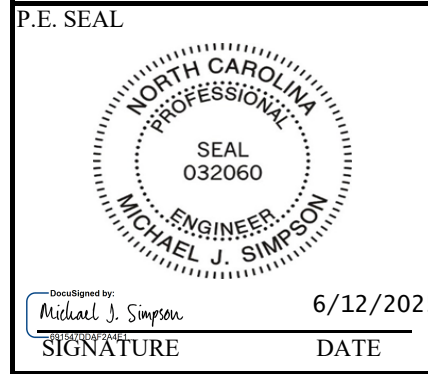


FOUNDATION RECOMMENDATIONS

PROJECT 49218.26
 TIP NO. _____
 COUNTY Cumberland
 STATION 19+50.27 -L-
14+08.59 -EY-

DESCRIPTION Gruber Road Bridge Over
All American Expressway on Fort Liberty

	INITIALS	DATE
DESIGN	EMB	5/13/25
CHECK	MJS	5/13/25



BRIDGE BENT	BENT STATION	FOUNDATION TYPE	FACTORED RESISTANCE	ADDITIONAL INFORMATION
END BENT 1	18+48.89 -L-	Cap on HP 14 x 73 Steel H-Piles	305 Kips/Pile	Bottom of Cap Elev. = 261 ft Average Estimated Pile Length = 90 ft Number of Piles/Cap = 16
BENT 1	19+50.27 -L-	Footings on HP 14 x 73 Steel H-Piles	270 Kips/Pile	Bottom of Footing Elev. = 236 ft Average Estimated Pile Length = 70 ft Number of Piles/Footing = 6 Number of Footings = 5
END BENT 2	20+51.65 -L-	Cap on HP 14 x 73 Steel H-Piles	305 Kips/Pile	Bottom of Cap Elev. = 255 ft Average Estimated Pile Length = 105 ft Number of Piles/Cap = 16

(SEE NOTES ON PLANS AND COMMENTS ON FOLLOWING PAGE.)

Bridge No. 231 on Gruber Road Over All American Expressway on Fort Liberty

Cumberland County

FOUNDATION RECOMMENDATIONS NOTES ON PLANS

1. FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.
2. INSTALL PILE SLEEVES BEFORE CONSTRUCTING THE MECHANICALLY STABILIZED EARTH (MSE) WALL AT END BENT NO. 1 AND END BENT NO. 2.
3. IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 35,000 TO 50,000 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT NO. 1, BENT NO. 1, AND END BENT NO. 2. THIS ESTIMATED ENERGY RANGE DOES NOT RELEASE THE CONTRACTOR FROM PROVIDING DRIVING EQUIPMENT IN ACCORDANCE WITH SUBARTICLE 450-3(D)(2) OF THE STANDARD SPECIFICATIONS.

FOUNDATION RECOMMENDATIONS COMMENTS

1. PILE LENGTHS ARE BASED ON PLUMB PILES FROM BOTTOM OF CAP/FOOTING TO ESTIMATED TIP ELEVATION, PLUS 1 OR 2 FEET EMBEDMENT INTO THE CAP/FOOTING AND ROUNDED UP TO THE NEAREST 5 FEET.
2. TYPE 2A ALTERNATE APPROACH FILL FOR INTEGRAL BRIDGE ABUTMENT WITH MSE WALLS IN ACCORDANCE WITH STANDARD DRAWING NO. 423.04 ARE REQUIRED AT END BENT NO. 1 AND END BENT NO. 2.
3. THE MSE WALL FOUNDATION RECOMMENDATIONS REPORT FOR MSE ABUTMENT WALLS LOCATED AT END BENT NO. 1 AND END BENT NO. 2 WILL BE SUBMITTED IN A SEPARATE REPORT. THIS REPORT WILL ADDRESS SETTLEMENT OF THE MSE WALLS, GLOBAL STABILITY AND EXTERNAL STABILITY OF THE MSE WALLS.

SUMMARY OF PILE INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent / Bent No, Pile(s) #(-#) (e.g., "Bent 1, Piles 1-5")	Number of Piles per Line	Factored Resistance per Pile KIPS	Pile Cut-Off (Top of Pile) Elevation FT	Estimated Pile Length per Pile FT	Scour Critical Elevation FT	Driven Piles			Predrilling for Piles **			Drilled-In Piles		
						Minimum Pile Tip (Tip No Higher Than) Elevation FT	Required Driving Resistance (RDR)* per pile KIPS	Pile Redrives Quantity EACH	Predrilling Length per Pile LIN FT	Predrilling Elevation (Elevation Not To Predrill Below) FT	Maximum Predrilling Diameter INCHES	Pile Excavation (Bottom of Hole) Elevation FT	Pile Excavation Not In Soil per Pile LIN FT	Pile Excavation In Soil per Pile LIN FT
End Bent No. 1, Piles 1 - 16	16	305	262.73	90			440	8						
Bent No. 1, Piles 1 - 30	30	270	237.14	70			390	15						
End Bent No. 2, Piles 1 - 16	16	305	256.67	105			440	8						
TOTAL QUANTITY:	62			5220				31						

* RDR = $\frac{\text{Factored Resistance} + \text{Factored Drag Load} + \text{Factored Dead Load}}{\text{Dynamic Resistance Factor}} + \text{Nominal Drag Load Resistance} + \text{Nominal Resistance from Scourable Material}$

** Predrilling for Piles is required for end bents/bents with a predrilling length and at the Contractor's option for end bents/bents with predrilling information but no predrilling length.

PILE DESIGN INFORMATION

(Blank entries indicate item is not applicable to structure)

End Bent / Bent No, Pile(s) #(-#) (e.g., "Bent 1, Piles 1-5")	Factored Axial Load per Pile KIPS	Factored Drag Load per Pile KIPS	Factored Dead Load * per Pile KIPS	Dynamic Resistance Factor	Nominal Drag Resistance per Pile KIPS	Nominal Scour Resistance per Pile KIPS
End Bent No. 1, Piles 1 - 16	305			0.70		
Bent No. 1, Piles 1 - 30	270			0.70		
End Bent No. 2, Piles 1 - 16	305			0.70		

* Factored Dead Load is factored weight of pile above the ground line.

SUMMARY OF DPT/PILE ORDER LENGTHS

(Blank entries indicate item is not applicable to structure)

Dynamic Pile Testing (DPT)		
End Bent / Bent No (e.g., "Bent 1 - Bent 3")	DPT Test Pile Length FT	DPT Testing Quantity EACH
End Bent No. 1	90	1
Bent No. 1	75	
End Bent No. 2	105	1
TOTAL QUANTITY:		2


PROJECT NO. 49218.26 Gruber Road Bridge

Cumberland COUNTY

STATION: 19+50.27 -L- / 14+08.59 -EY-

NOTES:

- The Pile Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer (Michael J. Simpson, #032672) on 06-12-2025.
- Total Pile Driving Equipment Setup quantity (not shown in Pile Foundation Tables) equals the number of driven piles, i.e., the number of piles with a Required Driving Resistance.
- The Engineer may adjust the quantity for DPT Testing and Pipe Pile Plates when necessary.

	STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
	PILE FOUNDATION TABLES					
SIGNATURE _____	DATE _____	REVISIONS				SHEET NO.
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	NO. <u>1</u>	BY: _____	DATE: _____	NO. <u>3</u>	BY: _____	DATE: _____
	<u>2</u>			<u>4</u>		
TOTAL SHEETS						

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	49218.26	1	10

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CUMBERLAND
 PROJECT DESCRIPTION GRUBER ROAD BRIDGE
OVER ALL AMERICAN EXPRESSWAY ON
FORT LIBERTY
 SITE DESCRIPTION REPLACE BRIDGE NO. 510231
STATION 19+50.27 -L-

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-8	BORE LOGS
9	SOIL TEST RESULTS
10	SITE PHOTOGRAPHS

REFERENCE: N/A

PROJECT: 49218

CAUTION NOTICE

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

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

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

NOTES:

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

PERSONNEL

C. STEPHENS, GIT

M. AKLAND, PG

SUBTERRA EXP.

INVESTIGATED BY B. SMITH, PG

DRAWN BY B. SMITH, PG

CHECKED BY N. MOHS, LG

SUBMITTED BY B. SMITH, PG

DATE APRIL, 2025

PREPARED IN THE OFFICE OF:



Signed by:

B. Smith 6/12/2025

D659DAEBB4E44BA

SIGNATURE

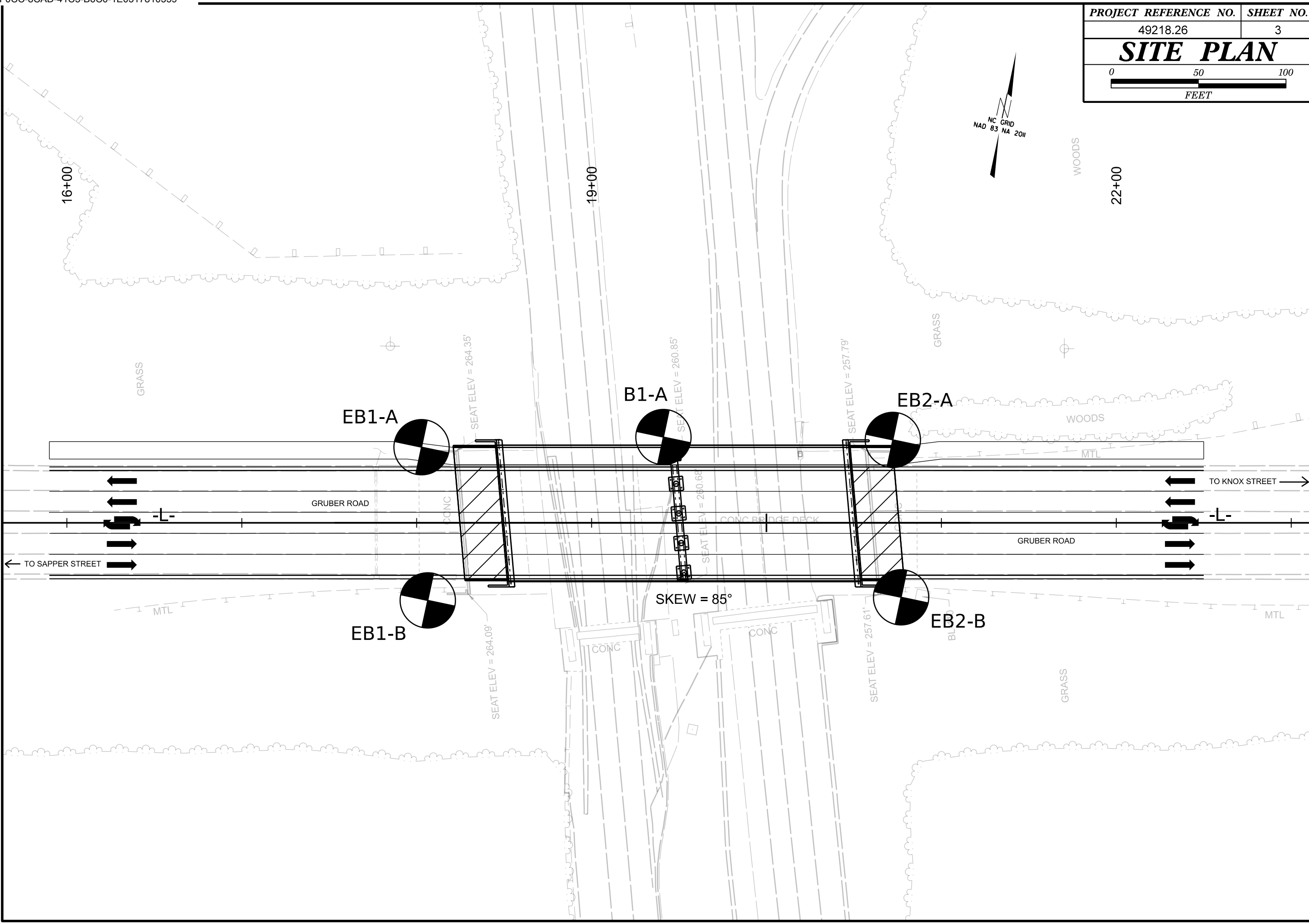
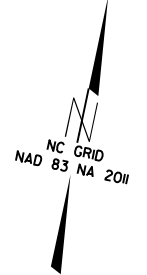
DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

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

SOIL DESCRIPTION	GRADATION	ROCK DESCRIPTION	TERMS AND DEFINITIONS																																																																																																																																																																			
SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, 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.	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:	ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION (FM) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MOTTLED (MOT) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (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.																																																																																																																																																																			
SOIL LEGEND AND AASHTO CLASSIFICATION <table border="1" style="width: 100%; border-collapse: collapse; font-size: 6pt;"> <tr> <th rowspan="2">GENERAL CLASS.</th> <th colspan="7">GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th colspan="4">SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th colspan="3">ORGANIC MATERIALS</th> </tr> <tr> <th>A-1</th> <th>A-3</th> <th colspan="2">A-2</th> <th>A-4</th> <th>A-5</th> <th>A-6</th> <th>A-7</th> <th>A-1, A-2</th> <th>A-4, A-5</th> <th colspan="2"></th> <th colspan="2"></th> </tr> <tr> <th>GROUP CLASS.</th> <th>A-1-a</th> <th>A-1-b</th> <th>A-2-4</th> <th>A-2-5</th> <th>A-2-6</th> <th>A-2-7</th> <th></th> <th></th> <th>A-3</th> <th>A-6, A-7</th> <th colspan="2"></th> <th colspan="2"></th> </tr> <tr> <th>SYMBOL</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="2"></td> </tr> <tr> <th>% PASSING #10</th> <td>50 MX</td> <td>50 MX</td> <td>51 MN</td> <td>35 MX</td> <td>35 MX</td> <td>35 MX</td> <td>36 MN</td> <td>36 MN</td> <td>36 MN</td> <td>36 MN</td> <td colspan="2"></td> <td colspan="2"></td> </tr> <tr> <th>% PASSING #40</th> <td>30 MX</td> <td>25 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MN</td> <td>10 MN</td> <td>10 MN</td> <td>10 MN</td> <td colspan="2"></td> <td colspan="2"></td> </tr> <tr> <th>% PASSING #200</th> <td>15 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MX</td> <td>10 MN</td> <td>10 MN</td> <td>10 MN</td> <td>10 MN</td> <td colspan="2"></td> <td colspan="2"></td> </tr> <tr> <th>MATERIAL</th> <td colspan="2">STONE FRAGS, GRAVEL, AND SAND</td> <td colspan="2">FINE SAND</td> <td colspan="2">SILTY OR CLAYEY GRAVEL AND SAND</td> <td colspan="2">SILTY SOILS</td> <td colspan="2">CLAYEY SOILS</td> <td colspan="2">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td colspan="2">HIGHLY ORGANIC SOILS</td> </tr> <tr> <th>GROUP INDEX</th> <td colspan="2">0</td> <td colspan="2">0</td> <td colspan="2">4 MX</td> <td colspan="2">8 MX</td> <td colspan="2">12 MX</td> <td colspan="2">16 MX</td> <td colspan="2">NO MX</td> </tr> <tr> <th>USUAL TYPES OF MAJOR MATERIALS</th> <td colspan="2">STONE FRAGS, GRAVEL, AND SAND</td> <td colspan="2">FINE SAND</td> <td colspan="2">SILTY OR CLAYEY GRAVEL AND SAND</td> <td colspan="2">SILTY SOILS</td> <td colspan="2">CLAYEY SOILS</td> <td colspan="2">SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER</td> <td colspan="2">HIGHLY ORGANIC SOILS</td> </tr> <tr> <th>GEN. RATING AS SUBGRADE</th> <td colspan="6">EXCELLENT TO GOOD</td> <td colspan="4">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSUITABLE</td> </tr> </table>	GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS			A-1	A-3	A-2		A-4	A-5	A-6	A-7	A-1, A-2	A-4, A-5					GROUP CLASS.	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7			A-3	A-6, A-7					SYMBOL															% PASSING #10	50 MX	50 MX	51 MN	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN					% PASSING #40	30 MX	25 MX	10 MX	10 MX	10 MX	10 MX	10 MN	10 MN	10 MN	10 MN					% PASSING #200	15 MX	10 MX	10 MX	10 MX	10 MX	10 MX	10 MN	10 MN	10 MN	10 MN					MATERIAL	STONE FRAGS, GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS		GROUP INDEX	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		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS		GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD						FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE	ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.	WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.	CRISTALLINE 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.
GENERAL CLASS.		GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS																																																																																																																																																									
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USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS, GRAVEL, AND SAND		FINE SAND		SILTY OR CLAYEY GRAVEL AND SAND		SILTY SOILS		CLAYEY SOILS		SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS																																																																																																																																																									
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MINERALOGICAL COMPOSITION MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.	COMPRESSIBILITY SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50	NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	COASTAL PLAIN SEDIMENTARY ROCK (CP) COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.																																																																																																																																																																			
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PLASTICITY <table border="1" style="width: 100%; border-collapse: collapse; font-size: 6pt;"> <tr> <th></th> <th>PLASTICITY INDEX (PI)</th> <th>DRY STRENGTH</th> </tr> <tr> <td>NON PLASTIC</td> <td>0-5</td> <td>VERY LOW</td> </tr> <tr> <td>SLIGHTLY PLASTIC</td> <td>6-15</td> <td>SLIGHT</td> </tr> <tr> <td>MODERATELY PLASTIC</td> <td>16-25</td> <td>MEDIUM</td> </tr> <tr> <td>HIGHLY PLASTIC</td> <td>26 OR MORE</td> <td>HIGH</td> </tr> </table>		PLASTICITY INDEX (PI)	DRY STRENGTH	NON PLASTIC	0-5	VERY LOW	SLIGHTLY PLASTIC	6-15	SLIGHT	MODERATELY PLASTIC	16-25	MEDIUM	HIGHLY PLASTIC	26 OR MORE	HIGH	INDURATION FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE - RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED - GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED - GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED - SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.	BENCH MARK: BORING COLLAR ELEVATIONS OBTAINED FROM NCDOT L&S. THEIR TEXT FILE WILL BE INCLUDED IN OUR ELECTRONIC SUBMITTAL. ELEVATION: N/A FEET NOTES:																																																																																																																																																					
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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.																																																																																																																																																																						

PROJECT REFERENCE NO.	SHEET NO.
49218.26	3
SITE PLAN	
 0 50 100 FEET	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.									
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 18+06		OFFSET 44 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 270.7 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,660		EASTING 2,005,695									
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Brown, M.		START DATE 07/17/24		COMP. DATE 07/17/24		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					
275															
270	270.7	0.0	3	3	5										270.7
265	266.4	4.3	5	6	5										267.7
260	261.4	9.3	3	5	6										258.7
255	256.4	14.3	2	3	3										243.7
250	251.4	19.3	3	3	5										228.7
245	246.4	24.3	3	4	5										213.7
240	241.4	29.3	7	8	9										203.7
235	236.4	34.3	5	7	8										198.7
230	231.4	39.3	5	7	9										
225	226.4	44.3	5	7	7										
220	221.4	49.3	4	5	7										
215	216.4	54.3	8	7	10										
210	211.4	59.3	12	20	32										
205	206.4	64.3	11	22	33										
200	201.4	69.3	16	19	21										
195	196.4	74.3	7	4	5										

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.									
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)								
BORING NO. EB1-B		STATION 18+06		OFFSET 44 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 270.7 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,660		EASTING 2,005,695									
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DRILLER Brown, M.		START DATE 07/17/24		COMP. DATE 07/17/24		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					
195															
190	191.4	79.3	17	23	31										193.7
185	186.4	84.3	13	15	19										184.9

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 12/19/24

SS-73 18%

SS-79 22%

SS-84 20%

Match Line

tan, yellow, and gray, dense to very dense, fine SAND (A-3)

Boring Terminated at Elevation 184.9 ft in Coastal Plain (fine SAND) - Middendorf Formation
- Slow/Hard Drilling reported from 57.0 - 67.0 feet.

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.									
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 20+77		OFFSET 43 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 262.8 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,718		EASTING 2,005,959									
DRILL RIG/HAMMER EFF./DATE SEL1975 DIETRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Brown, M.		START DATE 07/18/24		COMP. DATE 07/18/24		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					
265	262.8	0.0	2	4	8									GROUND SURFACE	0.0
260	258.5	4.3	3	3	4									COASTAL PLAIN (Middendorf Formation)	
														tan and brown, medium dense, silty SAND (A-2-4)	3.0
														tan and brown, loose, fine SAND (A-3)	7.0
255	253.5	9.3	3	3	3									tan, orange, and red, loose to medium dense, clayey SAND (A-2-6)	
250	248.5	14.3	4	4	5										
245	243.5	19.3	4	5	7										
240	238.5	24.3	4	5	11										
235	233.5	29.3	7	4	8									purple and red, medium dense, coarse SAND (A-1-b)	27.0
230	228.5	34.3	1	1	1									orange, tan, brown, gray, and purple, very loose to medium dense, silty SAND (A-2-4)	32.0
225	223.5	39.3	1	2	2									SS-111 30%	
220	218.5	44.3	4	4	6									Sat.	
215	213.5	49.3	5	6	7									SS-113 24%	
210	208.5	54.3	14	26	37									Sat.	
205	203.5	59.3	13	17	19									W	
200	198.5	64.3	WOR	WOH	WOH									Sat.	
195	193.5	69.3	15	16	13									SS-117 29%	
190	188.5	74.3	1	2	3									Sat.	
185														Sat.	

