

REFERENCE: SF-790254

PROJECT: 17BP.9.R.96

SEE SHEET 3 FOR PLAN SHEET LAYOUT AT TIME OF INVESTIGATION

CONTENTS

LINE	STATION	PLAN	PROFILE
-L-	12+50.00 - 18+40.00	4-5	N/A

CROSS SECTIONS

LINE	STATION	SHEETS
-L-	12+50.00 - 18+40.00	6-18

APPENDICES

APPENDIX	TITLE	SHEETS
A	CORE LOGS AND CORE PHOTOS	19-21
B	SOIL TEST RESULTS	22-23

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY ROWAN PROJECT DESCRIPTION BRIDGE NO. 254 OVER KERR CREEK ON CALDWELL ROAD (SR 1547)

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	SF-790254	1	

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...

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...

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...

- NOTES: 1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION... 2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS...

PERSONNEL

H. FISCHER, GIT

M. DANIELS, GIT

M.G. MOSELEY

J. MOSELEY

INVESTIGATED BY B. SMITH, PG

DRAWN BY B. SMITH, PG

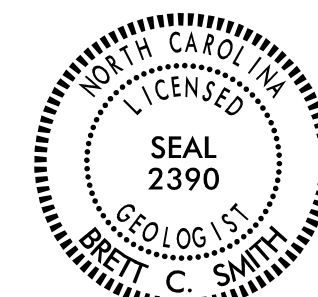
CHECKED BY M. CRUZ, PE

SUBMITTED BY B. SMITH, PG

DATE APRIL, 2023

Prepared in the Office of:

SUMMIT DESIGN AND ENGINEERING SERVICES FIRM NO. P-0339 and C-487 2715 Ashton Drive, Ste 104 Wilmington, NC 28412



DocuSigned by: [Signature] 04/21/2023 142A78E876B643C...

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><b>WELL GRADED</b> - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.  <b>UNIFORMLY GRADED</b> - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.  <b>GAP-GRADED</b> - 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><b>ALLUVIUM (ALLUV.)</b> - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.  <b>AQUIFER</b> - A WATER BEARING FORMATION OR STRATA.  <b>ARENACEOUS</b> - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.  <b>ARGILLACEOUS</b> - 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.  <b>ARTESIAN</b> - 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.  <b>CALCAREOUS (CALC.)</b> - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.  <b>COLLUVIUM</b> - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.  <b>CORE RECOVERY (REC.)</b> - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.  <b>DIKE</b> - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.  <b>DIP</b> - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.  <b>DIP DIRECTION (DIP AZIMUTH)</b> - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.  <b>FAULT</b> - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.  <b>FISSILE</b> - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.  <b>FLOAT</b> - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLOGGED FROM PARENT MATERIAL.  <b>FLOOD PLAIN (FP)</b> - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.  <b>FORMATION (FM)</b> - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.  <b>JOINT</b> - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.  <b>LEDGE</b> - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.  <b>LENS</b> - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.  <b>MOTTLED (MOT.)</b> - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS, MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.  <b>PERCHED WATER</b> - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.  <b>RESIDUAL (RES.) SOIL</b> - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.  <b>ROCK QUALITY DESIGNATION (RQD)</b> - 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.  <b>SAPROLITE (SAP.)</b> - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.  <b>SILL</b> - 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.  <b>SLICKENSIDE</b> - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.  <b>STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT)</b> - 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.  <b>STRATA CORE RECOVERY (SREC.)</b> - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.  <b>STRATA ROCK QUALITY DESIGNATION (SROD)</b> - 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.  <b>TOPSOIL (TS)</b> - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.</p>																																																																																																																																																																																										
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IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.</p> <p>MODERATE (MOD.): SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.</p> <p>MODERATELY SEVERE (MOD. SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. <i>IF TESTED, WOULD YIELD SPT REFUSAL</i></p> <p>SEVERE (SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &gt; 100 BPF</i></p> <p>VERY SEVERE (IV SEV.): ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. <i>IF TESTED, WOULD YIELD SPT N VALUES &lt; 100 BPF</i></p> <p>COMPLETE: ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.</p>										<p style="text-align: center;"><b>PERCENTAGE OF MATERIAL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>ORGANIC MATERIAL</th> <th>GRANULAR SOILS</th> <th>SILT - CLAY SOILS</th> <th>OTHER MATERIAL</th> </tr> <tr> <td>TRACE OF ORGANIC MATTER</td> <td>2 - 3%</td> <td>3 - 5%</td> <td>TRACE 1 - 10%</td> </tr> <tr> <td>LITTLE ORGANIC MATTER</td> <td>3 - 5%</td> <td>5 - 12%</td> <td>LITTLE 10 - 20%</td> </tr> <tr> <td>MODERATELY ORGANIC</td> <td>5 - 10%</td> <td>12 - 20%</td> <td>SOME 20 - 35%</td> </tr> <tr> <td>HIGHLY ORGANIC</td> <td>&gt; 10%</td> <td>&gt; 20%</td> <td>HIGHLY 35% AND ABOVE</td> </tr> </table>										ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE 1 - 10%	LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE 10 - 20%	MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME 20 - 35%	HIGHLY ORGANIC	> 10%	> 20%	HIGHLY 35% AND ABOVE
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**GEOTECHNICAL ENGINEERING UNIT**  


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**SUBSURFACE INVESTIGATION**

**SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES**  
**FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS**

AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

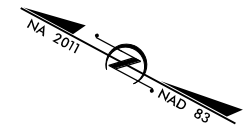
<b>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</b>  From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.						<b>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</b>  From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.					
SURFACE CONDITIONS	VERY GOOD	GOOD	FAIR	POOR	VERY POOR	SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)	VERY GOOD	GOOD	FAIR	POOR	VERY POOR
STRUCTURE	DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE	VERY GOOD - Very Rough, fresh unweathered surfaces	GOOD - Rough, slightly weathered surfaces	FAIR - Smooth, moderately weathered and altered surfaces	POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments	VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings
<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities                 </div> </div> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets                 </div> </div> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets                 </div> </div> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity                 </div> </div> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces                 </div> </div> <div style="display: flex; align-items: center;"> <div style="font-size: 0.8em;">                     LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes                 </div> </div> </div>	SURFACE CONDITIONS ↓ DECREASING INTERLOCKING OF ROCK PIECES ↓	90 80 70 60 50 40 30 20 10 N/A N/A	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	<div style="font-size: 0.8em;"> <p><b>A.</b> Thick bedded, very blocky sandstone. The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.</p> <p><b>B.</b> Sandstone with thin inter-layers of siltstone</p> <p><b>C.</b> Sandstone and siltstone in similar amounts</p> <p><b>D.</b> Siltstone or silty shale with sandstone layers</p> <p><b>E.</b> Weak siltstone or clayey shale with sandstone layers</p> <p><b>F.</b> Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p><b>G.</b> Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p><b>H.</b> Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.</p> </div> <p style="font-size: 0.7em; margin-top: 10px;">→ Means deformation after tectonic disturbance</p>	70 60 50 40 30 20 10	A B C D E F G H	A B C D E F G H	A B C D E F G H	A B C D E F G H

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.9.R.96	3	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
17BP.9.R.96		P.E.	
17BP.9.R.96		R.O.W.	

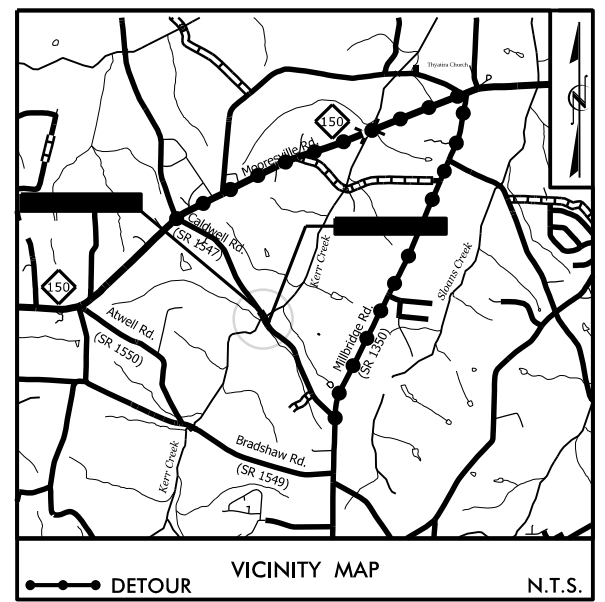
STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**ROWAN COUNTY**

LOCATION: BRIDGE #254 OVER KERR CREEK  
ON SR 1547 (CALDWELL RD)  
TYPE OF WORK: GRADING, PAVING, DRAINAGE, & STRUCTURE



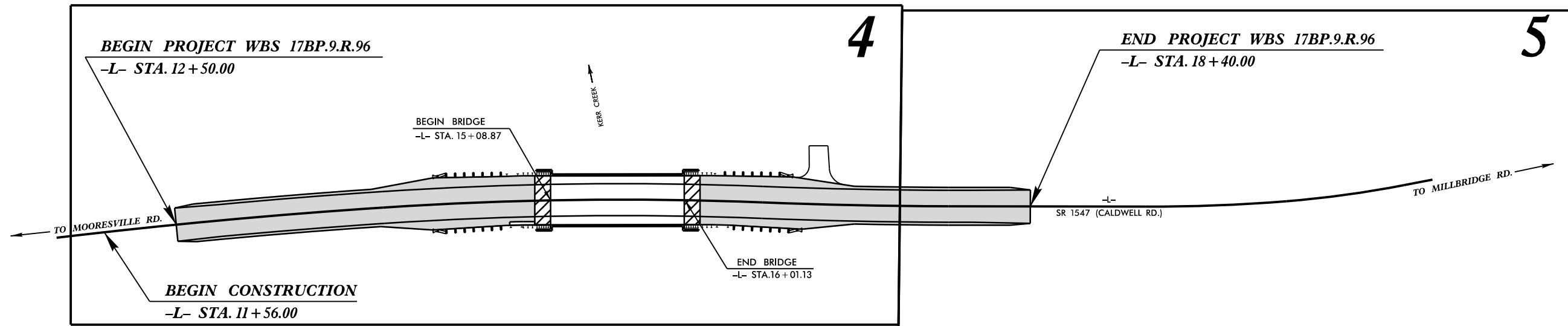
See Sheet 1A For Index of Sheets  
See Sheet 1B For Standard Symbol Sheet



DETOUR VICINITY MAP N.T.S.

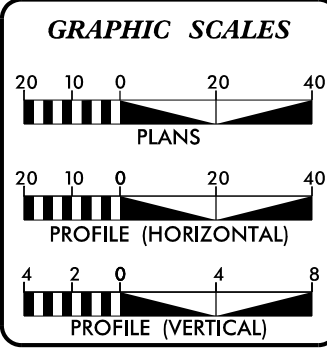
RIGHT-OF-WAY PLANS

PROJECT WBS: 17BP.9.R.96



THIS PROJECT IS NOT WITHIN ANY MUNICIPAL BOUNDARIES.  
CLEARING ON THIS PROJECT SHALL BE PERFORMED  
TO THE LIMITS ESTABLISHED BY METHOD II.

CONTRACT:



**DESIGN DATA**

ADT 2011	=	1100
ADT 2040	=	2200
DHV	=	N/A
D	=	N/A
T	=	6 %
V	=	55 MPH

FUNC. CLASSIFICATION:  
LOCAL  
SUB REGIONAL TIER

**PROJECT LENGTH**

LENGTH OF ROADWAY PROJECT WBS 17BP.9.R.96 = 0.095 MILES  
LENGTH OF STRUCTURE PROJECT WBS 17BP.9.R.96 = 0.017 MILES  
TOTAL LENGTH OF PROJECT WBS 17BP.9.R.96 = 0.112 MILES

NCDOT CONTACT: DANIEL DAGENHART  
Division Bridge Manager

PLANS PREPARED FOR THE NCDOT BY:

**STV** 100 Years  
STV Engineers, Inc.  
900 West Trade St., Suite 715  
Charlotte, NC 28202  
NC License Number F-0991

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:  
JANUARY 25, 2023

LETTING DATE:  
FEBRUARY 28, 2024

NIKKI T. HONEYCUTT, PE  
PROJECT ENGINEER

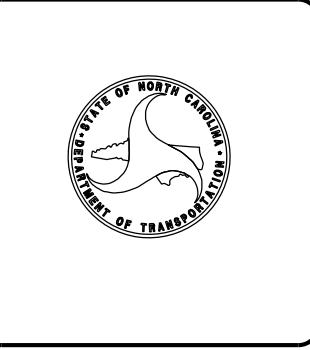
STEPHEN L. SAUCIER  
PROJECT DESIGNER

HYDRAULICS ENGINEER

SIGNATURE: \_\_\_\_\_ P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: \_\_\_\_\_ P.E.



