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REFERENCE: R-5737

PROJECT: 50195

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

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5737	1	8

STRUCTURE
SUBSURFACE INVESTIGATION

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3-7	RETAINING WALL ENVELOPES
8	SOIL TEST RESULTS

COUNTY DAVIDSON

PROJECT DESCRIPTION US 29/US 70/BUSINESS 85 AT
SR 1798 (OLD GREENSBORO ROAD) CONVERT AT-
GRADE INTERSECTION TO INTERCHANGE

SITE DESCRIPTION RWAL 1: LEFT OF -L- STA. 49 + 50
RWAL 2: RIGHT OF -L- STA. 50 + 00
RWAL 3: RIGHT OF -L- STA. 62 + 00
RWAL 4: LEFT OF -L- STA. 69 + 50

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

N. D. MOHS, LG

W. M. JOHNSON, LG

T. C. MCILROY

SUMMIT

INVESTIGATED BY N. D. MOHS, LG

DRAWN BY N. D. MOHS

CHECKED BY M. D. VALIQUETTE, PE

SUBMITTED BY N. D. MOHS, LG

DATE JANUARY 2019



Signature: Nathan Daniel Mohs

Date: 1/31/2019

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 208, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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 (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE. STRATA ROCK QUALITY DESIGNATION (SROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE. TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

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)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)		SURFACE CONDITIONS					GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)		SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)				
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.		VERY GOOD Very rough, fresh unweathered surfaces	GOOD Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered and altered surfaces	POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments	VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings	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.		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
STRUCTURE		DECREASING SURFACE QUALITY →					COMPOSITION AND STRUCTURE						
INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities		90			N/A	N/A	A. 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.	70					
BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets		80					B. Sandstone with thin inter-layers of siltstone	60					
VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets			70				C. Sandstone and siltstone in similar amounts		50				
BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity			60				D. Siltstone or silty shale with sandstone layers			40			
DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces				50			E. Weak siltstone or clayey shale with sandstone layers				30		
LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes					40		F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure					20	
					30		G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers						10
					20		H. Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.						
					10								
		N/A	N/A										

→ Means deformation after tectonic disturbance

8/17/99



-RPB- ST Sta. 10+00.00 =
-L- POT 47+20.00 (36' RT)

-RPB- SC Sta. 11+00.00

BEGIN PROP. RETAINING WALL RW1
w/ SINGLE FACE BARRIER
-RPB- 11+80.00
(23.5' LT)

-RPB- PRC Sta. 15+05.88

END PROP. RETAINING WALL RW1
w/ SINGLE FACE BARRIER
-RPB- 16+80.00
(23.5' LT)

RPB 1230

RPB 1330

RPB 1430

RPB 1530

RPB 1630

RPB 1680

PROP. RETAINING WALL
w/ SINGLE FACE BARRIER

N 51° 49' 43.2" E

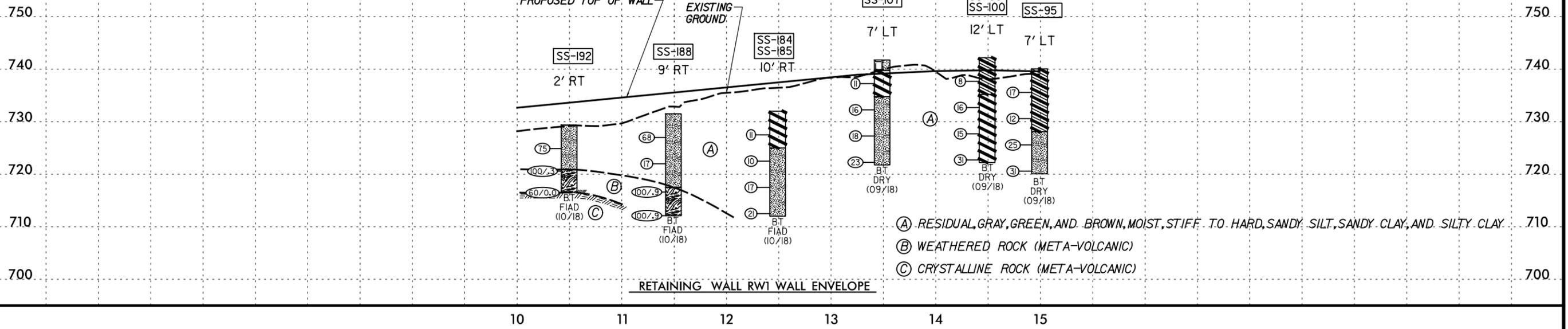
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N 51° 49' 43.2" E

