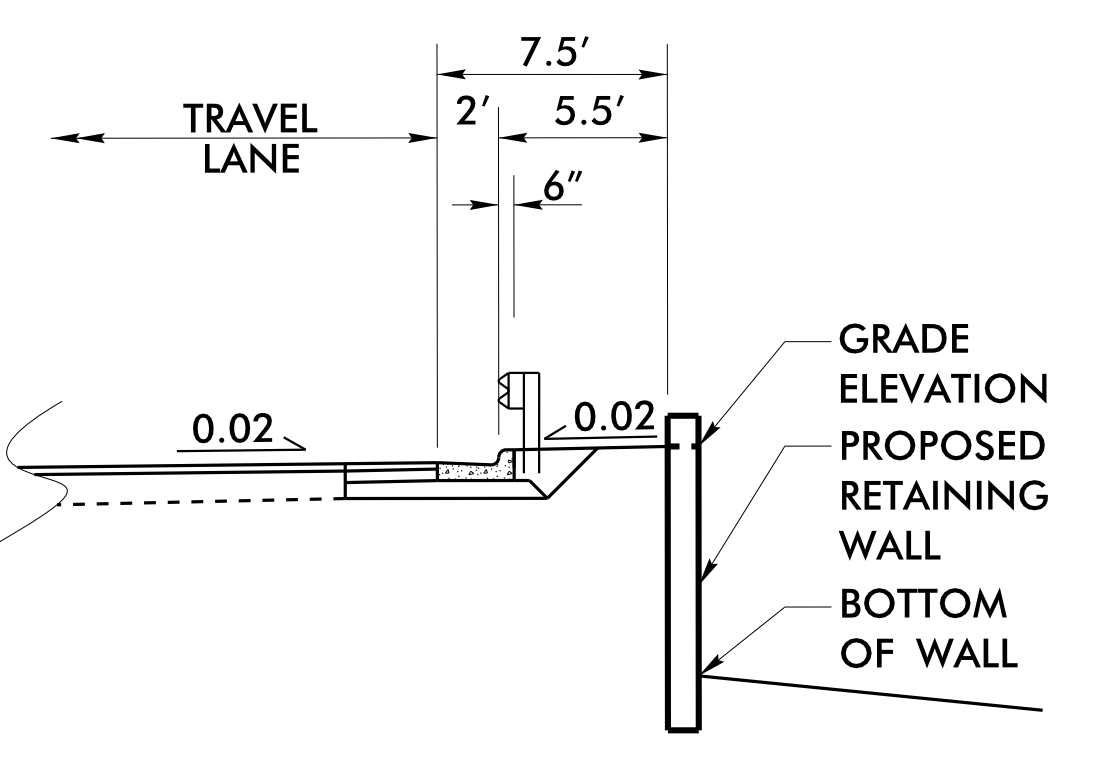
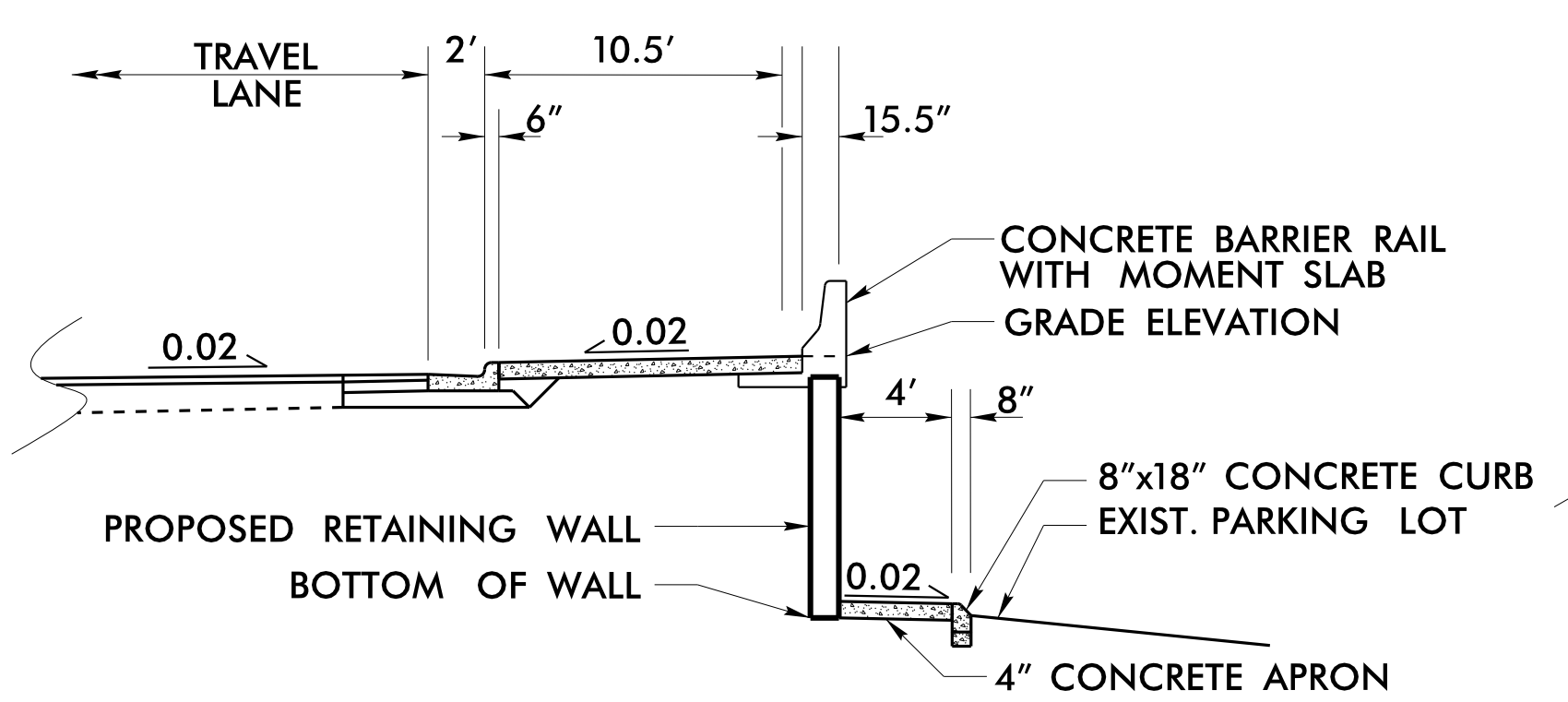
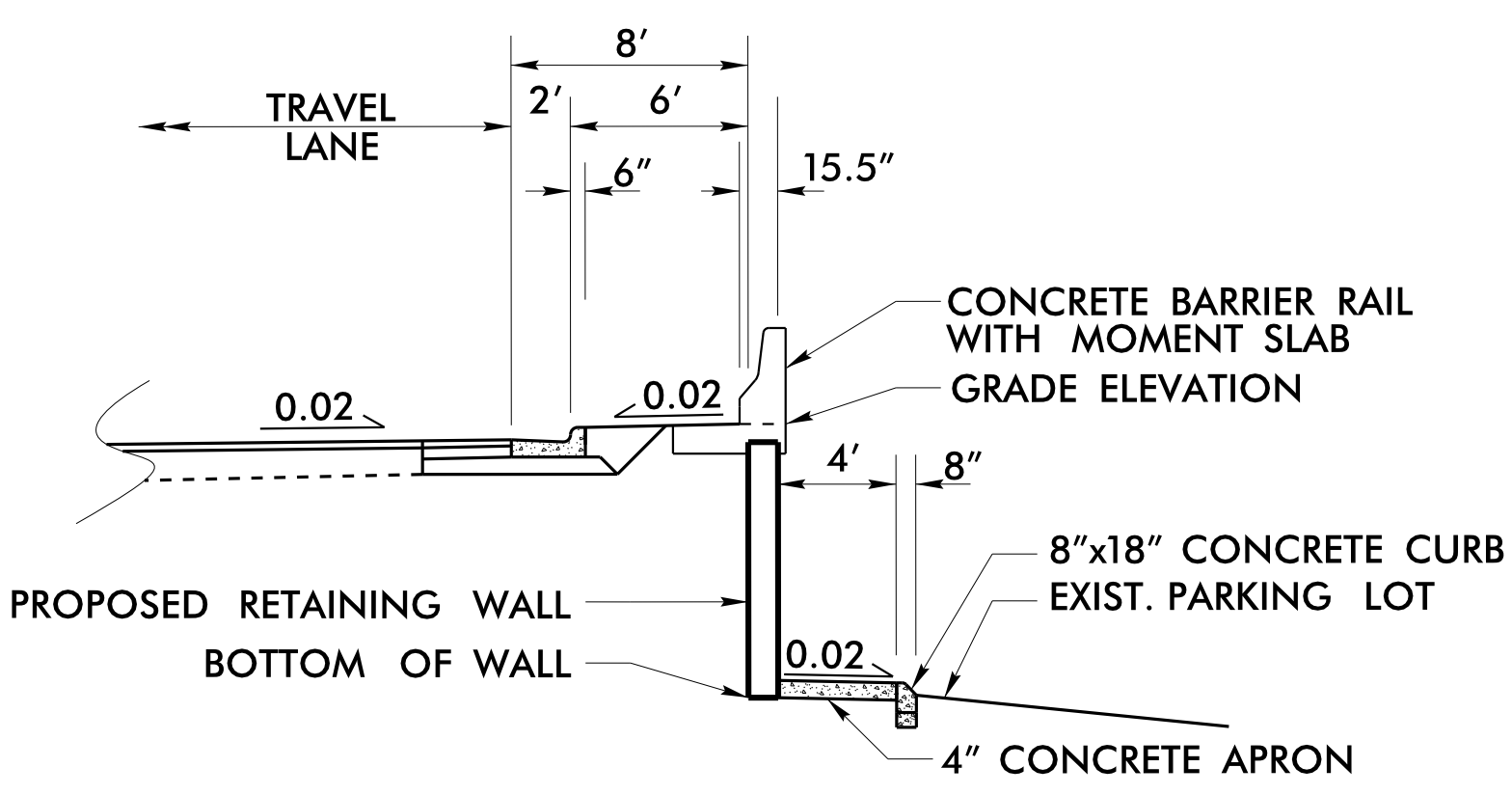
