NORTH CAROLINA
Department of Transportation









AGC-DOT WORKSHOP 2022

Structure Breakout

Aaron Earwood, PE
Eastern RBCE

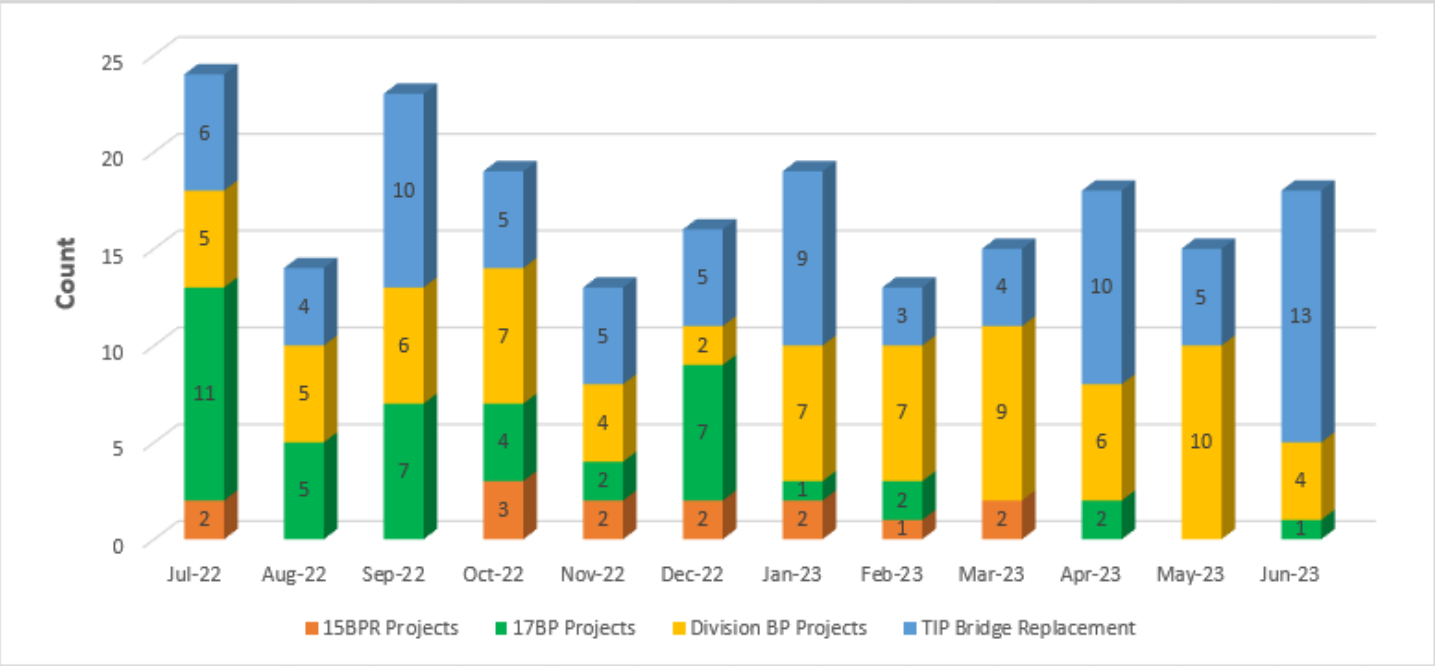
Aaron Griffith, PE
ACE Division 7

Chris Brown, PE
Sanford Contractors, Inc.

Structure Topics

- Bridge Program Funding
- Safety – Bridge Demolition
- Bridge Approach Fills
- Temporary Drainage at Bridge Approaches
- Pile Order Lengths and Foundation Tables
- Steel Pile Accessories
- Drilled-In Piles
- Drilled Shafts
- Buildups – 20^{th}, 40^{th}, 60^{th} Points
- Finishing Skewed Decks
- Rip Rap Slope Protection

Bridge Program / Funding

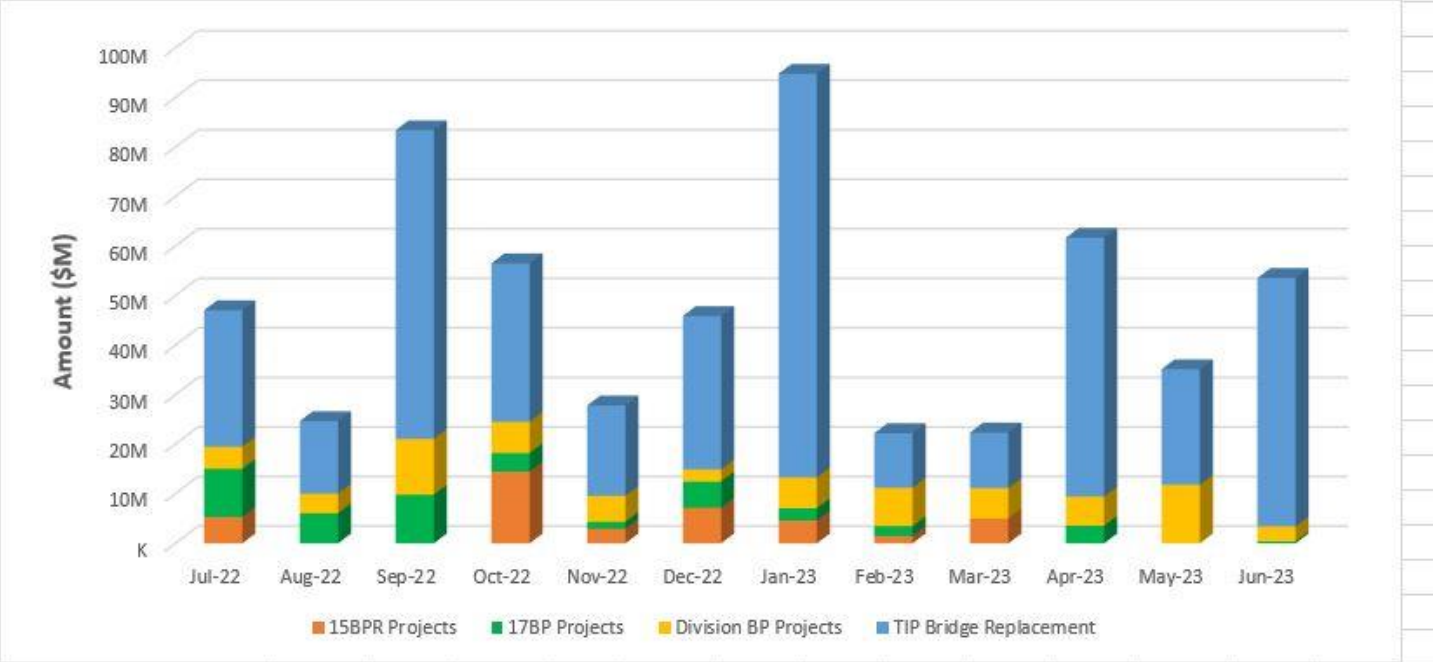


	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Total
15BPR Projects	2			3	2	2	2	1	2				14
17BP Projects	11	5	7	4	2	7	1	2		2		1	42
Division BP Projects	5	5	6	7	4	2	7	7	9	6	10	4	72
TIP Bridge Replacement	6	4	10	5	5	5	9	3	4	10	5	13	79
Total	24	14	23	19	13	16	19	13	15	18	15	18	207

NOTES

- **'TIP Bridge Replacement'** projects include **B-** projects, **BR-** projects, and **HB-** projects
- Resurfacing projects are not included in this data