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 12/19/24

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.									
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)								
BORING NO. EB2-B		STATION 20+77		OFFSET 43 ft RT		ALIGNMENT -L-									
COLLAR ELEV. 262.8 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,718		EASTING 2,005,959									
DRILL RIG/HAMMER EFF./DATE SEL1975 DIETRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Brown, M.		START DATE 07/18/24		COMP. DATE 07/18/24		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					
185															
	183.5	79.3	13	13	11									Match Line	
180														gray and pink, medium dense, coarse SAND (A-1-b) (continued)	82.0
	178.5	84.3	13	25	36									gray and orange, hard, silty CLAY (A-7-6)	85.8
														Boring Terminated at Elevation 177.0 ft in Coastal Plain (silty CLAY) - Middendorf Formation	
														- Slow/Hard Drilling reported from 53.0 - 58.0 feet.	

Laboratory Testing Summary

Project Number: N/A
 TIP Number: 49218.26
 County: Cumberland
 Description: Gruber Road Bridge over All American Expressway on Fort Liberty

Boring No.	Sample No.	Station	Offset (feet)	Northing	Easting	Depth Interval (feet)	Lab ID	AASHTO Class.	L.L.	P.I.	% by Weight				% Retained #4 Sieve	% Passing (sieves)			% Moisture	% Organic
											Coarse Sand	Fine Sand	Silt	Clay		#10	#40	#200		
EB1-A	SS-54	18+03	43'LT	500,745	2,005,673	13.7-15.2	24-1422	A-2-4 (0)	NP	NP	59.4	30.8	2.8	7.0	3.3	93.2	58.2	12.2	16.2%	-
EB1-A	SS-57	18+03	43'LT	500,745	2,005,673	28.7-30.2	24-1423	A-7-6 (11)	43	15	15.9	14.1	22.0	48.0	0.0	100.0	94.2	74.3	27.8%	-
EB1-A	SS-60	18+03	43'LT	500,745	2,005,673	43.7-45.2	24-1424	A-2-4 (0)	NP	NP	71.0	16.3	2.7	10.0	0.0	100.0	70.4	13.6	24.5%	-
EB1-A	SS-62	18+03	43'LT	500,745	2,005,673	53.7-55.2	24-1425	A-6 (12)	39	18	8.1	26.9	18.7	46.3	0.0	99.7	94.9	71.9	19.8%	-
EB1-B	SS-73	18+06	44'RT	500,660	2,005,695	19.3-20.8	24-1464	A-2-6 (0)	29	11	67.1	12.8	3.5	16.6	0.0	99.6	64.7	20.9	17.5%	-
EB1-B	SS-79	18+06	44'RT	500,660	2,005,695	49.3-50.8	24-1465	A-2-4 (0)	NP	NP	66.4	20.2	4.4	9.0	0.0	100.0	72.9	14.5	21.9%	-
EB1-B	SS-84	18+06	44'RT	500,660	2,005,695	74.3-75.8	24-1466	A-1-b (0)	21	5	70.9	13.9	3.0	12.2	0.0	99.7	40.5	16.8	20.3%	-
B1-A	SS-140	19+41	49'LT	500,779	2,005,807	9.3-10.8	24-1456	A-2-4 (0)	NP	NP	72.6	16.7	2.1	8.6	0.0	98.9	65.9	11.7	17.0%	-
B1-A	SS-142	19+41	49'LT	500,779	2,005,807	19.3-20.8	24-1457	A-7-6 (28)	52	24	0.5	3.0	29.4	67.1	0.0	100.0	99.6	98.1	37.7%	-
B1-A	SS-145	19+41	49'LT	500,779	2,005,807	34.3-35.8	24-1458	A-6 (4)	32	14	0.5	56.5	3.9	39.1	0.0	100.0	99.8	48.5	16.8%	-
EB2-A	SS-7	20+72	47'LT	500,805	2,005,936	29.3-30.8	24-1409	A-2-4 (0)	NP	NP	67.1	19.1	3.4	10.4	0.0	94.1	51.6	14.6	16.7%	-
EB2-A	SS-10	20+72	47'LT	500,805	2,005,936	44.3-45.8	24-1410	A-2-4 (0)	NP	NP	7.9	66.3	3.4	22.4	0.1	99.9	99.2	28.8	25.5%	-
EB2-A	SS-14	20+72	47'LT	500,805	2,005,936	64.3-65.8	24-1411	A-1-b (0)	NP	NP	76.0	15.8	3.1	5.1	0.0	98.8	39.0	9.9	20.0%	-
EB2-B	SS-111	20+77	43'RT	500,718	2,005,959	34.3-35.8	24-1467	A-2-4 (0)	NP	NP	7.1	63.3	6.5	23.1	0.0	99.7	98.7	33.8	30.3%	-
EB2-B	SS-113	20+77	43'RT	500,718	2,005,959	44.3-45.8	24-1468	A-2-4 (0)	NP	NP	73.6	13.6	4.2	8.6	0.0	100.0	66.0	13.9	24.3%	-
EB2-B	SS-117	20+77	43'RT	500,718	2,005,959	64.3-65.8	24-1469	A-1-b (0)	NP	NP	79.8	9.3	3.6	7.3	0.0	97.6	31.2	11.7	28.5%	-

Chad Hawkins

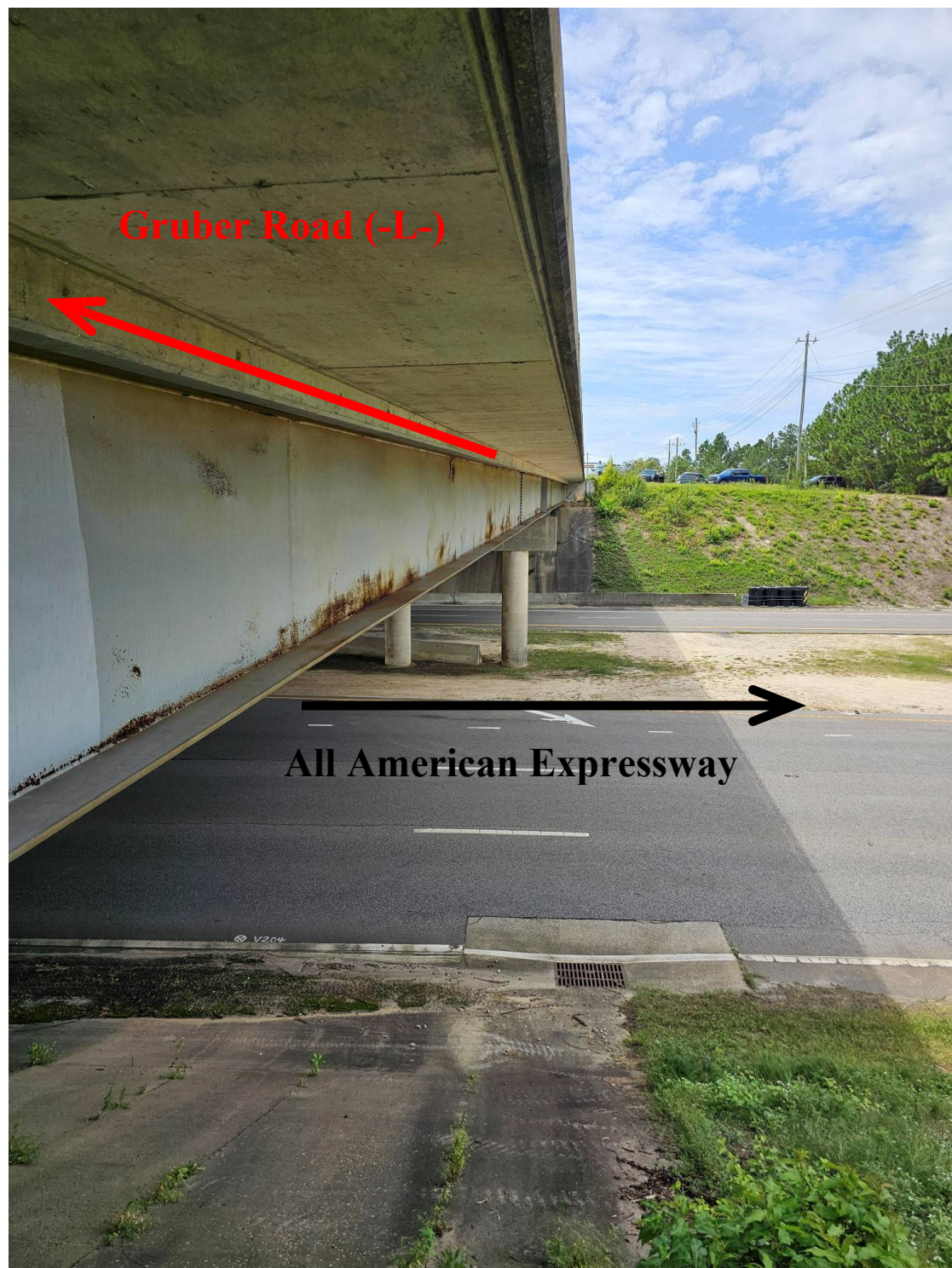
Certified Lab Technician Signature

147-02-0821

Certification Number

SITE PHOTOGRAPHS

Gruber Road Bridge over All American Expressway on Fort Liberty



Northeast Corner of Existing Bridge Facing West-Southwest



Southeast Corner of Existing Bridge Facing West-Southwest

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	49218.26	1	18

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY CUMBERLAND
 PROJECT DESCRIPTION GRUBER ROAD BRIDGE
OVER ALL AMERICAN EXPRESSWAY ON
ON FORT LIBERTY
 SITE DESCRIPTION MSE WALL NO.1 AT END BENT 1
AND MSE WALL NO.2 AT END BENT 2

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-II	BORE LOGS
12-18	SOIL TEST RESULTS

REFERENCE: NA

PROJECT: 49218

CAUTION NOTICE

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

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

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

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

PERSONNEL

C. STEPHENS, GIT

M. AKLAND, PG

SUBTERRA EXP.

INVESTIGATED BY B. SMITH, PG

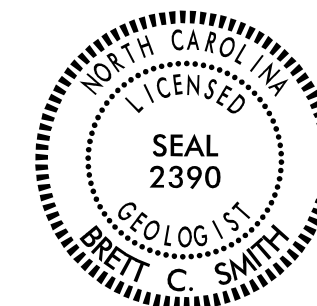
DRAWN BY B. SMITH, PG

CHECKED BY N. MOHS, LG

SUBMITTED BY B. SMITH, PG

DATE APRIL, 2025

PREPARED IN THE OFFICE OF:



Signed by: [Signature] 6/12/2025
 D659DAEBB4E44BA...
 SIGNATURE DATE

**DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED**

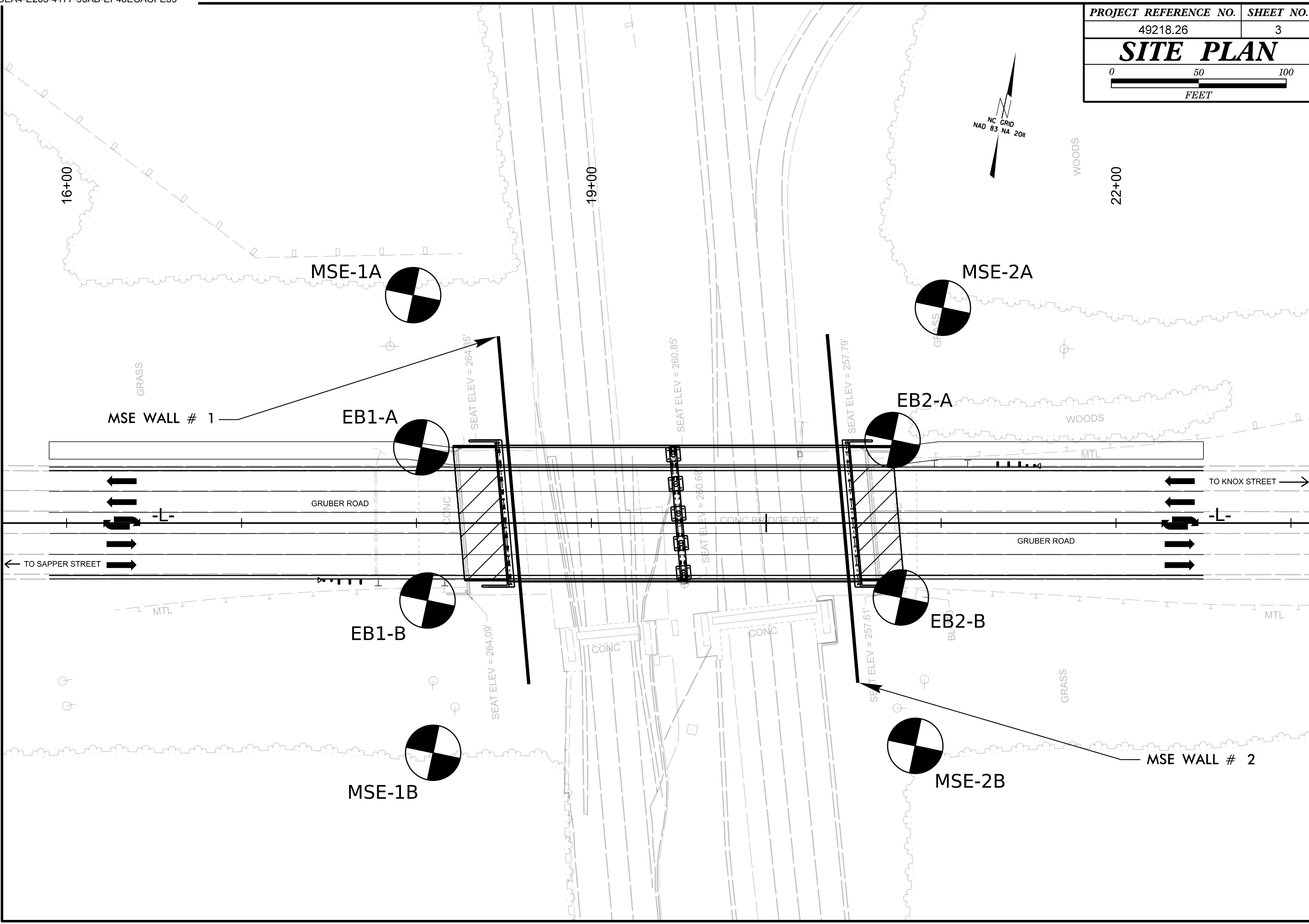
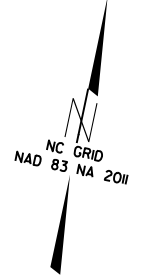
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS																			
<p>SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, <i>VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6</i></p>										<p>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.</p>										<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. AQUIFER - A WATER BEARING FORMATION OR STRATA. ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK. DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL. DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH. FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE. FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED 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 (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																			
SOIL LEGEND AND AASHTO CLASSIFICATION										ANGULARITY OF GRAINS										WEATHERED ROCK (WR)										CRYSTALLINE ROCK (CR)																			
<p>GENERAL CLASS. GRANULAR MATERIALS (≤ 35% PASSING #200) SILT-CLAY MATERIALS (> 35% PASSING #200) ORGANIC MATERIALS</p>										<p>THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>										<p>NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.</p>										<p>FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.</p>																			
MINERALOGICAL COMPOSITION										COMPRESSION										NON-CRYSTALLINE ROCK (NCR)										COASTAL PLAIN SEDIMENTARY ROCK (CP)																			
<p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.</p>										<p>SLIGHTLY COMPRESSIBLE LL < 31 MODERATELY COMPRESSIBLE LL = 31 - 50 HIGHLY COMPRESSIBLE LL > 50</p>										<p>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 SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.</p>																			
PERCENTAGE OF MATERIAL										GROUND WATER										WEATHERING										FRESH																			
<p>ORGANIC MATERIAL GRANULAR SOILS SILT - CLAY SOILS OTHER MATERIAL</p> <p>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</p>										<p>▽ 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</p>										<p>ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE. 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. 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. 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. 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> 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> 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> 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.</p>										<p>ROCK HARDNESS</p> <p>VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK. HARD CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN. MODERATELY HARD CAN BE SCRATCHED BY KNIFE OR PICK, GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS. MEDIUM HARD CAN BE GROUDED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK. SOFT CAN BE GROUDED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE. VERY SOFT CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.</p>																			
CONSISTENCY OR DENSENESS										MISCELLANEOUS SYMBOLS										RECOMMENDATION SYMBOLS										ABBREVIATIONS																			
<p>PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)</p>										<p>ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT INFERRED SOIL BOUNDARY INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY</p>										<p>DIP & DIP DIRECTION OF ROCK STRUCTURES SPT TEST BORE AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SPT N-VALUE</p>										<p>UNDERCUT SHALLOW UNDERCUT UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK</p>										<p>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_d - DRY UNIT WEIGHT SAMPLE ABBREVIATIONS S - BULK SS - SPLIT SPOON ST - SHELBY TUBE RS - ROCK RT - RECOMPACTED TRIAXIAL CBR - CALIFORNIA BEARING RATIO</p>									
TEXTURE OR GRAIN SIZE										SOIL MOISTURE - CORRELATION OF TERMS										FRACTURE SPACING										BEDDING																			
<p>U.S. STD. SIEVE SIZE OPENING (MM) 4 10 40 60 200 270 4.76 2.00 0.42 0.25 0.075 0.053</p>										<p>SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION</p> <p>LL - LIQUID LIMIT PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SHRINKAGE LIMIT</p> <p>- SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</p>										<p>TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FOOT VERY CLOSE LESS THAN 0.16 FEET</p>										<p>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</p>																			
PLASTICITY										EQUIPMENT USED ON SUBJECT PROJECT										INDURATION										NOTES:																			
<p>NON PLASTIC 0-5 VERY LOW SLIGHTLY PLASTIC 6-15 SLIGHT MODERATELY PLASTIC 16-25 MEDIUM HIGHLY PLASTIC 26 OR MORE HIGH</p>										<p>DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, D-50, MUD ROTARY</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>										<p>BENCH MARK: BORING COLLAR ELEVATIONS OBTAINED FROM NCDOT L&S. THEIR TEXT FILE WILL BE INCLUDED IN OUR ELECTRONIC SUBMITTAL. ELEVATION: N/A FEET</p>																			
COLOR										INDURATION										INDURATION										INDURATION																			
<p>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.</p>										<p>DRILL UNITS: CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, D-50, MUD ROTARY</p>										<p>FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC. FRIABLE RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE. MODERATELY INDURATED GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER. INDURATED GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER. EXTREMELY INDURATED SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.</p>										<p>BENCH MARK: BORING COLLAR ELEVATIONS OBTAINED FROM NCDOT L&S. THEIR TEXT FILE WILL BE INCLUDED IN OUR ELECTRONIC SUBMITTAL. ELEVATION: N/A FEET</p>																			

PROJECT REFERENCE NO.	SHEET NO.
49218.26	3
SITE PLAN	
 0 50 100 FEET	



GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.								
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)							
BORING NO. MSE-1A		STATION 17+98		OFFSET 130 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 265.5 ft		TOTAL DEPTH 75.3 ft		NORTHING 500,829		EASTING 2,005,650								
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER Brown, M.		START DATE 07/12/24		COMP. DATE 07/16/24		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				
270														
265	265.5	0.0	5	7	10									265.5 GROUND SURFACE 0.0
260	262.0	3.5	2	2	5									263.0 COASTAL PLAIN (Middendorf Formation) brown, tan, and orange, medium dense, silty SAND (A-2-4) with trace gravel 2.5
255	256.7	8.8	2	3	4									tan, brown, and orange, loose, fine SAND (A-3) 12.1
250	251.7	13.8	4	5	6									orange-brown and red, medium dense, silty SAND (A-2-4) with little clay 22.1
245	246.7	18.8	5	5	6									243.4 red, brown, and white, loose to medium dense, coarse SAND (A-1-b) with trace clay 22.1
240	241.7	23.8	4	4	6									233.4 red, tan, orange, and white, medium dense, silty SAND (A-2-4) with little clay and trace gravel 32.1
235	236.7	28.8	6	5	7									223.1 gray, red, orange, and purple, very stiff to hard, highly plastic (PI=44), silty CLAY (A-7-5) 42.4
230	231.7	33.8	5	5	6									
225	226.7	38.8	4	7	5									
220	221.7	43.8	7	11	17									
215	216.7	48.8	9	15	25									
210	211.7	53.8	9	21	36									
205	206.7	58.8	11	18	27									
200	201.7	63.8	19	21	25									
195	196.7	68.8	4	4	1									
	191.7	73.8	20	26	23									

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 1/14/25

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.								
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)							
BORING NO. MSE-1A		STATION 17+98		OFFSET 130 ft LT		ALIGNMENT -L-								
COLLAR ELEV. 265.5 ft		TOTAL DEPTH 75.3 ft		NORTHING 500,829		EASTING 2,005,650								
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic									
DRILLER Brown, M.		START DATE 07/12/24		COMP. DATE 07/16/24		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				
190														Match Line
														Boring Terminated at Elevation 190.2 ft in Coastal Plain (coarse SAND) - Middendorf Formation
														- Slow/Hard Drilling reported from 42.4 - 61.0 feet.

