NOTES:

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS WITH CAST-IN-PLACE (CIP) CONCRETE FACING, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS WITH CAST-IN-PLACE CONCRETE FACING SPECIAL PROVISION.

A FENCE IS REQUIRED ON TOP OF RETAINING WALL #19C. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #19C. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FORM LINER ARCHITECTURAL FINISH WILL ABUT AND BLEND INTO LAND BRIDGE FORM LINER ARCHITECTURAL FINISH. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

BEFORE BEGINNING MSE RETAINING WALL WITH CIP CONCRETE FACING DESIGN FOR RETAINING WALL #19C, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DO NOT USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL #19C.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL #19C.

A DRAIN IS REQUIRED FOR RETAINING WALL NO. #19C.

DO NOT USE AN MSE WALL SYSTEM WITH SEGMENTAL RETAINING WALL UNITS FOR THIS RETAINING WALL.

DESIGN THIS RETAINING WALL FOR WALL HEIGHTS EQUAL TO THE DESIGN HEIGHT (DIFFERENCE BETWEEN GRADE ELEVATION AND BOTTOM OF WALL ELEVATION) PLUS EMBEDMENT (DIFFERENCE BETWEEN BOTTOM OF WALL ELEVATION AND TOP OF LEVELING PAD ELEVATION).

DESIGN RETAINING WALL NO. #19C FOR THE FOLLOWING:
1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
2) DESIGN LIFE = 75 YEARS
3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 7350 PSF
4) MINIMUM REINFORCEMENT LENGTH (L) = 0.7xH OR 6.0 FT, WHICHEVER IS LONGER
5) MINIMUM EMBEDMENT DEPTH = 2.0 FT, SEE TABLE ON SHEET W19C-1 AND SPECIAL PROVISION
6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

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

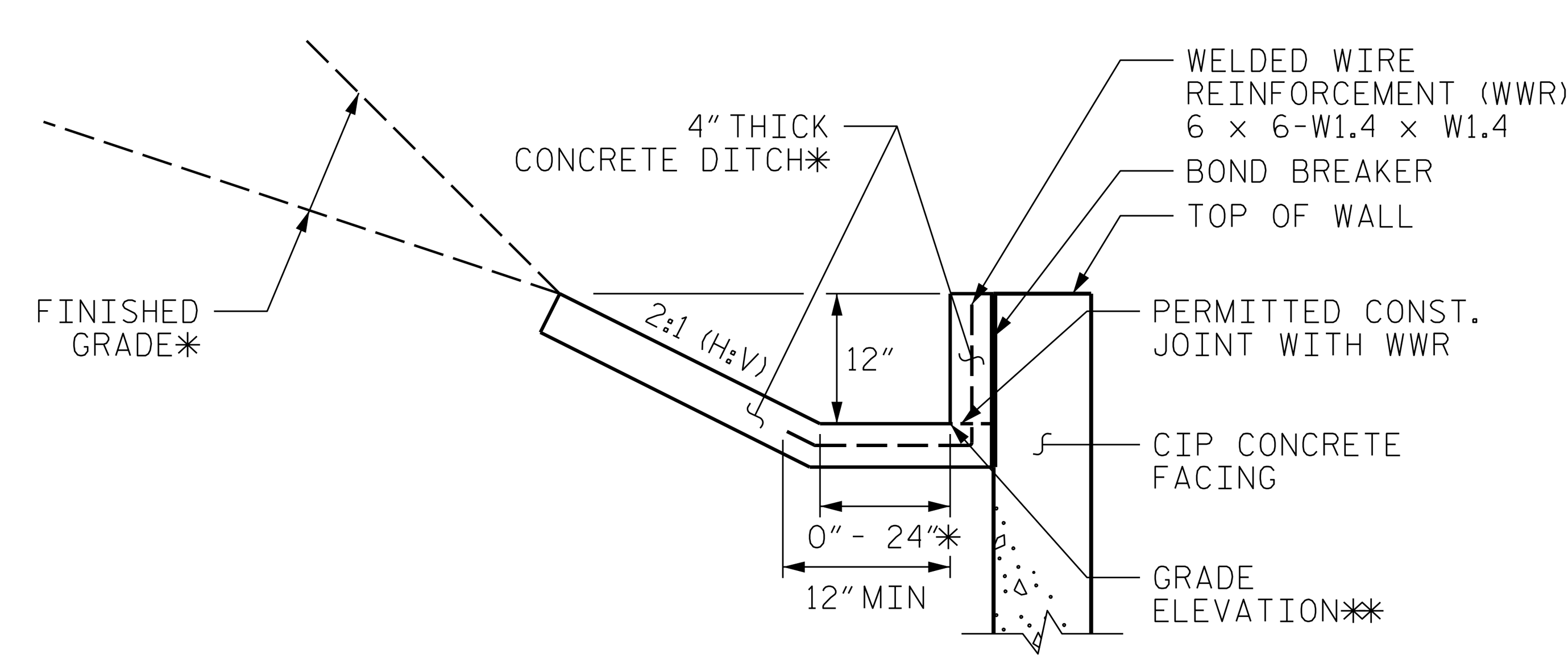
7) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION	120	30	0

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL #19C.

UNDERCUTTING SOFT AND/OR WET SOILS IN THE VICINITY OF THE WALL FOUNDATION MAY BE REQUIRED TO IMPROVE BEARING RESISTANCE. THE ENGINEER WILL DETERMINE THE SOILS BEARING RESISTANCE AFTER THE WALL IS EXCAVATED TO BEARING GRADE. IF REQUIRED BY THE ENGINEER, USE UNDERCUT EXCAVATION TO REMOVE SOFT AND/OR WET SOILS. UNDERCUT TO SUITABLE FOUNDATION SOILS. PLACE GEOTEXTILE FOR SOIL STABILIZATION IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SELECT GRANULAR MATERIAL. FOR UNDERCUT EXCAVATION AND SELECT GRANULAR MATERIAL SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION, SELECT GRANULAR MATERIAL, AND GEOTEXTILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.

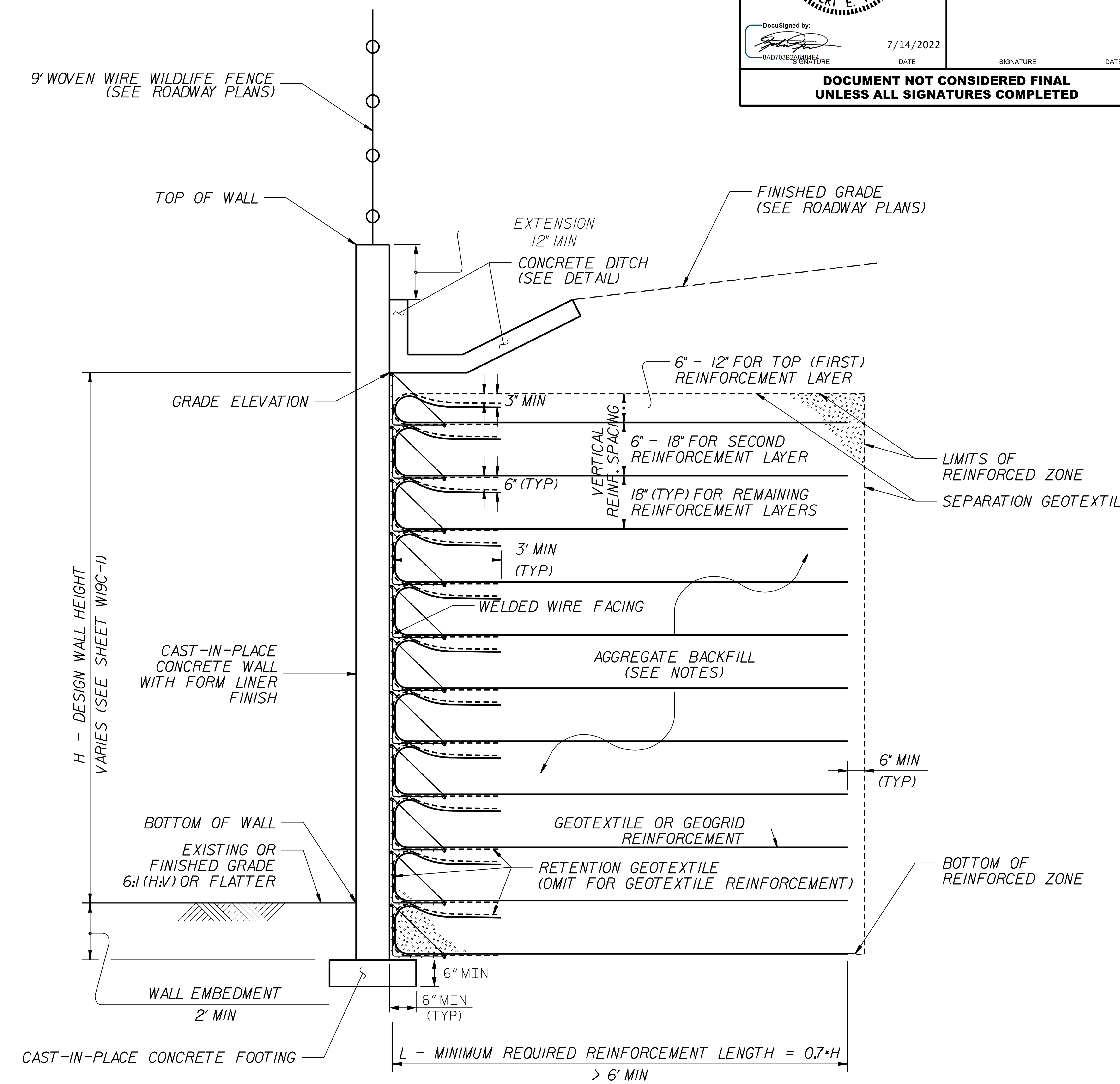
DO NOT PLACE CONCRETE, COARSE AGGREGATE, OR REINFORCEMENT FOR THIS RETAINING WALL UNTIL OBTAINING APPROVAL OF THE EXCAVATION DEPTH AND FOUNDATION MATERIAL.



CONCRETE DITCH BEHIND WALL WITH CONCRETE FACING

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

PREPARED BY: R. KRAL	DATE: 7/14/2022
REVIEWED BY: M. BREWER	DATE: 7/14/2022



TYPICAL SECTION

NOT TO SCALE

GEOTECHNICAL ENGINEER — SEAL 042642 NORTH CAROLINA PROFESSIONAL ENGINEER ROBERT E. KRAL — DocuSigned by: [signature] 7/14/2022

ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #19C: -L- 380+50, 48.5' RT TO 380+50, 124.6' RT

SHEET 2 OF 2

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

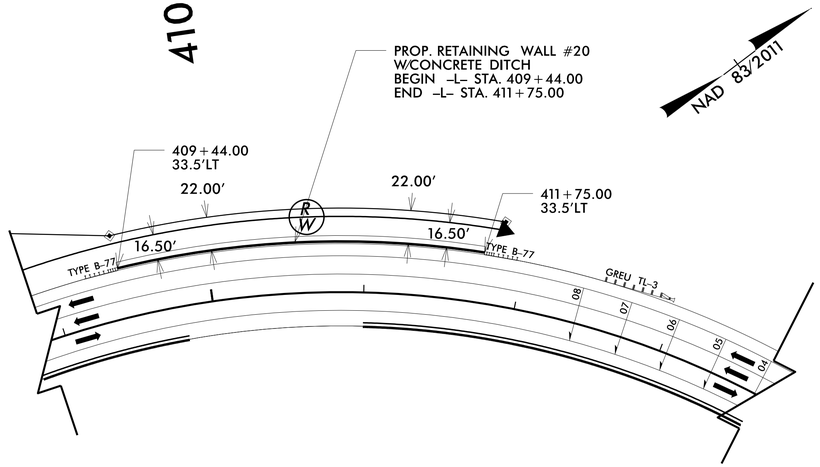
RETAINING WALL #19C
MECHANICALLY STABILIZED EARTH RETAINING WALL WITH CAST-IN-PLACE CONCRETE FACE

REVISIONS

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

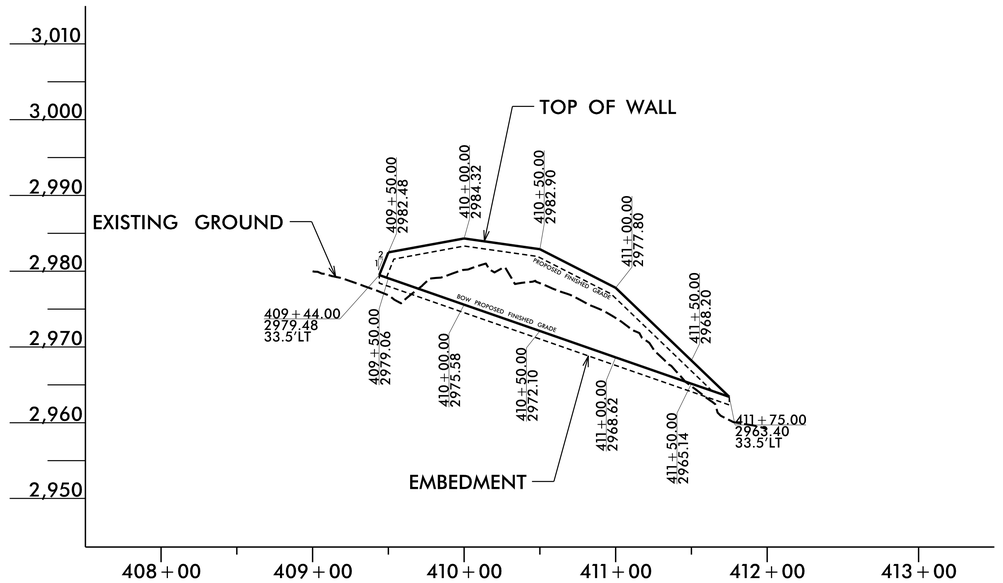
SHEET NO. W19C-2

RETAINING WALL #20:



RETAINING WALL #20 – PLAN

NOT TO SCALE



RETAINING WALL #20 – ENVELOPE

NOT TO SCALE
BOW = BOTTOM OF WALL
(LOOKING AT FACE OF WALL)

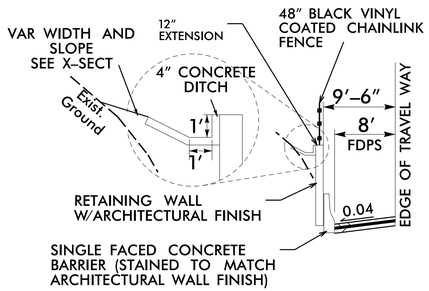
GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 6/9/2022
SIGNATURE DATE

ENGINEER
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



DETAIL FOR WALL #20

NOT TO SCALE
–L– STA. 409+44.00 TO –L– STA. 411+75.00, LT

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
20	1,900 *	2	10
FORM LINER ARCHITECTURAL FINISH			1,900 * SF
HORIZONTAL DRAINS (CONTIGENCY)			120 LF

*INCLUDES RETAINING WALL EMBEDMENT

SOIL NAIL RETAINING WALL #20						
STA. -L-	OFFSET FROM -L- (LT) FT.	ELEV. @ TOP OF WALL	BOW PROPOSED FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
409+44.00	29.74	2979.48	2979.48	2978.48	1.00	1.00
409+50.00	29.91	2982.48	2979.06	2978.06	1.00	3.42
410+00.00	30.74	2984.32	2975.58	2974.58	1.00	8.74
410+50.00	31.58	2982.90	2972.10	2971.10	1.00	10.80
411+00.00	32.41	2977.80	2968.62	2967.62	1.00	9.18
411+50.00	33.25	2968.20	2965.14	2964.14	1.00	3.06
411+75.00	34.08	2963.40	2963.40	2962.40	1.00	1.00

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #20: -L- 409+44, 34' LT TO 411+75, 34' LT
SHEET 1 OF 3

PREPARED BY: R. KRAL	DATE: 5/11/2022
REVIEWED BY: M. BREWER	DATE: 5/11/2022

RETAINING WALL #20 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

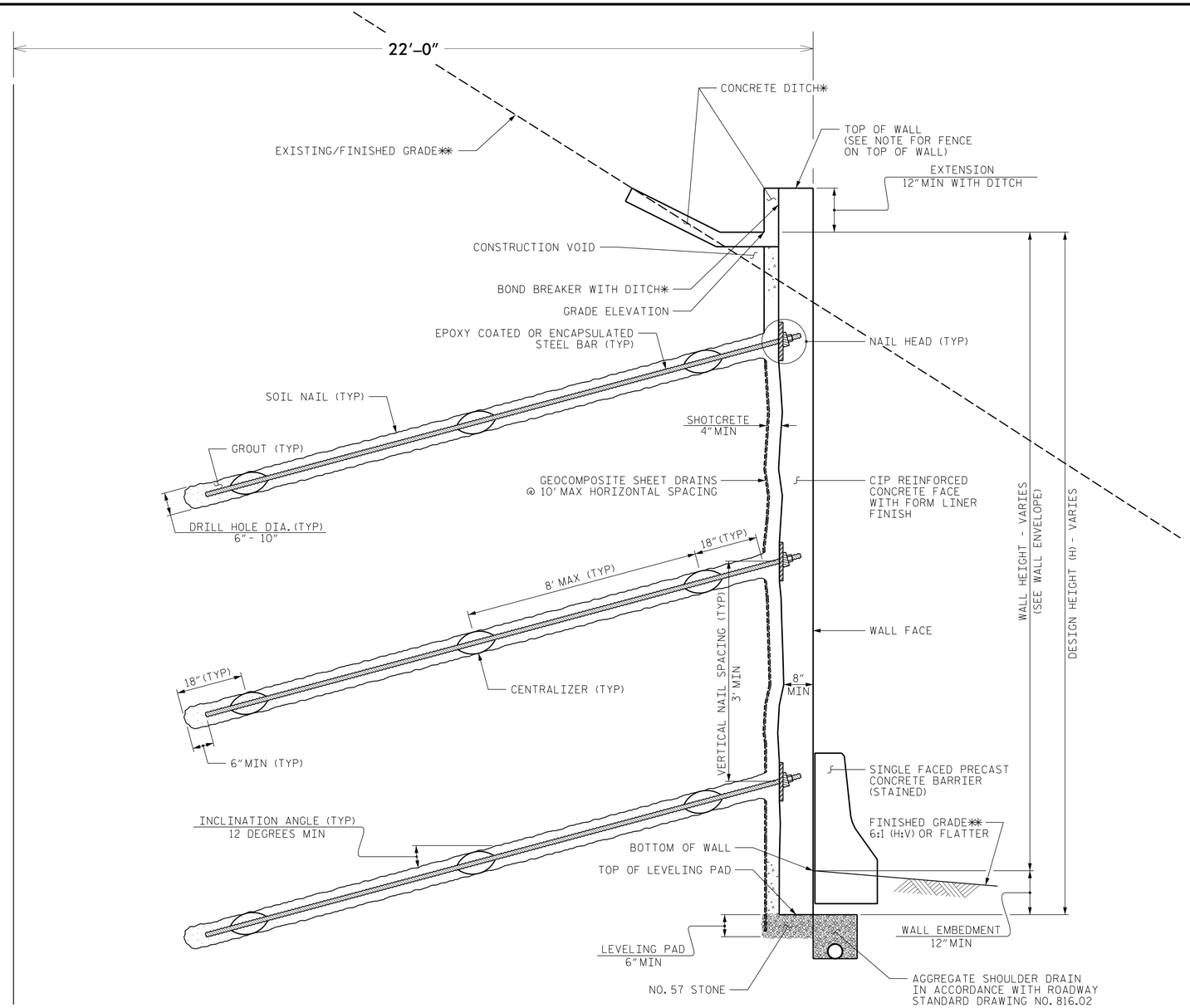
Prepared in the Office of:
CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #20
SOIL NAIL RETAINING WALL

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W20-1
2			4			

PERMANENT EASEMENT



SOIL NAIL WALL - TYPICAL SECTION

*SEE CONCRETE DITCH BEHIND WALL DETAILS.
**SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 6/9/2022
SIGNATURE DATE

ENGINEER
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NOTES:

FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.

