Greenville
NORTH CAROLINA

PUBLIC WORKS

To: All Interested Bidders and plan holders

From: James Lynn Raynor, PE

RE: Replacement of Bridge #421 Over Meeting House Branch on King George Rd.
B-5100
Addendum #1

Date: September 1, 2016

The following items clarify, add to, delete from and/or otherwise change and supersede information previously issued to you in the Bid Documents for the above-referenced project. As such, said items shall be considered part of the contract and receipt of this addendum shall be acknowledged appropriately in the bid package. Please review the following items carefully and adjust your proposal accordingly.

Pre-bid Minutes/Clarifications/Follow-up:

1. See Attachment 1, pre-bid meeting minutes, which as part of this addendum shall be considered part of the contract.

Changes/Additions to Bid List and Specifications:

1. The geotechnical report referenced in the bid documents is provided as Attachment #2 to this Addendum #1.

2. As noted in the pre-bid meeting minutes and shown on Page A-1 of the bid document, the liquidated damages for this project are $500 per calendar day. Page PSP-1, CONTRACT TIME AND LIQUIDATED DAMAGES, paragraph four, is revised as follows:
   "The liquidated damages for this contract are **Five Hundred Dollars ($500)** per calendar day."

Requests for additional information:

1. Question: What is the correct contract time for the project? Page A-1 shows 182 calendar days, and Page NP-1 shows 150 calendar days. **Answer: The correct contract time is one hundred eighty-two (182) calendar days. A revised page NP-1, which is the Notice to Proceed, will be executed with the low bidder showing the correct contract time of 182 calendar days.**

Any questions regarding this Addendum should be directed to Mr. Lynn Raynor, PE, at telephone 252-329-4620 or email at lraynor@greenvillenc.gov.

Attachments

ec: Scott Godefroy, PE, City Engineer
Bob May, PE, Wetherill Engineering, Inc.
File

Attachment 1

To: Pre-Bid Conference Attendees and Plan holders

From: James Lynn Raynor, PE
City of Greenville PWD

Subject: **B-5100, Replacement of Bridge #421 Over Meeting House Branch on King George Road**

Date: September 1, 2016

On Tuesday, August 16, 2016 at 10:00 a.m., a Pre-bid conference for the referenced project was held at the Public Works Department Conference Room at 1500 Beatty Street, Greenville, NC. Those in attendance were as follows:

Lynn Raynor - COG
Bob May – Wetherill Engineering, Inc.
Taaja Draughn – Carolina Earth Movers
Tyler Sutton – TA Loving Co.

The following items were discussed during the meeting.

MEETING ITEMS

1. Mr. Raynor welcomed everyone to the pre-bid meeting
    a. Attendance Sheet – passed around (attached)
    b. **Mr. Raynor noted the Pre-bid conference is not mandatory.**
    c. Introductions were made for those in attendance.

2. Legal Requirements
    a. Bonds/Insurance Certificates – Bid Bond, Payment/Performance Bonds/Insurance Certificate are required for this project
    b. DBE Requirements**/submittal with Bids**. The goal for this project has been set at 6%.

3. Project Data
    a. Mr. Raynor emphasized this project is federally funded through NCDOT. As such, all NCDOT specifications, processes, paperwork, submittals, materials certifications, testing requirements, certified payrolls, Davis-Bacon, etc. apply.
    b. The Contract Time is 182 calendar days. Date of Availability is December 1, 2016.
    c. Liquidated Damages
        - $500 per day after the contract completion date.
    d. Contract Award – Lowest responsive responsible bidder. Recommendation of contract award is anticipated at the October 10, 2016 City Council meeting. Concurrence of Award will be requested from NCDOT shortly thereafter.

e. Description – removal and replacement of existing bridge and approaches on King George Road. Type of work includes grading, drainage, paving, structure, traffic control, erosion control, waterline relocation, and related items.
f. Utilities:
    - – Relocation of electrical will be performed by Greenville Utilities Commission during the contract time once clearing operations are complete. Contractor will be required to coordinate with Brian Murphy of GUC (252-329-2173)
    - Waterline – GUC has already done work needed to facilitate relocation, including installation of new gate valves and thrust collars
    - Mr. May noted conflicts with gas facilities have been resolved
g. Construction Surveying is included in the contract, and shall be performed in according with NCDOT specifications.
h. Mr. Raynor advised that Contract Administration and Inspection for this contract will be performed by a private firm, yet to be determined.
i. Traffic Control – reasonable access to residences must be maintained.
j. Mr. Raynor emphasized the importance of erosion control given the project's location on Meeting House Branch.
k. Mr. May noted the approach slab on the north side is slightly narrower than is typically used to avoid conflict with the existing sanitary sewer line at the northeast corner of the proposed bridge, End Bent #2.
l. Mr. Raynor noted the contractor will need to coordinate with GUC Water Resources when replacing the driveway pipe on the northwest corner due to access needs for the pump station.
m. Mr. Raynor noted the temporary driveway on the southeast corner should be installed as quickly as possible to provide continued access for the property owner.
n. An addendum will be sent out with pre-bid minutes and any requests for information received. Last date for submission of requests for information is 5:00 PM on August 31, 2016. The addendum will be sent out the following day.
o. **Bid date – Tuesday, September 8, 2016 at 2:00 PM, 1500 Beatty St. Be sure to include all required documents with bids. (Bid Form, Bid Security, Non-Collusion Affidavit, Iran Divestment Act)**

4. Contact – Lynn Raynor, PE, CE II, 252-329-4620, lraynor@greenvillenc.gov
   Denisha Harris, Purchasing Manager/MWBE Coordinator, 252-329-4862, dharris@greenvillenc.gov

5. Questions – no further questions were noted.

FROEHLING & ROBERTSON, INC.

SUBSURFACE INVESTIGATION & BRIDGE FOUNDATION DESIGN RECOMMENDATIONS

Bridge No. 421 on King George Road over Meeting House Branch
City of Greenville

Pitt County, North Carolina
TIP No. B-5100
F&R Project No. 66N-0167

Prepared for:

WETHERILL ENGINEERING

559 Jones Franklin Road, Suite 164
Raleigh, North Carolina 27606

March 5, 2012

310 Hubert Street Raleigh, North Carolina 27603 919.828.3441

SINCE 1881

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603
T 919.828.3441 I F 919.828.5751
NC License #F-0266

March 5, 2012

Mr. Edward G. Wetherill, P.E.
Wetherill Engineering, Inc.
559 Jones Franklin Road, Suite 164
Raleigh, North Carolina 27606

Re: Subsurface Investigation and Bridge Foundation Design Recommendations for Bridge No. 421 on King George Road over Meeting House Branch
City of Greenville

WBS Element No.:	42236.1.1
STIP No.:	B-5100
Federal Aid No.:	BRZ-0220 (37)
County:	Pitt
F&R Project No.:	66N-0167

Dear Mr. Wetherill:

Froehling & Robertson, Inc. (F&R) has completed the subsurface investigation and bridge foundation design recommendations for the new structure proposed on King George Road over Meeting House Branch. Our design is based on information provided to us by Wetherill Engineering, Inc. This work was performed in general accordance with F&R's Proposal No. 1166-428G dated March 1, 2011 and revised May 2, 2011. Contained herein are the foundation recommendations, NCDOT legend sheet, plan view, Borelog reports, laboratory test results, and supporting calculations.

Please do not hesitate to contact us if you have any questions regarding this report or if you need additional services.

Sincerely,
FROEHLING & ROBERTSON, INC.