Bridge Program / Funding



	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Total ($M)
15BPR Projects	$5.33			$14.50	$2.95	$7.20	$4.62	$1.50	$5.04				**$41.14**
17BP Projects	$9.72	$6.08	$9.84	$3.71		$5.28	$2.46	$2.00	$0.00	$3.58	$0.00	$0.40	**$44.45**
Division BP Projects	$4.45	$3.95	$11.24	$6.33	$5.23	$2.45	$6.22	$7.75	$6.09	$5.87	$11.86	$3.02	**$74.45**
TIP Bridge Replacement	$27.55	$14.65	$62.32	$32.00	$18.25	$30.98	$81.50	$11.00	$11.25	$52.25	$23.30	$50.15	**$415.20**
Total ($M)	**$47.05**	**$24.68**	**$83.40**	**$56.54**	**$27.83**	**$45.90**	**$94.80**	**$22.25**	**$22.37**	**$61.70**	**$35.16**	**$53.57**	**$575.24**

NOTES

- **'TIP Bridge Replacement'** projects include **B**- projects, **BR**- projects, and **HB**- projects
- Resurfacing projects are not included in this data

Bridge Program / Funding

- Approximately 800 projects in the 5-year bridge program have been re-started
  - 200 Central Let
  - 600 Division Let
- Infrastructure Investment and Jobs Act (IIJA)
  - Extra funding for bridge program for the next 5 years
  - This is in addition to our yearly bridge program

MAJOR PROJECTS > $20M SCHEDULED FROM JULY 2022 TO JUNE 2023							
Let Date	TIP #	WBS #	County	Division	Description	Latest Estimate	Design-Build
7/19/2022	I-5889B	46409.3.3	Buncombe	13	I-40 MILE MARKER 45.25 TO MILE MARKER 50. REHABILITATE PAVEMENT AND PRESERVE BRIDGES 100352, 100356, 100344, 100347, 100339, AND 100334.	$20,410,000	No
7/19/2022	I-5987B	47533.3.3	Robeson	6	I-95 FROM SOUTH OF NC 20 TO SOUTH OF PROPOSED I-295. WIDEN TO EIGHT LANES.	$195,900,000	No
8/16/2022	R-5777C	44648.3.4	Craven	2	US 70 IMPROVEMENTS FROM THE HAVELOCK BYPASS TO EAST OF SR 1116 (THURMAN ROAD).	$225,800,000	Yes
8/16/2022	A-0009CA	32572.3.13	Graham	14	US 129 FROM 0.2 MILES SOUTH OF SR 1275 (FIVE POINTS ROAD) TO NC 143; NC 143 FROM US 129 TO SR 1223 (BEECH CREEK ROAD).	$29,000,000	No
8/16/2022	I-5987A	47533.3.2	Robeson	6	I-95 FROM SOUTH OF US 301 TO SOUTH OF NC 20. WIDEN TO EIGHTLANES.	$179,200,000	No
8/16/2022	R-3830	38887.3.2	Lee	8	NC 42/SR 1579 (BROADWAY ROAD) FROM US 421 IN SANFORD TO SR1538 (EAST HARRINGTON AVENUE) IN BROADWAY	$39,500,000	No
9/20/2022	A-0009CB	32572.3.14	Graham	14	NC 143 FROM SR 1223 (BEECH CREEK ROAD) TO 0.5 MILES NORTH OF APPALACHIAN TRAIL.	$60,000,000	No
9/20/2022	R-2561CA	34466.1.5	Columbus	6	NC 87 AT NC 11. CONSTRUCT INTERCHANGE.	$29,700,000	No
10/18/2022	A-0009CC	32572.3.15	Graham	14	NC 143 FROM 0.5 MILES NORTH OF APPALACHIAN TRAIL TO NC 28; NC 28 FROM NC 143 TO 0.3 MILES EAST OF SR 1235 (GUNTERS GAP ROAD).	$32,900,000	No
10/18/2022	R-5705B	46377.3.2	Harnett	6	NC 55 FROM NC 210 TO SR 4809 (JICARILA LANE) PART ON NEW LOCATION.	$39,400,000	No
10/18/2022	U-2579AA	34839.3.13	Forsyth	9	WINSTON-SALEM NORTHERN BELTWAY EASTERN SECTION (FUTURE I-74) FROM US 311 TO I-40 SEE R-2247 FOR PLANNING DOCUMENT	$95,100,000	No
11/15/2022	P-5707	44643.3.1	Wake	5	ROGERS ROAD (SR 2052) GRADE SEPARATION OVER CSX RAILROAD (CROSSING NO. 633905Y) AT MILE POST S142.53.	$24,400,000	No
1/17/2023	R-7571	53087.3.1	Robeson	6	US 74 AT NC 72 / NC 130. CONVERT AT-GRADE INTERSECTION TO INTERCHANGE	$20,300,000	No

MAJOR PROJECTS > $20M SCHEDULED FROM JULY 2022 TO JUNE 2023							
Let Date	TIP #	WBS #	County	Division	Description	Latest Estimate	Design-Build
2/21/2023	I-2513AA/ I-2513AB	34165.3.6 / 34165.3.7	Buncombe	13	I-40 FROM EAST OF SR 1224 (MONTE VISTA ROAD) TO PAVEMENT JOINT WEST OF SR 3412 (SAND HILL ROAD). RECONSTRUCT PAVEMENT. I-26, I-40 AT I-26/I-40 AND I-40/US 19/23 (SMOKEY PARK HIGHWAY)INTERCHANGES. CONSTRUCT THE FOLLOWING IMPROVEMENTS: WIDEN I-40 EASTBOUND TO I-26 EASTBOUND RAMP, WIDEN I-26 WESTBOUND BETWEEN I-40 RAMPS, CONSTRUCT NEW I-40 WESTBOUND TO US 19/23 (SMOKEY PARK	$43,700,000	No
3/21/2023	R-5705A	46377.3.1	Harnett	6	NC 55 FROM JUST SOUTH OF SR 1532 (OAK GROVE CHURCH ROAD) TONC 210 WIDEN TO MULTI-LANES.	$31,400,000	No
3/21/2023	U-5748	50168.3.1	Wake	5	US 401 AT SR 2044 (LIGON MILL ROAD)/SR 2224 (MITCHELL MILL ROAD)/ AND SR 2006 (PERRY CREEK ROAD) INTERSECTION IMPROVEMENTS.	$22,500,000	No
4/18/2023	U-4405B	39049.3.3	Cumberland	6	US 401 (RAEFORD ROAD) FROM EAST OF BUNCE ROAD TO EAST OF GLENSFORD DRIVE	$23,100,000	No
5/16/2023	U-5839	50230.3.1	Haywood	14	US 276 (RUSS AVENUE) FROM US 23/74 TO US 23 BUSINESS (MAIN STREET) UPGRADE CORRIDOR	$21,700,000	No
6/20/2023	U-5312	45446.3.1	Wilkes	11	US 421 - NC 16 TO US 421 BUSINESS, CONVERT EXISTING ROADWAYTO SUPER STREET AND ADD SERVICE ROADS	$31,700,000	No
6/20/2023	U-5813	44385.3.GV3	Randolph	8	US 64 FROM ASHEBORO BYPASS TO EAST OF I-73 / I-74 / US 220 IN ASHEBORO. WIDEN TO MULTILANES, RECONSTRUCT INTERCHANGE ATNC 49, MODIFY INTERCHANGE AT I-73 / I-74 / US 220 AND REPLACE BRIDGE 750171 OVER US 64 AND NC 49.	$31,900,000	No
				July 2022 to June 2023 TOTAL COST ESTIMATE FOR PROJECTS > $20M		**$1,197,610,000**	