FOR SINGLE FACED PRECAST CONCRETE BARRIER (STAINED), SEE ROADWAY PLANS, SECTION 857 OF THE STANDARD SPECIFICATIONS, AND SIMULATED STONE FORM LINER SPECIAL PROVISION.

A FENCE IS REQUIRED ON TOP OF RETAINING WALL #20. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #20. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECHTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FNISH SPECIAL PROVISION.

BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #20, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN RETAINING WALL #20 FOR THE FOLLOWING:
1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
2) DESIGN LIFE = 75 YEARS
3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
4) IN-SITU ASSUMED MEDIUM STIFF TO STIFF RESIDUAL SOIL PARAMETERS:
   UNIT WEIGHT, γ = 120 PCF
   FRICTION ANGLE, f = 32 DEGREES
   COHESION, c = 0 PSF
5) IN-SITU ASSUMED VERY STIFF TO HARD RESIDUAL SOIL PARAMETERS:
   UNIT WEIGHT, γ = 125 PCF
   FRICTION ANGLE, f = 38 DEGREES
   COHESION, c = 0 PSF
6) IN-SITU ASSUMED LOOSE TO MEDIUM DENSE RESIDUAL SOIL PARAMETERS:
   UNIT WEIGHT, γ = 120 PCF
   FRICTION ANGLE, ϕ = 32 DEGREES
   COHESION, c = 0 PSF

WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #20.

THE PROPOSED RIGHT OF WAY (ROW) BOUNDARY IS 16.5 FT FROM THE FACE OF RETAINING WALL #20. THE PROPOSED PERMANENT EASEMENT (PE) IS 22.0 FEET FROM THE FACE OF RETAINING WALL #20. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.

IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #20, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.

WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.

WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALL #20, THE CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE DITCH. ADDITIONAL WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.

FILL PLACEMENT WILL BE REQUIRED FROM -L- STATION 409+00 TO 409+70 AND -L- STATION 411+45 TO 411+75 PRIOR TO THE CONSTRUCTION OF RETAINING WALL #20.

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #20: -L- 409+44, 34' LT TO 411+75, 34' LT

PREPARED BY: R. KRAL	DATE: 5/11/2022
REVIEWED BY: M. BREWER	DATE: 5/11/2022

Prepared in the Office of:
CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #20
SOIL NAIL RETAINING WALL

REVISIONS

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

SHEET NO. W20-2

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 6/9/2022
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SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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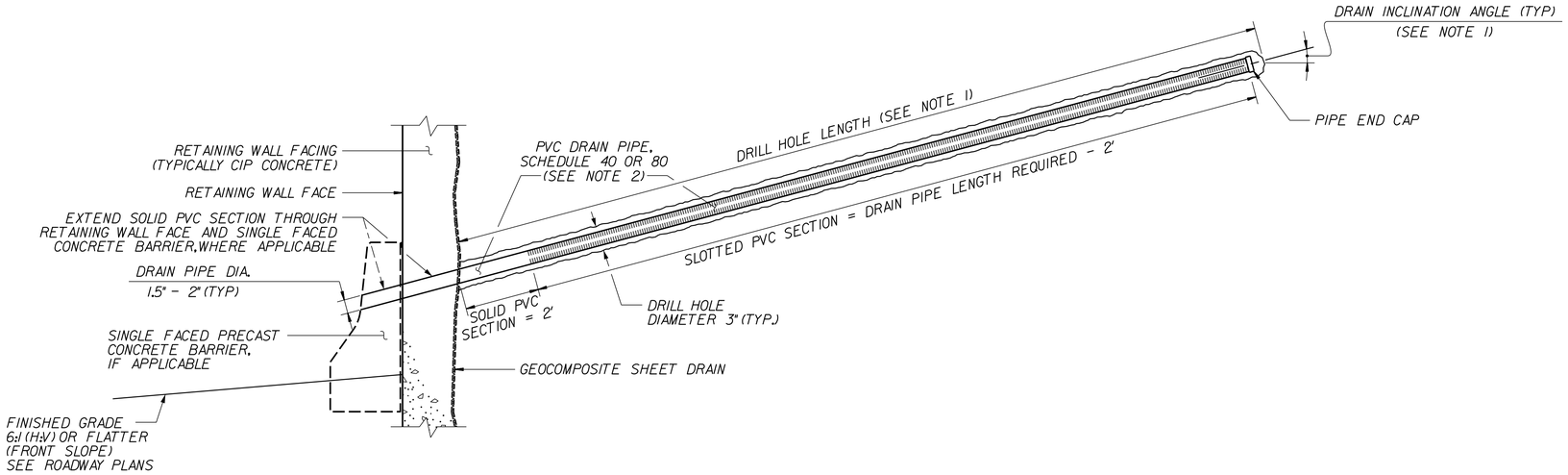
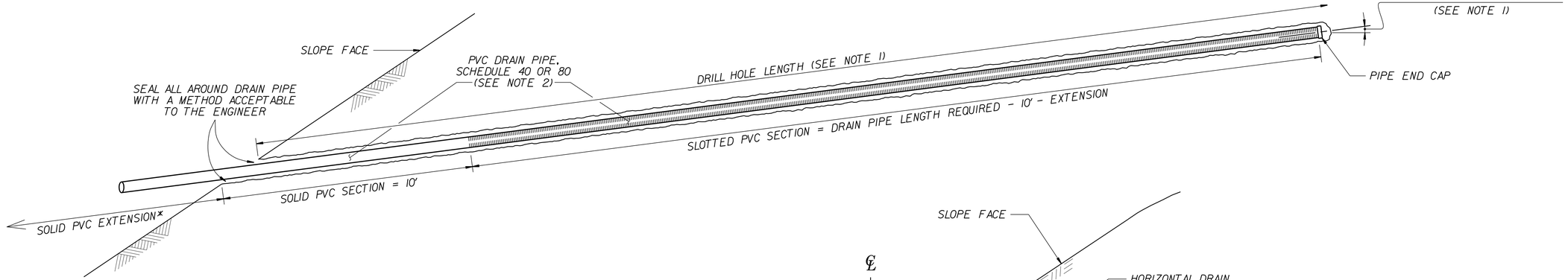
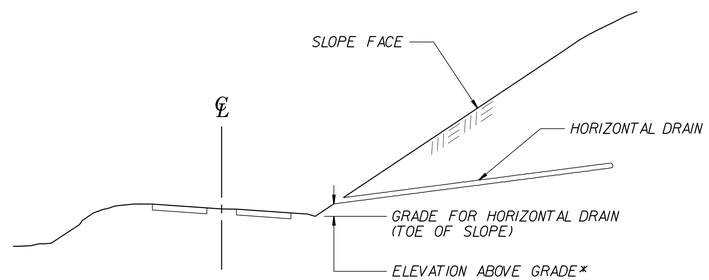


RETAINING WALL HORIZONTAL DRAIN



SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED



EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN

*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS,ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS,SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #20: -L- 409+44, 34' LT TO 411+75, 34' LT

SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 6/2/2022
REVIEWED BY: M. BREWER	DATE: 6/2/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

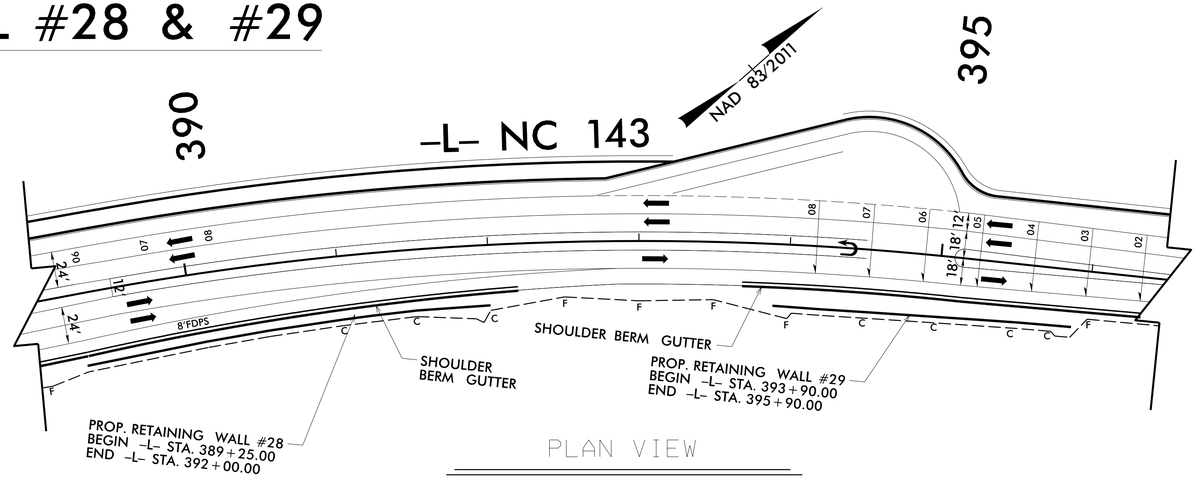
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #20
SOIL NAIL RETAINING WALL

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W20-3
2			4			

RETAINING WALL #28 & #29



PLAN VIEW

SCALE 50 FT = 1 IN

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

DocuSigned by: D. Matthew Brewer 7/15/2022
3B5129C0A4C1462...
SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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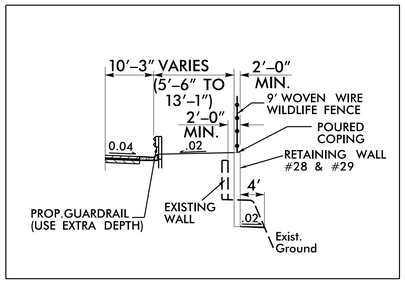
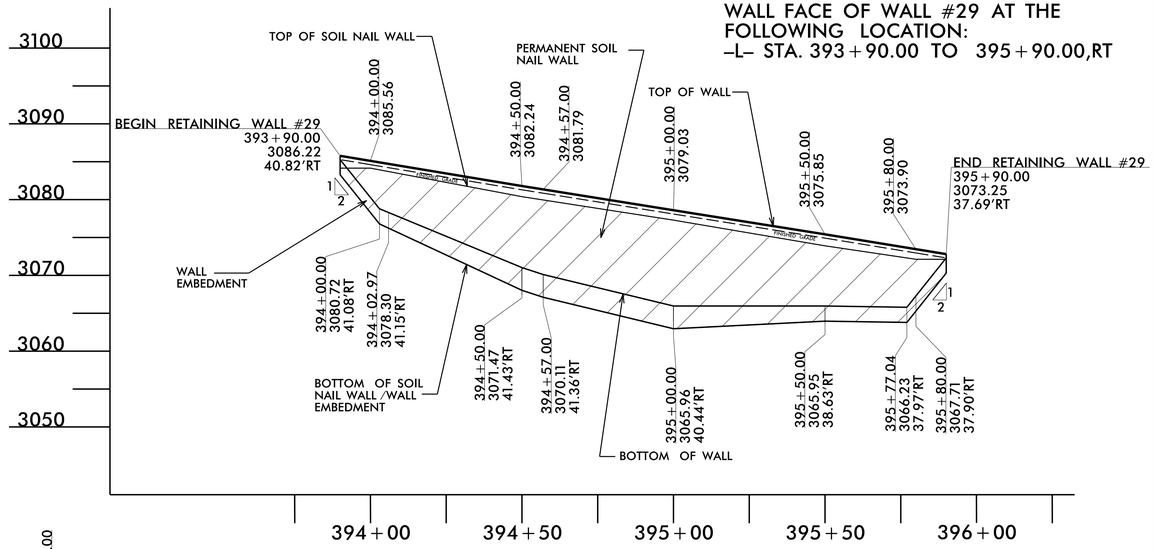


TYPICAL WALL SECTION

NOT TO SCALE

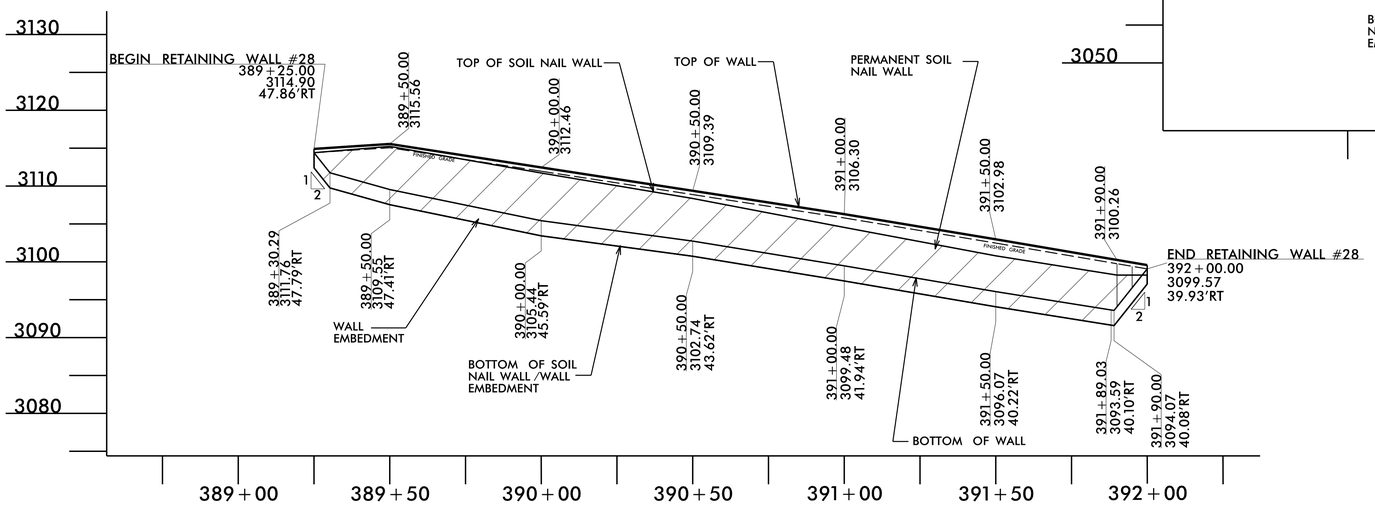
THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #29 AT THE FOLLOWING LOCATION:
–L– STA. 393+90.00 TO 395+90.00,RT



SMSE WALL ENVELOPE

NOT TO SCALE

(LOOKING AT WALL FACE)



SMSE WALL ENVELOPE

NOT TO SCALE

(LOOKING AT WALL FACE)

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #28 AT THE FOLLOWING LOCATION:
–L– STA. 389+25.00 TO 392+00.00,RT

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L-389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