13-MAR-2023 09:52 C:\Users\brgett\OneDrive - Summit Design and Engineering Services\Desktop\SF790254\_GEO\_RDWY\CADD\_GEO\TECH\PlanPro\SF790254\_GEO\_INV\_03.dgn \$\$\$USERNAME\$\$\$

**April 11, 2023**

**WBS Number:** 17BP.9.R.96  
**TIP Number:** SF-790254  
**Project ID:** 41340  
**County:** Rowan  
**Description:** Bridge No. 254 over Kerr Creek on Caldwell Road (SR 1547)

**SUBJECT:** Geotechnical Report - Roadway Subsurface Inventory

**Project Description**

The proposed 0.095-mile-long project is located in southwestern Rowan County, North Carolina. The project is located between the town of Mooresville and the city of Salisbury and does not fall within any municipal boundaries. The core of the project involves the replacement of one (1) single-span bridge crossing over Kerr Creek on Caldwell Road (SR 1547). The bridge will be replaced in place, which will require an off-site detour during construction. Roadway widening and grade changes are also proposed at the bridge approaches in order to accommodate the design of the new bridge. The proposed earthworks are mostly minor, with the proposed grade generally located within a few feet of the existing grade of Caldwell Road.

The geotechnical investigation for this project was conducted from January 18<sup>th</sup>, 2023, to January 19<sup>th</sup>, 2023. Five (5) total borings were advanced with a CME-550X equipped with an automatic hammer. It should be noted that due to overhead utility issues, one (1) of the proposed bridge borings, EB1-B, was deleted with the permission of NCDOT's foundation design engineer, Shiping Yang, Ph.D., P.E.

Standard Penetration Tests (SPT) were performed at all boring locations to provide subsurface information for roadway foundation design, slope design, and bridge foundation design. Drill tooling was advanced using 3.25-inch hollow-stem augers. Due to the presence of relatively shallow Crystalline Rock, two (2) of the five borings were cored to confirm in situ bedrock. NQ2 Wireline coring equipment was utilized in coring operations, typically with the hollow stem auger serving as casing within the overburden.

All borings were advanced by North Carolina Licensed Drillers (Certified Well Contractors - CWC). All borings were logged by a North Carolina Licensed Geologist (LG/PG), Geologist in Training (GIT), Engineer Intern (EI), or other professional geotechnical field staff deemed qualified by NCDOT. Outcrop mapping was performed by a North Carolina Licensed Geologist to further supplement subsurface information throughout the project corridor.

All borings were left open for a minimum of twenty-four (24) hours to collect groundwater data. Representative soil samples were collected, and ten (10) were submitted to Summit's soils laboratory for classification and moisture content testing. Due to the lack of significant cut sections on the project, no bulk samples were collected for California Bearing Ratio (CBR) testing. Based on the subsurface conditions encountered within the project corridor, no undisturbed samples were deemed necessary to obtain or submit to the laboratory.

All investigations and reporting were performed in accordance with the NCDOT Geotechnical Engineering Unit's 2021 "Geotechnical Investigation and Recommendations Manual." It should be noted that the foundation investigation and subsurface inventory reporting for the proposed bridge over Kerr Creek will be done at a later time and turned in under separate covers.

The following alignments were investigated for this project:

<u>Alignment</u>	<u>Station(±)</u>
-L-	12+50.00 - 18+40.00

**Physiography, Geography, and Geology**

The project area is located within the Piedmont Physiographic Province. The topography within this province is best characterized as gently rolling, well-rounded hills and long low ridges with a few hundred feet of elevation difference between the hills and valleys. The topography within the project corridor is best described as gently rolling. A topographic high of approximately 734 feet above sea level occurs along Caldwell Road (-L-) at the very end of the project corridor. From this area, the project descends toward the topographic low point of approximately 711 feet above sea level within the channel of Kerr Creek. The topography rises again from the creek channel and then runs mostly flat along Caldwell Road (-L-) toward the beginning of the project corridor.

The project area is located within the Yadkin-Peedee River Basin. Kerr Creek is the only significant water feature intersecting the project corridor. Kerr Creek flows to the northeast, where it merges with Sloans Creek, which empties into Second Creek. Second Creek continues to the northeast until it eventually merges with the South Yadkin River. Surface drainage within the project corridor would mainly be expected to follow the u-shaped terrain. Mostly flowing from the higher areas near each end of the project towards the channel of Kerr Creek, located near the middle of the project corridor.

The project area is located within the Charlotte Terrane. A Geological Terrane is a fault-bounded fragment of Earth's crust that shares a common geologic history distinguishing it from surrounding terranes or areas. The Charlotte Terrane consists of mostly metamorphosed igneous rocks such as metagranite, metadiorite, metagabbro, and metamorphosed volcanic rocks. These rocks range in age from about 420 to 615 million years old and were once part of an ancient chain of volcanic islands. More specifically, the project corridor is primarily underlain by Permian-aged Metamorphosed Quartz Diorite (Map Symbol: PzZq). Quaternary-aged alluvium is also present in the project corridor, primarily within the channel and floodplain of Kerr Creek.

**Soil Properties**

During the geotechnical investigation, Residual and Roadway Embankment soils were encountered within the project corridor. Alluvial soils were not encountered during the investigation but are believed to be present within the channel and narrow floodplain of Kerr Creek. The following sections of this text report break down the unique properties, characteristics, prevalence, and potential challenges associated with each of the soil origins encountered within the project corridor. This section also presents a summary of the laboratory data associated with each of the soil origins.

Residual Soils - Overview

Residual soils, soils derived from the weathering of rock, are the dominant soil origin found within the project corridor. In general, the Residual soils underlying the project follow the typical weathering profile observed throughout the Piedmont of North Carolina. The clays, when present, are usually found closer to the ground surface. The silts and sands are typically found deeper in the subsurface and closer to the parent rock source. However, much like the parent rocks that they weather from, Residual soils can vary significantly in some areas in both composition and vertical/horizontal distribution.

This is primarily due to complex structural features within the parent rock source, such as folding and faulting, as well as mineralogical variations within the rock mass itself. The compositional boundaries (also known as contacts) within or between Residual soils are shown in the graphical section of this report as dashed lines. However, in reality, these contacts are much more likely gradational, which means that the compositional changes between clay, silt, and sand occur gradually and over some vertical/horizontal distance.

Saprolite is a type of Residual soil that retains the relic structure or fabric of the parent rock source. In areas where the relic structure or fabric of the parent rock was evident, Residual soils were described in this report as “saprolitic.” Saprolitic soils or saprolite can, in some instances, be assigned a different set of engineering parameters than standard Residual soils. The relic structure or rock fabric present within saprolite can positively influence factors such as the shear strength of the soil. However, it should also be noted that saprolites can also retain relic discontinuities or joints that may have been present in the parent bedrock. These discontinuities can negatively influence factors such as the shear strength of the soil.

Residual Soils – General Characteristics

In general, the Residual soils present within the project corridor were found to be composed of red to red-orange, highly sandy, silty clays, especially within the upper ten feet of the subsurface. Deeper into the subsurface and closer to the parent rock source, the silty clays generally transitioned into orange-brown to tan, silty sands. Field moisture descriptions were typically reported as moist to wet within the more shallow clays and moist to saturated within the deeper sands. Soil densities were found to range from medium stiff to very stiff for the cohesive soils. Soil densities for non-cohesive (granular) soils typically varied from loose to medium dense.

Trace amounts of mica were encountered within the Residual soils present within the project corridor. The mica group of sheet silicates is among the most widely distributed minerals around the world and can occur in all types of rocks. Trace amounts of Manganese Oxide (MnO) were also encountered within the residual soils. MnO is a type of mineralization commonly present within deeply weathered cohesive Residual soils in the Piedmont of North Carolina.

Trace amounts of gravel-sized fragments of Weathered and Crystalline Rock were also encountered within the Residual soils. These rock fragments likely represent seams, lenses, ledges, or float material that remain consolidated within the surrounding unconsolidated soil. This occurs primarily thanks to complex differential weathering processes associated with structural features and the differences in mineralogy within the parent rock mass. It should be noted that these fragments often appear gravel-sized during the geotechnical investigation due to drilling and sampling procedures. In reality, these seams, lenses, or ledges may be up to a few feet thick, and some float materials may be cobble or boulder-sized.

Residual Soils – Laboratory Testing

Laboratory testing was conducted on suspected silt-clay material (cohesive soils) located near and above the proposed grade throughout the project corridor. In total, seven (7) suspected samples of Residual cohesive soils were submitted to Summit’s laboratory. Of those, six (6) were AASHTO classified as either A-7-5 or A-7-6. In

general, A-7 classified soils are composed predominantly of clay. They may be highly elastic and may have moderate to high plasticity indexes. The table below provides a summary of the results of the laboratory testing for the A-7 classified soils:

	<u>Liquid Limit (L.L)</u>	<u>Plastic Limit (P.L)</u>	<u>Plasticity Index (P.I.)</u>	<u>Natural Moisture</u>	<u>Passing # 200 Sieve</u>
LOW	41	24	16	23.2%	43%
HIGH	57	31	26	33.8%	84%
<b>AVERAGE</b>	<b>47</b>	<b>28</b>	<b>19</b>	<b>26.5%</b>	<b>56%</b>

One (1) of the seven suspected cohesive samples of Residual soil was AASHTO classified as A-2-4. In general, A-2 classified soils are composed predominately of sand with binder characteristics of A-4 or A-5 soils. The sample tested had a Liquid Limit of 31, a Plastic Limit of 22, and a Plasticity Index of 9. The sample had a moisture content of 24.1%, and 33% of the material passed the #200 sieve. For additional laboratory information on these samples and all samples tested within the project corridor, please refer to Appendix B of this report.

Residual Soils – Conclusions

Residual soils will be heavily impacted during the roadway construction, primarily as subgrade material, embankment foundation material, and as potential borrow material excavated from cut sections. From looking at the field and lab data, some general conclusions and assumptions can be made about these soils. The Residual soils throughout the project corridor should generally be suitable for use as a subgrade material, embankment foundation material, and acceptable for use as embankment fill or other types of borrow material.

A-7-5/A-7-6 AASHTO-classified soils can be deleterious and are very prevalent throughout the project corridor. However, after extensive lab testing, the average Plasticity Index (PI) values of these soils were determined to be, on average, only moderately plastic. This was primarily due to the relatively high sand content present within these soils throughout the project corridor. That being said, one area of highly plastic soils (PI value of 26 or more) was encountered during the geotechnical investigation.

Highly plastic soils can negatively affect embankment stability, embankment settlement, and subgrade stability. They also may not be suitable for use as embankment, subgrade, or backfill material on the project. Areas within the project corridor containing highly plastic soils will be highlighted in the “Areas of Special Geotechnical Interest” section of this report. It should be noted that additional areas of highly plastic soils that may have been missed during the geotechnical investigation may be uncovered during construction.

On average, soil moisture at the time of investigation was determined to be at or near optimum. However, some areas with Residual soils wetter than optimum were encountered during the geotechnical investigation. Soils (especially cohesive soils) that are wetter than optimum can present challenges during roadway construction and may require drying to attain optimum moisture. Areas within the project corridor containing wet or saturated cohesive soils will be highlighted in the “Areas of Special Geotechnical Interest” section of this report. It should be noted that additional areas of wet or saturated soils that may have been missed during the geotechnical investigation may be uncovered during construction and will need to be dealt with appropriately.

Manganese Oxide (MnO) was observed within the split spoon sampler during SPT testing; however, typically only in trace amounts. Manganese Oxide can generate nearly frictionless surfaces of indeterminate orientation throughout the Residual soil profile, which can lead to slope stability issues. However, no significant quantities of Manganese Oxide were observed during the geotechnical investigation, and this is not expected to impact slope stability on the project.