BRIDGE PROJECTS > $10M SCHEDULED FROM JULY 2022 TO JUNE 2023							
Let Date	TIP #	WBS #	County	Division	Description	Latest Estimate	Design-Build
9/20/2022	B-4442	38368.3.1	Buncombe	13	REPLACE BRIDGES 370 & 373 OVER REEMS CREEK ON US 19/23, US 25, & US 70	$26,600,000	No
9/20/2022	B-5612	45567.3.1	Pitt	2	BRIDGE 24 OVER THE TAR RIVER ON NC 222	$10,600,000	No
11/15/2022	B-5869	48063.3.1	Burke	13	REPLACE BRIDGE 99 OVER NORFOLK SOUTHERN RAILROAD ON US 64 /US 70 IN MORGANTON	$13,400,000	No
12/20/2022	B-5985	47749.3.1	Robeson	6	NC 41/NC 72 SR 1600 REPLACE BRIDGE 770125 & 770175 OVER LUMBER RIVER.	$16,675,000	No
1/17/2023	B-6051 / U-6143	48708.3.1 / 48326.3.1	Gaston	12	US 29 / US 74 REPLACE BRIDGE 350091 OVER CATAWBA RIVER.(COMB W/U-6143). / NC 7 (EAST CATAWBA STREET) AT US 74 (WILKINSON BOULEVARD) INTERSECTION. CONSTRUCT NORTHBOUND RIGHT-TURN LANE ON NC 7 (EAST CATAWBA STREET) AND EXTEND EXISTING WESTBOUND LEFT-TURN LANE ON US 74 (WILKINSON BOULEVARD).(COMB W/ B-6051).	$45,300,000	No
4/18/2023	BR-0041	67041.3.1	Rockingham	7	BRIDGE 780001 ON SR 2817 OVER US 29	$14,050,000	No
4/18/2023	BR-0043	67043.3.1	Rockingham	7	BRIDGE 780151 ON US 158 OVER US 29	$13,300,000	No
				July 2022 to June 2023 TOTAL COST ESTIMATE FOR BRIDGES > $10M		**$139,925,000**	

Contractor Fatality

Template Revision: 5/23/2018

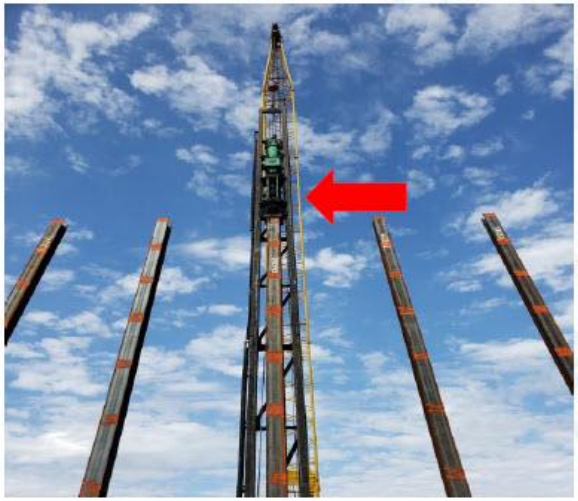
Incident Title:	Pile Driving – Struck-By	**Incident Date:**	3/8/2022
Contact Info:	Debbie Leonard – (252) 640-6421	**Location/Area:**	Div. 4/Nash County

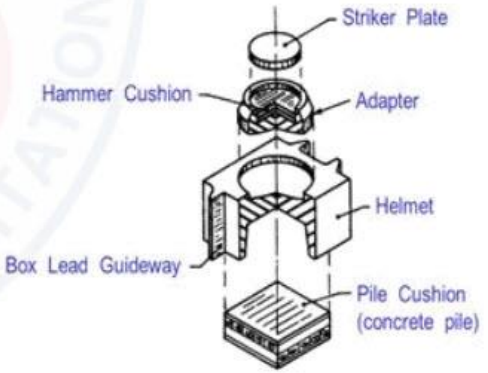
Incident Description

A contractor employee was fatally injured on a construction project in Nash County. The employee, who was wearing a hard hat, was standing adjacent to an active pile driving operation. While the pile was being driven, a section of the striker plate broke away. The portion of the striker plate fell approximately 50 feet striking the employee. The section of the striker plate that struck the employee was estimated to weigh 60 lbs. Photos below show the pile and pile driver, the section of the striker plate that struck the employee, and a diagram of the Helmet Components showing the location of a striker plate.

Root-Cause	Corrective Action
Under investigation by contract company and NC DOL OSH.	Perform a job hazard analysis (JHA). Potential actions may include designated exclusion zones during overhead work and equipment inspection.

Photos





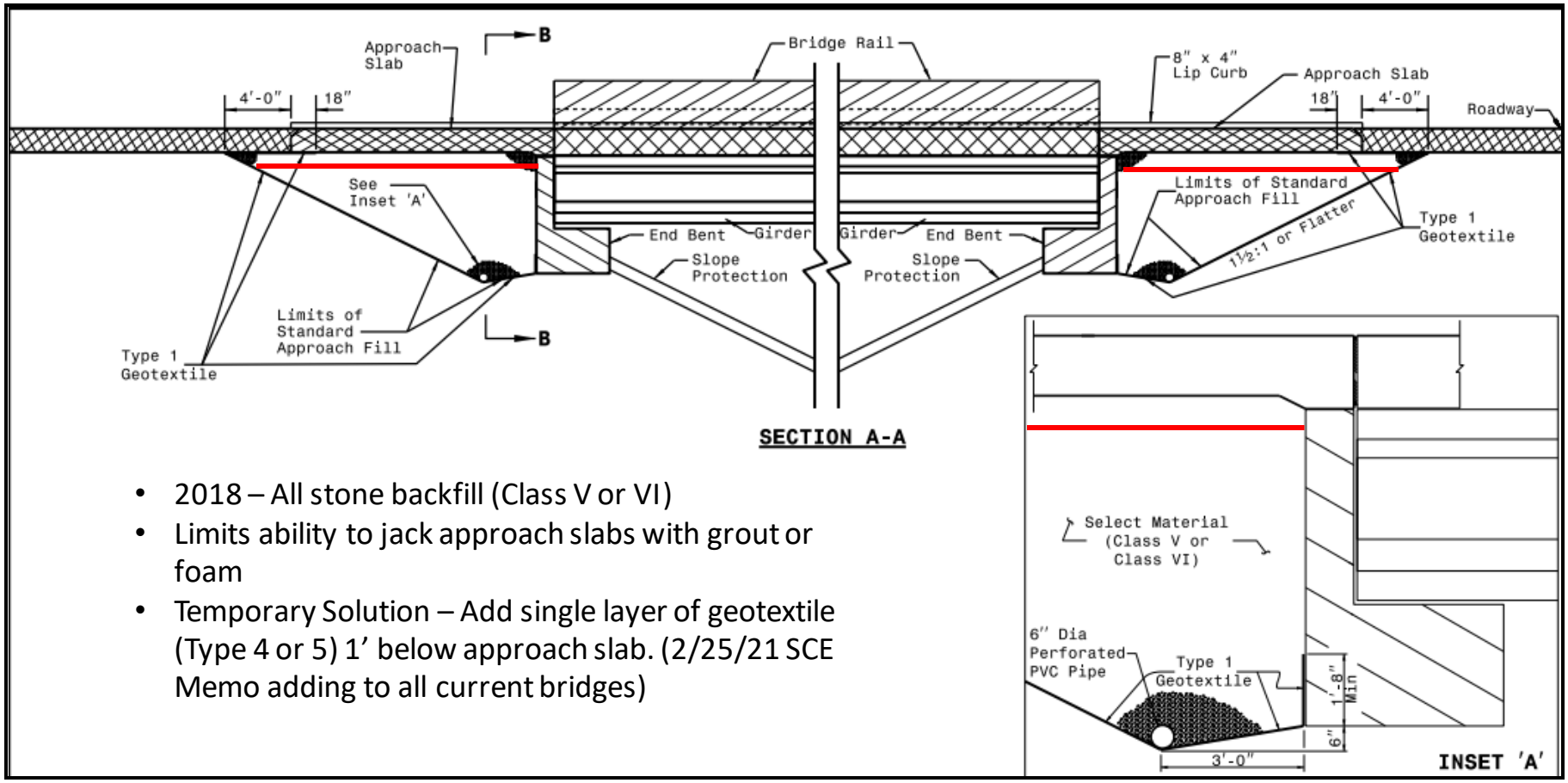
Safety Alert

Safety
Bridge Demolition

Bridge Demolition

- Avoid damage to critical load carrying components that are required to continue to support the structure
- Consider condition of existing components when planning demolition
- Ensure properly trained personnel
- Follow Bridge Demo Plan
  - If changes are needed, consult the Engineer