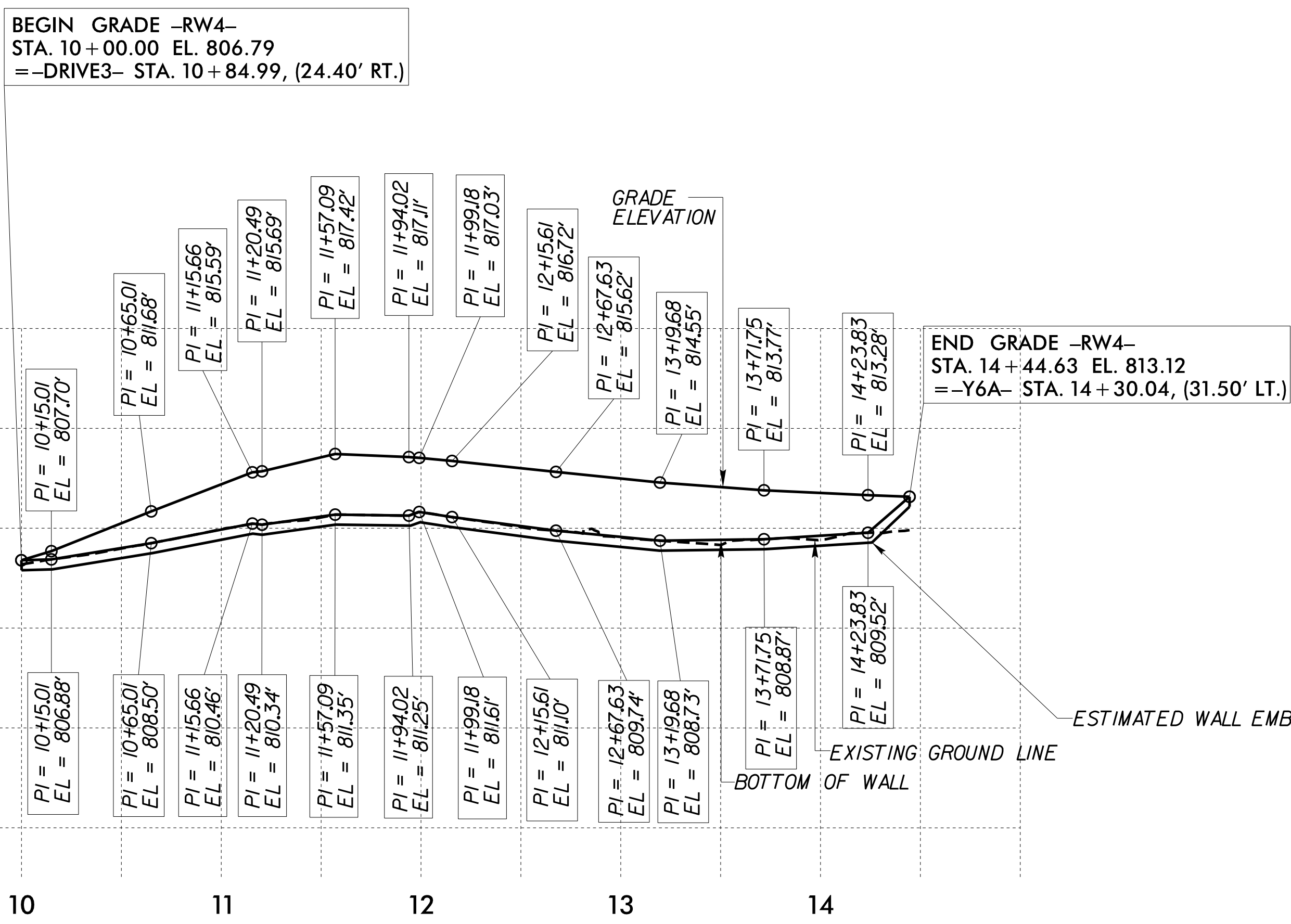
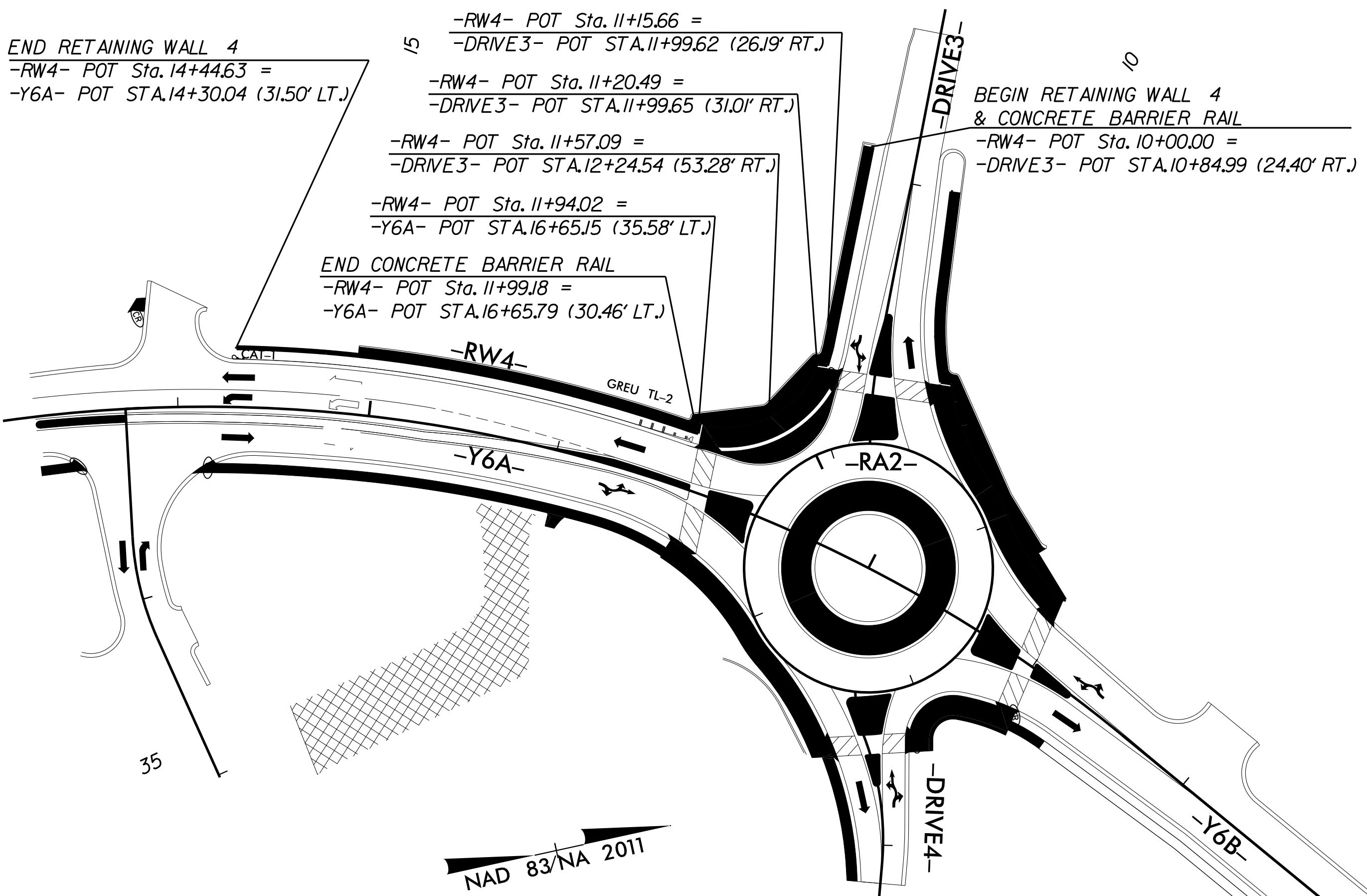