-L- TS Sta. 57+90.64

-L- SC Sta. 58+90.64

RETAINING WALL RW1 PLAN VIEW



RETAINING WALL RW1 WALL ENVELOPE

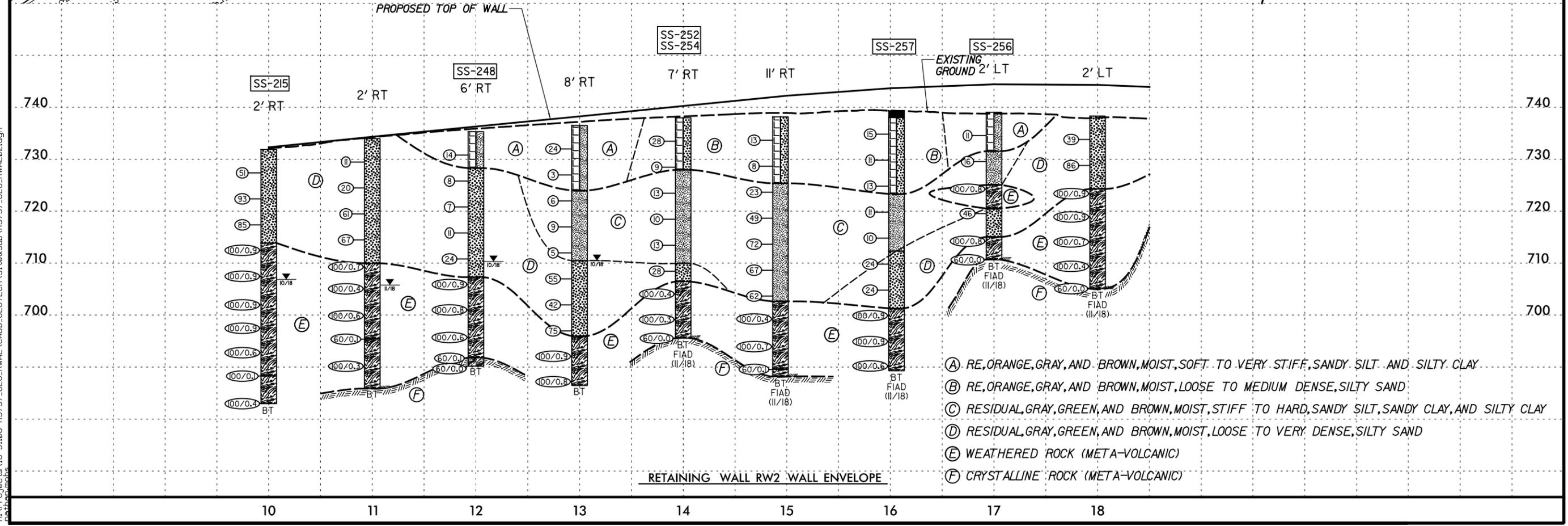
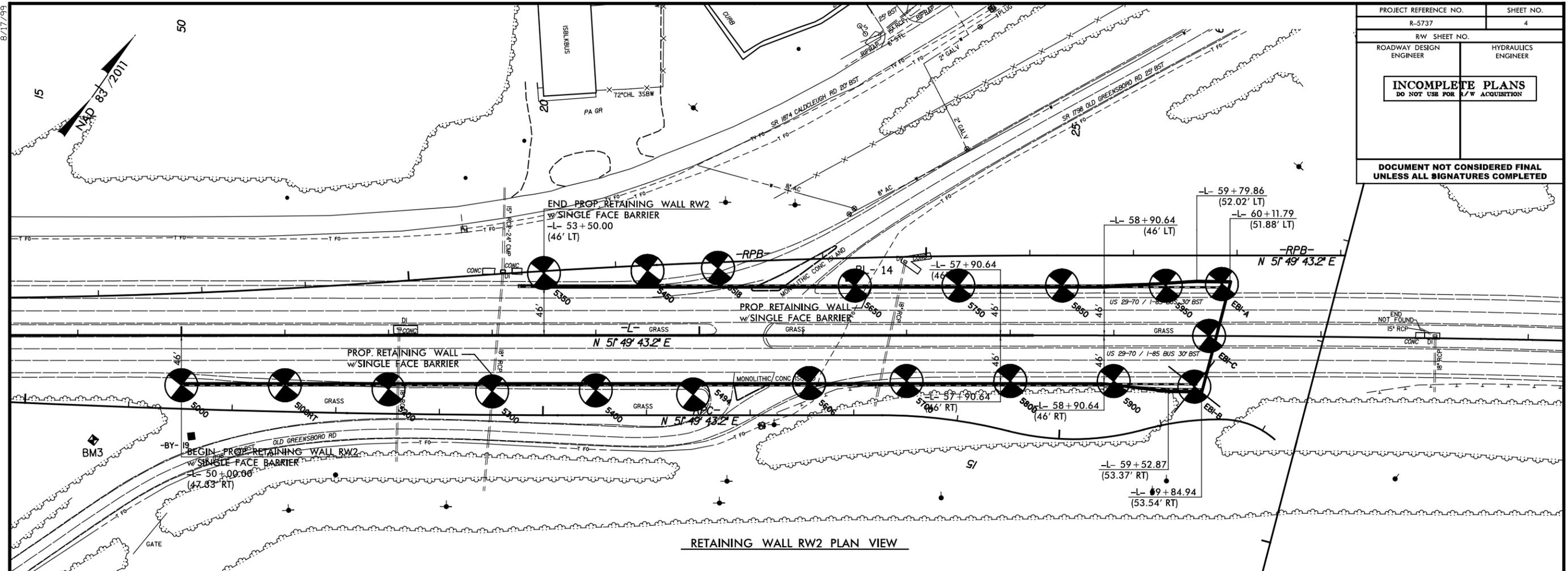
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ROADWAY DESIGN ENGINEER	
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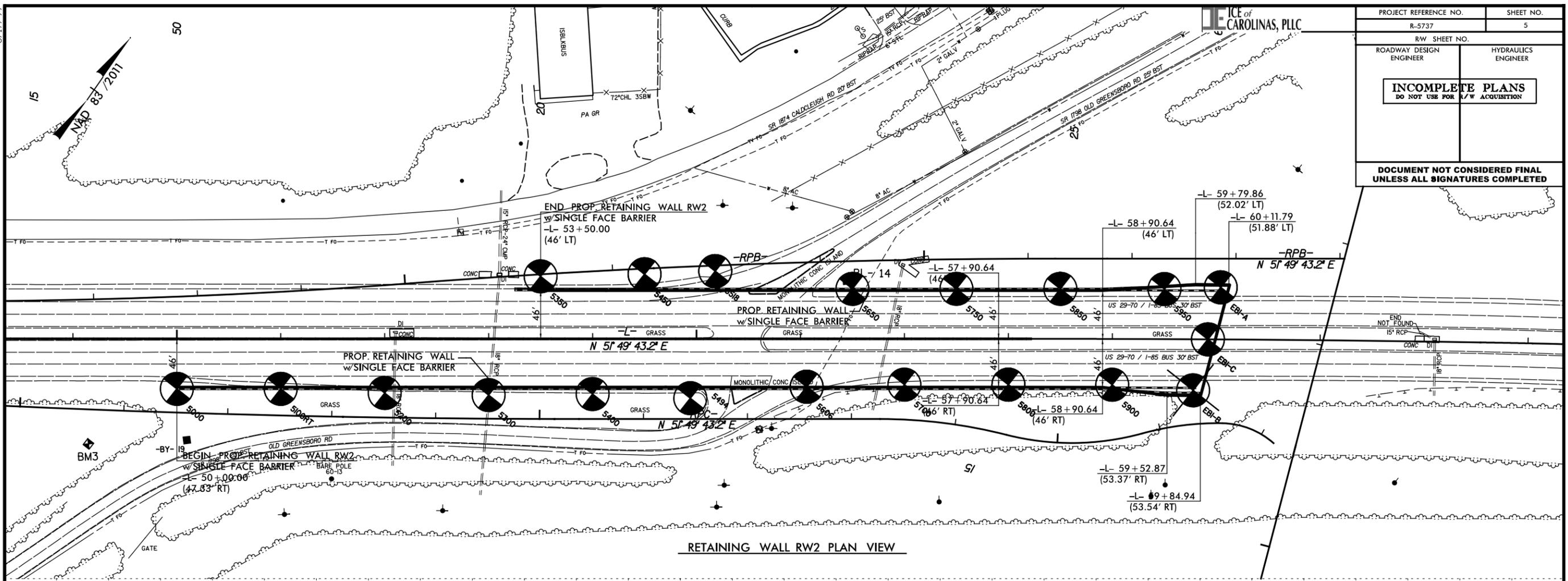
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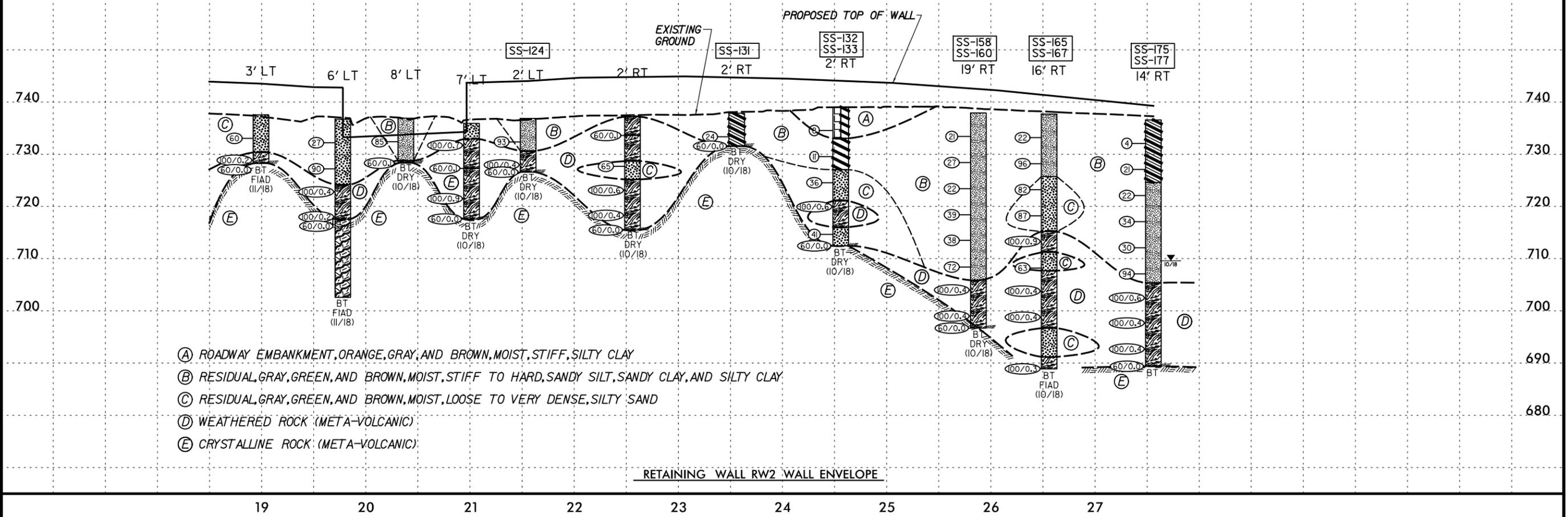
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DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



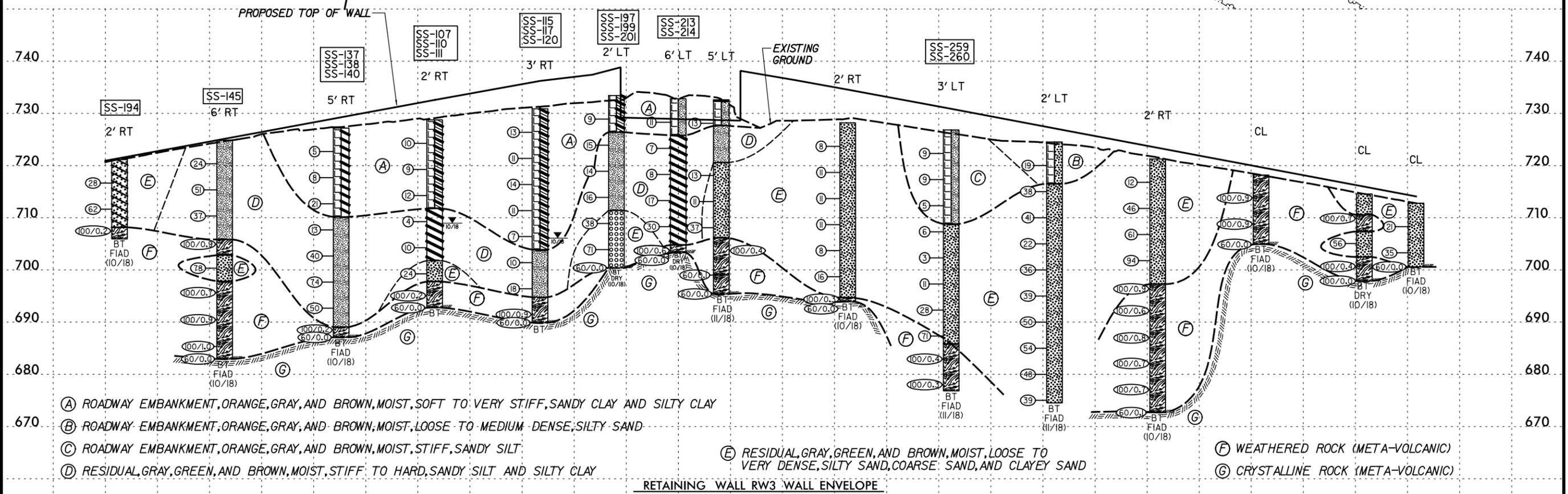
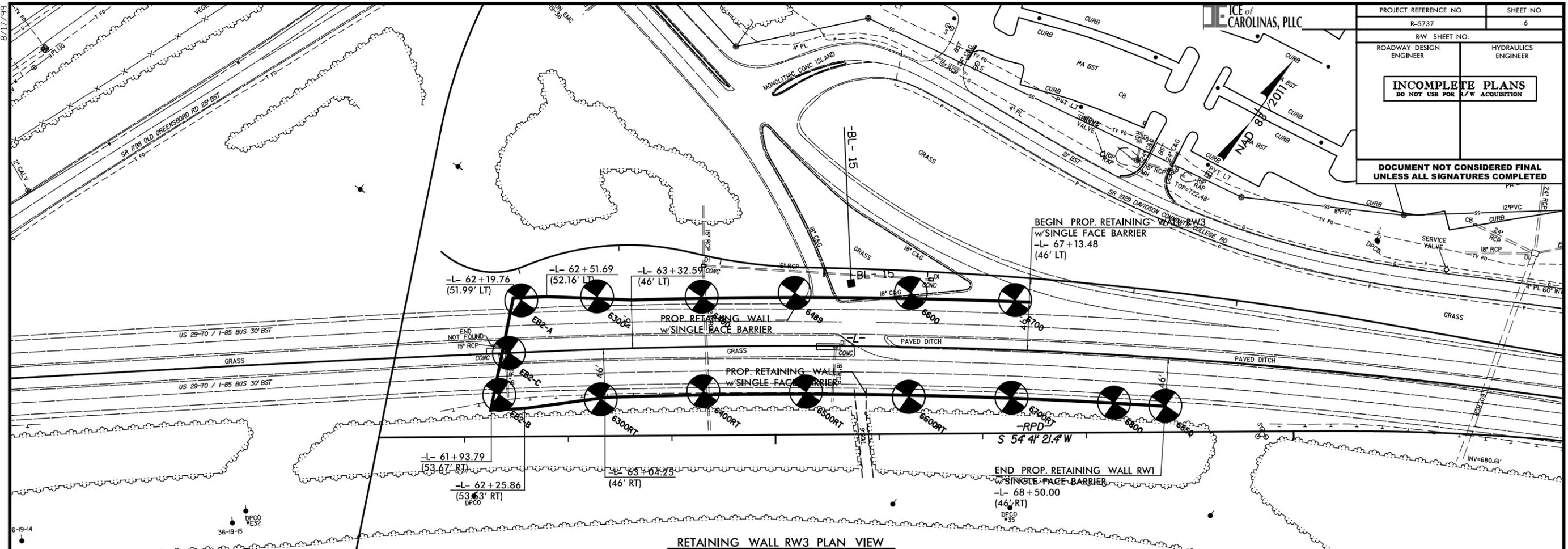
RETAINING WALL RW2 PLAN VIEW