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER PATRICK ALTON

Patrick Alton 3/5/12
W. Patrick Alton, P.E.
Geotechnical Engineer

Daniel K. Schaefer, P.E.
Raleigh Branch Manager

APPENDIX A

FOUNDATION RECOMMENDATIONS

FOUNDATION RECOMMENDATIONS

WBS # 42236.1.1

DESCRIPTION Bridge No. 421 on King George Road over Meeting House Branch

T.I.P. NO. B-5100

COUNTY Pitt

STATION 13+00 -L-

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER PATRICK ALTON

3/5/12

Patrick Alton

SIGNATURE

	INITIALS	DATE
DESIGN	WPA	Feb-12
CHECK	DKS	Mar-12
APPROVAL		

	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	12+72.40	Cap on HP 12X53 Steel Piles	75 Tons/Pile	BOC Elevation = 32.660' Avg. Pile Length = 65' ± 7 piles @ 6'-6" spacing
END BENT 2	13+27.62	Cap on HP 12X53 Steel Piles	75 Tons/Pile	BOC Elevation = 32.974' Avg. Pile Length = 60' ± 7 Piles @ 6'-6" spacing

NOTES ON PLANS & COMMENTS (See following page)

TIP # B-5100 **County** Pitt

FOUNDATION RECOMMENDATION NOTES ON PLANS

1) For Piles, see section 450 of the Standard Specifications.

2) Piles at End Bent 1 and End Bent 2 are designed for a factored resistance of 75 tons per pile.

3) Drive piles at End Bent 1 and End Bent 2 to a required driving resistance of 125 tons per pile.

4) Testing piles with the PDA during driving, restriking or redriving may be required. The engineer will determine the need for PDA testing. For PDA testing, see section 450 of the Standard Specifications.

5) Steel H-pile points are required for steel H-piles at End Bent 1 and End Bent 2. For steel pile points, see section 450 of the Standard Specifications.

FOUNDATION RECOMMENDATION COMMENTS

1) A Delmag D19-32 pile hammer was utilized as a common hammer type to determine potential pile driving stresses. This hammer should provide sufficient energy to drive the piles to the required driving resistance at the end bents. However, the actual hammer to be utilized will need to be submitted by the contractor and analyzed after letting.

2) 1.5 (H:V) or flatter End Slopes with rip rap slope protection are recommended as shown on the preliminary general drawing.

3) The reinforced bridge approach fill detail should be used at both end bents.

4) No waiting period is required at either end bent prior to construction.

BEARING PILE PAY ITEMS

(For 2012 Lettings and Later - Revised 4/18/11)

WBS ELEMENT 42236.1.1 DATE Feb-12

TIP NO. B-5100 DESIGNED BY WPA

COUNTY Pitt CHECKED BY DKS

STATION 13+00.00 -L-

DESCRIPTION Bridge No. 421 on King George Road over Meeting House Branch

NUMBER OF BENTS WITH PILES

NUMBER OF PILES PER BENT

NUMBER OF END BENTS WITH PILES

NUMBER OF PILES PER END BENT

Only required for "Predrilling for Piles" & "Pile Excavation" Pay Items

Bent # or End Bent #	PILE PAY ITEM QUANTITIES						
	Steel Pile Points (yes/no)	Pipe Pile Plates (yes/no/maybe)	Predrilling For Piles (per linear ft)	Pile Redrives (per each)	Pile Excavation (per linear ft)		PDA Testing (per each)
					In Soil	Not In Soil	
End Bent 1	Yes	No	0	0	0	0	*
End Bent 2	Yes	No	0	0	0	0	*
TOTALS			0	0	0	0	**1**

Notes:

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

If PDA testing may be required, show quantities of "PDA Testing" on the substructure plans as totals only. If PDA testing is required, show quantities of "PDA Testing" on the substructure plans for each bent or end bent.

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS HIGHWAY BUILDING 1589 MAIL SERVICE CENTER RALEIGH, NORTH CAROLINA 27699-1589	SUBJECT: Bridge No. 421 on King George Road over Meeting House Branch		WBS Element No. 42236.1.1
	PREPARED BY:	WPA	COUNTY: Pitt
	DATE:	Feb-12	TIP # B-5100
	CHECKED BY:	DKS	
	DATE:	Mar-12	

END BENTS SUMMARY

END BENT 1

Pile Type: HP 12X53 Steel Piles
Bottom of Cap Elevation: 32.660'
Anticipated Pile Length: 61' ±
Average Pile Length: 65' ±
Max Factored Load: 75 Tons/Pile
Required Ultimate Resistance: 110 Tons/Pile
Required Driving Resistance: 125 Tons/Pile

Provided By Wetherill
"Driven" Program Calculations
Anticipated pile length rounded up to nearest 5 tons
NCDOT Standard Loads (rounded up to nearest 5 tons)
NCDOT Resistance Factor = 0.7 (Steel H Piles in CP)
NCDOT Driving Resistance Factor = 0.6 for
WEAP Analysis with limited PDAs

END BENT 2

Pile Type: HP 12X53 Steel Piles
Bottom of Cap Elevation: 32.974'
Anticipated Pile Length: 57' ±
Average Pile Length: 60' ±
Max Factored Load: 75 Tons/Pile
Required Ultimate Resistance: 110 Tons/Pile
Required Driving Resistance: 125 Tons/Pile

Provided By Wetherill
"Driven" Program Calculations
Anticipated pile length rounded up to nearest 5 tons
NCDOT Standard Loads (rounded up to nearest 5 tons)
NCDOT Resistance Factor = 0.7 (Steel H Piles in CP)
NCDOT Driving Resistance Factor = 0.6 for
WEAP Analysis with limited PDAs

NOTES

See Notes on Sheet 2

COMMENTS

1. 1.5:1 (H:V) or flatter End Slopes with rip rap slope protection are recommended as shown on the preliminary general drawing.

2. A Delmag D19-32 pile hammer was utilized as a common hammer type to determine potential pile driving stresses. This hammer should provide sufficient energy to drive the piles to the required driving resistance at the end bents. However, the actual hammer to be utilized will need to be submitted by the contractor and analyzed after letting.

3. Reinforced bridge approach fill detail should be used at both end bents.

4. No waiting period is required at either end bent prior to construction.

APPENDIX B

NCDOT LEGEND SHEET, PLAN VIEW & BORELOG REPORTS

PROJECT REFERENCE NO.	SHEET NO.
42236.1.1 (B-5100)	2

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

SOIL DESCRIPTION

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

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

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

PLASTICITY

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

COLOR

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

GRADATION

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

ANGULARITY OF GRAINS

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

MINERALOGICAL COMPOSITION

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

COMPRESSIBILITY

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

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%
MODERATELY ORGANIC	5 - 10%	12 - 20%
HIGHLY ORGANIC	>10%	>20%

OTHER MATERIAL	
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
HIGHLY	35% AND ABOVE

GROUND WATER

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

MISCELLANEOUS SYMBOLS

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

ABBREVIATIONS

AR - AUGER REFUSAL
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
γ - UNIT WEIGHT
γ_d - 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:
- [ ] MOBILE B-___
- [ ] BK-51
- [ ] CME-45C
- [X] CME-55
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [ ] CORE BIT
- [X] DRAG BIT 2 15/16"

HAMMER TYPE:
- [X] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B_____
- [ ] -N_____
- [ ] -H_____