ESTIMATED MSE WALL QUANTITIES (SQUARE FEET)	
MSE RETAINING WALL NO. 4	2490 SF

PREPARED BY: DJP
REVIEWED BY: SCC

DATE: 8/21/2019
DATE: 10/1/2019

**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS**

**GEOTECHNICAL
ENGINEERING UNIT**

GEOTECHNICAL ENGINEER

ENGINEER

Seal: Michael H. Stephens, Professional Engineer, No. 028893, State of North Carolina, Exp. 10/8/2019

SIGNATURE: _____ DATE: _____

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

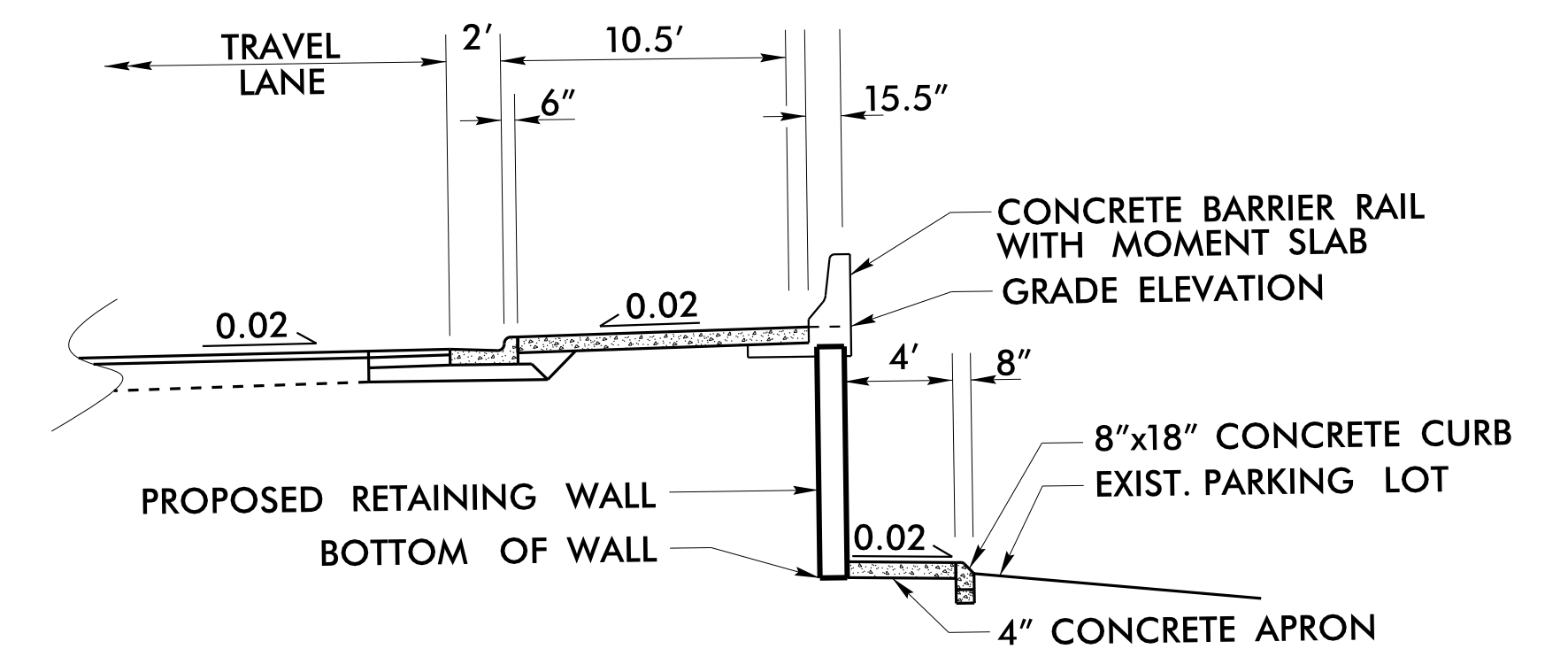
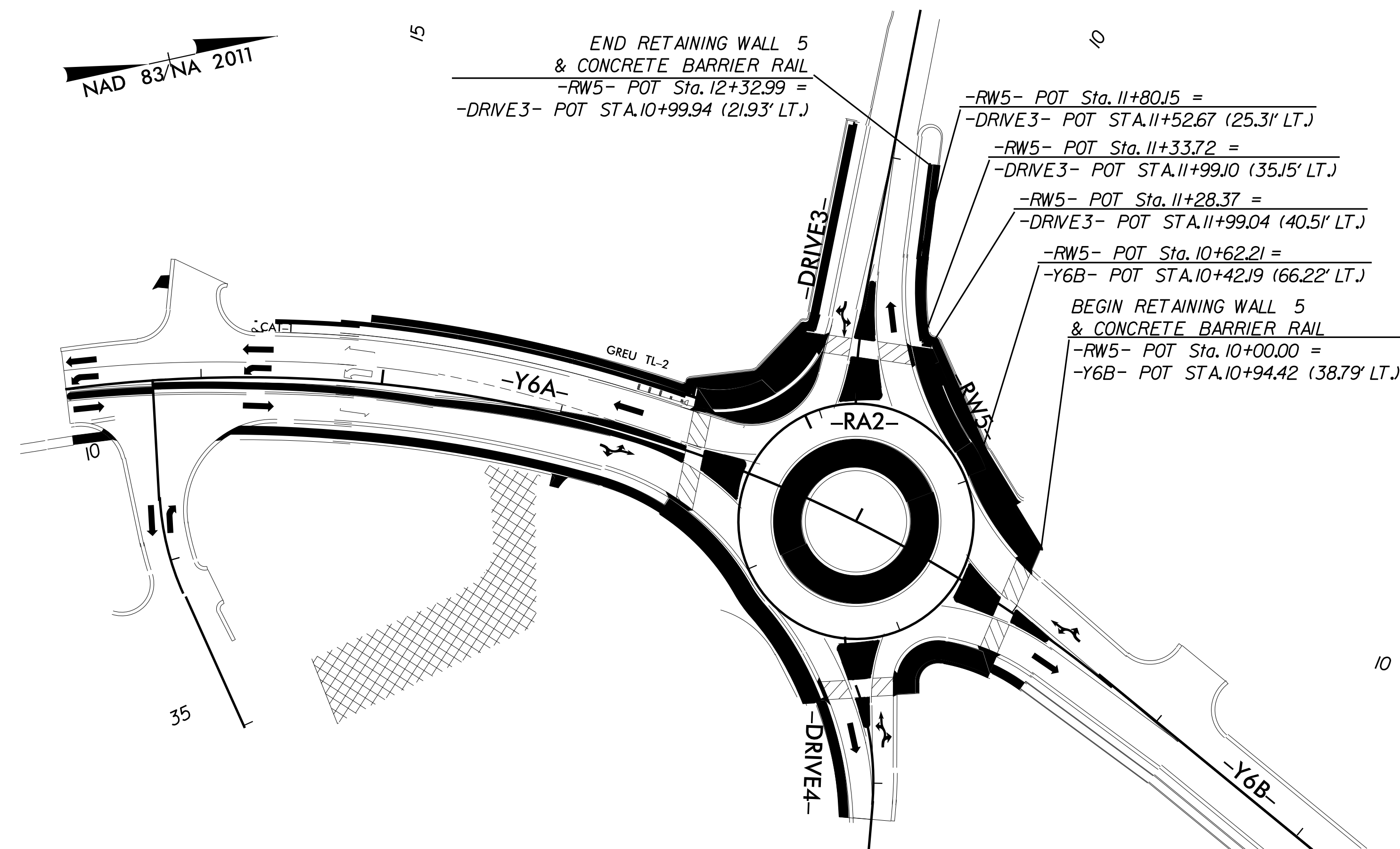
PROJECT NO.: 46451.1.1 (U-5906)

MECKLENBURG COUNTY

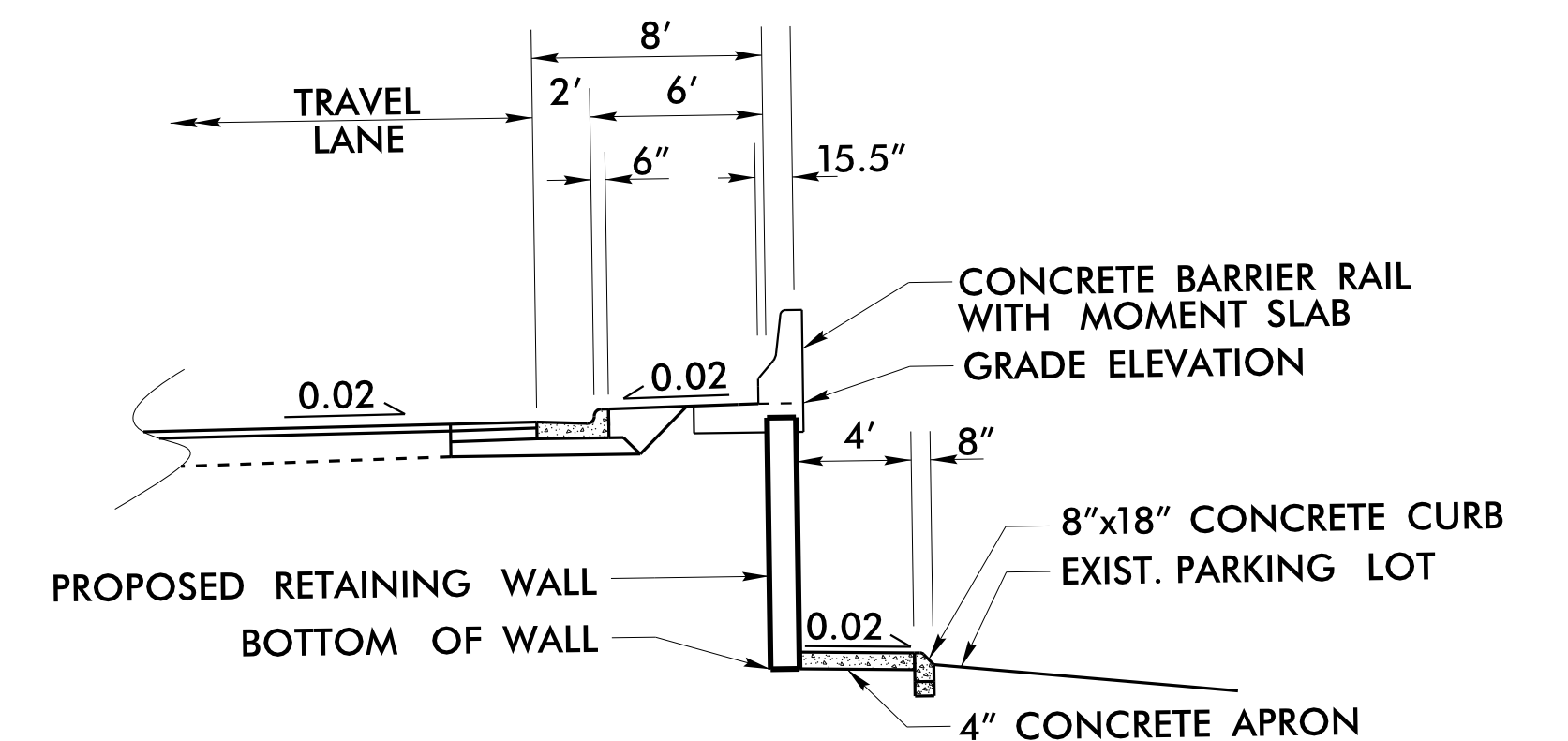
STATION: 10+84.99 -DRIVE3- TO 14+30.04 -Y6A-