RETAINING WALL RW2 WALL ENVELOPE

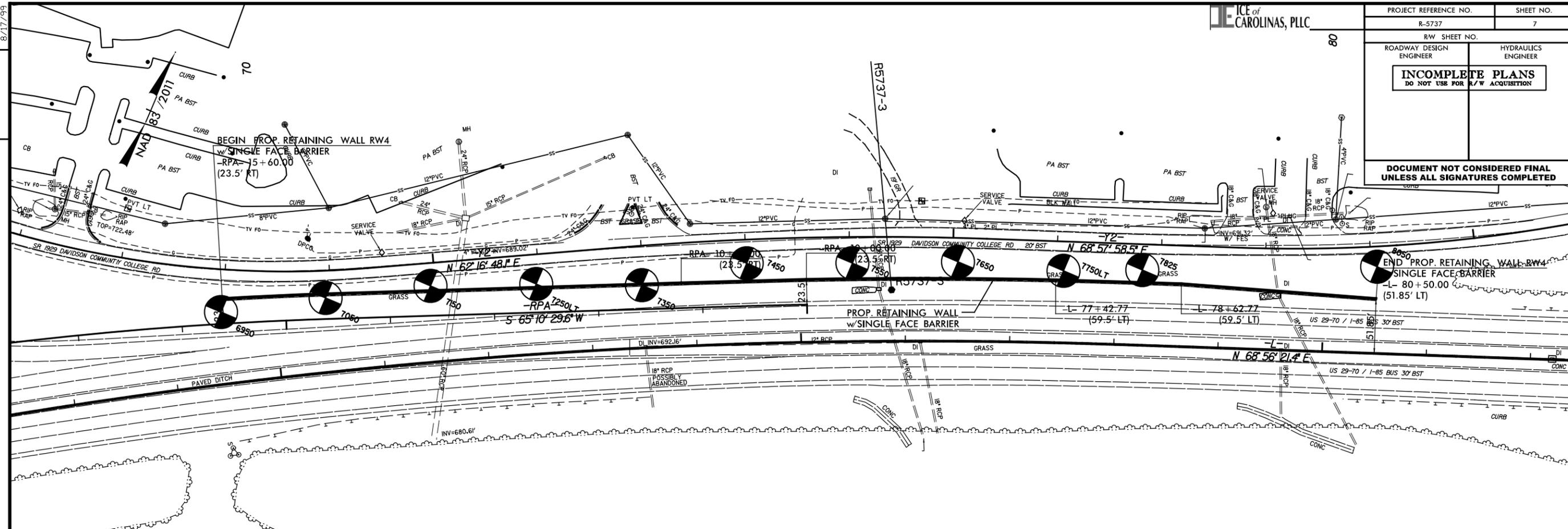
- (A) ROADWAY EMBANKMENT, ORANGE, GRAY, AND BROWN, MOIST, STIFF, SILTY CLAY
- (B) RESIDUAL, GRAY, GREEN, AND BROWN, MOIST, STIFF TO HARD, SANDY SILT, SANDY CLAY, AND SILTY CLAY
- (C) RESIDUAL, GRAY, GREEN, AND BROWN, MOIST, LOOSE TO VERY DENSE, SILTY SAND
- (D) WEATHERED ROCK (META-VOLCANIC)
- (E) CRYSTALLINE ROCK (META-VOLCANIC)

PROJECT REFERENCE NO.	SHEET NO.
R-5737	6
RW SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	
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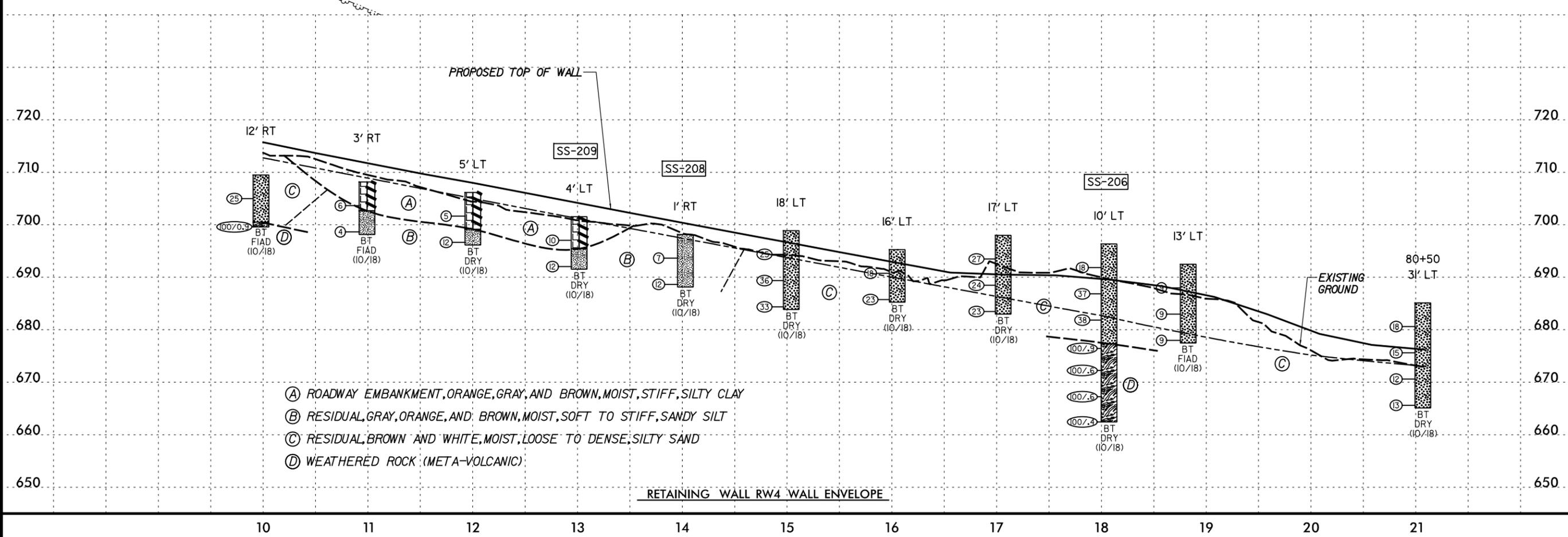


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PROJECT REFERENCE NO. R-5737	SHEET NO. 7
RW SHEET NO.	HYDRAULICS ENGINEER
ROADWAY DESIGN ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



RETAINING WALL RW4 PLAN VIEW



- (A) ROADWAY EMBANKMENT, ORANGE, GRAY, AND BROWN, MOIST, STIFF, SILTY CLAY
- (B) RESIDUAL, GRAY, ORANGE, AND BROWN, MOIST, SOFT TO STIFF, SANDY SILT
- (C) RESIDUAL, BROWN AND WHITE, MOIST, LOOSE TO DENSE, SILTY SAND
- (D) WEATHERED ROCK (META-VOLCANIC)