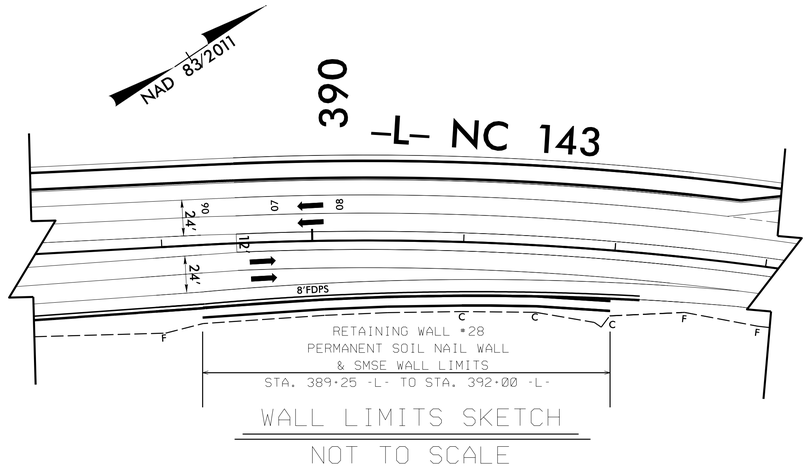
SHEET 1 OF 10

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W28_29 -1
2			4			



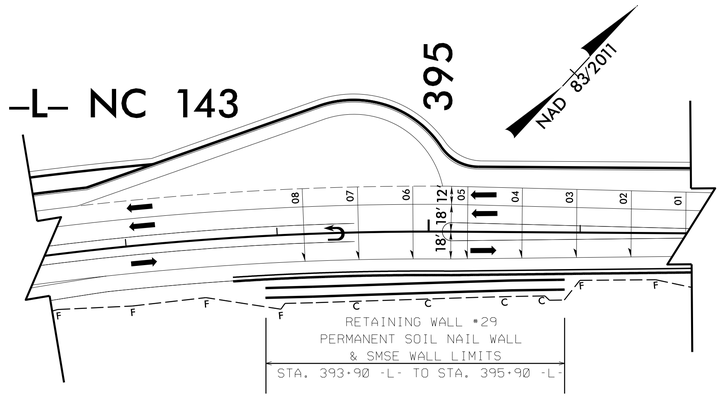
WALL LIMITS SKETCH

NOT TO SCALE

SMSE RETAINING WALL #28 INFORMATION									
STA. -L-	OFFSET RT FROM CL TO WALL FACE	TOP OF WALL	BOTTOM OF WALL	MINIMUM TOP OF LEVELING PAD	ESTIMATED MINIMUM SMSE WALL EMBEDMENT	* DESIGN SMSE WALL HEIGHT "H"	TOP OF SOIL NAIL WALL	APPROX. SOIL NAIL WALL HEIGHT	WALL REINFORCEMENT (MSE STRAP) LENGTH 'L'
389+25.00	47.86	3114.90	3114.40	3112.40	2.00	2.00	3115.00	2.60	0.5XH OR 6 FT (MIN)
389+50.00	47.41	3115.56	3109.55	3107.55	2.00	7.51	3115.24	7.69	0.5XH OR 6 FT (MIN)
390+00.00	45.59	3112.46	3105.44	3102.44	3.00	9.52	3111.72	9.28	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
390+50.00	43.62	3109.39	3102.74	3100.74	2.00	8.15	3108.37	7.63	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
391+00.00	41.94	3106.30	3099.48	3097.48	2.00	8.32	3104.54	7.06	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
391+50.00	40.22	3102.98	3096.07	3094.07	2.00	8.41	3100.79	6.72	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
391+90.00	40.08	3100.26	3094.07	3092.07	2.00	7.69	3098.25	6.18	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
392+00.00	39.93	3099.57	3099.07	3097.07	2.00	2.00	3098.00	0.93	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)

* FOR DESIGN WALL HEIGHT "H" AND ADDITIONAL CONSTRUCTION DETAILS, SEE ADDITIONAL SHEETS

ALL TABLE DIMENSIONS ARE GIVEN IN FEET



WALL LIMITS SKETCH

NOT TO SCALE

SMSE RETAINING WALL #29 INFORMATION									
STA. -L-	OFFSET RT FROM CL TO WALL FACE	TOP OF WALL	BOTTOM OF WALL	MINIMUM TOP OF LEVELING PAD	ESTIMATED MINIMUM SMSE WALL EMBEDMENT	* DESIGN SMSE WALL HEIGHT "H"	TOP OF SOIL NAIL WALL	APPROX. SOIL NAIL WALL HEIGHT	WALL REINFORCEMENT (MSE STRAP) LENGTH 'L'
393+90.00	40.82	3086.22	3085.72	3083.72	2.00	2.00	3084.15	0.43	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
394+00.00	41.08	3085.56	3080.72	3078.72	2.00	6.34	3084.15	5.43	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
394+50.00	41.43	3082.24	3071.47	3068.48	3.00	13.27	3080.39	11.92	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
394+57.00	41.36	3081.79	3070.11	3067.11	3.00	14.18	3079.90	12.79	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
395+00.00	40.44	3079.03	3065.96	3062.96	3.00	15.57	3077.29	14.33	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
395+50.00	38.63	3075.85	3065.95	3063.95	2.00	11.40	3073.90	9.95	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
395+77.04	37.97	3074.09	3066.23	3064.23	2.00	9.36	3072.30	8.07	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
395+80.00	37.90	3073.90	3068.71	3066.71	2.00	6.69	3072.12	5.41	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
395+90.00	37.69	3073.25	3072.75	3070.75	2.00	2.00	3072.12	1.37	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)

* FOR DESIGN WALL HEIGHT "H" AND ADDITIONAL CONSTRUCTION DETAILS, SEE ADDITIONAL SHEETS

ALL TABLE DIMENSIONS ARE GIVEN IN FEET

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

DocuSigned by: D. Matthew Brewer 7/15/2022
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SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L- 389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W28_29 -2

GEOTECHNICAL ENGINEER

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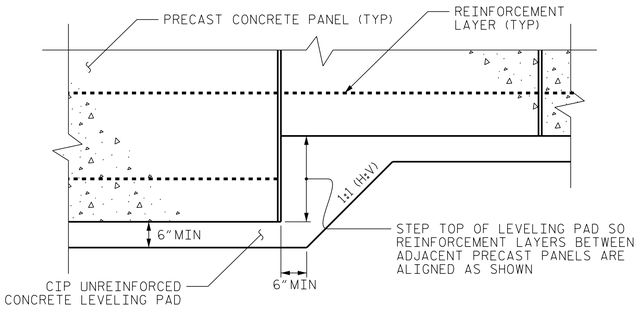
ESTIMATED SMSE WALL QUANTITIES

SHORED MSE RETAINING WALL #28	2,310	SQ. FT.
SHORED MSE RETAINING WALL #29	2,370	SQ. FT.

ESTIMATED SOIL NAIL WALL QUANTITIES

RETAINING WALL #	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
28	1,960 *	2	7
29	2,110 *	2	7

* INCLUDES RETAINING WALL EMBEDMENT



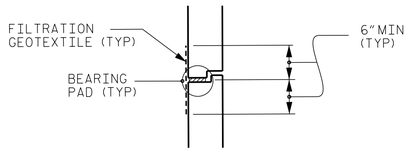
PRECAST PANELS
LEVELING PAD STEP DETAIL

NOT TO SCALE

FRONT SLOPE WALL EMBEDMENT

SLOPE IN FRONT OF STRUCTURES		MINIMUM EMBEDMENT DEPTH
HORIZONTAL	FOR WALLS	H/20
	FOR ABUTMENTS	H/10
3.0H:1.0V	WALLS	H/10
2.5H:1.0V	WALLS	H/8.5
2.0H:1.0V	WALLS	H/7
1.5H:1.0V	WALLS	H/5
1.25H:1.0V	WALLS	H/4
1.0H:1.0V	WALLS	H/3

NOTE:
1) MAINTAIN A MINIMUM BENCH WIDTH OF 4 FT IN FRONT OF THE WALL FOR ITS ENTIRE LENGTH.
2) MINIMUM EMBEDMENT DEPTH OF 2 FT, UNLESS LARGER DEPTHS DICTATED BY ABOVE TABLE.
3) MAXIMUM SLOPE OF 1H:1V WILL BE MAINTAINED ON FRONT SLOPES FOR THE ENTIRE LENGTH OF THE WALL.
4) SUBMIT WITH THE WALL DESIGN INTERNAL, EXTERNAL, AND GLOBAL STABILITY ANALYSES.
REFERENCE SPECIAL PROVISION GT-7 FOR SMSE WALL.



PRECAST PANEL
JOINT DETAILS

NOT TO SCALE

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L-389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

SHEET 3 OF 10

PREPARED BY: DMB	DATE: 7/14/2022
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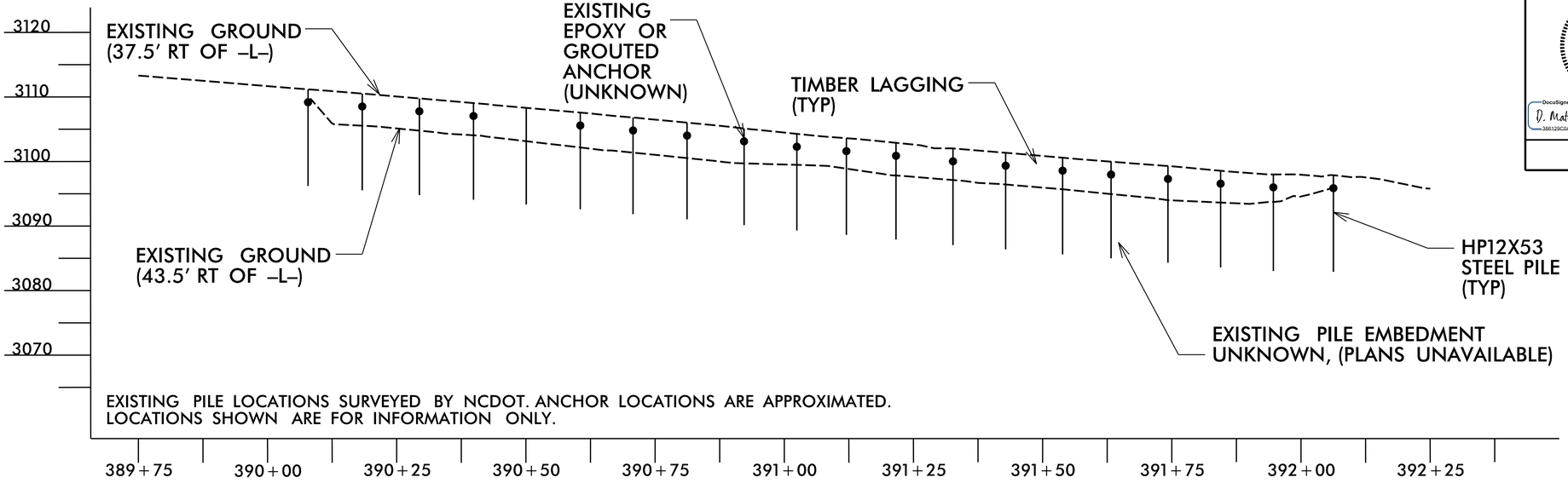
RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

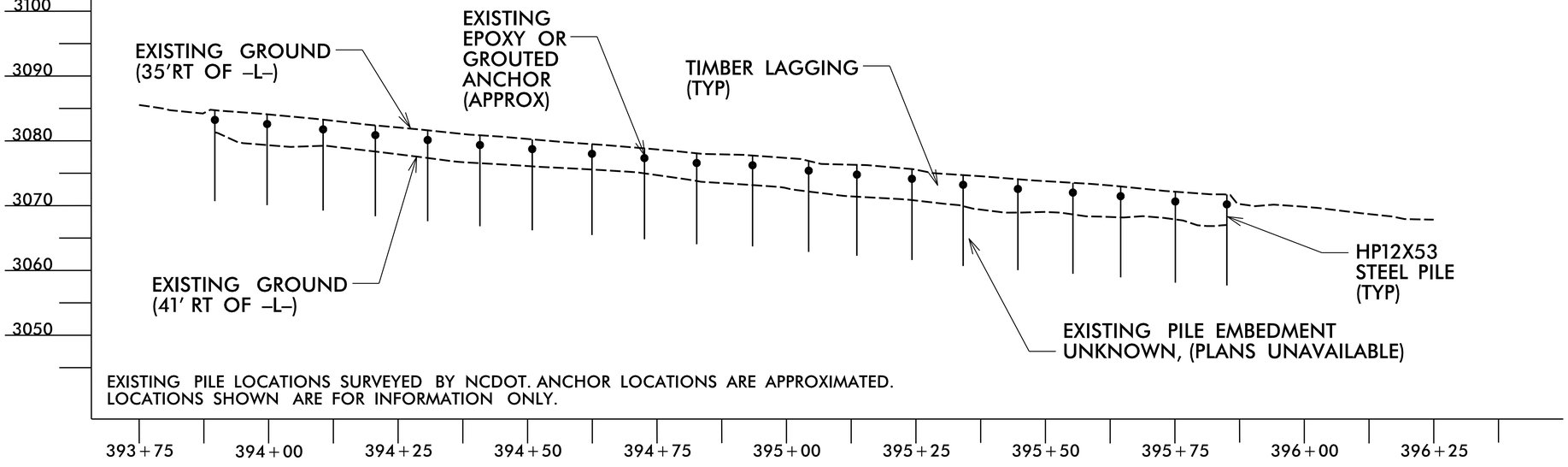
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W28_29 -3



EXISTING WALL PROFILE - #28

NOT TO SCALE
(LOOKING AT WALL FACE)



EXISTING WALL PROFILE - #29

NOT TO SCALE
(LOOKING AT WALL FACE)

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

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GRAHAM COUNTY

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SHEET 4 OF 10

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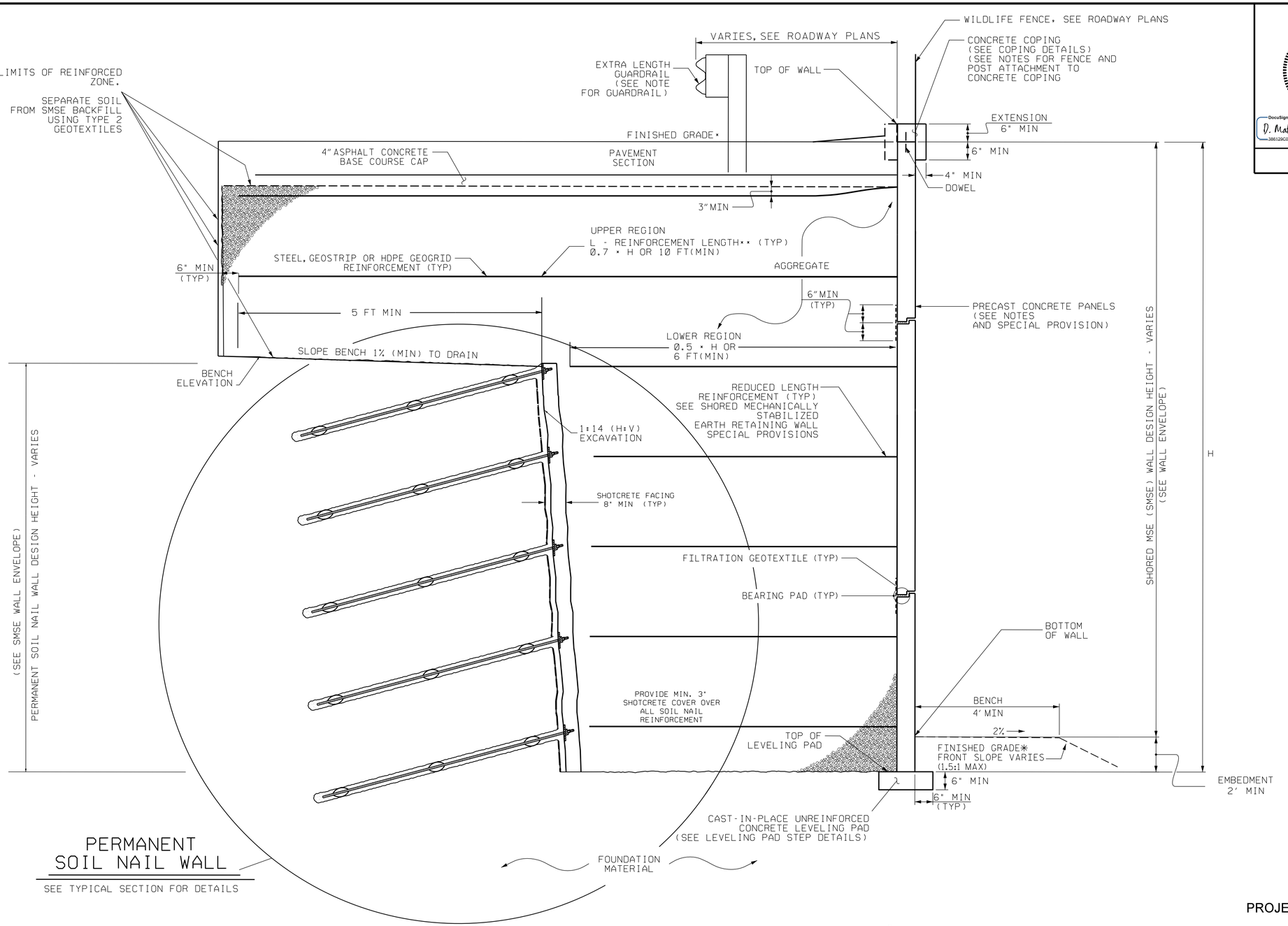
RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W28_29 -4



PERMANENT SOIL NAIL WALL

SEE TYPICAL SECTION FOR DETAILS

SMSE WALL WITH SOIL NAIL WALL > ⅔ H

RETAINING WALL *28 & *29

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

**SEE SMSE RETAINING WALLS SPECIAL PROVISION REINFORCEMENT LENGTH REQUIREMENTS.

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

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GRAHAM COUNTY

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RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

