GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C44768209231 4CC...

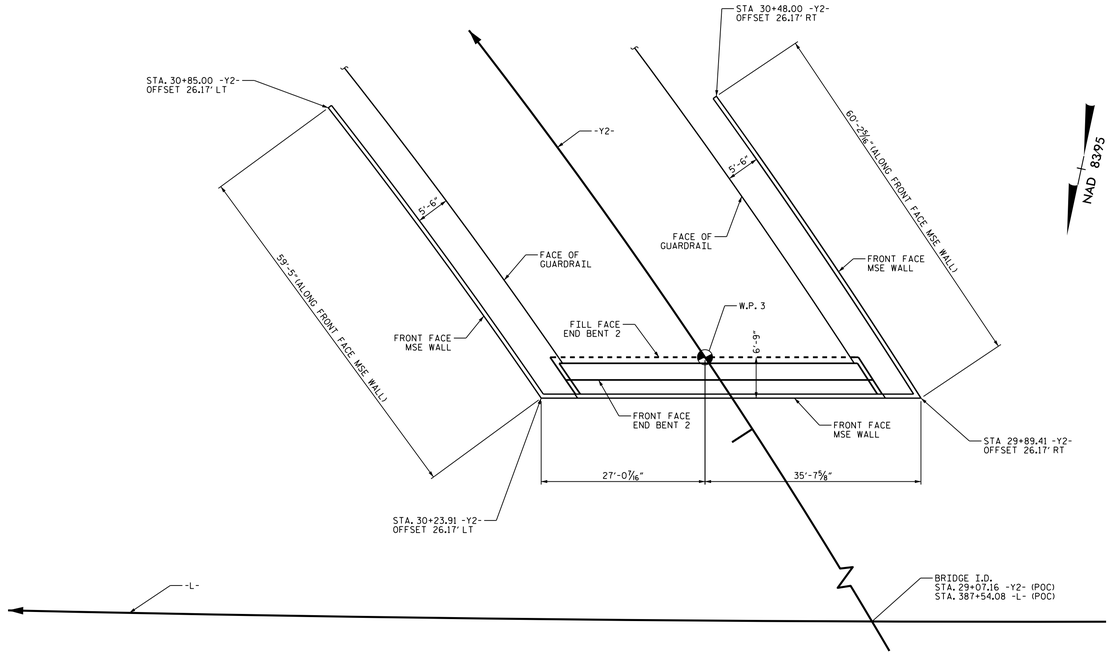
12/6/2016

SIGNATURE DATE

ENGINEER

SIGNATURE DATE

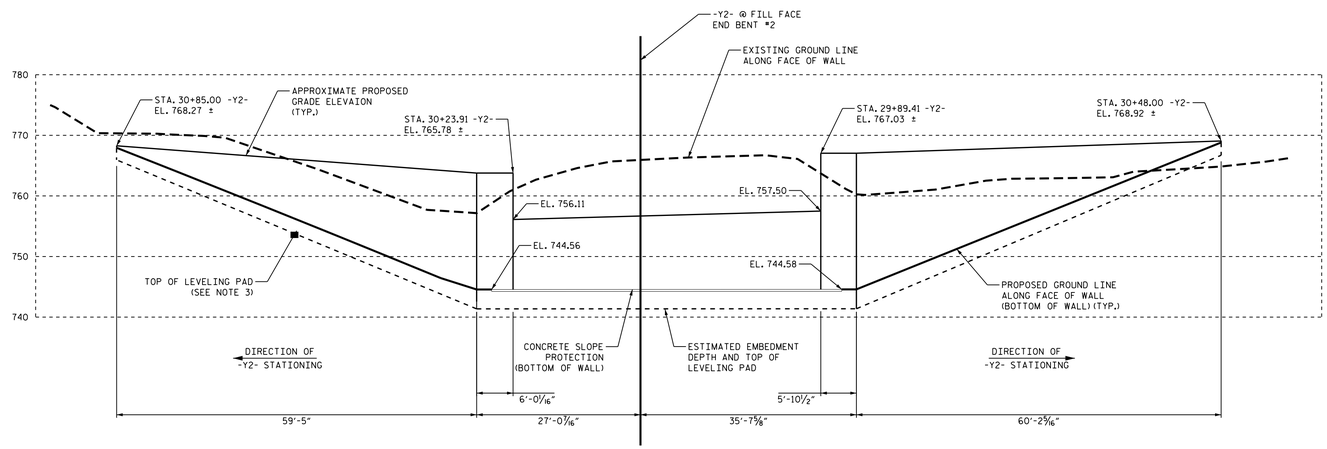
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - MSE RETAINING WALL NO. 1

ESTIMATED MSE WALL QUANTITIES (SQUARE FEET)	
MSE RETAINING WALL NO. 1	2,640 SF
MSE RETAINING WALL NO. 2	2,930 SF
MSE RETAINING WALL NO. 3	6,700 SF
MSE RETAINING WALL NO. 4	7,305 SF
MSE RETAINING WALL NO. 5	5,510 SF
MSE RETAINING WALL NO. 6	5,440 SF

* WALL AREA IS MEASURED USING THE DESIGN HEIGTH "H"



WALL ENVELOPE - MSE RETAINING WALL NO. 1

NOTE: OFFSET DIMENSIONS ARE FROM FACE OF WALL

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 IN FRONT OF THE WALL FOR ITS ENTIRE LENGTH.
2) MINIMUM EMBEDMENT DEPTH OF 2 FT, UNLESS LARGER DEPTHS DICTATED BY THE ABOVE TABLE.
3) SUBMITT WITH THE WALL DESIGN INTERNAL, EXTERNAL, AND GLOBAL STABILITY ANALYSISES.