RETAINING WALL RW4 WALL ENVELOPE

REVISIONS

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LABORATORY TESTING SUMMARY

PROJECT NUMBER: 50195.1.1

TIP: R-5737

COUNTY: Davidson

DESCRIPTION: US 29/US 70/Business 85 at SR 1798

Sample No.	Alignment	Station	Offset (feet)	Depth Interval (feet)	AASHTO Class.	L.L.	P.I.	% by Weight				% Retained #4 Sieve	% Passing (sieves)			% Moisture	% Organic
								Coarse Sand	Fine Sand	Silt	Clay		#10	#40	#200		
SS-215	-L-	50+00	48' RT	3.5 - 5.0	A-4 (0)	30	8	35.0	30.9	2.0	32.1	0	96	70	40	--	--
SS-248	-L-	52+00	52' RT	13.5 - 15.0	A-7-6 (12)	41	22	14.8	29.0	27.8	28.4	0	97	87	64	--	--
SS-175	-L-	53+50	60' LT	3.5 - 5.0	A-6 (4)	34	18	26.0	31.3	24.2	18.5	2	89	73	44	20.3	--
SS-177	-L-	53+50	60' LT	13.5 - 15.0	A-4 (0)	24	0	18.8	51.2	23.6	6.4	0	100	92	40	10.9	--
SS-252	-L-	54+00	53' RT	3.5 - 5.0	A-4 (1)	30	10	28.4	32.7	22.0	16.9	0	95	76	44	9.3	--
SS-254	-L-	54+00	53' RT	13.5 - 15.0	A-7-6 (26)	55	31	3.9	23.4	28.8	43.9	0	100	98	80	29.5	--
SS-165	-L-	54+50	62' LT	3.5 - 5.0	A-4 (0)	29	4	18.2	48.8	24.0	9.0	0	100	90	44	10.0	--
SS-167	-L-	54+50	62' LT	13.5 - 15.0	A-2-4 (0)	25	4	40.0	34.2	18.8	7.0	0	93	66	31	6.3	--
SS-158	-L-	55+18	65' LT	8.5 - 10.0	A-4 (0)	34	6	39.5	26.7	23.2	10.6	0	100	70	40	14.6	--
SS-160	-L-	55+18	65' LT	18.5 - 20.0	A-4 (0)	28	4	22.4	43.0	27.7	6.9	0	99	88	44	11.5	--
SS-257	-L-	56+06	46' RT	18.5 - 20.0	A-7-6 (65)	98	69	7.1	12.2	14.2	66.5	0	100	96	84	37.6	--
SS-132	-L-	56+50	48' LT	3.5 - 5.0	A-7-6 (10)	41	24	20.6	25.5	20.2	33.7	1	91	78	55	19.9	--
SS-133	-L-	56+50	48' LT	8.5 - 10.0	A-7-6 (17)	51	30	11.9	31.7	25.4	31.0	0	100	93	64	26.0	--
SS-256	-L-	57+00	44' RT	3.5 - 5.0	A-4 (0)	28	9	35.8	32.9	20.0	11.3	0	98	72	38	9.8	--
SS-131	-L-	57+50	48' LT	3.5 - 5.0	A-6 (4)	37	13	18.5	37.0	24.7	19.8	1	92	81	51	16.6	--
SS-124	-L-	59+50	48' LT	3.5 - 5.0	A-4 (0)	22	0	17.8	51.3	24.8	6.1	0	100	91	42	21.1	--
SS-115	-L-	63+00	51' LT	3.5 - 5	A-6 (6)	34	18	18.3	37.5	24.9	19.3	1	96	86	51	37.6	--
SS-117	-L-	63+00	51' LT	13.5 - 15.0	A-6 (6)	31	16	20.1	26.5	25.5	27.9	1	94	80	56	28.1	--
SS-120	-L-	63+00	51' LT	28.5 - 30.0	A-4 (0)	35	6	27.6	42.8	23.6	6.0	0	98	82	38	38.6	--
SS-107	-L-	64+00	48' LT	3.5 - 5.0	A-6 (3)	34	15	20.7	38.7	23.2	17.4	1	94	82	46	29.8	--
SS-110	-L-	64+00	48' LT	18.5 - 20.0	A-7-6 (11)	43	26	17.8	24.8	24.4	33.0	2	90	78	57	34.7	--
SS-111	-L-	64+00	48' LT	23.5 - 25.0	A-7-6 (50)	84	57	5.2	19.1	19.0	56.7	1	99	96	80	55.3	--
SS-259	-L-	64+00	43' RT	3.5 - 5.0	A-4 (1)	32	10	28.7	36.6	19.7	15.0	3	90	73	39	--	--
SS-260	-L-	64+00	43' RT	23.5 - 25.0	A-4 (0)	20	NP	19.6	37.5	26.3	16.6	1	95	82	50	--	--
SS-137	-L-	64+89	51' LT	3.5 - 5.0	A-7-6 (12)	44	24	12.8	33.8	28.4	25.0	1	98	90	61	23.9	--
SS-138	-L-	64+89	51' LT	8.5 - 10.0	A-7-6 (11)	45	24	16.5	30.1	23.7	29.7	2	95	84	57	22.7	--
SS-140	-L-	64+89	51' LT	18.5 - 20.0	A-4 (0)	31	7	20.7	48.0	22.1	9.2	0	97	88	39	18.7	--
SS-145	-L-	66+00	52' LT	3.5 - 5.0	A-4 (2)	34	6	9.6	48.6	33.1	8.7	0	100	97	56	14.3	--
SS-194	-L-	67+00	48' RT	3.5 - 5.0	A-2-6 (0)	38	17	49.6	19.2	17.0	14.2	14	73	43	26	13.1	--
SS-209	-L-	72+50	67' LT	3.5 - 5.0	A-7-6 (26)	58	33	5.8	23.3	22.9	48.0	0	100	97	76	30.0	--
SS-208	-L-	73+50	CL	3.5 - 5.0	A-4 (1)	33	6	16.2	46.5	28.6	8.7	0	100	94	47	16.3	--
SS-206	-L-	77+50	75' LT	3.5 - 5.0	A-2-4 (0)	32	5	36.8	30.8	23.6	8.8	0	89	65	35	12.2	--
SS-192	-RPB-	12+30	8' RT	3.5 - 5.0	A-4 (0)	23	0	12.0	50.7	28.6	8.7	0	100	95	51	8.0	--
SS-188	-RPB-	13+30	15' LT	3.5 - 5.0	A-4 (0)	23	0	15.5	46.0	30.8	7.7	0	100	92	51	7.1	--
SS-184	-RPB-	14+30	14' LT	3.5 - 5.0	A-7-6 (19)	51	26	6.3	28.0	31.4	34.3	0	100	98	73	30.5	--
SS-185	-RPB-	14+30	14' LT	8.5 - 10.0	A-4 (3)	38	9	9.7	49.4	27.9	13.0	0	100	97	52	15.8	--
S-107	-RPB-	15+30	30' LT	0.0 - 1.5	A-4 (1)	26	8	11.9	40.7	31.0	16.4	9	82	78	49	10.6	--
SS-103	-RPB-	15+30	30' LT	3.5 - 10.0	A-7-6 (15)	47	27	13.2	30.5	29.6	26.7	0	99	93	64	27.5	--
SS-105	-RPB-	15+30	30' LT	13.5 - 15.0	A-4 (0)	30	4	19.2	48.8	22.6	9.4	0	100	90	43	15.4	--
SS-99	-RPB-	16+30	35' LT	3.5 - 5.0	A-6 (3)	33	17	31.7	26.9	12.7	28.7	1	88	67	41	18.6	--
SS-100	-RPB-	16+30	35' LT	8.5 - 10.0	A-7-6 (11)	45	19	7.7	39.7	33.4	19.2	0	100	97	65	25.2	--
SS-95	-RPB-	16+80	30' LT	3.5 - 5.0	A-6 (12)	40	21	8.5	36.6	32.4	22.5	0	100	96	65	23.0	--

REFERENCE: R-5737

PROJECT: 50195

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

STRUCTURE
SUBSURFACE INVESTIGATION

COUNTY DAVIDSON
 PROJECT DESCRIPTION US 29/US 70/BUSINESS 85 AT
SR 1798 (OLD GREENSBORO ROAD) CONVERT AT-
GRADE INTERSECTION TO INTERCHANGE
 SITE DESCRIPTION BRIDGE NOS. 575 AND 576
ON US29/US 70/BUSINESS 85 (-L-) OVER -YI-

CONTENTS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
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2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5-7	CROSS SECTIONS
8-16	BORE LOGS & CORE REPORTS
17	SOIL TEST RESULTS
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21	SITE PHOTOGRAPH

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5737	1	21

CAUTION NOTICE

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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.