SHEET 1 OF 5

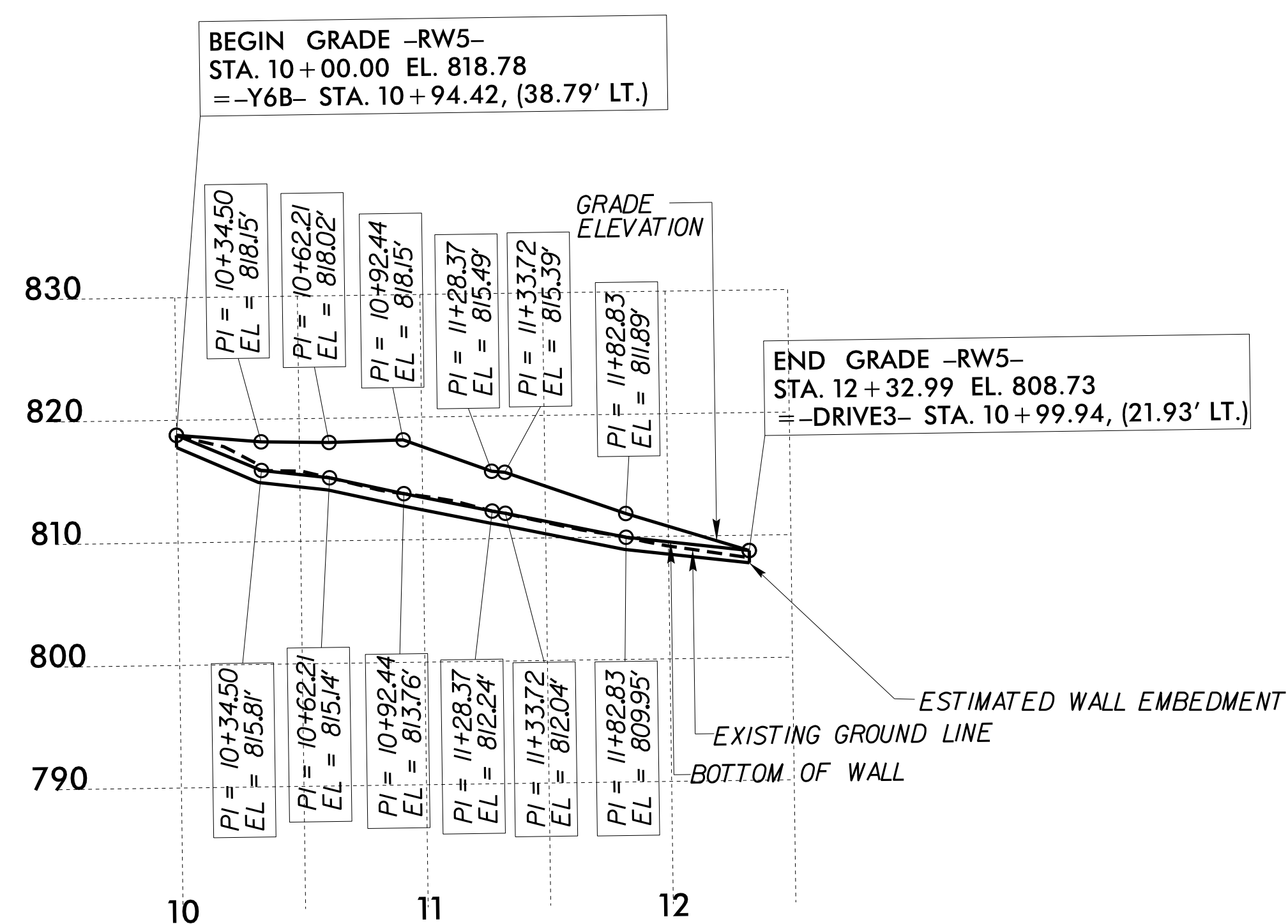
REVISIONS						SHEET NO. W1
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			



SECTION THROUGH RETAINING WALL
 -RW5- STA. 10+00.00 TO -RW5- STA. 11+28.37



SECTION THROUGH RETAINING WALL
 -RW5- STA. 11+28.37 TO -RW5- STA. 12+32.99



ESTIMATED MSE
WALL QUANTITIES
(SQUARE FEET)

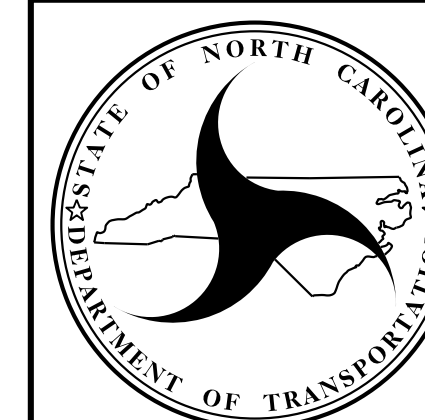
MSE RETAINING WALL NO.5	794 SF
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PROJECT NO.: 46451.1.1 (U-5906)

MECKLENBURG COUNTY

STATION: 10+94.42 -Y6B- TO 10+99.94 -DRIVE3-

SHEET 2 OF 5



**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS**

**GEOTECHNICAL
ENGINEERING UNIT**

RETAINING WALL NO. 5
MSE RETAINING WALL

REVISIONS						SHEET NO. W2
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

GEOTECHNICAL
ENGINEER

SEAL
028893
ENGINEER
MICHAEL H. STEPHENS

10/8/2019

SIGNATURE

DATE

ENGINEER

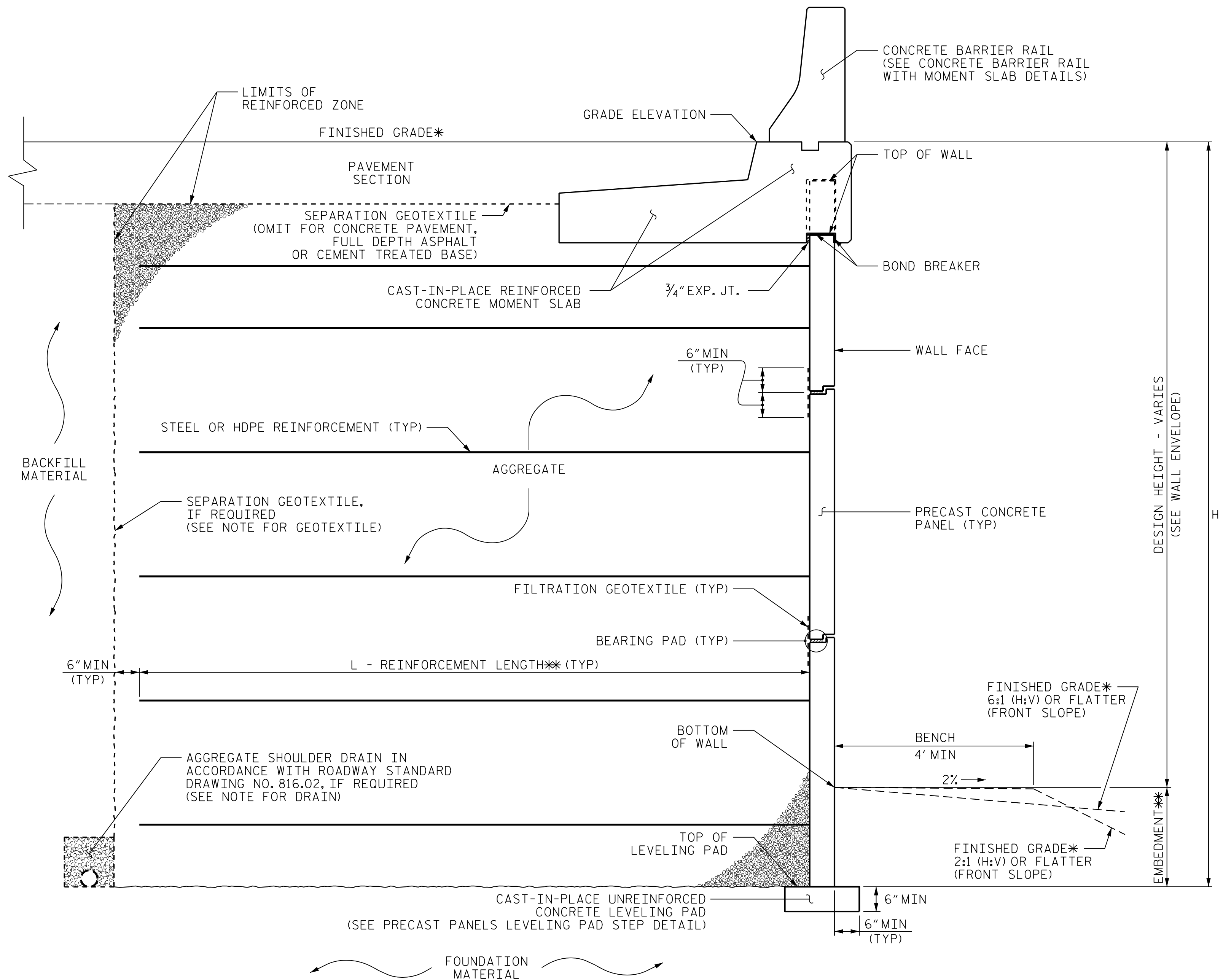
DESIGNED BY:
10/8/2019

10/8/2019

SIGNATURE

DATE

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED



MSE WALL WITH PRECAST PANELS - TYPICAL SECTION

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

PROJECT NO.: 46451.1.1 (U-5906)
MECKLENBURG COUNTY
STATION: RWALL4: 10+84.99 -DRIVE3- TO 14+30.04 -Y6A-
SHEET 4 OF 5 RWALL5: 10+94.42 -Y6B- TO 10+99.94 -DRIVE3-