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: 29+07.16 -Y2-

SHEET 01 OF 09 387+54.08 -L-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

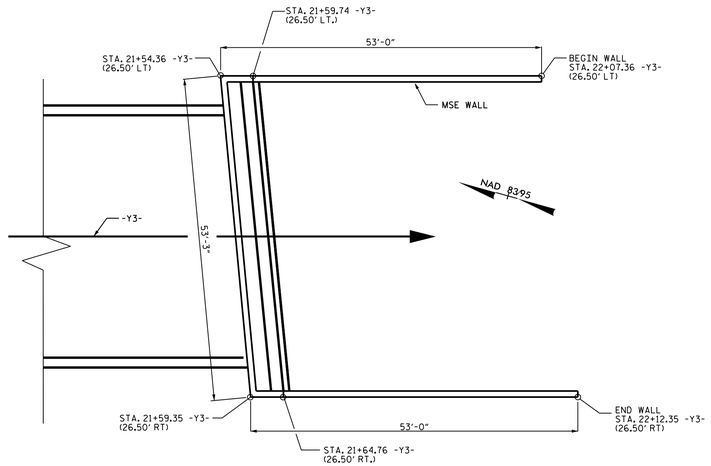
GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 1
BRIDGE 468, SITE 2

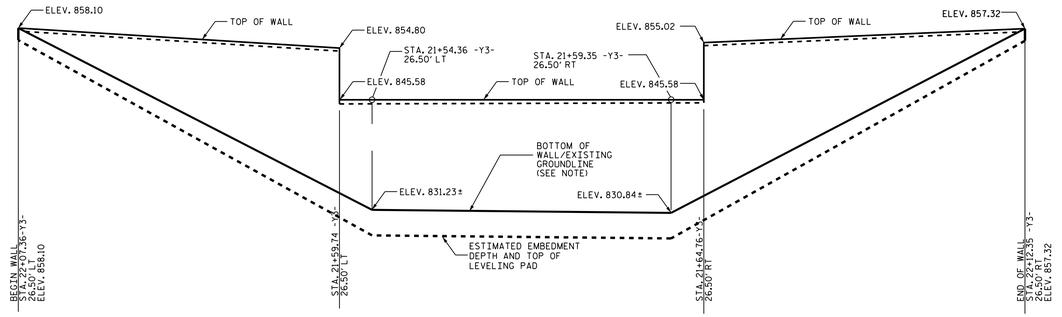
REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W-1
2			4			

GEOTECHNICAL ENGINEER	ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS DocuSigned by: Michael H. Stephens C44768209231 4CC...	
12/6/2016	
SIGNATURE DATE	SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - MSE RETAINING WALL NO. 2



MSE WALL ELEVATION

ELEVATION SHOWS EXPOSED WALL FACE

WALL ENVELOPE - MSE RETAINING WALL NO. 2

NOTE: OFFSET DIMENSIONS ARE FROM FACE OF WALL

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: 20+70.23 -Y3-

SHEET 02 OF 09 450+02.49 -L-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 2
BRIDGE 469, SITE 3

REVISIONS

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

SHEET NO. W-2

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C44768209231 4CC...