SHEET 5 OF 10

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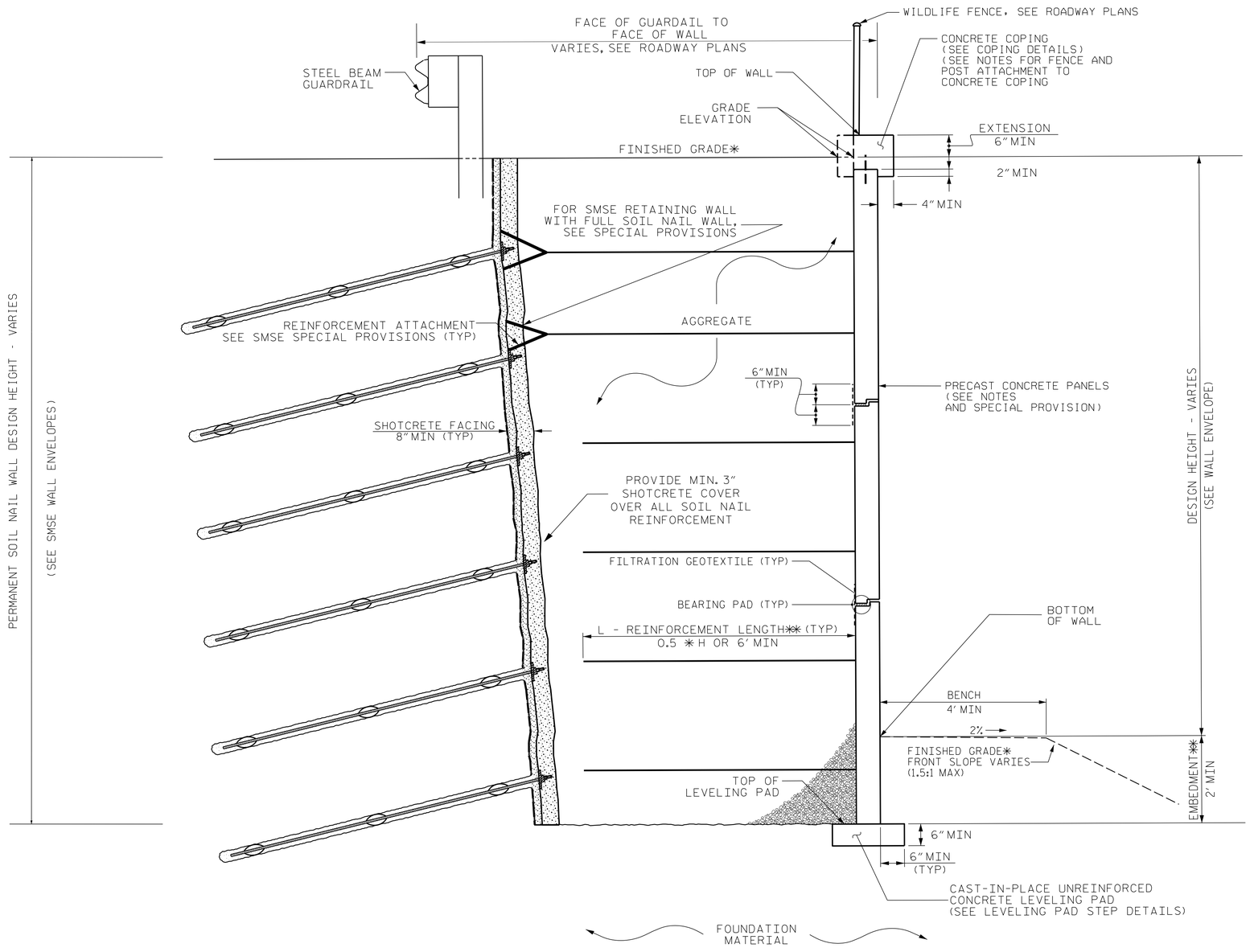
GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W28_29 -5



SMSE WALL WITH FULL HEIGHT SOIL NAIL WALL

RETAINING WALL #28

* SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.
** SEE SMSE RETAINING WALLS PROVISION FOR EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

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GRAHAM COUNTY

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SHEET 6 OF 10

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RETAINING WALL #28 AND #29
SHORED MECHANICALLY
STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W28_29 -6

NOTES:

FOR SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL RETAINING WALLS, SEE SHORED MECHANICALLY STABILIZED EARTH RETAINING WALLS SPECIAL PROVISION.

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.

FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.

USE AN SMSE WALL SYSTEM WITH PRECAST PANELS FOR THIS RETAINING WALL.

DO NOT USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL *28 AND *29.

A SMOOTH ARCHITECTURAL FINISH IS REQUIRED FOR PRECAST CONCRETE PANELS FOR RETAINING WALL *28 AND *29.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL *28 AND *29.

BEFORE BEGINNING SMSE WALL DESIGN FOR RETAINING WALL *28 AND *29, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN RETAINING WALL *28 AND *29 FOR WALL HEIGHTS EQUAL TO THE DESIGN HEIGHT (DIFFERENCE BETWEEN FINISHED GRADE/TOP OF WALL ELEVATION AND BOTTOM OF WALL ELEVATION) PLUS EMBEDMENT (DIFFERENCE BETWEEN BOTTOM OF WALL ELEVATION AND TOP OF LEVELING PAD ELEVATION).

DESIGN RETAINING WALL *28 AND *29 FOR THE FOLLOWING:
1) H = DESIGN HEIGHT + EMBEDMENT
2) DESIGN LIFE = 75 YEARS
3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL:
   RETAINING WALL *28: 2,000 PSF
   RETAINING WALL *29: 2,850 PSF
4) MINIMUM MSE REINFORCEMENT LENGTH (L) = VARIES, SEE TABLE ON SHEET W28_29-2
5) MINIMUM SOIL NAIL REINFORCEMENT LENGTHS ARE BASED ON SNAIL.
6) MINIMUM EMBEDMENT DEPTH = VARIES, SEE TABLE ON SHEET W28_29-2
7) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (C) PSF
COARSE	110	38	0
FINE	115	34	0
* SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.			

9) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (C) PSF
BACKFILL	120	32	0
FOUNDATION	120	32	0

DESIGN RETAINING WALL *28 AND *29 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH MSE AND SOIL NAIL REINFORCEMENT FOR RETAINING WALL *28 AND *29.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR MSE WALL PORTION OF RETAINING WALL *28 AND *29 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

FOR WILDLIFE FENCES ON THE TOP OF THE RETAINING WALL, SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

FOR SOIL NAIL RETAINING WALLS, SEE SMSE RETAINING WALL SPECIAL PROVISION.

THE SMSE WALL DESIGNER SHALL CONSULT WITH THE SOIL NAIL WALL DESIGNER TO VERIFY LOCATIONS WHERE "TEMPORARY SHORING" MAY BE REQUIRED FOR THE RETAINING WALL IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE TRAFFIC CONTROL PLANS. IN LOCATIONS WHERE "PERMANENT SOIL NAIL WALL" IS USED, PAYMENT WILL NOT BE MADE FOR "TEMPORARY SHORING" FOR TRAFFIC CONTROL.

THE PERMANENT SOIL NAIL WALL HEIGHT IS AN ESTIMATE ONLY, THAT IS BASED ON THE ANTICIPATED EXCAVATION PLUS THE MINIMUM EMBEDMENT LISTED.

WHERE APPLICABLE, DESIGN SOIL NAIL WALL REINFORCEMENT INCLINATION TO ACCOUNT FOR EXISTING OR FUTURE UTILITY CONFLICTS BEHIND THE SOIL NAIL WALL. VERIFY UTILITY LOCATION AND ELEVATION BEFORE BEGINNING SOIL NAIL WALL DESIGN OR CONSTRUCTION.

"TOP OF SOIL NAIL WALL" AS SHOWN IN THE WALL ENVELOPE REPRESENTS THE APPROXIMATE GRADE ELEVATION AT A DISTANCE OF 0.5 TIMES THE PROPOSED WALL HEIGHT ("H") AT THAT STATION OR ELEVATION AT THE TOP OF THE EXISTING WALL.

THE ESTIMATED SOIL NAIL WALL QUANTITY IS BASED ON 0.5 TIMES "H" (SMSE DESIGN HEIGHT) INCLUDING THE MINIMUM EMBEDMENT LISTED IN THE DESIGN TABLE ON SHEET W28_29-2. THESE VALUES ARE PROVIDED AS AN ESTIMATE ONLY AND MAY VARY DUE TO SITE CONDITIONS.

THE SOIL NAIL WALL DESIGNER IS RESPONSIBLE FOR DETERMINING GLOBAL STABILTIY BASED ON THE FINISHED SMSE WALL. A MINIMUM FACTOR OF SAFETY OF 1.35 IS REQUIRED FOR GLOBAL STABILITY. SUBMIT THESE RESULTS WITH THE WALL DESIGN PACKAGE. VERIFY UTILITY LOCATIONS AND ELEVATIONS BEFORE BEGINNING MSE WALL DESIGN OR CONSTRUCTION.

CONTRACTOR SHALL BE MADE AWARE THAT GRAVELLY SOILS AND BOULDER FILL WERE USED IN THE EXISTING ROADWAY EMBANKMENT AND MAY BE ENCOUNTERED DURING SOIL NAIL WALL CONSTRUCTION.

SPECIAL NOTES:

UNDERCUTTING COLLUVIAL SOILS BELOW THE SMSE WALL IS REQUIRED AS SHOWN ON SHEET W28_29-8. USE UNDERCUT EXCAVATION TO REMOVE SOILS AS DIRECTED BY THE ENGINEER. PLACE GEOTEXTILE FOR SOIL STABILIZATION WHEN NEEDED IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SUITABLE EMBANKMENT MATERIAL. FOR UNDERCUT EXCAVATION SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION AND GEOTEXILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.

EXTEND SOIL NAIL SHORING TO BOTTOM OF UNDERCUT EXCAVATION. DESIGN SOIL NAIL SHORING FOR THE HEIGHT EQUAL TO THE DIFFERENCE BETWEEN THE EXISTING ROADWAY GRADE AND THE BOTTOM OF THE UNDERCUT EXCAVATION. SOIL NAIL SHORING FOR UNDERCUT EXCAVATION WILL BE PAID IN ACCORDANCE WITH THE TEMPORARY SOIL NAIL SHORING FOR COLLUVIAL UNDERCUT SPECIAL PROVISION.

THE COLLUVIAL SOILS ARE SUITABLE FOR USE AS EMBANKMENT BUT WILL REQUIRE SIGNIFICANT DRYING TO ACHIEVE THE REQUIRED DENSITY. DO NOT USE COLLUVIAL SOILS IN THE UPPER 3 FEET OF EMBANKMENT DUE TO THE PRESENCE OF BOULDERS AND COBBLES. NO ADDITIONAL COMPENSATION WILL BE PROVIDED TO DRY COLLUVIAL SOILS OR FOR DOUBLE-HANDLING SOILS.

CONTROL GROUNDWATER DURING AND AT THE BOTTOM OF UNDERCUT EXCAVATION USING DITCHING, SUMPS, AND PERMANENT SHOULDER DRAINS AS DIRECTED BY THE ENGINEER. OUTLET SHOULDER DRAINS EVERY 50 TO 100 FEET AS DIRECTED BY THE ENGINEER.

THE EXISTING ANCHORED PILE PANEL WALLS WILL BE DEMOLISHED AS PART OF THE CONSTRUCTION OF RETAINING WALL *28 AND *29.

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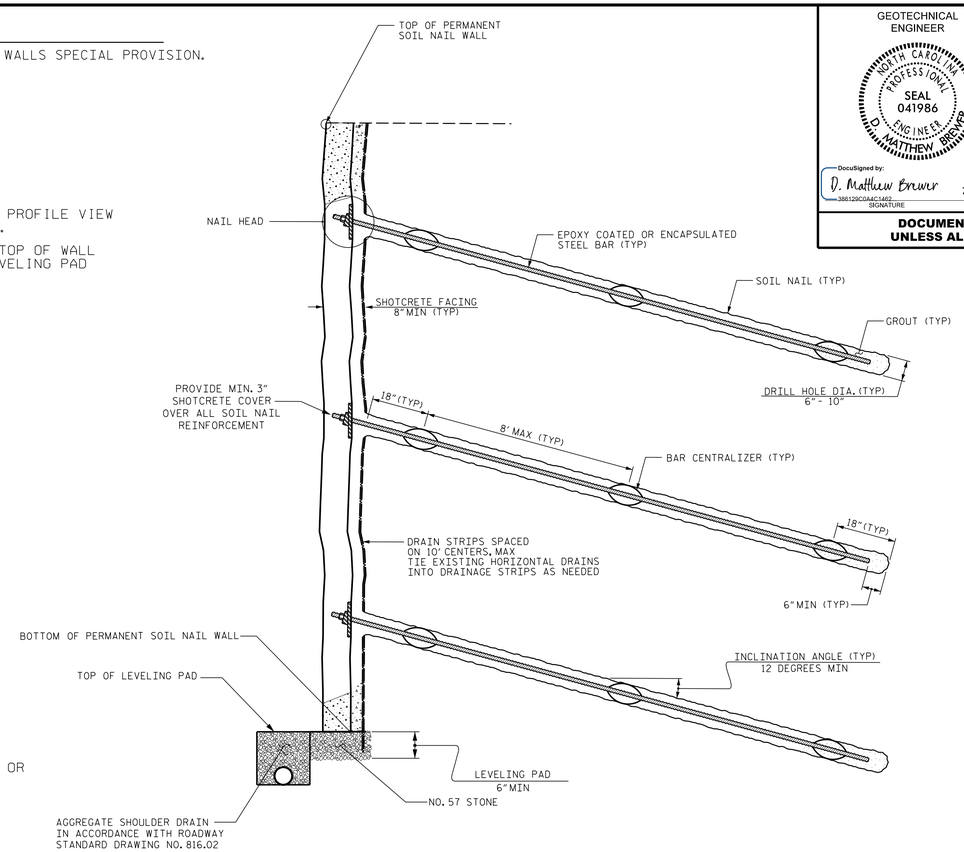
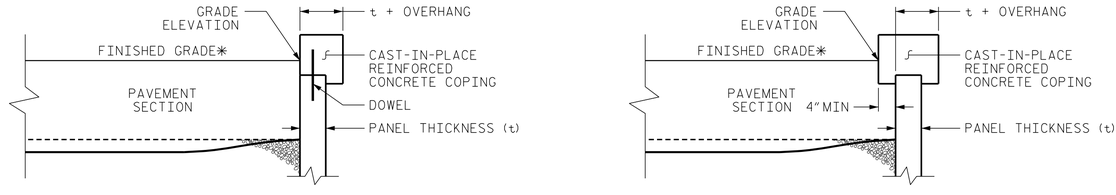


PERMANENT SOIL NAIL WALL - TYPICAL SECTION

NOT TO SCALE



COPING DETAILS

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.
*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L-389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

SHEET 7 OF 10

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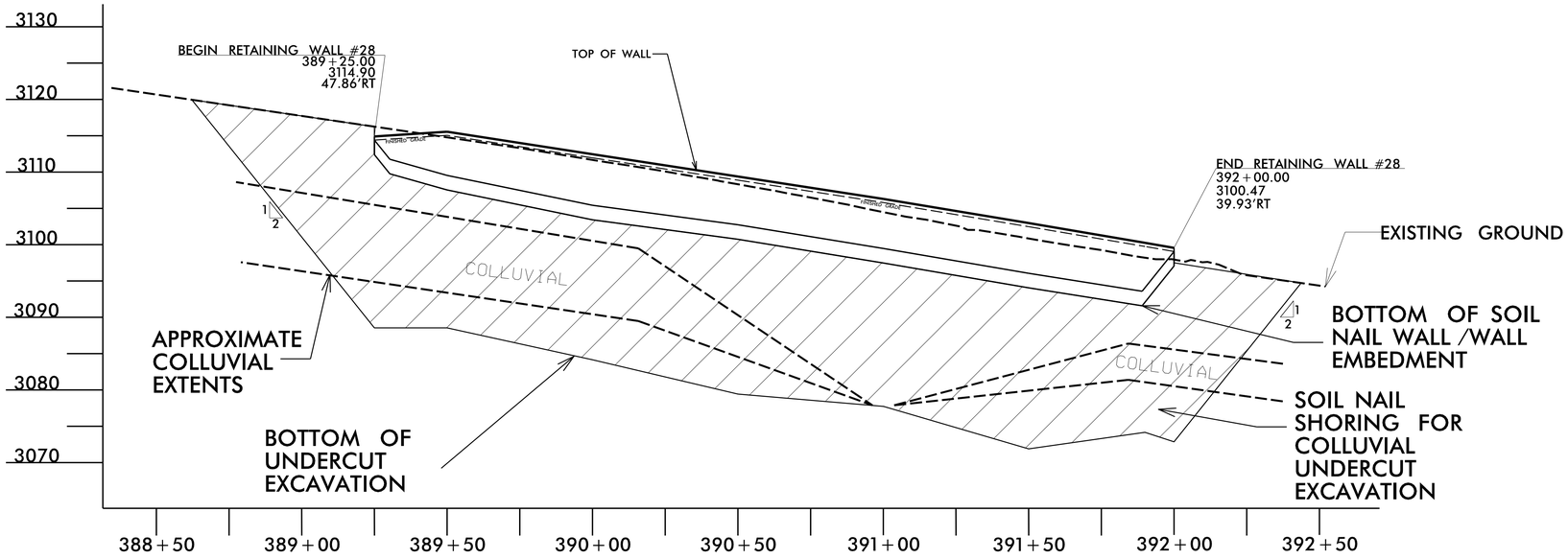
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #28 AND #29 SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS							SHEET NO.
NO.	BY	DATE	NO.	BY	DATE		
1			3				W28_29-7
2			4				



APPROXIMATE ENVELOPE - SHORING FOR UNDERCUT

NOT TO SCALE
(LOOKING AT WALL FACE)

GEOTECHNICAL ENGINEER

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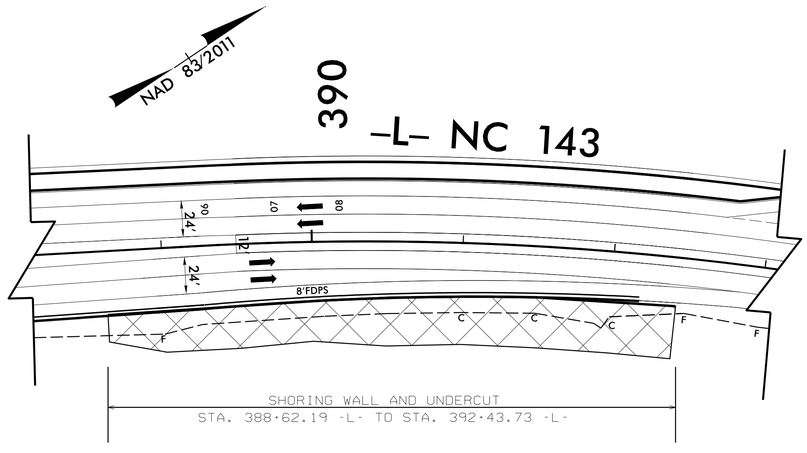
ESTIMATED SOIL NAIL WALL QUANTITIES

