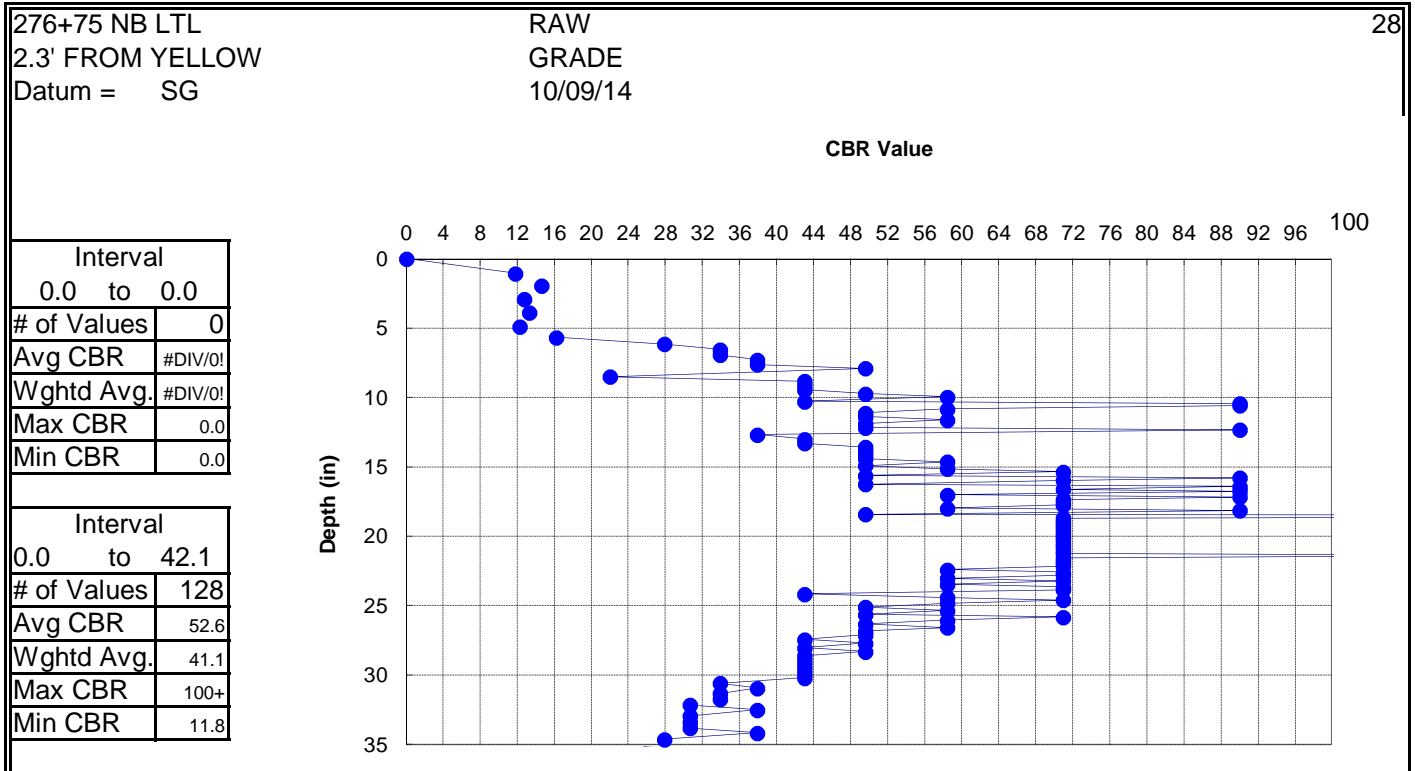
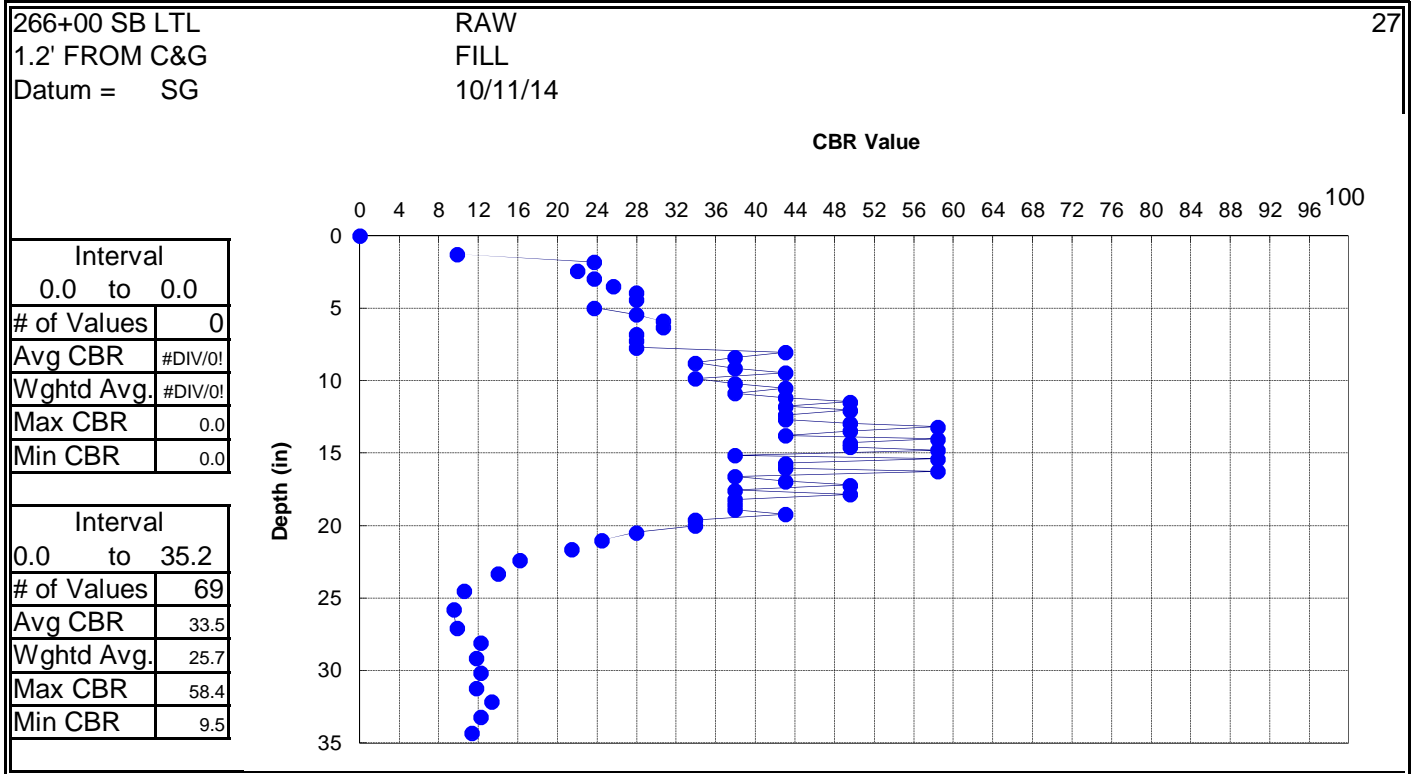


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GEOTECHS	TRIGON

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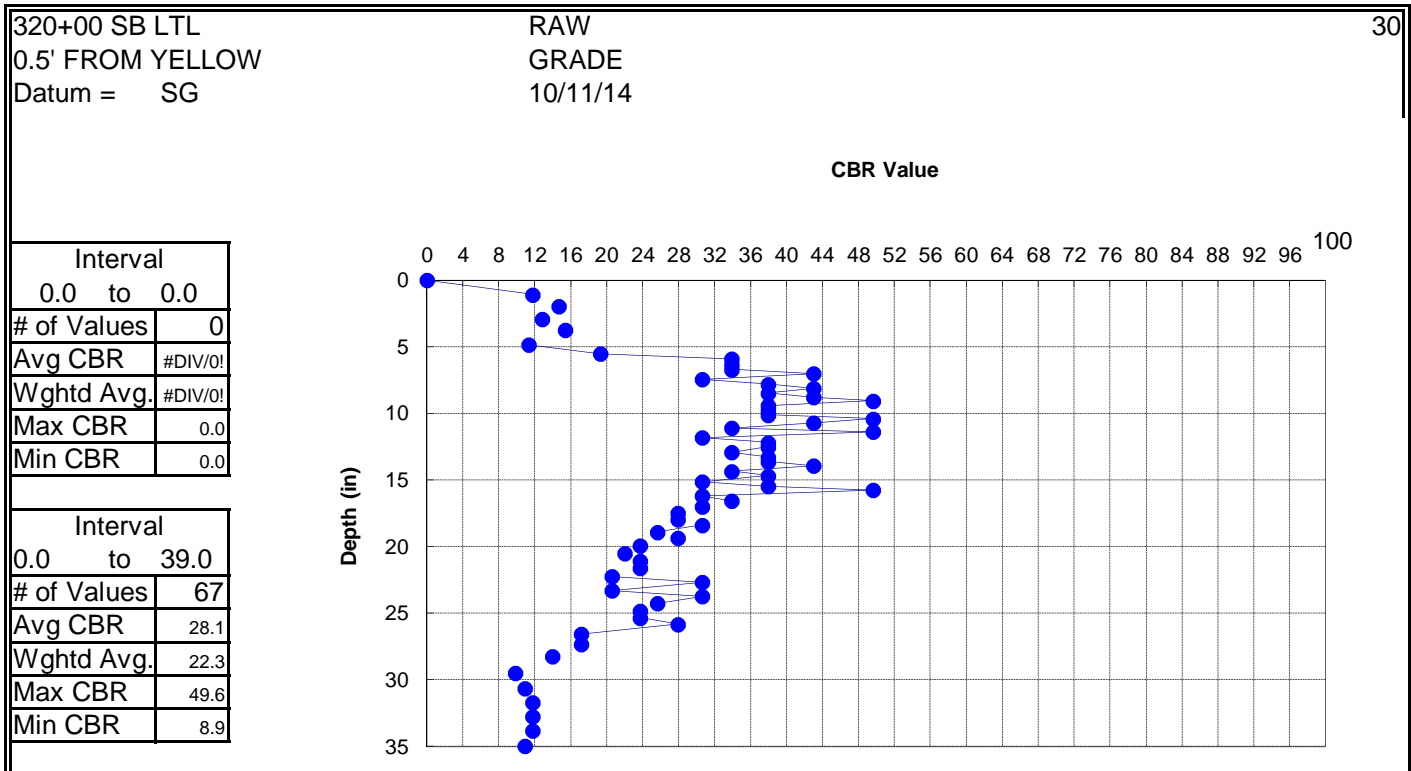
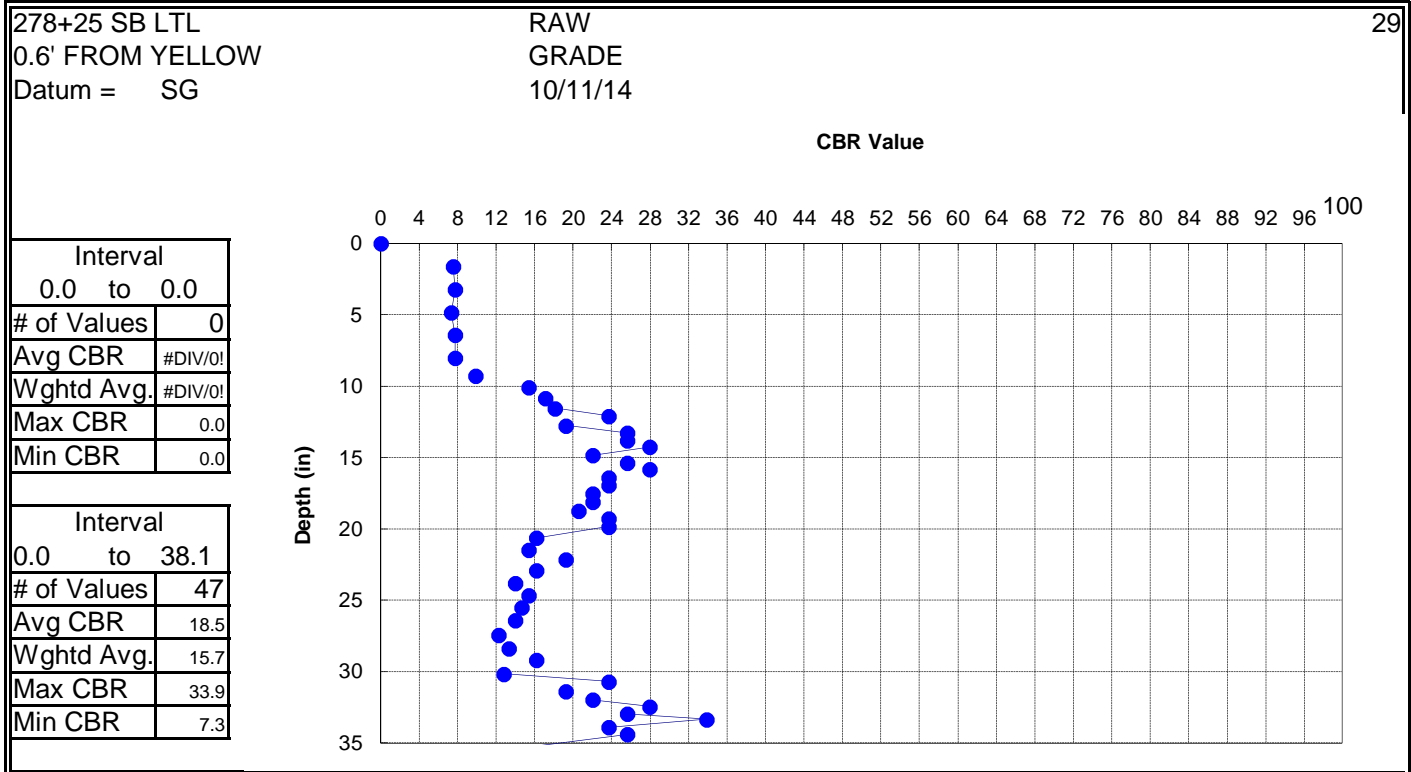