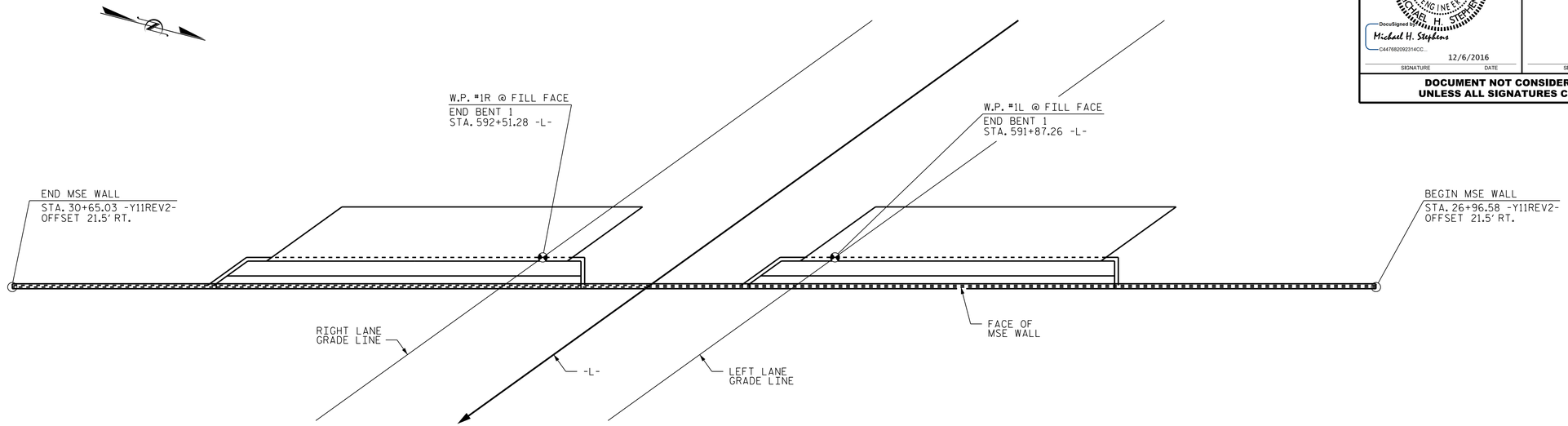
12/6/2016

SIGNATURE DATE

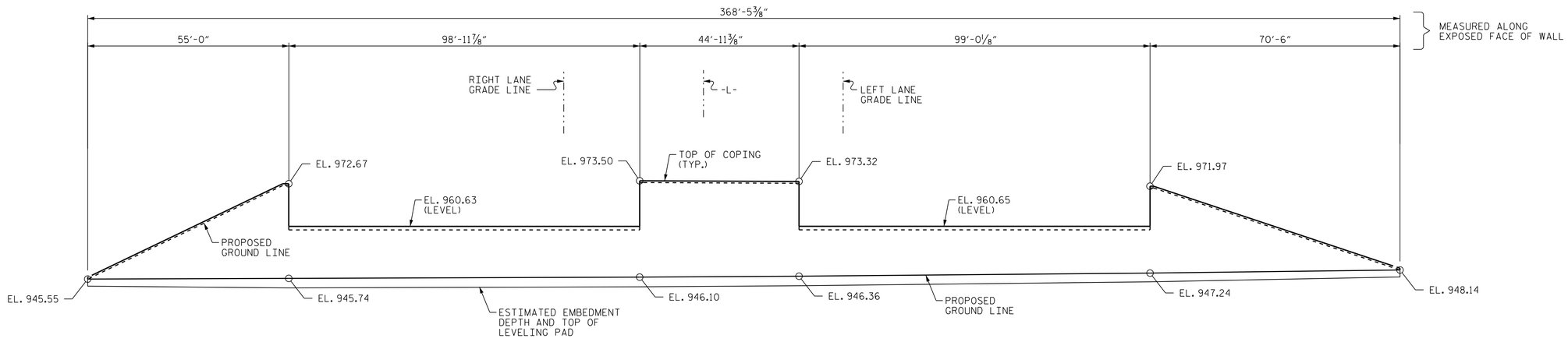
ENGINEER

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - RETAINING WALL NO. 3



WALL ENVELOPE - RETAINING WALL NO. 3

(LOOKING AT EXPOSED FACE OF MSE WALL)
(END BENT NOT SHOWN FOR CLARITY)

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: 596+50.98 -L-

SHEET 03 OF 09 23+68.80 -Y13-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 3
EB1, BRIDGE 472 AND 473,
SITE 6

REVISIONS

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

SHEET NO. W-3

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C44768209314CC...