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 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

N. D. MOHS, LG

W. M. JOHNSON, LG

T. C. MCILROY

SUMMIT

INVESTIGATED BY N. D. MOHS, LG

DRAWN BY S.G. THOMSON, PE

CHECKED BY M. D. VALIQUETTE, PE

SUBMITTED BY N. D. MOHS, LG

DATE JANUARY 2019



Seal: NORTH CAROLINA LICENSED GEOLOGIST SEAL 2124 NATHAN DANIEL MOHS

Signed by: Nathan Daniel Mohs

35A8C1164EEA408
2/8/2019

SIGNATURE _____ DATE _____

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 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, VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										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. ARGILLACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND. 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 (ROD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. STRATA CORE RECOVERY (SRC) - 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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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GRAVEL, AND SAND</td> <td></td> <td>FINE SAND</td> <td colspan="3">SILTY OR CLAYEY GRAVEL AND SAND</td> <td></td> <td>SILTY SOILS</td> <td></td> <td></td> <td>CLAYEY SOILS</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>GEN. RATING AS SUBGRADE</th> <td colspan="3">EXCELLENT TO GOOD</td> <td colspan="3">FAIR TO POOR</td> <td>FAIR TO POOR</td> <td>POOR</td> <td>UNSATURABLE</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="16">PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30</td> </tr> </table>										SOIL LEGEND AND AASHTO CLASSIFICATION										GENERAL CLASS.		GRANULAR MATERIALS (≤ 35% PASSING #200)					SILT-CLAY MATERIALS (> 35% PASSING #200)			ORGANIC MATERIALS		GROUP CLASS.	A-1	A-1-b	A-2	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5	A-6, A-7	SYMBOL																% PASSING	50 MX	30 MX	15 MX	50 MX	25 MX	10 MX	51 MN	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	MATERIAL PASSING #40	6 MX			40 MX	10 MX	10 MX	41 MN	GROUP INDEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS			CLAYEY SOILS					GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD			FAIR TO POOR			FAIR TO POOR	POOR	UNSATURABLE							PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30																<table border="1"> <tr> <th colspan="10">MINERALOGICAL COMPOSITION</th> </tr> <tr> <td colspan="10">MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. 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SIEVE SIZE OPENING (MM)</th> <th>4</th> <th>10</th> <th>40</th> <th>60</th> <th>200</th> <th>270</th> </tr> <tr> <td></td> <td>4.76</td> <td>2.00</td> <td>0.42</td> <td>0.25</td> <td>0.075</td> <td>0.053</td> </tr> <tr> <th>BOULDER (BLDR.)</th> <th>COBBLE (COB.)</th> <th>GRAVEL (GR.)</th> <th>COARSE SAND (CSE. SD.)</th> <th>FINE SAND (F SD.)</th> <th>SILT (SL.)</th> <th>CLAY (CL.)</th> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>GRAIN SIZE</th> <th>MM</th> <th>305</th> <th>75</th> <th>2.0</th> <th>0.25</th> <th>0.05</th> <th>0.005</th> </tr> <tr> <td></td> <th>IN.</th> <th>12</th> <th>3</th> <td></td> <td></td> <td></td> <td></td> </tr> </table> </td> </tr> <tr> <th colspan="10">SOIL MOISTURE - CORRELATION OF TERMS</th> </tr> <tr> <td colspan="10"> <table border="1"> <tr> <th>SOIL MOISTURE SCALE (ATTERBERG LIMITS)</th> <th>FIELD MOISTURE DESCRIPTION</th> <th>GUIDE FOR FIELD MOISTURE DESCRIPTION</th> </tr> <tr> <td rowspan="2">LL PLASTIC RANGE (PI) PL</td> <td>LIQUID LIMIT</td> <td>- SATURATED - (SAT.) USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE</td> </tr> <tr> <td>PLASTIC LIMIT</td> <td>- WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE</td> </tr> <tr> <td rowspan="2">OM SL</td> <td>OPTIMUM MOISTURE SHRINKAGE LIMIT</td> <td>- MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE</td> </tr> <tr> <td></td> <td>- DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE</td> </tr> </table> </td> </tr> <tr> <th colspan="10">PLASTICITY</th> </tr> <tr> <td colspan="10"> <table border="1"> <tr> <th>NON PLASTIC</th> <th>SLIGHTLY PLASTIC</th> <th>MODERATELY PLASTIC</th> <th>HIGHLY PLASTIC</th> </tr> <tr> <td></td> <td>0-5</td> <td>6-15</td> <td>16-25</td> </tr> <tr> <td></td> <td></td> <td>26 OR MORE</td> <td></td> </tr> <tr> <th colspan="4">DRY STRENGTH</th> </tr> <tr> <td></td> <td>VERY LOW</td> <td>SLIGHT</td> <td>MEDIUM</td> </tr> <tr> <td></td> <td></td> <td></td> <td>HIGH</td> </tr> </table> </td> </tr> <tr> <th colspan="10">COLOR</th> </tr> <tr> <td colspan="10">DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. 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EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 GEOTECHNICAL ENGINEERING UNIT

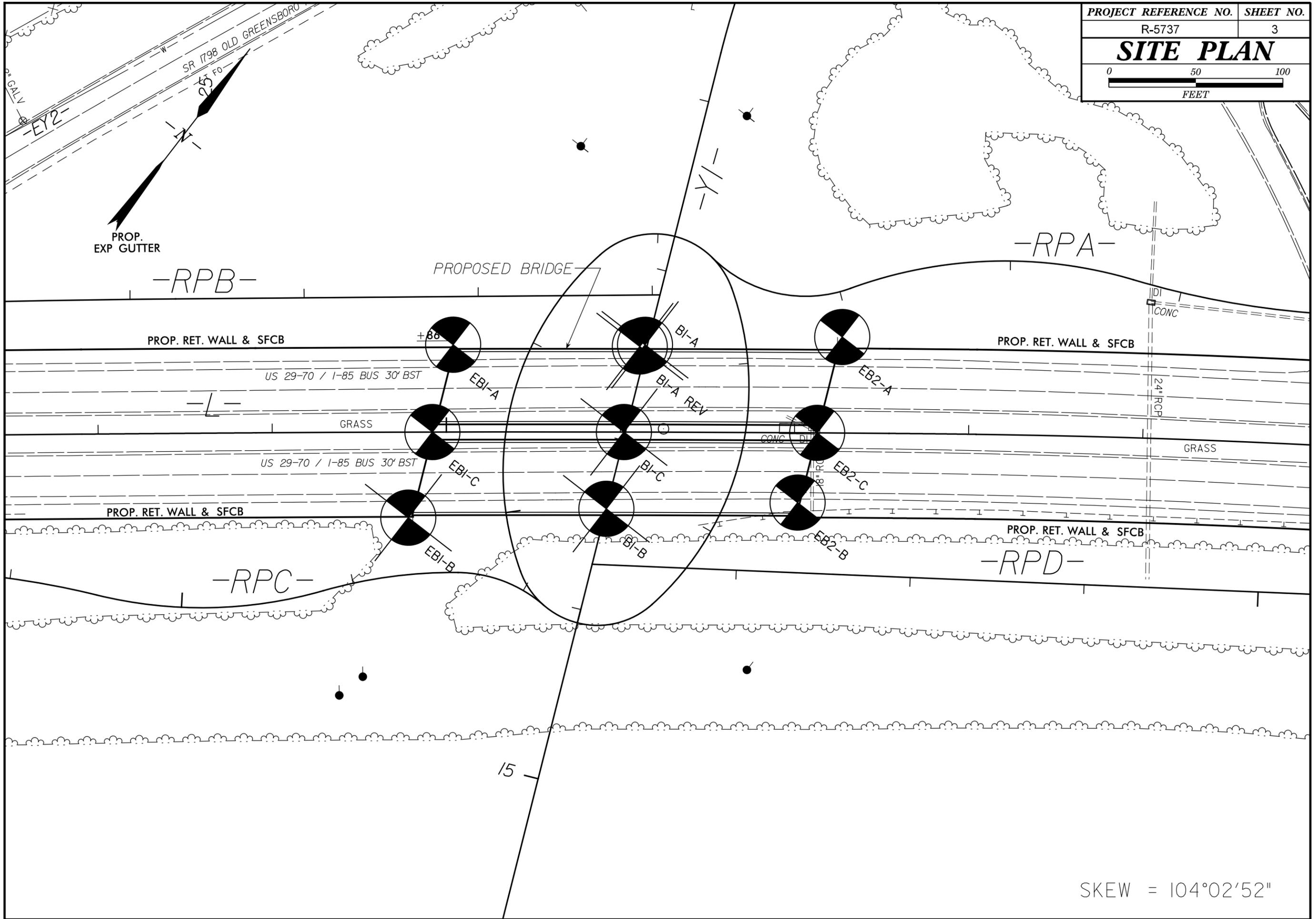
SUBSURFACE INVESTIGATION

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

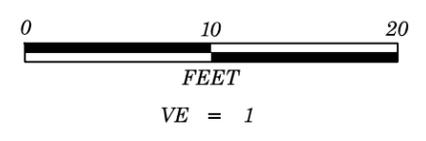
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