Bridge Approach Fills



- 2018 – All stone backfill (Class V or VI)
- Limits ability to jack approach slabs with grout or foam
- Temporary Solution – Add single layer of geotextile (Type 4 or 5) 1’ below approach slab. (2/25/21 SCE Memo adding to all current bridges)

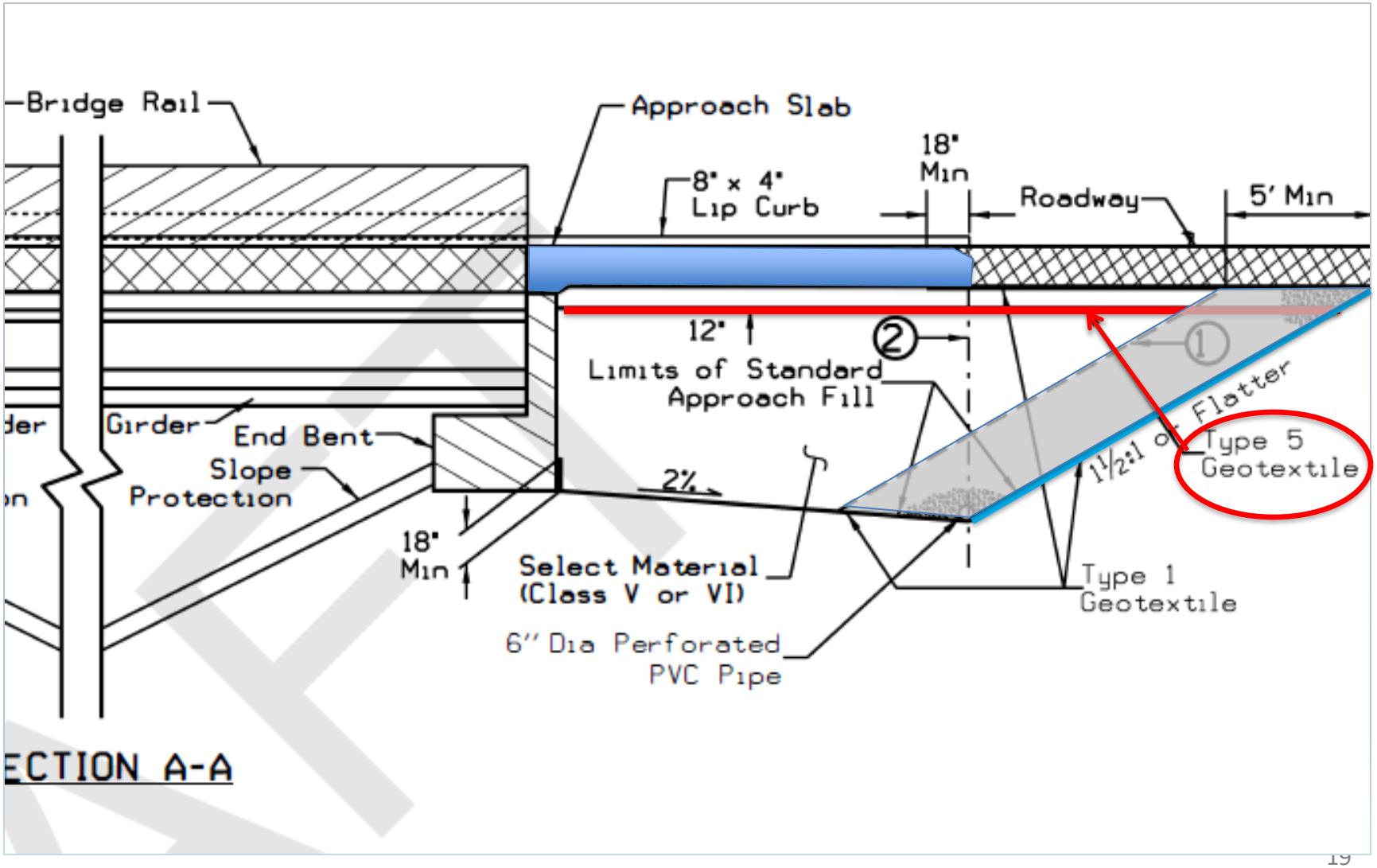
Emphasis Areas

- Increased inspection of embankments within 50’ of bridges
- Soil Density Tests close to backslope of approach fills
- Sufficient compactive effort on Class V or VI Stone
  - Small plate tamps generally not sufficient. Use trench rollers or larger/heavier plate tamps
  - Limit lift thicknesses

Workgroup Recommendations

- Increased embankment densities within 50'-100' of bridges (Proposing 1 per 2' of fill)
- Sufficient compactive effort on Class V or VI Stone
  - Trench Roller (Rammax) or Larger
  - Establish Maximum Lift Thickness
- Modify approach fill details to allow large rollers
- Overbuild embankment and cut back

Bridge Approach Fills




KOMATSU

Temporary Drainage at Approach Slabs

Temporary Drainage at Approach Slabs

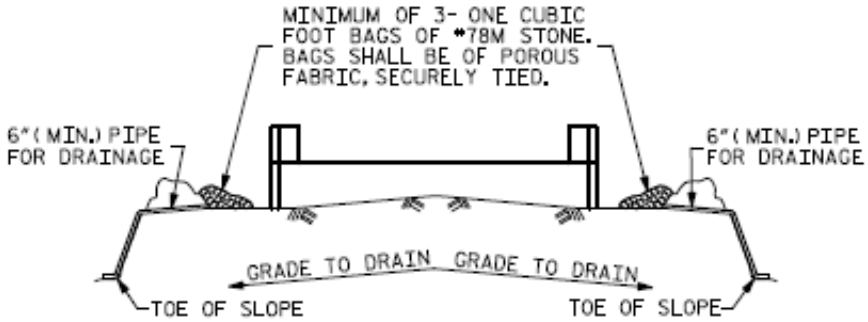
422-3 Construction Methods (for approach slabs)

Temporarily cover or fill the opening in the joint at the end bent until installation of the joint seal, if applicable. Make sure that the covering or filler provides for drainage off the bridge deck and keeps debris out of the joint and off the end bent cap.

Construct temporary slope drains in accordance with Section 1622. Locate this erosion control item as shown in the Structure plan detail.

Backfill around the approach slabs as soon as practical to prevent erosion adjacent to the slab.

Temporary Drainage at Approach Slabs



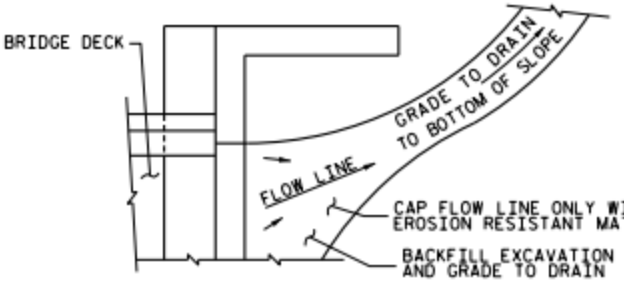
BAGGED STONE AND PIPE SHALL BE PLACED IMMEDIATELY AFTER COMPLETION OF END BENT EXCAVATION. PIPE MAY BE EITHER CONCRETE, CORRUGATED STEEL, CORRUGATED ALUMINUM ALLOY, OR CORRUGATED PLASTIC. PERFORATED PIPE WILL NOT BE ALLOWED.

