

REFERENCE: BD-5112AB

PROJECT: 45358.3.28

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	45358.3.28	1	8

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY Cleveland
PROJECT DESCRIPTION DIVISION 12 LOW IMPACT
BRIDGE REPLACEMENT
SITE DESCRIPTION BRIDGE NO. 022309 ON SR 1627
(PRUETT ROAD) OVER BALD KNOB CREEK

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2, 2A	LEGEND
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PERSONNEL

P. Weaver
R. Toothman
W. Trapp

INVESTIGATED BY ESP Associates, P.A.
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SUBMITTED BY ESP Associates, P.A.
DATE November, 2014

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 - 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.

NORTH CAROLINA
LICENSED
SEAL
1500
GEOLOGIST
PAUL M. WEAVER

Paul M. Weaver 11/13/2014
SIGNATURE DATE

**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SUBSURFACE INVESTIGATION
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS
(PAGE 1 OF 2)**

SOIL DESCRIPTION										GRADATION									
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 (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, <i>VERY STIFF, GRN, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i>										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.									
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS									
GENERAL CLASS. GRANULAR MATERIALS (<= 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS										THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.									
GROUP CLASS. A-1, A-1-b, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5, A-7-5, A-1, A-2, A-4, A-5, A-6, A-7										MINERALOGICAL COMPOSITION									
SYMBOL										MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.									
% PASSING										COMPRESSIBILITY									
MATERIAL PASSING #40 LL PI										SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50									
GROUP INDEX										PERCENTAGE OF MATERIAL									
USUAL TYPES OF MAJOR MATERIALS										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									
GEN. RATING AS SUBGRADE										GROUND WATER									
EXCELLENT TO GOOD FAIR TO POOR FAIR TO POOR POOR UNSUITABLE										▽ WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING ▽ 24 STATIC WATER LEVEL AFTER 24 HOURS ▽ PW PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA ○ SPRING OR SEEP									
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS									
PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (IN-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)										ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY									
VERY LOOSE MEDIUM DENSE DENSE VERY DENSE VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD										DIP & DIP DIRECTION OF ROCK STRUCTURES TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION									
TEXTURE OR GRAIN SIZE										RECOMMENDATION SYMBOLS									
U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270										UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL									
BOULDER (BLDR.) COBBLE (COB.) GRAVEL (GR.) COARSE SAND (CS, SD.) FINE SAND (F SD.) SILT (SL.) CLAY (CL.)										UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL									
GRAIN SIZE MM 305 75 2.0 0.25 0.075 0.005										ABBREVIATIONS									
SOIL MOISTURE - CORRELATION OF TERMS										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 W - UNIT WEIGHT W _u - DRY UNIT WEIGHT									
SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION										SAMPLE ABBREVIATIONS									
LL LIQUID LIMIT PLASTIC RANGE (PI) PL PLASTIC LIMIT OM OPTIMUM MOISTURE SL SHRINKAGE LIMIT										S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO									
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT									
PLASTICITY INDEX (PI) DRY STRENGTH										DRILL UNITS: CME-45C CME-55 CME-550 VANE SHEAR TEST PORTABLE MOIST CME-550									
NON PLASTIC SLIGHTLY PLASTIC MODERATELY PLASTIC HIGHLY PLASTIC										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 3/4" HOLLOW AUGER									
COLOR										HAMMER TYPE: AUTOMATIC MANUAL CORE SIZE: B H N HAND TOOLS: POST HOLE DIGGER HAND AUGER SOUNDING ROD VANE SHEAR TEST									
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.																			