PREPARED BY: DJP	DATE: 8/21/2019
REVIEWED BY: SCC	DATE: 10/1/2019

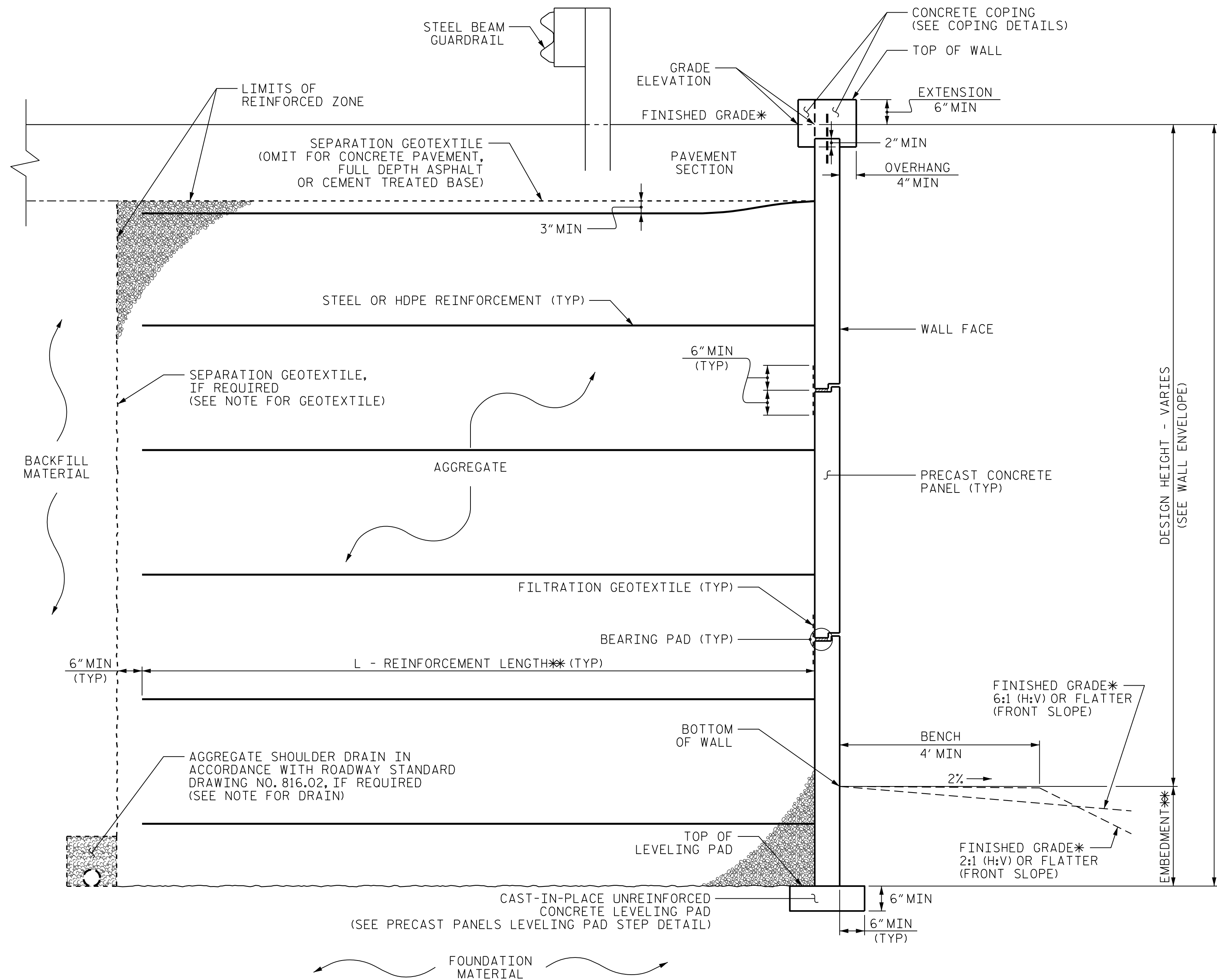


NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL
ENGINEERING UNIT

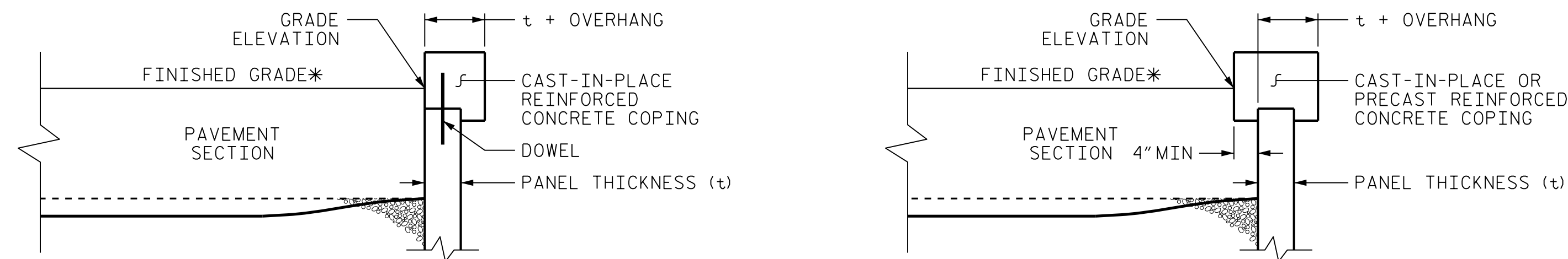
REVISIONS						SHEET NO. W3
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

RETAINING WALL NO. 4 AND 5
MSE RETAINING WALL



MSE WALL WITH PRECAST PANELS - TYPICAL SECTION

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



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

SEAL
028893
ENGINEER
MICHAEL H. STEPHENSON
08/2019

Designed by:
08/2019

SIGNATURE

DATE

ENGINEER

SIGNATURE

DATE

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

PROJECT NO.: 46451.1.1 (U-5906)
MECKLENBURG COUNTY
STATION: RWALL4: 10+84.99 -DRIVE3- TO 14+30.04 -Y6A-
SHEET 4 OF 5 RWALL5: 10+94.42 -Y6B- TO 10+99.94 -DRIVE3-

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL
ENGINEERING UNIT

REVISIONS						SHEET NO. W4
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

PREPARED BY: DJP	DATE: 8/21/2019
REVIEWED BY: SCC	DATE: 10/1/2019

GEOTECHNICAL
ENGINEER

SEAL
028893
ENGINEER

DESIGNED BY:
MICHAEL H. STEPHENSON
2002314CC...
8/8/2019

SIGNATUREDATE

ENGINEER

SIGNATUREDATE

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

NOTES:

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.

A CONCRETE BARRIER RAIL WITH MOMENT SLAB IS REQUIRED ABOVE RETAINING WALL NOS. 4 AND 5. SEE PLANS FOR CONCRETE BARRIER RAIL WITH MOMENT SLAB DETAILS.

AT THE CONTRACTOR'S OPTION, USE AN MSE WALL SYSTEM WITH SEGMENTAL RETAINING WALL (SRW) UNITS THAT MEET ARTICLE 1040-4 OF THE STANDARD SPECIFICATIONS FOR RETAINING WALL NOS. 4 AND 5.

AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL NOS. 4 AND 5.

CIP REINFORCED CONCRETE COPING IS REQUIRED FOR RETAINING WALL NO. 4 FROM STATION 11+94.02 -RW4- TO 14+44.63 -RW4-.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL NOS. 4 AND 5 IF COARSE AGGREGATE IS USED.

A DRAIN IS REQUIRED FOR RETAINING WALL NOS. 4 AND 5.

BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NOS. 4 AND 5, 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 NOS. 4 AND 5 FOR THE FOLLOWING:

1) H = DESIGN HEIGHT + EMBEDMENT

2) DESIGN LIFE = 100 YEARS

3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 2100 PSF

4) MINIMUM REINFORCEMENT LENGTH (L) = 0.8H OR 6 FT, WHICHEVER IS LONGER

5) MINIMUM EMBEDMENT ELEVATION = 1 FT

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:

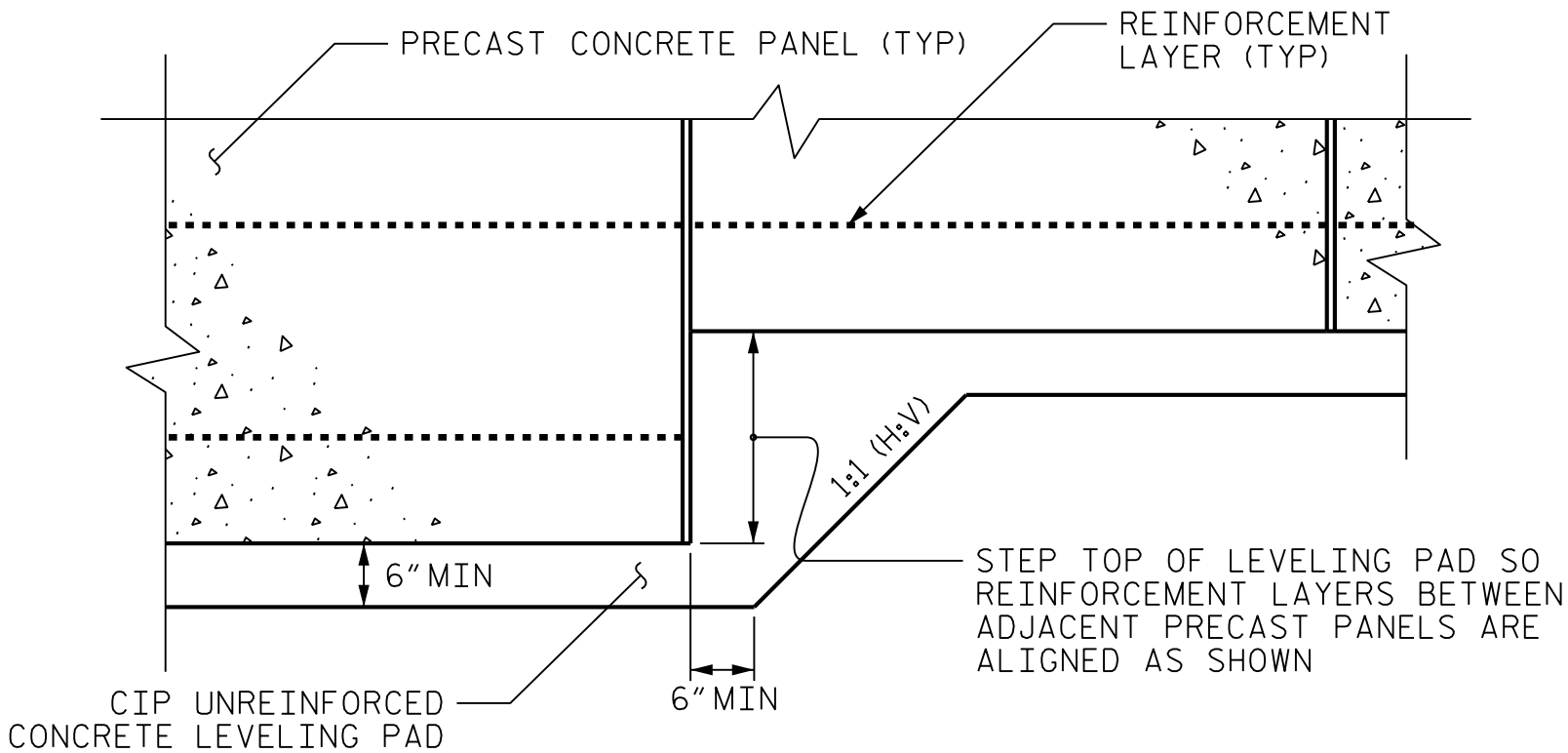
MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION	120	30	0

DESIGN RETAINING WALL NOS. 4 AND 5 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 REINFORCEMENT FOR RETAINING WALL NOS. 4 AND 5.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NOS. 4 AND 5 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

TEMPORARY SHORING MAY BE REQUIRED FOR RETAINING WALL NOS. 4 AND 5 IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE ROADWAY, STRUCTURE or TRAFFIC CONTROL PLANS.