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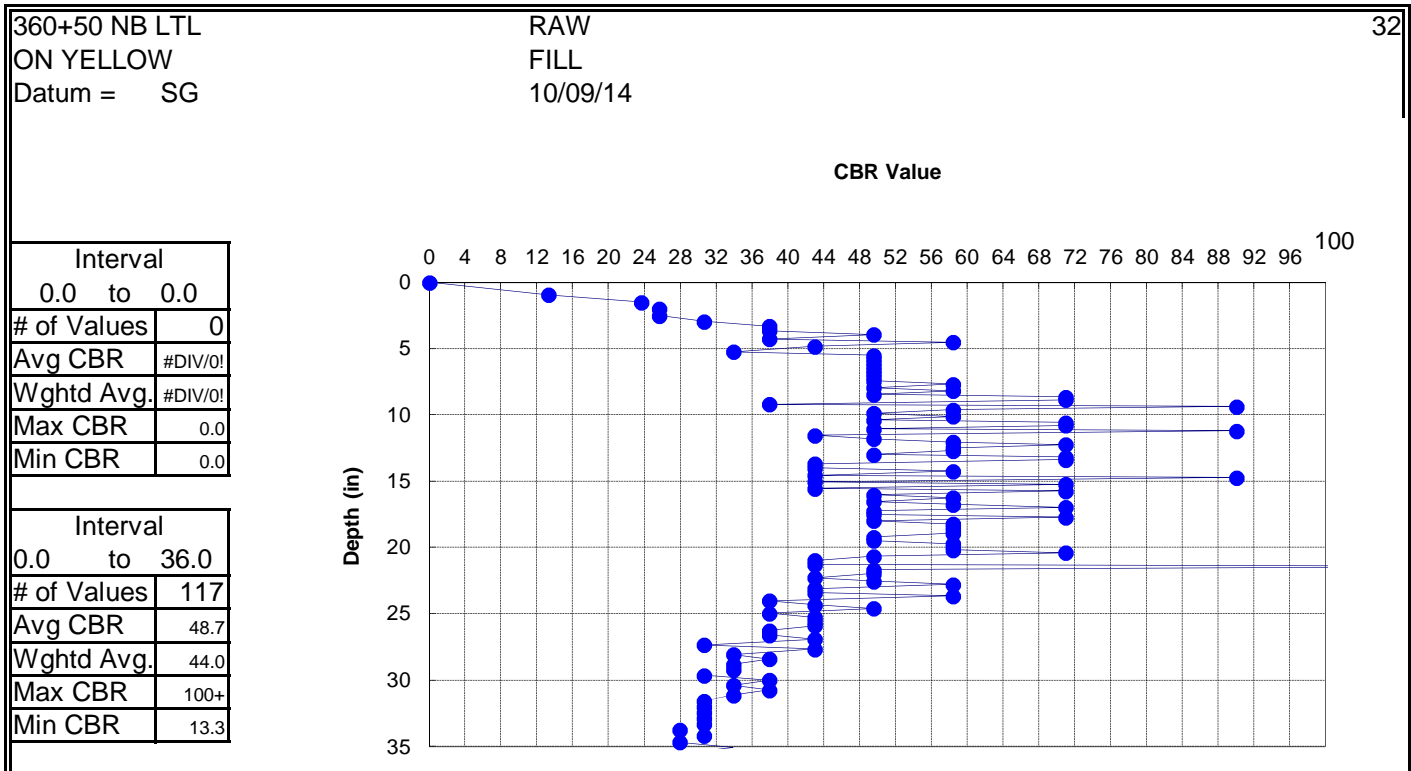
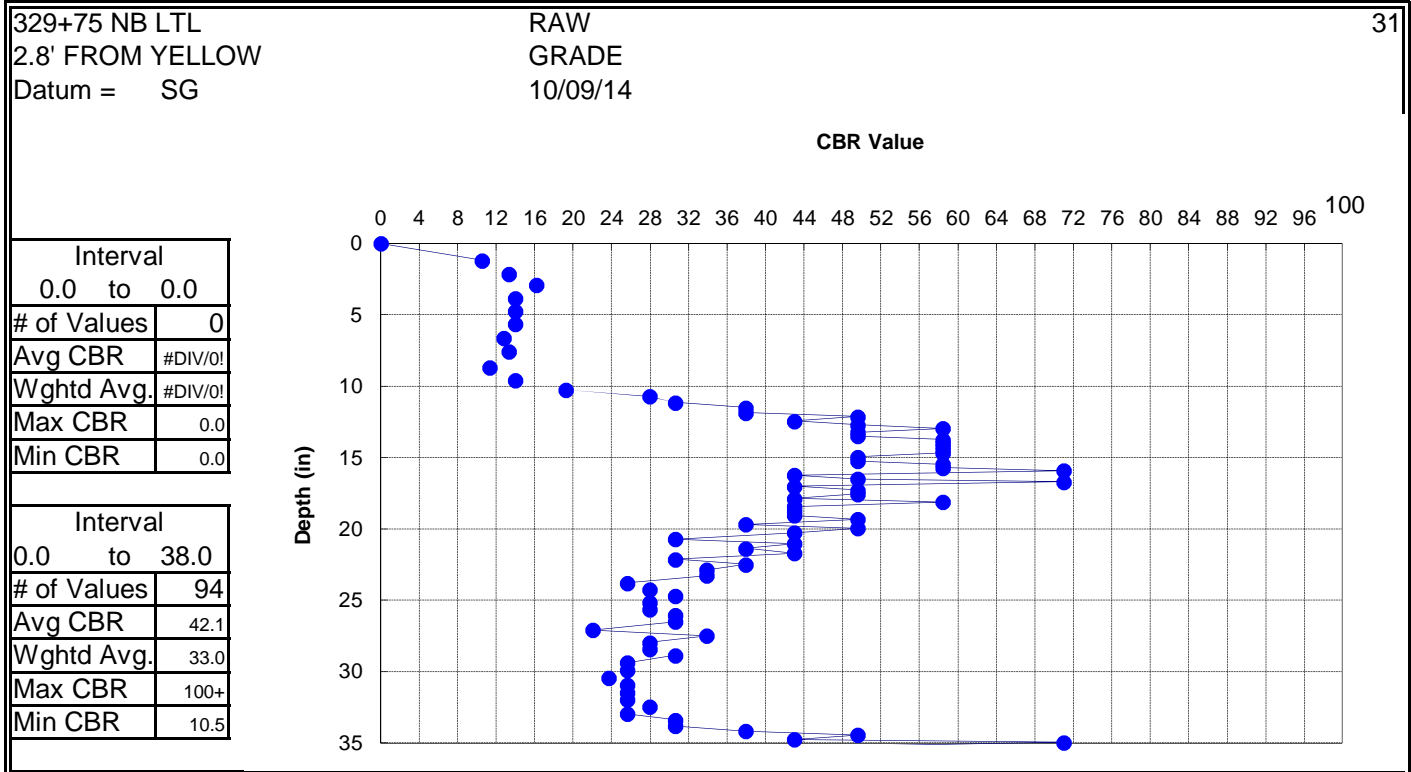