45358.3.28

2A

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

SUBSURFACE INVESTIGATION

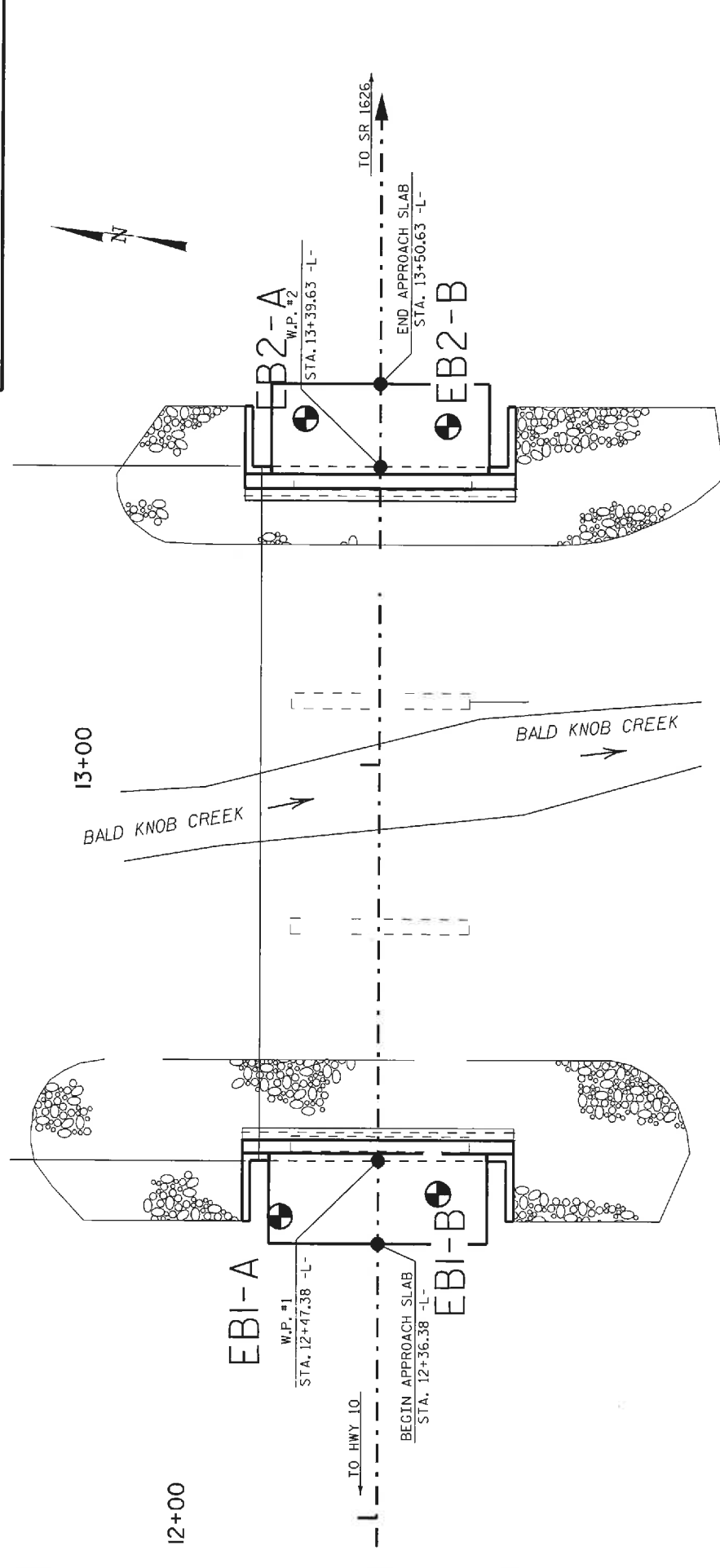
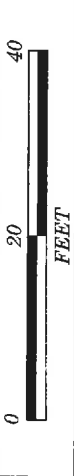
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS (PAGE 2 OF 2)

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
<p>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:</p>		<p>ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.</p> <p>AQUIFER - A WATER BEARING FORMATION OR STRATA.</p> <p>ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.</p> <p>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.</p> <p>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.</p> <p>CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.</p> <p>COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.</p> <p>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.</p> <p>DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.</p> <p>DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.</p> <p>DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.</p> <p>FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.</p> <p>FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.</p> <p>FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.</p> <p>FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.</p> <p>FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.</p> <p>JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.</p> <p>LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.</p> <p>LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.</p> <p>MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.</p> <p>PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.</p> <p>RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.</p> <p>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.</p> <p>SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.</p> <p>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.</p> <p>SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.</p> <p>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.</p> <p>STRATA CORE RECOVERY (ISREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.</p> <p>STRATA ROCK QUALITY DESIGNATION (ISROD) - 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.</p> <p>TOPSOIL (ITS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>	
<p>WEATHERED ROCK (WR)  NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p> <p>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.</p> <p>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.</p> <p>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.</p>			
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. <i>IF TESTED, WOULD YIELD SPT REFUSAL.</i>		
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. <i>IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF.</i>		
VERY SEVERE (V 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. <i>IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF.</i>		
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 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 FINGER NAIL.		
FRACTURE SPACING		BEDDING	
IERM	SPACING	IERM	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			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.			
FRISABLE	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; SMALL BREAKS ACROSS GRAINS.		
		<p>BENCH MARK: BM#1: -BL- STA. 16+92.51, 107.14' RT N 655552, E 1226651</p> <p style="text-align: right;">ELEVATION: 1017.87 FEET</p>	
NOTES:			
F.I.A.D. = FILLED IN AFTER DRILLING			

PROJECT REFERENCE NO. SHEET NO.