RETAINING WALL #	SOIL NAIL SHORING (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
28	7,000	3	23



SHORING AND UNDERCUT LIMITS SKETCH

SCALE: 50' = 1"

ESTIMATED QUANTITIES - RETAINING WALL #28

UNDERCUT EXCAVATION	6,900 CY
GEOTEXTILE FOR SOIL STABILIZATION	1,350 SY
SELECT GRANULAR MATERIAL	1,350 CY
SHOULDER DRAIN	800 LF
CONCRETE PAD FOR SHOULDER DRAIN PIPE OUTLET	5 EA

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RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

SHEET 8 OF 10

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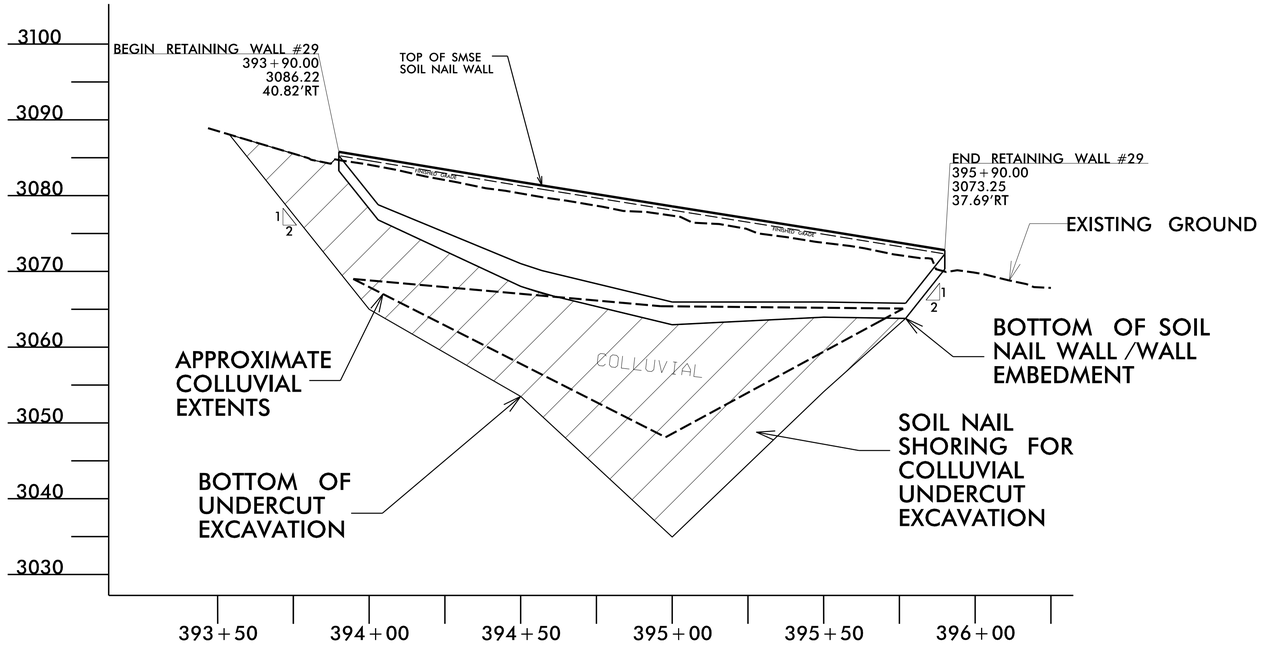
CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

RETAINING WALL #28 AND #29 SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

REVISIONS

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

SHEET NO. W28_29 -8

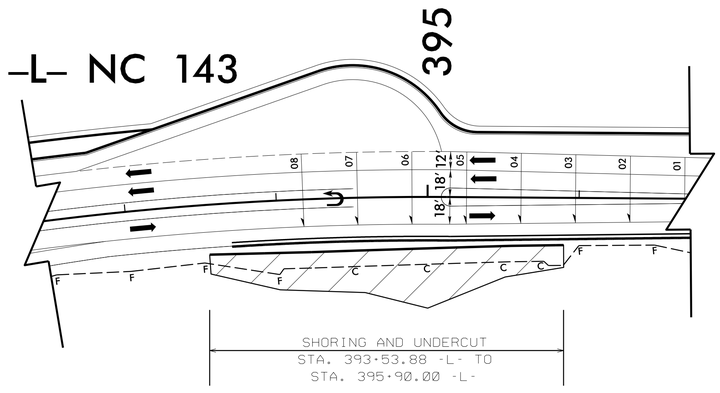


APPROXIMATE ENVELOPE - SHORING FOR UNDERCUT

NOT TO SCALE
(LOOKING AT WALL FACE)

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL #	SOIL NAIL SHORING (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
29	3,200	3	11

ESTIMATED QUANTITIES - RETAINING WALL #29	
UNDERCUT EXCAVATION	3,400 CY
GEOTEXTILE FOR SOIL STABILIZATION	730 SY
SELECT GRANULAR MATERIAL	730 CY
SHOULDER DRAIN	500 LF
CONCRETE PAD FOR SHOULDER DRAIN PIPE OUTLET	3 EA



SHORING AND UNDERCUT LIMITS SKETCH

SCALE: 50' = 1"

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER

DocuSigned by: D. Matthew Brewer 7/15/2022
SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L-389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

RETAINING WALL #28 AND #29 SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

REVISIONS

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

SHEET NO. W28_29 -9

GEOTECHNICAL ENGINEER	ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 041986 ENGINEER D. MATTHEW BREWER	
DocuSigned by: D. Matthew Brewer 7/15/2022 — 335129C0A4C1462... SIGNATURE DATE	SIGNATURE DATE

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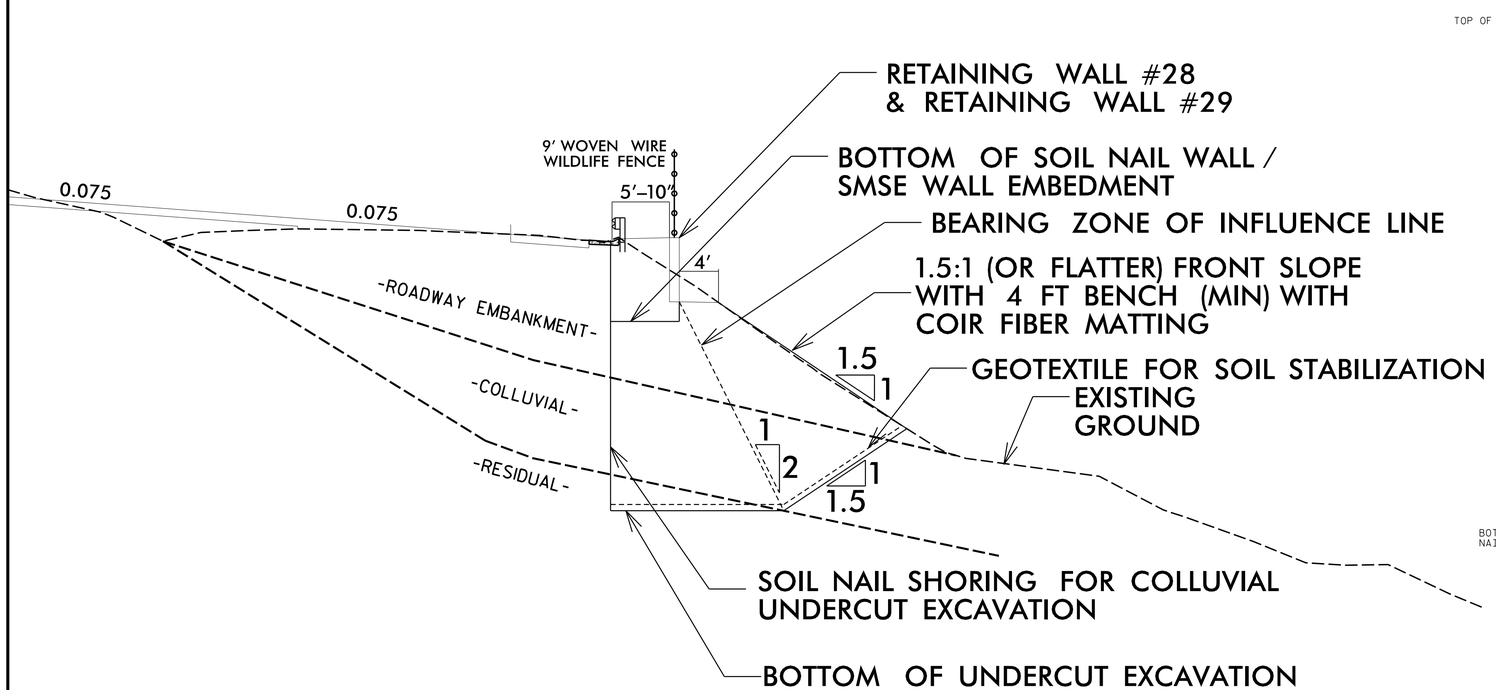
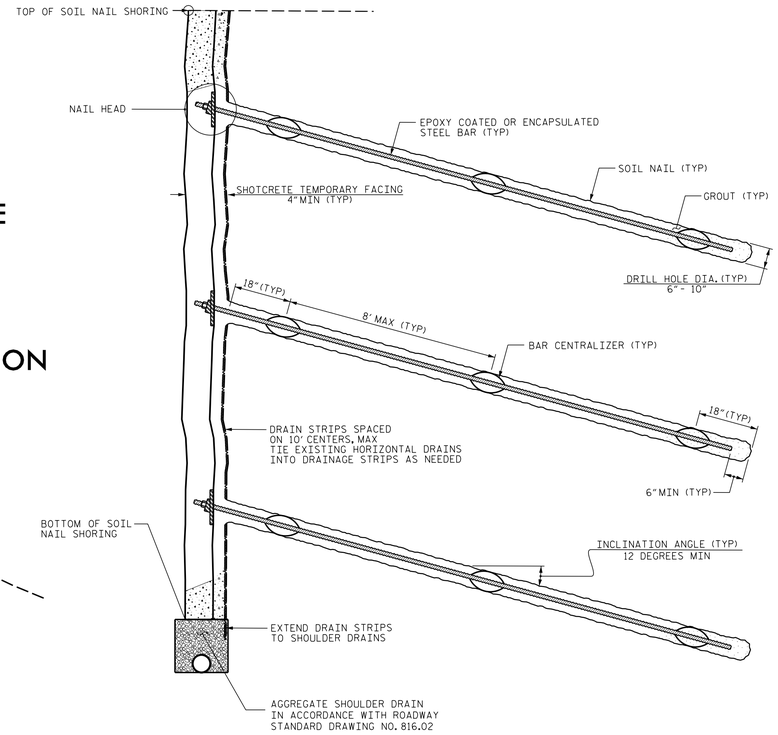


UNDERCUT EXCAVATION - TYPICAL SECTION - RETAINING WALL #28 & #29

NOT TO SCALE

RETAINING WALL # 28: STA. 388+62.19 -L- TO STA. 392+43.73 -L- &
RETAINING WALL #29: STA. 393+53.88 -L- TO STA. 395+90.00 -L-



SOIL NAIL SHORING - TYPICAL SECTION

NOT TO SCALE

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #28 STATION: -L-389+25, 47' RT TO 392+00, 39' RT

RETAINING WALL #29 STATION: -L- 393+90, 40' RT TO 395+90, 37' RT

SHEET 10 OF 10

PREPARED BY: DMB	DATE: 7/14/2022
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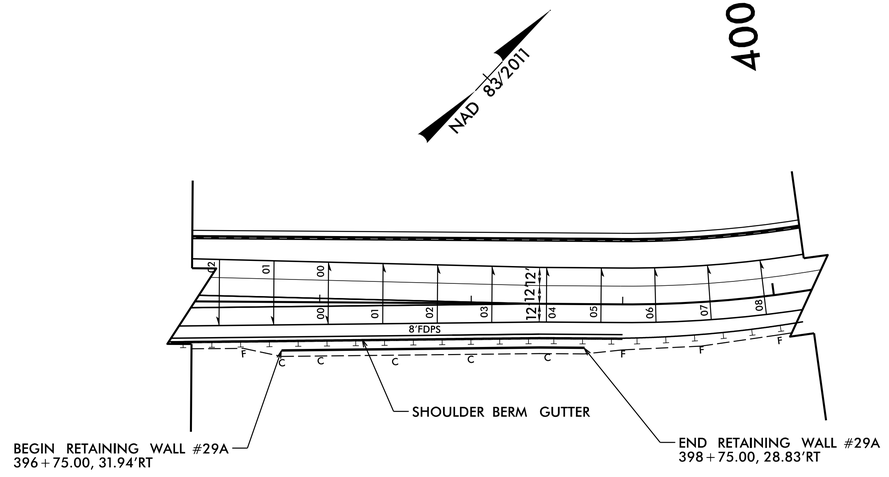
RETAINING WALL #28 AND #29 SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

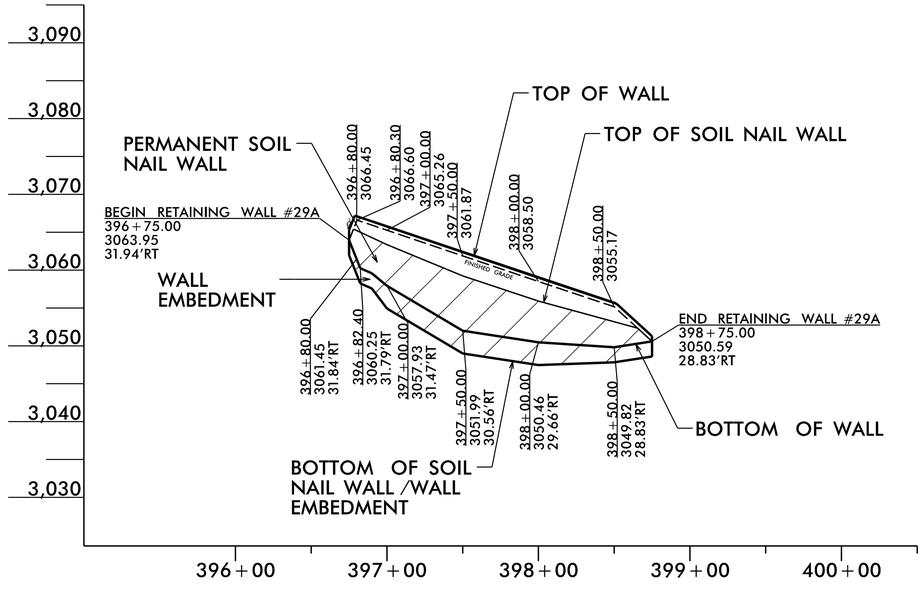
REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W28_29 -10
2			4			

RETAINING WALL #29A



PLAN VIEW

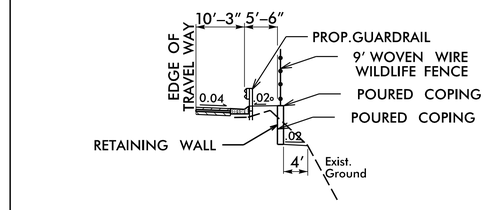
SCALE 50 FT • 1 IN



SMSE WALL ENVELOPE

NOT TO SCALE
(LOOKING AT WALL FACE)

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #29A AT THE FOLLOWING LOCATION:
–L– STA. 396+75.00 TO 398+75.00,RT



DETAIL FOR WALL #29A

–L– STA. 396+75.00 TO –L– STA. 398+75.00, RT

TYPICAL WALL SECTION

NOT TO SCALE

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 8AD703B2A846F4...

7/15/2022

SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 1 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

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RETAINING WALL #29A
SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W29A-1

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

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7/15/2022

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SMSE RETAINING WALL #29A INFORMATION

STA. -L-	OFFSET RT FROM CL TO WALL FACE	FINISHED GRADE	BOTTOM OF WALL	MINIMUM TOP OF LEVELING PAD	ESTIMATED MINIMUM SMSE WALL EMBEDMENT	* DESIGN SMSE WALL HEIGHT "H"	TOP OF SOIL NAIL WALL	APPROX. SOIL NAIL WALL HEIGHT	WALL REINFORCEMENT (MSE STRAP) LENGTH 'L'
396+75.00	31.94	3063.95	3063.95	3061.95	2.00	2.00	3063.95	2.00	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
396+80.00	31.84	3066.45	3061.45	3059.45	2.00	7.00	3065.23	5.78	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
396+80.30	31.82	3066.60	3061.30	3059.30	2.00	7.30	3065.20	5.90	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
396+82.40	31.79	3066.46	3060.25	3058.25	2.00	8.21	3065.00	6.75	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
397+00.00	31.47	3065.26	3057.93	3054.93	3.00	10.33	3063.36	8.43	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
397+50.00	30.56	3061.87	3051.99	3048.99	3.00	12.88	3059.23	10.24	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
398+00.00	29.66	3058.50	3050.46	3047.46	3.00	11.04	3055.98	8.52	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
398+50.00	28.83	3055.17	3049.82	3047.82	2.00	7.35	3053.19	5.37	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)
398+75.00	28.83	3050.59	3050.59	3048.59	2.00	2.00	3050.59	2.00	LOWER: 0.5XH OR 6 FT (MIN) UPPER: 0.7XH OR 10 FT (MIN)

* FOR DESIGN WALL HEIGHT "H" AND ADDITIONAL CONSTRUCTION DETAILS, SEE ADDITIONAL SHEETS

ALL TABLE DIMENSIONS ARE GIVEN IN FEET

FRONT SLOPE WALL EMBEDMENT

SLOPE IN FRONT OF STRUCTURES		MINIMUM EMBEDMENT DEPTH
HORIZONTAL	FOR WALLS	H/20
	FOR ABUTMENTS	H/10
3.0H:1.0V	WALLS	H/10
2.5H:1.0V	WALLS	H/8.5
2.0H:1.0V	WALLS	H/7
1.5H:1.0V	WALLS	H/5
1.25H:1.0V	WALLS	H/4
1.0H:1.0V	WALLS	H/3

NOTE:
1) MAINTAIN A MINIMUM BENCH WIDTH OF 4.0 FT IN FRONT OF THE WALL FOR ITS ENTIRE LENGTH.
2) MINIMUM EMBEDMENT DEPTH OF 2 FT, UNLESS LARGER DEPTHS DICTATED BY ABOVE TABLE.
3) MAXIMUM SLOPE OF 1H:1V WILL BE MAINTAINED ON FRONT SLOPES FOR THE ENTIRE LENGTH OF THE WALL.
4) SUBMIT WITH THE WALL DESIGN INTERNAL, EXTERNAL, AND GLOBAL STABILITY ANALYSES.