**CONE PENETROMETER RESULTS
NC - DOT, GEOTECHNICAL ENGINEERING UNIT**

PROJECT NO.	45849.1.FR1
PROJECT ID	W-5519
ROUTE	I-95BUS/US 301
COUNTY	CUMBERLAND

GEOLOGIST	J.B. BARFIELD
GEOTECHS	TRIGON

FILE	W-5519_CONEPEN2
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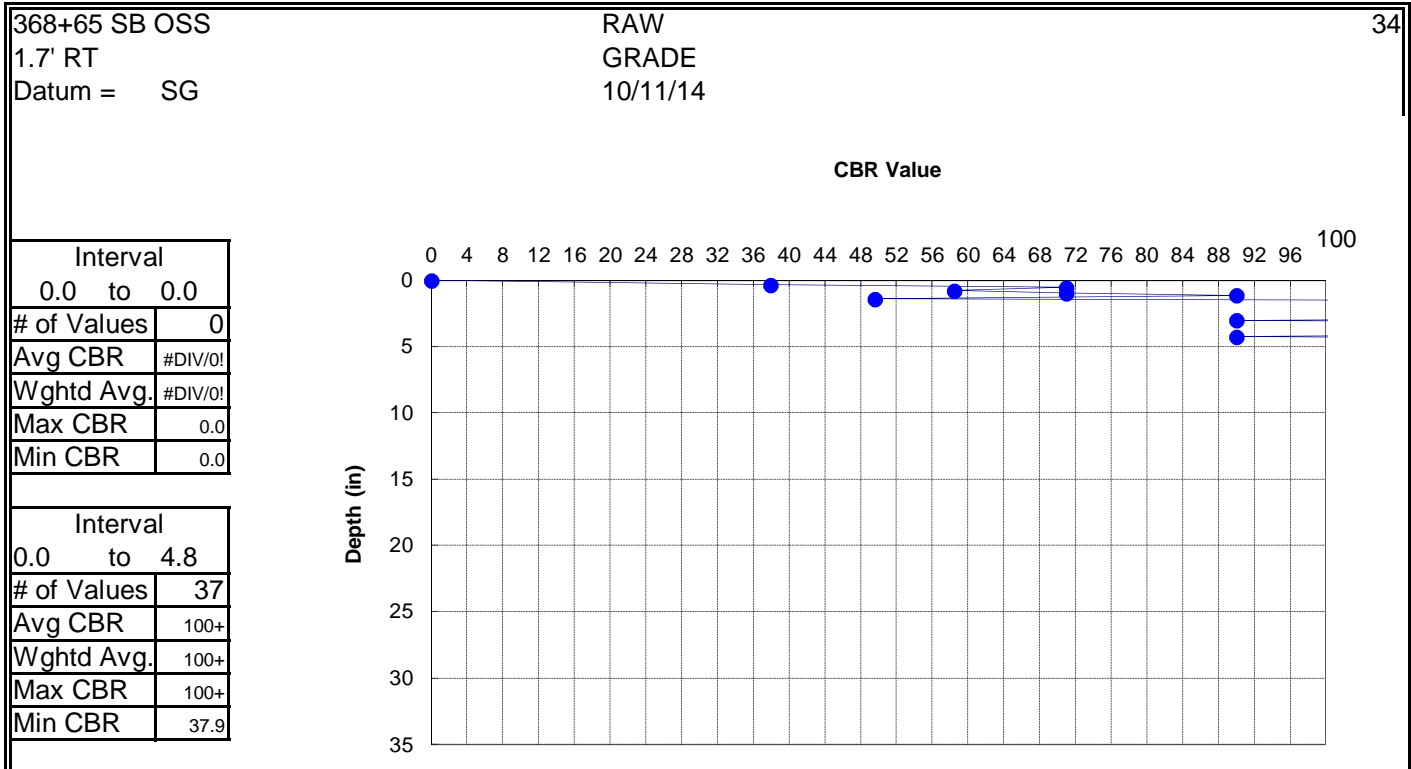
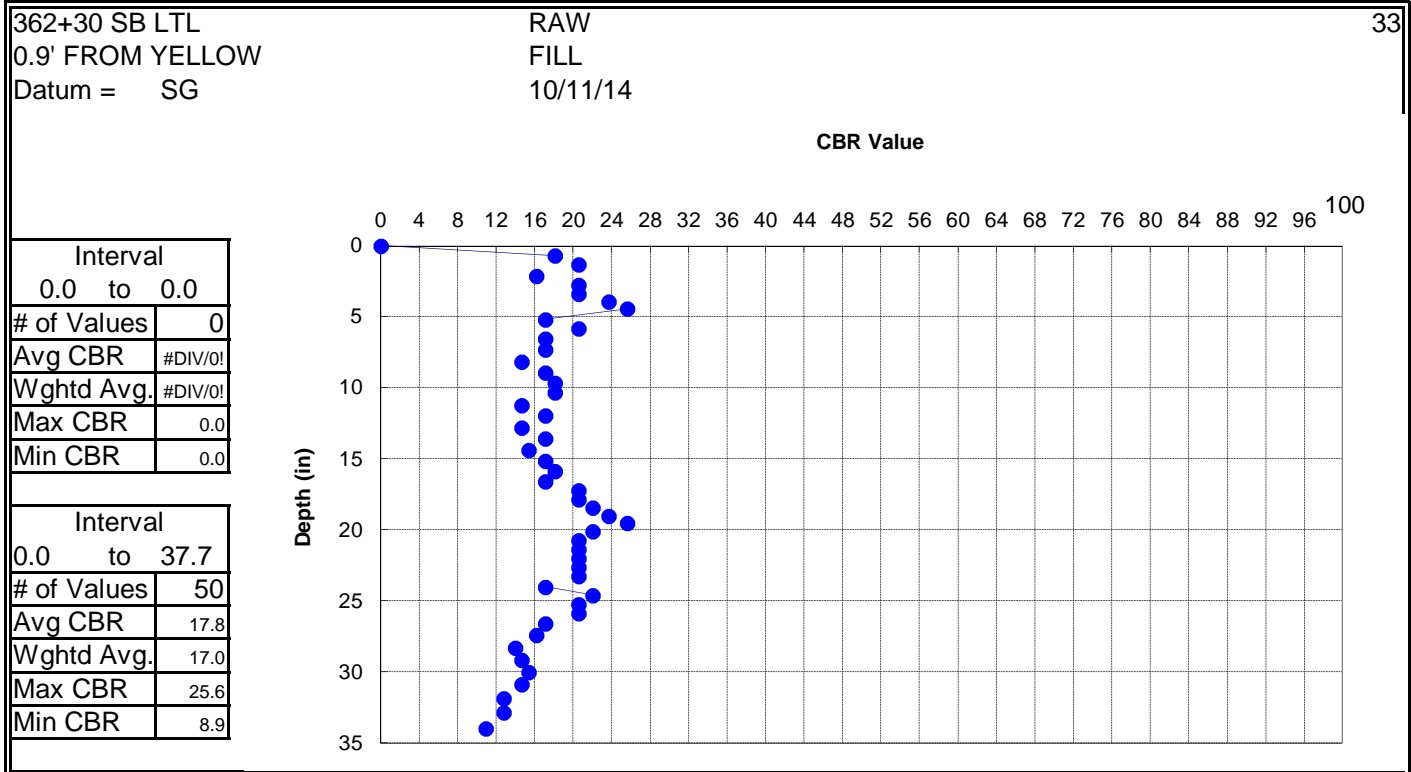


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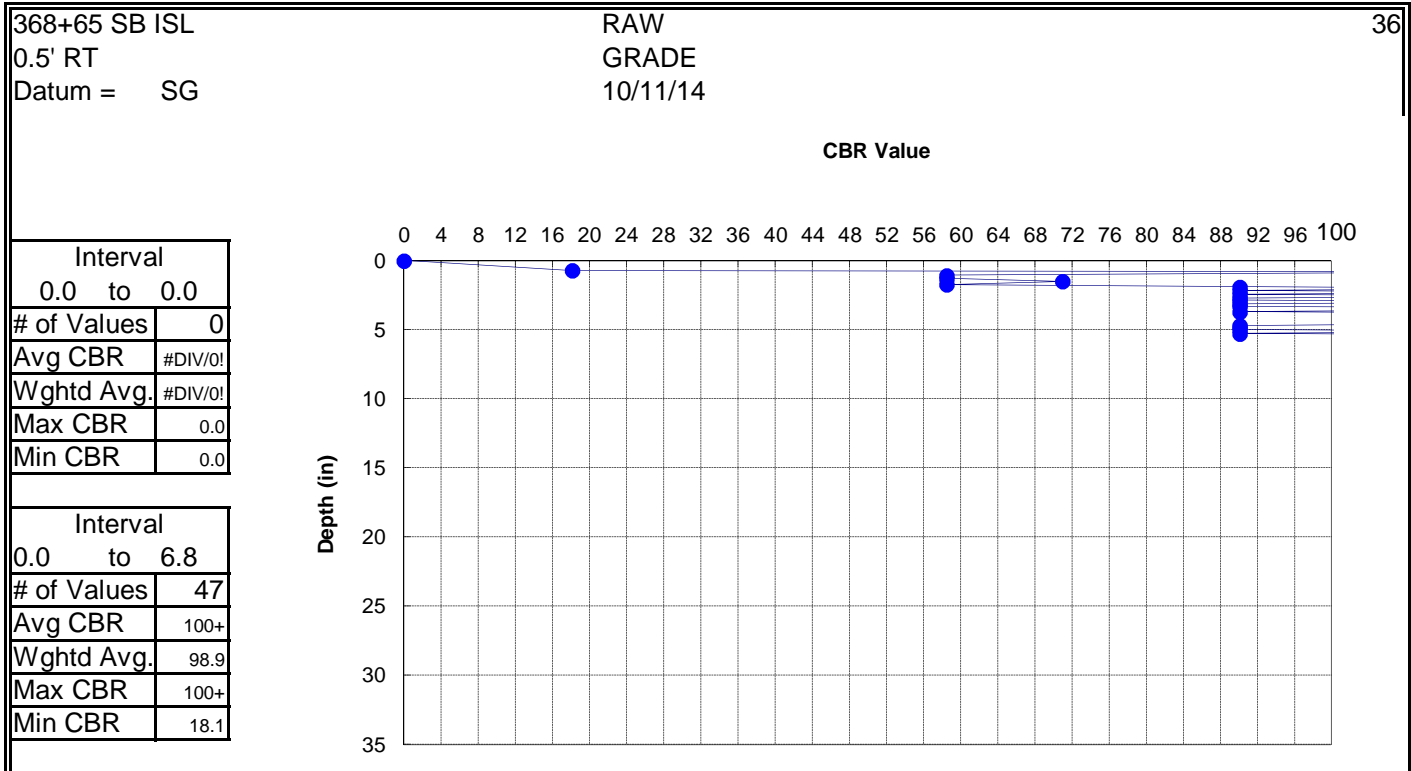
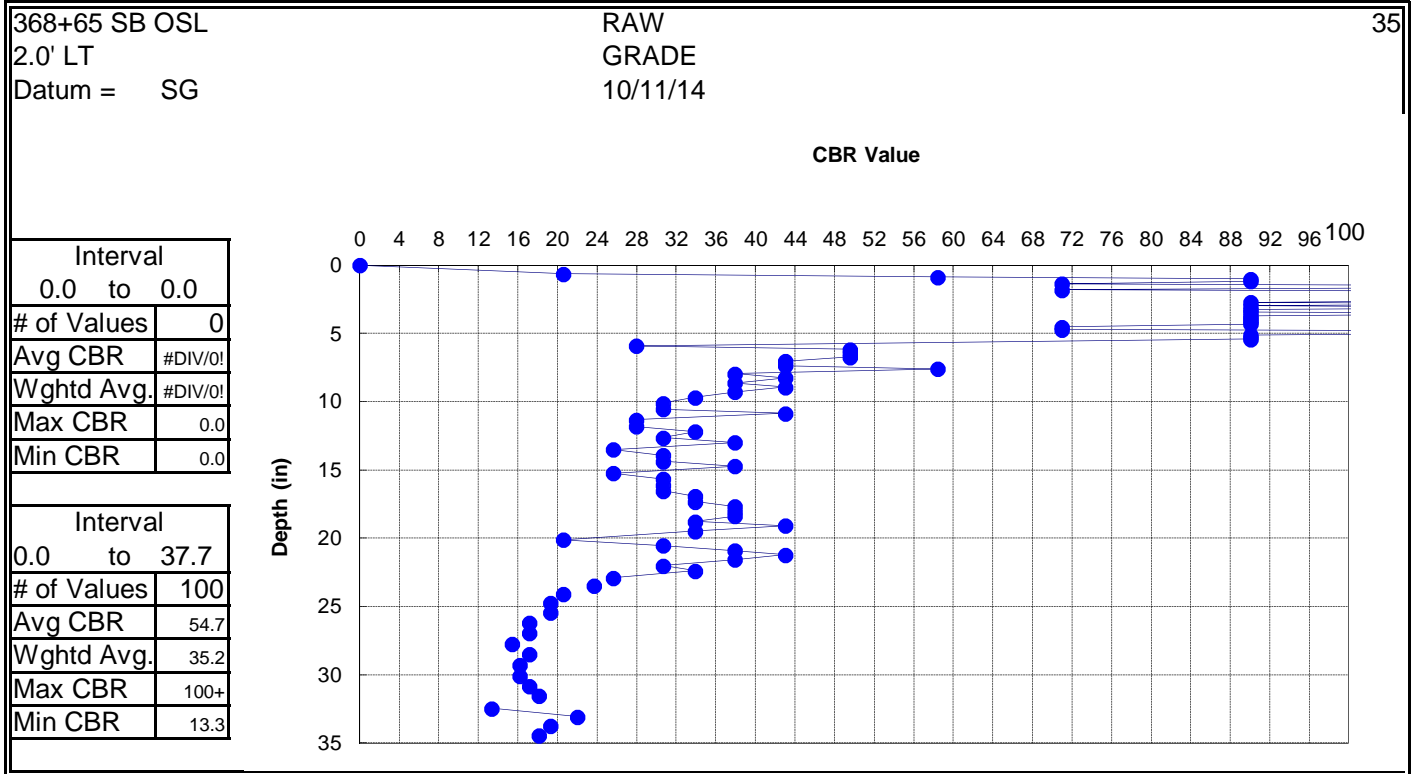