45358.3.28 3

SITE PLAN



12+00

13+00

BALD KNOB CREEK

BALD KNOB CREEK

EB1-A

W.P. #1
STA. 12+47.38 -L-

BEGIN APPROACH SLAB
STA. 12+36.38 -L-

EB1-B

EB2-A

W.P. #2
STA. 13+39.63 -L-

END APPROACH SLAB
STA. 13+50.63 -L-

EB2-B

TO HWY 10

TO SR 1626





NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 45358.3.28	TIP BD-5112AB	COUNTY CLEVELAND	GEOLOGIST Weaver, PM
SITE DESCRIPTION Bridge No. 22309 on SR 1627 (Pruett Road) over Bald Knob Creek			GROUND WTR (ft)
BORING NO. EB1-A	STATION 12+40	OFFSET 13 ft LT	ALIGNMENT -L-
COLLAR ELEV. 1,021.1 ft	TOTAL DEPTH 18.6 ft	NORTHING 655,643	EASTING 1,226,451
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 81% 02/07/2014			DRILL METHOD H.S. Augers
DRILLER Toothman, R		START DATE 11/04/14	COMP. DATE 11/04/14
			HAMMER TYPE Automatic
			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						ELEV. (ft)
1025																
1020	1,020.1	1.0													1,021.1	0.0
	1,017.6	3.5	5	5	3											
1015	1,015.1	6.0	2	2	1											
	1,012.6	8.5	1	3	2											
1010			1	1	1											
	1,007.6	13.5	7	93/0.2											1,009.4	11.7
1005															1,007.1	14.0
	1,002.6	18.5													1,002.5	18.6
			60/0.1													

NCDOT BORE SINGLE BRIDGE 022309 GINT FILES.GPJ NC_DOT.GDT 11/10/14



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 45358.3.28		TIP BD-5112AB		COUNTY CLEVELAND		GEOLOGIST Weaver, PM											
SITE DESCRIPTION Bridge No. 22309 on SR 1627 (Pruett Road) over Bald Knob Creek							GROUND WTR (ft)										
BORING NO. EB1-B		STATION 12+43		OFFSET 8 ft RT		ALIGNMENT -L-	0 HR. 12.5										
COLLAR ELEV. 1,021.4 ft		TOTAL DEPTH 25.5 ft		NORTHING 655,622		EASTING 1,226,457	24 HR. FIAD										
DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 81% 02/07/2014				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER Toothman, R		START DATE 11/04/14		COMP. DATE 11/04/14		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)			
1025																	
1020	1,020.4	1.0	4	4	3									1,021.4	GROUND SURFACE	0.0	
	1,017.9	3.5	2	4	3	7							M	ROADWAY EMBANKMENT Red, Medium Stiff to Soft, Clayey SILT (A-5) with Some Gravel Below 3.5 Feet			
1015	1,015.4	6.0	3	2	1	7							M				
	1,012.9	8.5	2	1	1	3							W				
1010	1,007.9	13.5	6	10	7								W				
	1,002.9	18.5	20	53	47/0.3								M	RESIDUAL Gray, Tan, and Brown; Medium Dense; Silty; Coarse to Fine SAND (A-2-4)		11.8	
1005	1,002.9	18.5												1,006.1	WEATHERED ROCK Brown and Gray, BIOTITE GNEISS with Crystalline Rock Lenses		15.3
1000	997.9	23.5												999.3	Gray with White, MICA SCHIST		22.1
	995.9	25.5												995.9	Boring Terminated with Standard Penetration Test Refusal at Elevation 995.9 ft On Crystalline Rock: MICA SCHIST		25.5
		60/0.0															

NCDOT BORE SINGLE BRIDGE 022309 GINT FILES.GPJ NC_DOT.GDT 11/10/14



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

WBS 45358.3.28 TIP BD-5112AB COUNTY CLEVELAND GEOLOGIST Weaver, PM

SITE DESCRIPTION Bridge No. 22309 on SR 1627 (Pruett Road) over Bald Knob Creek

BORELOG NO. EB2-B STATION 13+45 OFFSET 9 ft RT ALIGNMENT -L- GROUND WTR (ft)
0 HR. 17.2

COLLAR ELEV. 1,021.1 ft TOTAL DEPTH 18.5 ft NORTHING N/A EASTING N/A 24 HR. FIAD

DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 81% 02/07/2014 DRILL METHOD H.S. Augers HAMMER TYPE Automatic

DRILLER Toothman, R START DATE 11/04/14 COMP. DATE 11/04/14 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			
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV. (ft)	DEPTH (ft)		
1025																	
1020	1,020.1	1.0													1,021.1	GROUND SURFACE	0.0
	1,017.6	3.5	4	4	3											ROADWAY EMBANKMENT	
															1,018.0	Red, Medium Stiff, Clayey SILT (A-5)	3.1
1015	1,015.1	6.0	3	7	7											Red, Medium Dense to Loose, Silty, Coarse to Fine SAND (A-2-4)	
			3	3	3										1,013.2		7.9
1010	1,012.6	8.5														RESIDUAL	
																Red and Brown, Loose, Silty, Coarse to Fine SAND (A-2-4)	
	1,007.6	13.5	2	1	2										1,007.8		13.3
1005																Orange and Tan, Soft, Fine Sandy SILT (A-4)	
	1,002.6	18.5													1,003.2		17.9
			60/0.0												1,002.6	WEATHERED ROCK	18.3
															1,002.6	MICA SCHIST	18.5
																CRYSTALLINE ROCK	
																MICA SCHIST	
																Boring Terminated with Standard Penetration Test Refusal at Elevation 1,002.6 ft On Crystalline Rock: MICA SCHIST	