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

REVISED 09/23/09

PROJECT REFERENCE NO.	SHEET NO.
42236.1.1 (B-5100)	2A

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

ROCK DESCRIPTION

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

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

WEATHERING

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

ROCK HARDNESS

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

FRACTURE SPACING

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

BEDDING

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

INDURATION

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

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

TERMS AND DEFINITIONS

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

AQUIFER - A WATER BEARING FORMATION OR STRATA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

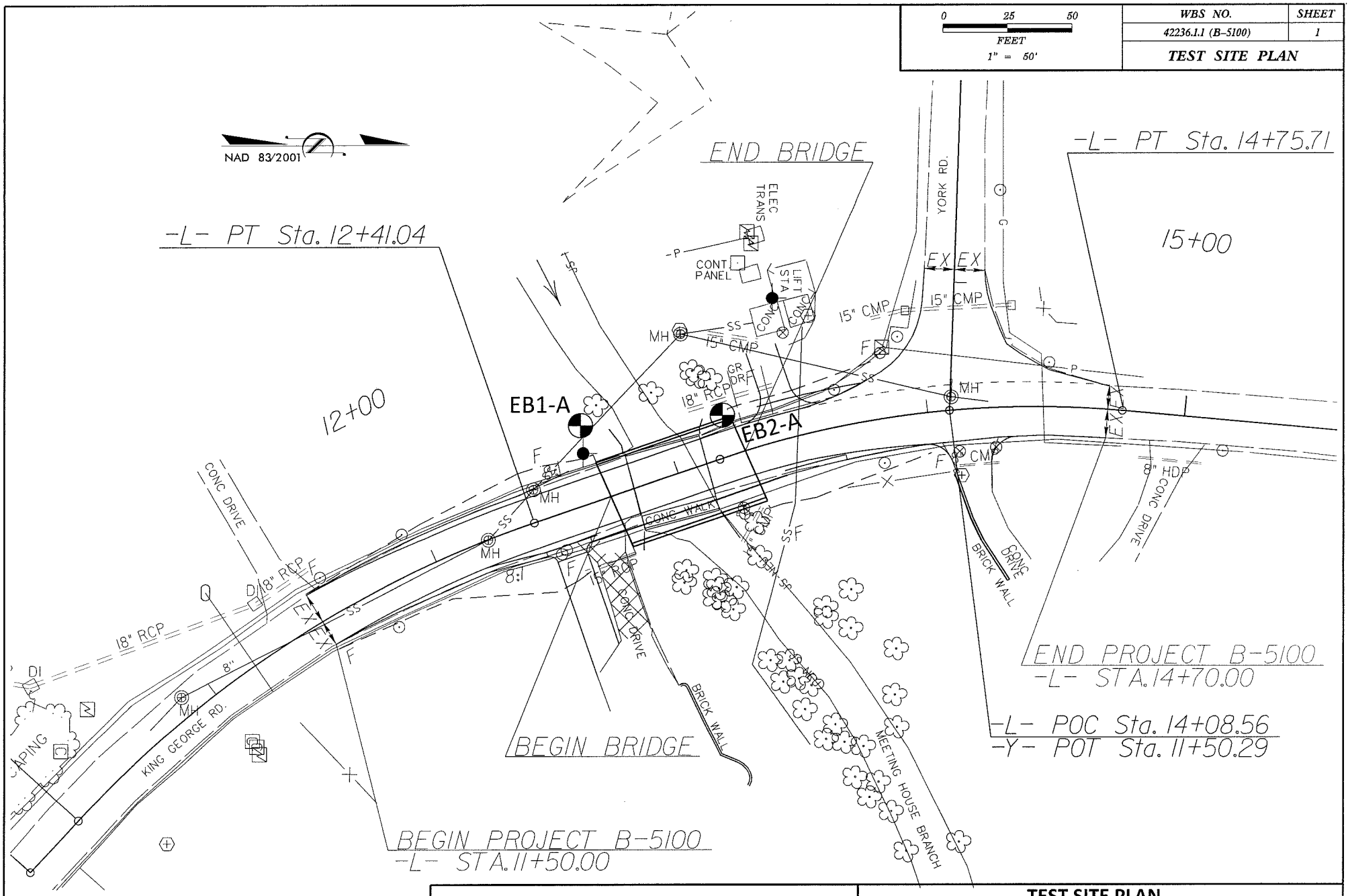
TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: TBM: 1 (IRON ROD) N: 670,065.97 E: 2,498,138.46

ELEVATION: 41.87 FT.

NOTES:

REVISED 09/23/09



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TEST SITE PLAN

WBS NO.: 42236.1.1		F&R PROJECT NO.: 66N-0167
I.D. NO.: B-5100	F.A. PROJECT NO.: BRZ-0220(37)	COUNTY: Pitt
PROJECT DESCRIPTION: Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek		
SITE DESCRIPTION: N/A		
DRAWN BY: D. Racey	CHECKED BY: P. Alton, P.E.	
DATE: February 2012	SCALE: 1"=50'	

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 12+70	**OFFSET** 30 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 33.9 ft	**TOTAL DEPTH** 76.6 ft	**NORTHING** 670,244	**EASTING** 2,496,045	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Gilchrist	**START DATE** 02/13/12	**COMP. DATE** 02/13/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
40										
35										
	33.9	0.0								33.9 GROUND SURFACE 0.0
			WOH	3	3	6		M		**ROADWAY EMBANKMENT**
										31.9 Black, fine sandy SILT (A-4), with trace clay & organics (roots & wood fragments). 2.0
30	30.4	3.5	WOH	1	4	5		M		**ALLUVIAL**
										Gray & black, silty fine SAND (A-2-4), with trace root fragments & clay.
25	25.4	8.5	1	1	5	6		W		
										21.9 12.0
20	20.4	13.5	3	2	4	6	SS-22	32%		**COASTAL PLAIN**
										Gray, fine sandy CLAY (A-6), with little silt, trace shell fragments.
15	15.4	18.5	2	1	2	3		W		
										11.9 22.0
10	10.4	23.5	1	2	1	3		W		Gray & black, silty fine to coarse SAND (A-2-4), with little clay, trace shell fragments & mica, trace root fragments from 28.5'-30.0', trace cemented sand fragments from 58.5'-59.1'.
5	5.4	28.5	3	2	3	5		W		
0	0.4	33.5	3	5	7	12		W		
-5	-4.6	38.5	3	5	8	13		W		
-10	-9.6	43.5	3	5	5	10		W		
-15	-14.6	48.5	4	4	8	12		W		
-20	-19.6	53.5	4	5	7	12		W		
-25	-24.6	58.5	27	73/0.1		100/0.6		W		Driller indicated softer drilling at 60.5'.
-30	-29.6	63.5	17	12	10	22		W		
-35	-34.6	68.5	60	40/0.2		100/0.7		W		
-40	-39.6	73.5								

NCDOT BORE SINGLE 66N-0167 BORELOGS.GPJ NC_DOT.GDT 2/27/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 12+70	**OFFSET** 30 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 33.9 ft	**TOTAL DEPTH** 76.6 ft	**NORTHING** 670,244	**EASTING** 2,496,045	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/13/12	**COMP. DATE** 02/13/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
-40											
			11	10	15	Match Line 25		W		-41.5	75.4
	-42.6	76.5	60/0.1			60/0.1				-42.7 **COASTAL PLAIN SEDIMENTARY ROCK**	76.6

Boring Terminated with Standard Penetration Test Refusal at Elevation -42.7 ft in (COASTAL PLAIN SEDIMENTARY ROCK)

NOTES:

1) 0.0-0.1' = Surficial Organic Soils
2) Driller indicates softer drilling at a depth of 60.5'.
3) Driller indicates harder drilling at a depth of 75.4'.
4) 0 hr. water level not measured due to mud rotary drilling techniques.
5) Drag bit refusal at a depth of 76.5'.