Trace amounts of mica were observed throughout the Residual soil profile within the project corridor. Highly micaceous soils can be characterized by high compressibility, poor compactibility, and low shear strength. If encountered near the proposed subgrade, highly micaceous soils could present challenges during the construction of the roadway. However, only trace amounts of mica were reported during the geotechnical investigation, and this is not anticipated to be an issue during construction.

#### Roadway Embankment Soils - Overview

Roadway Embankment soils from the construction of Caldwell Road (SR 1547) are also present throughout the project corridor. Roadway Embankment soils are often quite similar to the local soils from which they are typically sourced. However, they often have a “reworked” appearance, with a large variation in grain size. They can contain little to trace amounts of organic material, gravel, cobbles, boulders and/or other types of debris. Based on the earliest available United States Geological Survey (USGS) Historical Topographic Maps obtained for the project corridor, Caldwell Road (-L-) was constructed sometime prior to 1953.

#### Roadway Embankment Soils – General Characteristics

Roadway Embankment soils within the project corridor were found to be primarily composed of brown to orange-brown, silty sands. Some areas of highly sandy, silty clays were also encountered. Field moisture descriptions typically indicated that Roadway Embankment soils were moist to wet. Soil densities were typically medium stiff for cohesive soils and loose for non-cohesive (granular) soils. Little to trace amounts of mica and gravel were also observed within the Roadway Embankment soils.

#### Roadway Embankment Soils – Laboratory Testing

Due to their mostly granular composition, Roadway Embankment soils within the project corridor were tested only on a limited basis. Laboratory testing was conducted on three (3) samples of suspected cohesive Roadway Embankment soils. Two (2) of the samples were AASHTO classified as A-2-4 and one (1) as A-7-6. The A-7-6 sample tested had a Liquid Limit of 48, a Plastic Limit of 25, and a Plasticity Index of 23. The sample had a moisture content of 31.8%, and 60% of the material passed the #200 sieve. For additional laboratory information on these samples and all samples tested within the project corridor, please refer to Appendix B of this report.

#### Roadway Embankment Soils – Conclusions

Roadway Embankment soils are present throughout the length of the project corridor ranging from a few to several feet thick, with the thickest areas located at the existing bridge approaches. These soils are predicted to be heavily impacted during construction and when they are, primarily as subgrade material.

If properly constructed, Roadway Embankment soils typically do not present significant issues during future construction projects. However, some older Roadway Embankment fills across the state can be poorly compacted, contain highly plastic clays, perched water, and even miscellaneous debris such as tree trunks. In areas where the construction of the existing roadway required rock excavation or blasting, the Roadway Embankment is often laden with significant quantities of gravel, cobbles, and boulders that were removed from cut areas and used within the embankment.

From looking at the field and limited lab data, some general conclusions and assumptions can be made about these soils. The Roadway Embankment soils throughout the project corridor should be suitable for use as a subgrade material, embankment foundation material, and acceptable for use as embankment fill or other types of borrow material. In addition, on average, soil moisture at the time of investigation was determined to be at or

near optimum. However, some areas with Roadway Embankment soils wetter than optimum were encountered during the geotechnical investigation.

Soils (especially cohesive soils) that are wetter than optimum can present challenges during roadway construction and may require drying to attain optimum moisture. Areas within the project corridor containing wet or saturated cohesive soils will be highlighted in the “Areas of Special Geotechnical Interest” section of this report. It should be noted that additional areas of wet or saturated soils that may have been missed during the geotechnical investigation may be uncovered during construction and will need to be dealt with appropriately. In addition, it should be noted that there may be small areas of highly plastic Roadway Embankment soils that may have been missed during the geotechnical investigation and may be later uncovered during construction, at which point they will need to be dealt with appropriately.

### **Rock Properties**

The Residual soils described in the previous section were developed from the weathering of Metamorphosed Quartz Diorite, which is believed to underly the entire project corridor. This unit is described as foliated to massive and is believed to be Permian in age, approximately 252 - 299 million years old. Crystalline Rock was encountered at all three of the bridge borings drilled. Due to the relatively shallow depth encountered and the potential impact on the foundation design of the bridge, rock coring was performed to confirm in-situ bedrock and rock quality. Approximately twenty-nine (29) feet of rock coring was advanced at two different boring locations at the proposed bridge end bents.

White, gray, and black, Metamorphosed Quartz Diorite was retrieved from the core barrel at each location. In general, the rock recovered was fresh to very slightly weathered, with some moderate to moderately severely weathered zones. The rock was also generally hard to very hard, with some moderate to medium hard areas in the more weathered zones. In general, natural fractures observed within the core suggested a mostly moderately close fracture spacing (1 - 3 feet) within the rock mass. However, some areas exhibited a wide fracture spacing (3 - 10 feet), while the more weathered zones showed a close fracture spacing (0.16 - 1 foot). The more weathered zones also exhibited iron-oxide staining, especially near fractures.

Recovery (REC) percentages ranged from 83% to 93%. Rock Quality Designation (RQD) percentages ranged from 70% to 89%. Geologic Strength Index (GSI) values within this rock unit ranged from 70 to 90. Differential weathering is not only evident in the varying rock lines within the project corridor but is also evident within the rock mass itself. Moderate to moderately severe weathering zones were documented within the core. One interpretation of core loss or lack of recovery, which was documented during this investigation, is that those were zones or seams of severe to very severely weathered Crystalline Rock. REC percentages, RQD percentages, and GSI values are affected by this loss and can be significantly lower in these areas.

The typical transition zone of Weathered Rock seen throughout the piedmont was not commonly encountered during the investigation. Crystalline Rock was often encountered immediately underlying loose to medium-dense Residual soils. One boring (EB2-B) encountered approximately one foot of Weathered Metamorphosed Diorite above the Crystalline Rock. Outcrop mapping was also conducted along the length of the project corridor. One potential outcropping of Crystalline Rock was observed within the project corridor. This area was identified within the existing ditch line located immediately left of EB1-A. No strike and dip measurements of foliation planes were taken due to no obvious identifiable planar features such as foliation.

Crystalline Rock was encountered within six (6) feet of proposed grade at one location within the project corridor and could be a factor during the roadway construction, specifically during the ditch construction on the northeast

corner of the proposed bridge. This area will be highlighted in the “Areas of Special Geotechnical Interest” section of this report. It should be noted that there may be small areas of Crystalline Rock within six feet of the proposed grade of the roadway that may have been missed during the geotechnical investigation. These areas may be later uncovered during construction and will need to be dealt with appropriately.

**Groundwater Properties**

At shallow depths and under unconfined conditions, groundwater flow within the project corridor would be expected to be primarily driven by variations in the elevation of the water table surface. This driving mechanism is called topographically-driven flow because the elevation of the water table usually mimics the elevation of the ground surface. Therefore, surface topography may be used to infer the direction of shallow groundwater flow in an area. It should be noted that shallow, unconfined groundwater can vary significantly based on seasonal variations in precipitation and climatic issues such as drought.

Deeper water-bearing zones usually occur within the underlying bedrock, which in this case, is composed of Crystalline Rock (Metamorphosed Quartz Diorite). The movement of groundwater through Crystalline Rocks is one of the least predictable phenomena in all of groundwater science. This is because the porosity of these rocks is very low, and a network of fractures usually controls permeability. The direction of groundwater movement in deeper bedrock aquifers may not be consistent with shallow, unconfined, and topographically-driven groundwater flow.

The geotechnical investigation was conducted during a period of average to slightly above-average rainfall. Groundwater was encountered in three (3) of the six (6) total drilled borings, approximately 50% of the borings. Top-of-water table elevations varied from 711.5 feet to 719.0 feet, with an average elevation of 715.4 feet above sea level. Groundwater was encountered from as shallow as 6 feet beneath the ground surface to as deep as 14 feet, with an average of 10.0 feet.

Perched water was suspected in at least one of the three borings that encountered groundwater, EB2-B. Perched water is water maintained above the normal groundwater level by the presence of an intervening impervious stratum. Some examples of an impervious stratum could be a thick clay layer, a seam of Weathered Rock, or even Crystalline Rock. Perched water is more easily drained and dealt with during construction than encountering the actual ground water table. During the Geotechnical Investigation, groundwater was not encountered within six feet of proposed grade.

A visual reconnaissance for springs, seeps, and ponds or lakes was also conducted. None of these features or any other unusual groundwater features were observed within or adjacent to the project footprint. In addition, a visual reconnaissance for water wells was conducted throughout the project corridor. This was used in conjunction with the final survey file to attempt to identify water wells within or immediately adjacent to the proposed right of way of the project. Some water well locations are well hidden, and it is possible that some wells were missed or misidentified by the final survey and/or visual reconnaissance. No water wells were observed or noted within the final survey file.

**Areas of Special Geotechnical Interest**

Plastic Soils - During the geotechnical investigation, highly plastic clays were encountered in one area within the project corridor. Highly plastic soils can be problematic during and after construction. They can negatively affect embankment stability, embankment settlement, subgrade stability and may not be suitable for use as borrow

material. More detailed information on these soils can be found in the “Soil Properties” section of this text report. The following approximate locations listed below show the areas where highly plastic clays are believed to be present within the project corridor:

<u>Alignment</u>	<u>Station(±)</u>	<u>Offset</u>
-L-	12+50.00 – 14+75.00	Left & Right

Wet Cohesive Soils - During the geotechnical investigation, wet cohesive (fine-grained) soils were encountered in one area within the project corridor. Fine-grained soils wetter than optimum can be problematic during and after construction, and in particular, can affect subgrade stability. In most instances, these areas overlap with the areas of highly plastic soils indicated in the previous section. More information on these soils can be found in the “Soils Properties” section of this text report. The following locations listed below show areas where wet cohesive soils are believed to be present within the project corridor:

<u>Alignment</u>	<u>Station(±)</u>	<u>Offset</u>
-L-	16+01.13 – 18+40.00	Left & Right

Crystalline Rock - During the geotechnical investigation, Crystalline Rock was encountered in several areas. The excavation of Crystalline Rock can be problematic during construction and may require specialized equipment and/or blasting. More detailed information on the rocks underlying the project corridor can be found in the “Rock Properties” section of this text report. The following approximate locations listed below show areas where Crystalline Rock is believed to be present within six feet of proposed grade:

<u>Alignment</u>	<u>Station(±)</u>	<u>Offset</u>
-L-	14+75.00 – 15+08.87	Left

**References**

North Carolina Geological Survey, 1985, Geologic map of North Carolina: North Carolina Geological Survey, General Geologic Map, scale 1:500000.