BAGGED STONE SHALL REMAIN IN PLACE UNTIL THE ENGINEER DIRECTS THAT IT BE REMOVED. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF SILT ACCUMULATIONS AT BAGGED STONE WHEN SO DIRECTED BY THE ENGINEER. BAGS SHALL BE REMOVED AND REPLACED WHENEVER THE ENGINEER DETERMINES THAT THEY HAVE DETERIORATED AND LOST THEIR EFFECTIVENESS.

NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK AND THE ENTIRE COST OF THIS WORK SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR THE SEVERAL PAY ITEMS.

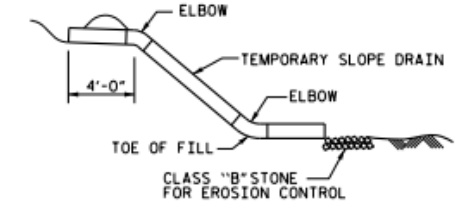
TEMPORARY DRAINAGE AT END BENT

Temporary Drainage at Approach Slabs

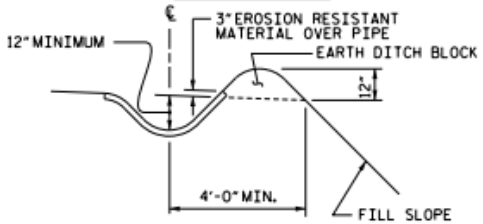


NOTE: IF THE APPROACH SLAB IS NOT CONSTRUCTED IMMEDIATELY AFTER THE BACKFILLING OF THE END BENT EXCAVATION, GRADE TO DRAIN TO THE BOTTOM OF THE SLOPE AND PROVIDE EROSION RESISTANT MATERIAL, SUCH AS FIBERGLASS ROVING OR AS DIRECTED BY THE ENGINEER TO PREVENT SOIL EROSION AND TO PROTECT THE AREA ADJACENT TO THE STRUCTURE. THE CONTRACTOR WILL BE REQUIRED TO REMOVE THESE MATERIALS PRIOR TO CONSTRUCTION OF THE APPROACH SLAB.

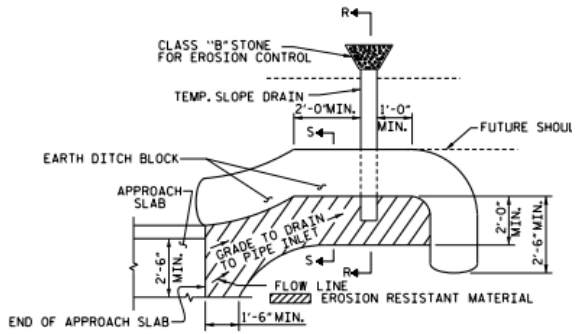
TEMPORARY DRAINAGE DETAIL



SECTION R-R



SECTION S-S



NOTE: IMMEDIATELY AFTER THE CONSTRUCTION OF THE APPROACH SLAB, THE CONTRACTOR SHALL PROVIDE TEMPORARY BERM AND SLOPE DRAIN. CONTRACTOR SHALL GRADE TO PIPE INLET AND PROVIDE EROSION RESISTANT MATERIAL AS SHOWN. THE EROSION RESISTANT MATERIAL SHALL BE EITHER 1) ASPHALT PLANT MIX, TYPE 1 OR TYPE 2, MIN. 2" DEPTH, 2) EROSION CONTROL MAT, OR 3) CONCRETE, AS DIRECTED BY THE ENGINEER. THE SLOPE DRAIN SHALL CONSIST OF A NON-PERFORATED TEMPORARY DRAINAGE PIPE, 12 INCHES IN DIAMETER.

PLAN VIEW

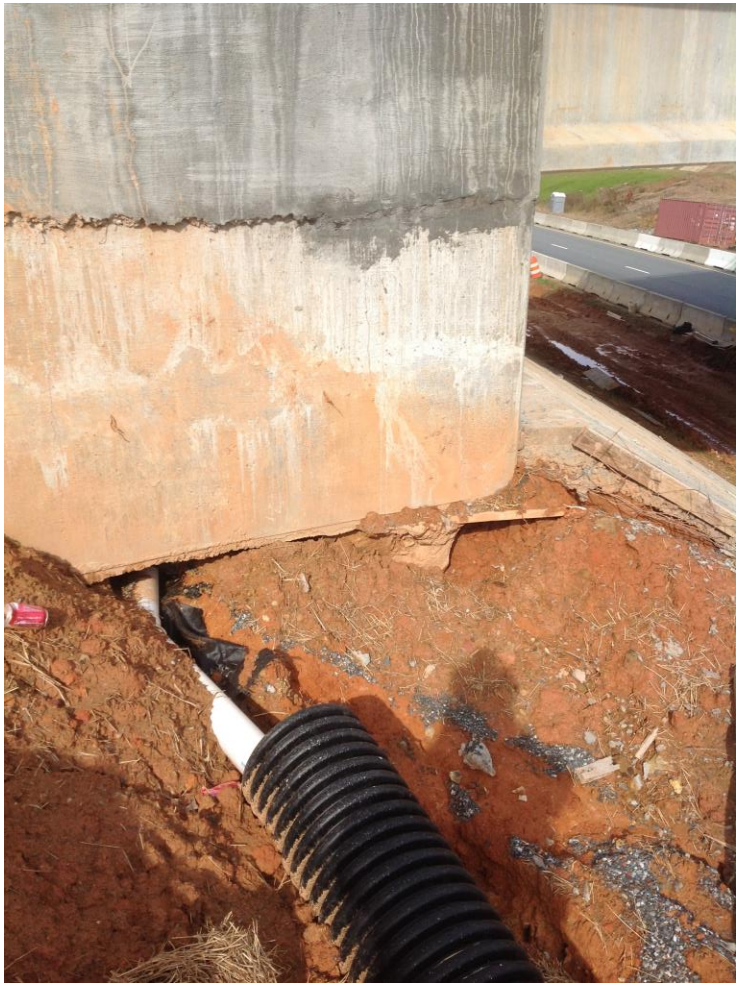
TEMPORARY BERM AND SLOPE DRAIN DETAILS

(TO BE USED WHEN SHOULDER BERM GUTTER IS REQUIRED)