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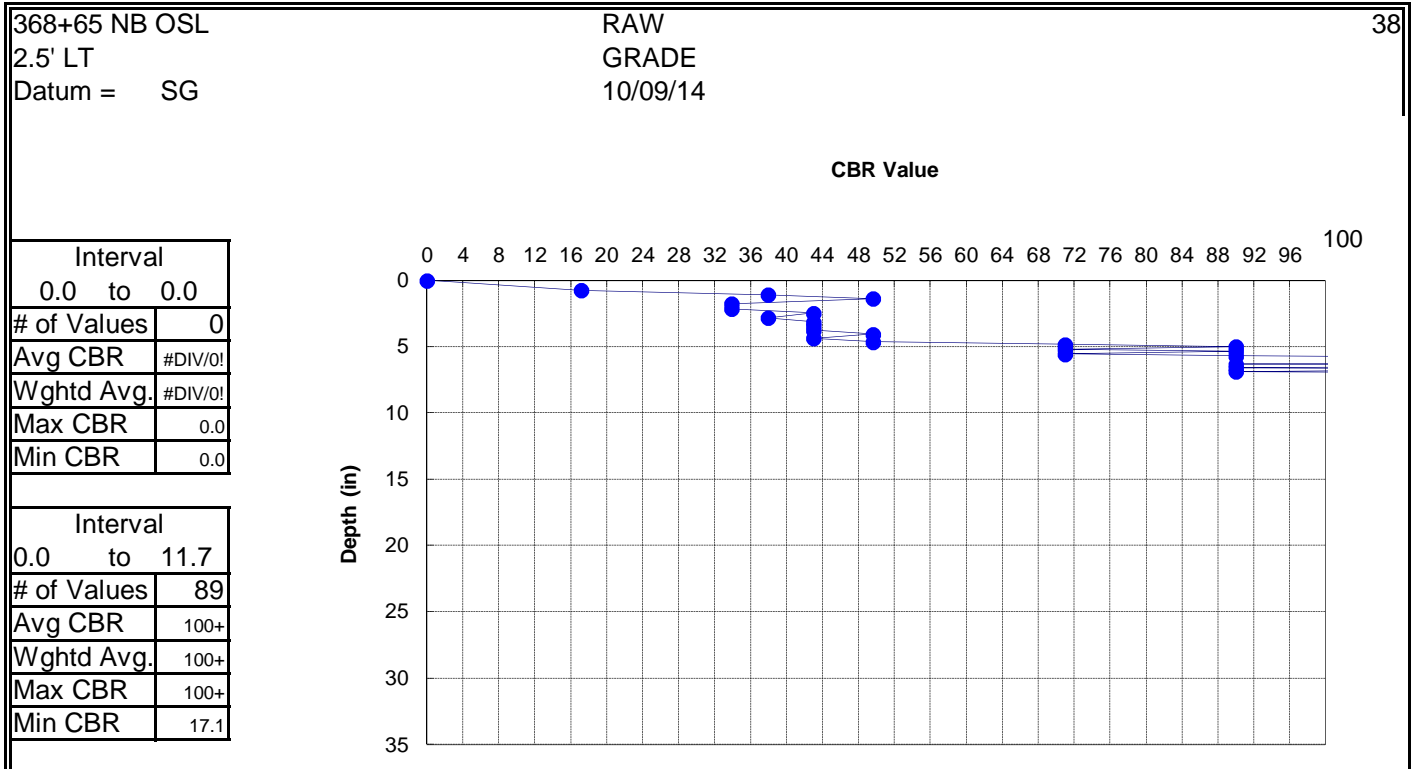
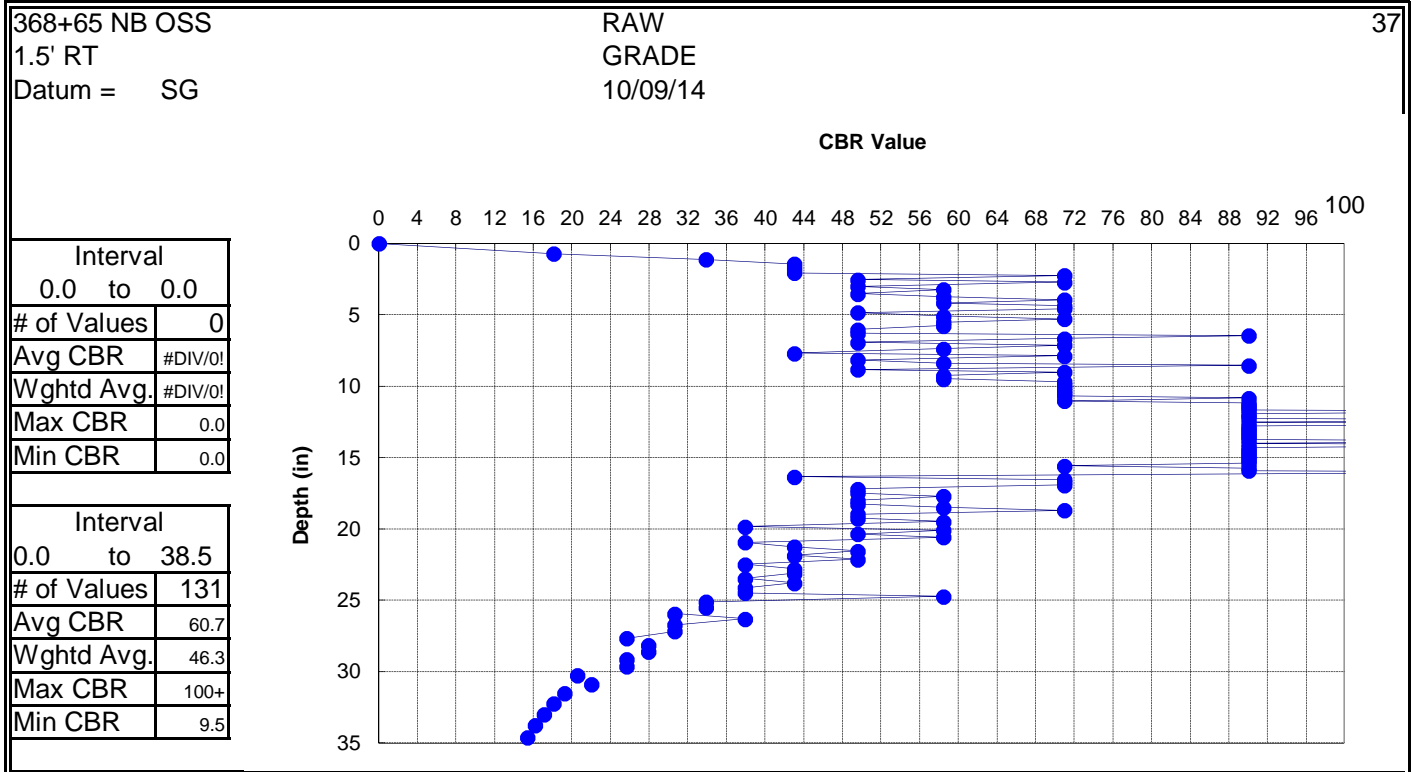


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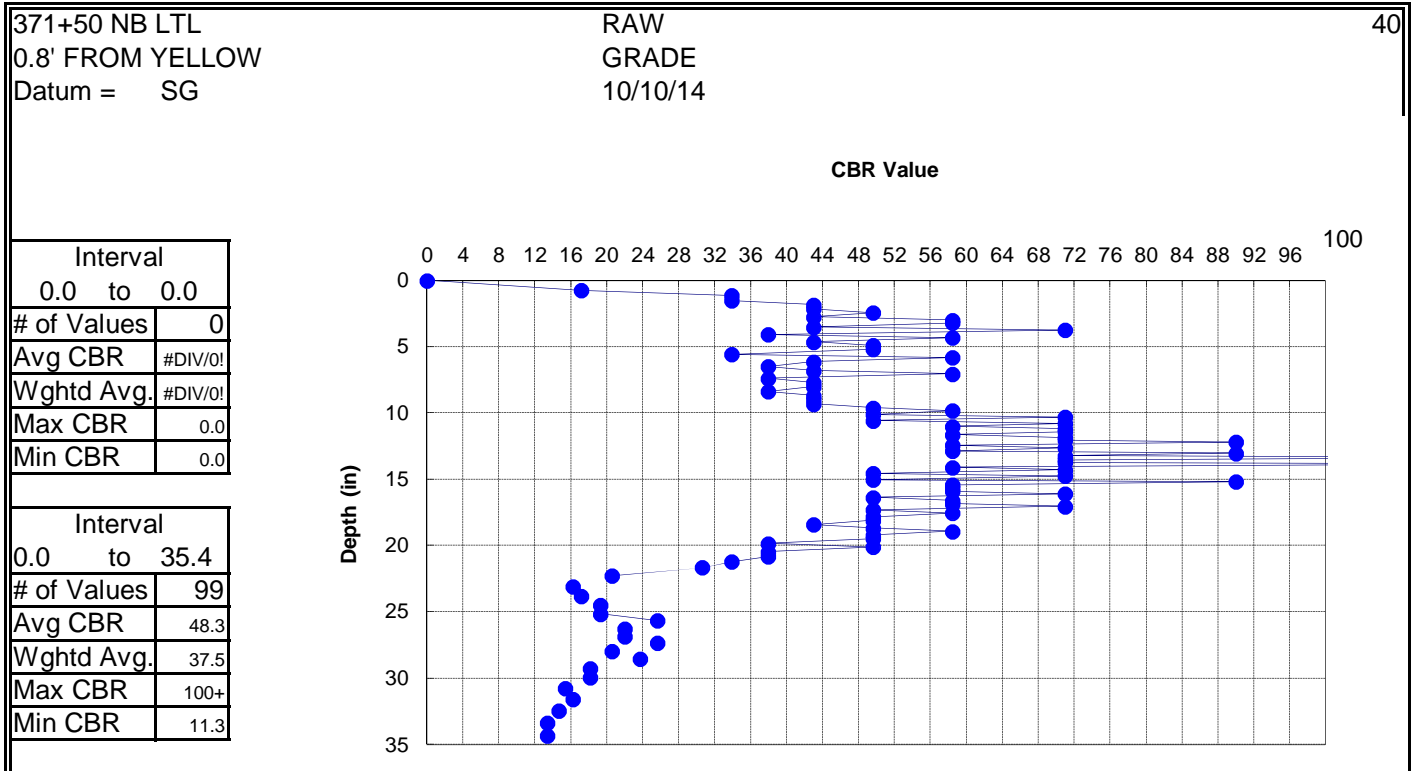
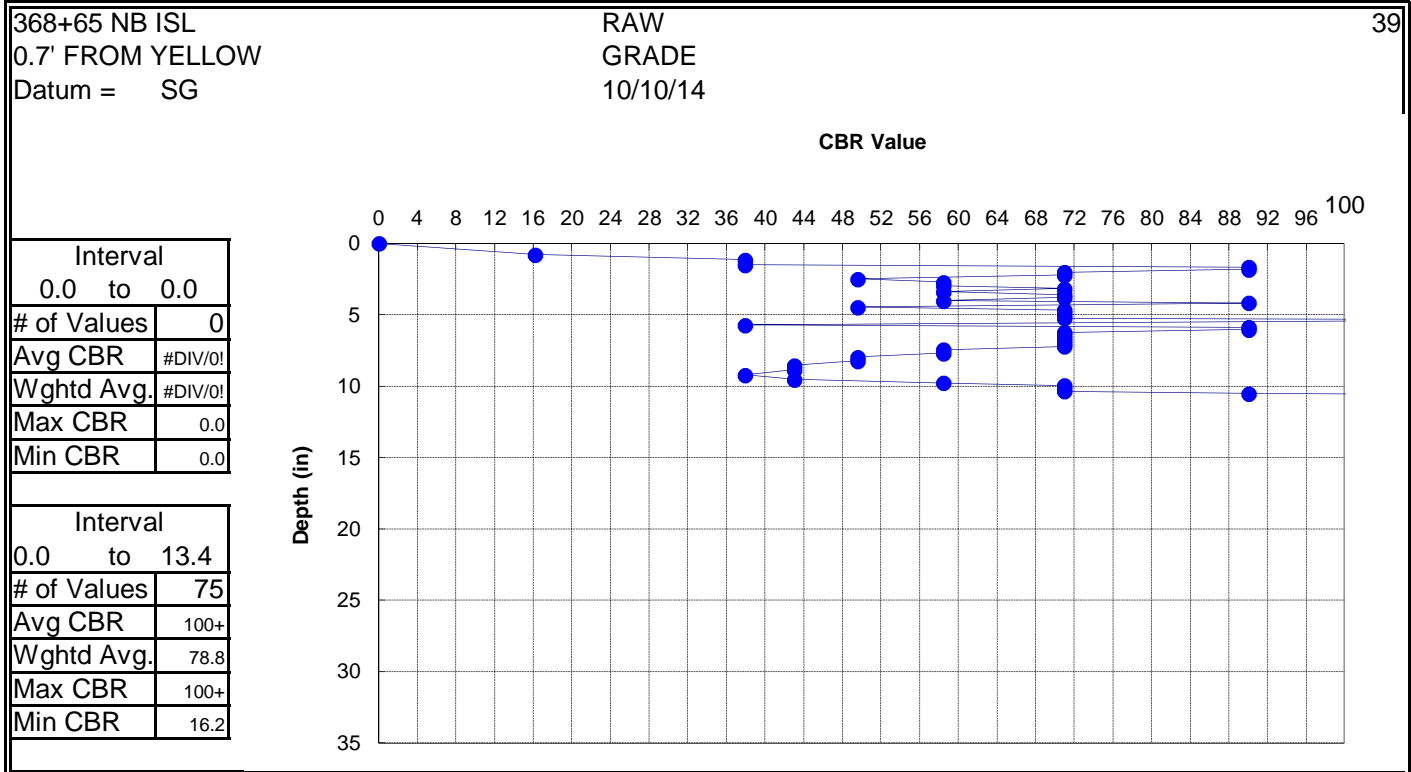