BOC = 1015.8



Job No.:	BD-5112AB	Sheet		of	
Task:	Foundation Recs	Phase			
Job Name:	Div 12 Bridge No. 22309				
By:	PJR	Date:	11/6/2014		
Checked By:	GRT	Date:	11/6/2014		

CALCULATIONS



Job No.:	BD-5112AB	Sheet		of	
Task:	Foundation Recs	Phase			
Job Name:	Div 12 Bridge No. 22309				
By:	PJR	Date:	11/6/2014		
Checked By:	GRT	Date:	11/6/2014		

END BENT 1

Bottom of Cap Elevation: End Bent 1 = 1016.53 ft. (left), 1017.61 ft. (right)

No. of Piles = 5 (3 vertical, 2 battered)

Pile Type = HP 12 X 53 or HP 14 X 73, Use HP 14 X 73. See WEAP analysis below

Factored load = 254 kips/pile = 127 tons/pile, Use 130 tons/pile

Assume piles will be driven 1 foot into weathered rock.

Axial Analysis

Use APILE to determine skin resistance. Borings EB1-A and EB1-B used in analysis.

Use unplugged section for skin resistance, $P = 84$ in, Required skin resistance = $260/0.45 = 578$ k/pile

Skin Resistance from APILE = 42 kips.

Assume piles will be driven 1 ft into weathered rock.

Remaining capacity will be from end bearing on rock.

Pile length Left Side = $1016.5 - 1007 + 1 + 1 = 11.5$ ft, Use 15 ft

Pile length Right Side = $1017.6 - 1006 + 1 + 1 = 13.6$ ft, Use 15 ft

Weap Analysis

Required driving resistance = $260/0.6 = 433$ k, Use 430 kips = 215 tons

Skin Resistance from APILE = 42 kips. % Skin Resistance = $42/430 = 10\%$

Due to relatively high compressive stresses on HP12x53, use HP14x73, See WEAP output

Delmag D 19-32 (42.4 ft-kip): Max comp stress 37.5 ksi, Blow counts = 67 bpf, Ok

Since D 19-32 works, no hammer energy range note is required.

Miscellaneous

1.5:1 rip rap slope okay

Pile points required due to crystalline rock lenses and weathered rock

No downdrag

No waiting periods



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 45358.3.28 TIP BD-5112AB COUNTY CLEVELAND GEOLOGIST Weaver, PM

SITE DESCRIPTION Bridge No. 22309 on SR 1627 (Pruett Road) over Bald Knob Creek

BORING NO. EB1-A STATION 12+40 OFFSET 13 ft LT ALIGNMENT -L- GROUND WTR (ft) 0 HR. 11.5

COLLAR ELEV. 1,021.1 ft TOTAL DEPTH 18.6 ft NORTHING N/A EASTING N/A 24 HR. FIAD

DRILL RIG/HAMMER EFF./DATE TRI9435 CME-55 81% 02/07/2014 DRILL METHOD H.S. Augers HAMMER TYPE Automatic

DRILLER Toothman, R START DATE 11/04/14 COMP. DATE 11/04/14 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					ELEV. (ft)
1025															
1020	1,020.1	1.0		5	5	3								1,021.1	0.0
	1,017.6	3.5		2	2	1									
1015	1,015.1	6.0		1	3	2									
	1,012.6	8.5		1	1	1									
1010															
	1,007.6	13.5		7	93/0.2									1,009.4	11.7
1005														1,007.1	14.0
	1,002.6	18.5		60/0.1										1,002.5	18.5

BOC = 10/12.5

M
W
W
W

ROADWAY EMBANKMENT
Red, Stiff to Soft, Clayey SILT (A-5) with
Some Wood Fragments Above 3.5 feet and
Some Gravel Below 3.5 Feet