Temporary Drainage at Approach Slabs

Temporary Drainage at Approach Slabs

Temporary Drainage at Approach Slabs



Temporary Drainage at Approach Slabs

Temporary Drainage at Approach Slabs

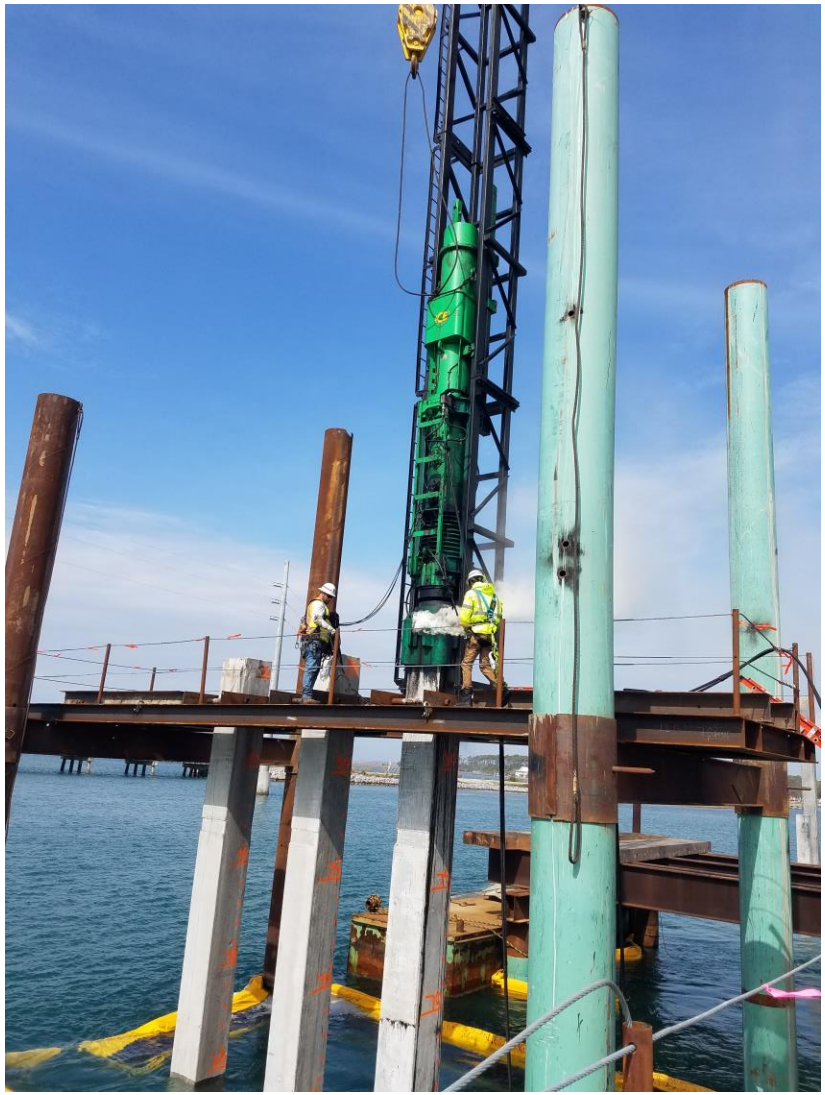
Temporary Drainage at Approach Slabs

Summary

- Prior to paving being performed on the grade, ensure diversion ditches are in place daily before leaving project and that they are maintained so that all water approaching bridge from grade is directed to temporary slope drains before getting to the approach slabs.
- During and after paving on the grade to tie into approach slabs, install series of sandbags or other devices ahead of the approach slab to reduce the velocity of water flowing towards the bridge and help direct it to either temporary slope drains or permanent drainage structures.
- On the bridge, follow the recommendations from the plans regarding temporary drainage. If the grade of the bridge is steep, more may be needed to slow the water.
- Have collection pipe(s) installed at low points on the approach slab that are large enough to collect water running off of the bridge from a heavy thunderstorm. Make sure the water exiting the pipe is directed to a temporary slope drain or to a permanent structure that can handle it.

Concrete Pile Order Lengths & Foundation Tables

Concrete Pile Order Lengths



Geotech Provides Order Lengths based on PDA Test Results (longer bridges)

or

Geotech Provides Order Lengths in plans (shorter bridges)

NCDOT will pay for the entire pile order length, including cutoff

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

209 S. Glenburnie Road
New Bern, 28560

November 18, 2021

Balfour Beatty Infrastructure
3314 Jaeckle Drive
Unit 140
Wilmington, NC 28403

RE: Authorized Pile Lengths for Bents 26 and 27
STATE PROJECT: B-4863
WBS NO.: 50212.3.1
CONTRACT NO.: C204372
COUNTY: Carteret

Gentlemen:

Authorized pile lengths (order lengths) for the bridge bents listed below are as follows. Drive criteria shall be provided by your PDA Consultant using these authorized lengths.

Bridge Bent	Authorized Length (ft)
Bent 26	86
Bent 27	83

Lengths for the remaining bridge bents will be provided once driving of the applicable PDA test pile is completed.

Recommended by: Thomas G. Santee
Thomas G. Santee, P.E.

Authorized by: _____
Brad McMannen, P.E.

SUMMARY OF PILE INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) #-# (e.g., "Bent 1, Piles 1-5")	Factored Resistance per Pile TONS	Pile Cut-Off (Top of Pile) Elevation FT	Estimated Pile Lenth per Pile FT	Scour Critical Elevation FT	Driven Piles			Predrilling for Piles*			Drilled-in Piles		
					Min Pile Tip (Tip No Higher Than) Elev FT	Required Driving Resistance (RDR)** per Pile TONS	Total Pile Redrives Quantity EACH	Predrilling Length per Pile Lin FT	Predrilling Elevation (Elev Not To Predrill Below) FT	Maximum Predrilling Dia INCHES	Pile Excavation (Bottom of Hole) Elev FT	Pile Exc Not in Soil per Pile Lin FT	Pile Exc in Soil per Pile Lin FT

*Predrilling for Piles is required for end bents/bents with a predrilling length and at the Contractor's option for end bents/bents with predrilling information but no predrilling length.

$$**RDR = \frac{Factored\ Resistance + Factored\ Downdrag\ Load + Factored\ Dead\ Load}{Dynamic\ Resistance\ Factor} + Nominal\ Downdrag\ Resistance + \frac{Nominal\ Scour\ Resistance}{Scour\ Resistance\ Factor}$$

PILE DESIGN INFORMATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) #-# (e.g., "Bent 1, Piles 1-5")	Factored Axial Load per Pile TONS	Factored Downdrag Load per Pile TONS	Factored Dead Load* per Pile TONS	Dynamic Resistance Factor	Nominal Downdrag Resistance per Pile TONS	Nominal Scour Resistance per Pile TONS	Scour Resistance Factor (Default = 1.00)
							1.00
							1.00
							1.00
							1.00
							1.00

*Factored Dead Load is factored weight of pile above the ground line.

SUMMARY OF DRILLED PIER INFORMATION/INSTALLATION

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) #-# (e.g., "Bent 1, Piers 1-3")	Factored Resistance per Pier TONS	Minimum Pier Tip (Tip No Higher Than) Elevation FT	Required Tip Resistance per Pier TSF	Scour Critical Elevation FT	Minimum Drilled Pier Penetration into Rock per Pier Lin FT	Drilled Pier Length per Pier Lin FT	Drilled Pier Length Not in Soil per Pier Lin FT	Drilled Pier Length in Soil per Pier Lin FT	Permanent Steel Casing Required? YES or MAYBE	Permanent Steel Casing Tip Elevation (Elev Not To Extend Casing Below) FT	Permanent Steel Casing Length* per Pier Lin FT

*Permanent Steel Casing Length equals the difference between the ground line or top of drilled pier elevation, whichever is higher, and the permanent casing tip elevation.

SUMMARY OF PDA/PILE ORDER LENGTHS

(Blank entries indicate item is not applicable to structure)

Pile Driving Analyzer (PDA)				Pile Order Lengths	
End Bent/ Bent No	PDA Testing Required? YES or MAYBE	PDA Test Pile Length FT	Total PDA Testing Quantity EACH	End Bent/ Bent No(s)	Pile Order Length Basis* EST or PDA

*EST = Pile order lengths from estimated pile lengths; PDA = Pile order lengths based on PDA testing. For groups of end bents/bents with pile order lengths based on PDA testing, the first end bent/bent no. listed for each group is the representative end bent/bent with the PDA.

SUMMARY OF PILE ACCESSORIES

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pile(s) #-# (e.g., "Bent 1, Piles 1-5")	Pipe Pile Plates Required? YES or MAYBE	Steel Pile Points			Steel Pile Tips Required? YES
		Pipe Pile Cutting Shoes Required? YES	Pipe Pile Conical Points Required? YES	H-Pile Points Required? YES	
TOTAL QTY:					

SUMMARY OF DRILLED PIER TESTING

(Blank entries indicate item is not applicable to structure)

End Bent/ Bent No, Pier(s) #-# (e.g., "Bent 1, Piers 1-3")	Standard Penetration Test (SPT) Required? YES or MAYBE	Crosshole Sonic Logging (CSL) Required?* YES or MAYBE	Total CSL Tube Length (For All Tubes) per Pier Lin FT	Shaft Inspection Device (SID) Required? YES or MAYBE	Pile Integrity Test (PIT) Required? MAYBE
TOTAL QTY:					

*CSL Tubes are required if CSL Testing is or may be required. The number of CSL Tubes per drilled pier is equal to one tube per foot of design pier diameter with at least 4 tubes per pier. The length of each CSL Tube is equal to the drilled pier length plus 1.5 ft.