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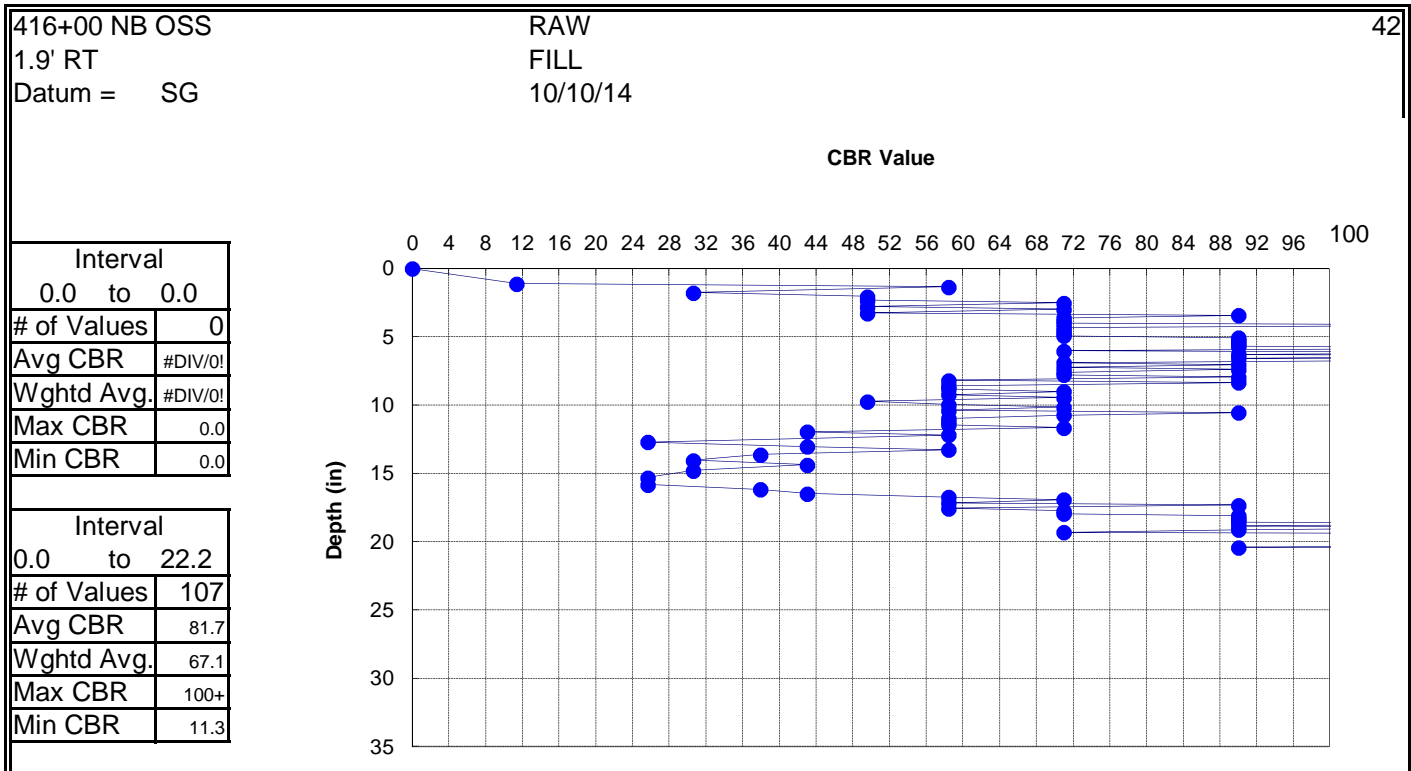
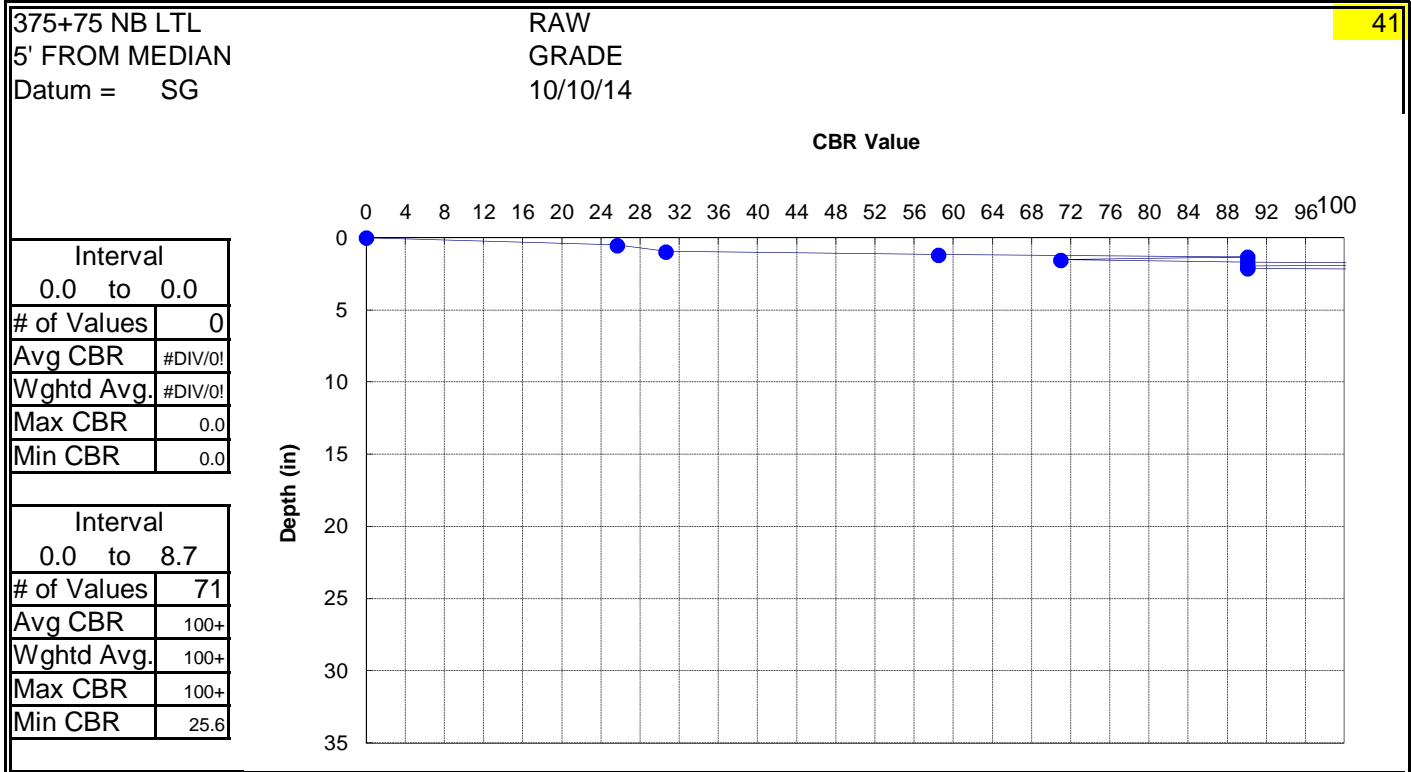


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GEOLOGIST	J. B. BARFIELD
GEOTECHS	TRIGON