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.										
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 18+03		OFFSET 43 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 270.6 ft		TOTAL DEPTH 85.2 ft		NORTHING 500,745		EASTING 2,005,673										
DRILL RIG/HAMMER EFF./DATE SEL1975 DIETRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER Brown, M.		START DATE 07/16/24		COMP. DATE 07/16/24		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						
275																
270	270.6	0.0	2	2	2											270.6
265	267.0	3.6	2	4	4											
260	263.2	7.4	4	4	6											
255	261.7	8.9	3	4	4											
250	256.9	13.7	2	2	3											
245	251.9	18.7	5	6	7											
240	246.9	23.7	4	5	5											
235	241.9	28.7	2	7	10											
230	236.9	33.7	5	6	7											
225	231.9	38.7	4	6	8											
220	226.9	43.7	4	5	6											
215	221.9	48.7	5	5	6											
210	216.9	53.7	6	12	22											
205	211.9	58.7	10	19	39											
200	206.9	63.7	14	18	25											
195	201.9	68.7	15	16	17											
	196.9	73.7	3	8	11											

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.										
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)									
BORING NO. EB1-A		STATION 18+03		OFFSET 43 ft LT		ALIGNMENT -L-										
COLLAR ELEV. 270.6 ft		TOTAL DEPTH 85.2 ft		NORTHING 500,745		EASTING 2,005,673										
DRILL RIG/HAMMER EFF./DATE SEL1975 DIETRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic											
DRILLER Brown, M.		START DATE 07/16/24		COMP. DATE 07/16/24		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
195																
190	191.9	78.7	17	15	13											
	186.9	83.7	14	16	24											

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 1/14/25

Match Line

tan, brown, orange and pink, medium dense to dense, silty SAND (A-2-4) (continued)

Boring Terminated at Elevation 185.4 ft in Coastal Plain (silty SAND) - Middendorf Formation

- Slow/Hard Drilling reported from 52.0 - 66.0 feet.
- Loss of Drilling Fluid reported from 46.0 - 52.0 feet.

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.	
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)
BORING NO. EB1-B		STATION 18+06		OFFSET 44 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 270.7 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,660		EASTING 2,005,695	
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic		
DRILLER Brown, M.		START DATE 07/17/24		COMP. DATE 07/17/24		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					
275															
270	270.7	0.0	3	3	5									270.7	GROUND SURFACE
265	266.4	4.3	5	6	5									267.7	COASTAL PLAIN (Middendorf Formation) orange and brown, loose, silty SAND (A-2-4) tan and brown, medium dense, fine SAND (A-3)
260	261.4	9.3	3	5	6										
255	256.4	14.3	2	3	3										
250	251.4	19.3	3	3	5										
245	246.4	24.3	3	4	5										
240	241.4	29.3	7	8	9										
235	236.4	34.3	5	7	8										
230	231.4	39.3	5	7	9										
225	226.4	44.3	5	7	7										
220	221.4	49.3	4	5	7										
215	216.4	54.3	8	7	10										
210	211.4	59.3	12	20	32										
205	206.4	64.3	11	22	33										
200	201.4	69.3	16	19	21										
195	196.4	74.3	7	4	5										

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Stephens, C.	
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)
BORING NO. EB1-B		STATION 18+06		OFFSET 44 ft RT		ALIGNMENT -L-	
COLLAR ELEV. 270.7 ft		TOTAL DEPTH 85.8 ft		NORTHING 500,660		EASTING 2,005,695	
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024			DRILL METHOD Mud Rotary		HAMMER TYPE Automatic		
DRILLER Brown, M.		START DATE 07/17/24		COMP. DATE 07/17/24		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					
195															
190	191.4	79.3	17	23	31										
185	186.4	84.3	13	15	19										

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					
195															
190	191.4	79.3	17	23	31										
185	186.4	84.3	13	15	19										

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 1/14/25

GEOTECHNICAL BORING REPORT

BORE LOG

WBS N/A		TIP 49218.26		COUNTY CUMBERLAND		GEOLOGIST Akland, M.										
SITE DESCRIPTION Gruber Road Bridge over All American Expressway on Fort Liberty							GROUND WTR (ft)									
BORING NO. MSE-2A		STATION 21+01		OFFSET 123 ft LT		ALIGNMENT -L-	0 HR. N/A									
COLLAR ELEV. 257.0 ft		TOTAL DEPTH 70.5 ft		NORTHING 500,885		EASTING 2,005,948	24 HRCaved - 39.2									
DRILL RIG/HAMMER EFF./DATE SEL1975 DIEDRICH D-50 85% 06/25/2024				DRILL METHOD Mud Rotary		HAMMER TYPE Automatic										
DRILLER Brown, M.		START DATE 07/09/24		COMP. DATE 07/11/24		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)		
260														257.0	0.0	GROUND SURFACE
255	257.0	0.0	8	11	14	25						D		257.0		COASTAL PLAIN (Middendorf Formation) tan, brown, and orange, medium dense, silty SAND (A-2-4) with trace gravel
250	253.2	3.8	9	8	8	16						M		250.0	7.0	tan and orange, medium dense, moderately plastic (PI=24), clayey SAND (A-2-7)
245	248.0	9.0	5	6	11	17						SS-21	16%	245.0	12.0	brown, red, orange, and yellow, loose to medium dense, silty SAND (A-2-4)
240	243.0	14.0	4	5	5	10						M		243.0		white, brown, red, and orange, loose, clayey SAND (A-2-6)
235	238.0	19.0	8	14	15	29						M		238.0		brown, red, white, and orange, loose to medium dense, silty SAND (A-2-4) with little clay
230	233.0	24.0	4	4	3	7						M		233.0	22.0	orange white, and purple, medium stiff, sandy SILT (A-4) with some clay
225	228.0	29.0	4	5	6	11						M		228.0		orange and white, loose to medium dense, silty SAND (A-2-4)
220	223.0	34.0	4	4	5	9						M		223.0		
215	218.0	39.0	4	5	5	10						W		218.0		
210	213.0	44.0	4	4	4	3						W		213.0		
205	208.0	49.0	1	1	2	3						SS-29	31%	208.0	52.0	
200	203.0	54.0	1	2	3	5						SS-30	30%	203.0	57.0	
195	198.0	59.0	2	2	4	6						Sat.		198.0		
190	193.0	64.0	3	7	9	16						Sat.		193.0		
	188.0	69.0	12	11	8	19						Sat.		188.0	70.5	
															Boring Terminated at Elevation 186.5 ft in Coastal Plain (silty SAND) - Middendorf Formation	
															- Slow/Hard Drilling reported from 46.0 - 46.8 feet.	

NCDOT BORE DOUBLE 49218.26 GEO BRDG510231_BH.GPJ NC_DOT.GDT 1/14/25

Laboratory Testing Summary

Project Number: N/A
 TIP Number: 49218.26
 County: Cumberland
 Description: Gruber Road Bridge over All American Expressway on Fort Liberty

Boring No.	Sample No.	Station	Offset (feet)	Northing	Easting	Depth Interval (feet)	Lab ID	AASHTO Class.	L.L.	P.I.	% by Weight				% Retained #4 Sieve	% Passing (sieves)			% Moisture	% Organic
											Coarse Sand	Fine Sand	Silt	Clay		#10	#40	#200		
MSE-1A	SS-35	17+98	130'LT	500,829	2,005,650	3.5-5.0	24-1426	A-3 (0)	NP	NP	61.8	33.5	0.7	4.0	0.1	99.8	74.8	5.2	19.5%	-
MSE-1A	SS-39	17+98	130'LT	500,829	2,005,650	23.8-25.3	24-1427	A-1-b (0)	25	6	79.5	9.4	1.3	9.8	0.1	98.3	33.0	11.9	23.9%	-
MSE-1A	SS-43	17+98	130'LT	500,829	2,005,650	43.8-50.3	24-1428	A-7-5 (53)	79	44	1.6	1.7	3.1	93.6	0.1	99.8	98.6	97.2	25.6%	-
EB1-A	SS-54	18+03	43'LT	500,745	2,005,673	13.7-15.2	24-1422	A-2-4 (0)	NP	NP	59.4	30.8	2.8	7.0	3.3	93.2	58.2	12.2	16.2%	-
EB1-A	SS-57	18+03	43'LT	500,745	2,005,673	28.7-30.2	24-1423	A-7-6 (11)	43	15	15.9	14.1	22.0	48.0	0.0	100.0	94.2	74.3	27.8%	-
EB1-A	SS-60	18+03	43'LT	500,745	2,005,673	43.7-45.2	24-1424	A-2-4 (0)	NP	NP	71.0	16.3	2.7	10.0	0.0	100.0	70.4	13.6	24.5%	-
EB1-A	SS-62	18+03	43'LT	500,745	2,005,673	53.7-55.2	24-1425	A-6 (12)	39	18	8.1	26.9	18.7	46.3	0.0	99.7	94.9	71.9	19.8%	-
EB1-B	SS-73	18+06	44'RT	500,660	2,005,695	19.3-20.8	24-1464	A-2-6 (0)	29	11	67.1	12.8	3.5	16.6	0.0	99.6	64.7	20.9	17.5%	-
EB1-B	SS-79	18+06	44'RT	500,660	2,005,695	49.3-50.8	24-1465	A-2-4 (0)	NP	NP	66.4	20.2	4.4	9.0	0.0	100.0	72.9	14.5	21.9%	-
EB1-B	SS-84	18+06	44'RT	500,660	2,005,695	74.3-75.8	24-1466	A-1-b (0)	21	5	70.9	13.9	3.0	12.2	0.0	99.7	40.5	16.8	20.3%	-
MSE-1B	SS-92	18+10	131'RT	500,575	2,005,716	24.4-25.9	24-1461	A-2-4 (0)	NP	NP	70.9	17.3	2.8	9.0	0.0	99.8	61.6	12.6	25.8%	-
MSE-1B	SS-95	18+10	131'RT	500,575	2,005,716	39.4-40.9	24-1462	A-7-6 (17)	43	16	2.3	9.4	29.5	58.8	0.0	100.0	98.2	91.9	32.7%	-
MSE-1B	SS-101	18+10	131'RT	500,575	2,005,716	69.4-70.9	24-1463	A-1-b (0)	NP	NP	76.5	13.2	4.1	6.2	0.0	97.4	34.8	11.6	19.0%	-
MSE-2A	SS-21	21+01	123'LT	500,885	2,005,948	9.0-10.5	24-1412	A-2-7 (1)	47	24	68.9	10.7	4.2	16.2	0.0	98.2	38.4	21.1	16.1%	-
MSE-2A	SS-29	21+01	123'LT	500,885	2,005,948	49.0-50.5	24-1413	A-2-4 (0)	NP	NP	40.0	41.4	4.2	14.4	0.0	100.0	89.7	20.0	30.5%	-
MSE-2A	SS-30	21+01	123'LT	500,885	2,005,948	54.0-55.5	24-1414	A-4 (0)	NP	NP	8.6	51.1	11.8	28.5	0.0	99.5	96.6	44.2	29.6%	-
EB2-A	SS-7	20+72	47'LT	500,805	2,005,936	29.3-30.8	24-1409	A-2-4 (0)	NP	NP	67.1	19.1	3.4	10.4	0.0	94.1	51.6	14.6	16.7%	-
EB2-A	SS-10	20+72	47'LT	500,805	2,005,936	44.3-45.8	24-1410	A-2-4 (0)	NP	NP	7.9	66.3	3.4	22.4	0.1	99.9	99.2	28.8	25.5%	-
EB2-A	SS-14	20+72	47'LT	500,805	2,005,936	64.3-65.8	24-1411	A-1-b (0)	NP	NP	76.0	15.8	3.1	5.1	0.0	98.8	39.0	9.9	20.0%	-
EB2-B	SS-111	20+77	43'RT	500,718	2,005,959	34.3-35.8	24-1467	A-2-4 (0)	NP	NP	7.1	63.3	6.5	23.1	0.0	99.7	98.7	33.8	30.3%	-
EB2-B	SS-113	20+77	43'RT	500,718	2,005,959	44.3-45.8	24-1468	A-2-4 (0)	NP	NP	73.6	13.6	4.2	8.6	0.0	100.0	66.0	13.9	24.3%	-
EB2-B	SS-117	20+77	43'RT	500,718	2,005,959	64.3-65.8	24-1469	A-1-b (0)	NP	NP	79.8	9.3	3.6	7.3	0.0	97.6	31.2	11.7	28.5%	-
MSE-2B	SS-124	20+85	127'RT	500,636	2,005,985	9.3-10.8	24-1481	A-2-6 (0)	32	13	66.0	13.5	1.5	19.0	0.0	98.9	56.4	21.3	27.3%	-
MSE-2B	SS-128	20+85	127'RT	500,636	2,005,985	24.3-25.8	24-1482	A-6 (6)	32	12	2.2	37.8	18.8	41.2	0.0	99.9	98.8	65.6	30.3%	-
MSE-2B	SS-129	20+85	127'RT	500,636	2,005,985	29.3-30.8	24-1459	A-6 (14)	40	13	0.6	13.4	31.6	54.4	0.0	100.0	99.5	91.5	30.8%	-
MSE-2B	SS-132	20+85	127'RT	500,636	2,005,985	49.4-50.9	24-1460	A-7-6 (13)	41	21	13.4	19.4	14.1	53.1	0.0	99.7	93.7	70.7	29.3%	-

Chad Hawkins

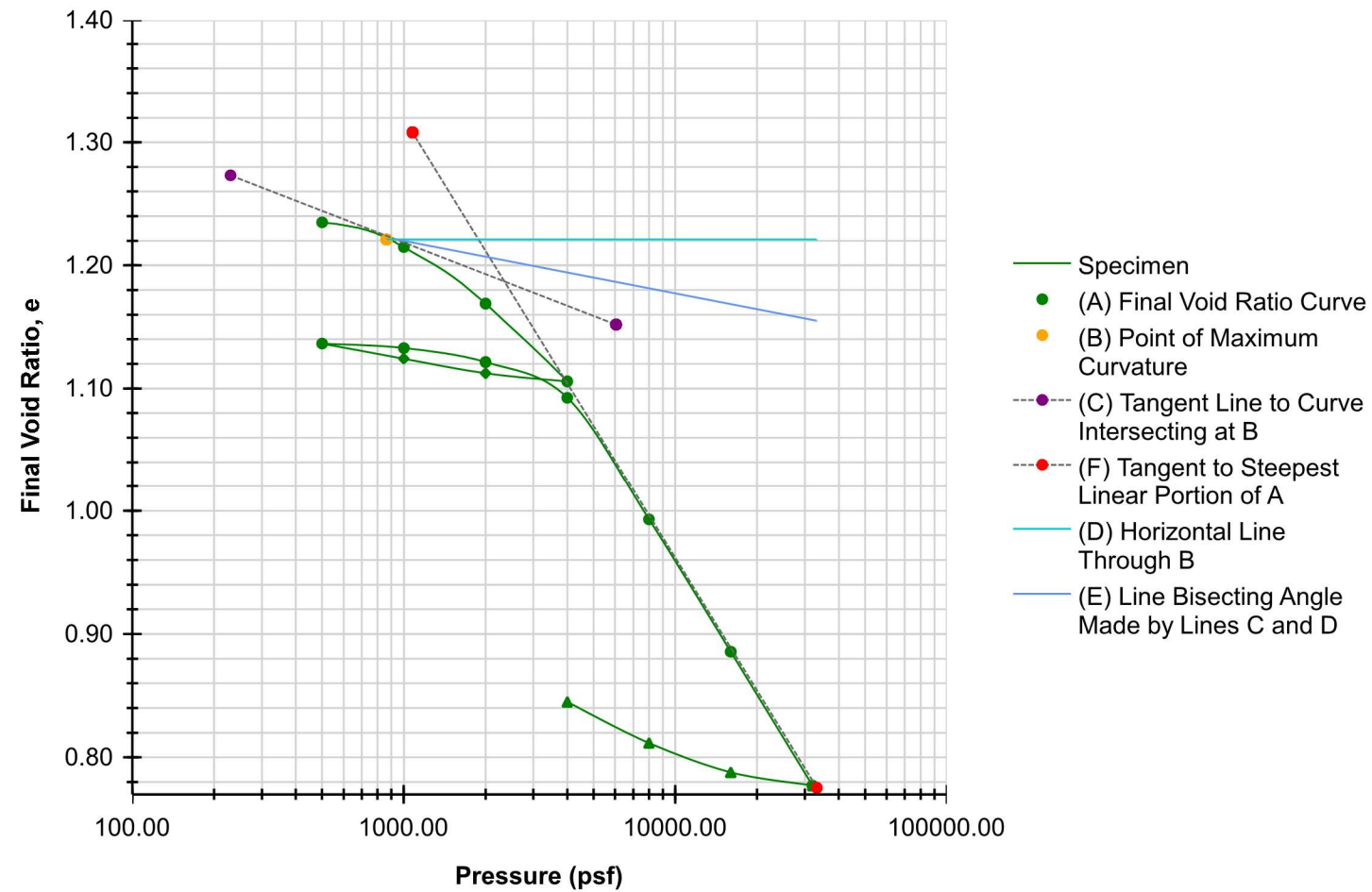
Certified Lab Technician Signature

147-02-0821

Certification Number

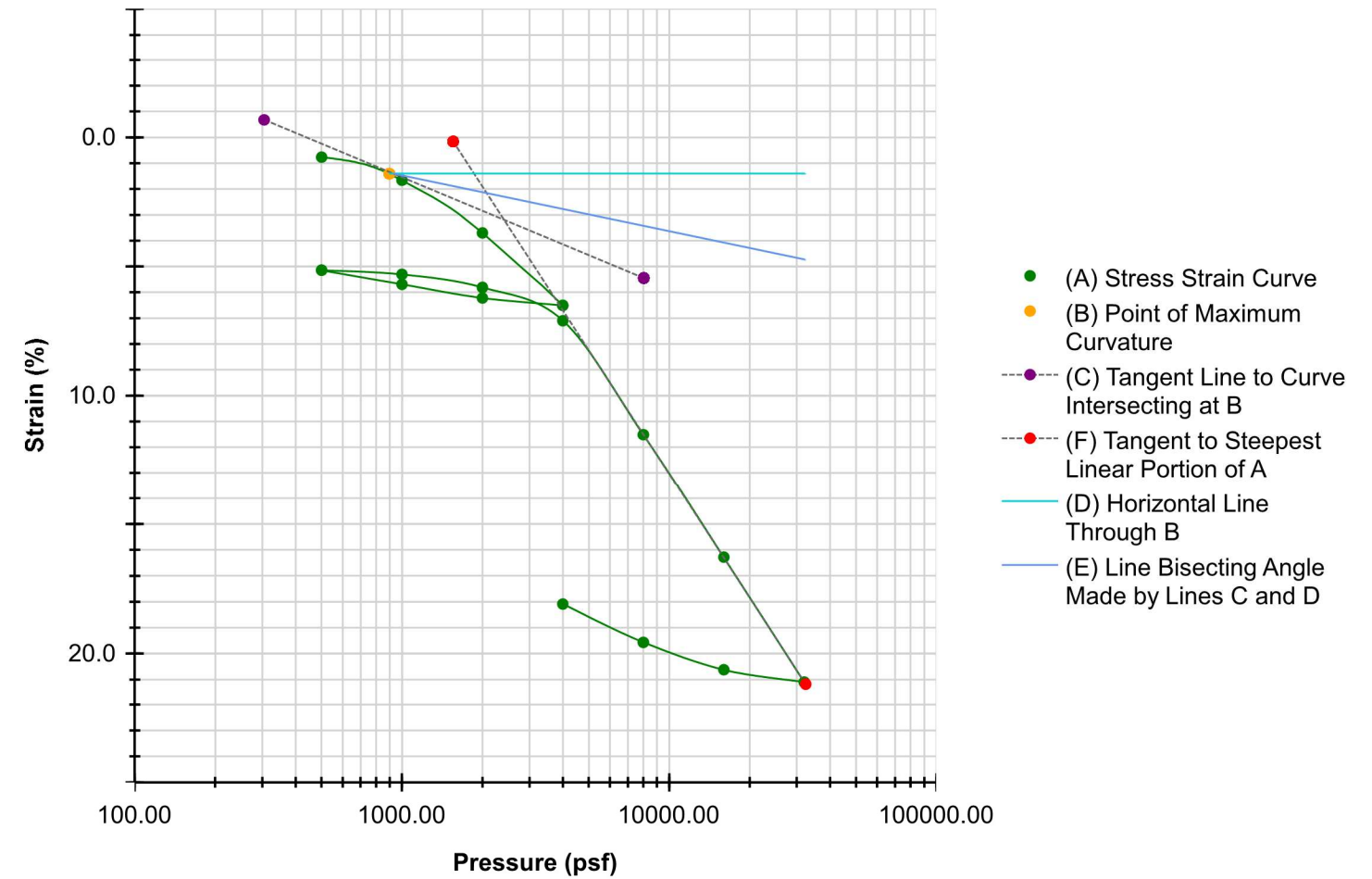
Final Voids [Log]

ASTM D2435



Percent Strain [Log]

ASTM D2435



Preconsolidation Stress (psf)	2072.24	Cc	0.362	Cr	0.037
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	BEFORE	AFTER	Liquid Limits	65	Test Date	8/26/2024
Moisture (%)	45.9	36.4	Plastic Limits	31		
Dry Density (pcf)	75.3	93.4				
Saturation (%)	99.4	121.2				
Void Ratio	1.26	0.82	Specific Gravity	2.72	ASSUMED	

Sample Description	tan/brown/gray clay		
Project Number	23-045.01	Depth (ft)	28-30
Sample Number	ST-1	Boring Number	MSE-2B
Project	Gruber Road over All American Freeway		
Client			
Location			