PROJECT NO. _____

_____ COUNTY

STATION: _____

NOTES:

1. The Pile and Drilled Pier Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer (PE seal name and #) on mm-dd-yyyy.
2. Total Pile Driving Equipment Setup quantity (not shown in Pile Foundation Tables) equals the number of driven piles, i.e., the number of piles with a Required Driving Resistance.
3. The Engineer will determine the need for PDA Testing, Pipe Pile Plates, Permanent Steel Casing, SPTs, CSL Testing, SID Inspections and PITs when these items may be required.

NORTH CAROLINA PROFESSIONAL SEAL PE # ENGINEER PE SEAL NAME

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

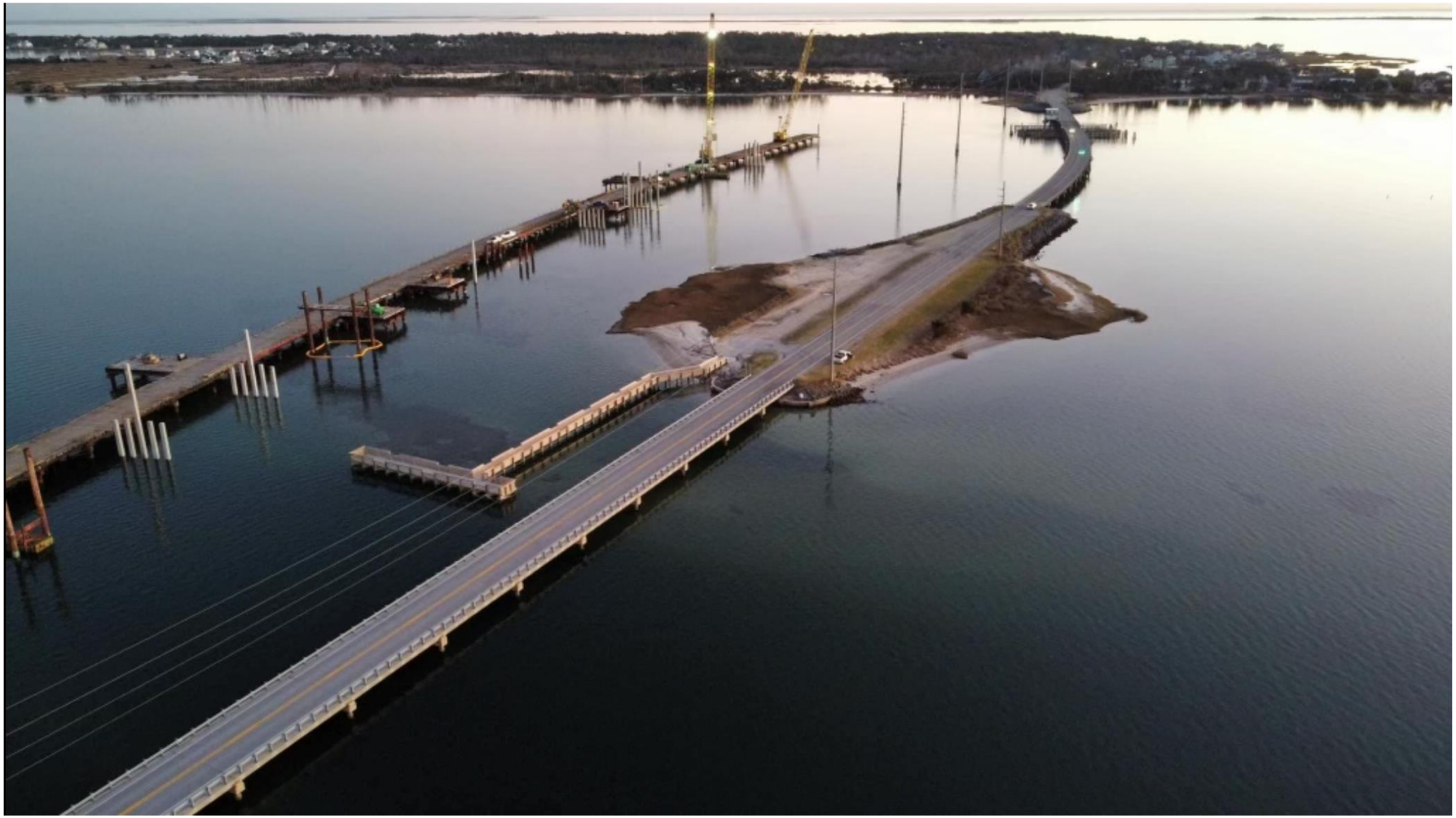
PILE AND DRILLED PIER FOUNDATION TABLES

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	TOTAL SHEETS
1			3			
2			4			

B-4863 – Harkers Island Bridge

- First project to implement new provision

Full Implementation – October 2021 Letting



Pile Excavation

Plan Notes

FOUNDATION NOTES:

FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

PILES AT END BENT 1 ARE DESIGNED FOR A FACTORED RESISTANCE OF 115 TONS PER PILE.

DRIVE PILES AT END BENT 1 TO A REQUIRED DRIVING RESISTANCE OF 195 TONS PER PILE.

PILES AT END BENT 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 115 TONS PER PILE.

DRIVE PILES AT END BENT 2 TO A REQUIRED DRIVING RESISTANCE OF 195 TONS PER PILE.

DRILLED-IN PILES ARE REQUIRED FOR END BENT 2. EXCAVATE HOLES AT PILE LOCATIONS TO ELEVATION 543.2 FT. FOR PILE EXCAVATION, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT 1 AND 2. FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

FOUNDATION NOTES

PILES

1. FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

2. PILES AT END BENT NO. 1 AND END BENT NO. 2 ARE DESIGNED FOR A FACTORED RESISTANCE OF 140 TONS PER PILE AND 135 TONS PER PILE, RESPECTIVELY.

3. DRIVE PILES AT END BENT NO. 1 AND END BENT NO. 2 TO A REQUIRED DRIVING RESISTANCE OF 235 TONS PER PILE AND 225 TONS PER PILE, RESPECTIVELY.

4. STEEL H-PILE POINTS ARE REQUIRED FOR STEEL H-PILES AT END BENT NO. 1 AND END BENT NO. 2. FOR STEEL PILE POINTS, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

5. DRILLED-IN PILES #3 THROUGH PILE #7 ARE REQUIRED FOR INTEGRAL END BENT NO. 1. EXCAVATE HOLES AT PILE LOCATIONS TO ELEVATION 768.3 FT, FILL THE BOTTOM 3 FT OF HOLES FOR PILE EXCAVATION WITH CONCRETE OR GROUT AND THE REST OF THE HOLES WITH CLASS II OR III SELECT MATERIAL THAT MEETS SECTION 1016 OF THE STANDARD SPECIFICATIONS. FOR PILE EXCAVATION, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

6. DRILLED-IN PILES #1 THROUGH PILE #3 ARE REQUIRED FOR INTEGRAL END BENT NO. 2. EXCAVATE HOLES AT PILE LOCATIONS TO ELEVATION 764.7 FT, FILL THE BOTTOM 3 FT OF HOLES FOR PILE EXCAVATION WITH CONCRETE OR GROUT AND THE REST OF HOLES WITH CLASS II OR III SELECT MATERIAL THAT MEETS SECTION 1016 OF THE STANDARD SPECIFICATIONS. FOR PILES EXCAVATION, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

Pile Excavation

450-3(E)

(E) Drilled-in Piles

Perform pile excavation to elevations shown in the plans or approved by the Engineer. Excavate holes at pile locations with diameters that will result in at least 3 inches of clearance all around piles. Before filling holes, support and center piles in excavations and when noted in the plans, drive piles to the required driving resistance. Remove any fluids from excavations and, at the Contractor's option, fill holes with concrete, grout or flowable fill unless required otherwise in the contract.