REFERENCE SPECIAL PROVISION GT-7 FOR SMSE WALL.

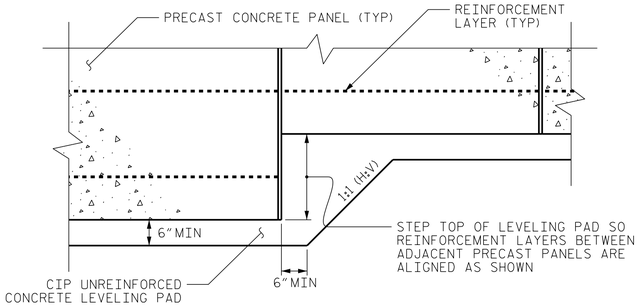
ESTIMATED SMSE WALL #29A QUANTITIES

SHORED MSE RETAINING WALL #29A	2,070 SQ. FT.

ESTIMATED SOIL NAIL WALL QUANTITIES

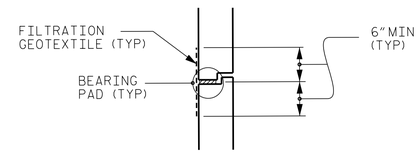
RETAINING WALL #	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
29A	1,550 *	2	5

* INCLUDES RETAINING WALL EMBEDMENT



PRECAST PANELS LEVELING PAD STEP DETAIL

NOT TO SCALE



PRECAST PANEL JOINT DETAILS

NOT TO SCALE

PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 2 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
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Prepared in the Office of:

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RETAINING WALL #29A SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W29A-2

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 8AD703B2A846F4...

7/15/2022

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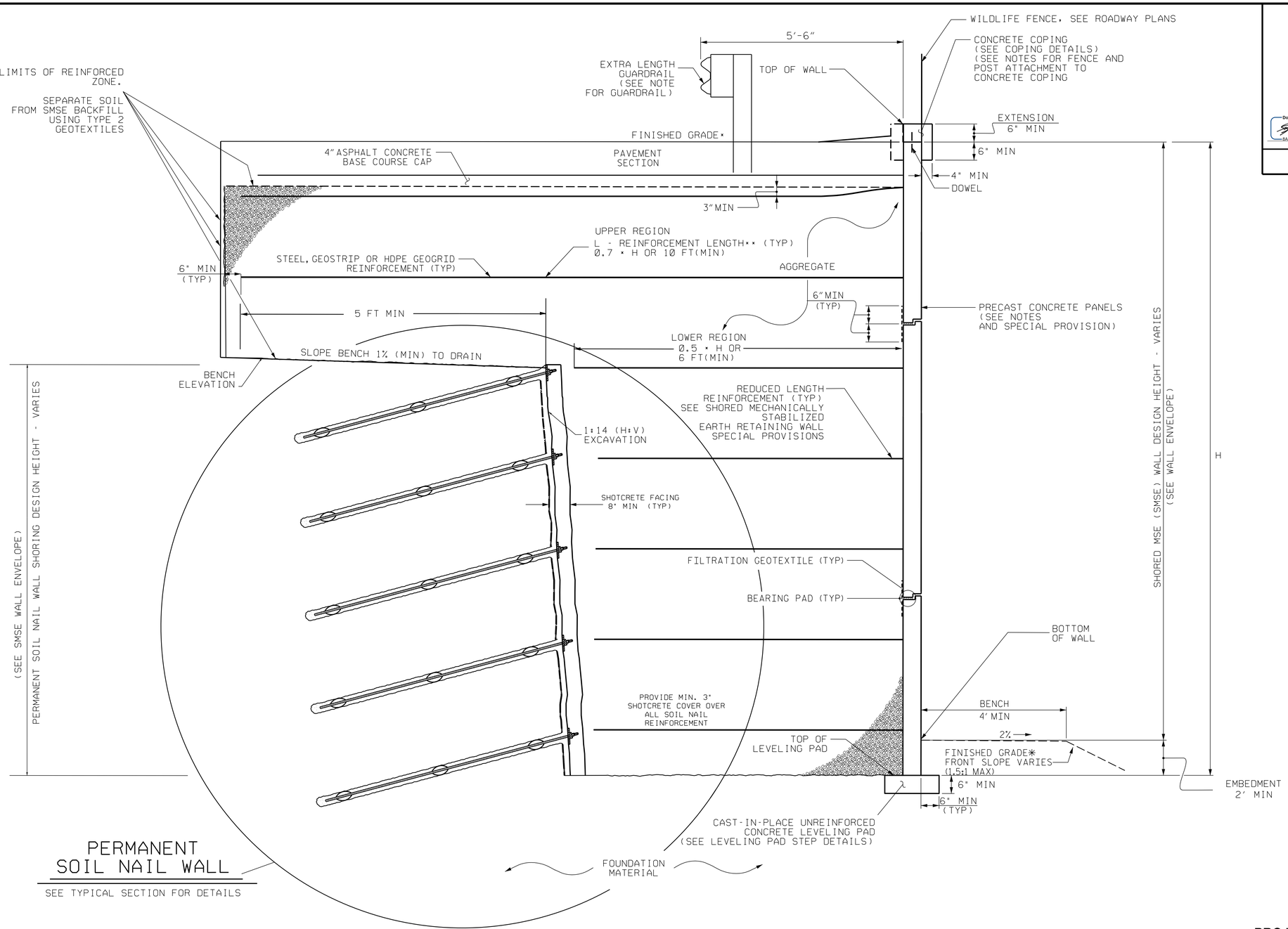

PERMANENT SOIL NAIL WALL

SEE TYPICAL SECTION FOR DETAILS

SMSE WALL WITH SOIL NAIL WALL> ⅔ H

-L- STATION 396+75 TO 398+75

*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

**SEE SMSE RETAINING WALLS SPECIAL PROVISION REINFORCEMENT LENGTH REQUIREMENTS.

PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 3 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP

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SUITE 800
CHARLOTTE, NC 28227
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #29A SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS

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

SHEET NO. W29A-3

NOTES:

FOR SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL RETAINING WALLS, SEE SHORED MECHANICALLY STABILIZED EARTH RETAINING WALLS SPECIAL PROVISION.

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.

FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.

USE AN SMSE WALL SYSTEM WITH PRECAST PANELS FOR THIS RETAINING WALL.

DO NOT USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL •29A.

A SMOOTH ARCHITECTURAL FINISH IS REQUIRED FOR PRECAST CONCRETE PANELS FOR RETAINING WALL •29A.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL •29A.

BEFORE BEGINNING SMSE WALL DESIGN FOR RETAINING WALL •29A, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN RETAINING WALL •29A FOR WALL HEIGHTS EQUAL TO THE DESIGN HEIGHT (DIFFERENCE BETWEEN FINISHED GRADE/TOP OF WALL ELEVATION AND BOTTOM OF WALL ELEVATION) PLUS EMBEDMENT (DIFFERENCE BETWEEN BOTTOM OF WALL ELEVATION AND TOP OF LEVELING PAD ELEVATION).

DESIGN RETAINING WALL •29A FOR THE FOLLOWING:
1) H = DESIGN HEIGHT + EMBEDMENT
2) DESIGN LIFE - 75 YEARS
3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 2,400 PSF
4) MINIMUM MSE REINFORCEMENT LENGTH (L) = VARIES, SEE TABLE ON SHEET W29A-2
5) MINIMUM SOIL NAIL REINFORCEMENT LENGTHS ARE BASED ON SNAIL.
6) MINIMUM EMBEDMENT DEPTH = 5 FT (MIN), SEE TABLE ON SHEET W29A-2
7) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (C) PSF
COARSE	110	38	Ø
FINE	115	34	Ø
* SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.			

9) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (C) PSF
BACKFILL	120	32	0
FOUNDATION	120	32	0

DESIGN RETAINING WALL •29A FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH MSE AND SOIL NAIL REINFORCEMENT FOR RETAINING WALL •29A.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR MSE WALL PORTION OF RETAINING WALL •29A UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

FOR WILDLIFE FENCES ON THE TOP OF THE RETAINING WALL, SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

FOR SOIL NAIL RETAINING WALLS, SEE SMSE RETAINING WALL SPECIAL PROVISION.

THE SMSE WALL DESIGNER SHALL CONSULT WITH THE SOIL NAIL WALL DESIGNER TO VERIFY LOCATIONS WHERE "TEMPORARY SHORING" MAY BE REQUIRED FOR THE RETAINING WALL IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE TRAFFIC CONTROL PLANS. IN LOCATIONS WHERE "PERMANENT SOIL NAIL WALL" IS USED, PAYMENT WILL NOT BE MADE FOR "TEMPORARY SHORING" FOR TRAFFIC CONTROL.

THE PERMANENT SOIL NAIL WALL HEIGHT IS AN ESTIMATE ONLY, THAT IS BASED ON THE ANTICIPATED EXCAVATION PLUS THE MINIMUM EMBEDMENT LISTED.

WHERE APPLICABLE, DESIGN SOIL NAIL WALL REINFORCEMENT INCLINATION TO ACCOUNT FOR EXISTING OR FUTURE UTILITY CONFLICTS BEHIND THE SOIL NAIL WALL. VERIFY UTILITY LOCATION AND ELEVATION BEFORE BEGINNING SOIL NAIL WALL DESIGN OR CONSTRUCTION.

"TOP OF SOIL NAIL WALL" AS SHOWN IN THE WALL ENVELOPE REPRESENTS THE APPROXIMATE GRADE ELEVATION AT A DISTANCE OF Ø.5 TIMES THE PROPOSED WALL HEIGHT ("H") AT THAT STATION OR ELEVATION AT THE TOP OF THE EXISTING WALL.

THE ESTIMATED SOIL NAIL WALL QUANTITY IS BASED ON Ø.5 TIMES "H" (SMSE DESIGN HEIGHT) INCLUDING THE MINIMUM EMBEDMENT LISTED IN THE DESIGN TABLE ON SHEET W29A-2. THESE VALUES ARE PROVIDED AS AN ESTIMATE ONLY AND MAY VARY DUE TO SITE CONDITIONS.

THE SOIL NAIL WALL DESIGNER IS RESPONSIBLE FOR DETERMINING GLOBAL STABILTIY BASED ON THE FINISHED SMSE WALL. A MINIMUM FACTOR OF SAFETY OF 1.35 IS REQUIRED FOR GLOBAL STABILITY. SUBMIT THESE RESULTS WITH THE WALL DESIGN PACKAGE. VERIFY UTILITY LOCATIONS AND ELEVATIONS BEFORE BEGINNING MSE WALL DESIGN OR CONSTRUCTION.

CONTRACTOR SHALL BE MADE AWARE THAT GRAVELLY SOILS AND BOULDER FILL WERE USED IN THE EXISTING ROADWAY EMBANKMENT AND MAY BE ENCOUNTERED DURING SOIL NAIL WALL CONSTRUCTION.

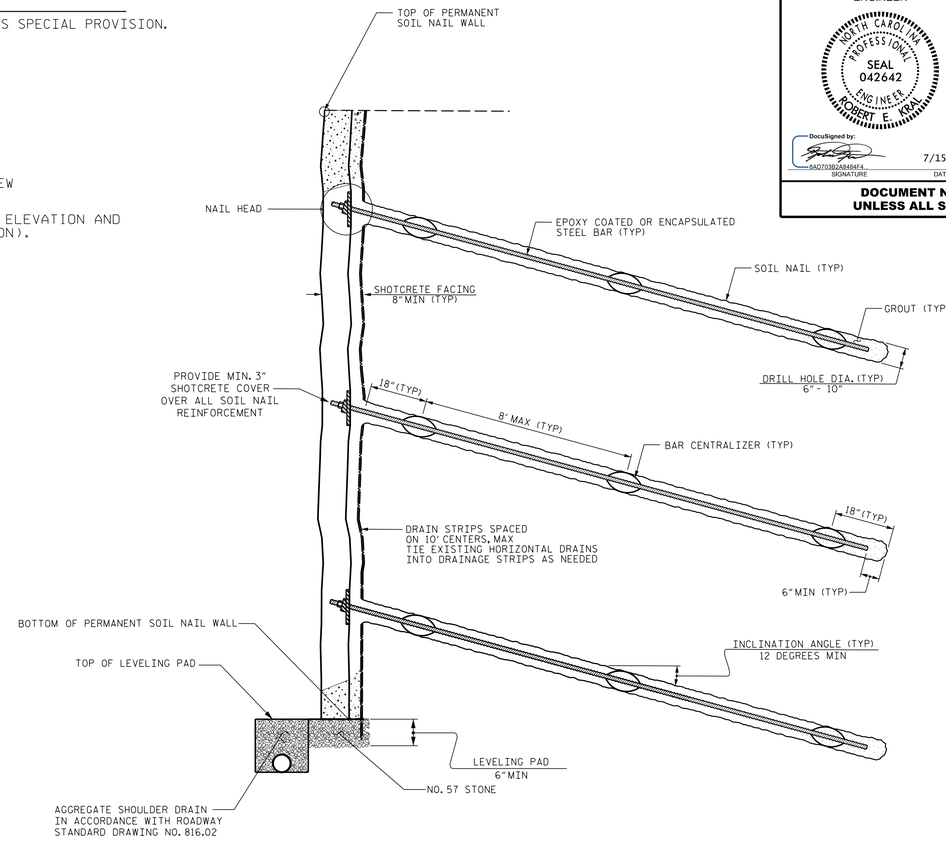
SPECIAL NOTES:

UNDERCUTTING COLLUVIAL SOILS BELOW THE SMSE WALL IS REQUIRED AS SHOWN ON SHEET W29A-5. USE UNDERCUT EXCAVATION TO REMOVE SOILS AS DIRECTED BY THE ENGINEER. PLACE GEOTEXTILE FOR SOIL STABILIZATION WHEN NEEDED IN THE BOTTOM OF THE EXCAVATION AND BACKFILL WITH SUITABLE EMBANKMENT MATERIAL. FOR UNDERCUT EXCAVATION SEE STANDARD SPECIFICATIONS. UNDERCUT EXCAVATION AND GEOTEXILE FOR SOIL STABILIZATION WILL BE PAID AS SEPARATE ADDITIONAL QUANTITIES.

EXTEND SOIL NAIL SHORING TO BOTTOM OF UNDERCUT EXCAVATION. DESIGN SOIL NAIL SHORING FOR THE HEIGHT EQUAL TO THE DIFFERENCE BETWEEN THE EXISTING ROADWAY GRADE AND THE BOTTOM OF THE UNDERCUT EXCAVATION. SOIL NAIL SHORING FOR UNDERCUT EXCAVATION WILL BE PAID IN ACCORDANCE WITH THE TEMPORARY SOIL NAIL SHORING FOR COLLUVIAL UNDERCUT SPECIAL PROVISION.

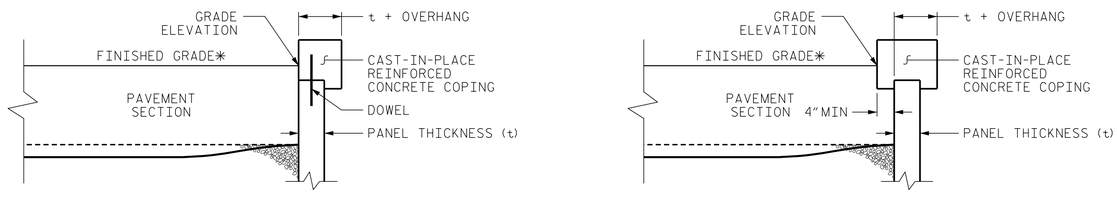
THE COLLUVIAL SOILS ARE SUITABLE FOR USE AS EMBANKMENT BUT WILL REQUIRE SIGNIFICANT DRYING TO ACHIEVE THE REQUIRED DENSITY. DO NOT USE COLLUVIAL SOILS IN THE UPPER 3 FEET OF EMBANKMENT DUE TO THE PRESENCE OF BOULDERS AND COBBLES. NO ADDITIONAL COMPENSATION WILL BE PROVIDED TO DRY COLLUVIAL SOILS OR FOR DOUBLE-HANDLING SOILS.

CONTROL GROUNDWATER DURING AND AT THE BOTTOM OF UNDERCUT EXCAVATION USING DITCHING, SUMPS, AND PERMANENT SHOULDER DRAINS AS DIRECTED BY THE ENGINEER. OUTLET SHOULDER DRAINS EVERY 50 TO 100 FEET AS DIRECTED BY THE ENGINEER.