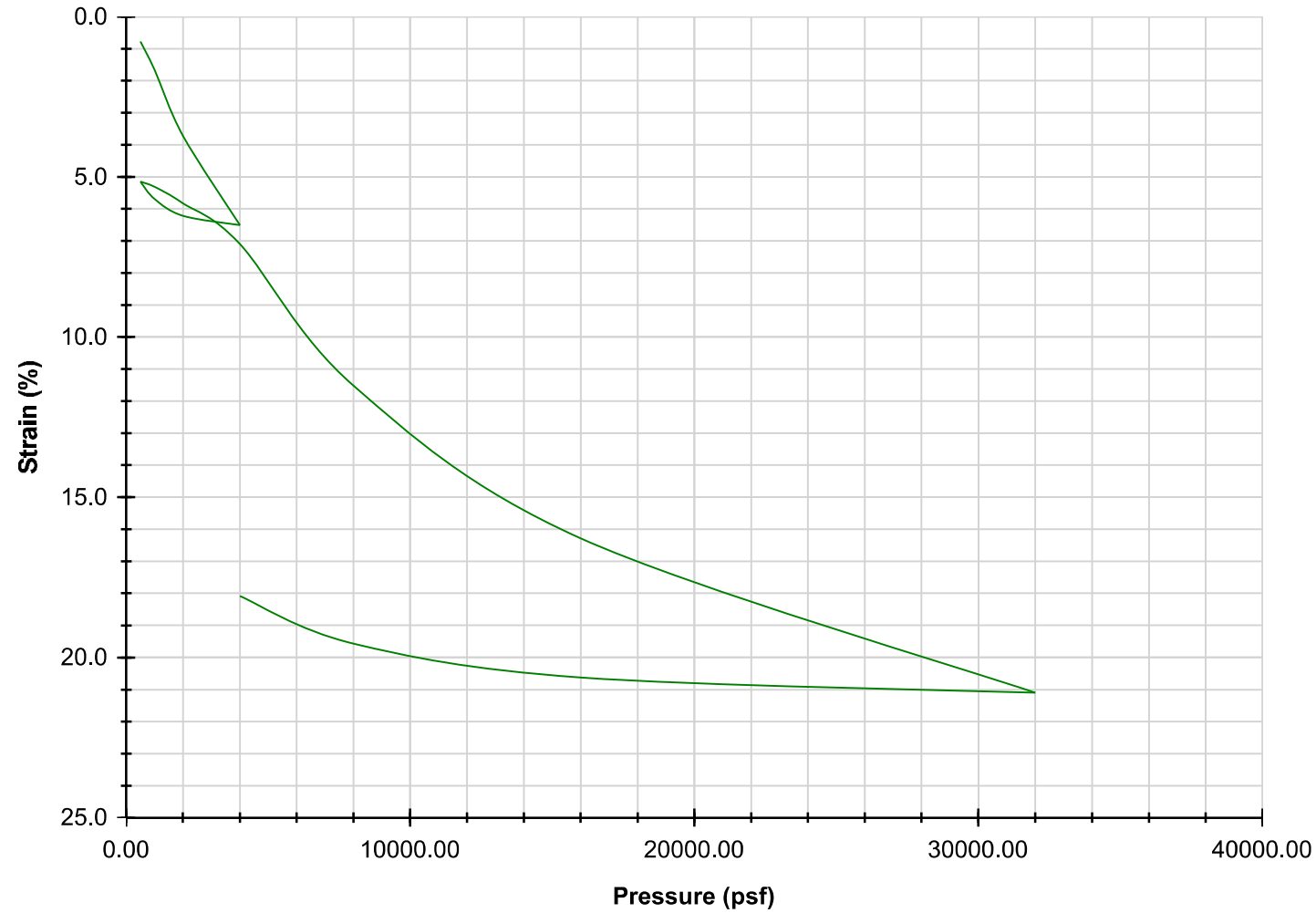
Preconsolidation Stress (psf)	2074.74
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	BEFORE	AFTER	Liquid Limits	65	Test Date	8/26/2024
Moisture (%)	45.9	36.4	Plastic Limits	31		
Dry Density (pcf)	75.3	93.4				
Saturation (%)	99.4	121.2				
Void Ratio	1.26	0.82	Specific Gravity	2.72	ASSUMED	

Sample Description	tan/brown/gray clay		
Project Number	23-045.01	Depth (ft)	28-30
Sample Number	ST-1	Boring Number	MSE-2B
Project	Gruber Road over All American Freeway		
Client			
Location			

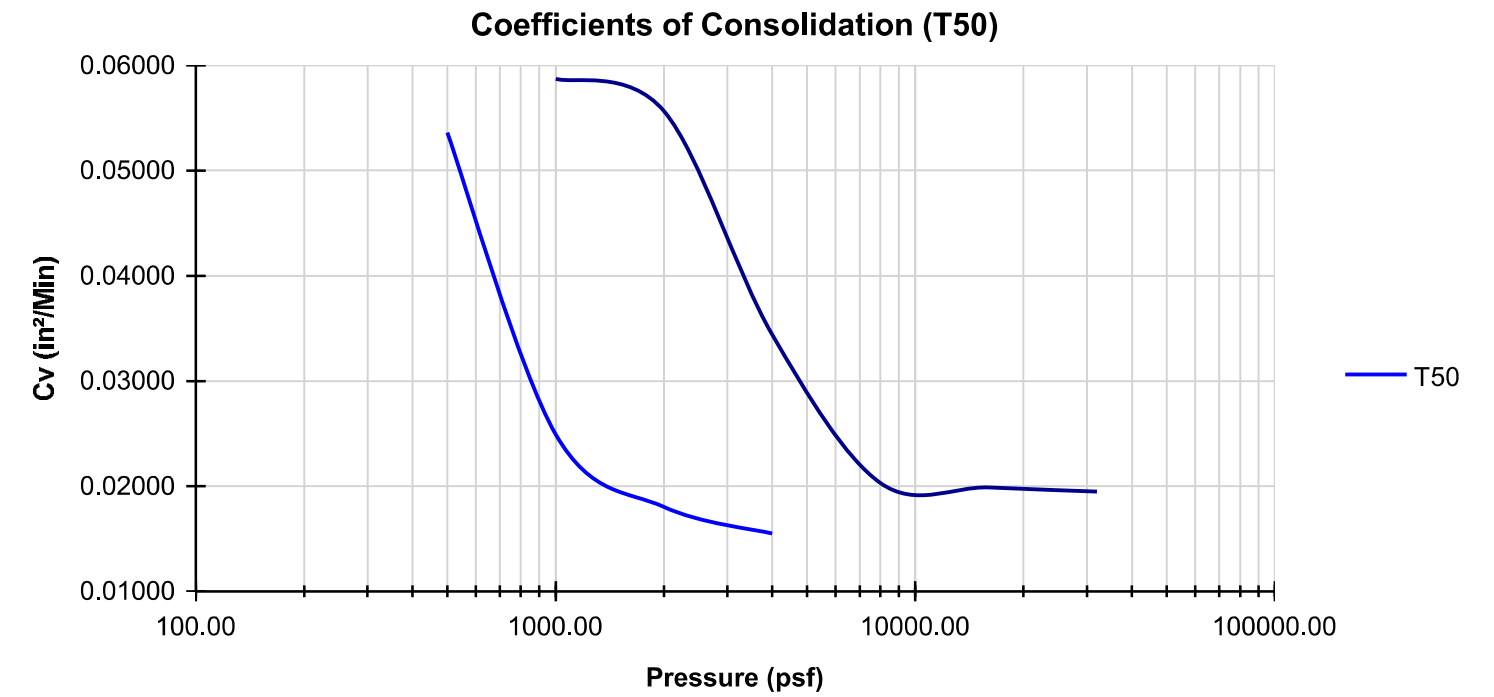
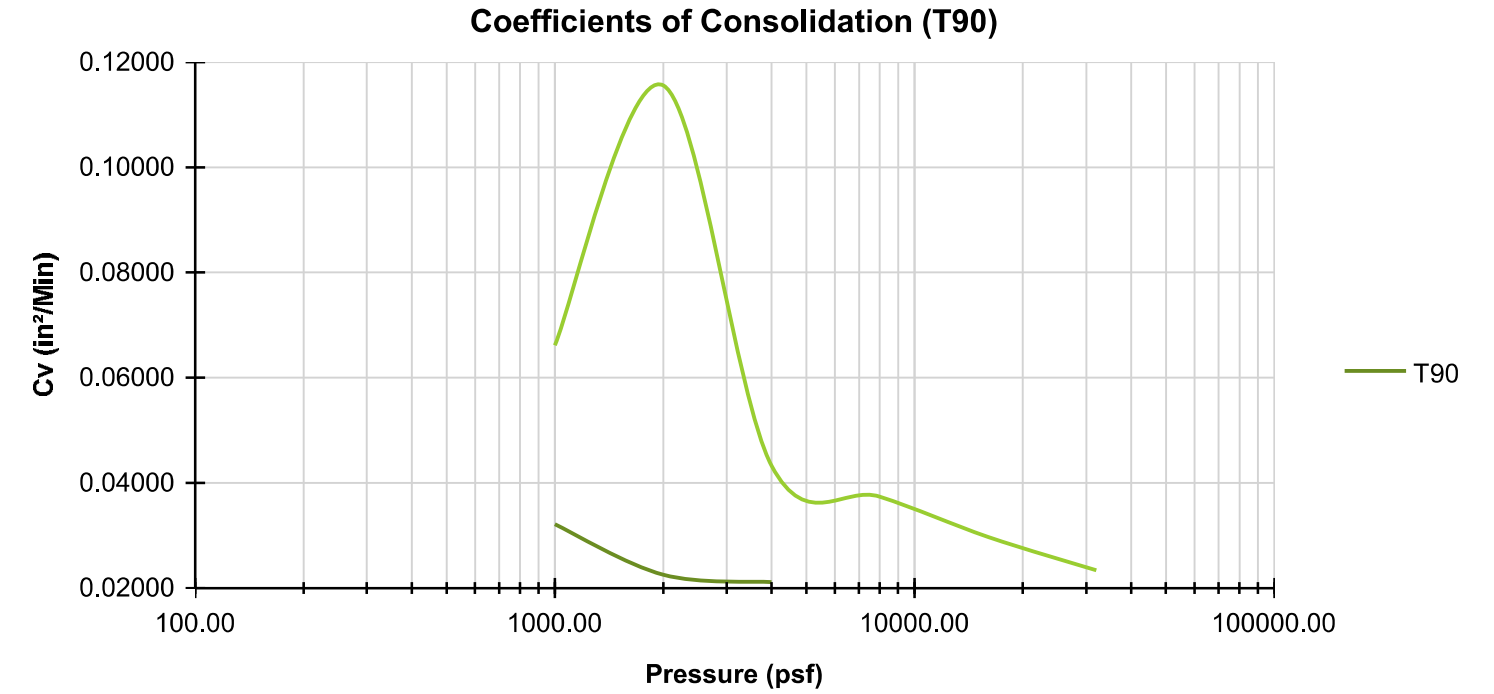
Percent Strain

ASTM D2435



Coefficients of Consolidation

ASTM D2435

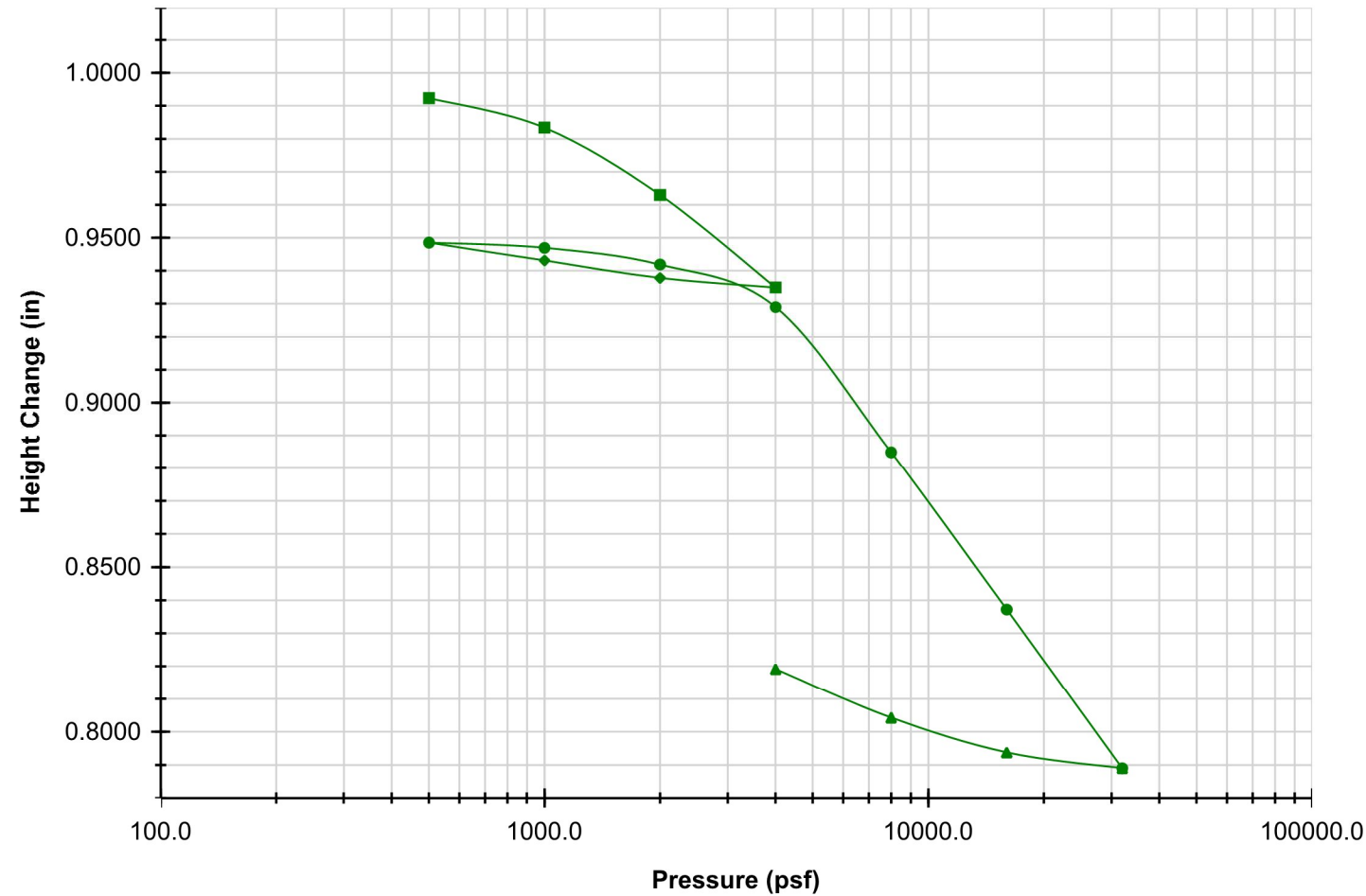


	BEFORE	AFTER	Liquid Limits	65	Test Date 8/26/2024
Moisture (%)	45.9	36.4	Plastic Limits	31	
Dry Density (pcf)	75.3	93.4			
Saturation (%)	99.4	121.2			
Void Ratio	1.26	0.82	Specific Gravity	2.72	ASSUMED

Sample Description	tan/brown/gray clay				
Project Number	23-045.01	Depth (ft)	28-30	Remarks	
Sample Number	ST-1	Boring Number	MSE-2B		
Project	Gruber Road over All American Freeway				
Client					
Location					

Height Change [Log]

ASTM D2435



Consolidation Test - Results

Summary

AS1M D2435

Sample Description	tan/brown/gray clay			Remarks
Project Number	23-045.01	Depth (ft)	28-30	
Sample Number	ST-1	Boring Number	MSE-2B	
Project Client	Gruber Road over All American Freeway			
Location				

Index	Loading Sequence (psf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Voids (in)	Vertical Strain (%)	Void Ratio	T90 Litting Time (Hr)	T150 Litting Time (Hr)	T90 Cv (in ² /Min)	T50 Cv (in ² /Min)	Sequence Status
0	0.00	0.0000	1.0000	0.0000	0.0	1.256	0.000	0.000	0.00000	0.00000	ENABLED
1	500.00	0.0077	0.9923	0.5483	0.8	1.235	0.008	0.015	0.00000	0.05361	ENABLED
2	1,000.00	0.0166	0.9834	0.5394	1.7	1.215	0.106	0.032	0.03210	0.02492	ENABLED
3	2,000.00	0.0370	0.9630	0.5190	3.7	1.169	0.146	0.042	0.02252	0.01801	ENABLED
4	4,000.00	0.0651	0.9349	0.4910	6.5	1.106	0.146	0.046	0.02114	0.01551	ENABLED
5	2,000.00	0.0622	0.9378	0.4938	6.2	1.112	0.000	0.000	0.00000	0.00000	ENABLED
6	1,000.00	0.0569	0.9431	0.4991	5.7	1.124	0.000	0.000	0.00000	0.00000	ENABLED
7	500.00	0.0515	0.9485	0.5046	5.1	1.136	0.000	0.000	0.00000	0.00000	ENABLED
8	1,000.00	0.0531	0.9470	0.5030	5.3	1.133	0.048	0.013	0.06615	0.05872	ENABLED
9	2,000.00	0.0581	0.9419	0.4979	5.8	1.121	0.027	0.013	0.11556	0.05565	ENABLED
10	4,000.00	0.0710	0.9290	0.4850	7.1	1.092	0.070	0.021	0.04332	0.03441	ENABLED
11	8,000.00	0.1151	0.8849	0.4409	11.5	0.993	0.074	0.032	0.03740	0.02032	ENABLED
12	16,000.00	0.1628	0.8372	0.3932	16.3	0.886	0.083	0.029	0.02971	0.01987	ENABLED
13	32,000.00	0.2110	0.7890	0.3450	21.1	0.777	0.094	0.026	0.02338	0.01948	ENABLED
14	16,000.00	0.2062	0.7938	0.3498	20.6	0.788	0.000	0.000	0.00000	0.00000	ENABLED
15	8,000.00	0.1957	0.8043	0.3604	19.6	0.812	0.000	0.000	0.00000	0.00000	ENABLED
16	4,000.00	0.1809	0.8191	0.3752	18.1	0.845	0.000	0.000	0.00000	0.00000	ENABLED

	BEFORE	AFTER	Liquid Limits	65	Test Date 8/26/2024
Moisture (%)	45.9	36.4	Plastic Limits	31	
Dry Density (pcf)	75.3	93.4			
Saturation (%)	99.4	121.2			
Void Ratio	1.26	0.82	Specific Gravity	2.72	ASSUMED

Checked By: JDC

Checked Date: 9/18/2024

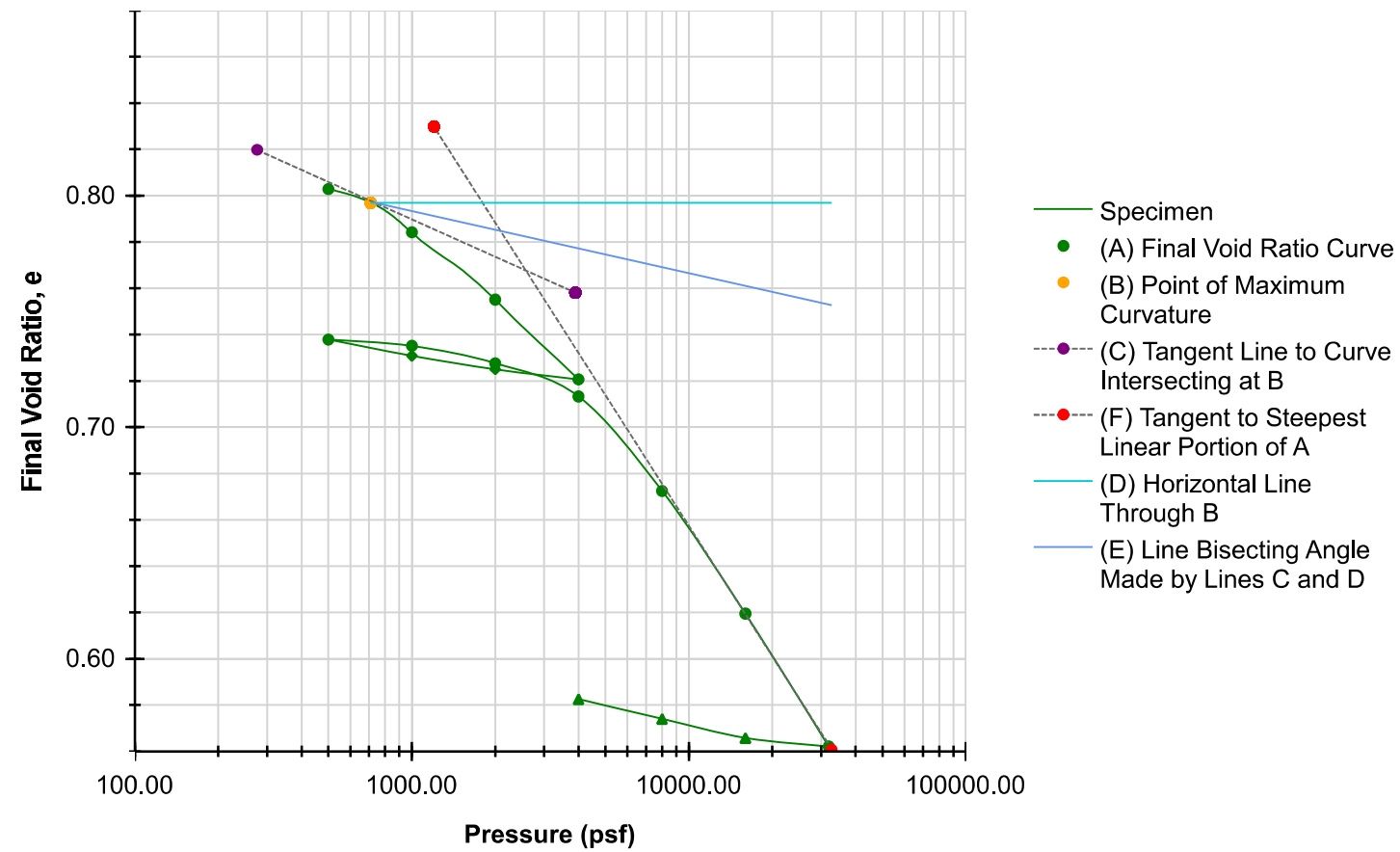
Sample Description	tan/brown/gray clay			Remarks
Project Number	23-045.01	Depth (ft)	28-30	
Sample Number	ST-1	Boring Number	MSE-2B	
Project Client	Gruber Road over All American Freeway			
Location				