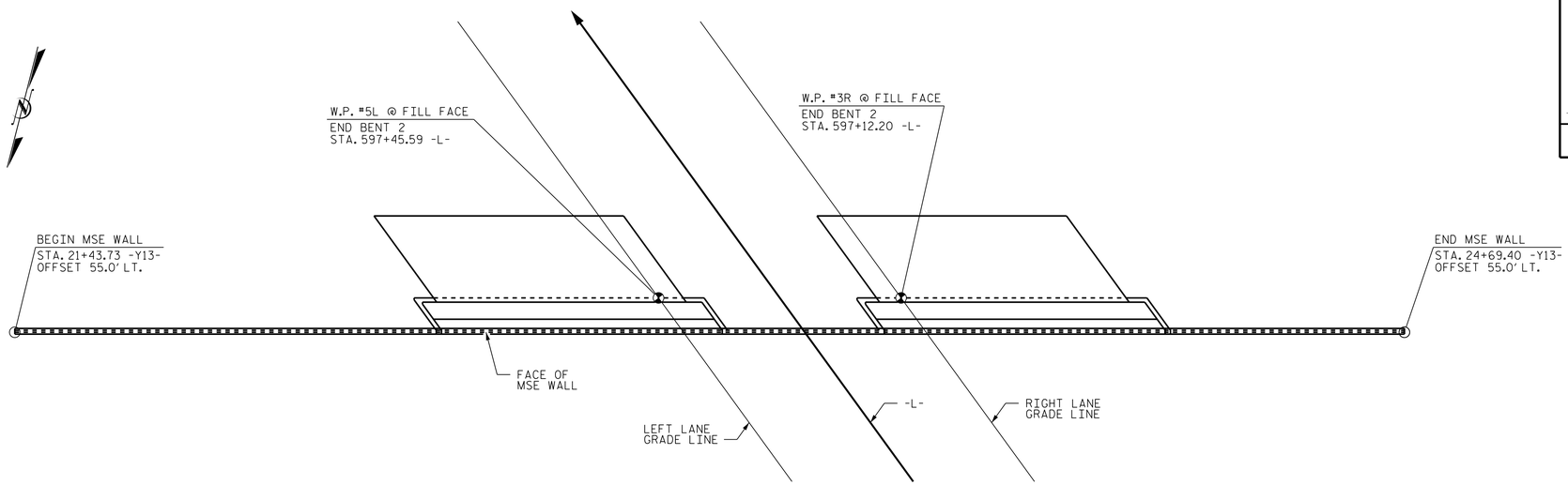
12/6/2016

SIGNATURE DATE

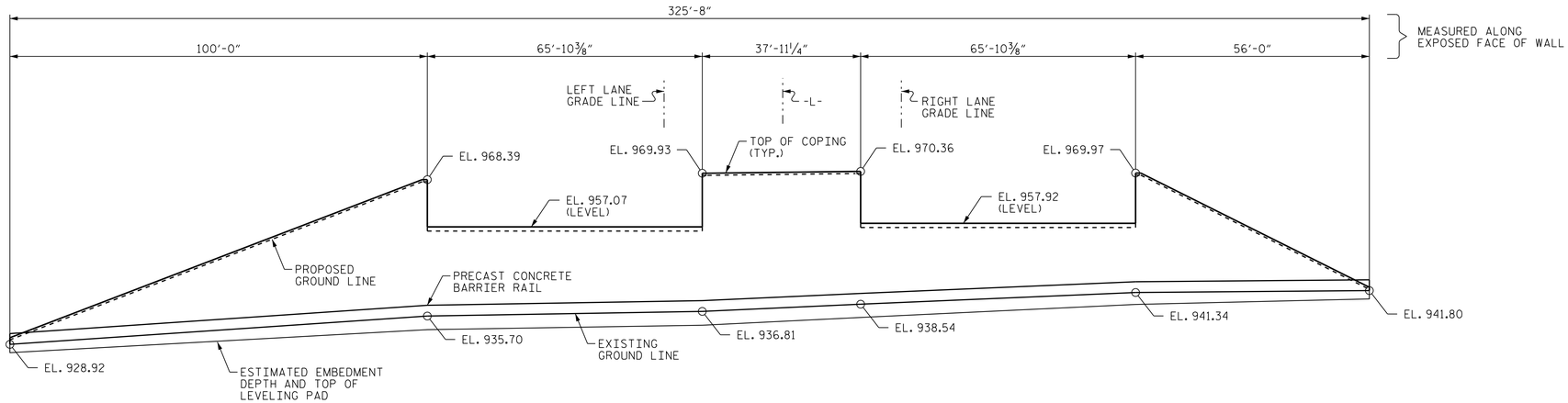
ENGINEER

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - RETAINING WALL NO. 4



WALL ENVELOPE - RETAINING WALL NO. 4

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: 596+50.98 -L-

SHEET 04 OF 09 23+68.80 -Y13-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 4 EB2, BRIDGE NO. 472 AND 473, SITE 6

REVISIONS

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

SHEET NO. W-4

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C44768209231 4CC...