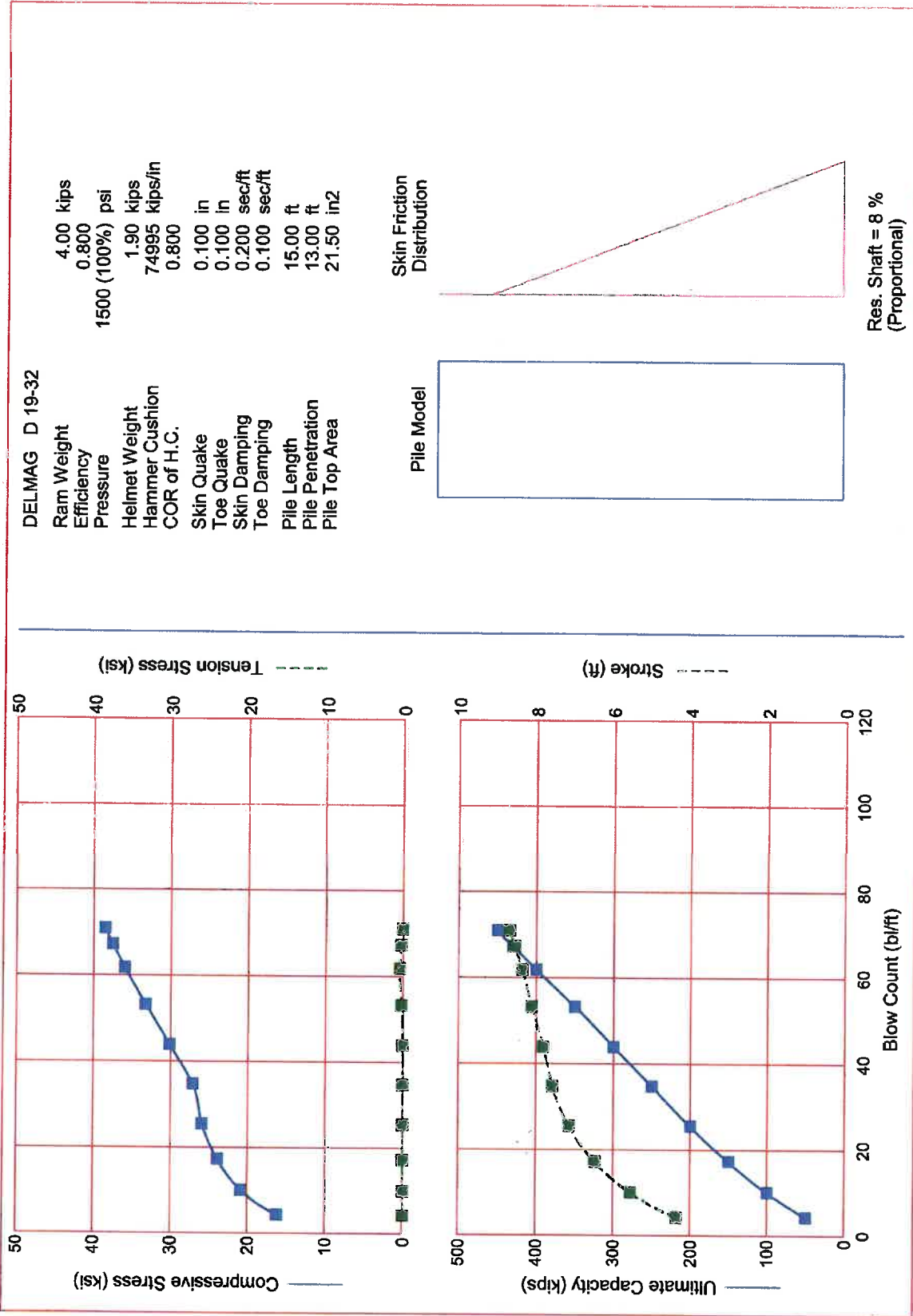
RESIDUAL
Brown and Gray, Silty, Coarse to Fine SAND
(A-2-4) with Some Rock Fragments

WEATHERED ROCK
Brown and Gray, BIOTITE GNEISS with
Abundant Crystalline Rock Lenses

Boring Terminated with Standard
Penetration Test Refusal at Elevation
1,002.5 ft On Crystalline Rock: BIOTITE
GNEISS