Checked By: JDC

Checked Date: 9/18/2024

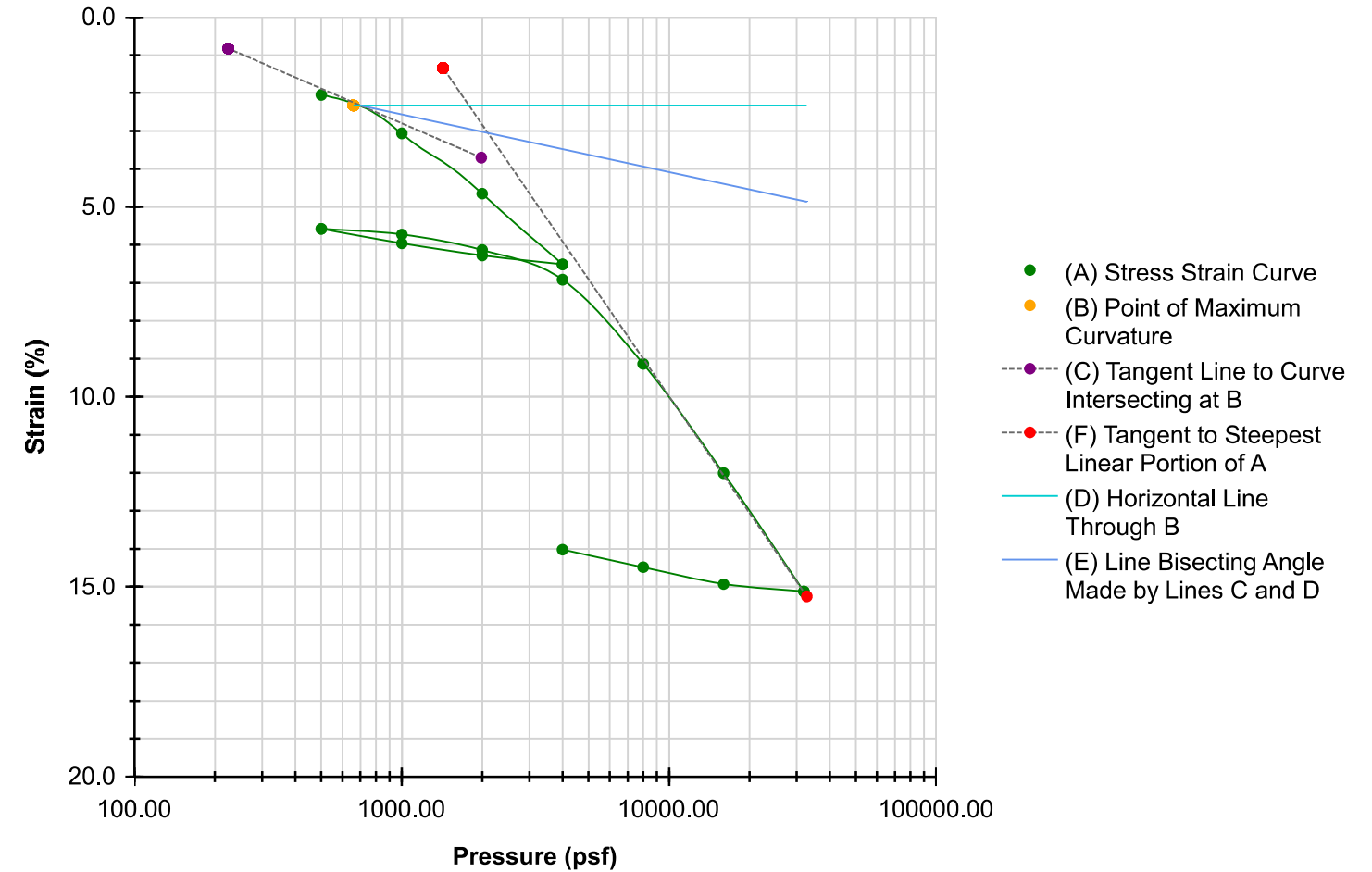
Final Voids [Log]

D2435



Percent Strain [Log]

D2435



Preconsolidation Stress (psf)	2092.73	Cc	0.186	Cr	0.021
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	BEFORE	AFTER	Liquid Limits	28	Test Date	8/26/2024
Moisture (%)	30.2	24.4	Plastic Limits	19		
Dry Density (pcf)	92.1	108.5				
Saturation (%)	97.4	117.5				
Void Ratio	0.84	0.56	Specific Gravity	2.72	ASSUMED	

Sample Description	red/brown/tan/gray silty clay with pockets of silty sand		
Project Number	23-045.01	Depth (ft)	30-32
Sample Number	ST-2	Boring Number	MSE-2B
Project	Gruber Road over All American Freeway		
Client			
Location			

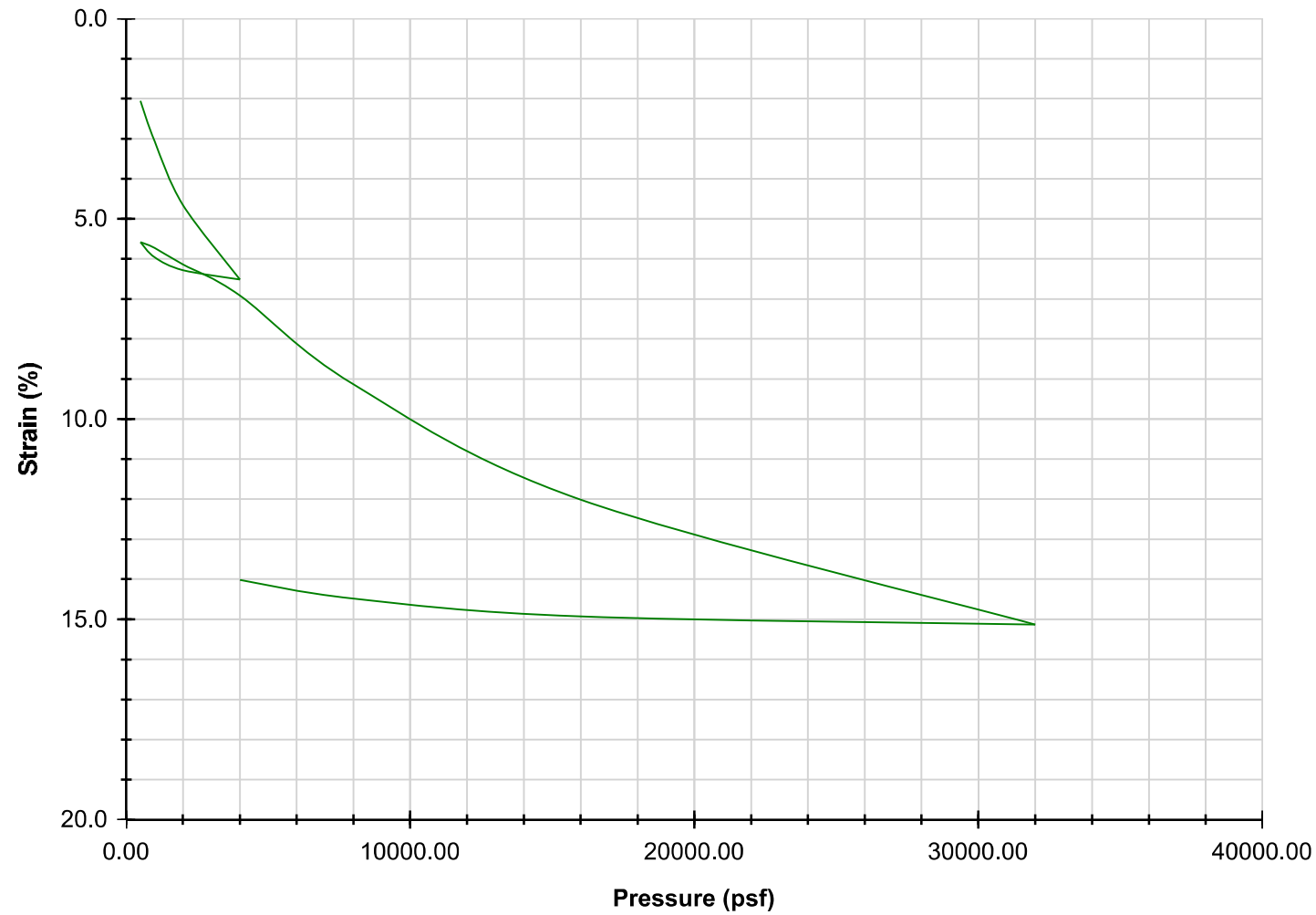
Preconsolidation Stress (psf)	2097.82
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	BEFORE	AFTER	Liquid Limits	28	Test Date	8/26/2024
Moisture (%)	30.2	24.4	Plastic Limits	19		
Dry Density (pcf)	92.1	108.5				
Saturation (%)	97.4	117.5				
Void Ratio	0.84	0.56	Specific Gravity	2.72	ASSUMED	

Sample Description	red/brown/tan/gray silty clay with pockets of silty sand		
Project Number	23-045.01	Depth (ft)	30-32
Sample Number	ST-2	Boring Number	MSE-2B
Project	Gruber Road over All American Freeway		
Client			
Location			

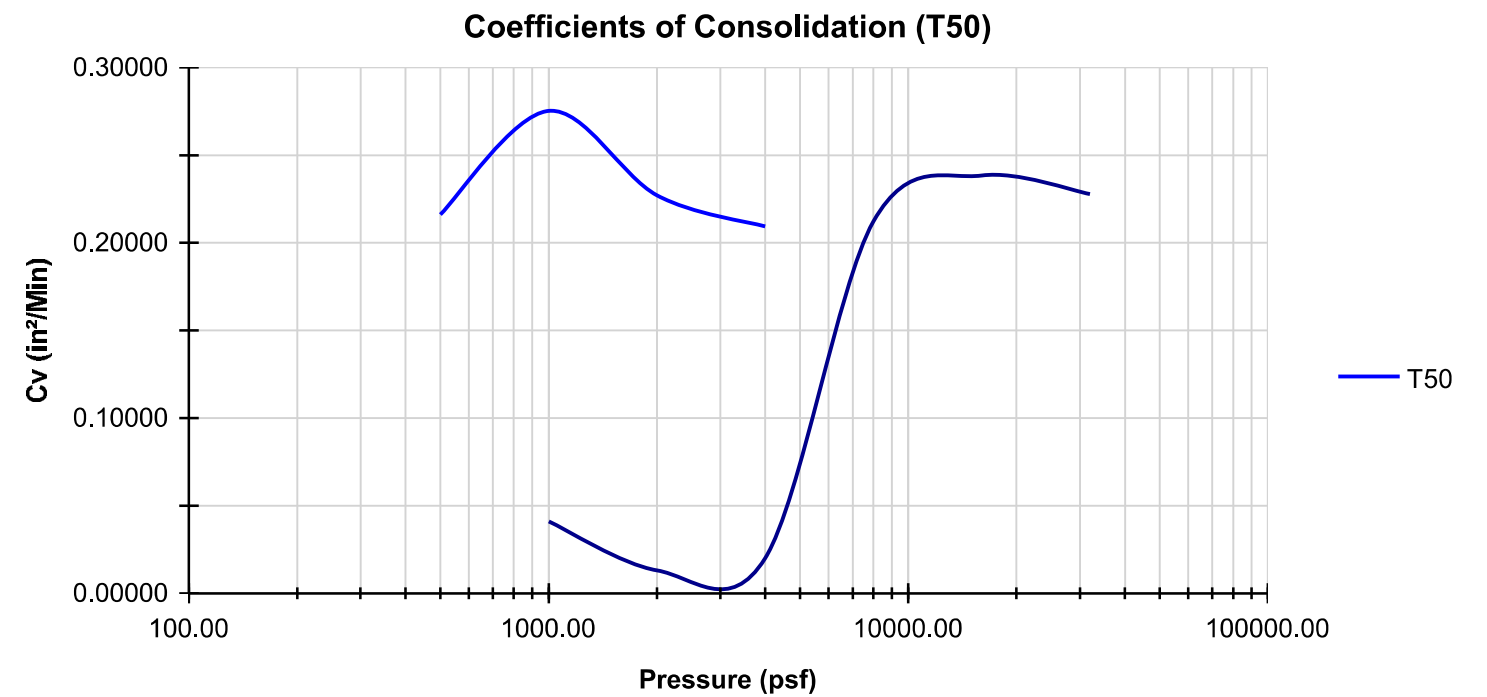
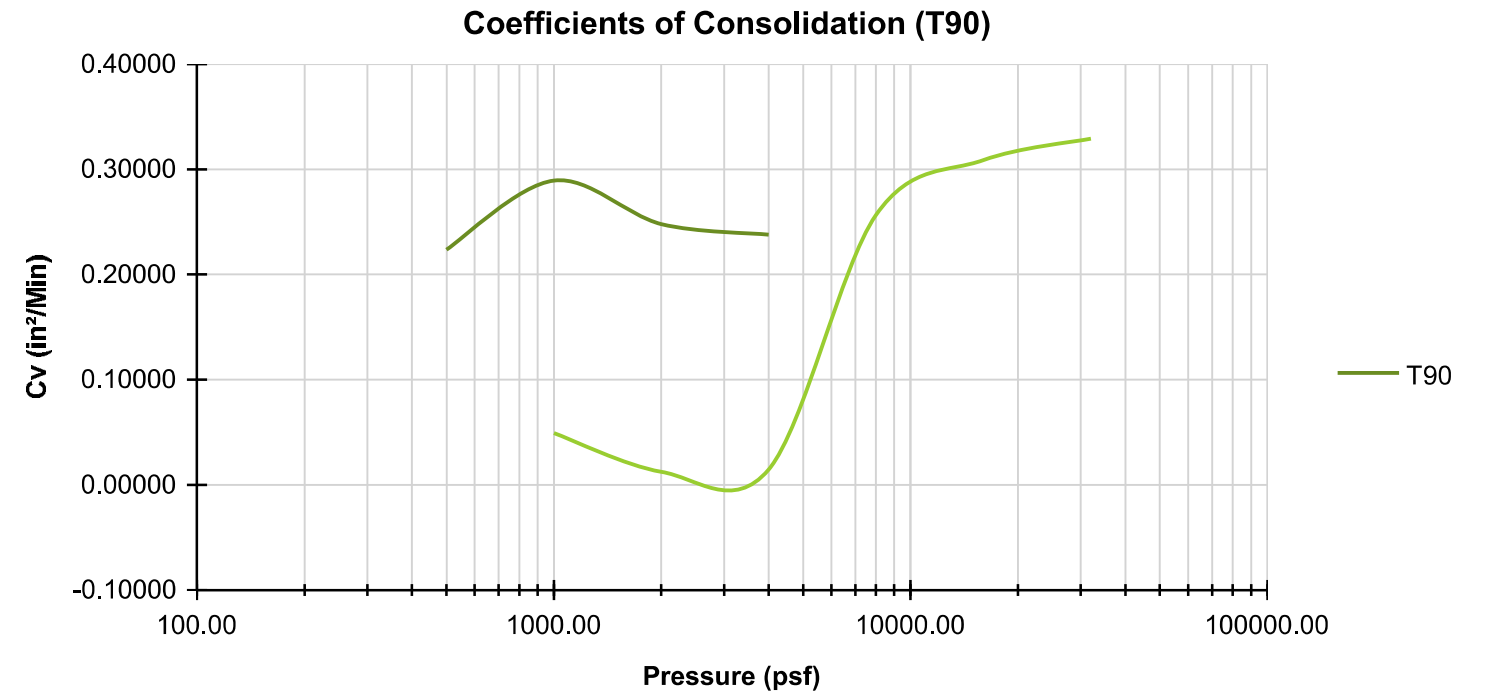
Percent Strain

D2435



Coefficients of Consolidation

D2435

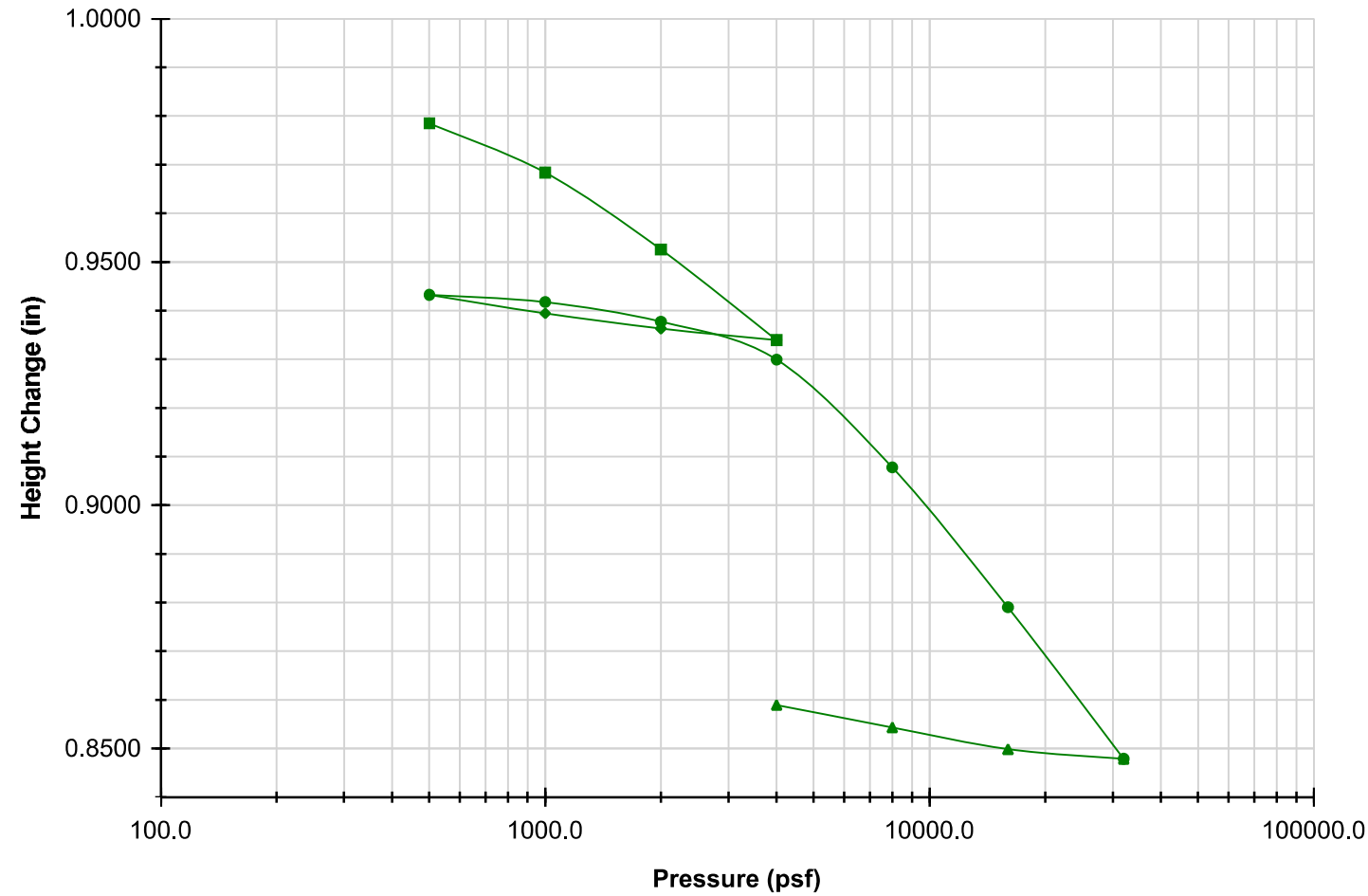


	BEFORE	AFTER	Liquid Limits	28	Test Date 8/26/2024
Moisture (%)	30.2	24.4	Plastic Limits	19	
Dry Density (pcf)	92.1	108.5			
Saturation (%)	97.4	117.5			
Void Ratio	0.84	0.56	Specific Gravity	2.72	ASSUMED

Sample Description	red/brown/tan/gray silty clay with pockets of silty sand				
Project Number	23-045.01	Depth (ft)	30-32	Remarks	
Sample Number	ST-2	Boring Number	MSE-2B		
Project	Gruber Road over All American Freeway				
Client					
Location					

Height Change [Log]

D2435



Consolidation Test - Results

Summary

D2435

Sample Description	red/brown/tan/gray silty clay with pockets of silty sand			Remarks
Project Number	23-045.01	Depth (ft)	30-32	
Sample Number	ST-2	Boring Number	MSE-2B	
Project	Gruber Road over All American Freeway			
Client				
Location				