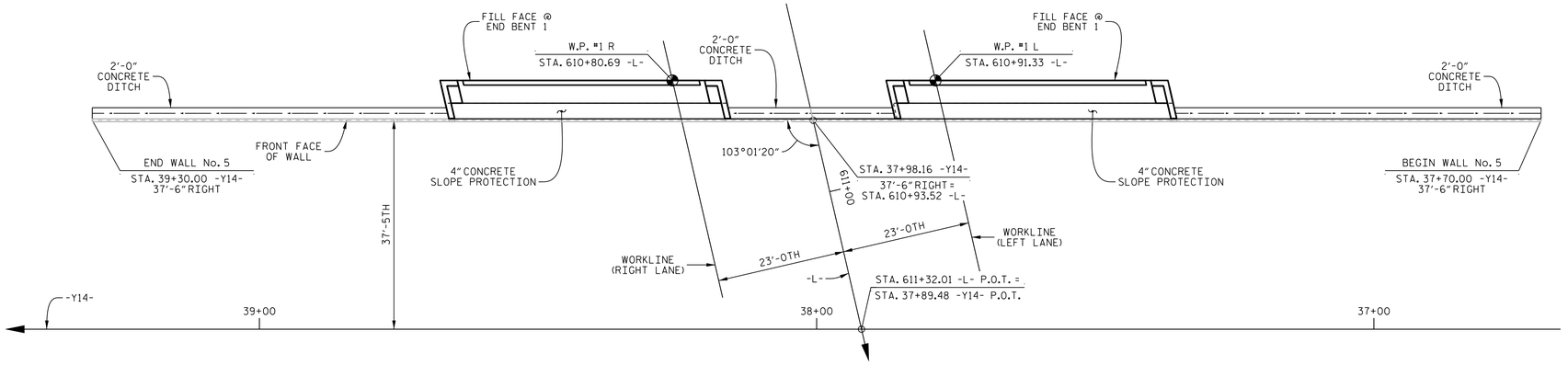
12/6/2016

SIGNATURE DATE

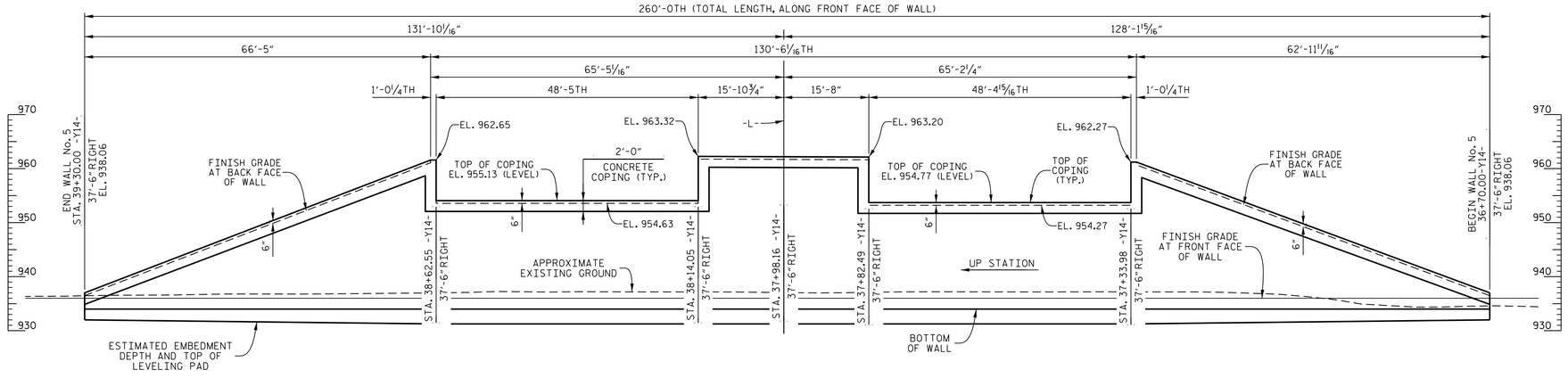
ENGINEER

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - RETAINING WALL NO. 5



WALL ENVELOPE - RETAINING WALL NO. 5

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: STA. 37+98.16 -Y14-

SHEET 05 OF 09 STA. 610+93.52 -L-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 5 EB1, BRIDGE NOS. 474 AND 475, SITE 7

REVISIONS

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

SHEET NO. W-5

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C447682092314CC...

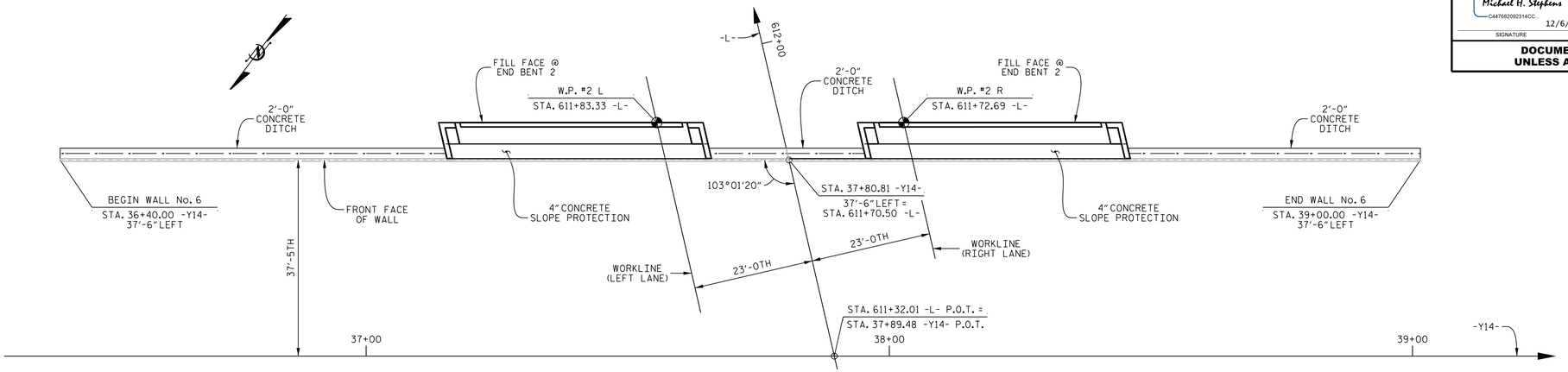
12/6/2016

SIGNATURE DATE

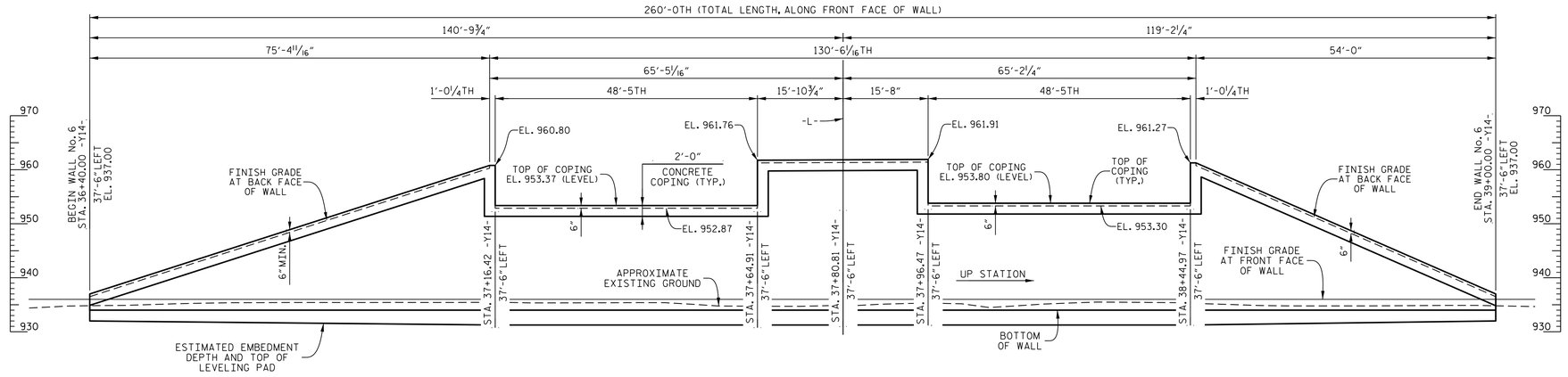
ENGINEER

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PLAN VIEW - RETAINING WALL NO. 6



WALL ENVELOPE - RETAINING WALL NO. 6

(LOOKING AT EXPOSED FACE OF MSE WALL)
(END BENT NOT SHOWN FOR CLARITY)

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: STA. 37+80.81 -Y14-

SHEET 06 OF 09 STA. 611+70.50 -L-

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL NO. 6
EB2, BRIDGE NOS. 474 AND 475, SITE 7

REVISIONS

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

SHEET NO. W-6

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

DocuSigned by: Michael H. Stephens C44768209314CC...