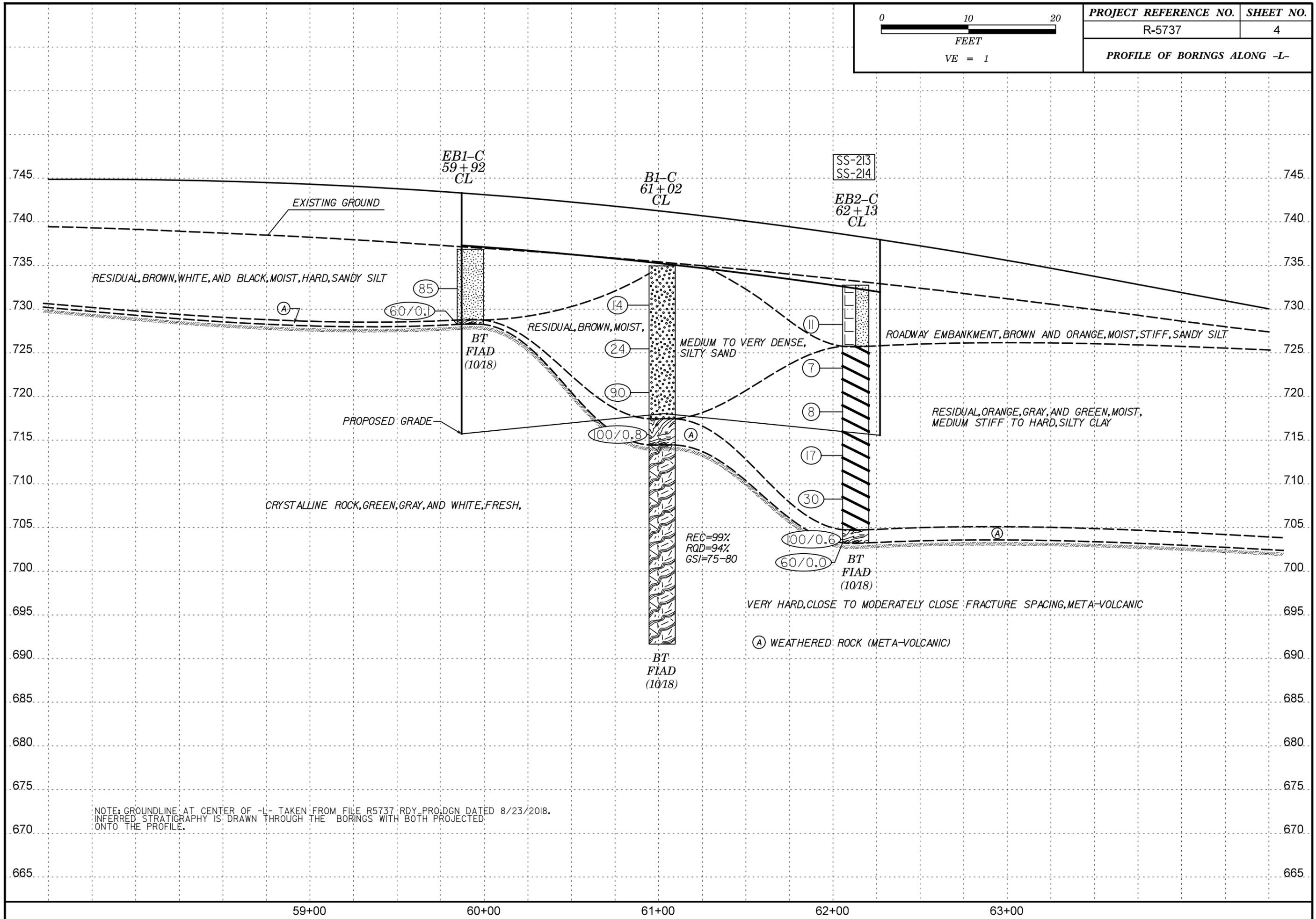
<p>GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)</p> <p>From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. 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.</p> <p>STRUCTURE</p>	<p>SURFACE CONDITIONS</p> <p>VERY GOOD Very rough, fresh unweathered surfaces</p> <p>GOOD Rough, slightly weathered, iron stained surfaces</p> <p>FAIR Smooth, moderately weathered and altered surfaces</p> <p>POOR Slickensided, highly weathered surfaces with compact coatings or fillings or angular fragments</p> <p>VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings</p> <p>DECREASING SURFACE QUALITY →</p>	<p>GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos, P and Hoek E., 2000)</p> <p>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.</p> <p>SURFACE CONDITIONS OF DISCONTINUITIES (Predominantly bedding planes)</p> <p>VERY GOOD - Very Rough, fresh unweathered surfaces</p> <p>GOOD - Rough, slightly weathered surfaces</p> <p>FAIR - Smooth, moderately weathered and altered surfaces</p> <p>POOR - Very smooth, occasionally slickensided surfaces with compact coatings or fillings with angular fragments</p> <p>VERY POOR - Very smooth, slickensided or highly weathered surfaces with soft clay coatings or fillings</p> <p>COMPOSITION AND STRUCTURE</p>	
<p>DECREASING INTERLOCKING OF ROCK PIECES</p> <p>INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities</p> <p>BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets</p> <p>VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets</p> <p>BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity</p> <p>DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces</p> <p>LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes</p>	<p>90</p> <p>80</p> <p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p> <p>N/A</p> <p>N/A</p>	<p>A. 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. Sandstone with thin inter-layers of siltstone</p> <p>C. Sandstone and siltstone in similar amounts</p> <p>D. Siltstone or silty shale with sandstone layers</p> <p>E. Weak siltstone or clayey shale with sandstone layers</p> <p>F. Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure</p> <p>G. Undisturbed silty or clayey shale with or without a few very thin sandstone layers</p> <p>H. 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> <p>→ Means deformation after tectonic disturbance</p>	<p>70</p> <p>60</p> <p>50</p> <p>40</p> <p>30</p> <p>20</p> <p>10</p> <p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p> <p>F</p> <p>G</p> <p>H</p>



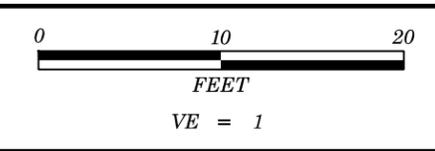
SKEW = 104°02'52"



PROJECT REFERENCE NO.	SHEET NO.
R-5737	4
PROFILE OF BORINGS ALONG -L-	

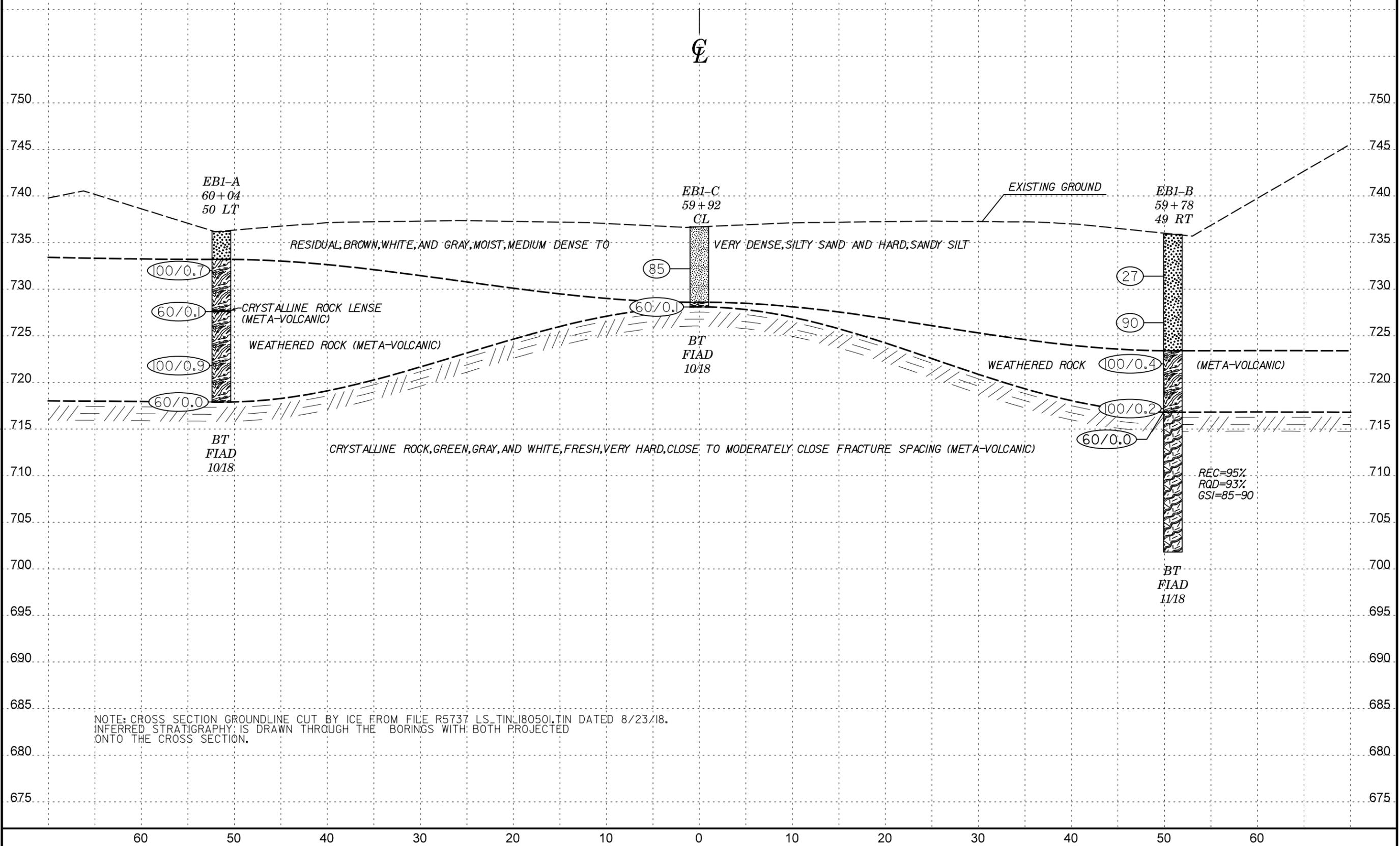


NOTE: GROUNDLINE AT CENTER OF -L- TAKEN FROM FILE R5737_RDY_PRO.DGN DATED 8/23/2018. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE PROFILE.