The Geology of the Carolinas, J. Wright Horton, Jr., and Victor A. Zullo

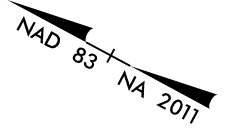
Groundwater Science, Charles R. Fitts

Respectfully Submitted,



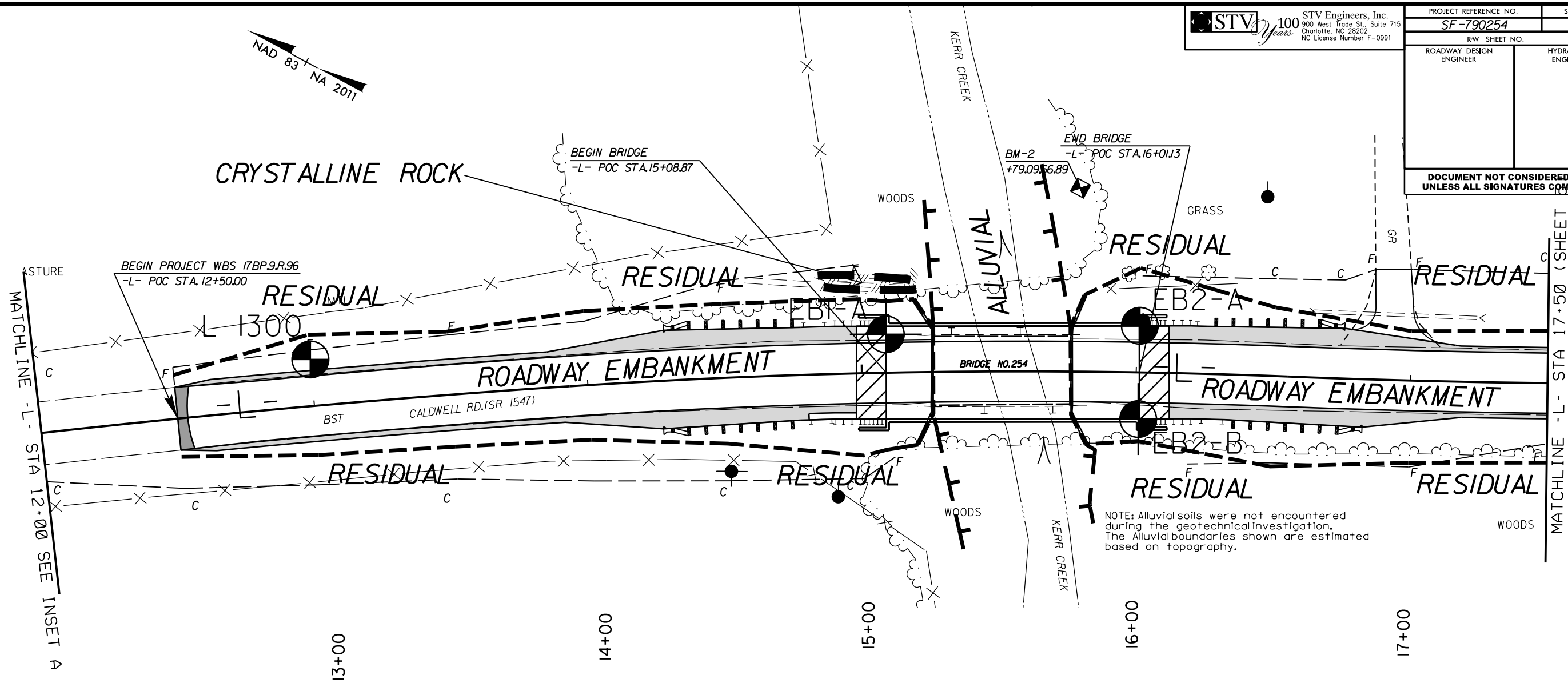
Brett Smith, PG  
 Project Geologist  
 Summit Design and Engineering Services, PLLC  
 NC License # 2390

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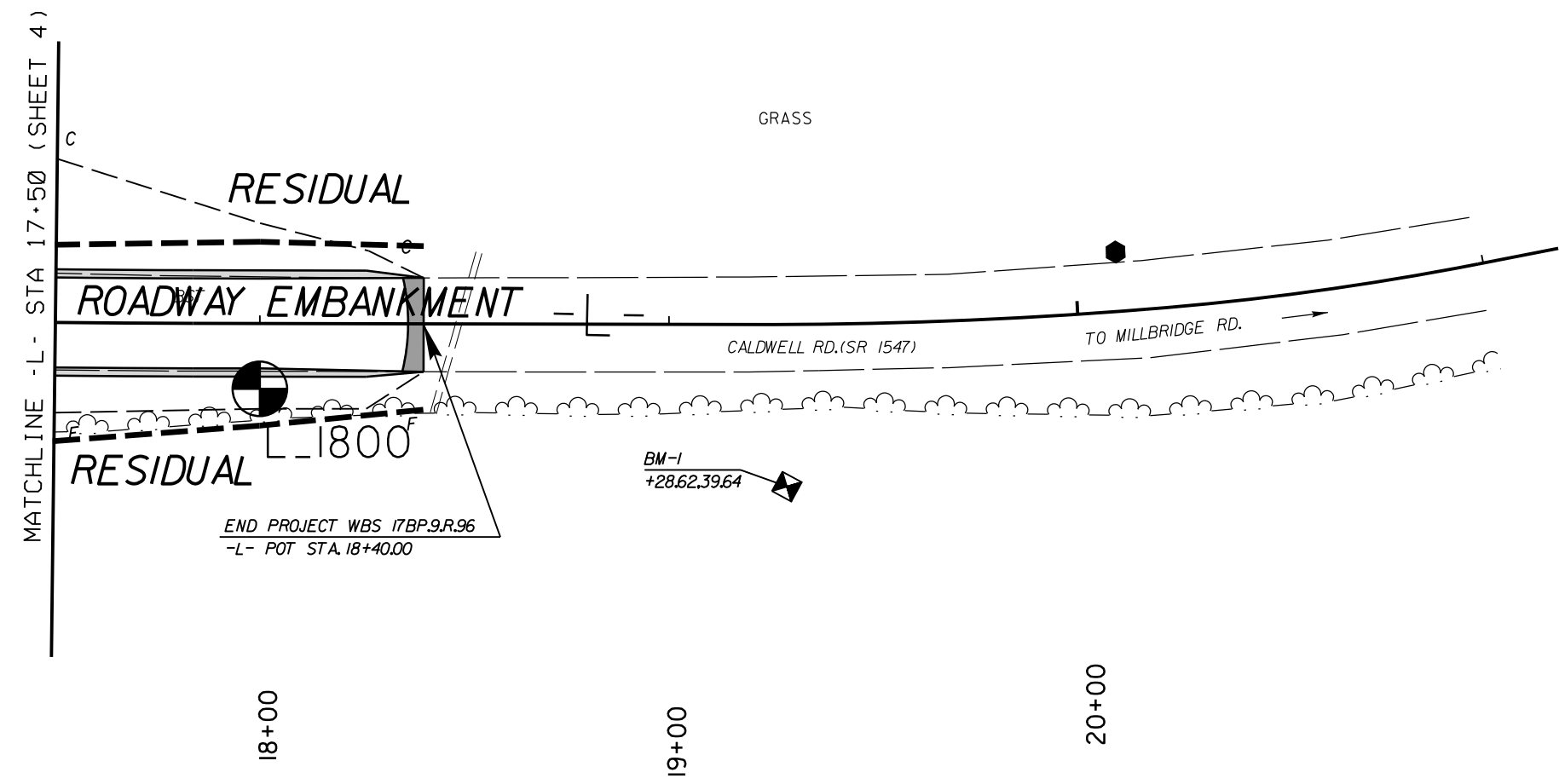
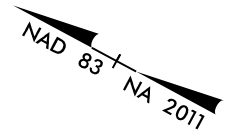
NOTE: Alluvial soils were not encountered during the geotechnical investigation. The Alluvial boundaries shown are estimated based on topography.

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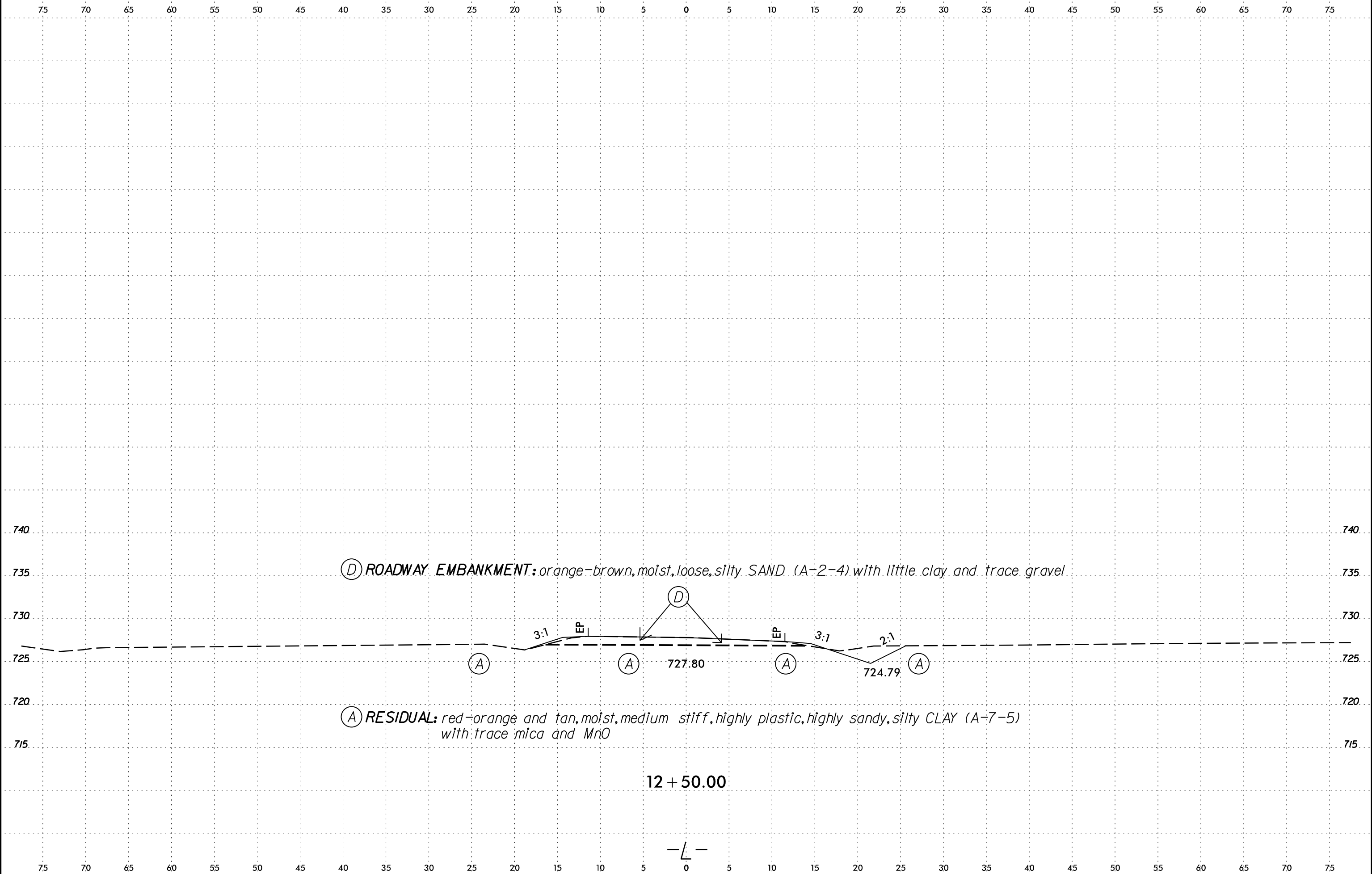
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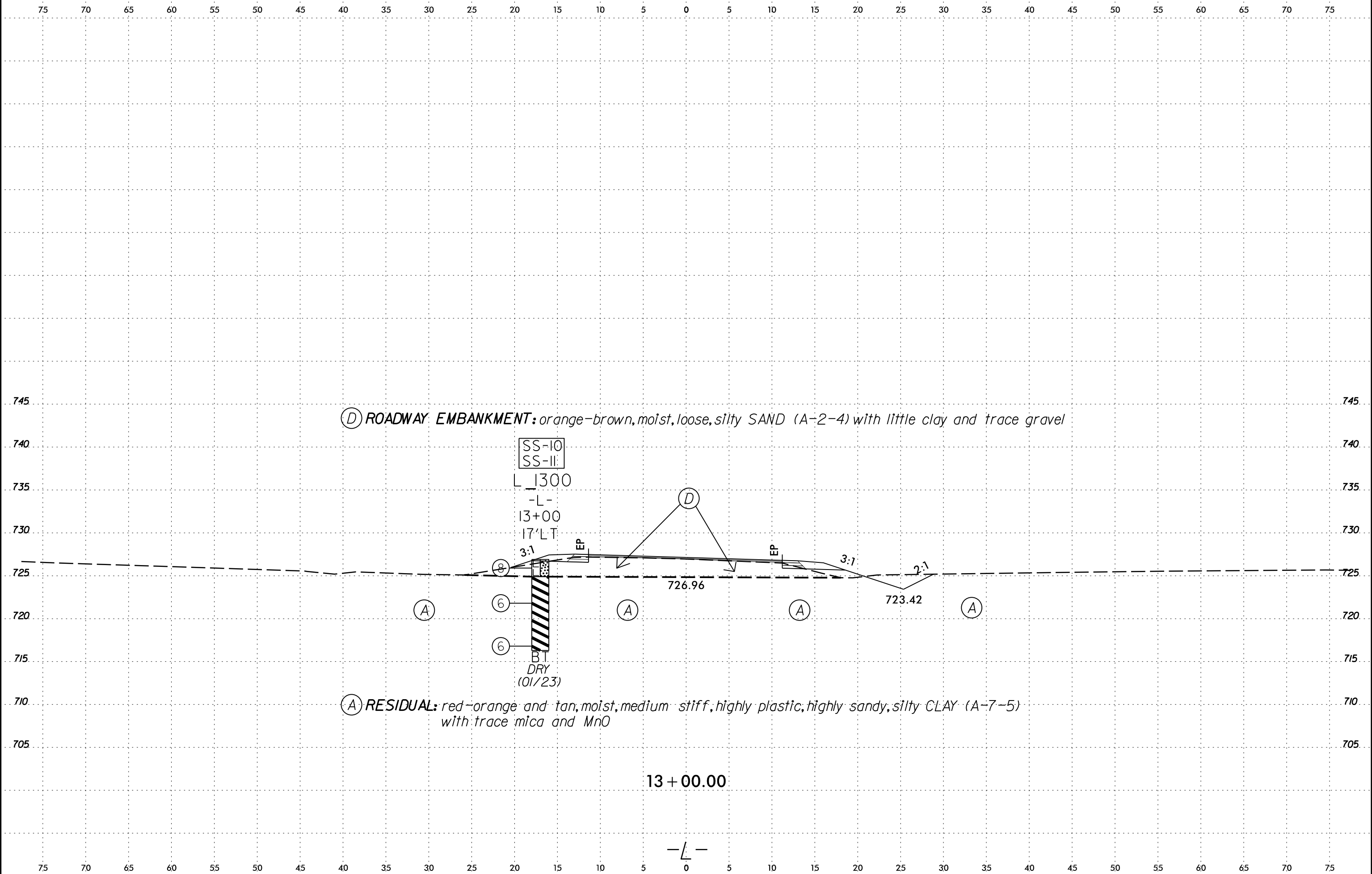
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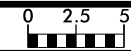