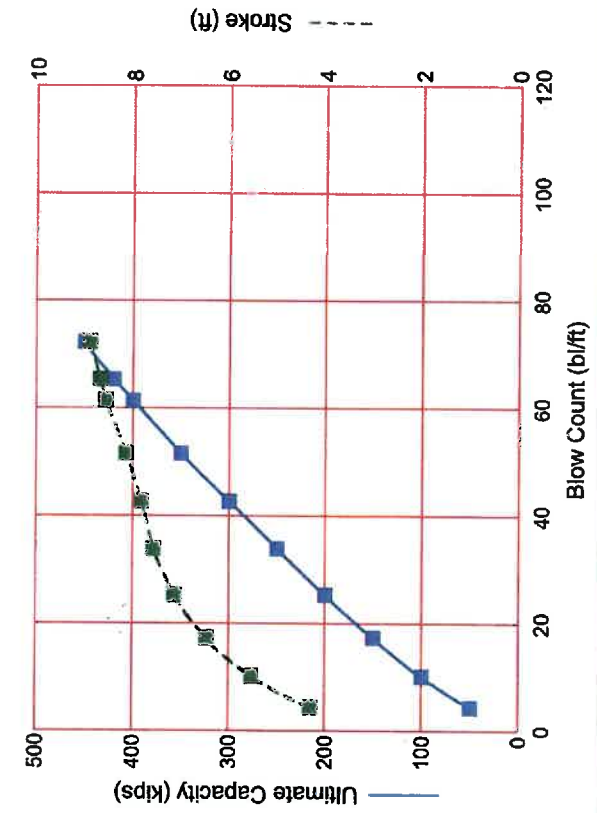
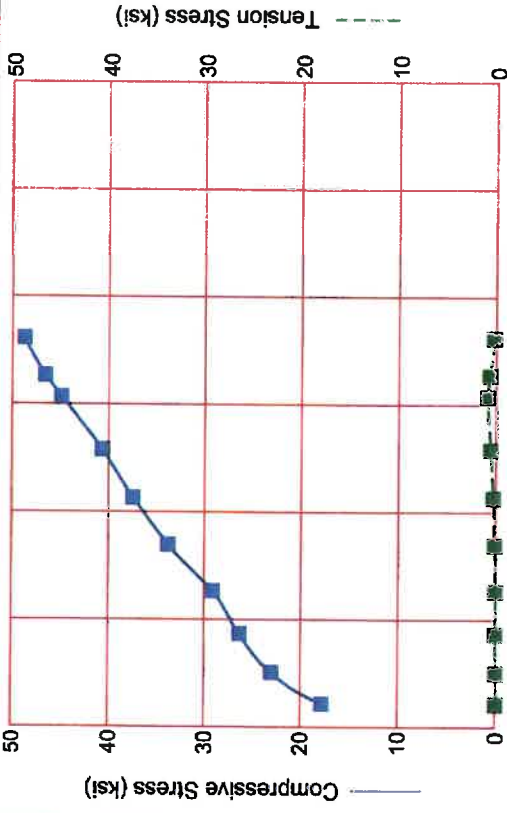
NCDOT BORE SINGLE BRIDGE 022309 GINT FILES.GPJ NC_DOT.GDT 11/6/14

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	16.23	0.02	4.4	4.37	21.43
100.0	20.91	0.03	10.2	5.55	18.36
150.0	23.94	0.09	17.4	6.48	17.04
200.0	25.92	0.07	25.6	7.15	16.43
250.0	27.15	0.11	34.9	7.58	15.97
300.0	30.18	0.13	44.0	7.82	15.66
350.0	33.28	0.29	53.3	8.12	15.65
400.0	35.96	0.52	61.9	8.37	15.92
430.0	37.52	0.33	67.3	8.56	16.17
450.0	38.51	0.12	71.0	8.69	16.35



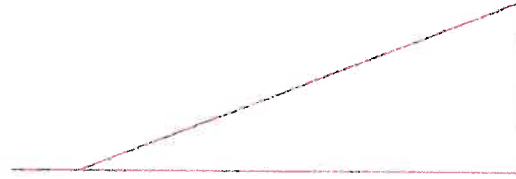
Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	17.83	0.01	4.4	4.31	21.45
100.0	23.05	0.03	10.2	5.53	18.37
150.0	26.34	0.08	17.4	6.47	17.01
200.0	29.14	0.07	25.4	7.14	16.40
250.0	33.80	0.18	34.0	7.57	15.97
300.0	37.50	0.33	42.7	7.83	15.73
350.0	40.75	0.62	51.6	8.15	15.85
400.0	44.95	0.90	61.4	8.56	16.45
420.0	46.66	0.75	65.4	8.68	16.67
450.0	48.79	0.30	72.3	8.88	16.92

Stresses developed in HP 12 X 53 are too high.
Recommend HP 14 X 73 to reduce stress below 40 ksi.



DELMAG D 19-32
 Ram Weight 4.00 kips
 Efficiency 0.800
 Pressure 1500 (100%) psi
 Helmet Weight 1.90 kips
 Hammer Cushion 74995 kips/in
 COR of H.C. 0.800
 Skin Quake 0.100 in
 Toe Quake 0.100 in
 Skin Damping 0.200 sec/ft
 Toe Damping 0.100 sec/ft
 Pile Length 15.00 ft
 Pile Penetration 13.00 ft
 Pile Top Area 15.60 in²

Skin Friction Distribution



Res. Shaft = 8 %
 (Proportional)

Pile Model



1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 5.0 - (C) COPYRIGHT ENSOFT, INC., 1987-2008.

Division 12 Bridge 22309 EB1

DESIGNER : PRamsey

DATE : 11-6-2014

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 84.40 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.15 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 13.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 0.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	28.00	0.00
8.00	SAND	0.00	115.00	28.00	0.00
8.00	SAND	0.00	125.00	32.00	0.00
12.00	SAND	0.00	125.00	32.00	0.00
12.00	SAND	0.00	130.00	45.00	0.00
30.00	SAND	0.00	130.00	45.00	0.00