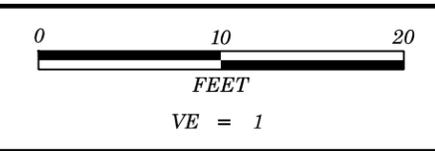


PROJECT REFERENCE NO.	SHEET NO.
R-5737	5
END BENT 1 CROSS SECTION AT STATION 59+92	

SKEW=104°02'27"

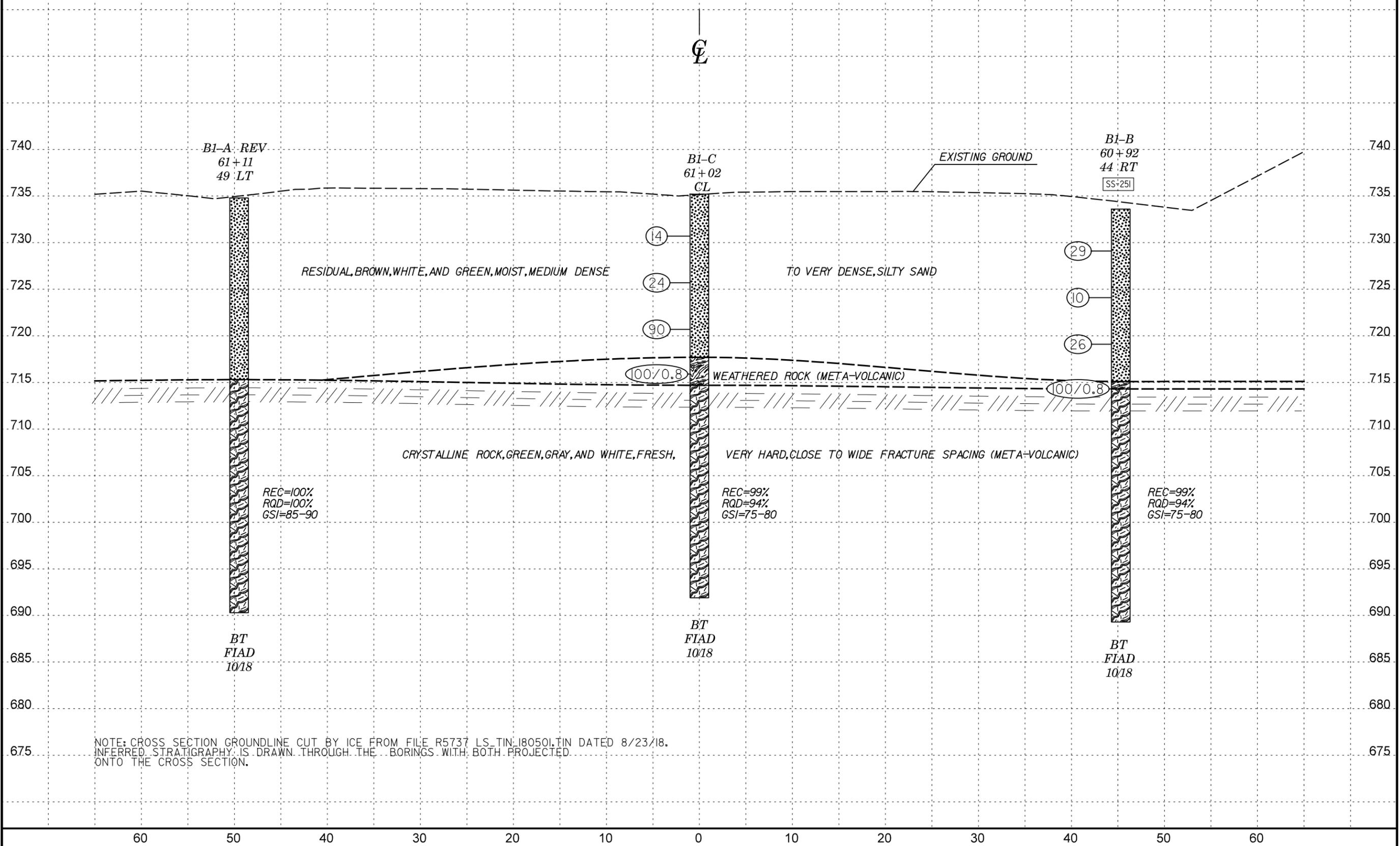


NOTE: CROSS SECTION GROUNDLINE CUT BY ICE FROM FILE R5737_LS_TIN_L180501.TIN DATED 8/23/18. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION.

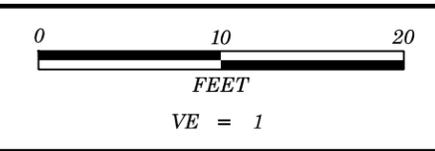


PROJECT REFERENCE NO.	SHEET NO.
R-5737	6
BENT 1 CROSS SECTION AT STATION 61+03	

SKEW=104°02'27"

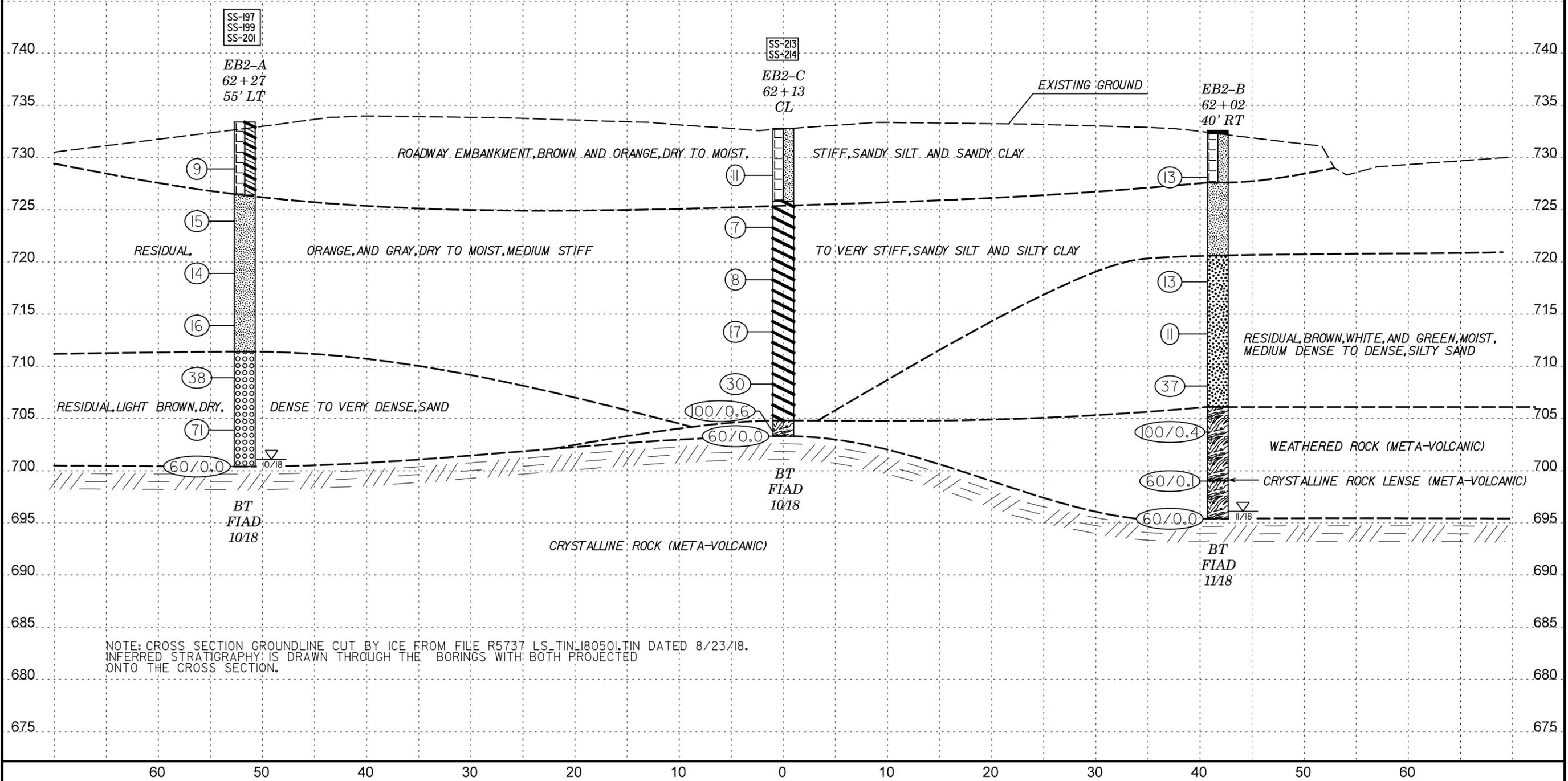


NOTE: CROSS SECTION GROUNDLINE CUT BY ICE FROM FILE R5737 LS_TIN_I80501.TIN DATED 8/23/18.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED
ONTO THE CROSS SECTION.