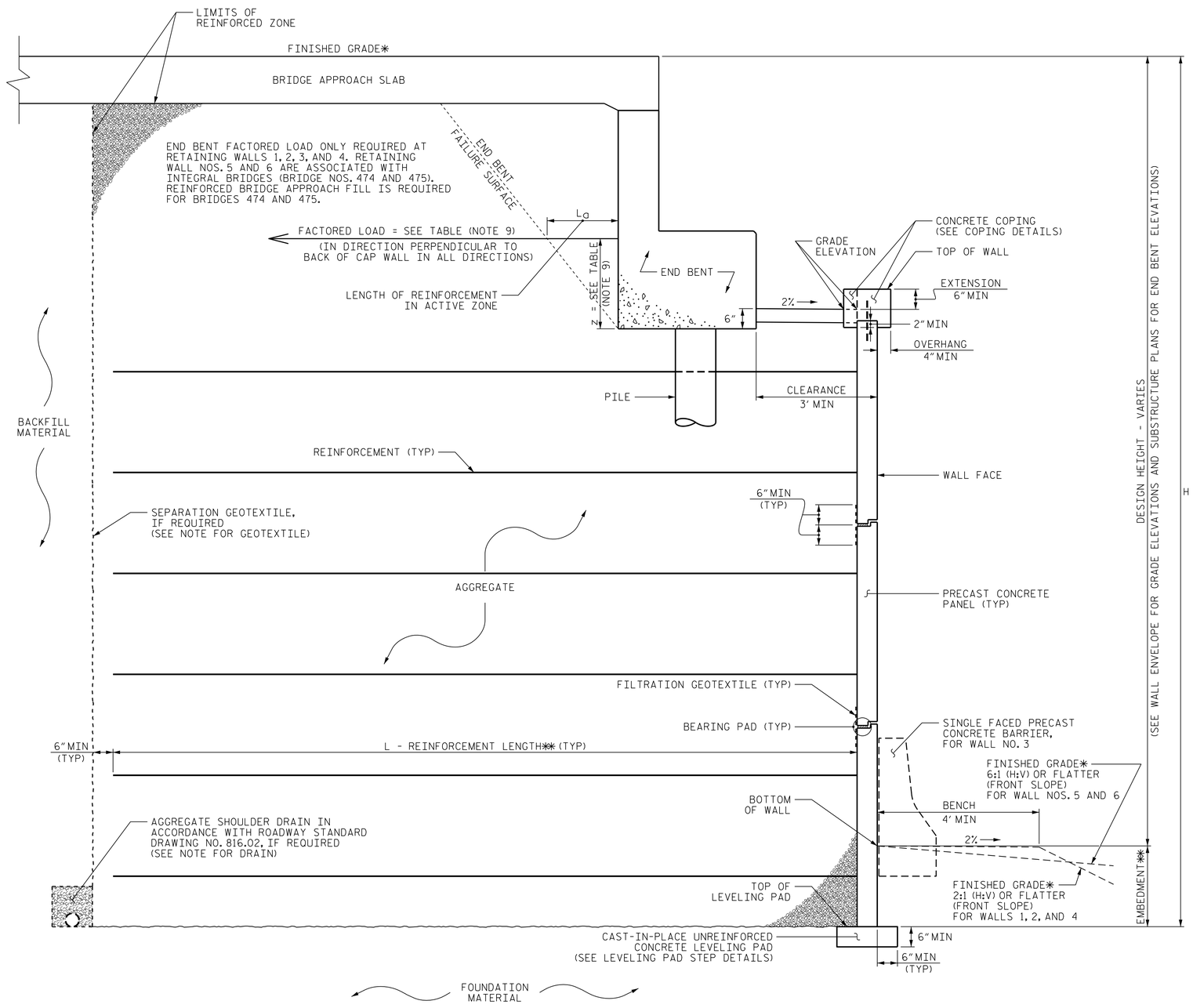
12/6/2016

SIGNATURE DATE

ENGINEER

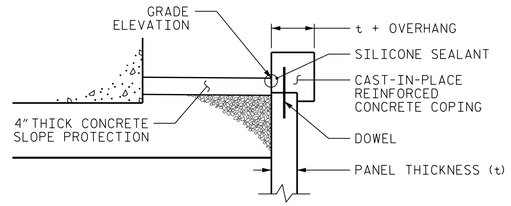
SIGNATURE DATE

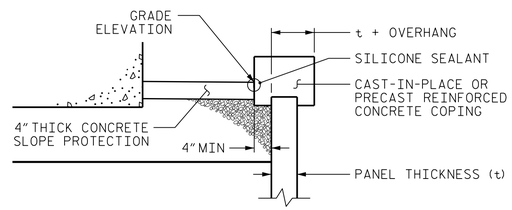
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



MSE ABUTMENT 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.