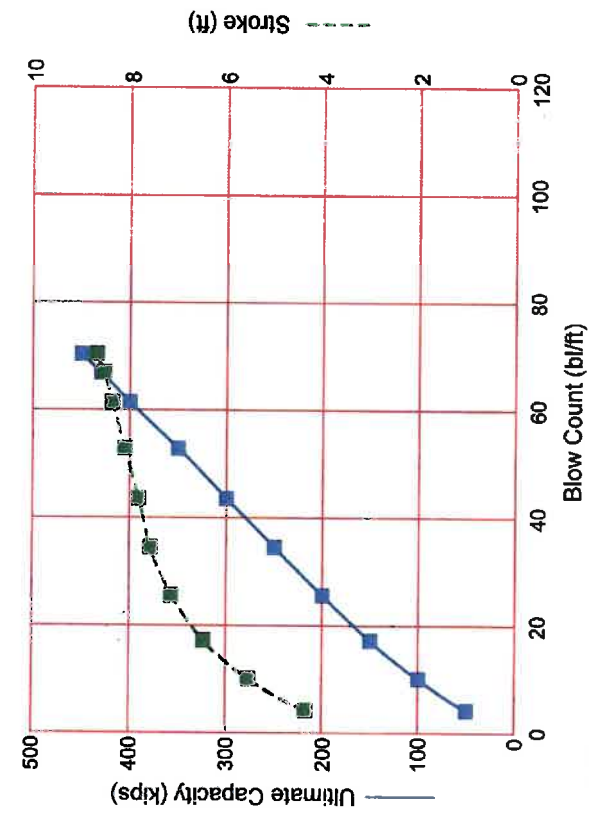
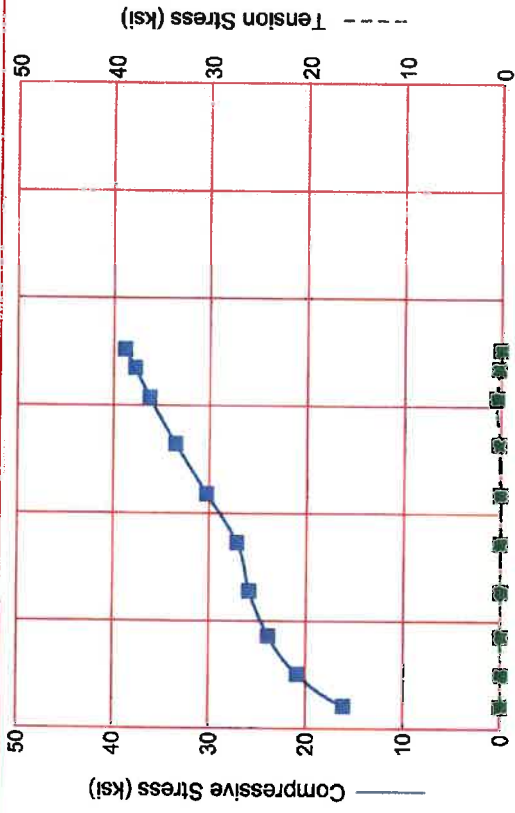
1

* COMPUTATION RESULT *

* FED. HWY. METHOD * * ARMY CORPS METHOD * * LAMBDA 2 METHOD *

PILE PENETR- ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP
0.0	0.0	0.5	0.5	0.0	0.8	0.8	0.0	0.0	0.0
1.0	0.2	0.7	0.8	0.0	1.1	1.1	0.0	0.0	0.0
2.0	0.6	0.9	1.5	0.0	1.4	1.4	0.0	0.0	0.0
3.0	1.4	1.1	2.5	0.0	1.8	1.8	0.0	0.0	0.0
4.0	2.6	1.5	4.1	0.0	2.3	2.3	0.0	0.0	0.0
5.0	4.0	2.2	6.2	0.0	3.0	3.0	0.0	0.0	0.0
6.0	5.8	2.9	8.7	0.0	3.7	3.7	0.0	0.0	0.0
7.0	7.9	3.7	11.5	0.0	4.5	4.5	0.0	0.0	0.0
8.0	10.3	12.6	22.9	0.0	9.3	9.3	0.0	0.0	0.0
9.0	13.8	31.3	45.1	0.0	18.6	18.6	0.0	0.0	0.0
10.0	18.6	51.5	70.1	0.0	28.6	28.6	0.0	0.0	0.0
11.0	23.9	73.3	97.2	0.0	39.3	39.3	0.0	0.0	0.0
12.0	29.7	96.4	126.2	0.0	50.9	50.9	0.0	0.0	0.0
13.0	41.9	102.2	144.1	0.0	54.7	54.7	0.0	0.0	0.0

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	16.19	0.06	4.3	4.36	21.41
100.0	20.87	0.03	10.2	5.54	18.38
150.0	23.89	0.09	17.3	6.47	17.06
200.0	25.87	0.07	25.7	7.14	16.34
250.0	27.13	0.12	34.6	7.58	16.01
300.0	30.27	0.14	43.6	7.82	15.71
350.0	33.52	0.28	52.9	8.11	15.68
400.0	36.24	0.51	61.5	8.37	15.94
430.0	37.78	0.31	67.0	8.54	16.14
450.0	38.82	0.16	70.4	8.69	16.38