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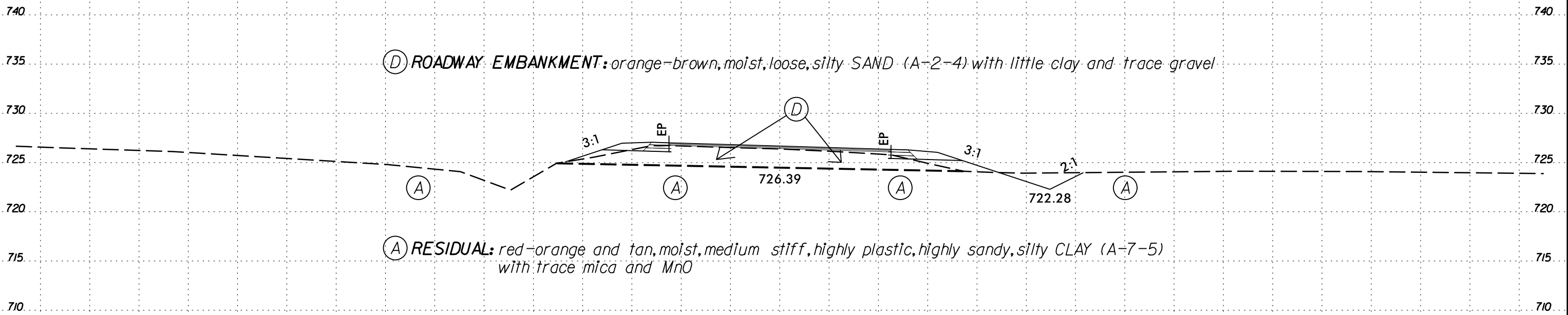


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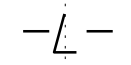




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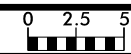
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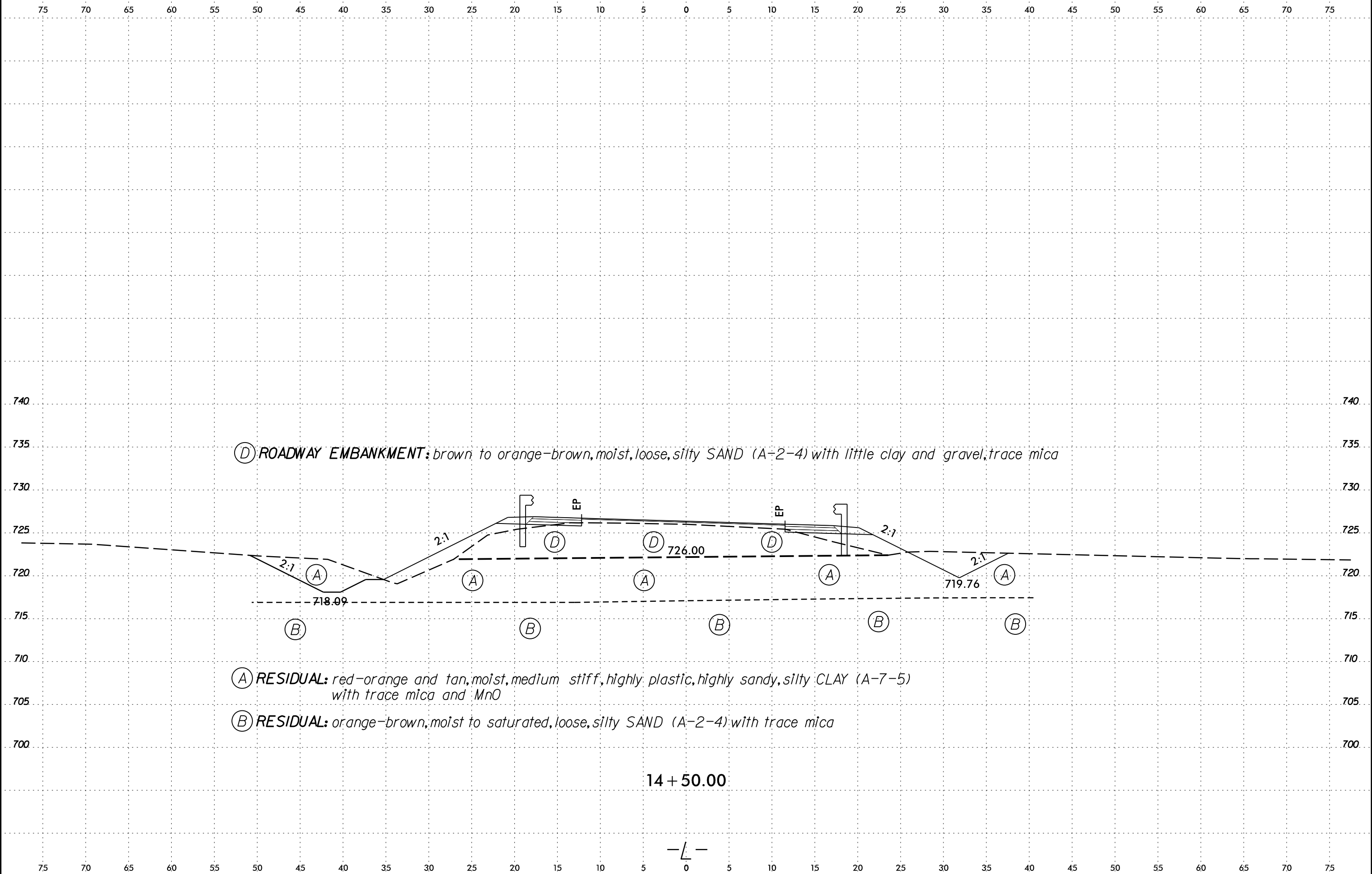
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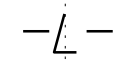


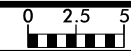
(D) ROADWAY EMBANKMENT: brown to orange-brown, moist, loose, silty SAND (A-2-4) with little clay and gravel, trace mica

(A) RESIDUAL: red-orange and tan, moist, medium stiff, highly plastic, highly sandy, silty CLAY (A-7-5) with trace mica and MnO

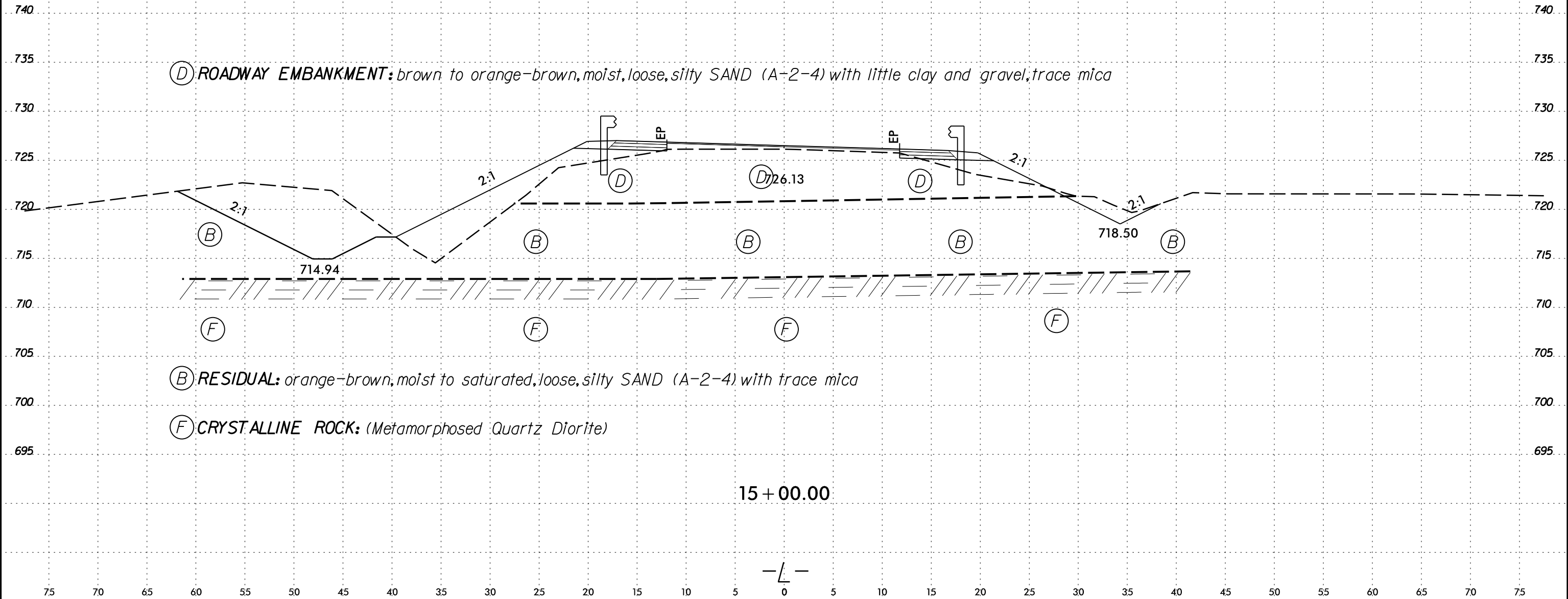
(B) RESIDUAL: orange-brown, moist to saturated, loose, silty SAND (A-2-4) with trace mica

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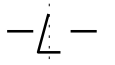


(D) ROADWAY EMBANKMENT: brown to orange-brown, moist, loose, silty SAND (A-2-4) with little clay and gravel, trace mica