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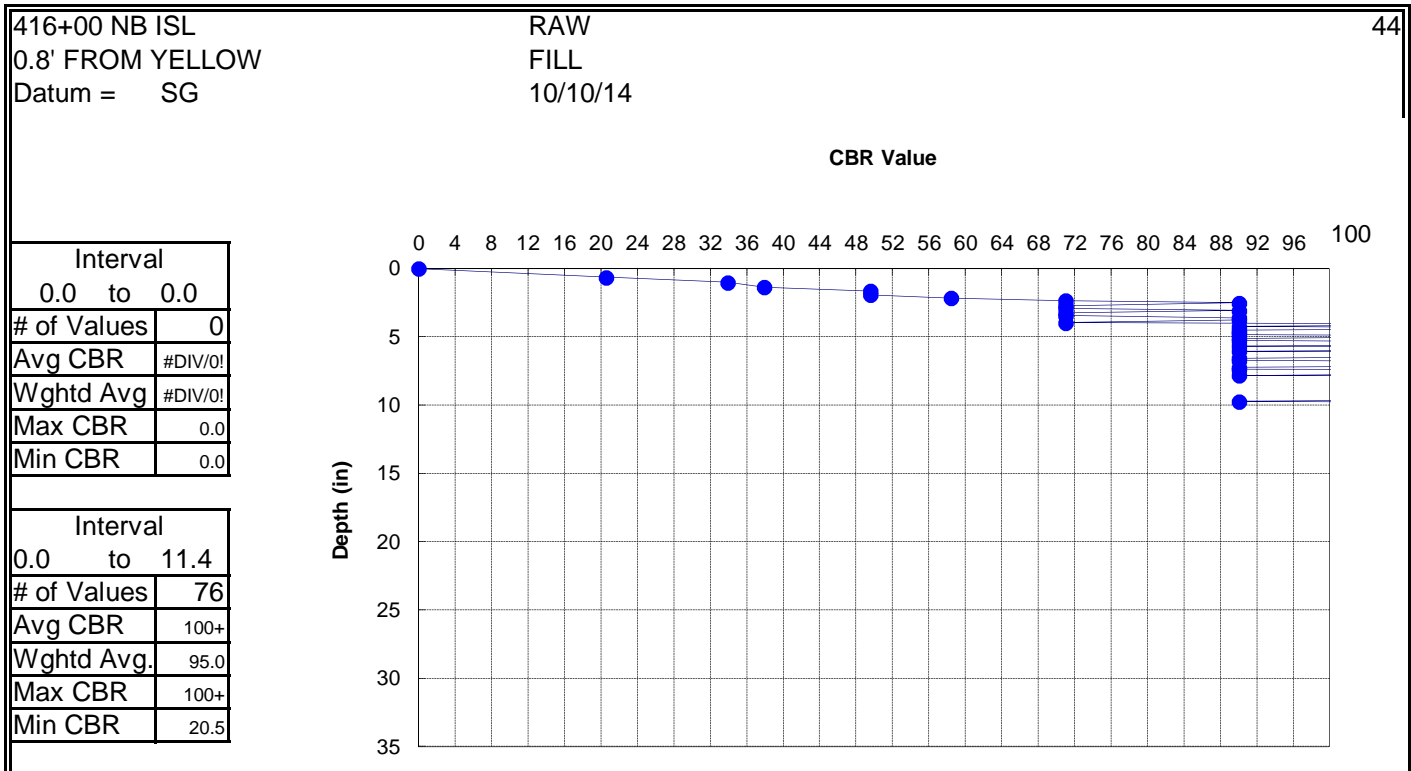
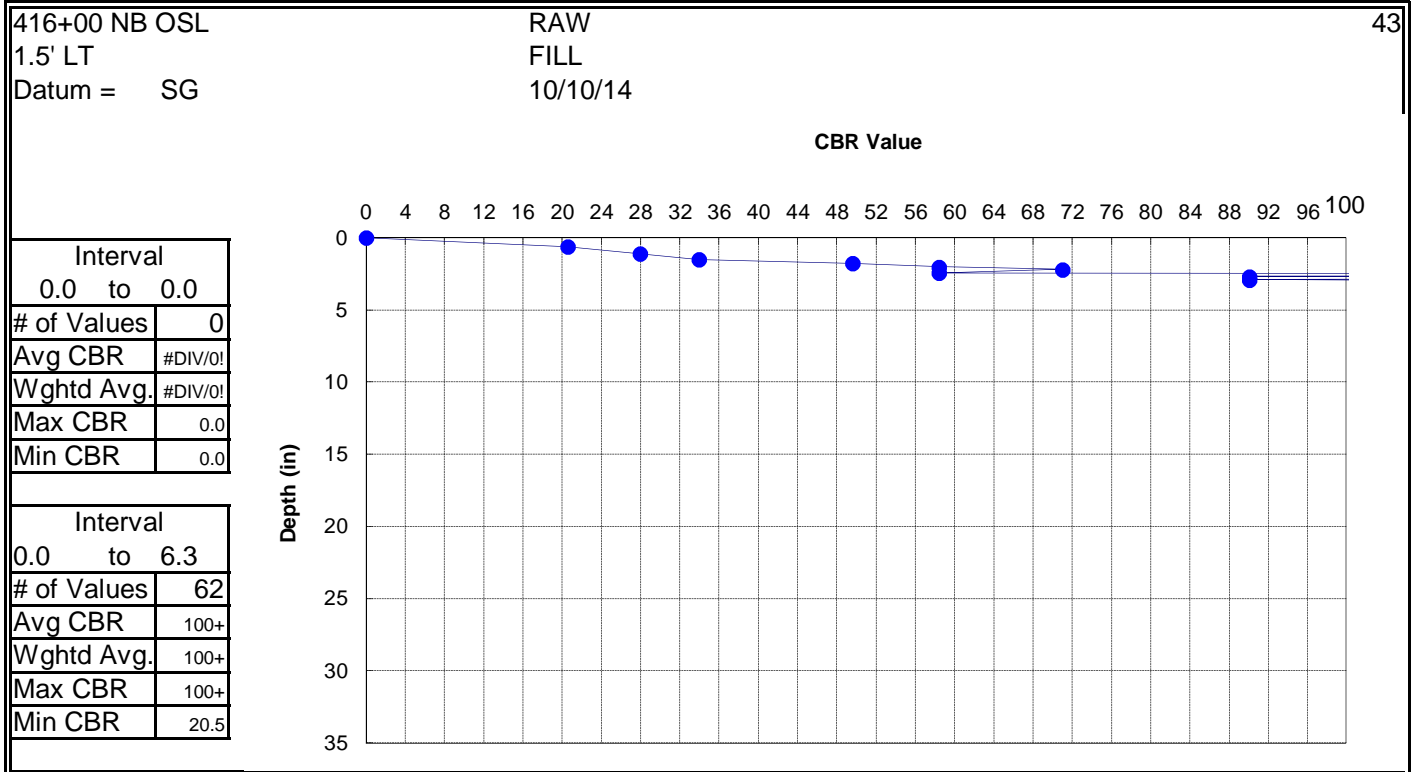


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ROUTE	I-95BUS/ US 301
COUNTY	CUMBERLAND

GEOLOGIST	J. B. BARFIELD
GEOTECHS	TRIGON

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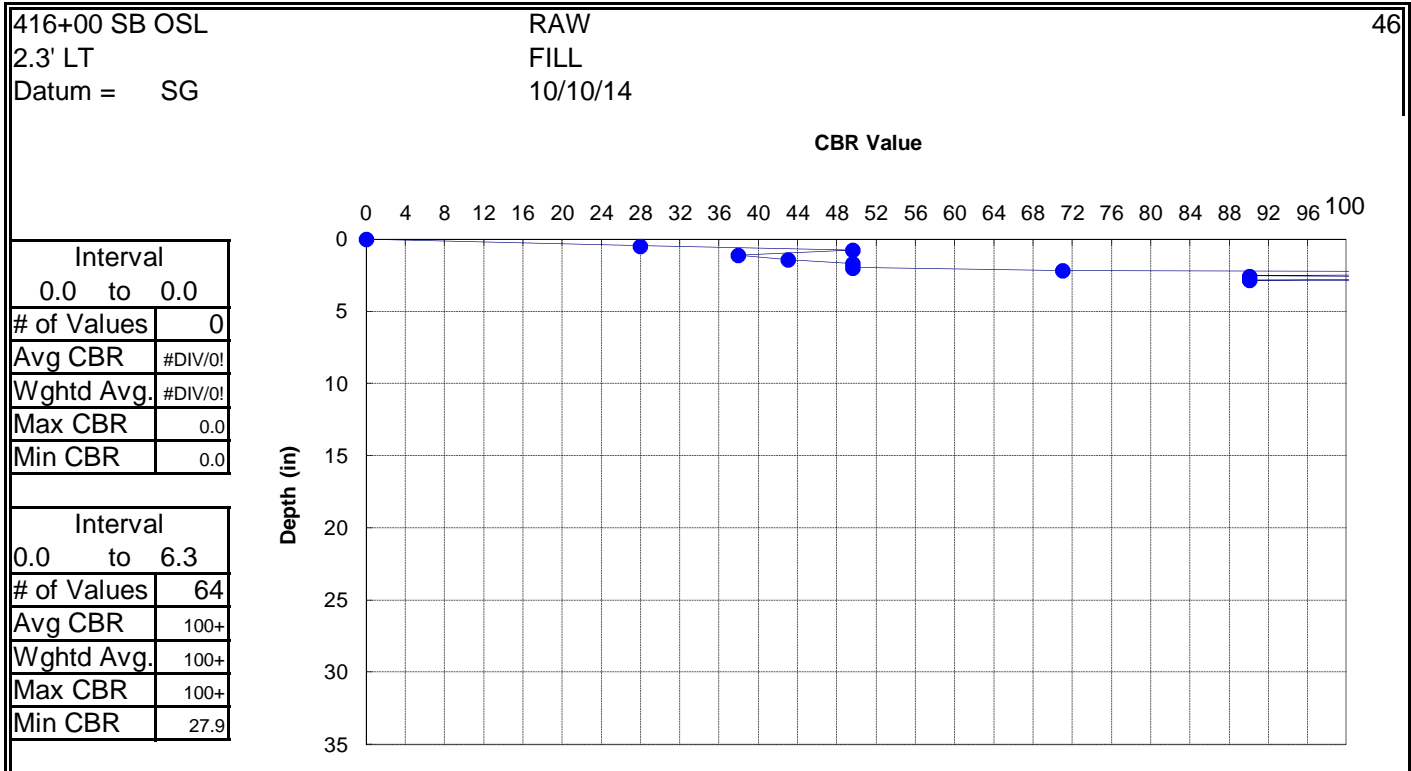
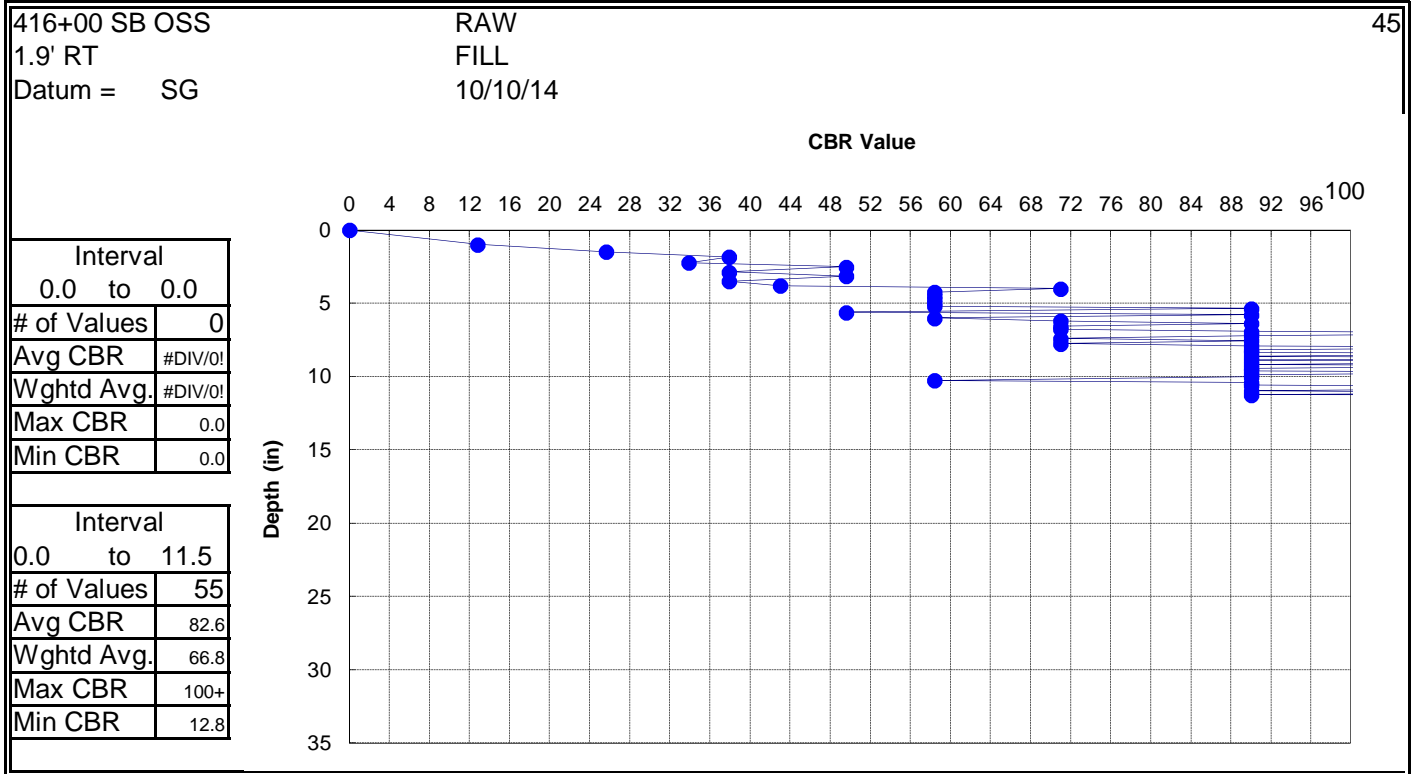