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 13+23	**OFFSET** 16 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 36.3 ft	**TOTAL DEPTH** 79.1 ft	**NORTHING** 670,299	**EASTING** 2,496,041	**24 HR.** 10.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER J. Gilchrist	**START DATE** 02/10/12	**COMP. DATE** 02/10/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
40										
	36.3	0.0								36.3 GROUND SURFACE 0.0
35			2	2	3	5		M		**ROADWAY EMBANKMENT**
	32.8	3.5								34.3 Brown tan, fine sandy CLAY (A-6). 2.0
			2	3	3	6		M		**ALLUVIAL**
30										Tan & gray, fine sandy CLAY (A-6), with little silt & trace organics (large wood fragment).
	27.8	8.5								29.3 7.0
			1	1	1	2		W		Black, gray & brown, silty fine to coarse SAND (A-2-4), with trace organics & root fragments, trace gravel from 13.5'-14.5', some clay from 14.5'-15.0'.
25										
	22.8	13.5	6	1	5	6		W		
20										
	17.8	18.5								19.3 17.0
			1	2	3	5		W		**COASTAL PLAIN** Gray, fine sandy CLAY (A-6), with trace shell fragments, little silt.
15										
	12.8	23.5								14.3 22.0
			2	1	2	3		W		Gray & black, silty fine to coarse SAND (A-2-4), with trace shell fragments, little clay, trace cemented sand fragments from 63.5'-63.8' & 78.5'-79.1'.
10										
	7.8	28.5								
			2	3	3	6	SS-8	21%		
5										
	2.8	33.5								
			3	4	4	8		W		
0										
	-2.2	38.5								
			3	4	6	10		W		
-5										
	-7.2	43.5								
			4	4	6	10		W		
-10										
	-12.2	48.5								
			4	5	6	11		W		
-15										
	-17.2	53.5								
			4	5	7	12		W		
-20										
	-22.2	58.5								
			6	9	11	20		W		
-25										
	-27.2	63.5	100/0.3			100/0.3		W		Driller indicated harder drilling at 62.0'.
-30										
	-32.2	68.5								Driller indicated softer drilling at 66.5'.
			8	20	25	45		W		
-35										
	-37.2	73.5	100/0.4			100/0.4		W		
-40										

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 13+23	**OFFSET** 16 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 36.3 ft	**TOTAL DEPTH** 79.1 ft	**NORTHING** 670,299	**EASTING** 2,496,041	**24 HR.** 10.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/10/12	**COMP. DATE** 02/10/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-40						Match Line				
	-42.2	78.5	10	90/0.1		100/0.6		W		-42.8 / 79.1

Boring Terminated at Elevation -42.8 ft in (COASTAL PLAIN SEDIMENTARY ROCK)

NOTES:

1) 0.0-0.3' = Surficial Organic Soils
2) Driller indicates harder drilling at a depth of 62.0'.
3) Driller indicates softer drilling at a depth of 66.5'.
4) Drag bit refusal at a depth of 79.1'.
5) 0 hr. water level not measured due to mud rotary drilling techniques.

APPENDIX C

LABORATORY TEST RESULTS

North Carolina Department of Transportation
Division of Highways
Materials and Test Unit
Soils Laboratory

T.I.P. ID NO.: B-5100
DESCRIPTION: Bridge No. 421 on SR 1706 (King George Road) over Meeting House Creek

REPORT ON SAMPLES OF: SOIL FOR QUALITY

PROJECT:	42236.1.1	COUNTY:	Pitt
DATE SAMPLED:	2/12	RECEIVED:	2/21/12
SAMPLED FROM:	-L-	REPORTED:	2/27/12
SUBMITTED BY:	W.P. Alton, PE	BY:	D. Jenks Cert No. 101-02-0603

TEST RESULTS

PROJ. SAMPLE NO.	SS-22	SS-8				
BORING NO.	EB1-A	EB2-A				
Retained #4 Sieve %	1.9	5.0				
Passing #10 Sieve %	97.1	89.7				
Passing #40 Sieve %	92.2	65.5				
Passing #200 Sieve %	46.9	34.8				

SOIL MORTAR - 100%						
Coarse Sand Ret - #60 %	9.5	43.3				
Fine Sand Ret - #270 %	45.8	22.0				
Silt 0.053 - 0.010 mm %	14.0	16.6				
Clay < 0.010 mm %	30.7	18.1				
L.L.	36	26				
P.L.	20	20				
P.I.	16	6				
AASHTO Classification	A-6 (4)	A-2-4 (0)				
Station -L-	12+70	13+23				
Offset	30' LT	16' LT				
Depth (ft)	13.5	28.5				
to	15.0	30.0				
Moisture Content (%)	32.0	20.8				

NP=Not plastic
NT=Not tested
ND = Not Determined

W.P. Alton, P.E.
Soils Engineer

APPENDIX D

SUPPORTING CALCULATIONS

End Bent Geometry and Loads

Bridge Width	CS Unit Length	Factored Pile Reaction (kips)	Factored Pile Reaction (tons)
27'	25'-0"	106	53
	30'-0"	118	59
	35'-0"	126	63
	40'-0"	132	66
	45'-0"	140	70
	50'-0"	154	77
	55'-0"	162	81
	60'-0"	170	85
	65'-0"	178	89
	70'-0"	184	92
30'	25'-0"	110	55
	30'-0"	122	61
	35'-0"	132	66
	40'-0"	140	70
	45'-0"	148	74
	50'-0"	162	81
	55'-0"	170	85
	60'-0"	180	90
	65'-0"	188	94
	70'-0"	194	97
33'	25'-0"	92	46
	30'-0"	102	51
	35'-0"	110	55
	40'-0"	118	59
	45'-0"	122	61
	50'-0"	134	67
	55'-0"	142	71
	60'-0"	148	74
	65'-0"	156	78
	70'-0"	162	81
From BSR → 36'	25'-0"	96	48
	30'-0"	108	54
	35'-0"	116	58
	40'-0"	122	61
	45'-0"	130	65
	50'-0"	142	71
From PGD → 55'-0"	55'-0"	148 →	74 ← Round up to 75 Tons, use for pile analysis
	60'-0"	156	78
	65'-0"	164	82
	70'-0"	170	85
39'	25'-0"	100	50
	30'-0"	112	56
	35'-0"	120	60
	40'-0"	126	63
	45'-0"	136	68
	50'-0"	146	73
	55'-0"	154	77
	60'-0"	162	81
	65'-0"	170	85
	70'-0"	176	88

Bridge Width	Skew	Cap Length	No. of Vertical Piles	Pile Spacing
27'	60/120	38'-2"	5	8'-6"
	75/105	34'-3"	5	7'-6"
	90	33'-0"	5	7'-6"
30'	60/120	41'-8"	5	9'-6"
	75/105	37'-4"	5	8'-3"
	90	36'-0"	5	8'-3"
33'	60/120	45'-2"	7	7'-0"
	75/105	40'-6"	7	6'-0"
	90	39'-0"	7	6'-0"
36'	60/120	48'-7"	7	7'-6"
	75/105	43'-7"	7	6'-6"
	90	42'-0"	7	6'-6"
39'	60/120	52'-0"	7	8'-0"
	75/105	46'-8"	7	7'-0"
	90	45'-0"	7	7'-0"