PROJECT REFERENCE NO.	SHEET NO.
R-5737	7
END BENT 2 CROSS SECTION AT STATION 62+14	

SKEW=104°02'27"



NOTE: CROSS SECTION GROUNDLINE CUT BY ICE FROM FILE R5737 LS_TIN_180501.TIN DATED 8/23/18.
 INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED
 ONTO THE CROSS SECTION.

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 50195.1.1		TIP R-5737		COUNTY DAVIDSON		GEOLOGIST M. Johnson									
SITE DESCRIPTION Bridge on US 29/US 70/Business 85 (-L-) over -Y1-							GROUND WTR (ft)								
BORING NO. EB1-C		STATION 59+92		OFFSET CL		ALIGNMENT -L-									
COLLAR ELEV. 736.9 ft		TOTAL DEPTH 8.6 ft		NORTHING 770,748		EASTING 1,649,128									
DRILL RIG/HAMMER EFF./DATE SUMMIT CME-550X 92% 10/30/2018				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic									
DRILLER Contract Driller		START DATE 10/17/18		COMP. DATE 10/17/18		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)	
740															
735														736.9	0.0
	733.4	3.5	4	17	68										
730															
	728.4	8.5	60/0.1											728.8	8.1
														728.3	8.6

NCDOT BORE DOUBLE R5737_GEO_BRDG_BH.GPJ NC_DOT.GDT 1/24/19

GROUND SURFACE
RESIDUAL
Brown, White, and Black, Sandy Silt

WEATHERED ROCK
(Meta-Volcanic)
Boring Terminated with Standard Penetration Test Refusal at Elevation 728.3 ft on Crystalline Rock (Meta-Diorite)

GEOTECHNICAL BORING REPORT BORE LOG

WBS 50195.1.1		TIP R-5737		COUNTY DAVIDSON		GEOLOGIST M. Johnson										
SITE DESCRIPTION Bridge on US 29/US 70/Business 85 (-L-) over -Y1-							GROUND WTR (ft)									
BORING NO. B1-C		STATION 61+02		OFFSET CL		ALIGNMENT -L-										
COLLAR ELEV. 735.0 ft		TOTAL DEPTH 43.3 ft		NORTHING 770,815		EASTING 1,649,215										
DRILL RIG/HAMMER EFF./DATE SUMMIT CME-550X 92% 10/30/2018				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic										
DRILLER Contract Driller		START DATE 10/17/18		COMP. DATE 10/17/18		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						
735														735.0	GROUND SURFACE	0.0
730	731.5	3.5	1	6	8								M	RESIDUAL Brown, Silty Sand		
725	726.5	8.5	9	11	13								M			
720	721.5	13.5	21	42	48								M			
715	716.5	18.5	41	59/0.3										717.5	WEATHERED ROCK (Meta-Volcanic)	17.5
710														714.5	CRYSTALLINE ROCK Green, Gray, and White, Fresh, Very Hard, Close to Moderately Close Fracture Spacing, Meta-Volcanic REC=99% RQD=94% GSI=75-80	20.5
705																
700																
695														691.7	Boring Terminated at Elevation 691.7 ft in Crystalline Rock (Meta-Diorite)	43.3

NCDOT BORE DOUBLE R5737_GEO_BRDG_BH.GPJ NC_DOT.GDT 1/24/19

CORE LOG

WBS 50195.1.1		TIP R-5737		COUNTY DAVIDSON		GEOLOGIST M. Johnson					
SITE DESCRIPTION Bridge on US 29/US 70/Business 85 (-L-) over -Y1-							GROUND WTR (ft)				
BORING NO. B1-C		STATION 61+02		OFFSET CL		ALIGNMENT -L-					
COLLAR ELEV. 735.0 ft		TOTAL DEPTH 43.3 ft		NORTHING 770,815		EASTING 1,649,215					
DRILL RIG/HAMMER EFF./DATE SUMMIT CME-550X 92% 10/30/2018				DRILL METHOD NW Casing W/SPT & Core		HAMMER TYPE Automatic					
DRILLER Contract Driller		START DATE 10/17/18		COMP. DATE 10/17/18		SURFACE WATER DEPTH N/A					
CORE SIZE NQ				TOTAL RUN 22.8 ft							
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN		STRATA		LOG	DESCRIPTION AND REMARKS	DEPTH (ft)
					REC. (ft) %	RQD (ft) %	REC. (ft) %	RQD (ft) %			
714.5	714.5	20.5	3.5	2:31/0.5 1:44/1.0 1:50/1.0 1:46/1.0	(3.3) 94%	(2.4) 69%	(22.8) 100%	(21.7) 95%		Begin Coring @ 20.5 ft	
710	711.0	24.0	4.5	1:47/1.0 1:50/1.0 1:58/1.0 1:50/1.0 1:20/0.5	(4.5) 100%	(4.5) 100%				714.5 Green, Gray, and White, Fresh, Very Hard, Close to Moderately Close Fracture Spacing, Meta-Volcanic REC=99% RQD=94% GSI=75-80	20.5
705	706.5	28.5	4.8	1:39/1.0 1:48/1.0 1:51/1.0 2:01/1.0 1:58/0.8	(4.8) 100%	(4.8) 100%					
700	701.7	33.3	5.0	2:06/1.0 1:59/1.0 1:59/1.0 2:03/1.0 2:21/1.0	(5.0) 100%	(5.0) 100%					
695	696.7	38.3	5.0	1:59/1.0 2:12/1.0 1:55/1.0 1:54/1.0 2:01/1.0	(5.0) 100%	(5.0) 100%					
	691.7	43.3								Boring Terminated at Elevation 691.7 ft in Crystalline Rock (Meta-Diorite)	43.3

NCDOT CORE DOUBLE R5737_GEO_BRDG_BH.GPJ NC_DOT.GDT 1/24/19

LABORATORY TESTING SUMMARY

PROJECT NUMBER: 50195.1.1TIP: R-5737COUNTY: DavidsonDESCRIPTION: Bridge on US 29/US 70/Business 85 (-L-) over -Y1-

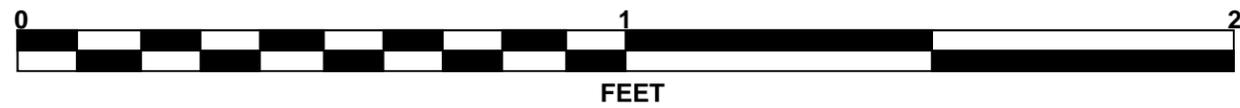
Boring No.	Sample No.	Alignment	Station	Offset (feet)	Depth Interval (feet)	AASHTO Class.	L.L.	P.I.	% by Weight				% Retained #4 Sieve	% Passing (sieves)			% Moisture	% Organic
									Coarse Sand	Fine Sand	Silt	Clay		#10	#40	#200		
B1-B	SS-251	-L-	60+92	44' RT	3.5 - 5.0	A-2-4 (0)	23	NP	53.5	26.1	9.6	10.8	1	90	52	22	8.1	--
EB2-C	SS-213	-L-	62+13	CL	8.5 - 10.0	A-7-6 (41)	68	42	2.9	15.8	35.0	46.3	0	100	98	88	36.8	--
EB2-C	SS-214	-L-	62+13	CL	18.5 - 20.0	A-4 (0)	29	2	6.7	55.6	27.0	10.7	0	100	98	52	14.3	--
EB2-A	SS-197	-L-	62+27	50' LT	3.5 - 5.0	A-6 (9)	40	21	14.6	36.1	24.8	24.5	0	96	88	56	18.9	--
EB2-A	SS-199	-L-	62+27	50' LT	13.5 - 15.0	A-4 (0)	29	0	7.2	53.4	25.7	13.7	0	100	98	51	12.7	--
EB2-A	SS-201	-L-	62+27	50' LT	23.5 - 25.0	A-1-b (0)	21	0	54.0	28.4	10.7	6.9	3	82	49	18	4.8	--

Boring No.	Sample No.	Alignment	Station	Offset (feet)	Depth (feet)	Rock Type	Geologic Map Unit	Run RQD %	Length (in)	Diameter (in)	Unit Weight (PCF)	Unconfined Compressive Strength (PSI)
B1-A_REV	RS-1	-L-	61+11	49' LT	29.5 - 30.0'	META-VOLCANIC	CZv	100%	3.88	1.97	179.7	13,930
B1-B	RS-2	-L-	60+92	44' RT	30.3 - 31.4'	META-VOLCANIC	CZv	100%	3.91	1.97	170.8	21,120

CORE PHOTOGRAPHS

EB1-B

BOXES 1 & 2: 19.1 - 34.1 FEET



B1-C

BOXES 1 - 3: 20.5 - 43.3 FEET



CORE PHOTOGRAPHS

B1-A_REV
BOXES 1 - 4: 19.5 - 44.5 FEET



CORE PHOTOGRAPHS

B1-B

BOXES 1 - 3: 19.3 - 44.3 FEET



PROJECT NO.	SHEET NO.
R-5737	21

SITE PHOTOGRAPH



View looking north from End Bent 1