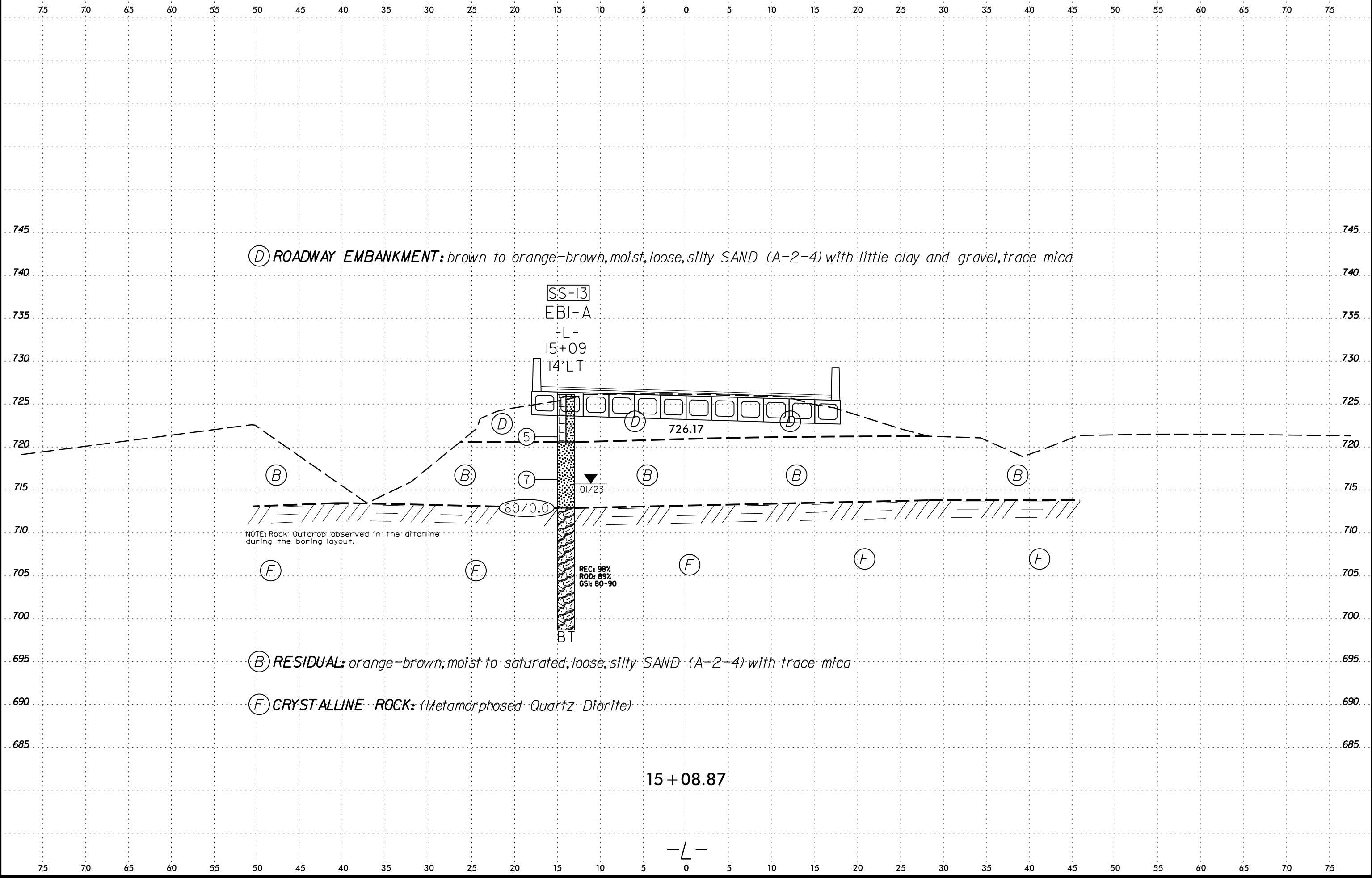
(B) RESIDUAL: orange-brown, moist to saturated, loose, silty SAND (A-2-4) with trace mica

(F) CRYSTALLINE ROCK: (Metamorphosed Quartz Diorite)

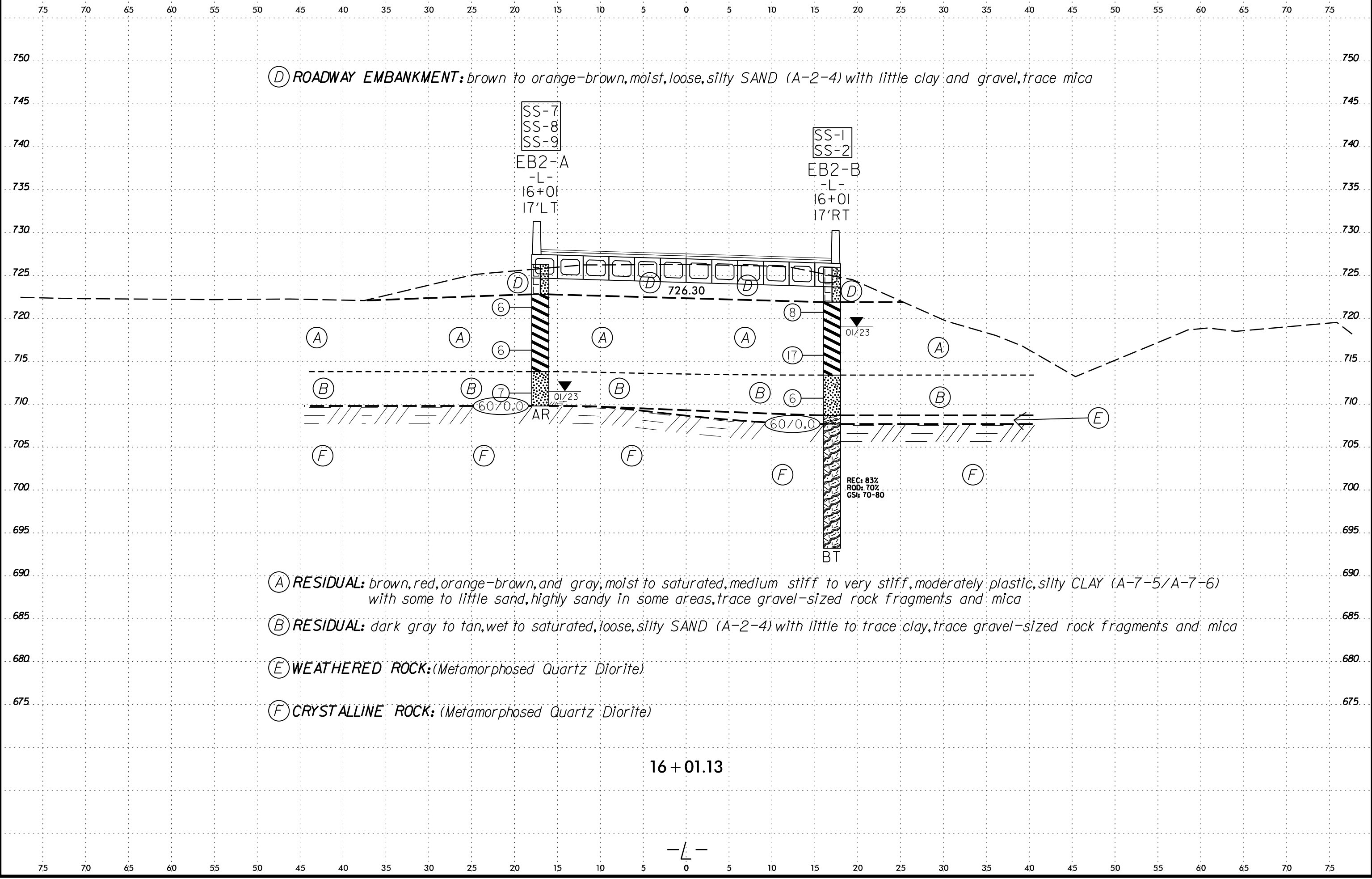
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Ⓓ **ROADWAY EMBANKMENT:** brown to orange-brown, moist, loose, silty SAND (A-2-4) with little clay and gravel, trace mica

SS-7  
SS-8  
SS-9

EB2-A  
-L-  
16+01  
17'LT

SS-1  
SS-2

EB2-B  
-L-  
16+01  
17'RT

REC: 83%  
ROD: 70%  
GS: 70-80

BT

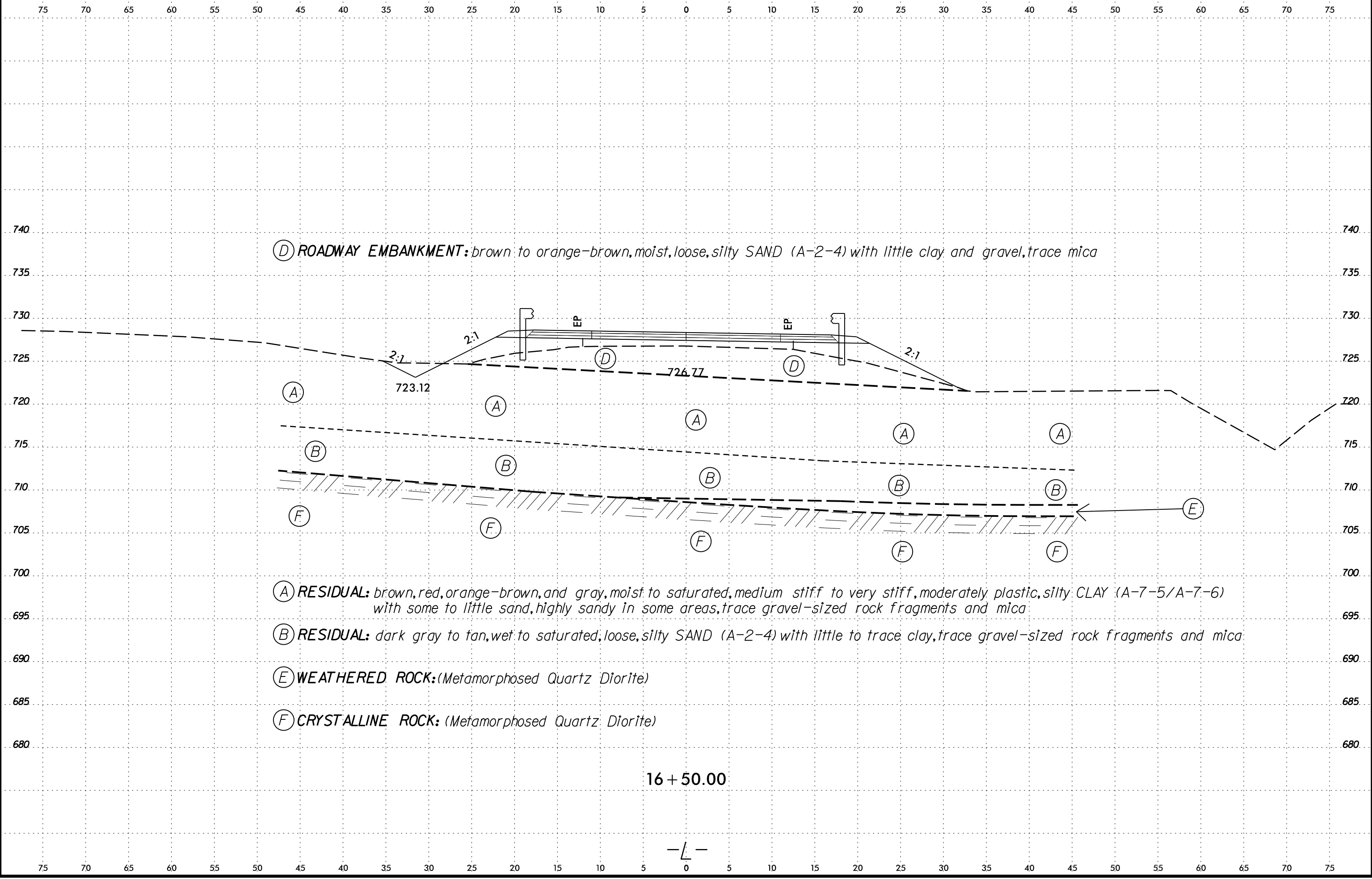
Ⓐ **RESIDUAL:** brown, red, orange-brown, and gray, moist to saturated, medium stiff to very stiff, moderately plastic, silty CLAY (A-7-5/A-7-6) with some to little sand, highly sandy in some areas, trace gravel-sized rock fragments and mica

Ⓑ **RESIDUAL:** dark gray to tan, wet to saturated, loose, silty SAND (A-2-4) with little to trace clay, trace gravel-sized rock fragments and mica