PRECAST PANELS
LEVELING PAD STEP DETAIL

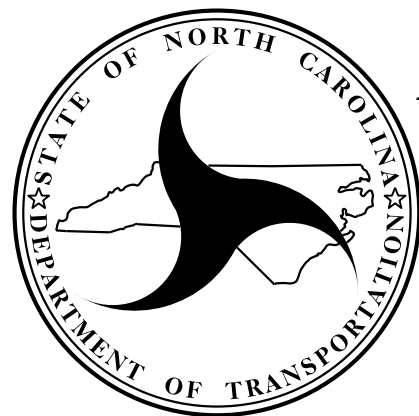
PROJECT NO.: 46451.1.1 (U-5906)

MECKLENBURG COUNTY

STATION: RWALL4: 10+84.99 -DRIVE3- TO 14+30.04 -Y6A-
RWALL5: 10+94.42 -Y6B- TO 10+99.94 -DRIVE3-

SHEET 3 OF 5

PREPARED BY: DJP	DATE: 8/21/2019
REVIEWED BY: SCC	DATE: 10/1/2019

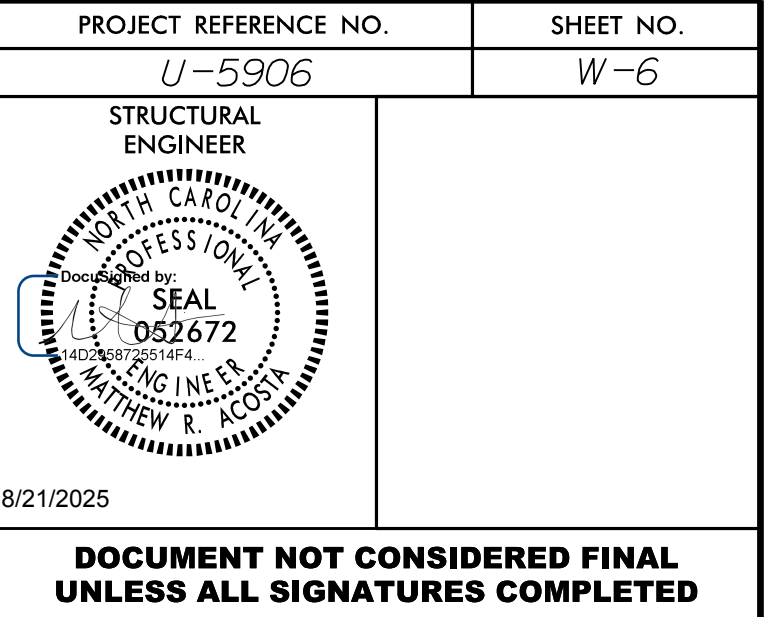


NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL
ENGINEERING UNIT

RETAINING WALL NOS. 4 AND 5
MSE RETAINING WALL

REVISIONS						SHEET NO. W5
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			



RS&H 1520 SOUTH BOULEVARD, SUITE 200
CHARLOTTE, NC 28203
NC FIRM LICENSE No: F-0493

IF EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, BARRIERS, PIPES, INLETS OR UTILITIES WILL INTERFERE WITH CONCRETE BARRIER RAIL WITH MOMENT SLAB OR CONCRETE FACING FOR RETAINING WALL WILL BE THICKER THAN 8" CONCRETE BARRIER RAIL WITH MOMENT SLAB DETAILS SHALL BE REVISED AND SUBMITTED FOR APPROVAL.

DETAIL ``B''

DETAIL ``C''

BAR TYPES

The image displays three types of reinforcement bars, each with specific dimensions and shapes:

- Bar Type 1:** A U-shaped bar with a total width of 8 inches. The top flange has a width of 2 3/4 inches and a height of 1 1/4 inches. The vertical leg has a height of 10 1/2 inches. The bottom flange has a width of 2 3/4 inches and a height of 1 1/4 inches. The top flange is bent up at a 45-degree angle, with a bend radius of 5 3/4 inches. The top flange has a width of 1' - 5 7/8 inches and a height of 1' - 1 3/4 inches. The bottom flange has a width of 2 3/4 inches and a height of 1 1/4 inches.
- Bar Type 2:** A U-shaped bar with a total width of 8 3/4 inches. The top flange has a width of 4 inches and a height of 3' - 4 inches. The vertical leg has a height of 2' - 7 inches. The bottom flange has a width of 4 inches and a height of 3' - 4 inches. The top flange is bent up at a 45-degree angle, with a bend radius of 2' - 7 inches. The top flange has a width of 2' - 7 inches and a height of 3' - 4 inches. The bottom flange has a width of 4 inches and a height of 3' - 4 inches.
- Bar Type 3:** A U-shaped bar with a total width of 1' - 1 1/2 inches. The top flange has a width of 1' - 6 inches and a height of 1' - 6 inches. The vertical leg has a height of 1' - 6 inches. The bottom flange has a width of 1' - 6 inches and a height of 1' - 6 inches. The top flange is bent up at a 45-degree angle, with a bend radius of 1' - 6 inches. The top flange has a width of 1' - 6 inches and a height of 1' - 6 inches. The bottom flange has a width of 1' - 6 inches and a height of 1' - 6 inches.

ALL BAR DIMENSIONS ARE OUT-TO-OUT

BILL OF MATERIAL

WALL #4		WALL #5	
BARRIER RAIL		BARRIER RAIL	
* EPOXY COATED REINFORCING STEEL	4,100 LBS.	* EPOXY COATED REINFORCING STEEL	5,000 LBS.
CLASS AA CONCRETE	27.0 CU.YDS.	CLASS AA CONCRETE	33.0 CU.YDS.
PAY LENGTH	200.00 LIN.FT.	PAY LENGTH	243.75 LIN.FT.
MOMENT SLAB		MOMENT SLAB	
REINFORCING STEEL	5,700 LBS.	REINFORCING STEEL	6,900 LBS.
CLASS AA CONCRETE	61.5 CU.YDS.	CLASS AA CONCRETE	75.0 CU.YDS.
PAY LENGTH	200.00 LIN.FT.	PAY LENGTH	243.75 LIN.FT.

Technical drawing of a concrete barrier rail cross-section. The drawing shows a vertical section of the barrier with various dimensions and reinforcement details.

Dimensions:

- Top width: $1\frac{1}{2}''$
- Top width: $1'-6''$
- Top width: $9\frac{3}{4}''$
- Top width: $4\frac{7}{8}''$
- Top width: $3\frac{3}{8}''$
- Height: $10''$
- Height: $2'-8''$
- Height: $3''$
- Height: $7''$
- Height: $11'-5''$ (labeled as "B" BARS)

Reinforcement Details:

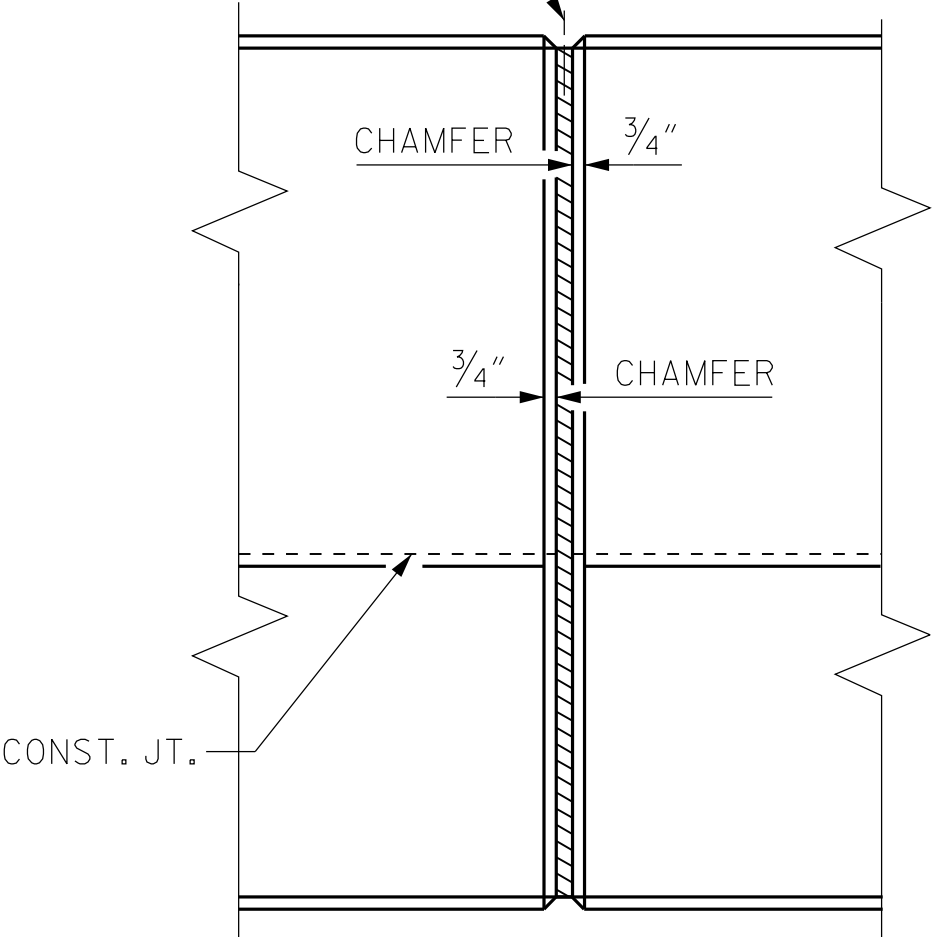
- #5 S4 @ $1'-0''$ CTS.
- #5 S1 @ $1'-0''$ CTS.