7 piles at 6'-6" spacing

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 12+70	**OFFSET** 30 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 33.9 ft	**TOTAL DEPTH** 76.6 ft	**NORTHING** 670,244	**EASTING** 2,496,045	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/13/12	**COMP. DATE** 02/13/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
						BOC EL = 32.660' per PGD				ELEV. (ft) DEPTH (ft)
40										
35										
	33.9	0.0								33.9 GROUND SURFACE 0.0
			WOH	3	3	6		M		**ROADWAY EMBANKMENT**
30	30.4	3.5	WOH	1	4	5 ① γ=115		M		31.9 Black, fine sandy SILT (A-4), with trace clay & organics (roots & wood fragments). 2.0
25	25.4	8.5	1	1	5	6		W		**ALLUVIAL** Gray & black, silty fine SAND (A-2-4), with trace root fragments & clay.
20	20.4	13.5	3	2	4	6 ② γ=115 c=400	SS-22	32%		21.9 12.0 **COASTAL PLAIN** Gray, fine sandy CLAY (A-6), with little silt, trace shell fragments.
15	15.4	18.5	2	1	2	3		W		
10	10.4	23.5	1	2	1	3 ③ γ=115		W		11.9 22.0 Gray & black, silty fine to coarse SAND (A-2-4), with little clay, trace shell fragments & mica, trace root fragments from 28.5'-30.0', trace cemented sand fragments from 58.5'-59.1'.
5	5.4	28.5	3	2	3	5 32'		W		
0	0.4	33.5	3	5	7	12		W		
-5	-4.6	38.5	3	5	8	13 ④ γ=120		W		
-10	-9.6	43.5	3	5	5	10		W		
-15	-14.6	48.5	4	4	8	12		W		
-20	-19.6	53.5	4	5	7	12		W		
-25	-24.6	58.5	27	73/0.1		58.5 ⑤ γ=125 100/0.6 60.5		W		Driller indicated softer drilling at 60.5'.
-30	-29.6	63.5	17	12	10	⑥ γ=120 22		W		
-35	-34.6	68.5	60	40/0.2		68.5' 100/0.7 ⑦ γ=125 72'		W		
-40	-39.6	73.5				⑧				

NCDOT BORE SINGLE 66N-0167 BORELOGS.GPJ NC_DOT.GDT 2/27/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer	
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 12+70	**OFFSET** 30 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 33.9 ft	**TOTAL DEPTH** 76.6 ft	**NORTHING** 670,244	**EASTING** 2,496,045	**24 HR.** 4.0
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/13/12	**COMP. DATE** 02/13/12	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
-40											
			11	10	15	Match Line (8) γ=120		W		-41.5	75.4
	-42.6	76.5	60/0.1			(9) γ=125 60/0.1				-42.7 **COASTAL PLAIN SEDIMENTARY ROCK**	76.6

Boring Terminated with Standard Penetration Test Refusal at Elevation -42.7 ft in (COASTAL PLAIN SEDIMENTARY ROCK)

NOTES:

1) 0.0-0.1' = Surficial Organic Soils
2) Driller indicates softer drilling at a depth of 60.5'.
3) Driller indicates harder drilling at a depth of 75.4'.
4) 0 hr. water level not measured due to mud rotary drilling techniques.
5) Drag bit refusal at a depth of 76.5'.

NCDOT BORE SINGLE 66N-0167 BORELOGS.GPJ NC_DOT.GDT 2/27/12

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\USERS\PALTON\DESKTOP\DRIVEN~1\EB1-A.DVN
Project Name: B-5100 Pitt County Project Date: 02/29/2012
Project Client: WEI
Computed By: Patrick Alton
Project Manager: Patrick Alton

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 1.20 ft
Perimeter Analysis: Pile
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	4.00 ft
	- Driving/Restrike	4.00 ft
	- Ultimate:	4.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	12.00 ft	0.00%	115.00 pcf	29.7/29.7	Nordlund
2	Cohesive	10.00 ft	0.00%	115.00 pcf	400.00 psf	T-79 Steel
3	Cohesionless	10.00 ft	0.00%	115.00 pcf	28.1/28.1	Nordlund
4	Cohesionless	26.50 ft	0.00%	120.00 pcf	30.3/30.3	Nordlund
5	Cohesionless	2.00 ft	0.00%	125.00 pcf	43.0/43.0	Nordlund
6	Cohesionless	8.00 ft	0.00%	120.00 pcf	32.2/32.2	Nordlund
7	Cohesionless	3.50 ft	0.00%	125.00 pcf	43.0/43.0	Nordlund
8	Cohesionless	3.40 ft	0.00%	120.00 pcf	32.6/32.6	Nordlund
9	Cohesionless	1.20 ft	0.00%	125.00 pcf	43.0/43.0	Nordlund

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.19 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.20 ft	0.00 Kips	0.24 Kips	0.24 Kips
3.99 ft	1.45 Kips	0.81 Kips	2.26 Kips
4.01 ft	1.46 Kips	0.82 Kips	2.28 Kips
11.99 ft	10.77 Kips	1.43 Kips	12.21 Kips
12.01 ft	10.81 Kips	0.39 Kips	11.19 Kips
21.01 ft	29.47 Kips	0.39 Kips	29.86 Kips
21.99 ft	31.65 Kips	0.39 Kips	32.04 Kips
22.01 ft	31.69 Kips	1.43 Kips	33.13 Kips
31.01 ft	54.91 Kips	1.43 Kips	56.34 Kips
31.99 ft	57.84 Kips	1.43 Kips	59.27 Kips
32.01 ft	57.90 Kips	1.65 Kips	59.55 Kips
41.01 ft	93.90 Kips	1.65 Kips	95.54 Kips
50.01 ft	138.40 Kips	1.65 Kips	140.05 Kips
58.49 ft	188.12 Kips	1.65 Kips	189.77 Kips
58.51 ft	188.34 Kips	72.94 Kips	261.28 Kips
60.49 ft	219.45 Kips	72.94 Kips	292.39 Kips
→ 60.51 ft	→ 219.69 Kips	3.81 Kips	223.50 Kips
68.49 ft	285.47 Kips	3.81 Kips	289.27 Kips
68.51 ft	285.73 Kips	72.94 Kips	358.67 Kips
71.99 ft	350.25 Kips	72.94 Kips	423.18 Kips
72.01 ft	350.53 Kips	4.52 Kips	355.05 Kips
75.39 ft	383.57 Kips	4.52 Kips	388.09 Kips
75.41 ft	383.87 Kips	72.94 Kips	456.80 Kips
76.59 ft	407.55 Kips	72.94 Kips	480.48 Kips

Factored load = 75 T (from NCDOT std loads)
Resistance factor = 0.7 (Steel H-piles in CP)

$\frac{75T}{0.7} = 107T$, round up to 110T (220k) ✓ ultimate resistance required

220 k available at ~60.5' bgs ✓, tip EL = (-)26.6' ✓

Pile length = BOC EL − Tip EL + 1' pile embed into cap (assume)