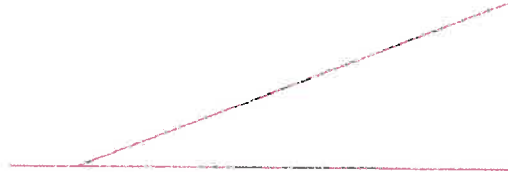
DELMAG D 19-32

Ram Weight	4.00 kips
Efficiency	0.800
Pressure	1500 (100%) psi
Helmet Weight	1.90 kips
Hammer Cushion	74995 kips/in
COR of H.C.	0.800
Skin Quake	0.100 in
Toe Quake	0.100 in
Skin Damping	0.200 sec/ft
Toe Damping	0.100 sec/ft
Pile Length	15.00 ft
Pile Penetration	13.00 ft
Pile Top Area	21.50 in ²

Pile Model



Skin Friction Distribution



Res. Shaft = 7 %
(Proportional)

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
 VERSION 5.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2008.

Division 12 Bridge 22309 EB1

DESIGNER : Pramsey

DATE : 11-5-2014

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 84.40 IN.
 TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.15 SQF
 OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
 INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
 PILE LENGTH = 13.00 FT.
 MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 0.00 FT.
 INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	28.00	0.00
12.00	SAND	0.00	115.00	28.00	0.00
12.00	SAND	0.00	130.00	45.00	0.00
30.00	SAND	0.00	130.00	45.00	0.00

1

 * COMPUTATION RESULT *

 * FED. HWY. METHOD * * ARMY CORPS METHOD * * LAMBDA 2 METHOD *

PILE PENETR- ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP
0.0	0.0	0.5	0.5	0.0	0.8	0.8	0.0	0.0	0.0
1.0	0.2	0.7	0.8	0.0	1.1	1.1	0.0	0.0	0.0
2.0	0.6	0.9	1.5	0.0	1.4	1.4	0.0	0.0	0.0
3.0	1.4	1.1	2.5	0.0	1.8	1.8	0.0	0.0	0.0
4.0	2.6	1.3	3.9	0.0	2.1	2.1	0.0	0.0	0.0
5.0	4.0	1.5	5.5	0.0	2.5	2.5	0.0	0.0	0.0
6.0	5.8	1.7	7.5	0.0	2.8	2.8	0.0	0.0	0.0
7.0	7.9	1.8	9.7	0.0	3.1	3.1	0.0	0.0	0.0
8.0	10.3	10.2	20.5	0.0	7.5	7.5	0.0	0.0	0.0
9.0	13.0	28.8	41.8	0.0	16.9	16.9	0.0	0.0	0.0
10.0	16.1	49.0	65.1	0.0	27.0	27.0	0.0	0.0	0.0
11.0	19.5	70.9	90.3	0.0	37.9	37.9	0.0	0.0	0.0
12.0	23.2	94.2	117.4	0.0	49.7	49.7	0.0	0.0	0.0
13.0	34.0	100.4	134.5	0.0	53.5	53.5	0.0	0.0	0.0



Job No.:	BD-5112AB	Sheet		of	
Task:	Foundation Recs	Phase			
Job Name:	Div 12 Bridge No. 22309				
By:	PJR	Date:	11/6/2014		
Checked By:	GRT	Date:	11/6/2014		

END BENT 2

Bottom of Cap Elevation: End Bent 1 = 1014.75 ft. (left), 1015.83 ft. (right)

No. of Piles = 5 (3 vertical, 2 battered)

Pile Type = HP 12 X 53 or HP 14 X 73, Use HP 14 X 73. See WEAP analysis below

Factored load = 254 kips/pile = 127 tons/pile, Use 130 tons/pile

Assume piles will be driven 1 foot into weathered rock.

Axial Analysis

Use APILE to determine skin resistance. Boring EB2-A used in analysis.

Use unplugged section for skin resistance, P = 84 in, Required skin resistance = $260/0.45 = 578$ k/pile

Skin Resistance from APILE = 34 kips.

Assume piles will be driven 1 ft into weathered rock.

Remaining capacity will be from end bearing on rock.

Pile length Left Side = $1014.8 - 1002.5 + 1 + 1 = 14.3$ ft, Use 15 ft

Pile length Right Side = $1015.8 - 1003.5 + 1 + 1 = 14.3$ ft, Use 15 ft

Weap Analysis

Required driving resistance = $260/0.6 = 433$ k, Use 430 kips = 215 tons

Skin Resistance from APILE = 34 kips. % Skin Resistance = $34/430 = 7\%$

Due to relatively high compressive stresses on HP12x53, use HP14x73, See WEAP output

Delmag D 19-32 (42.4 ft-kip): Max comp stress 37.8 ksi, Blow counts = 67 bpf, Ok

Since D 19-32 works, no hammer energy range note is required.

Miscellaneous

1.5:1 rip rap slope okay

Pile points required due to weathered rock

No downdrag

No waiting periods