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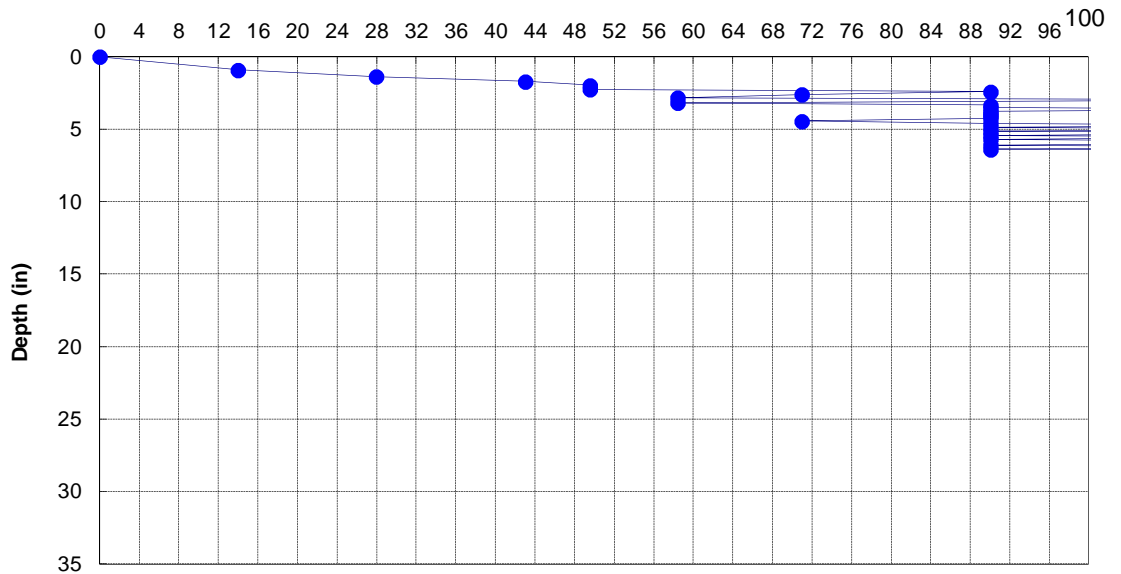
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416+00 SB ISL
0.5' FROM YELLOW
Datum = SG

RAW
FILL
10/10/14

47

CBR Value



Interval	
0.0 to 0.0	
# of Values	0
Avg CBR	#DIV/0!
Wghtd Avg.	#DIV/0!
Max CBR	0.0
Min CBR	0.0

Interval	
0.0 to 9.4	
# of Values	63
Avg CBR	100+
Wghtd Avg.	94.8
Max CBR	100+
Min CBR	13.9



December 5, 2014

Mr. Trent Huffman, PE
Moffatt & Nichol
1616 East Millbrook Road, Suite 160
Raleigh, NC 27608

Re: Roadway Subsurface Investigation - Recommendations
TIP No.: W-5519
County: Cumberland
Project Description: I-95 Business / US-301 from NC 87 South to NC 59
Falcon Project No.: G14025.00

Dear Mr. Huffman,

As authorized, Falcon Engineering, Inc. (Falcon) has completed the geotechnical subsurface investigation for the above referenced project in Cumberland County, North Carolina. Our investigation was performed in general accordance with our Scope and Fee Estimate for Geotechnical Investigation and Engineering Services, dated January 30, 2014 (Falcon Proposal number F2014-004). This report includes roadway geotechnical recommendations for the preparation of final design, right of way plans, construction cost estimates, and construction procedures.

Recommendations and evaluations provided by Falcon are based on the information provided by Moffatt and Nichol and established NCDOT standards. Modifications of our recommendations and evaluations may be required if there are changes to the design or location of the roadway. Recommendations in this report are in part based on data obtained from soil borings. The nature and extent of variations between borings may not become evident until construction.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made. Falcon appreciates the opportunity to have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely,

FALCON ENGINEERING, INC.

Report Prepared By:

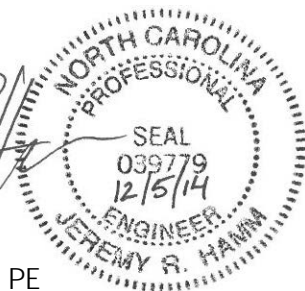
Report Reviewed By:

A handwritten signature in blue ink, appearing to read "T.E. Evans".

Thomas E. Evans, PE
Geotechnical Engineer

A handwritten signature in black ink, appearing to read "Jeremy R. Hamm".

Jeremy R. Hamm, PE
Geotechnical Department Manager



TIP: W-5519
COUNTY: Cumberland
DESCRIPTION: I-95 Business / US 301 from NC 87 South to NC 59
SUBJECT: Roadway Subsurface Investigation – Recommendations

I. Slope/Embankment Stability

A. Slope Design

Existing cut and fill slopes along I-95 Business are relatively flat, with little to no embankments. The existing slopes appear stable based on our site reconnaissance. Very little earthwork is proposed for this project, limiting proposed slopes to 3:1 and shallower and generally do not exceed 3 feet. It is recommended all roadway embankment fill and cut slopes be constructed at a 2:1(H:V) ratio or flatter for this project. The stability of all slopes is subject to the stabilization recommendations provided below, and additional stabilization of areas not specifically recommended but where similar subsurface conditions exist.

B. Geotextile for Soil Stabilization

It is recommended a quantity of 500 SY of Geotextile for Soil Stabilization be included in the project as a contingency to be used at the discretion of the Engineer.

II. Subgrade Stability

A. Subgrade Undercut

It is recommended that a quantity of 250 CY of Undercut for Soil Stabilization be included in the contract as a contingency to be used at the discretion of the Engineer.

B. Geotextile for Soil Stabilization

It is recommended that a quantity of 250 SY of Geotextile for Soil Stabilization be included in the contract as a contingency to be used at the discretion of the Engineer.

C. Aggregate Subgrade

Highly plastic material was encountered within 18" of proposed subgrade in the following area:

<u>Station</u>	<u>Offset</u>	<u>Depth</u>
265+67 to 266+65 -L-	RT	Up to 18"



Aggregate Subgrade is recommended to stabilize pavement subgrade in this area. It is recommended a quantity of 100 CY of Shallow Undercut, 100 SY of Geotextile for Soil Stabilization, and 200 tons of Class IV Subgrade Stabilization be included in the contract in conjunction with the area listed above.

It is recommended an additional quantity of 100 CY of Shallow Undercut, 100 SY of Geotextile for Soil Stabilization, and 200 tons of Class IV Subgrade Stabilization be included in the contract as a contingency to be used at the discretion of the Engineer.

D. Subsurface Drainage - Underdrains

Across the majority of the project groundwater was not encountered. An isolated occurrence of groundwater within 2 feet of subgrade was measured at station 262+00 -L-. Depending on modifications to site drainage and sensitivity of borrow material to moisture, the use of subsurface drains may be warranted in these areas. It is recommended a quantity of 1,000 LF of 6-inch perforated corrugated plastic pipe be included in the contract as a contingency to be used at the discretion of the Engineer. Construction of underdrains shall follow Standard Specifications, Section 815 "Subsurface Drainage", and Roadway Standard Drawing 815.03 "Pipe Underdrain and Blind Drain".

III. Borrow Specifications

A. Common Borrow

Common borrow for embankment fill shall meet the Exception to Statewide Criteria outlined in the Standard Specification, Article 1018-2, Section II (B).

B. Select Granular Material

It is recommended a quantity of 250 CY of Class II or III Select Granular Material be included in the contract as a contingency to be used at the discretion of the Engineer.

C. Shrinkage Factor

A shrinkage factor of 25 percent is recommended to be used in the earthwork computations for this project.





NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING UNIT

Summary of Quantities

WBS No.: N/A

County: Cumberland

Project Engineer: Hamm, J. R.

TIP No.: W-5519

Field Office: Consultant

Project Geologist: Paul, A. S.

Description: I-95 Business / US-301 from NC 87 South to NC 59

Pay Item No.	Pay Item/ Quantity Adjustment	Spec Book Section No. or Special Provision (SP) Reference	Report Section	Alignment	Begin Station	End Station	Quantity	Units
0036000000-E	Undercut Excavation	225 - Roadway Excavation	II. A	Contingency	N/A	N/A	250	CY
Total Quantity of Undercut Excavation =							250	CY
0195000000-E	Select Granular Material	265 - Select Granular Material	III. B	Contingency	N/A	N/A	250	CY
Total Quantity of Select Granular Material =							250	CY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	I. B	Contingency	N/A	N/A	500	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. B	Contingency	N/A	N/A	250	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. C	-L-	265+67.00	266+65.00	100	SY
0196000000-E	Geotextile for Soil Stabilization	270 - Geotextile for Soil Stabilization	II. C	Contingency	N/A	N/A	100	SY
Total Quantity of Geotextile for Soil Stabilization =							950	SY
1099500000-E	Shallow Undercut	505 - Aggregate Subgrade	II. C	-L-	265+67.00	266+65.00	100	CY
1099500000-E	Shallow Undercut	505 - Aggregate Subgrade	II. C	Contingency	N/A	N/A	100	CY
Total Quantity of Shallow Undercut =							200	CY
1099700000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	II. C	-L-	265+67.00	266+65.00	200	TON
1099700000-E	Class IV Subgrade Stabilization	505 - Aggregate Subgrade	II. C	Contingency	N/A	N/A	200	TON
Total Quantity of Class IV Subgrade Stabilization =							400	TON
2044000000-E	6" Perforated Subdrain Pipe	815 - Subsurface Drainage	II. D	Contingency	N/A	N/A	1,000	LF
Total Quantity of 6" Perforated Subdrain Pipe =							1,000	LF

These Items Only Impact Earthwork Totals								
N/A	Shrinkage Factor	235 - Embankments	III. C	N/A	N/A	N/A	25	%

PROJECT: REFERENCE: W-5519

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5519	1	4

CONTENTS

LINE	STATION	PLAN	PROFILE	XSECT
-L-	265+50 TO 267+00	-	-	3

ROADWAY
SUBSURFACE INVESTIGATION

COUNTY CUMBERLAND
PROJECT DESCRIPTION I-95 BUSINESS /US 301 FROM
NC 87 SOUTH TO NC 59

RECOMMENDATIONS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

- NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

A. S. PAUL

T. E. EVANS

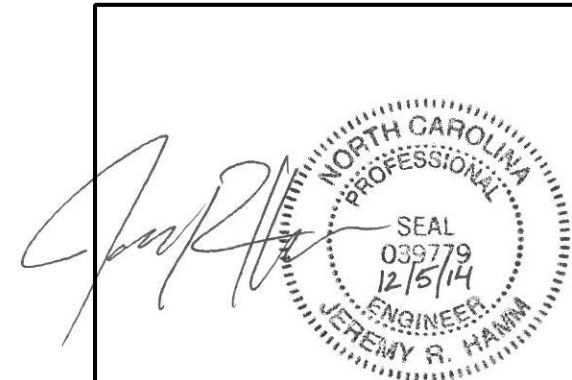
INVESTIGATED BY A. S. PAUL

DRAWN BY ASP & TEE

CHECKED BY J. R. HAMM

SUBMITTED BY FALCON

DATE DECEMBER 2014



SIGNATURE

DATE

SIGNATURE

DATE

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

SOIL DESCRIPTION

SOIL IS CONSIDERED 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 THE STANDARD PENETRATION TEST (AASHTO T 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

Table with columns for General Class, Group Class, Symbol, % Passing #10, #40, #200, Material Passing #40 LL, PI, Group Index, Usual Types of Major Materials, Gen. Rating as Subgrade, and Soil Legend symbols for Granular, Silty-clay, and Organic materials.