Labels:

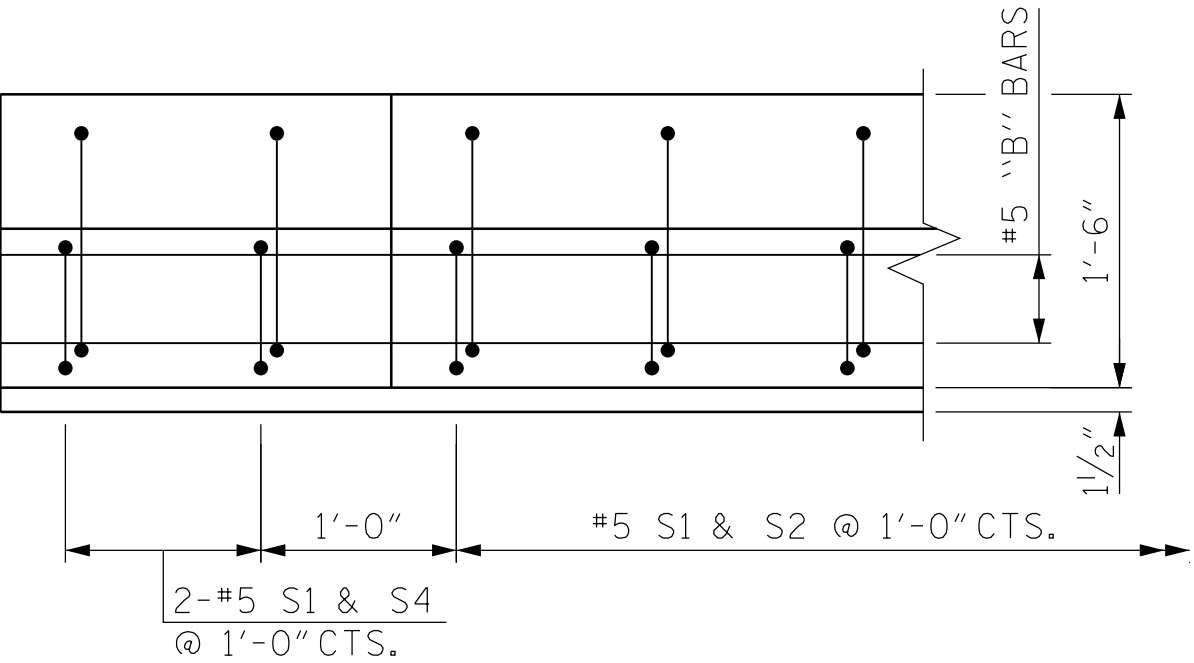
- CONCRETE BARRIER RAIL
- FINISHED GRADE (SEE PLANS FOR FINISHED GRADE DETAILS)

END OF RAIL DETAILS

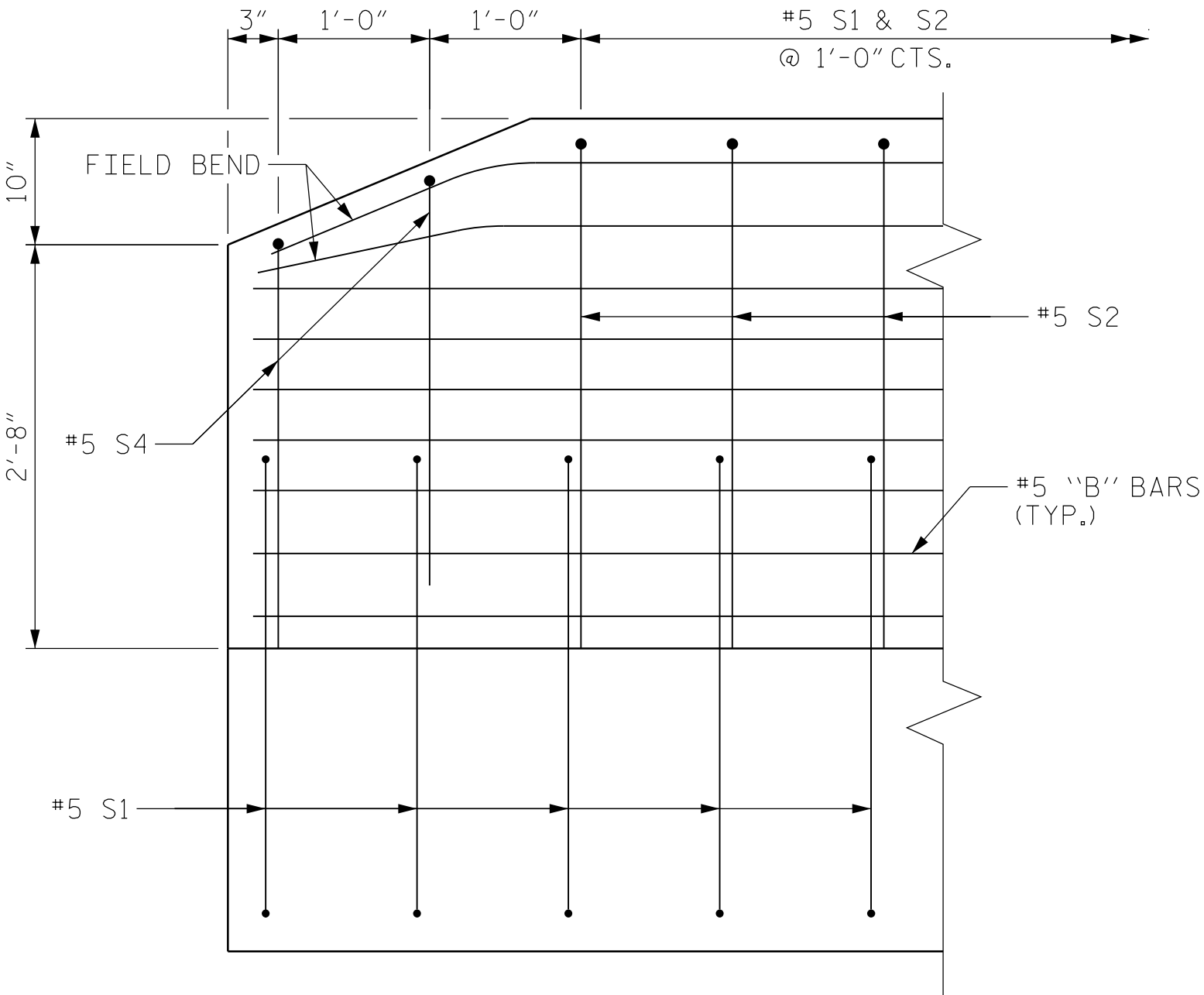
Q 1/2" EXP. JT. MAT'L HELD IN
PLACE WITH GALVANIZED NAILS.



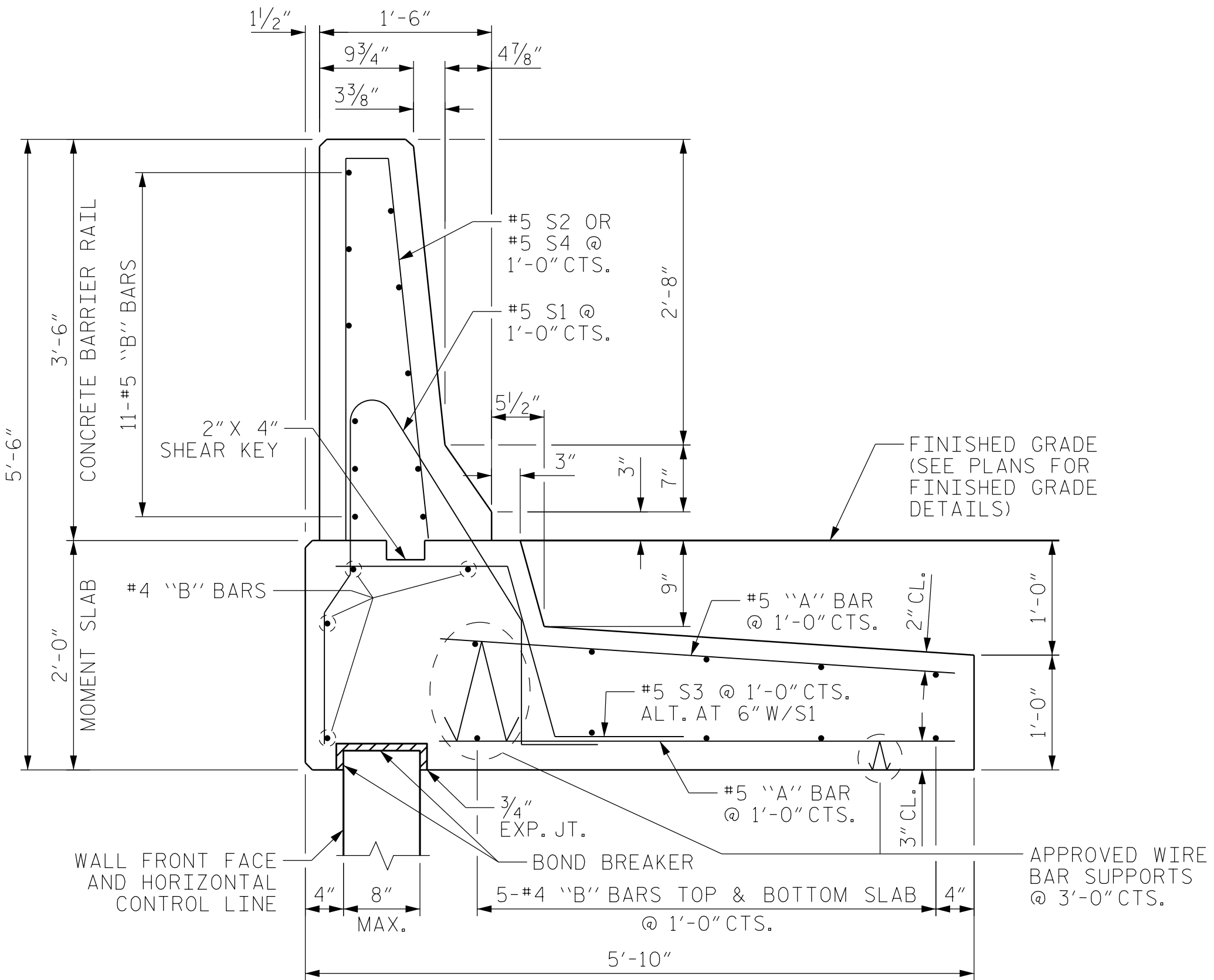
ELEVATION AT EXPANSION JOINTS



PLAN VIEW



SIDE VIEW

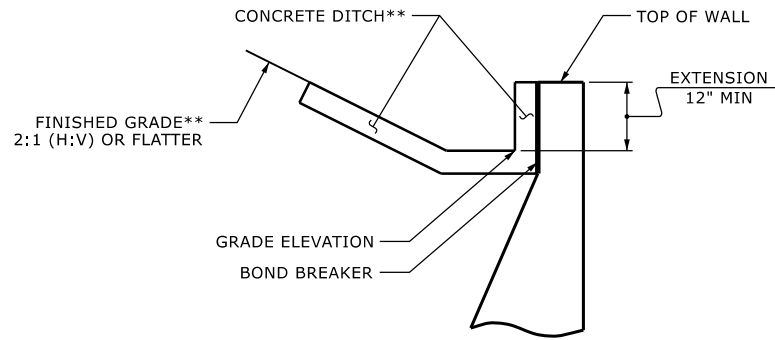


CONCRETE BARRIER RAIL WITH MOMENT SLAB

PROJECT REFERENCE NO.		SHEET NO.
U-5906		W-8
STRUCTURAL ENGINEER 		
8/21/2025		
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		