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: VARIES, SEE ROADWAY PLANS

SHEET 07 OF 09

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALLS

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

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

Digitally signed by Michael H. Stephens
C447682092314CC...

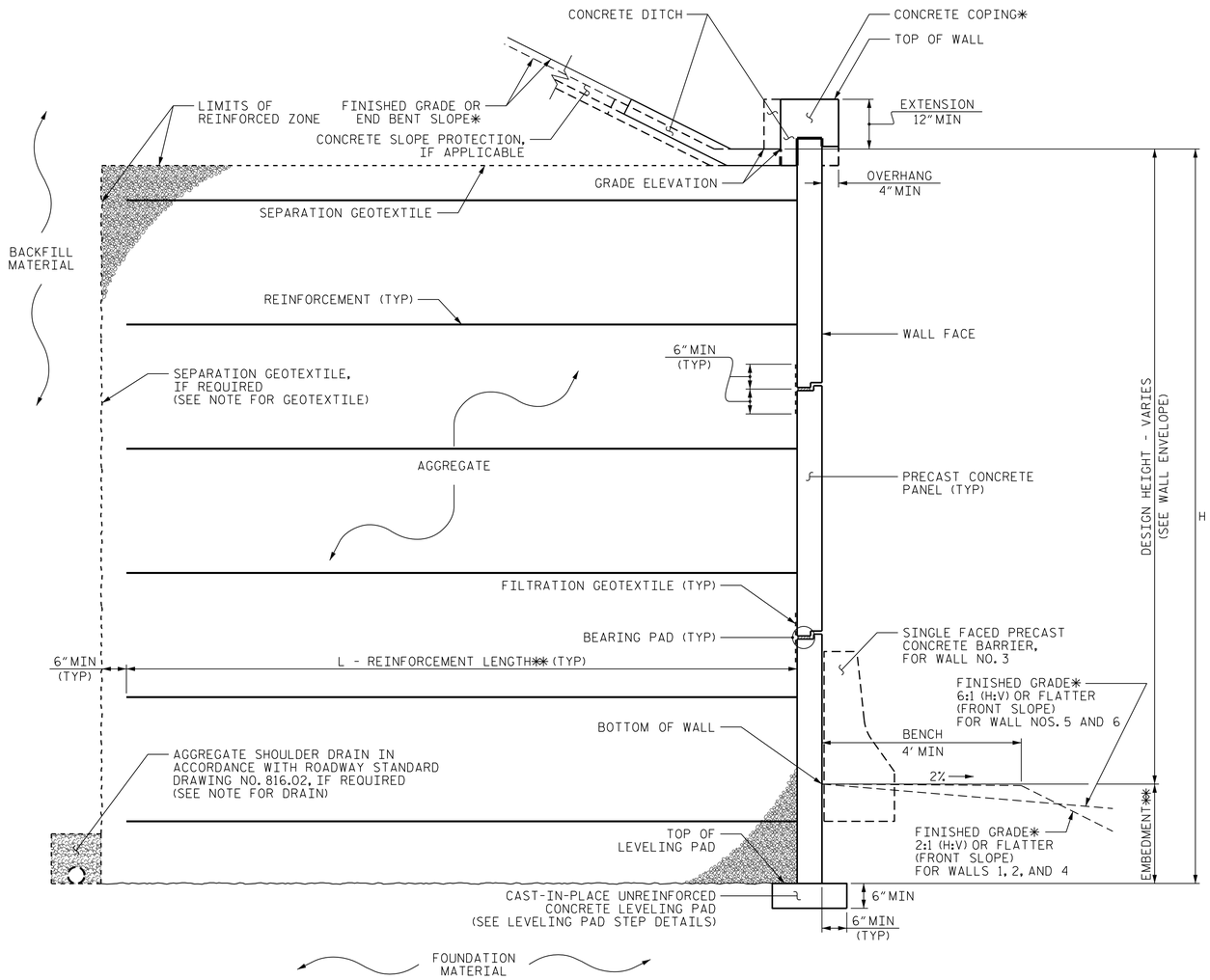
12/6/2016

SIGNATURE DATE

ENGINEER

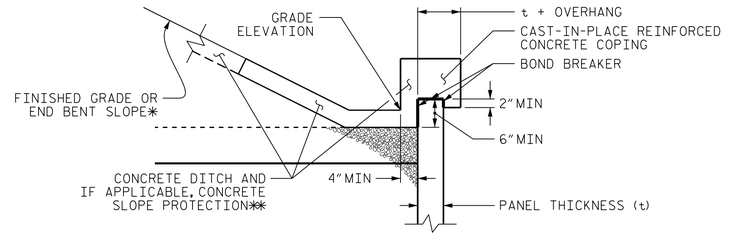
SIGNATURE DATE

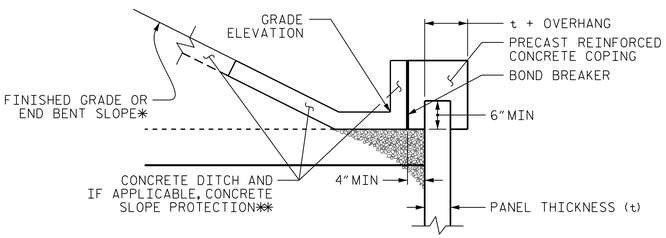
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



MSE WALL WITH PRECAST PANELS - TYPICAL SECTION

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





COPING DETAILS

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

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: VARIES, SEE ROADWAY PLANS

SHEET 08 OF 09

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALLS

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	W-8
1			3			
2			4			

GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

Docusigned by: Michael H. Stephens C447682092314CC...