Index	Loading Sequence (psf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Voids (in)	Vertical Strain (%)	Void Ratio	T90 Litting Time (hr)	T150 Litting Time (hr)	T90 Cv (in ² /Min)	T50 Cv (in ² /Min)	Sequence Status
0	0.00	0.0000	0.9990	0.0000	0.0	0.844	0.000	0.000	0.00000	0.00000	ENABLED
1	500.00	0.0205	0.9785	0.4357	2.1	0.803	0.015	0.004	0.22336	0.21598	ENABLED
2	1,000.00	0.0306	0.9684	0.4256	3.1	0.784	0.011	0.003	0.28938	0.27524	ENABLED
3	2,000.00	0.0464	0.9526	0.4098	4.6	0.755	0.013	0.003	0.24814	0.22706	ENABLED
4	4,000.00	0.0651	0.9339	0.3912	6.5	0.721	0.013	0.003	0.23774	0.20926	ENABLED
5	2,000.00	0.0627	0.9363	0.3935	6.3	0.725	0.000	0.000	0.00000	0.00000	ENABLED
6	1,000.00	0.0596	0.9394	0.3967	6.0	0.731	0.000	0.000	0.00000	0.00000	ENABLED
7	500.00	0.0557	0.9433	0.4005	5.6	0.738	0.000	0.000	0.00000	0.00000	ENABLED
8	1,000.00	0.0572	0.9418	0.3990	5.7	0.735	0.064	0.016	0.04913	0.04110	ENABLED
9	2,000.00	0.0613	0.9377	0.3949	6.1	0.728	0.246	0.048	0.01264	0.01313	ENABLED
10	4,000.00	0.0691	0.9299	0.3872	6.9	0.713	0.208	0.030	0.01466	0.02022	ENABLED
11	8,000.00	0.0912	0.9078	0.3650	9.1	0.672	0.011	0.003	0.25636	0.21209	ENABLED
12	16,000.00	0.1200	0.8790	0.3362	12.0	0.620	0.009	0.002	0.30867	0.23832	ENABLED
13	32,000.00	0.1511	0.8479	0.3051	15.1	0.562	0.008	0.002	0.32902	0.22769	ENABLED
14	16,000.00	0.1492	0.8498	0.3071	14.9	0.566	0.000	0.000	0.00000	0.00000	ENABLED
15	8,000.00	0.1447	0.8543	0.3115	14.5	0.574	0.000	0.000	0.00000	0.00000	ENABLED
16	4,000.00	0.1401	0.8589	0.3162	14.0	0.582	0.000	0.000	0.00000	0.00000	ENABLED

	BEFORE	AFTER	Liquid Limits	28	Test Date 8/26/2024
Moisture (%)	30.2	24.4	Plastic Limits	19	
Dry Density (pcf)	92.1	108.5			
Saturation (%)	97.4	117.5			
Void Ratio	0.84	0.56	Specific Gravity	2.72	ASSUMED

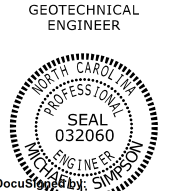
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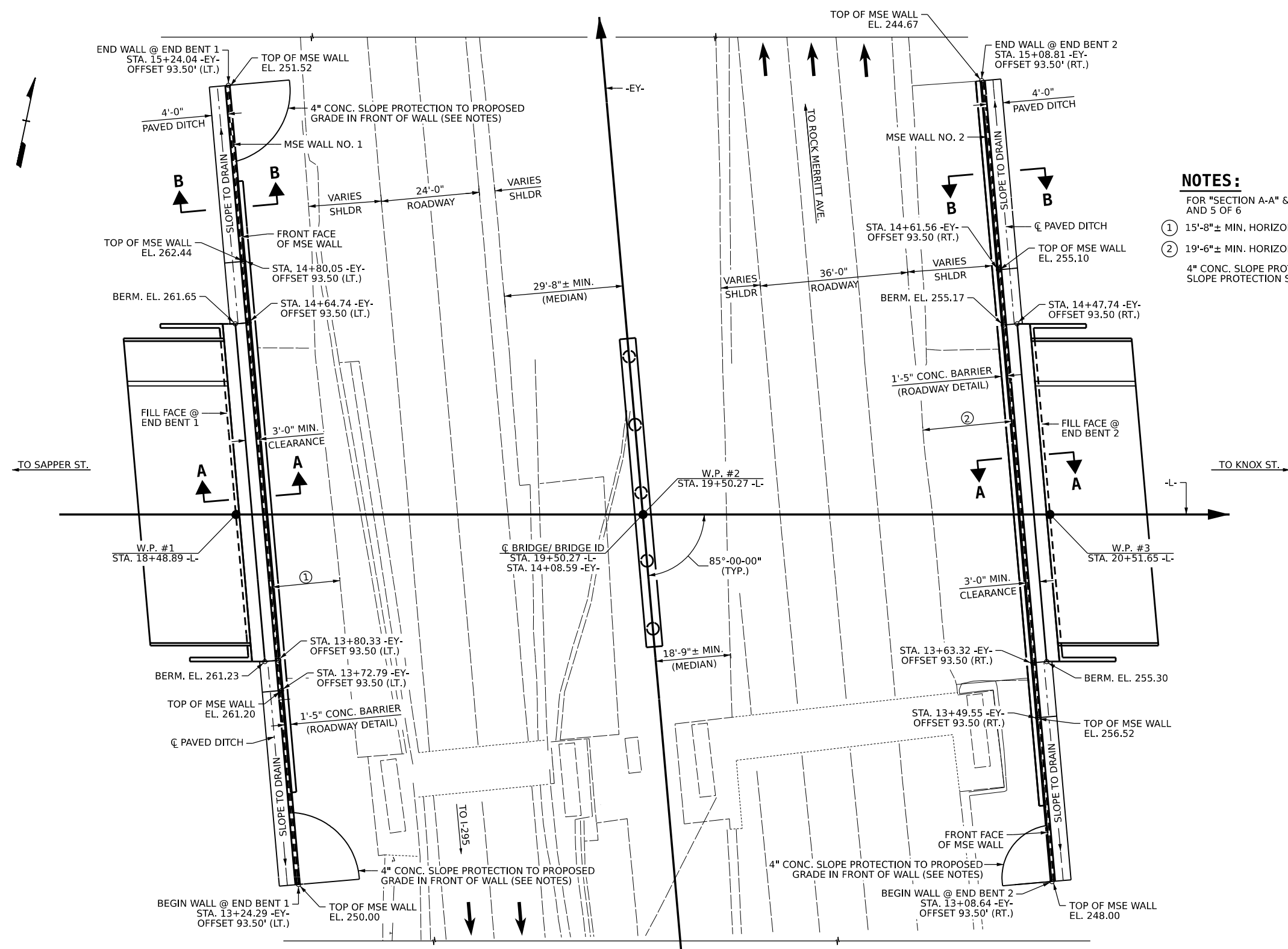
Checked Date: 9/18/2024

Sample Description	red/brown/tan/gray silty clay with pockets of silty sand		
Project Number	23-045.01	Depth (ft)	30-32
Sample Number	ST-2	Boring Number	MSE-2B
Project	Gruber Road over All American Freeway		
Client			
Location			

Checked By: JDC

Checked Date: 9/18/2024

GEOTECHNICAL ENGINEER  Michael G. Simpson 05/25/2025	ENGINEER _____ DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



- NOTES:**
- FOR "SECTION A-A" & "SECTION B-B", SEE SHEET 4 AND 5 OF 6
 - ① 15'-8"± MIN. HORIZONTAL CL. FROM E.O.P TO MSE WALL.
 - ② 19'-6"± MIN. HORIZONTAL CL. FROM E.O.P TO MSE WALL.
 - 4" CONC. SLOPE PROTECTION IS INCIDENTAL TO THE 4" INCH SLOPE PROTECTION STRUCTURES PAY ITEM.

PLAN

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 1 OF 6

PREPARED BY: E. BENSON DATE: 05/25
 REVIEWED BY: M. SIMPSON DATE: 05/25




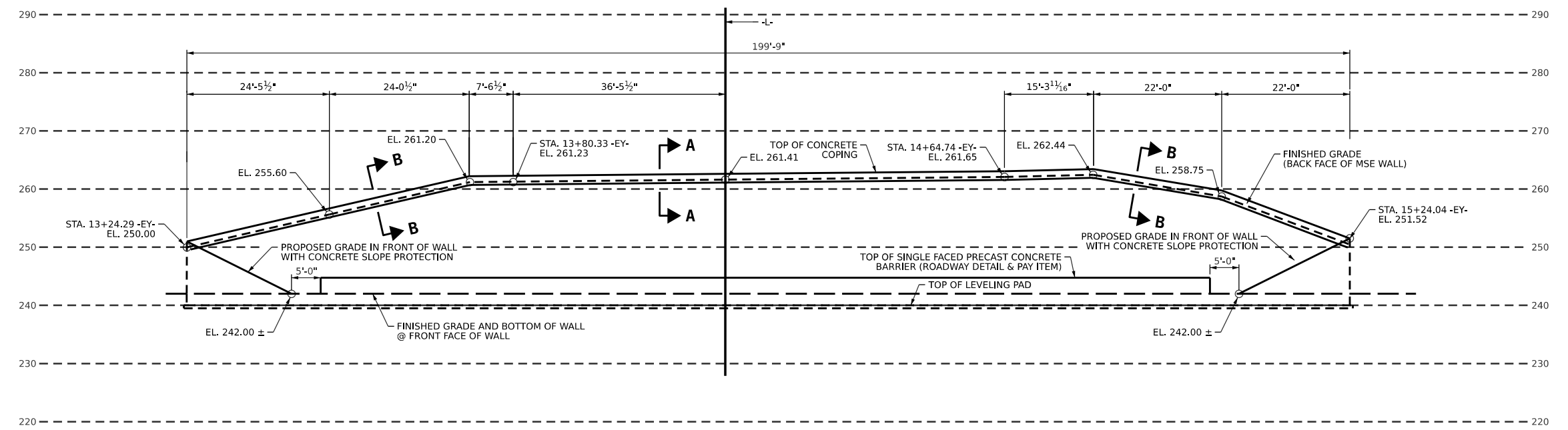
NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

 GEOTECHNICAL
 ENGINEERING UNIT

MSE WALL NO. 1 AT END BENT NO. 1 & MSE WALL NO. 2 AT END BENT NO. 2					
PLAN VIEW					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-1

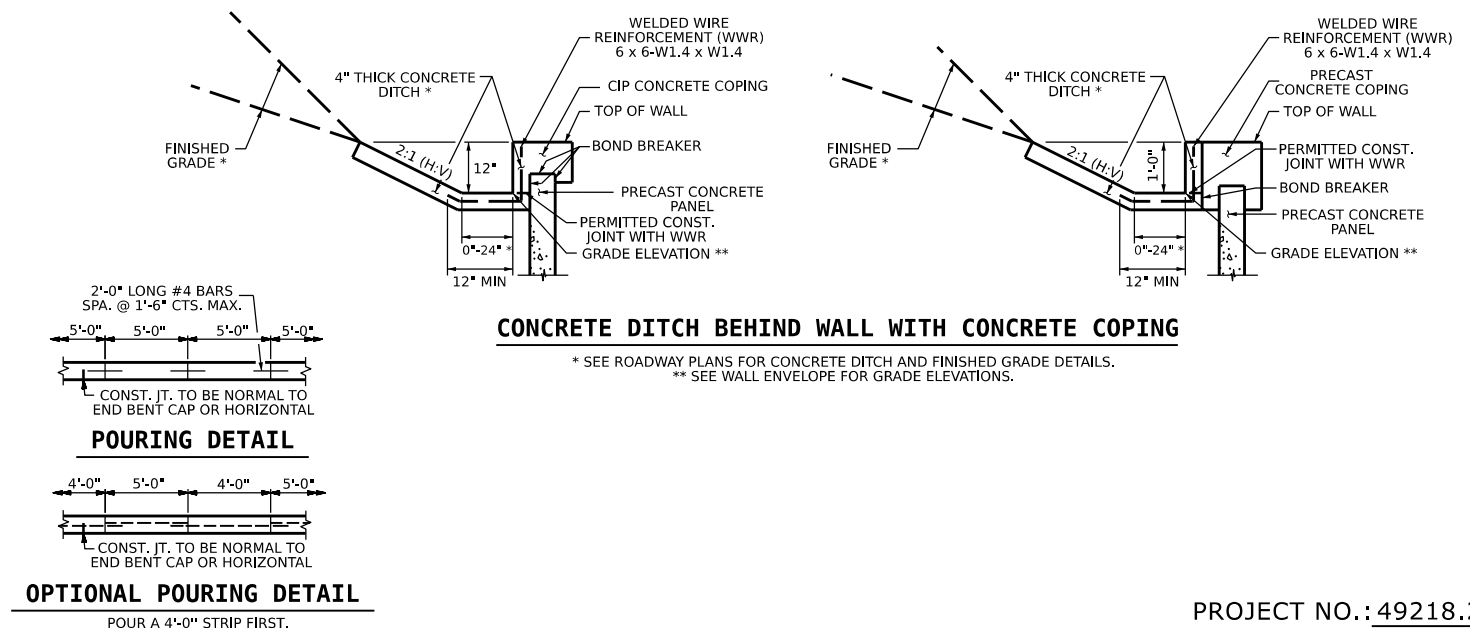
GEOTECHNICAL ENGINEER  Michael S. Simpson 05/25/2025	ENGINEER _____ DATE SIGNATURE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



LOOKING DOWNSTATION (-L-) @ FRONT FACE OF MSE WALL @ END BENT 1

NOTES:

FOR CONCRETE DITCHES, SEE SECTION 850 OF THE STANDARD SPECIFICATIONS.
 FOR ADDITIONAL MSE WALL AND COPING DETAILS, SEE SHEETS 4 AND 5 OF 6.
 SLOPE PROTECTION SHALL BE PLACED UNDER THE ENDS OF THE BRIDGE AS SHOWN IN THE DETAILS.
 SLOPE PROTECTION SHALL CONSIST OF 4" POURED-IN-PLACE CONCRETE PAVING AS SHOWN IN THE DETAILS ON THIS SHEET. SEE SHEET 4 AND 5 OF 6 FOR ADDITIONAL DETAILS. CONCRETE SHALL BE CLASS "B". THE CONCRETE SURFACE SHALL BE FLOATED WITH A WOODEN FLOAT AND FINISHED. WELDED WIRE FABRIC REINFORCING SHALL BE 6 X 6 - W1.4 X W1.4, 60" WIDE. SLOPE PROTECTION SHALL BE POURED IN 5' STRIPS AS SHOWN IN THE "POURING DETAIL" WITH 2'-0" LONG #4 BARS PLACED ALONG THE SLOPE BETWEEN STRIPS AT 1'-6" MAXIMUM SPACING. SLOPE PROTECTION MAY BE POURED IN ALTERNATE 4' AND 5' STRIPS AS SHOWN IN THE "OPTIONAL POURING DETAIL" WITH ADJACENT RUNS OF WELDED WIRE FABRIC LAPPING AT LEAST 6".
 FOR LOCATION OF CONST JOINTS & OTHER NOTES, SEE "MSE WALL NOTES", SHEET 6 OF 6.
 FOR QUANTITIES SEE SHEET 3 OF 6.



CONCRETE DITCH BEHIND WALL WITH CONCRETE COPING

* SEE ROADWAY PLANS FOR CONCRETE DITCH AND FINISHED GRADE DETAILS.
 ** SEE WALL ENVELOPE FOR GRADE ELEVATIONS.

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 2 OF 6

PREPARED BY: E. BENSON DATE: 05/25
 REVIEWED BY: M. SIMPSON DATE: 05/25




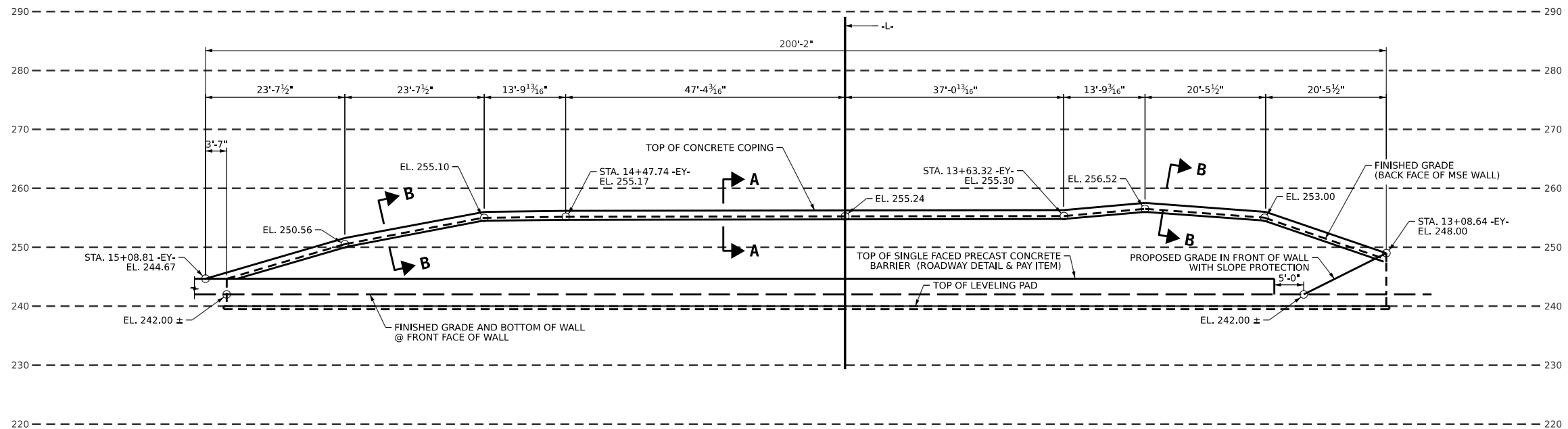
NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

 GEOTECHNICAL
 ENGINEERING UNIT

FRONT FACE OF MSE WALL NO. 1 AT END BENT NO. 1 WALL ENVELOPE					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-2

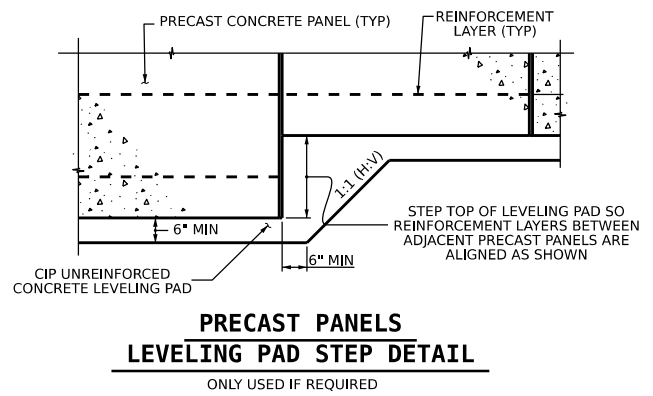
GEOTECHNICAL ENGINEER  Michael O. Simpson 05/25/2025	ENGINEER _____ SIGNATURE DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



LOOKING UPSTATION (-L-) @ FRONT FACE OF MSE WALL @ END BENT 2

ESTIMATED MSE WALL QUANTITIES (SQ. FEET)*	
WALL NO. 1	3,890
WALL NO. 2	2,695

*QUANTITY INCLUDES EMBEDMENT AND EXTENSION



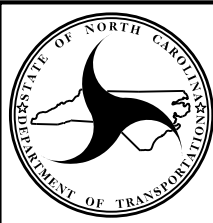
NOTES:
 FOR "SECTION A-A", & "SECTION B-B", SEE SHEETS 4 AND 5 OF 6.
 FOR MSE WALL NOTES, SEE SHEET 6 OF 6.

BRIDGE @ STA. 19+50.27 -L-	4" INCH SLOPE PROTECTION	* WELDED WIRE FABRIC 60 INCHES WIDE
	SQUARE YARDS	APPROX. L.F.
END BENT 1	26	52
END BENT 2	26	52

* QUANTITY SHOWN IS BASED ON 5' POURS.