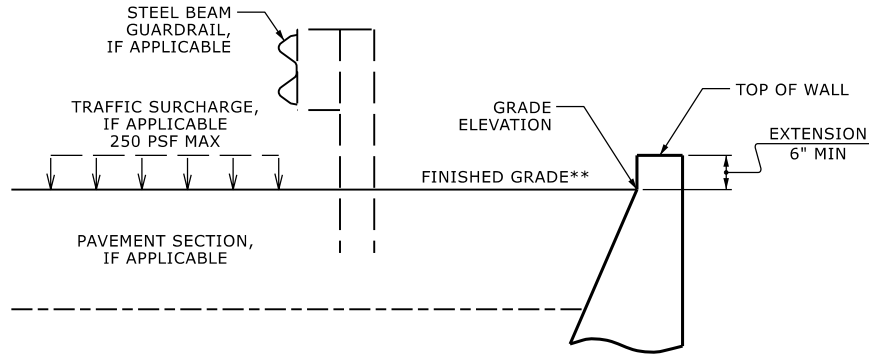
RS&H 1520 SOUTH BOULEVARD, SUITE 200
CHARLOTTE, NC 28203
NC FIRM LICENSE No: F-0493

LOCATION: TORRENCE CHAPEL ROAD AND SHOPPING CENTER DRIVEWAY INTERSECTION	
TIP NO.: U-5906	COUNTY: MECKLENBURG
DESIGNED BY: M. ACOSTA, PE	
CHECKED BY: V. SELLERS, PE	DATE: 08/2025



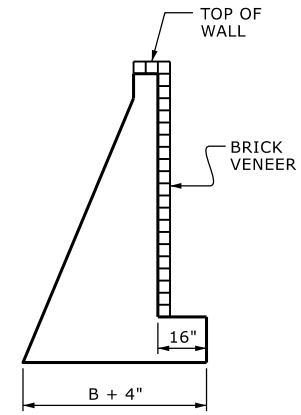
SLOPE CASE

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



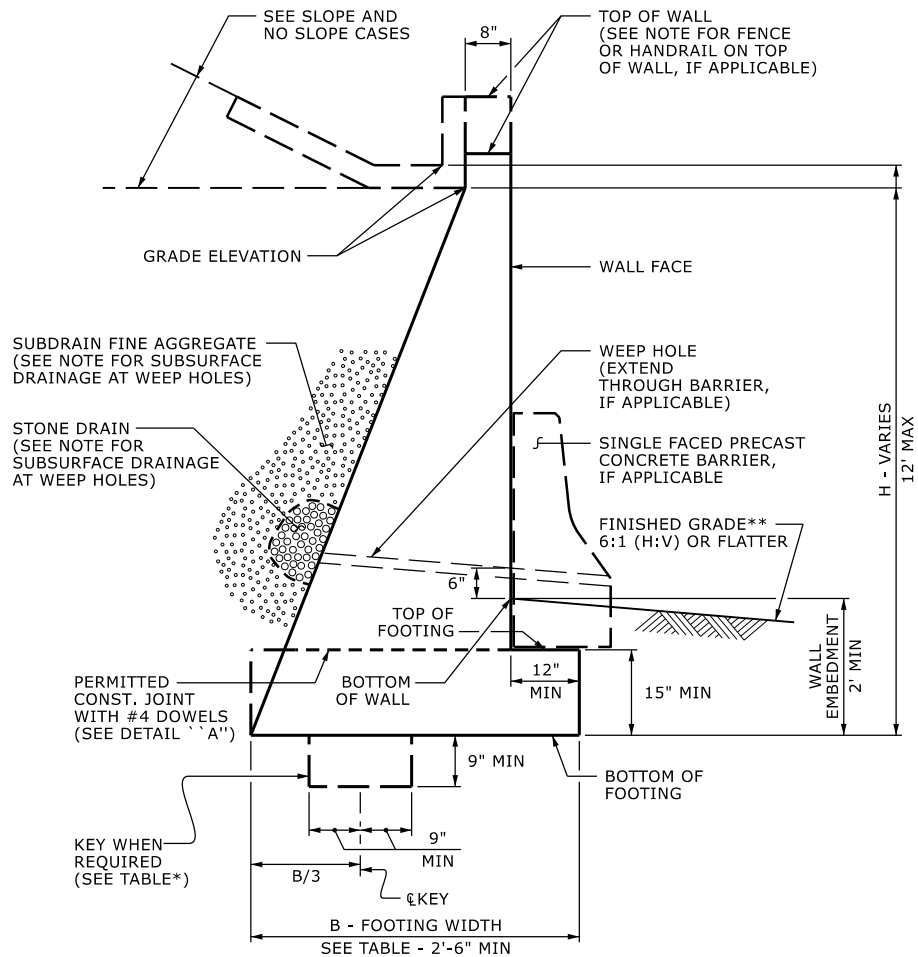
NO SLOPE CASE

**SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.



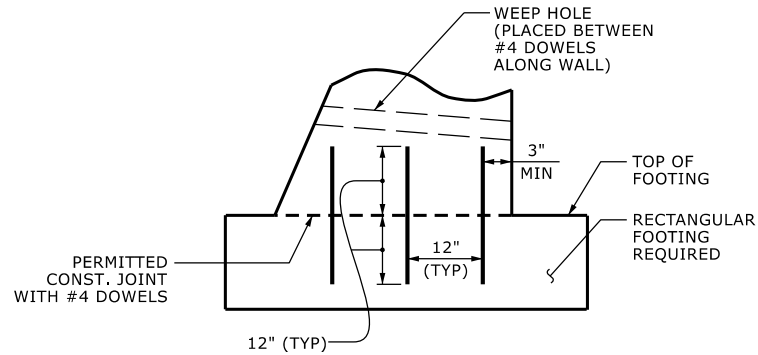
BRICK VENEER DETAIL

(WHEN APPLICABLE)



STANDARD CIP GRAVITY WALL

**SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.



DETAIL "A"

H (FT)	3 - < 6	6 - 9	> 9 - 12
SLOPE CASE	.66	.70*	.75*
NO SLOPE CASE WITH TRAFFIC SURCHARGE	.80	.75*	.70*
NO SLOPE CASE WITHOUT TRAFFIC SURCHARGE	.60	.60	.60

B/H RATIO (B = 2'-6" MIN)

*KEY IS REQUIRED FOR "SLOPE CASE" OR "NO SLOPE CASE WITH TRAFFIC SURCHARGE" WHEN H IS 6' OR GREATER.

NOTES:

FOR STANDARD CIP GRAVITY RETAINING WALLS, SEE SECTION 453 OF THE STANDARD SPECIFICATIONS.

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

FOR SINGLE FACED PRECAST CONCRETE BARRIER, SEE ROADWAY PLANS AND SECTION 857 OF THE STANDARD SPECIFICATIONS.

FOR FENCES OR HANDRAILS ON TOP OF WALLS, SEE ROADWAY PLANS FOR FENCE OR HANDRAIL ATTACHMENT DETAILS.

FOR SUBSURFACE DRAINAGE AT WEEP HOLES, SEE ARTICLE 414-8 OF THE STANDARD SPECIFICATIONS.

STANDARD CIP GRAVITY WALLS ARE BASED ON THE FOLLOWING IN-SITU ASSUMED SOIL PARAMETERS:
UNIT WEIGHT, $\gamma = 120$ PCF
FRICTION ANGLE, $\phi = 35$ DEGREES (GROUNDWATER WITHIN 7' OF BOTTOM OF FOOTING)
FRICTION ANGLE, $\phi = 30$ DEGREES (GROUNDWATER MORE THAN 7' BELOW BOTTOM OF FOOTING)
COHESION, $c = 0$ PSF

DO NOT USE STANDARD CIP GRAVITY WALLS IF ASSUMED SOIL PARAMETERS ARE NOT APPLICABLE OR GROUNDWATER IS ABOVE BOTTOM OF FOOTING.

DO NOT USE STANDARD CIP GRAVITY WALLS WHEN VERY LOOSE OR SOFT SOIL OR MUCK IS BELOW WALLS.

BEFORE BEGINNING STANDARD CIP GRAVITY WALL CONSTRUCTION, SURVEY WALL LOCATIONS AND SUBMIT WALL PROFILE VIEWS (WALL ENVELOPES) FOR REVIEW. FOR WALL ENVELOPES, INCLUDE BOTTOM OF WALL, EXISTING GROUND AND GRADE ELEVATIONS AND OTHER ELEVATIONS AS NEEDED AT INTERVALS OF 25' OR LESS ALONG WALLS. DO NOT START WALL CONSTRUCTION UNTIL WALL ENVELOPES ARE ACCEPTED.

FOR BRICK VENEERS, SUBMIT BRICK SAMPLES FOR APPROVAL BEFORE BEGINNING STANDARD CIP GRAVITY WALL CONSTRUCTION.

DO NOT PLACE CONCRETE FOR FOOTINGS UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

WHEN CONSTRUCTING STANDARD CIP GRAVITY WALLS WITH A CONSTRUCTION JOINT AS SHOWN IN DETAIL "A", PROVIDE A MINIMUM OF 3 EQUALLY SPACED #4 DOWELS AT INTERVALS OF 1'-6" ALONG WALLS.

PROJECT NO.: _____

_____ COUNTY

STATION: _____

SHEET _ OF _ WALL ID RW-_-_-



NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL
ENGINEERING UNIT

STANDARD DETAIL NO. 453.01

STANDARD
CIP GRAVITY
RETAINING WALL

SHEET
NO.

DATE: 02-18-2025 -