12/6/2016

SIGNATURE DATE

ENGINEER

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NOTES:

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

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

AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6.

AN ASHLAR FORM LINER ARCHITECTURAL FINISH IS REQUIRED FOR PRECAST CONCRETE PANELS FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6. CREATE AN ASHLAR ARCHITECTURAL FINISH ON THE EXPOSED WALL FACE. THE PATTERN IS TO HAVE A MINIMUM/MAXIMUM RELIEF OF 0.5 INCH/1.0 INCH, OR AS DIRECTED BY THE ENGINEER. THE SELECTED ASHLAR PATTERN IS TO BE APPROVED BY THE ENGINEER PRIOR TO ORDERING OR PLACEMENT IN THE FORMS. THE COPING IS TO BE SMOOTH FINISHED. THE ARCHITECTURAL FINISH WILL BE CONSIDERED INCIDENTAL TO THE SQUARE FOOT COST OF THE WALL. NO ADDITIONAL PAYMENT WILL BE PROVIDED.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6 WHEN COARSE AGGREGATE IS USED.

A DRAIN IS REQUIRED FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6.

BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6, 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. 1, 2, 3, 4, 5, AND 6 FOR THE FOLLOWING:
1) H = DESIGN HEIGHT + EMBEDMENT
2) DESIGN LIFE = 100 YEARS
3) MAXIMUM FACTORED BEARING PRESSURE AT BASE OF WALL = SEE TABLE
4) MINIMUM REINFORCEMENT LENGTH (L) = 1.0H OR 6 FT, WHICHEVER IS LONGER FOR WALL NOS. 1, 2, AND 4
0.8H OR 6 FT, WHICHEVER IS LONGER FOR WALL NOS. 3, 5, AND 6
5) MINIMUM EMBEDMENT ELEVATION = VARIES, SEE MSE WALL PROVISION
6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) LB/CF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) LB/SF
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) LB/CF	FRICTION ANGLE (ϕ) DEGREES	COHESION (c) LB/SF
BACKFILL	30	120	0
FOUNDATION	30	120	0

8) MAXIMUM FACTORED BEARING PRESSURE AT BASE OF WALL:

RETAINING WALL NO.	MAX. FACTORED BEARING PRESSURE LB/SF
WALL NO. 1	4,500
WALL NO. 2	6,200
WALL NO. 3	6,500
WALL NO. 4	7,600
WALL NO. 5	7,600
WALL NO. 6	7,600

9) END BENT STRAP FACTORED LOAD:

RETAINING WALL NO.	FACTORED STRAP LOAD KIP/LFT	STRAP LOCATION FROM BOTTOM OF CAP, Z FT
WALL NO. 1	10	5.0
WALL NO. 2	3.8	4.6
WALL NO. 3*	16	3.5
WALL NO. 4*	16	3.5
WALL NO. 5	NOT REQUIRED (INTEGRAL BRIDGE) - REINFORCED BRIDGE APPROACH FILL REQUIRED	
WALL NO. 6		
*FACTORED LOADS PROVIDED ARE FOR LT LANE AND RT LANE END BENTS.		

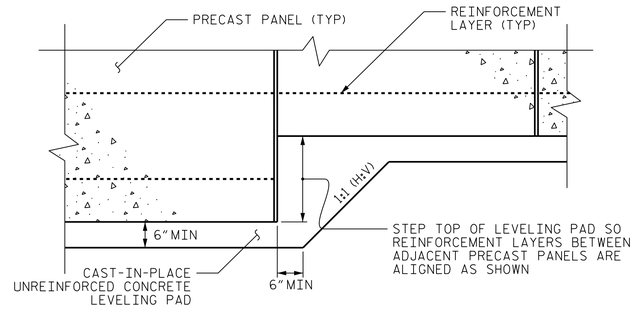
DESIGN RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

DESIGN REINFORCEMENT CONNECTED TO END BENT CAPS FOR FACTORED LOAD AND LENGTH OF REINFORCEMENT IN ACTIVE ZONE (L_a) SHOWN. CAST REINFORCEMENT CONNECTORS INTO CAP BACKWALL FOR END BENTS LOCATED AT RETAINING WALL NOS. 1, 2, 3, AND 4. MAINTAIN A CLEARANCE OF AT LEAST 3" BETWEEN CONNECTORS AND REINFORCING STEEL IN CAP.

FOUNDATIONS FOR END BENTS AT RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6 WILL INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6. SEE FOUNDATION LAYOUT SHEET FOR FOUNDATION LOCATIONS.

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. 1, 2, 3, 4, 5, AND 6.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NOS. 1, 2, 3, 4, 5, AND 6 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.



PRECAST CONCRETE PANELS

LEVELING PAD STEP DETAILS

PROJECT NO.: 34497.1.2 (R-2707C)

CLEVELAND COUNTY

STATION: VARIES, SEE ROADWAY PLANS

SHEET 09 OF 09

PREPARED BY: MHS	DATE: 11/17/16
REVIEWED BY: SY/SCC	DATE: 11/17/16

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

MSE RETAINING WALL

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	W-9
1	-	-	3	-	-	
2	-	-	4	-	-	