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 3 OF 6

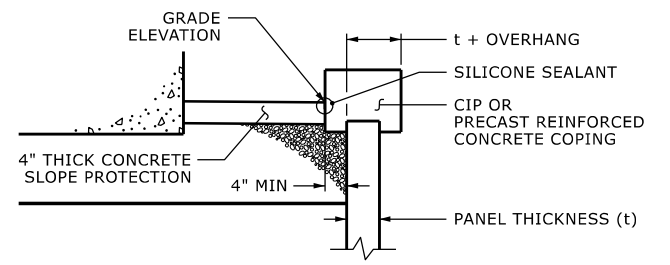
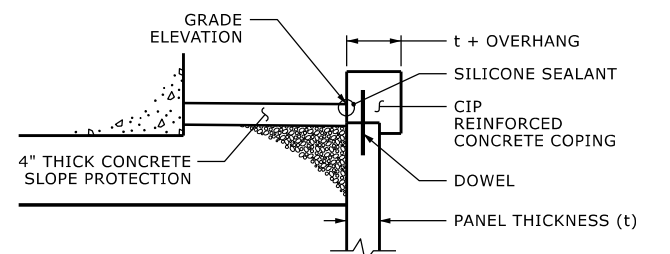
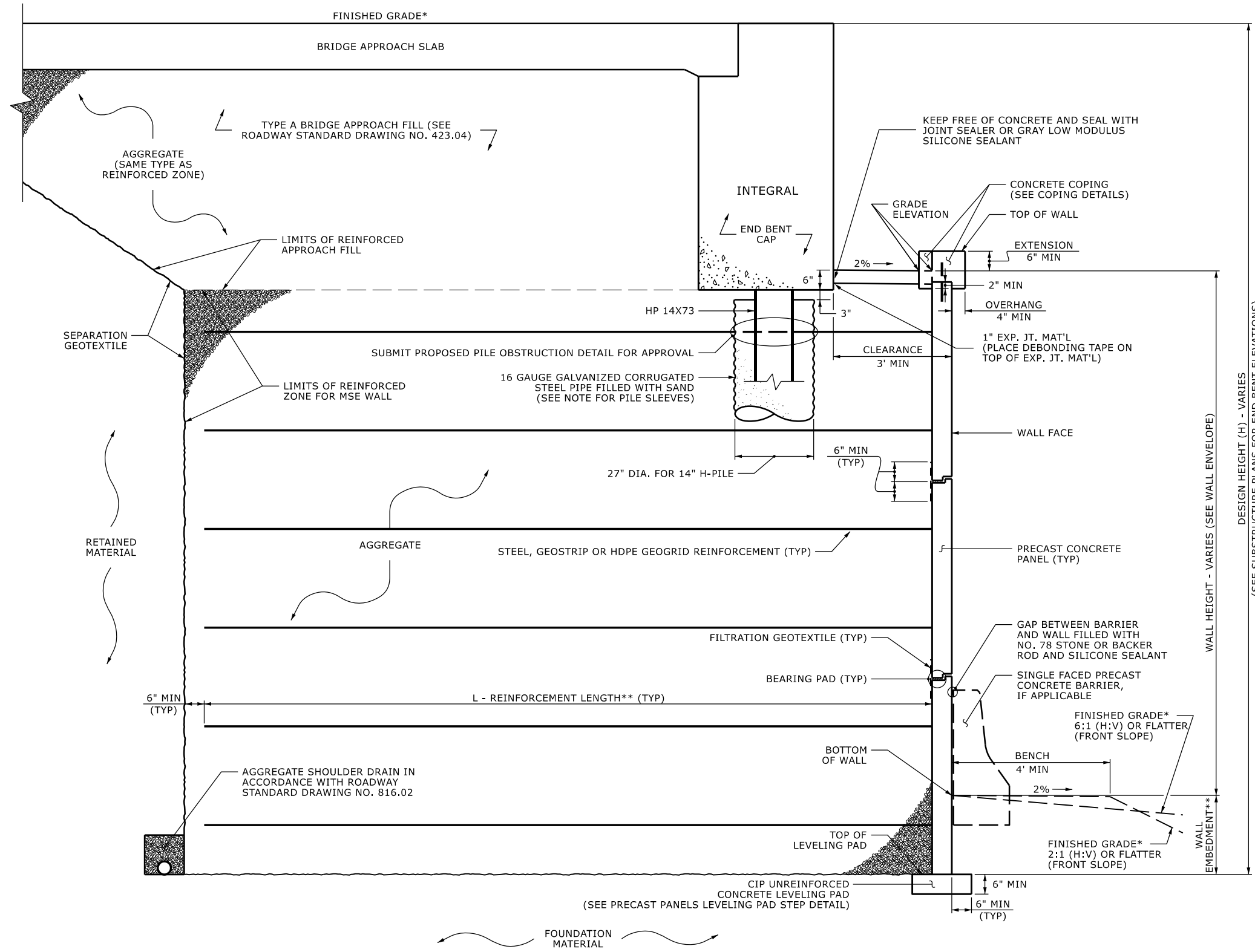
PREPARED BY: E. BENSON DATE: 05/25
 REVIEWED BY: M. SIMPSON DATE: 05/25



NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
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 GEOTECHNICAL ENGINEERING UNIT

FRONT FACE OF MSE WALL NO. 2 AT END BENT NO. 2 WALL ENVELOPE					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-3



COPING DETAILS
 AT THE CONTRACTOR'S OPTION,
 CONNECT COPING TO PANELS WITH DOWELS
 OR EXTEND COPING DOWN BACK OF PANELS.

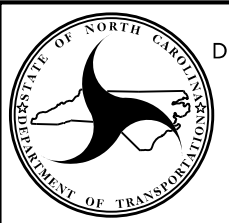
MSE ABUTMENT WALL WITH PRECAST PANELS - TYPICAL SECTION (A-A)

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.
 **SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE,
 MSE WALL NOTES FOR WALL EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 4 OF 6

GEOTECHNICAL ENGINEER Michael G. Simpson 05/25/2025	ENGINEER _____ DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

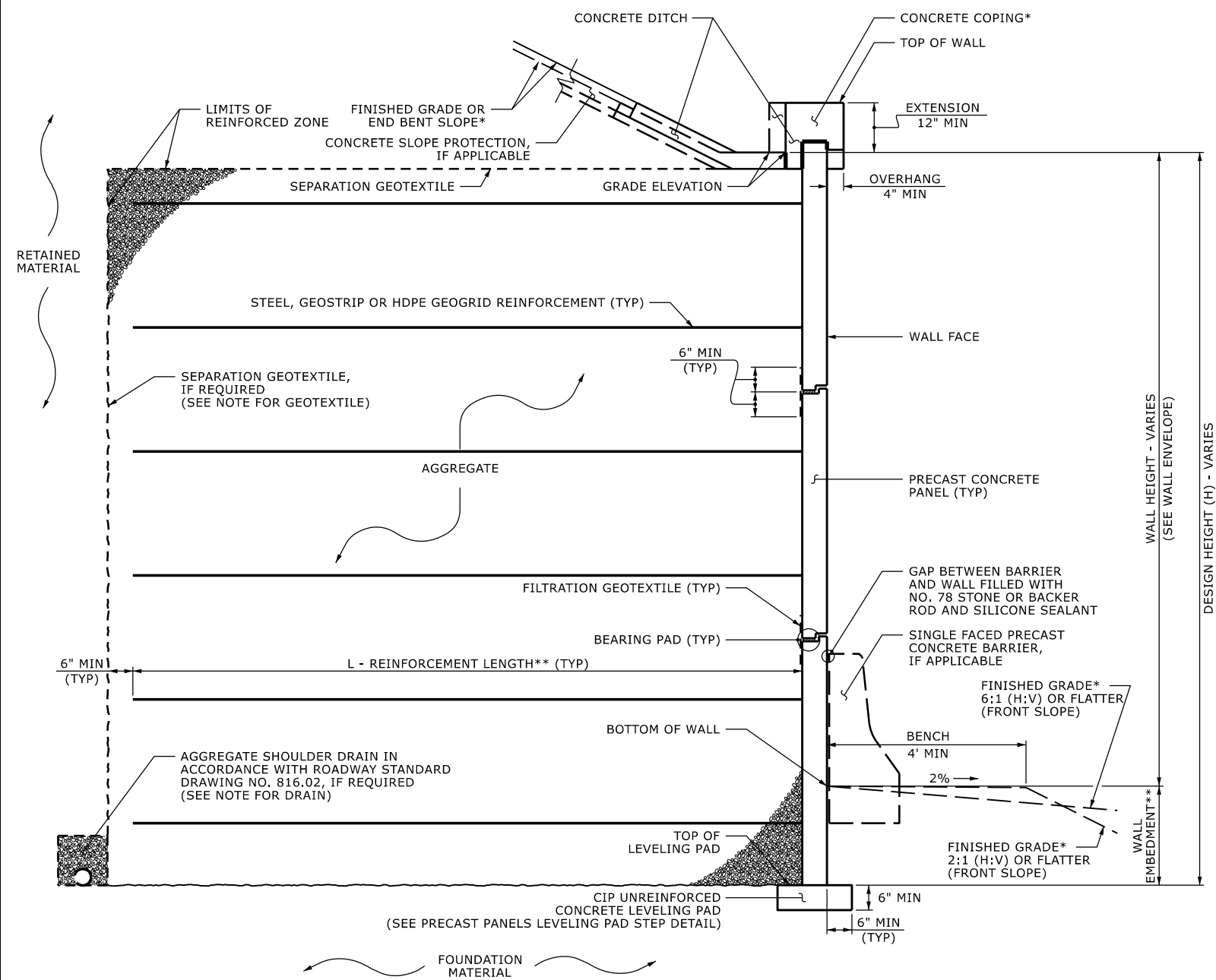
PREPARED BY: E. BENSON	DATE: 05/25
REVIEWED BY: M. SIMPSON	DATE: 05/25



NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
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 ENGINEERING UNIT

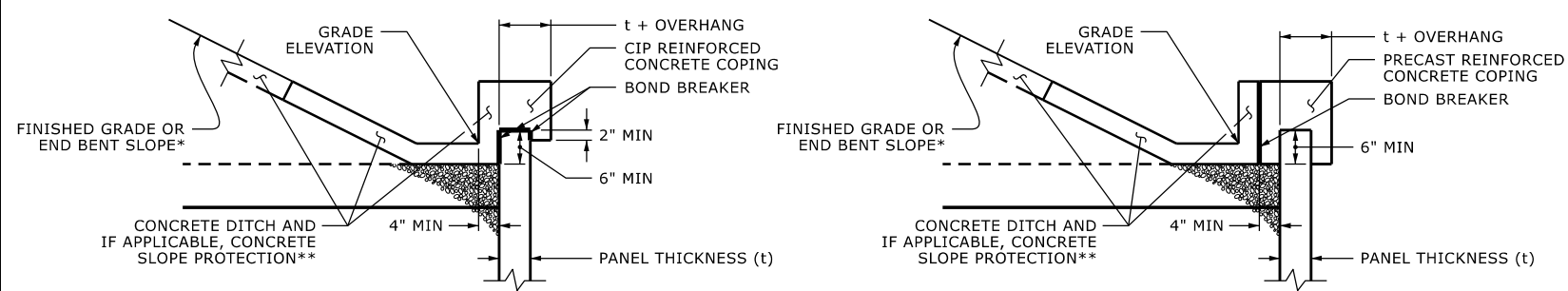
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-4



MSE WALL WITH PRECAST PANELS - TYPICAL SECTION (B-B)

*SEE COPING DETAILS AND PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.
 **SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR WALL EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.



COPING DETAILS

*SEE PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.
 **SEE CONCRETE DITCH BEHIND WALL DETAILS.

GEOTECHNICAL ENGINEER Michael S. Simpson 05/25/2025	ENGINEER _____ SIGNATURE DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 5 OF 6

PREPARED BY: E. BENSON DATE: 05/25
 REVIEWED BY: M. SIMPSON DATE: 05/25



NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS

 GEOTECHNICAL
 ENGINEERING UNIT

REVISIONS						SHEET NO. W-5
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

MSE WALL NOTES:

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.
 FOR TYPE 2A BRIDGE APPROACH FILL, SEE BRIDGE APPROACH FILLS PROVISION AND ROADWAY STANDARD DRAWING NO. 423.04
 FOR SINGLE FACED PRECAST CONCRETE BARRIER, SEE ROADWAY PLANS AND SECTION 857 OF THE STANDARD SPECIFICATIONS.
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALLS AT WALL NO. 1 AND WALL NO. 2.
 A DRAIN IS REQUIRED FOR RETAINING WALLS AT WALL NO. 1 AND WALL NO. 2.
 PILE SLEEVES ARE REQUIRED AROUND PILES FOR WALL NO. 1 AND WALL NO. 2 LOCATED AT STATIONS 18+48.89 AND 20+51.65 -L-, RESPECTIVELY.
 BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NO. 1 AND WALL NO. 2, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN RETAINING WALLS AT WALL NO. 1 AND WALL NO. 2 FOR THE FOLLOWING:
 1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
 2) DESIGN LIFE = 100 YEARS
 3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL SHALL BE AS SHOWN BELOW.
 MINIMUM REINFORCEMENT LENGTH (L) SHALL BE AS SHOWN BELOW OR 6 FT, WHICHEVER IS LONGER.

WALL NO.	WALL STATION -EY-	REINFORCEMENT LENGTH RATIO	MAXIMUM FACTORED PRESSURE ON FOUNDATION MATERIAL (KSF)
1	13+24.29 TO 15+24.04	0.75H	6.1
2	13+08.64 TO 15+08.81	0.7H	4.9

4) MINIMUM EMBEDMENT DEPTH = H/10 OR 2 FT BELOW PROPOSED GRADE, WHICHEVER IS GREATER.

5) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (c) PSF
COARSE	110	38	0

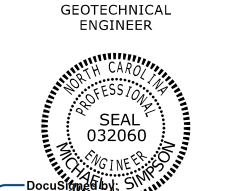
*SEE MSE RETAINING WALLS PROVISION FOR COARSE AGGREGATE MATERIAL REQUIREMENTS.

6) IN-SITU ASSUMED MATERIAL PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION AT MSE WALL NO. 1	110	31	0
FOUNDATION AT MSE WALL NO. 2	110	30	0

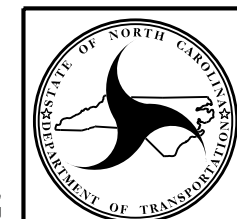
MSE WALL NOTES CONTINUED:

DESIGN RETAINING WALLS AT WALL NO. 1 AND WALL NO. 2 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.
 FOUNDATIONS FOR SIGNS OR LIGHTING MAY BE LOCATED BEHIND RETAINING WALL NO. 1 AND WALL NO. 2, AND MAY INTERFERE WITH REINFORCEMENT. BEFORE BEGINNING MSE WALL CONSTRUCTION, SUBMIT PROPOSED CONSTRUCTION METHODS FOR THESE FOUNDATIONS FOR APPROVAL.
 EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 1 AND WALL NO. 2. THE CONTRACTOR SHALL INSTALL DRAINAGE BOXES, PIPES, AND OTHER PLANNED OBSTRUCTIONS LOCATED WITHIN THE REINFORCED ZONE ONCE THE REINFORCED ZONE REACHES THE PLANNED ELEVATION FOR THE OBSTRUCTION.
 FOUNDATIONS FOR END BENT NO. 1 AND NO. 2 LOCATED AT STATIONS 18+48.89 AND 20+51.65 -L-, RESPECTIVELY, WILL INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 1 AND NO. 2. SEE "FOUNDATION LAYOUT" SHEET FOR FOUNDATION LOCATIONS.
 DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NO. 1 AND WALL NO. 2 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIALS ARE APPROVED BY THE GEOTECHNICAL ENGINEER.
 INSTALLATION OF SLEEVES OR CORRUGATED PIPES MAY BE NECESSARY FOR PLANNED VERTICAL OBSTRUCTIONS WITHIN THE REINFORCED ZONE. STRAPS SHALL BE INSTALLED AROUND OBSTRUCTIONS AS RECOMMENDED BY THE WALL DESIGNER AND APPROVED BY THE ENGINEER.
 INSTALLATION OF 27-INCH DIAMETER CORRUGATED METAL CANS AROUND THE PILES AFTER THEY ARE DRIVEN FROM THE BOTTOM OF THE PILE CAP TO THE LEVELING PAD ELEVATION IS REQUIRED FOR PILES AT END BENTS NO. 1 AND NO. 2.
 THE CORRUGATED METAL CANS SHALL BE DESIGNED TO WITHSTAND THE PRESSURES FROM COMPACTION OPERATIONS ON ADJACENT FILL WITHOUT DISTORTION. AT A MINIMUM, CORRUGATED METAL CANS SHALL BE 16-GUAGE WITH A WALL THICKNESS OF 0.064 INCHES.
 LOOSELY BACKFILL CORRUGATED METAL CANS USING THE SAME MATERIAL AS MSE REINFORCED ZONE AFTER ANY WAITING PERIOD AND PRIOR TO CONSTRUCTION OF THE END BENT PILE CAP. DO NOT COMPACT MATERIAL WITHIN THE CAN.
 INSTALL PILES AT END BENTS BEFORE CONSTRUCTING MSE ABUTMENT WALL.
 SLIP JOINTS ARE REQUIRED APPROXIMATELY EVERY 80 FEET OF WALL FACE.
 COASTAL PLAIN CLAY SOILS MAY BE ENCOUNTERED AT WALL NO. 1. THE GEOTECHNICAL ENGINEER SHOULD EVALUATE THE FOUNDATION SOILS PRIOR TO FILL PLACEMENT AT END BENT NO. 1.

GEOTECHNICAL ENGINEER  Docusign by: Michael G. Simpson 05/25/2025	ENGINEER _____ SIGNATURE DATE
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	

PROJECT NO.: 49218.26
 CUMBERLAND COUNTY
 STATION: 19+50.27 -L-
 SHEET 6 OF 6

PREPARED BY: E. BENSON DATE: 05/25
 REVIEWED BY: M. SIMPSON DATE: 05/25



NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 GEOTECHNICAL
 ENGINEERING UNIT

MSE WALL NOTES					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

MECHANICALLY STABILIZED EARTH RETAINING WALLS**(1-16-24)****1.0 GENERAL**

Construct mechanically stabilized earth (MSE) retaining walls consisting of steel or geosynthetic reinforcement in the reinforced zone connected to vertical facing elements. Use precast concrete panels for vertical facing elements and coarse aggregate in the reinforced zone unless noted otherwise in the plans. Provide reinforced concrete coping and pile sleeves as required. Design and construct MSE retaining walls based on actual elevations and wall dimensions in accordance with the contract and accepted submittals. Use a prequalified MSE Wall Installer to construct MSE retaining walls.

Define MSE wall terms as follows:

Geosynthetic Reinforcement – Polyester Type (PET), HDPE or Polypropylene (PP) geosynthetic grids, i.e., geogrid reinforcement or polymer straps, i.e., geostrip reinforcement,

Geogrid – PET, HDPE or PP geogrid,

Reinforcement – Steel or geosynthetic reinforcement,

Aggregate – Coarse or fine aggregate,

Panel – Precast concrete panel,

Coping – Precast or CIP concrete coping,

Design Height (H) – Wall height + wall embedment as shown in the plans,

MSE Wall – Mechanically stabilized earth retaining wall,

MSE Wall Vendor – Vendor supplying the chosen MSE wall system,

MSE Panel Wall – MSE wall with panels,

MSE Segmental Wall – MSE wall with segmental retaining wall (SRW) units and

Abutment Wall – MSE wall with bridge foundations in any portion of the reinforced zone or an MSE wall connected to an abutment wall (even if bridge foundations only penetrate a small part of the reinforced zone, the entire MSE wall is considered an abutment wall).

For bridge approach fills behind end bents with MSE abutment walls, design reinforcement connected to end bent caps in accordance with the plans and this provision.

Use an approved MSE wall system in accordance with the plans and any NCDOT restrictions or exceptions for the chosen system. Value engineering proposals for other MSE wall systems will not be considered. Do not use MSE wall systems with an “approved for provisional use” status for MSE walls with design heights greater than 35 ft or walls supporting or adjacent to railroads or interstate highways. The list of approved MSE wall systems with approval status is available from:

connect.ncdot.gov/resources/Geological/Pages/Products.aspx

2.0 MATERIALS

Refer to the *Standard Specifications*.

Item	Section
Aggregate	1014
Asphalt Concrete Base Course, Type B25.0C	620
Corrugated Steel Pipe	1032-3

Gruber Road Bridge

GT-1.2

Cumberland County

Epoxy, Type 3A	1081
Geosynthetics	1056
Grout, Type 3	1003
Joint Materials	1028
Portland Cement Concrete, Class A	1000
Precast Retaining Wall Coping	1077
Reinforcing Steel	1070
Retaining Wall Panels	1077
Segmental Retaining Wall Units	1040-4
Select Material, Class V	1016
Shoulder Drain Materials	816-2
Steel Pipe	1036-4(A)

Use galvanized corrugated steel pipe with a zinc coating weight of 2 oz/sf (G200) for pile sleeves. Provide Type 2 geotextile for filtration and separation geotextiles. Use Class A concrete for CIP coping, leveling concrete and pads. Use galvanized steel pipe, threaded rods and nuts for the PET geogrid reinforcement vertical obstruction detail. Provide galvanized Grade 36 anchor rods and Grade A hex nuts that meet AASHTO M 314 for threaded rods and nuts.

Use panels and SRW units from producers approved by the Department and licensed by the MSE Wall Vendor. Provide steel strip connectors embedded in panels fabricated from structural steel that meets the requirements for steel strip reinforcement. Unless required otherwise in the contract, produce panels with a smooth flat final finish that meets Article 1077-11 of the *Standard Specifications*. Accurately locate and secure reinforcement connectors in panels and maintain required concrete cover. Produce panels within 1/4" of the panel dimensions shown in the accepted submittals.

Damaged panels or SRW units with excessive discoloration, chips or cracks as determined by the Engineer will be rejected. Do not damage reinforcement connection devices or mechanisms in handling or storing panels and SRW units.

Store steel materials on blocking at least 12" above the ground and protect it at all times from damage; and when placing in the work make sure it is free from dirt, dust, loose mill scale, loose rust, paint, oil or other foreign materials. Handle and store geosynthetics in accordance with Article 1056-2 of the *Standard Specifications*. Load, transport, unload and store MSE wall materials so materials are kept clean and free of damage. Bent, damaged or defective materials will be rejected.

A. Aggregate

Use standard size No. 57, 57M, 67 or 78M that meets Table 1005-1 of the *Standard Specifications* for coarse aggregate and the following for fine aggregate:

1. Standard size No. 1S, 2S, 2MS or 4S that meets Table 1005-2 of the *Standard Specifications* or
2. Gradation that meets Class III, Type 3 select material in accordance with Article

1016-3 of the *Standard Specifications*.

Fine aggregate is exempt from mortar strength in Subarticle 1014-1(E) of the *Standard Specifications*. Use fine aggregate with a maximum organic content of 1.0%. Provide aggregate with chemical properties that meet the following requirements:

AGGREGATE pH REQUIREMENTS		
Aggregate Type (in reinforced zone)	Reinforcement or Connector Material	pH
Coarse or Fine	Steel	5 – 10
Coarse or Fine	Geosynthetic	4.5 – 9

AGGREGATE ELECTROCHEMICAL REQUIREMENTS (Steel Reinforcement/Connector Materials Only)			
Aggregate Type (in reinforced zone)	Resistivity	Chlorides	Sulfates
Coarse	$\geq 5,000 \Omega \cdot \text{cm}$	$\leq 100 \text{ ppm}$	$\leq 200 \text{ ppm}$
Fine	$\geq 3,000 \Omega \cdot \text{cm}$		

Use aggregate from sources participating in the Department’s Aggregate QC/QA Program as described in Section 1006 of the *Standard Specifications*. Sample and test aggregate in accordance with the *Mechanically Stabilized Earth Wall Aggregate Sampling and Testing Procedures*.