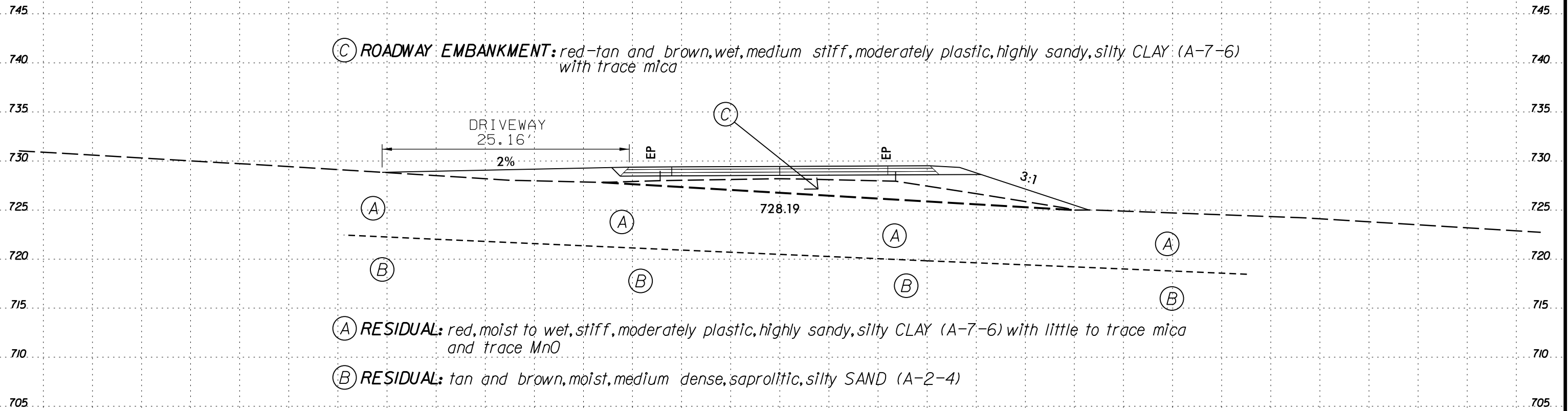
Ⓔ **WEATHERED ROCK:** (Metamorphosed Quartz Diorite)

Ⓕ **CRYSTALLINE ROCK:** (Metamorphosed Quartz Diorite)

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Ⓒ ROADWAY EMBANKMENT: red-tan and brown, wet, medium stiff, moderately plastic, highly sandy, silty CLAY (A-7-6) with trace mica

DRIVEWAY  
25.16'  
2%

3:1

728.19

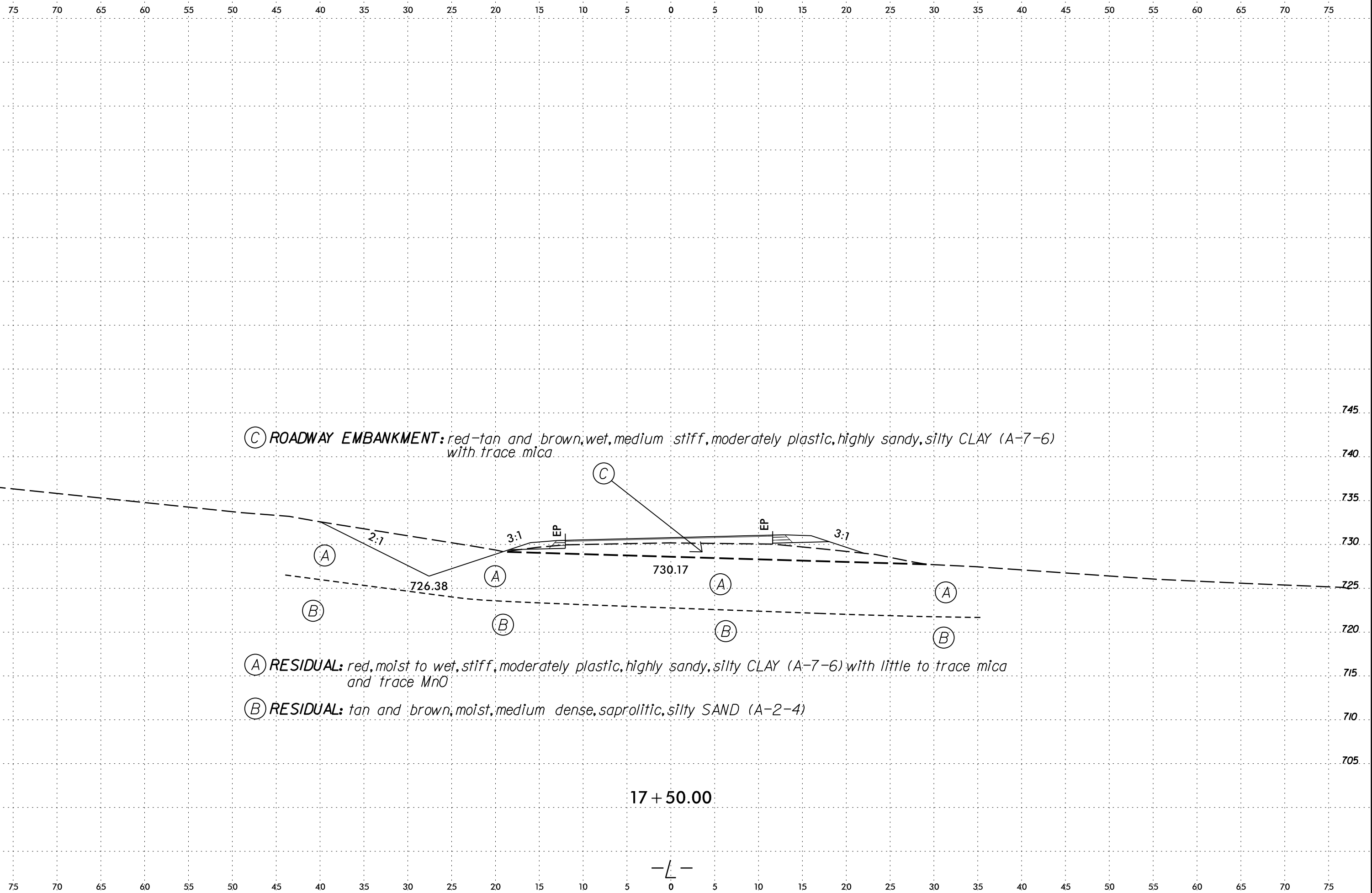
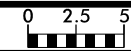
Ⓐ RESIDUAL: red, moist to wet, stiff, moderately plastic, highly sandy, silty CLAY (A-7-6) with little to trace mica and trace MnO

Ⓑ RESIDUAL: tan and brown, moist, medium dense, saprolitic, silty SAND (A-2-4)

17+00.00

—L—

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

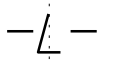


Ⓒ **ROADWAY EMBANKMENT:** red-tan and brown, wet, medium stiff, moderately plastic, highly sandy, silty CLAY (A-7-6) with trace mica

Ⓐ **RESIDUAL:** red, moist to wet, stiff, moderately plastic, highly sandy, silty CLAY (A-7-6) with little to trace mica and trace MnO

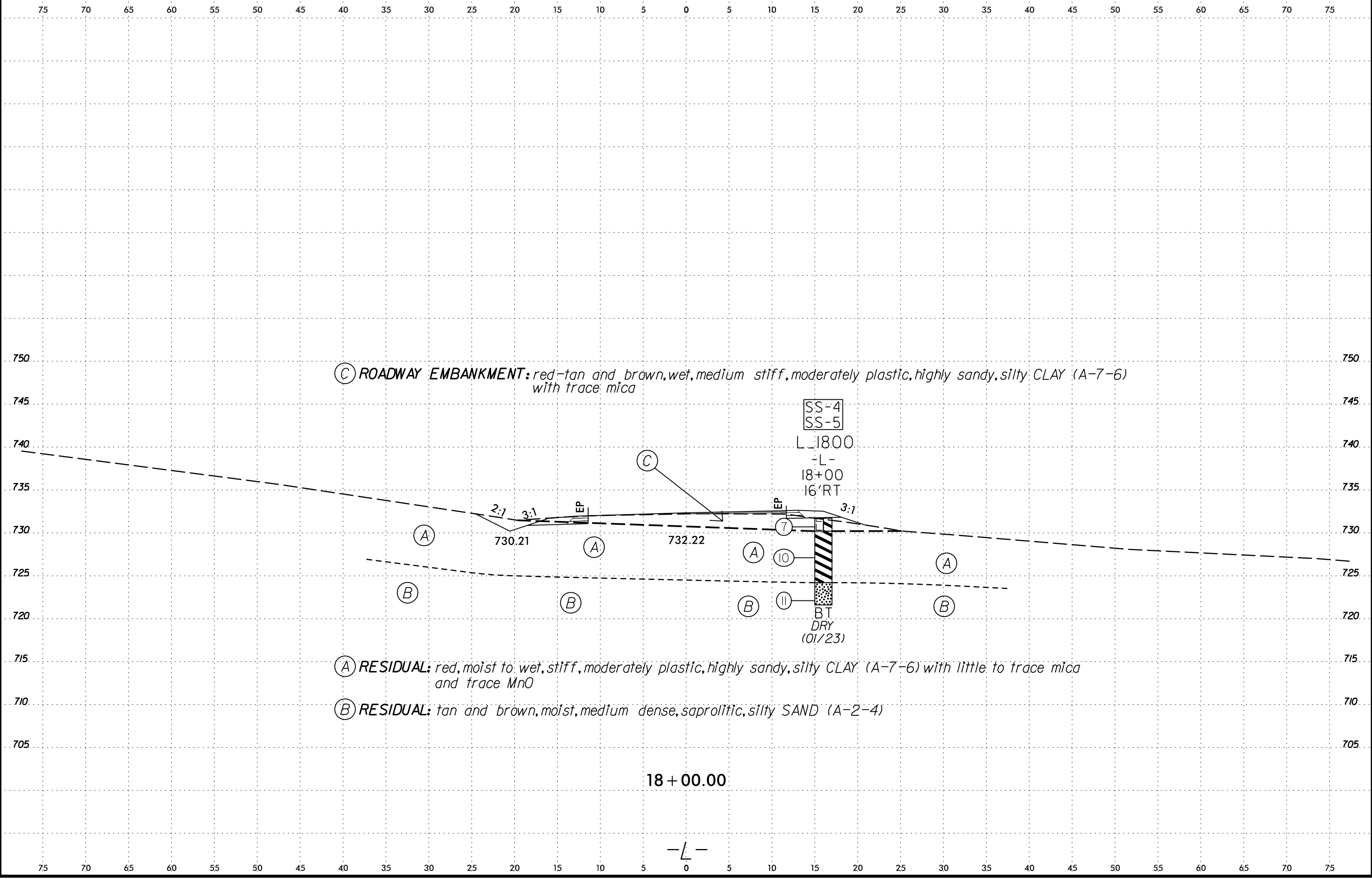
Ⓑ **RESIDUAL:** tan and brown, moist, medium dense, saprolitic, silty SAND (A-2-4)

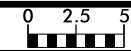
17 + 50.00



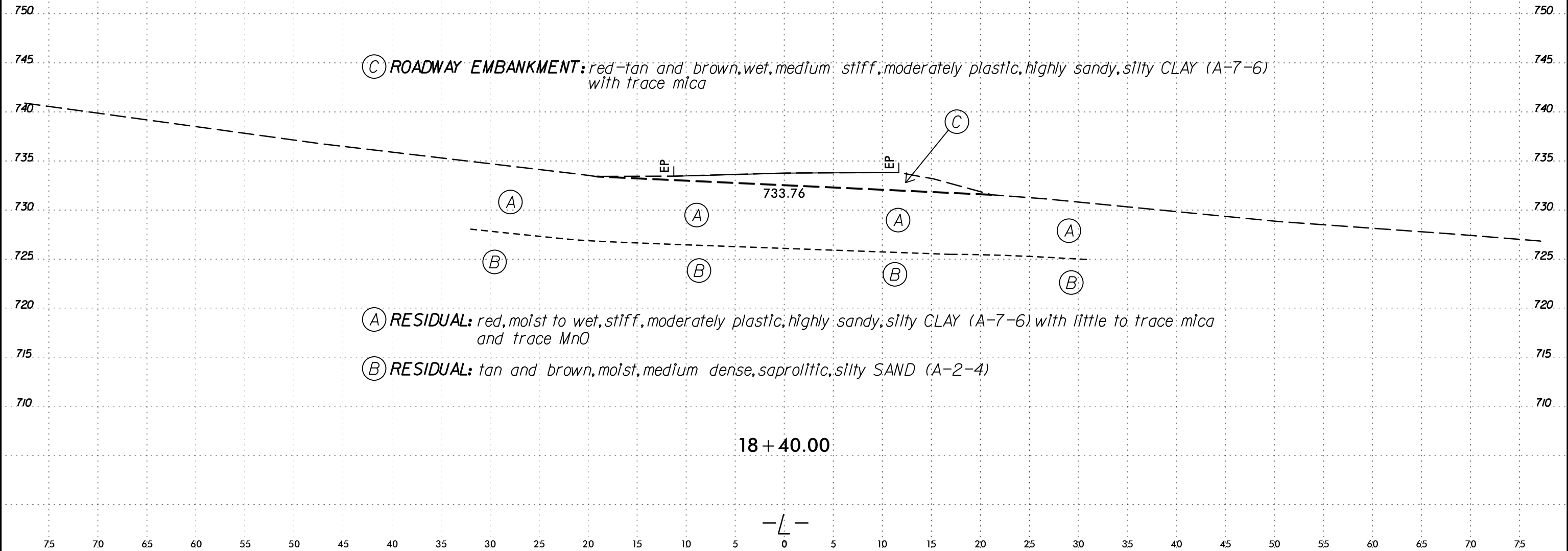
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75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
SUBSURFACE INVESTIGATION  
APPENDIX A  
CORE LOGS AND CORE PHOTOS