= 32.660 − (-)26.6 + 1 = 60.26' ∴ Anticipated pile length = 61' ✓

Average pile length = 65' ✓

Drive piles to $\frac{75T}{0.6} = 125T$ (250k) ✓

For prelim WEAP analysis, use 85 % skin and pile penetration of 60' ✓ MR

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 13+23	**OFFSET** 16 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 36.3 ft	**TOTAL DEPTH** 79.1 ft	**NORTHING** 670,299	**EASTING** 2,496,041	**24 HR.** 10.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/10/12	**COMP. DATE** 02/10/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
						BOC EL = 32.974' per PGD				ELEV. (ft) DEPTH (ft)
40										
	36.3	0.0								36.3 GROUND SURFACE 0.0
35			2	2	3	5		M		**ROADWAY EMBANKMENT**
	32.8	3.5								34.3 Brown tan, fine sandy CLAY (A-6). 2.0
			2	3	3	6 ① γ=115 ≤=500		M		**ALLUVIAL**
30										Tan & gray, fine sandy CLAY (A-6), with little silt & trace organics (large wood fragment).
	27.8	8.5								29.3 7.0
			1	1	1	2		W		Black, gray & brown, silty fine to coarse SAND (A-2-4), with trace organics & root fragments, trace gravel from 13.5'-14.5', some clay from 14.5'-15.0'.
25										
	22.8	13.5				② γ=115				
			6	1	5	6		W		
20										
	17.8	18.5								19.3 17.0
			1	2	3	③ γ=115 ≤=400 5		W		**COASTAL PLAIN** Gray, fine sandy CLAY (A-6), with trace shell fragments, little silt.
15										
	12.8	23.5								14.3 22.0
			2	1	2	3		W		Gray & black, silty fine to coarse SAND (A-2-4), with trace shell fragments, little clay, trace cemented sand fragments from 63.5'-63.8' & 78.5'-79.1'.
10										
	7.8	28.5								
			2	3	3	④ γ=115 6	SS-8	21%		
5										
	2.8	33.5								
			3	4	4	8		W		
0						37'				
	-2.2	38.5								
			3	4	6	10		W		
-5										
	-7.2	43.5								
			4	4	6	10		W		
-10										
	-12.2	48.5								
			4	5	6	⑤ γ=120 11		W		
-15										
	-17.2	53.5								
			4	5	7	12		W		
-20										
	-22.2	58.5								
			6	9	11	20		W		
-25										
	-27.2	63.5				62'				Driller indicated harder drilling at 62.0'.
			100/0.3			⑥ γ=125 100/0.3		W		
-30						66.5'				Driller indicated softer drilling at 66.5'.
	-32.2	68.5								
			8	20	25	⑦ 45 γ=125		W		
-35						72'				
	-37.2	73.5								
			100/0.4			⑧ γ=125 100/0.4		W		
-40										

NCDOT BORE SINGLE 66N-0167 BORELOGS.GPJ NC_DOT.GDT 2/27/12

NCDOT GEOTECHNICAL ENGINEERING UNIT
BORELOG REPORT

SHEET

WBS 42236.1.1	**TIP** B-5100	**COUNTY** PITT	**GEOLOGIST** M. Brewer
SITE DESCRIPTION Bridge #421 on SR 1706 (King George Rd.) over Meeting House Creek			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 13+23	**OFFSET** 16 ft LT	**ALIGNMENT** -L- — **0 HR.** N/A
COLLAR ELEV. 36.3 ft	**TOTAL DEPTH** 79.1 ft	**NORTHING** 670,299	**EASTING** 2,496,041 — **24 HR.** 10.9
DRILL RIG/HAMMER EFF./DATE F&R2175 CME-55 83% 12/15/2011		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic
DRILLER J. Gilchrist	**START DATE** 02/10/12	**COMP. DATE** 02/10/12	**SURFACE WATER DEPTH** N/A

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
-40						Match Line				
	-42.2	78.5	10	90/0.1		100/0.6		W		-42.8 79.1
										Boring Terminated at Elevation -42.8 ft in (COASTAL PLAIN SEDIMENTARY ROCK)

NOTES:

1) 0.0-0.3' = Surficial Organic Soils
2) Driller indicates harder drilling at a depth of 62.0'.
3) Driller indicates softer drilling at a depth of 66.5'.
4) Drag bit refusal at a depth of 79.1'.
5) 0 hr. water level not measured due to mud rotary drilling techniques.

NCDOT BORE SINGLE 66N-0167 BORELOGS.GPJ NC_DOT.GDT 2/27/12

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\USERS\PALTON\DESKTOP\DRIVEN~1\EB2-A.DVN
Project Name: B-5100 Pitt County Project Date: 02/29/2012
Project Client: WEI
Computed By: Patrick Alton
Project Manager: Patrick Alton

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 3.30 ft
Perimeter Analysis: Pile
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	10.90 ft
	- Driving/Restrike	10.90 ft
	- Ultimate:	10.90 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	7.00 ft	0.00%	115.00 pcf	500.00 psf	T-79 Steel
2	Cohesionless	10.00 ft	0.00%	115.00 pcf	28.1/28.1	Nordlund
3	Cohesive	5.00 ft	0.00%	115.00 pcf	400.00 psf	T-79 Steel
4	Cohesionless	15.00 ft	0.00%	115.00 pcf	28.3/28.3	Nordlund
5	Cohesionless	25.00 ft	0.00%	120.00 pcf	30.1/30.1	Nordlund
6	Cohesionless	4.50 ft	0.00%	125.00 pcf	43.0/43.0	Nordlund
7	Cohesionless	5.50 ft	0.00%	125.00 pcf	37.0/37.0	Nordlund
8	Cohesionless	7.10 ft	0.00%	125.00 pcf	43.0/43.0	Nordlund

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.29 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.30 ft	0.00 Kips	0.48 Kips	0.48 Kips
6.99 ft	8.93 Kips	0.48 Kips	9.42 Kips
7.01 ft	8.97 Kips	1.08 Kips	10.05 Kips
10.89 ft	15.24 Kips	1.43 Kips	16.67 Kips
10.91 ft	15.28 Kips	1.43 Kips	16.71 Kips
16.99 ft	28.76 Kips	1.43 Kips	30.20 Kips
17.01 ft	28.81 Kips	0.39 Kips	29.19 Kips
21.99 ft	39.21 Kips	0.39 Kips	39.59 Kips
22.01 ft	39.26 Kips	1.43 Kips	40.69 Kips
31.01 ft	68.91 Kips	1.43 Kips	70.35 Kips
36.99 ft	92.36 Kips	1.43 Kips	93.79 Kips
37.01 ft	92.45 Kips	1.53 Kips	93.98 Kips
46.01 ft	139.16 Kips	1.53 Kips	140.69 Kips
55.01 ft } 7'	194.27 Kips } 48.52 k	1.53 Kips	195.80 Kips
61.99 ft	242.79 Kips	1.53 Kips	244.31 Kips
62.01 ft	243.04 Kips	72.94 Kips	315.98 Kips
66.49 ft	327.14 Kips	72.94 Kips	400.08 Kips
66.51 ft	327.48 Kips	22.12 Kips	349.60 Kips
71.99 ft	410.01 Kips	22.12 Kips	432.12 Kips
72.01 ft	410.37 Kips	72.94 Kips	483.31 Kips
79.09 ft	565.63 Kips	72.94 Kips	638.57 Kips