SOIL NAIL WALL - TYPICAL SECTION

NOT TO SCALE



COPING DETAILS

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.
*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 8AD703B2A846F4... SIGNATURE 7/15/2022 DATE

ENGINEER SIGNATURE DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 4 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
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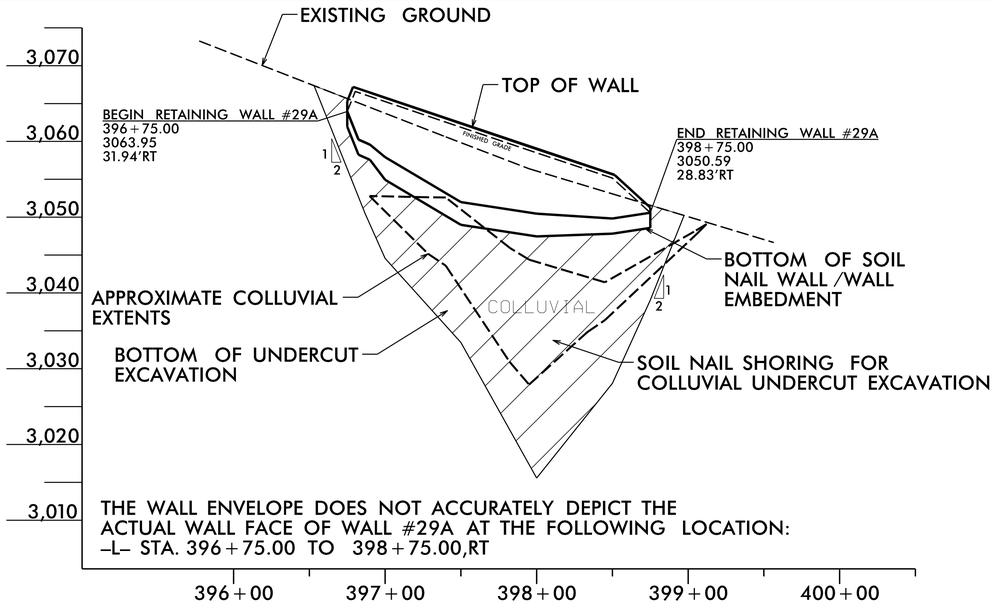
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

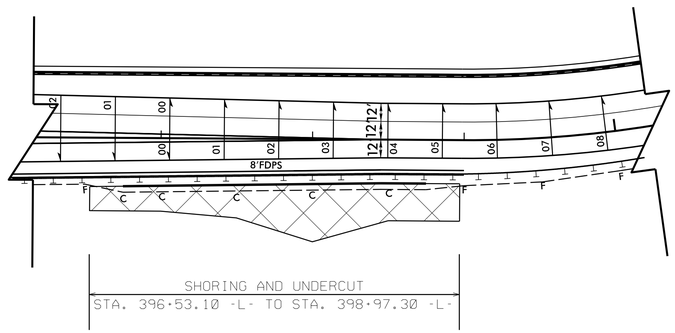
RETAINING WALL #29A SHORED MECHANICALLY STABILIZED EARTH (SMSE) WALL

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W29A-4
2			4			



APPROXIMATE ENVELOPE - SHORING FOR UNDERCUT

NOT TO SCALE
(LOOKING AT WALL FACE)



SHORING AND UNDERCUT LIMITS SKETCH

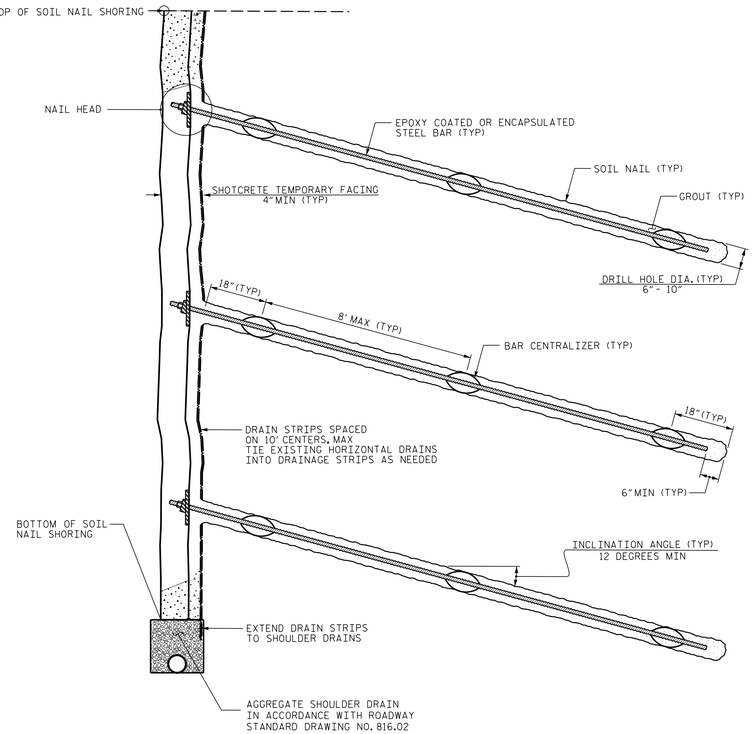
SCALE: 50' = 1"

ESTIMATED SOIL NAIL SHORING QUANTITIES

RETAINING WALL #	SOIL NAIL SHORING (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
29A	3,930	3	10

ESTIMATED QUANTITIES

UNDERCUT EXCAVATION	3,850 CY
GEOTEXTILE FOR SOIL STABILIZATION	800 SY
SELECT GRANULAR MATERIAL	800 CY
SHOULDER DRAIN	500 LF
CONCRETE PAD FOR SHOULDER DRAIN PIPE OUTLET	3 EA



SOIL NAIL SHORING - TYPICAL SECTION

NOT TO SCALE

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 8AD703B2A846F4...

7/15/2022

SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 5 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

RETAINING WALL #29A SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

REVISIONS

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

SHEET NO. W29A-5

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

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7/15/2022

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ENGINEER

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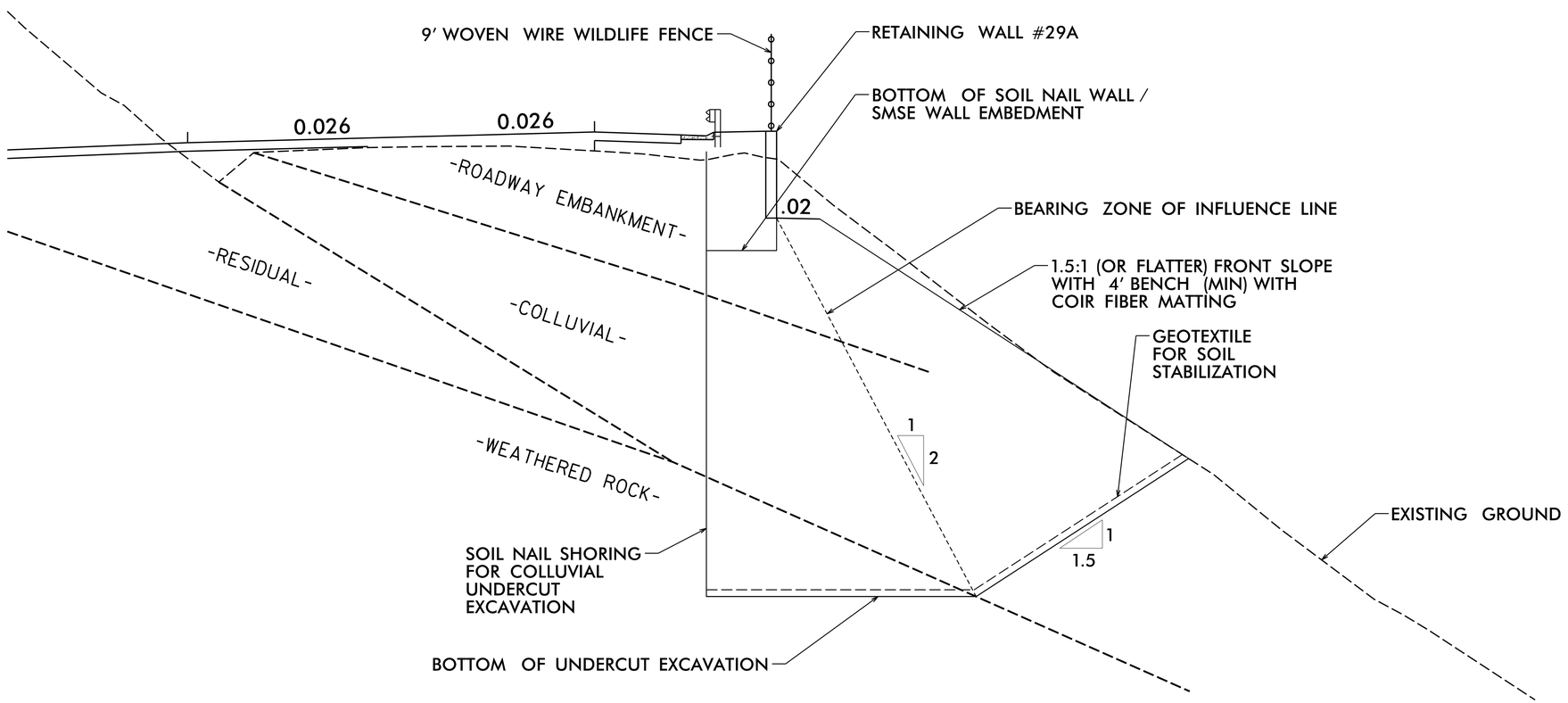


UNDERCUT EXCAVATION - TYPICAL SECTION - RETAINING WALL #29A

NOT TO SCALE

STA. 396+53.10 -L- TO STA. 398+97.30 -L-

PROJECT NO.: A-0009CB

GRAHAM COUNTY

STATION: -L-396+75, 32' RT TO 398+75, 29' RT

SHEET 6 OF 6

PREPARED BY: DMB	DATE: 7/14/2022
REVIEWED BY: REK	DATE: 7/14/2022

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP

2400 CROWNPOINT EXECUTIVE DRIVE
SUITE 800
CHARLOTTE, NC 28227
(980) 339-8684

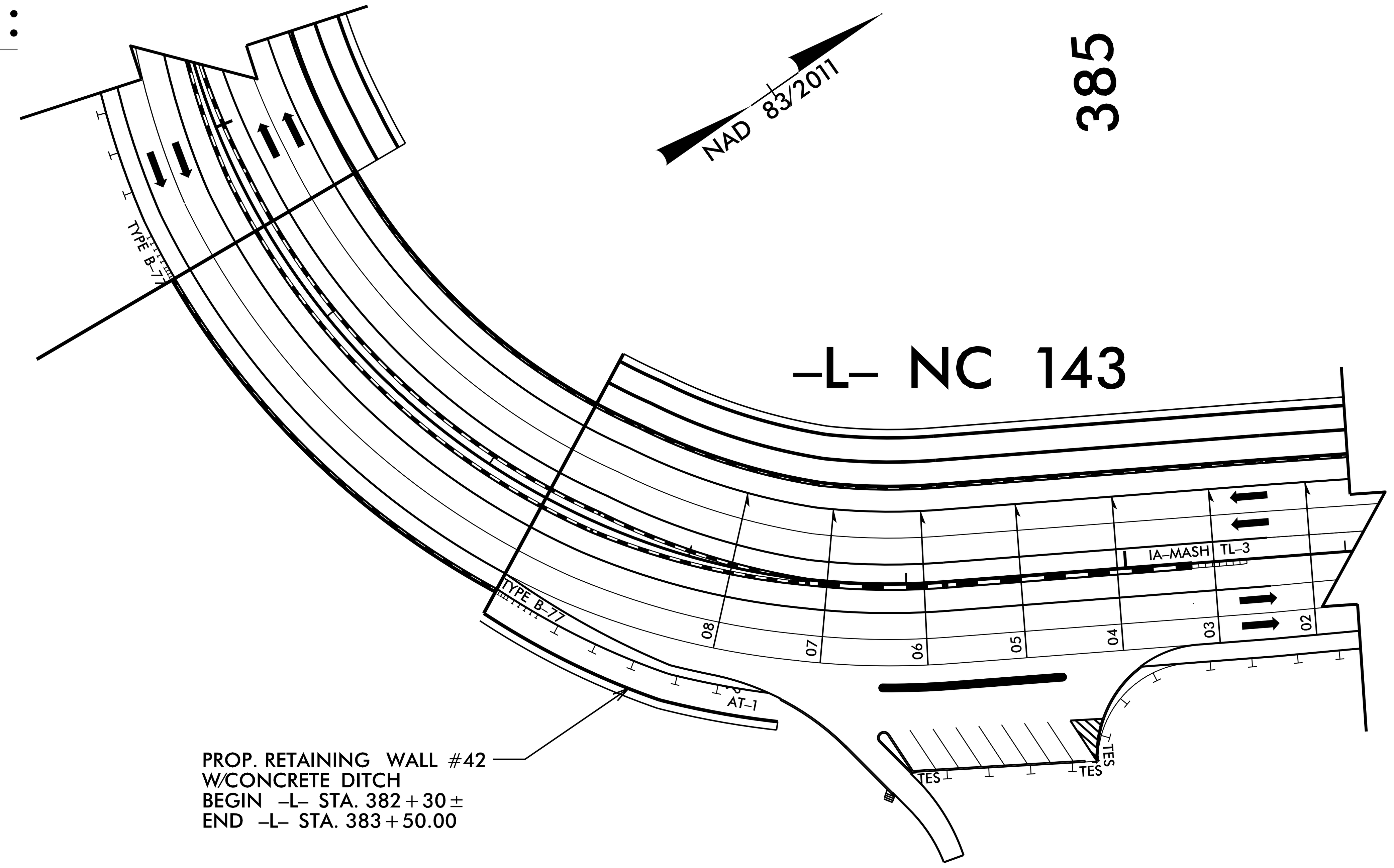
RETAINING WALL #29A SOIL NAIL SHORING FOR UNDERCUT EXCAVATION

REVISIONS

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

SHEET NO. W29A-6

RETAINING WALL #42:



RETAINING WALL #42 – PLAN

NOT TO SCALE

GEOTECHNICAL ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL
DocuSigned by:
7/14/2022
SIGNATURE DATE
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SIGNATURE DATE

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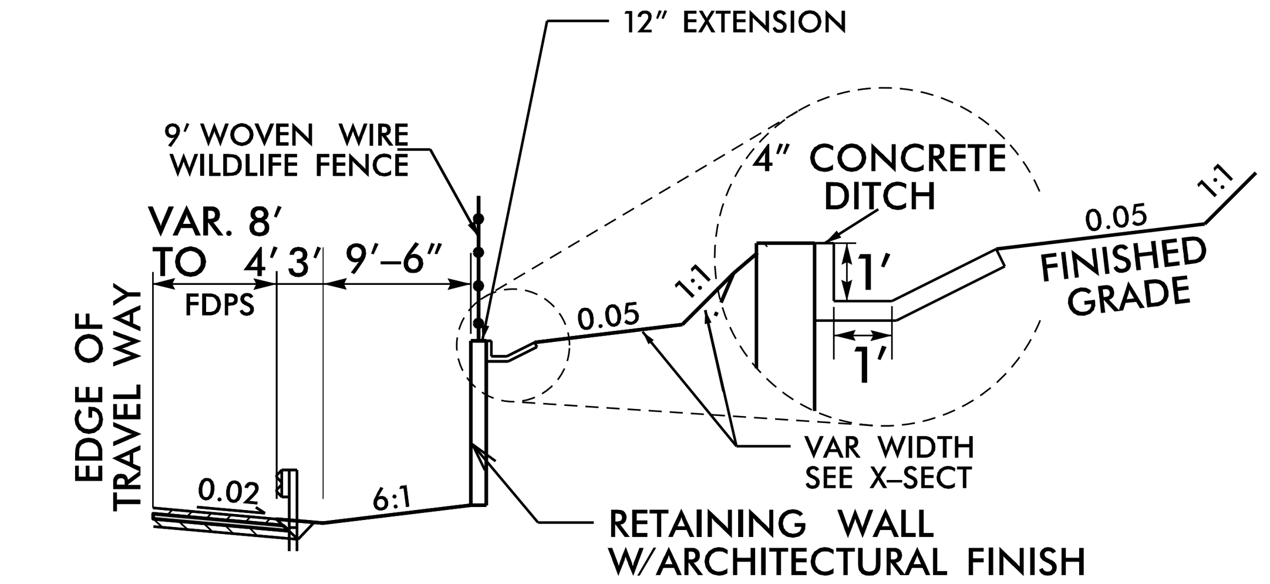