REFERENCE: SF-790254

PROJECT: 17BP.9.R.96

Prepared In the Office of:



2715 Ashton Drive, Ste 104  
Wilmington, NC 28412  
Voice: (910) 475-1208  
www.summitde.com

# GEOTECHNICAL BORING REPORT

## CORE LOG

WBS 17BP.9.R.96		TIP SF-790254		COUNTY ROWAN		GEOLOGIST Fischer, H.						
SITE DESCRIPTION Bridge No. 254 over Kerr Creek on Caldwell Road (SR 1547)							GROUND WTR (ft)					
BORING NO. EB1-A		STATION 15+09		OFFSET 14 ft LT		ALIGNMENT -L-						
COLLAR ELEV. 726.1 ft		TOTAL DEPTH 27.4 ft		NORTHING 685,707		EASTING 1,505,734						
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 83% 11/12/2021				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic						
DRILLER Moseley, M.G.		START DATE 01/19/23		COMP. DATE 01/19/23		SURFACE WATER DEPTH N/A						
CORE SIZE NQ2		TOTAL RUN 14.2 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
712.88	712.9	13.2	4.2	N=60/0.0 0:15/0.2 0:45/1.0 0:41/1.0 0:45/1.0 1:50/1.0	(3.9) 93%	(3.4) 81%		(13.9) 98%	(12.6) 89%	ELEV. (ft)		
710	708.7	17.4	5.0	1:56/1.0 1:50/1.0 1:09/1.0 1:05/1.0 1:18/1.0	(5.0) 100%	(4.5) 90%				ELEV. (ft)		
705	703.7	22.4	5.0	1:28/1.0 1:40/1.0 1:45/1.0 1:36/1.0 1:58/1.0	(5.0) 100%	(4.7) 94%				ELEV. (ft)		
700	698.7	27.4								ELEV. (ft)		
<p style="text-align: center;">Begin Coring @ 13.2 ft</p> <p style="text-align: center;"><b>CRYSTALLINE ROCK</b></p> <p style="text-align: center;">white, gray, and black, fresh to very slight weathering, hard to very hard, moderately close fracture spacing, METAMORPHOSED QUARTZ DIORITE</p> <p style="text-align: center;">GSI: 80-90</p> <p style="text-align: center;">Boring Terminated at Elevation 698.7 ft in Crystalline Rock (METAMORPHOSED QUARTZ DIORITE)</p> <ul style="list-style-type: none"> <li>- Topsoil Thickness = 0.1 Feet</li> <li>- Auger Refusal at 13.2 Feet</li> <li>- Began Coring at 13.2 Feet</li> </ul>												

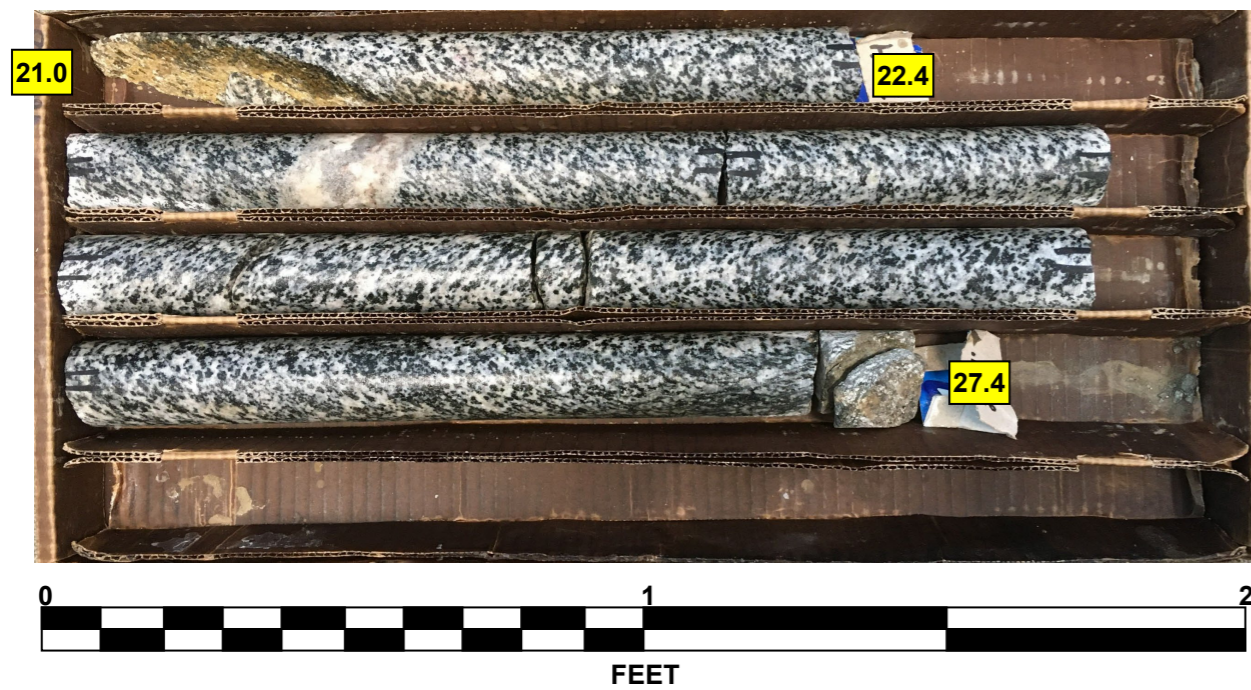
WBS 17BP.9.R.96		TIP SF-790254		COUNTY ROWAN		GEOLOGIST Fischer, H.						
SITE DESCRIPTION Bridge No. 254 over Kerr Creek on Caldwell Road (SR 1547)							GROUND WTR (ft)					
BORING NO. EB2-B		STATION 16+01		OFFSET 17 ft RT		ALIGNMENT -L-						
COLLAR ELEV. 725.9 ft		TOTAL DEPTH 32.7 ft		NORTHING 685,611		EASTING 1,505,750						
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 83% 11/12/2021				DRILL METHOD SPT Core Boring		HAMMER TYPE Automatic						
DRILLER Moseley, M.G.		START DATE 01/18/23		COMP. DATE 01/18/23		SURFACE WATER DEPTH N/A						
CORE SIZE NQ2		TOTAL RUN 14.5 ft										
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		SAMP. NO.	STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %		REC. (ft) %	RQD (ft) %			
707.7	707.7	18.2	4.5	N=60/0.0 0:37/0.5 1:22/1.0 1:59/1.0 2:54/1.0 4:10/1.0	(3.9) 87%	(3.2) 71%		(12.1) 83%	(10.1) 70%	ELEV. (ft)		
705	703.2	22.7	5.0	0:56/1.0 1:02/1.0 1:00/1.0 1:03/1.0 1:09/1.0	(4.5) 90%	(4.3) 86%				ELEV. (ft)		
700	698.2	27.7	5.0	0:54/1.0 1:15/1.0 1:09/1.0 0:56/1.0 1:46/1.0	(3.7) 74%	(2.6) 52%				ELEV. (ft)		
695	693.2	32.7								ELEV. (ft)		
<p style="text-align: center;">Begin Coring @ 18.2 ft</p> <p style="text-align: center;"><b>CRYSTALLINE ROCK</b></p> <p style="text-align: center;">white, gray, and black with some orange-brown (iron-oxide) staining, especially around fractures, mostly slight to very slight weathering with some moderate to moderate severely weathered zones (interpreted from core loss), mostly hard to very hard, moderately hard in the more weathered zones, generally close fracture spacing with one set of healed high angle fractures noted, METAMORPHOSED QUARTZ DIORITE.</p> <p style="text-align: center;">GSI = 70-80</p> <p style="text-align: center;">Boring Terminated at Elevation 693.2 ft in Crystalline Rock (METAMORPHOSED QUARTZ DIORITE)</p> <ul style="list-style-type: none"> <li>- Topsoil Thickness = 0.3 Feet</li> <li>- Auger Refusal at 18.2 Feet</li> <li>- Began Coring at 18.2 Feet</li> </ul>												

NCDOT CORE DOUBLE SF790254\_GEO\_RDWY\_L\_GPJ\_NC\_DOT.GDT 4/11/23

# CORE PHOTOGRAPHS

## EB1-A

BOXES 1 & 2: 13.2 - 27.4 FEET



## EB2-B

BOXES 1 & 2: 18.2 - 32.7 FEET



NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
GEOTECHNICAL ENGINEERING UNIT  
**SUBSURFACE INVESTIGATION**  
APPENDIX B  
SOIL TEST RESULTS

REFERENCE: SF-790254

PROJECT: 17BP.9.R.96

Prepared In the Office of:



2715 Ashton Drive, Ste 104  
Wilmington, NC 28412  
Voice: (910) 475-1208  
www.summitde.com

SUMMARY OF LABORATORY DATA

WBS Number: 17BP.9.R.96

TIP Number: SF-790254

County: Rowan

Description: Bridge No. 254 over Kerr Creek on Caldwell Road (SR 1547)



Sample No.	Boring ID	Alignment	Station	Offset	Sample Depth (ft.)	Natural Moisture Content (%)	AASHTO Classification	Atterberg Limits			Gradation Results							
								L.L.	P.L.	P.I.	Retained #4 Sieve (%)	Pass #10 Sieve (%)	Pass #40 Sieve (%)	Pass #200 Sieve (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)
SS-10	L_1300	-L-	13+00	17'LT	0.0 - 1.5	11.8	A-2-4	26	17	9	2	94	68	32	44.6	25.8	11.8	17.8
SS-11	L_1300	-L-	13+00	17'LT	4.1 - 5.6	25.3	A-7-5	57	31	26	0	100	83	59	27.5	15.9	16.1	40.5
SS-13	EB1-A	-L-	15+09	14'LT	3.9 - 5.4	17.2	A-2-4	38	30	8	20	72	53	26	40.5	29.3	16.7	13.5
SS-7	EB2-A	-L-	16+01	17'LT	4.0 - 5.5	25.5	A-7-6	41	24	17	1	98	82	48	28.2	29.4	14.3	28.1
SS-8	EB2-A	-L-	16+01	17'LT	9.0 - 10.5	23.9	A-7-6	44	28	16	1	99	86	56	22.2	28.0	17.2	32.6
SS-9	EB2-A	-L-	16+01	17'LT	14.0 - 15.5	24.1	A-2-4	31	22	9	9	85	69	33	33.4	34.9	11.7	20.0
SS-1	EB2-B	-L-	16+01	17'RT	4.2 - 5.7	23.2	A-7-6	42	26	16	6	91	74	43	31.1	30.1	17.6	21.2
SS-2	EB2-B	-L-	16+01	17'RT	9.2 - 10.7	33.8	A-7-5	55	31	24	0	100	95	84	8.3	11.1	47.3	33.3
SS-4	L_1800	-L-	18+00	16'RT	0.0 - 1.5	31.8	A-7-6	48	25	23	0	100	88	60	20.3	27.9	28.5	23.3
SS-5	L_1800	-L-	18+00	16'RT	3.6 - 5.1	27.1	A-7-6	42	25	17	0	99	81	46	28.2	34.7	30.1	7.0