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

CONSISTENCY OR DENSENESS

Table mapping Primary Soil Type (Granular, Silty-clay) to Consistency/Dense ness (Very Loose to Very Dense) and Range of Standard Penetration Resistance (N-value) and Range of Unconfined Compressive Strength (tons/ft²).

TEXTURE OR GRAIN SIZE

Table showing U.S. Std. Sieve Size (mm and in) and corresponding percentages for Boulder, Cobble, Gravel, Coarse Sand, Fine Sand, Silt, and Clay.

SOIL MOISTURE - CORRELATION OF TERMS

Table correlating Soil Moisture Scale (Atterberg Limits), Field Moisture Description (Saturated, Wet, Moist, Dry), and Guide for Field Moisture Description (Liquid Limit, Plastic Limit, Optimum Moisture Shrinkage Limit).

PLASTICITY

Table showing Plasticity Index (PI) ranges (Non-plastic to Highly plastic) and corresponding Dry Strength (Very Low to High).

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). 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. UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES 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 WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE LL < 31
MODERATELY COMPRESSIBLE LL = 31 - 50
HIGHLY COMPRESSIBLE LL > 50

PERCENTAGE OF MATERIAL

Table showing percentages for Organic Material, Granular Soils, Silty-clay Soils, and Other Material (Trace of organic matter, Little organic matter, Moderately organic, Highly organic).

GROUND WATER

- Water level in bore hole immediately after drilling
Static water level after 24 hours
Perched water, saturated zone, or water bearing strata
Spring or seep

MISCELLANEOUS SYMBOLS

Diagrammatic symbols for Roadway Embankment (RE), Soil Symbol, Artificial Fill (AF), Inferred Soil Boundary, Inferred Rock Line, Alluvial Soil Boundary, Dip and Dip Direction, SPT Test Boring, Auger Boring, Core Boring, Monitoring Well, Piezometer Installation, Slope Indicator Installation, Cone Penetrometer Test, Sounding Rod, Test Boring with Core, SPT N-Value.

RECOMMENDATION SYMBOLS

Symbols for Undercut Excavation, Shallow Undercut, Unclassified Excavation - Unsuitable Waste, Unclassified Excavation - Acceptable Degradable Rock, Unclassified Excavation - Acceptable, but not to be used in the top 3 feet of embankment or backfill.

ABBREVIATIONS

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

EQUIPMENT USED ON SUBJECT PROJECT

- Drill Units: CME-45C, CME-55, CME-550, Vane Shear Test, Portable Hoist
Advancing Tools: Clay Bits, 6" Continuous Flight Auger, 8" Hollow Augers, Hard Faced Finger Bits, Tung-Carbide Inserts, Casing w/ Advancer, Tricone *Steel Teeth, Tricone *Tung-Carb., Core Bit
Hammer Type: Automatic, Manual
Core Size: -B, -H, -N
Hand Tools: Post Hole Digger, Hand Auger, Sounding Rod, Vane Shear Test, Kessler DCP

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. 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:

Diagrams and descriptions for Weathered Rock (WR), Crystalline Rock (CR), Non-Crystalline Rock (NCR), and Coastal Plain Sedimentary Rock (CP). Includes descriptions of grain sizes and material types.

WEATHERING

- FRESH: Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
VERY SLIGHT (IV 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 kaolinitization. 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 kaolinitized to some extent. Some fragments of strong rock usually remain. If tested, would yield spt n values > 100 bpf.
VERY SEVERE (IV SEV.): All rock except quartz discolored or stained. Rock fabric elements are discernible but mass is effectively reduced to soil status, with only fragments of strong rock remaining. Saprolite is an example of rock weathered to a degree that only minor vestiges of original rock fabric remain. If tested, would yield 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 pieces 1 inch maximum size by hard blows of the point of a geologist's pick.
SOFT: Can be grooved 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

Table showing Fracture Spacing (Term, Spacing) and Bedding (Term, Thickness) categories and their corresponding values.

INDURATION

- FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF 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, SUCH 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 (ROD) - 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 (SROD) - 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 MARKS

BORING ELEVATIONS RETRIEVED FROM *.TIN* FILES
ELEVATION: FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLED

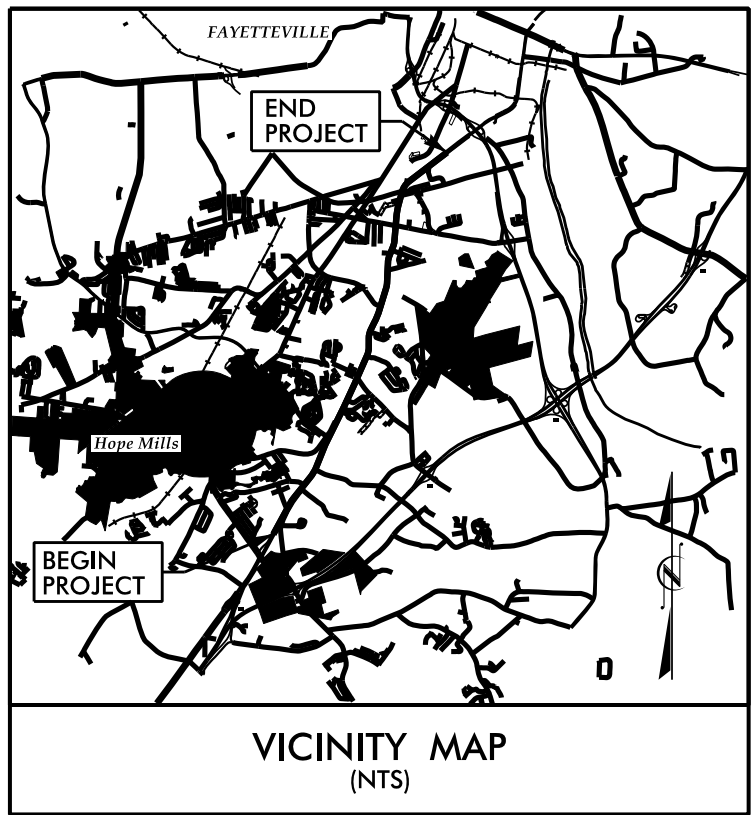
09/28/14

See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbols

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS
CUMBERLAND COUNTY

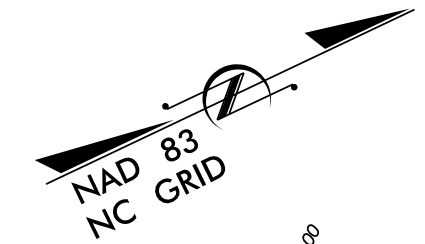
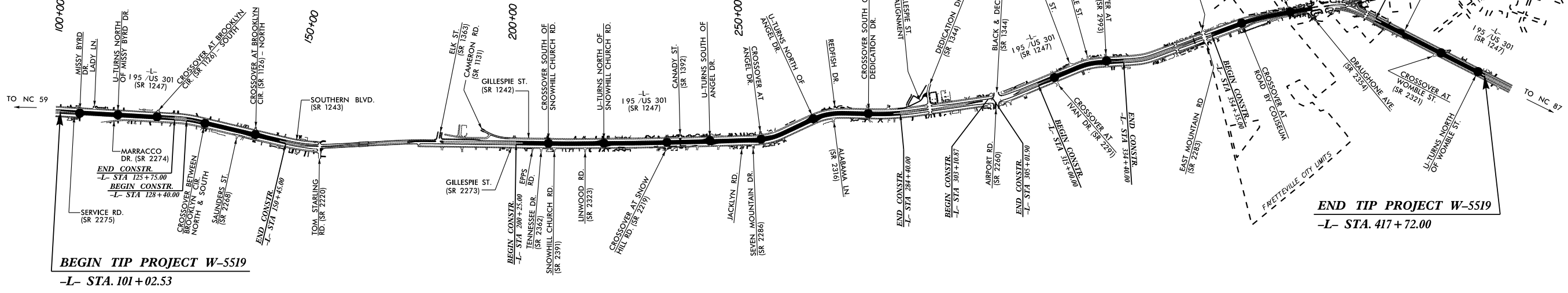
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	W-5519	2A	4
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
45849.1.FR1	HSIP-095-2(128)46	PE	
45849.2.FR1	HSIP-095-2(128)46	R/W	
45849.3.FR1	HSIP-095-2(128)46	CONST	

TIP PROJECT: W-5519



LOCATION: I-95 BUSINESS /US 301 FROM NC 87 SOUTH TO NC 59

TYPE OF WORK: PAVING, GRADING, DRAINAGE, PAVEMENT MARKINGS AND SIGNING



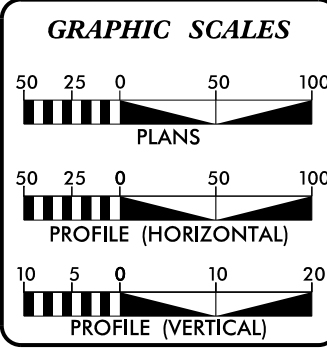
NCDOT CONTACT: SEAN MATUSZEWSKI
PROJECT ENGINEER - DIVISION DESIGN CONSTRUCTION

A PORTION OF THIS PROJECT IS WITHIN MUNICIPAL BOUNDARIES OF THE CITY OF FAYETTEVILLE, N.C.

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD II

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

CONTRACT:



DESIGN DATA

ADT 2015	=	26,160
ADT 2035	=	41,860
K	=	10 %
D	=	70 %
T	=	9 % *
V	=	60 MPH
* TTST = 9% DUAL N/A		
FUNC CLASS =		
PRINCIPAL ARTERIAL		
REGIONAL TIER		

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT W-5519	=	3.814 mi.
LENGTH STRUCTURE TIP PROJECT W-5519	=	0.000 mi.
TOTAL LENGTH TIP PROJECT W-5519	=	3.814 mi.

Prepared For NCDOT In the Office of:

moftatt & nichol
1616 EAST MILLBROOK ROAD, SUITE 160
RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4869 FAX

2012 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
NOV. 24, 2014

LETTING DATE:
NOV. 17, 2015

TIM REID, P.E.
PROJECT ENGINEER

TRENT HUFFMAN, P.E.
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

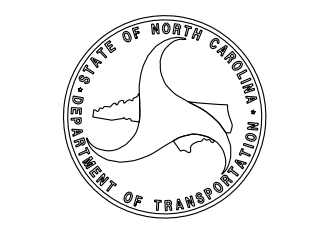
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RALEIGH, NORTH CAROLINA 27609
(919) 781-4626 VOICE (919) 781-4869 FAX

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

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(919) 781-4626 VOICE (919) 781-4869 FAX

SIGNATURE: _____ P.E.



\$\$\$\$\$ SYSTEM \$\$\$\$\$\$
\$\$\$\$\$ DN \$\$\$\$\$\$
\$\$\$\$\$ USERNAME \$\$\$\$\$\$

8/23/99