220 k ultimate resistance required ✓

$\frac{48.52\,k}{7\,ft} = 6.9\,k/ft$ skin ✓

$194.27 + 6.9x = 220,\ x = 3.7'$ ✓

$55 + 3.7 = 58.7'$ bgs, tip EL = (-)22.4' ✓

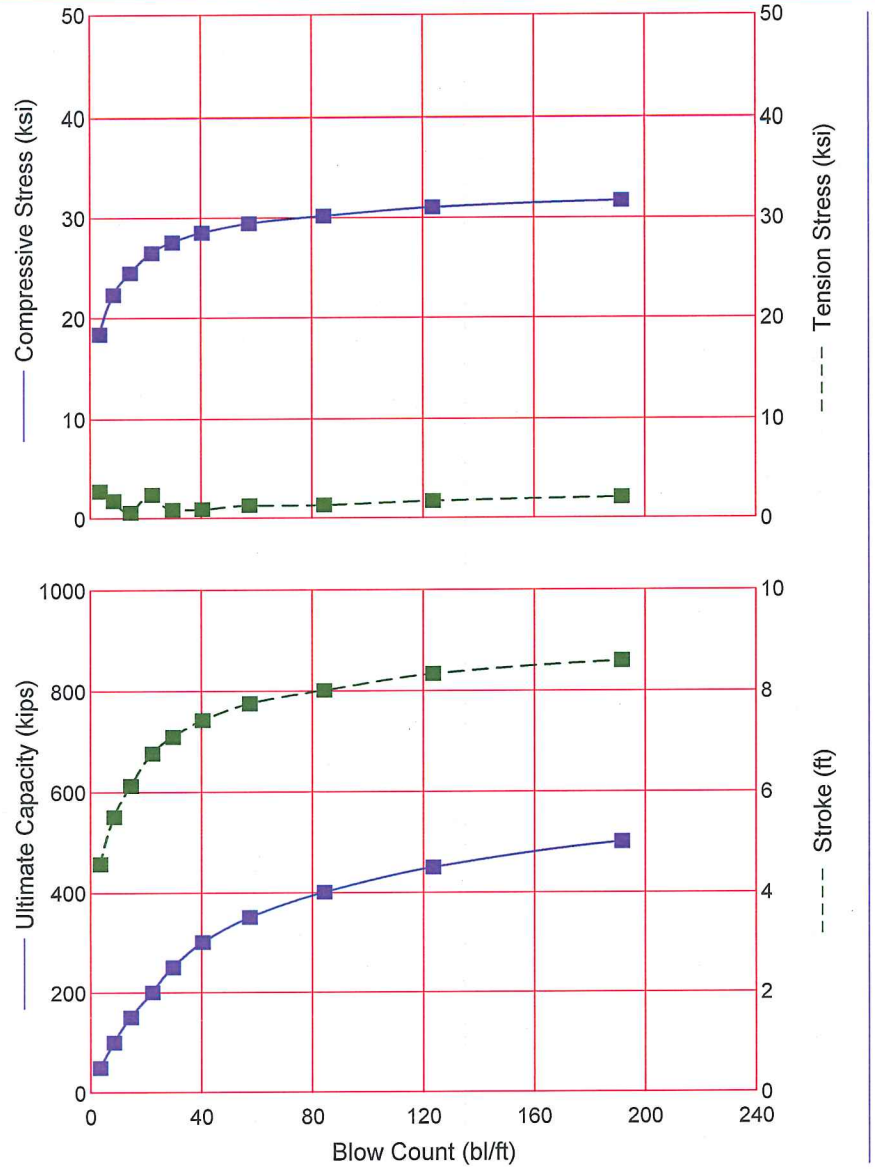
$L = 32.974 - (-)22.4 + 1 = 56.4'$ ∴ Anticipated pile length = 57' ✓

Average pile length = 60' ✓

✓

Froehling & Robertson, Inc.
B-5100 Pitt County - End Bent 1

29-Feb-2012
GRLWEAP Version 2010



DELMAG D 19-32

Ram Weight	4.00	kips
Efficiency	0.800	
Pressure	1500 (100%)	psi
Helmet Weight	1.90	kips
Hammer Cushion	60155	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.200	in
Skin Damping	0.062	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	65.00	ft
Pile Penetration	60.00	ft
Pile Top Area	15.60	in2

Res. Shaft = 85 %
(Proportional)

Froehling & Robertson, Inc.
B-5100 Pitt County - End Bent 1

29-Feb-2012
GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	18.40	2.71	3.6	4.57	21.25
100.0	22.32	1.76	8.6	5.50	18.77
150.0	24.51	0.58	14.6	6.12	17.49
200.0	26.53	2.35	22.4	6.76	17.46
250.0	27.58 < 45 ✓	0.84	30 < 29.8 < 180 ✓	7.09	17.08
300.0	28.52	0.89	40.5	7.42	17.56
350.0	29.44	1.28	57.5	7.75	17.95
400.0	30.17	1.31	84.3	8.01	18.31
450.0	31.02	1.72	123.6	8.34	18.81
500.0	31.68	2.08	191.7	8.59	19.20

A hammer similar to a Delmag D 19-32 should be able to drive the piles to the required resistance although a reduced stroke or smaller hammer may need to be considered.

Input File: F:\PROJECTS 66N\66N-0167 (WEI-B-5100 PITT COUNTY)\WEAP FILES\EB1-A.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
Hammer File Version: 2003 (8/11/2011)

Input File Contents

B-5100 Pitt County - End Bent 1

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
6	0	40	0	1	0	0	0	0	0	85	1	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	141.900	12.040	H Pile

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
1.900	227.000	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
65.000	15.60	30000.0	492.000	3.971	0	0.850	0.010

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 19-32	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.76	10.61	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
15.50	124.70	157.70	0.002	0.002	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1500.00	1350.00	1215.00	1094.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
10.6100	0.8000	1500.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.100	0.200	0.062	0.150	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Dpth	Dpth						
0.00	0.00	60.00	60.00	0.00	0.00	0.00	0.00	0.00	0.0
12.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
32.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
32.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
58.50	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
58.50	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
60.00	1.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
60.00	1.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
60.50	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
60.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
65.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0

Rult

50.0	100.0	150.0	200.0	250.0	300.0	350.0	400.0	450.0	500.0

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

B-5100 Pitt County - End Bent 1

Hammer Model: D 19-32 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.7	1.000	0.0100	
3	0.800	140046.7	1.000	0.0100	
4	0.800	140046.7	1.000	0.0100	
5	0.800	140046.7	1.000	0.0100	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	1.900	60155.0	0.800	0.0100	5.8
Combined Pile Top		12000.0			

HAMMER OPTIONS:

Hammer File ID No.	40	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.76			
Rated Stroke	(ft)	10.61	Efficiency		0.800
Maximum Pressure	(psi)	1500.00	Actual Pressure	(psi)	1500.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	227.00	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		0.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	60155.0	Stiffness	(kips/in)	0.0

PILE PROFILE:

Toe Area	(in2)	141.900	Pile Type	H Pile
Pile Size	(inch)	12.040		

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	15.60	30000.	492.0	4.0	0	16807.	27.8
65.0	15.60	30000.	492.0	4.0	0	16807.	27.8

Wave Travel Time 2L/c (ms) 7.735

Pile and Soil Model — Total Capacity Rut (kips) 50.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.173	12000	0.010	0.000	0.85	0.0	0.062	0.100	3.25	4.0	15.6
2	0.173	12000	0.000	0.000	1.00	0.0	0.062	0.100	6.50	4.0	15.6
3	0.173	12000	0.000	0.000	1.00	0.2	0.062	0.100	9.75	4.0	15.6
4	0.173	12000	0.000	0.000	1.00	0.5	0.062	0.100	13.00	4.0	15.6
5	0.173	12000	0.000	0.000	1.00	0.7	0.062	0.100	16.25	4.0	15.6
6	0.173	12000	0.000	0.000	1.00	1.1	0.062	0.100	19.50	4.0	15.6
7	0.173	12000	0.000	0.000	1.00	1.1	0.062	0.100	22.75	4.0	15.6
9	0.173	12000	0.000	0.000	1.00	1.2	0.062	0.100	29.25	4.0	15.6
10	0.173	12000	0.000	0.000	1.00	1.3	0.062	0.100	32.50	4.0	15.6
11	0.173	12000	0.000	0.000	1.00	1.4	0.062	0.100	35.75	4.0	15.6
12	0.173	12000	0.000	0.000	1.00	2.0	0.062	0.100	39.00	4.0	15.6
13	0.173	12000	0.000	0.000	1.00	2.6	0.062	0.100	42.25	4.0	15.6
14	0.173	12000	0.000	0.000	1.00	2.9	0.062	0.100	45.50	4.0	15.6
15	0.173	12000	0.000	0.000	1.00	3.2	0.062	0.100	48.75	4.0	15.6
16	0.173	12000	0.000	0.000	1.00	3.5	0.062	0.100	52.00	4.0	15.6
17	0.173	12000	0.000	0.000	1.00	3.8	0.062	0.100	55.25	4.0	15.6
18	0.173	12000	0.000	0.000	1.00	4.1	0.062	0.100	58.50	4.0	15.6
19	0.173	12000	0.000	0.000	1.00	4.4	0.062	0.100	61.75	4.0	15.6
20	0.173	12000	0.000	0.000	1.00	7.0	0.062	0.100	65.00	4.0	15.6
Toe						7.5	0.150	0.200			