B. Reinforcement

Provide steel or geosynthetic reinforcement supplied by the MSE Wall Vendor or a manufacturer approved or licensed by the vendor. Use reinforcement approved for the chosen MSE wall system. The list of approved reinforcement for each MSE wall system is available from the website shown elsewhere in this provision.

1. Steel Reinforcement

Provide Type 1 material certifications in accordance with Article 106-3 of the *Standard Specifications* for steel reinforcement. Use welded wire grid reinforcement (“mesh”, “mats” and “ladders”) that meet Article 1070-3 of the *Standard Specifications* and steel strip reinforcement (“straps”) that meet ASTM A572, A1011 or A463. Use 10 gauge or heavier structural steel Grade 50 or higher for steel strip reinforcement. Galvanize steel reinforcement in accordance with Section 1076 of the *Standard Specifications* or provide aluminized steel strip reinforcement that meet ASTM A463, Type 2-100.

2. Geosynthetic Reinforcement

Provide Type 1 material certifications and identify geosynthetic reinforcement in accordance with Article 1056-3 of the *Standard Specifications*. Define machine

direction (MD) and cross-machine direction (CD) for geogrids per Article 1056-3 of the *Standard Specifications*.

Use HDPE or PP geogrid for geogrid reinforcement cast into backwalls of end bent caps. Use PET or HDPE geogrid for geogrid reinforcement connected directly to SRW units and only HDPE geogrid for geogrid reinforcement cast into panels.

Provide extruded geogrids produced in the United States and manufactured from punched and drawn polypropylene sheets for PP geogrids that meet the following:

PP GEOGRID REQUIREMENTS		
Property	Requirement¹	Test Method
Aperture Dimensions ²	1" x 1.2"	N/A
Minimum Rib Thickness ²	0.07" x 0.07"	N/A
Tensile Strength @ 2% Strain ²	580 lb/ft x 690 lb/ft	ASTM D6637, Method B
Tensile Strength @ 5% Strain ²	1,200 lb/ft x 1,370 lb/ft	
Ultimate Tensile Strength ²	1,850 lb/ft x 2,050 lb/ft	
Junction Efficiency ³ (MD)	93%	ASTM D7737
Flexural Rigidity ⁴	2,000,000 mg-cm	ASTM D7748
Aperture Stability Modulus ⁵	0.55 lb-ft/degrees	ASTM D7864
UV Stability (Retained Strength)	100% (after 500 hr of exposure)	ASTM D4355

1. MARV per Article 1056-3 of the *Standard Specifications* except dimensions and thickness are nominal.
2. Requirement for MD x CD.
3. Junction Efficiency (%) = (Average Junction Strength (X_{jave}) / Ultimate Tensile Strength in the MD from ASTM D6637, Method A) x 100.
4. Test specimens two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs, and sufficiently long to enable measurement of the overhang dimension.
5. Applied moment of 17.7 lb-inch (torque increment).

C. Bearing Pads

For MSE panel walls, use preformed ethylene propylene diene monomer rubber bearing pads that meet ASTM D2000 Grade 2, Type A, Class A with a durometer hardness of 60 or 80 ± 5 . Provide bearing pads with thicknesses that meet the following:

BEARING PAD THICKNESS	
Facing Area per Panel (A)	Minimum Pad Thickness After Compression (based on 2 times panel weight above pads)
$A \leq 30$ sf	1/2"
$30 \text{ sf} < A \leq 75$ sf	3/4"

D. Miscellaneous Components

Miscellaneous components may include connectors (e.g., anchors, bars, clamps, pins,

plates, ties, etc.), fasteners (e.g., bolts, nuts, washers, etc.) and any other MSE wall components not included above. Use 10 gauge or heavier structural steel Grade 50 or higher for steel strip panel anchors and connectors. Galvanize steel components in accordance with Section 1076 of the *Standard Specifications*. Provide miscellaneous components approved for the chosen MSE wall system. The list of approved miscellaneous components for each MSE wall system is available from the website shown elsewhere in this provision.

3.0 PRECONSTRUCTION REQUIREMENTS

A. MSE Wall Surveys

The Retaining Wall Plans show a plan view, typical sections, details, notes and an elevation or profile view (wall envelope) for each MSE wall. Before beginning MSE wall design, survey existing ground elevations shown in the plans and other elevations in the vicinity of MSE wall locations as needed. For proposed slopes above or below MSE walls, survey existing ground elevations to at least 10 ft beyond slope stake points. Based on these elevations, finished grades and actual MSE wall dimensions and details, submit revised wall envelopes for acceptance. Use accepted wall envelopes for design.

B. MSE Wall Designs

For MSE wall designs, submit PDF files of working drawings and design calculations at least 30 days before the preconstruction meeting. Note name and NCDOT ID number of the panel or SRW unit production facility on working drawings. Do not begin MSE wall construction until a design submittal is accepted.

Use a prequalified MSE Segmental Wall Design Consultant to design MSE segmental walls. Provide MSE segmental wall designs sealed by a Design Engineer approved as a Geotechnical Engineer (key person) for the MSE Segmental Wall Design Consultant. Provide MSE panel wall designs sealed by a Design Engineer licensed in the state of North Carolina and employed or contracted by the MSE Wall Vendor.

Design MSE walls in accordance with the plans, *AASHTO LRFD Bridge Design Specifications* and any NCDOT restrictions for the chosen MSE wall system unless otherwise required. For abutment walls only, design MSE walls for seismic if wall sites meet either or both of the following:

- Wall site is in seismic zone 2 based on Figure 2-1 of the *Structure Design Manual*,
- Wall site is classified as AASHTO Site Class E, as noted in the plans, and is in or west of Pender, Duplin, Wayne, Johnston, Wake, Durham or Person County.

Connect reinforcement to panels or SRW units with methods or devices approved for the chosen system. Use a uniform reinforcement length throughout the height of the wall of at least $0.7H$ or 6 ft, whichever is longer, unless noted otherwise in the plans. Extend the reinforced zone at least 6" beyond end of reinforcement. Do not locate drains, the reinforced zone or leveling pads outside right-of-way or easement limits.

Use the simplified method for determining maximum reinforcement loads and design parameters approved for the chosen MSE wall system or default values in accordance with the AASHTO LRFD specifications. Design steel components including reinforcement and connectors for the design life noted in the plans and aggregate type in the reinforced zone. If an MSE wall system with geosynthetic reinforcement includes any steel parts for obstructions, bin walls, connections or other components, design steel exposed to aggregate for the design life noted in the plans and aggregate type in the reinforced zone. Use “loss of galvanizing” metal loss rates for nonaggressive backfill in accordance with the AASHTO LRFD specifications for galvanized and aluminized steel and metal loss rates for carbon steel in accordance with the following:

CARBON STEEL CORROSION RATES	
Aggregate Type (in reinforced zone)	Carbon Steel Loss Rate (after coating depletion)
Coarse	0.47 mil/year
Fine (except abutment walls)	0.58 mil/year
Fine (abutment walls)	0.70 mil/year

For PET or HDPE geogrid and geostrip reinforcement and geosynthetic connectors, use approved geosynthetic properties for the design life noted in the plans and aggregate type in the reinforced zone. For geogrid reinforcement connected to end bent caps, embed reinforcement or connectors in caps as shown in the plans. For PP geogrid reinforcement connected to end bent caps, use the following design parameters for the aggregate type in the reinforced approach fill.

PP GEOGRID REINFORCEMENT DESIGN PARAMETERS				
Aggregate Type (in reinforced zone)	T_{al} (MD)	F*	α	ρ
Coarse	400 lb/ft	0.70	0.8	32.0°
Fine	428 lb/ft	0.54	0.8	28.35°

Where,

- T_{al} = long-term design strength (LTDS),
- F* = pullout resistance factor,
- α = scale effect correction factor and
- ρ = soil-geogrid friction angle.

When noted in the plans, design MSE walls for a live load (traffic) surcharge of 250 psf in accordance with Figure C11.5.6-3(b) of the AASHTO LRFD specifications. For steel beam guardrail with 8 ft posts or concrete barrier rail above MSE walls, analyze top 2 reinforcement layers for traffic impact loads in accordance with Section 7.2 of *FHWA Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume I* (Publication No. FHWA-NHI-10-024) except use the following for geosynthetic reinforcement rupture:

$$\phi T_{al} R_c \geq T_{max} + (T_I / RF_{CR})$$

Where,

- ϕ = resistance factor for tensile resistance in accordance with Section 7.2.1 of the FHWA MSE wall manual,
- T_{al} = long-term geosynthetic design strength approved for chosen MSE wall system,
- R_c = reinforcement coverage ratio = 1 for continuous geosynthetic reinforcement,
- T_{max} = factored static load in accordance with Section 7.2 of the FHWA MSE wall manual,
- T_I = factored impact load in accordance with Section 7.2 of the FHWA MSE wall manual and
- RF_{CR} = creep reduction factor approved for chosen MSE wall system.

When shown in the plans for abutment walls, use pile sleeves to segregate piles from aggregate in the reinforced zone. If existing or future obstructions such as foundations, guardrail, fence or handrail posts, moment slabs, pavements, pipes, inlets or utilities will interfere with reinforcement, maintain a clearance of at least 3" between obstructions and reinforcement unless otherwise approved. Design reinforcement for obstructions and locate reinforcement layers so all of reinforcement length is within 3" of corresponding connection elevations. Modify PET geogrid reinforcement for obstructions as shown in the plans.

Use 6" thick CIP unreinforced concrete leveling pads beneath panels and SRW units that are continuous at steps and extend at least 6" in front of and behind bottom row of panels or SRW units. Unless required otherwise in the plans, embed top of leveling pads in accordance with the following requirements:

WALL EMBEDMENT REQUIREMENTS		
Front Slope¹ (H:V)	Minimum Embedment Depth² (whichever is greater)	
6:1 or flatter (except abutment walls)	H/20	1 ft for H ≤ 10 ft 2 ft for H > 10 ft
6:1 or flatter (abutment walls)	H/10	2 ft
> 6:1 to < 3:1	H/10	2 ft
3:1 to 2:1	H/7	2 ft

1. Front slope is as shown in the plans.
2. H is the maximum design height per wall.

When noted in the plans, locate a continuous aggregate shoulder drain along the base of the reinforced zone behind the aggregate. Provide wall drainage systems consisting of drains and outlet components in accordance with Roadway Standard Drawing No. 816.02.

For MSE panel walls, cover joints at back of panels with filtration geotextiles at least 12" wide. If the approval of the chosen MSE wall system does not require a minimum number of bearing pads, provide the number of pads in accordance with the following:

NUMBER OF BEARING PADS

Facing Area per Panel (A)	Maximum Height of Wall Above Horizontal Panel Joint	Minimum Number of Pads per Horizontal Panel Joint
A ≤ 30 sf	25 ft	2
	35 ft ¹	3
30 sf < A ≤ 75 sf	25 ft	3
	35 ft ¹	4

1. Additional bearing pads per horizontal panel joint may be required for wall heights above joints greater than 35 ft.

For MSE segmental walls, coarse aggregate is required in any SRW unit core spaces and between and behind SRW units for a horizontal distance of at least 18".

Separation geotextiles are required between the aggregate and overlying fill sections. When noted in the plans, separation geotextiles are also required at the back of the reinforced zone between the aggregate and backfill or natural ground. When placing pavement sections directly on the reinforced zone, cap aggregate with 4" of asphalt concrete base course. Unless required otherwise in the plans, use reinforced concrete coping at top of walls that meets the following requirements:

1. Coping dimensions as shown in the plans,
2. At the Contractor's option, coping that is precast or CIP concrete for MSE panel walls unless CIP coping is required as shown in the plans,
3. CIP concrete coping for MSE segmental walls and
4. At the Contractor's option and when shown in the plans, CIP concrete coping that extends down back of panels or SRW units or connects to panels or SRW units with dowels.

For MSE segmental walls with dowels, attach dowels to top courses of SRW units in accordance with the following:

1. Set dowels in core spaces of SRW units filled with grout instead of coarse aggregate or
2. Embed adhesively anchored dowels in holes of solid SRW units with epoxy.

For MSE panel walls with coping, connect CIP concrete coping or leveling concrete for precast concrete coping to top row of panels with dowels cast into panels. When concrete barrier rail is required above MSE walls, use concrete barrier rail with moment slab as shown in the plans.

Submit working drawings and design calculations for acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing plan views, wall profiles with foundation pressures, typical sections with reinforcement and connection details, aggregate locations and types, geotextile locations and details of leveling pads, panels or SRW units, coping, bin walls, slip joints, pile sleeves, etc. If

necessary, include details on working drawings for concrete barrier rail with moment slab, reinforcement splices if allowed for the chosen MSE wall system, reinforcement connected to end bent caps, curved MSE walls with tight (short) radii and obstructions extending through walls or interfering with reinforcement, leveling pads, barriers or moment slabs. Submit design calculations for each wall section with different surcharge loads, geometry or material parameters. At least one analysis is required for each wall section with different reinforcement lengths. When designing MSE walls with computer software other than MSEW, use MSEW manufactured by ADAMA Engineering, Inc. to verify the design. At least one MSEW analysis is required per 100 ft of wall length with at least one analysis for the wall section with the longest reinforcement. Submit electronic MSEW input files and PDF output files with design calculations.

C. Preconstruction Meeting

Before starting MSE wall construction, hold a preconstruction meeting to discuss the construction and inspection of the MSE walls. If this meeting occurs before all MSE wall submittals have been accepted, additional preconstruction meetings may be required before beginning construction of MSE walls without accepted submittals. The Resident or Bridge Maintenance Engineer, Area Construction Engineer, Geotechnical Operations Engineer, Contractor and MSE Wall Installer Superintendent will attend preconstruction meetings.

4.0 CORROSION MONITORING

Corrosion monitoring is required for MSE walls with steel reinforcement. The Engineer will determine the number of monitoring locations and where to install the instrumentation. Contact M&T before beginning wall construction. M&T will provide the corrosion monitoring instrumentation kits and if necessary, assistance with installation.

5.0 SITE ASSISTANCE

Unless otherwise approved, an MSE Wall Vendor representative is required to assist and guide the MSE Wall Installer on-site for at least 8 hours when the first panels or SRW units and reinforcement layer are placed. If problems are encountered during construction, the Engineer may require the vendor representative to return to the site for a time period determined by the Engineer.

6.0 CONSTRUCTION METHODS

Control drainage during construction in the vicinity of MSE walls. Direct run off away from MSE walls, aggregate and backfill. Contain and maintain aggregate and backfill and protect material from erosion.

Excavate as necessary for MSE walls in accordance with the accepted submittals. If applicable and at the Contractor's option, use temporary shoring for wall construction instead of temporary slopes to construct MSE walls. Define "temporary shoring for wall construction" as temporary shoring not shown in the plans or required by the Engineer including shoring for OSHA reasons or the Contractor's convenience.

Unless required otherwise in the plans, install foundations and if required, pile sleeves located in the reinforced zone before placing aggregate or reinforcement. Brace piles in the reinforced zone to maintain alignment when placing and compacting aggregate. Secure piles together with steel members near top of piles. Clamp members to piles instead of welding if bracing is at or below pile cut-off elevations.

Notify the Engineer when foundation excavation is complete. Do not place leveling pad concrete, aggregate or reinforcement until excavation dimensions and foundation material are approved.

Construct CIP concrete leveling pads at elevations and with dimensions shown in the accepted submittals and in accordance with Section 420 of the *Standard Specifications*. Cure leveling pads at least 24 hours before placing panels or SRW units.

Erect and support panels and stack SRW units so the final wall position is as shown in the accepted submittals. Stagger SRW units to create a running bond by centering SRW units over joints in the row below as shown in the accepted submittals. Space bearing pads in horizontal panel joints as shown in the accepted submittals and cover all panel joints with filtration geotextiles as shown in the accepted submittals. Attach filtration geotextiles to back of panels with adhesives, tapes or other approved methods.

Construct MSE walls with the following tolerances:

- A. SRW units are level from front to back and between units when checked with a 4 ft long level,
- B. Vertical joint widths are 1/4" maximum for SRW units and 3/4", $\pm 1/4$ " for panels,
- C. Final wall face is within 3/4" of horizontal and vertical alignment shown in the accepted submittals when measured along a 10 ft straightedge and
- D. Final wall plumbness (batter) is not negative (wall face leaning forward) and within 0.5° of vertical unless otherwise approved.

Place reinforcement at locations and elevations shown in the accepted submittals and within 3" of corresponding connection elevations. Install reinforcement with the direction shown in the accepted submittals. Before placing aggregate, pull geosynthetic reinforcement taut so it is in tension and free of kinks, folds, wrinkles or creases. Reinforcement may be spliced once per reinforcement length if shown in the accepted submittals. Use reinforcement pieces at least 6 ft long. Contact the Engineer when unanticipated existing or future obstructions such as foundations, guardrail, fence or handrail posts, pavements, pipes, inlets or utilities will interfere with reinforcement. To avoid obstructions, deflect, skew or modify reinforcement as shown in the accepted submittals.

Place aggregate in the reinforced zone in 8" to 10" thick lifts. Compact fine aggregate in accordance with Subarticle 235-3(C) of the *Standard Specifications*. Use only hand operated compaction equipment to compact aggregate within 3 ft of panels or SRW units. At a distance greater than 3 ft, compact aggregate with at least 4 passes of an 8 ton to 10 ton vibratory roller in a direction parallel to the wall face. Smooth wheeled or rubber tired rollers are also acceptable for compacting aggregate. Do not use sheepsfoot, grid rollers or other

types of compaction equipment with feet. Do not displace or damage reinforcement when placing and compacting aggregate. End dumping directly on geosynthetics is not permitted. Do not operate heavy equipment on reinforcement until it is covered with at least 8" of aggregate. Replace any damaged reinforcement to the satisfaction of the Engineer.

Backfill for MSE walls outside the reinforced zone in accordance with Article 410-8 of the *Standard Specifications*. If a drain is required, install wall drainage systems as shown in the accepted submittals and in accordance with Section 816 of the *Standard Specifications*. If pile sleeves are required, fill sleeves with loose uncompacted sand before constructing end bent caps.

Install dowels as necessary for SRW units and place and construct coping and leveling concrete as shown in the accepted submittals. Construct leveling concrete in accordance with Section 420 of the *Standard Specifications*. Construct CIP concrete coping in accordance with Subarticle 452-4(B) of the *Standard Specifications*. When single faced precast concrete barrier is required in front of and against MSE walls, stop coping just above barrier so coping does not interfere with placing barrier up against wall faces. If the gap between a single faced barrier and wall face is wider than 2", fill gap with Class V select material (standard size No. 78M stone). Otherwise, fill gap with backer rod and seal joint between barrier and MSE wall with silicone sealant.

When separation geotextiles are required, overlap adjacent geotextiles at least 18" and hold geotextiles in place with wire staples or anchor pins as needed. Seal joints above and behind MSE walls between coping and concrete slope protection with silicone sealant.

7.0 MEASUREMENT AND PAYMENT

MSE Retaining Wall No. ___ will be measured and paid in square feet. MSE walls will be measured as the square feet of wall face area with the pay height equal to the difference between top of wall and top of leveling pad elevations. Define "top of wall" as top of coping or top of panels or SRW units for MSE walls without coping.

The contract unit price for *MSE Retaining Wall No. ___* will be full compensation for providing designs, submittals, labor, tools, equipment and MSE wall materials, excavating, hauling and removing excavated materials, placing and compacting aggregate and backfill material and supplying site assistance, leveling pads, panels, SRW units, reinforcement, aggregate, wall drainage systems, geotextiles, aggregate concrete base course, bearing pads, coping, miscellaneous components and any incidentals necessary to construct MSE walls. The contract unit price for *MSE Retaining Wall No. ___* will also be full compensation for reinforcement and connector design for reinforcement connected to end bent caps, wall modifications for obstructions, pile sleeves filled with sand, joints sealed with silicone sealant and gaps between barriers and MSE walls filled with backer rod or No. 78M stone, if required.

No separate payment will be made for temporary shoring for wall construction. Temporary shoring for wall construction will be incidental to the contract unit price for *MSE Retaining Wall No. ___*.

Gruber Road Bridge

GT-1.12

Cumberland County

The contract unit price for *MSE Retaining Wall No. ___* does not include the cost for ditches, fences, handrails, barrier or guardrail associated with MSE walls as these items will be paid for elsewhere in the contract. The contract unit price for *MSE Retaining Wall No. ___* also does not include the cost for constructing bridge approach fills behind end bents with MSE abutment walls. See *Bridge Approach Fills* provision for measurement and payment of Type 2 Bridge Approach Fills.

Where it is necessary to provide backfill material behind the reinforced zone from sources other than excavated areas or borrow sources used in connection with other work in the contract, payment for furnishing and hauling such backfill material will be paid as extra work in accordance with Article 104-7 of the *Standard Specifications*. Placing and compacting such backfill material is not considered extra work but is incidental to the work being performed.

Payment will be made under:

Pay Item

MSE Retaining Wall No. ___

Pay Unit

Square Foot



DocuSigned by:
Michael J. Simpson/2025
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