DETAIL FOR WALL #42

NOT TO SCALE
-L- STA. 382+30± TO -L- STA. 383+50.00, RT

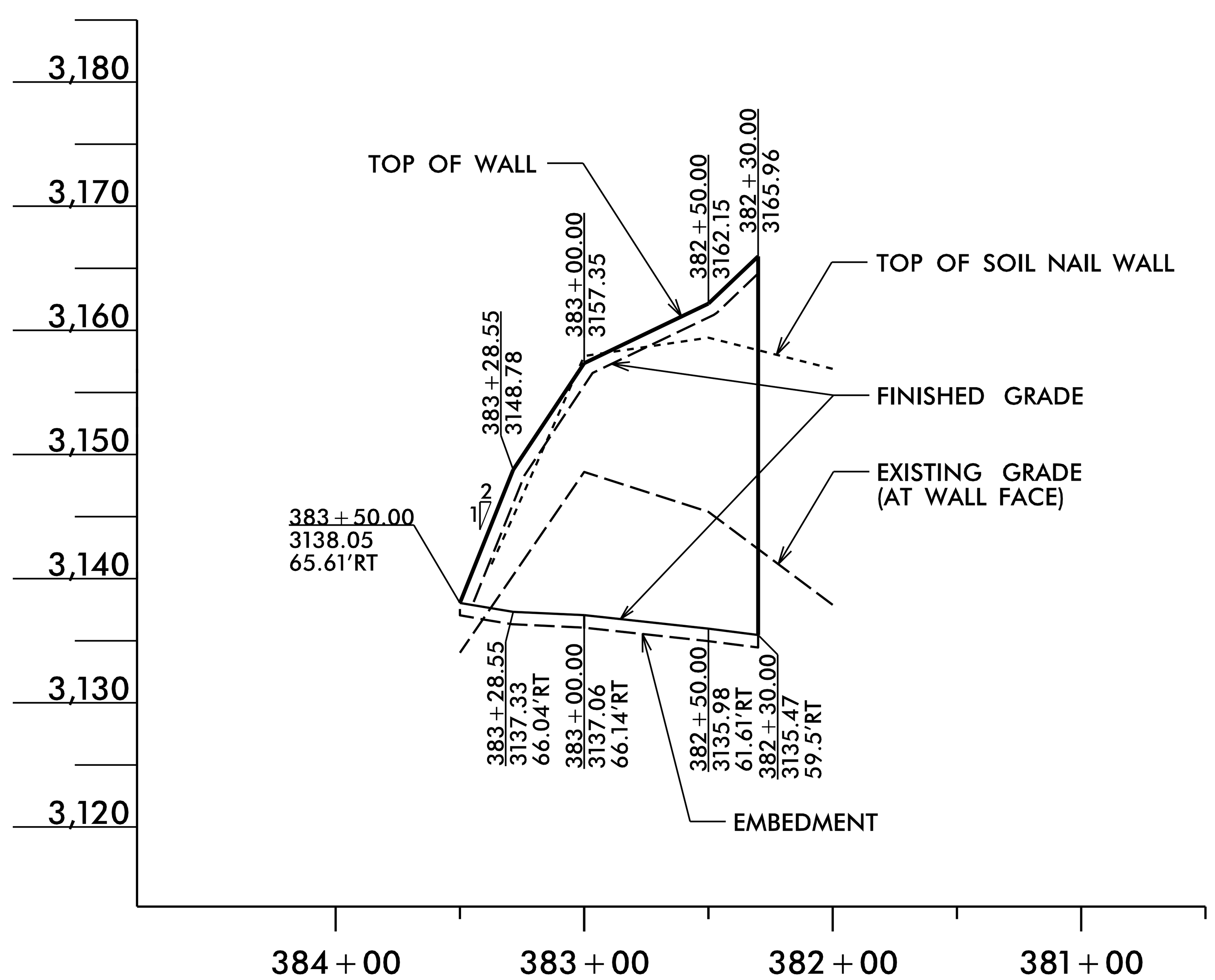
ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQUARE FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
42	2,430*	2	5
SIMULATED STONE FORM LINER SYSTEM AND SURFACE FINISH			2,310 SF
HORIZONTAL DRAINS (CONTINGENCY)			60 LF

* INCLUDES RETAINING WALL EMBEDMENT

RETAINING WALL #42					
STA. -L-	OFFSET FROM -L- (RT) FT.	ELEV. @ TOP OF WALL FT.	* PROPOSED FINISHED GRADE FT.	* EXPOSED WALL HEIGHT FT.	** DESIGN WALL HEIGHT "H" FT.
382+30.00	59.50	3165.96	3135.47	30.49	30.49
382+50.00	61.61	3162.15	3135.98	26.17	26.17
383+00.00	66.14	3157.35	3137.06	20.29	20.29
383+28.55	66.04	3148.78	3137.33	11.45	11.45
383+50.00	65.61	3138.05	3138.05	0.00	1.00

* ELEVATION @ PROPOSED FINISHED GRADE AND EXPOSED WALL HEIGHT DO NOT INCLUDE EMBEDMENT DEPTH

** FOR DESIGN WALL HEIGHT "H" AND ADDITIONAL CONSTRUCTION DETAILS SEE SHEET W42-2



RETAINING WALL #42 – ENVELOPE

NOT TO SCALE
(LOOKING AT FACE OF WALL)

PREPARED BY: R. KRAL	DATE: 7/14/2022
REVIEWED BY: M. BREWER	DATE: 7/14/2022

RETAINING WALL #42 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

PROJECT NO.: A-0009CB
GRAHAM COUNTY
RETAINING WALL #42: -L- 382+30, 59.5' RT TO 383+50, 65.6' RT
SHEET 1 OF 3

Prepared in the Office of:

CAROLINAS GEOTECHNICAL GROUP
2400 CROWNPOINT EXECUTIVE DRIVE
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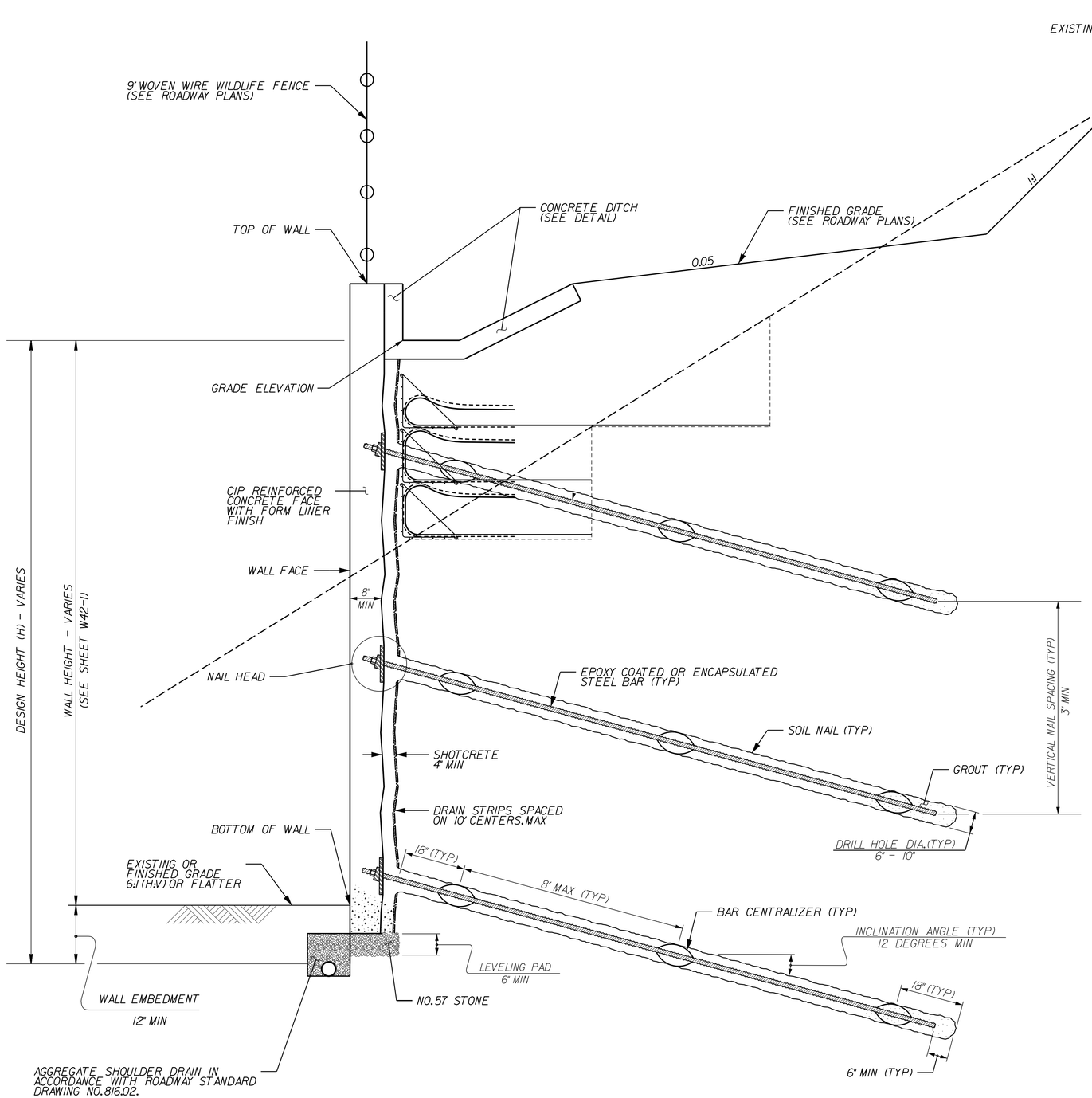
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #42
SOIL NAIL RETAINING WALL WITH CAST-IN-PLACE CONCRETE FACE

REVISIONS							
NO.	BY	DATE	NO.	BY	DATE	SHEET NO.
1			3			W42-1
2			4			



TYPICAL SECTION

NOT TO SCALE

STATION –L– 382+30.00 TO 383+50.00

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 8AD703B2A3E8474... SIGNATURE 7/14/2022 DATE

ENGINEER

SIGNATURE DATE

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NOTES:

FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.

A FENCE IS REQUIRED ON TOP OF RETAINING WALL #42. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.

A FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR THE CIP REINFORCED CONCRETE FACE FOR RETAINING WALL #42. THE CONTRACTOR SHALL PROVIDE THE REQUESTED FINISH BEFORE BEGINNING CIP REINFORCED CONCRETE FACE CONSTRUCTION. THE APPEARANCE (STONE SIZE AND SHAPE, STONE COLOR, AND STONE TEXTURE, PATTERN, AND RELIEF) SHOULD MATCH NATURAL STONE AND ROCK. FOR FORM LINER ARCHITECTURAL FINISH, SEE THE SIMULATED STONE FORM LINER FINISH SPECIAL PROVISION.

BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #42, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN THIS RETAINING WALL FOR WALL HEIGHTS EQUAL TO THE DESIGN HEIGHT (DIFFERENCE BETWEEN GRADE ELEVATION AND BOTTOM OF WALL ELEVATION) PLUS EMBEDMENT (DIFFERENCE BETWEEN BOTTOM OF WALL ELEVATION AND TOP OF LEVELING PAD ELEVATION).

DESIGN RETAINING WALL NO. #42 FOR THE FOLLOWING:
1) DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
2) DESIGN LIFE = 75 YEARS
3) MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW FINISHED GRADE)
4) IN-SITU ASSUMED BACKFILL SOIL PARAMETERS:
   UNIT WEIGHT, γ = 120 PCF
   FRICTION ANGLE, ϕ = 30 DEGREES
   COHESION, c = 0 PSF
5) IN-SITU ASSUMED DENSE/VERY STIFF RESIDUAL SOIL PARAMETERS:
   UNIT WEIGHT, γ = 125 PCF
   FRICTION ANGLE, ϕ = 36 DEGREES
   COHESION, c = 0 PSF
6) IN-SITU ASSUMED WEATHERED ROCK (META-SANDSTONE) PARAMETERS:
   UNIT WEIGHT, γ = 135 PCF
   FRICTION ANGLE, ϕ = 32 DEGREES
   COHESION, c = 500 PSF
7) IN-SITU ASSUMED CRYSTALLINE ROCK (META-SANDSTONE) PARAMETERS:
   UNIT WEIGHT, γ = 170 PCF
   FRICTION ANGLE, ϕ = 34 DEGREES
   COHESION, c = 1,000 PSF
8) WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.

WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR THE RETAINING WALL.

IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #42, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.

THE PROPOSED RIGHT OF WAY (ROW) AND PERMANENT EASEMENT (PE) BOUNDARY VARIES FROM THE FACE OF RETAINING WALL #42. SEE THE ROADWAY PLANS FOR OFFSET DISTANCES FROM THE FACE OF RETAINING WALL #42. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PE BOUNDARY.

WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.

GROUND MAY NOT EXIST ABOVE THE BOTTOM OF THE WALL IN SOME PORTIONS OF THE WALL ENVELOPE. USE CONVENTIONAL GRADING, TEMPORARY WALL, OR OTHER METHOD ACCEPTABLE TO THE ENGINEER TO CREATE GROUND ABOVE EXISTING GRADE IN ORDER TO CONSTRUCT THE SOIL NAIL WALL. THE CONTRACT UNIT PRICE FOR SOIL NAIL RETAINING WALLS WILL BE FULL COMPENSATION FOR THIS WORK, IF REQUIRED.

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #42: -L- 382+30, 59.5' RT TO 383+50, 65.6' RT

SHEET 2 OF 3

PREPARED BY: R. KRAL	DATE: 7/14/2022
REVIEWED BY: M. BREWER	DATE: 7/14/2022

Prepared in the Office of:

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #42 SOIL NAIL RETAINING WALL WITH CAST-IN-PLACE CONCRETE FACE

REVISIONS

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

SHEET NO. W42-2

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 042642 ENGINEER ROBERT E. KRAL

DocuSigned by: 7/14/2022
SIGNATURE DATE

ENGINEER

SIGNATURE DATE

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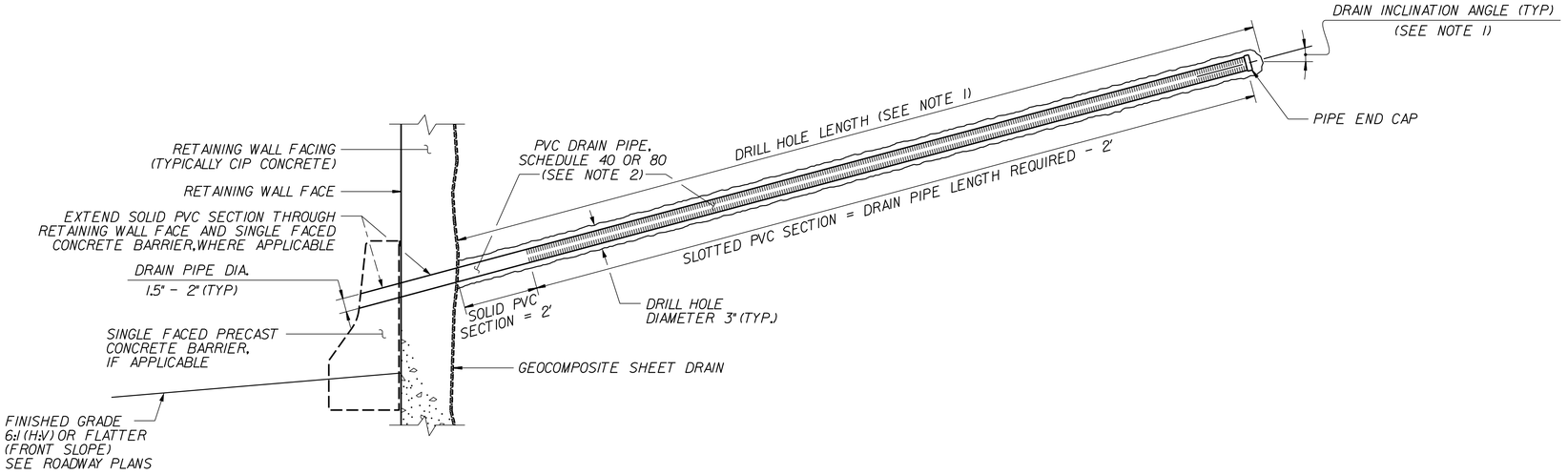
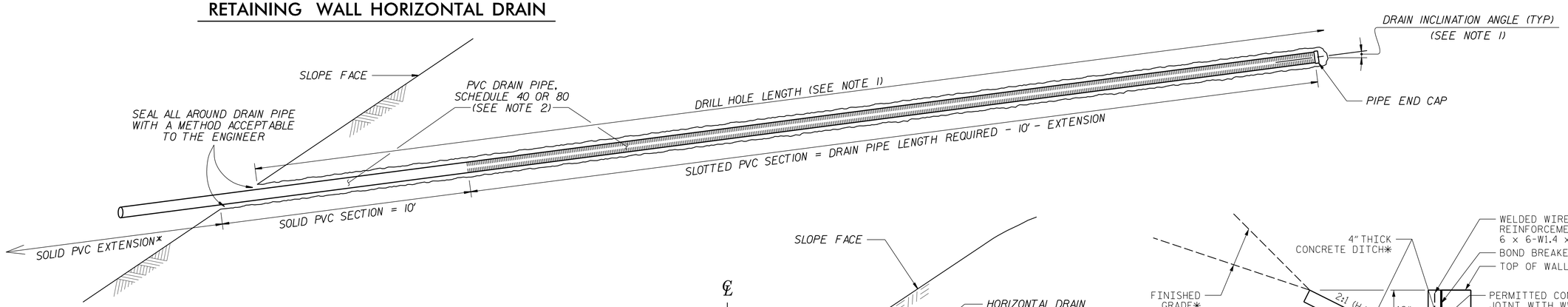
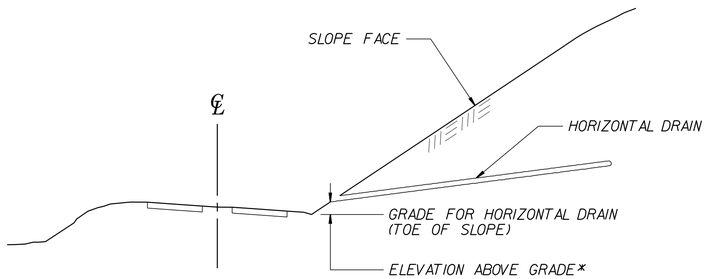


RETAINING WALL HORIZONTAL DRAIN



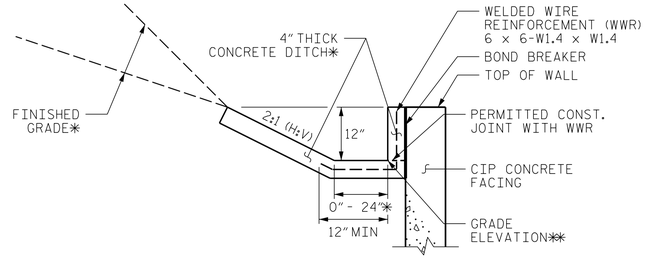
SLOPE HORIZONTAL DRAIN

*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED



EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN

*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE



CONCRETE DITCH BEHIND WALL WITH CONCRETE FACING

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

NOTES:

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-12).

PROJECT NO.: A-0009CB

GRAHAM COUNTY

RETAINING WALL #42: -L- 382+30, 59.5' RT TO 383+50, 65.6' RT

SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 7/14/2022
REVIEWED BY: M. BREWER	DATE: 7/14/2022

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

RETAINING WALL #42
SOIL NAIL RETAINING WALL WITH CAST-IN-PLACE CONCRETE FACE

REVISIONS

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

SHEET NO. W42-3