3.464 kips total unreduced pile weight (g= 32.17 ft/s2)
3.464 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
Pile Penetration (ft)	60.00	Pile Damping Fact.(k/ft/s)	0.557
% Shaft Resistance	85		
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	1	Analysis Time-Input (ms)	0
Output Level: Variable vs Time			
Gravity Mass, Pile, Hammer:	32.170	32.170 32.170	
Output Segment Generation: Automatic			

B-5100 Pitt County - End Bent 1 02/29/2012
Froehling & Robertson, Inc. GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
50.0	3.6	4.57	4.54	-2.71	3	10	18.40	6	3	21.3	55.4
100.0	8.6	5.50	5.49	-1.76	6	44	22.32	6	3	18.8	50.3
150.0	14.6	6.12	6.14	-0.58	4	31	24.51	5	3	17.5	47.6
200.0	22.4	6.76	6.70	-2.35	6	28	26.53	5	3	17.5	45.4
250.0	29.8	7.09	7.08	-0.84	5	28	27.58	5	3	17.1	44.3
300.0	40.5	7.42	7.40	-0.89	5	42	28.53	5	3	17.6	43.3
350.0	57.5	7.75	7.75	-1.28	5	21	29.44	5	3	18.0	42.4
400.0	84.3	8.01	8.05	-1.31	5	21	30.17	5	3	18.3	41.7
450.0	123.6	8.34	8.33	-1.72	5	17	31.02	5	3	18.8	40.9
500.0	191.7	8.59	8.54	-2.07	5	17	31.67	5	3	19.2	40.4

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FOUNDATION RECOMMENDATIONS

WBS # 42236.1.1

T.I.P. NO. B-5100

COUNTY Pitt

STATION 13+00 -L-

DESCRIPTION Bridge No. 421 on King George Road over Meeting House Branch

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER PATRICK ALTON 3-15-12

SIGNATURE

	INITIALS	DATE
DESIGN	WPA	Feb-12
CHECK	DKS	Mar-12
REVISED	WPA	Mar-12

	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	12+72.40	Cap on HP 12X53 Steel Piles	75 Tons/Pile	BOC Elevation = 32.660' Avg. Pile Length = 65' ± 7 piles @ 6'-6" spacing
END BENT 2	13+27.62	Cap on HP 12X53 Steel Piles	75 Tons/Pile	BOC Elevation = 32.974' Avg. Pile Length = 60' ± 7 Piles @ 6'-6" spacing

NOTES ON PLANS & COMMENTS (See following page)

TIP # B-5100 **County** Pitt

FOUNDATION RECOMMENDATION NOTES ON PLANS

1) For Piles, see section 450 of the Standard Specifications.

2) Piles at End Bent 1 and End Bent 2 are designed for a factored resistance of 75 tons per pile.

3) Drive piles at End Bent 1 and End Bent 2 to a required driving resistance of 125 tons per pile.

4) Testing piles with the PDA during driving, restriking or redriving may be required. The engineer will determine the need for PDA testing. For PDA testing, see section 450 of the Standard Specifications.

FOUNDATION RECOMMENDATION COMMENTS

1) A Delmag D19-32 pile hammer was utilized as a common hammer type to determine potential pile driving stresses. This hammer should provide sufficient energy to drive the piles to the required driving resistance at the end bents. However, the actual hammer to be utilized will need to be submitted by the contractor and analyzed after letting.

2) 1.5 (H:V) or flatter End Slopes with rip rap slope protection are recommended as shown on the preliminary general drawing.

3) The reinforced bridge approach fill detail should be used at both end bents.

4) No waiting period is required at either end bent prior to construction.

BEARING PILE PAY ITEMS

(For 2012 Lettings and Later - Revised 4/18/11)

WBS ELEMENT: 42236.1.1 DATE: Feb-12

TIP NO.: B-5100 DESIGNED BY: WPA

COUNTY: Pitt CHECKED BY: DKS

STATION: 13+00.00 -L-

DESCRIPTION: Bridge No. 421 on King George Road over Meeting House Branch

NUMBER OF BENTS WITH PILES

NUMBER OF PILES PER BENT

NUMBER OF END BENTS WITH PILES

NUMBER OF PILES PER END BENT

Only required for "Predrilling for Piles" & "Pile Excavation" Pay Items

	PILE PAY ITEM QUANTITIES						
Bent # or End Bent #	Steel Pile Points (yes/no)	Pipe Pile Plates (yes/no/maybe)	Predrilling For Piles (per linear ft)	Pile Redrives (per each)	Pile Excavation (per linear ft)		PDA Testing (per each)
					In Soil	Not In Soil	
End Bent 1	No	No	0	0	0	0	*
End Bent 2	No	No	0	0	0	0	*
TOTALS			0	0	0	0	**1**

Notes:

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

If PDA testing may be required, show quantities of "PDA Testing" on the substructure plans as totals only. If PDA testing is required, show quantities of "PDA Testing" on the substructure plans for each bent or end bent.

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS HIGHWAY BUILDING 1589 MAIL SERVICE CENTER RALEIGH, NORTH CAROLINA 27699-1589	SUBJECT: Bridge No. 421 on King George Road over Meeting House Branch		WBS Element No. 42236.1.1
	PREPARED BY:	WPA	COUNTY: Pitt
	DATE:	Feb-12	TIP # B-5100
	CHECKED BY:	DKS	
	DATE:	Mar-12	

END BENTS SUMMARY

END BENT 1

Pile Type: HP 12X53 Steel Piles	
Bottom of Cap Elevation: 32.660'	Provided By Wetherill
Anticipated Pile Length: 61' ±	"Driven" Program Calculations
Average Pile Length: 65' ±	Anticipated pile length rounded up to nearest 5 tons
Max Factored Load: 75 Tons/Pile	NCDOT Standard Loads (rounded up to nearest 5 tons)
Required Ultimate Resistance: 110 Tons/Pile	NCDOT Resistance Factor = 0.7 (Steel H Piles in CP)
Required Driving Resistance: 125 Tons/Pile	NCDOT Driving Resistance Factor = 0.6 for WEAP Analysis with limited PDAs

END BENT 2

Pile Type: HP 12X53 Steel Piles	
Bottom of Cap Elevation: 32.974'	Provided By Wetherill
Anticipated Pile Length: 57' ±	"Driven" Program Calculations
Average Pile Length: 60' ±	Anticipated pile length rounded up to nearest 5 tons
Max Factored Load: 75 Tons/Pile	NCDOT Standard Loads (rounded up to nearest 5 tons)
Required Ultimate Resistance: 110 Tons/Pile	NCDOT Resistance Factor = 0.7 (Steel H Piles in CP)
Required Driving Resistance: 125 Tons/Pile	NCDOT Driving Resistance Factor = 0.6 for WEAP Analysis with limited PDAs

NOTES

See Notes on Sheet 2

COMMENTS

1. 1.5:1 (H:V) or flatter End Slopes with rip rap slope protection are recommended as shown on the preliminary general drawing.

2. A Delmag D19-32 pile hammer was utilized as a common hammer type to determine potential pile driving stresses. This hammer should provide sufficient energy to drive the piles to the required driving resistance at the end bents. However, the actual hammer to be utilized will need to be submitted by the contractor and analyzed after letting.

3. Reinforced bridge approach fill detail should be used at both end bents.

4. No waiting period is required at either end bent prior to construction.