(1) Pile Excavation

Use equipment with sufficient capacity to drill through soil, rock, boulders, timbers, man-made objects and any other materials encountered. Do not use blasting to advance pile excavations. Blasting for core removal is only permitted when approved by the Engineer. Contain and dispose of drilling spoils as directed and in accordance with Section 802. Drilling spoils consist of all materials and fluids removed from pile excavations.

If unstable, caving or sloughing soils are anticipated or encountered, use slurry or temporary steel casings to stabilize holes. When using slurry, submit slurry details including product information and additives, manufacturer's recommendations for use, slurry equipment details and documentation that mixing water is suitable for slurry before beginning drilling. When using temporary casings, use smooth non-corrugated clean watertight steel casings of ample strength to withstand handling and installation stresses and pressures imposed by concrete, earth, backfill and fluids. Use steel casings with an outside diameter equal to the hole size and a wall thickness of at least 1/4 inch.

Pile Excavation

Pile Excavation

Pile Excavation

Pile Excavation vs Pile Driving

- Pile depth is designed for 10’ minimum seat in most circumstances. If rock is apparent at less than 10’ across the width of the cap, pile excavation is to be performed to at least the 10’ drill mark of each pile. Drill depth for piles may be deeper depending on fill height placed above previous ground elevation and the depth of the end bent.
- Contractor may discover actual depth of rock by performing probe test with driving rods, pre-drilling, or by using pile hammer with a lighter stroke than design capacity.
- Once layout of cap and piles is completed, outside piles can be tested for rock depth using one of the methods to discover the rock elevation. If the rock elevations are similar for the outside piles, the depths of the interior piles are likely to be similar also. If the outside piles vary to where the rock depth for one is above 10’ and the other below 10’, then the interior piles need to be tested as well to see what the rock elevation is for those piles.
- If all piles are tested for rock depth and the elevation of the rock varies above and below the 10’ mark going across the cap with different piles, contact your Area Construction Engineer and the Geotech Unit for guidance and have the rock depths/elevations for each pile ready so that they can evaluate it.
- Contractor may opt to drill deeper than the 10’ depth in the event the rock is deeper to avoid having to mobilize a pile hammer.

Drilled Shaft Extensions

When are they needed?

- Rock line is lower than anticipated
- Extend rock socket
- Soil conditions at plan tip elevation are unsuitable
- Not enough bearing at plan tip elevation

Drilled Shaft Extensions

Next Steps

- Contact Area Construction Engineer and Geotech Unit.
- Have details of shaft ready to share (depth, rock socket height, soil/rock conditions, etc.)
- If soil is questionable, pictures of the last spoils to come out of the shaft are helpful for Geotech to examine.

Drilled Shaft Extensions

Once Decision to Extend Shaft is made…

- Typically, three feet of additional vertical reinforcing steel is built into each drilled shaft cage. Make sure to tie the spiral so the 3' extension is at the bottom of the cage (unlike the below picture)

- If the shaft is plan length or your extension is less than 3' you will only need to cut steel to match the new depth of the shaft.

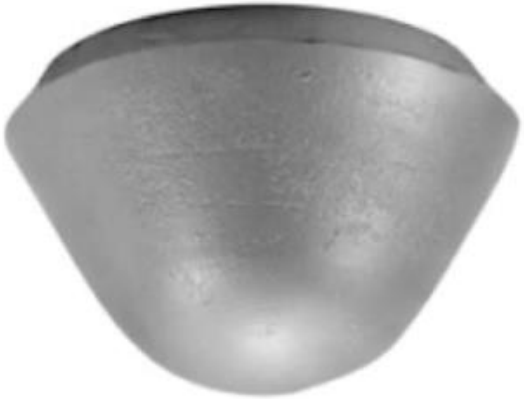
(*See Structure Bulletin Volume 4, Issue 9*)

Drilled Shaft Extensions

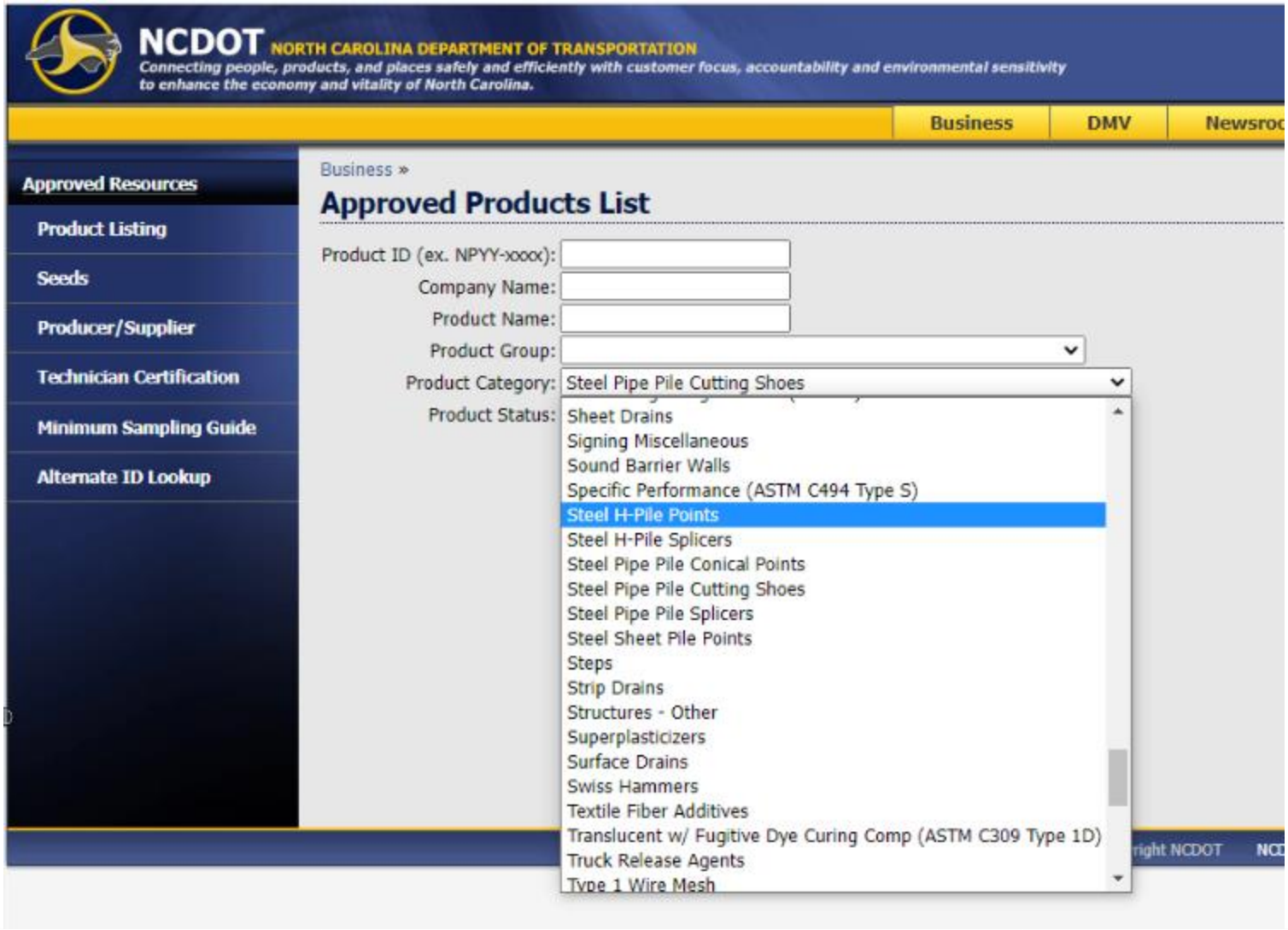
- If extension ends up being greater than 3’, discuss with Area Construction Engineer and Geotech Unit to see if spiral reinforcing steel will also need to be added along with additional vertical reinforcing steel and CSL tube extensions.

- The longer extensions will be case-by-case decisions on what needs to be done.

Steel Pile Accessories

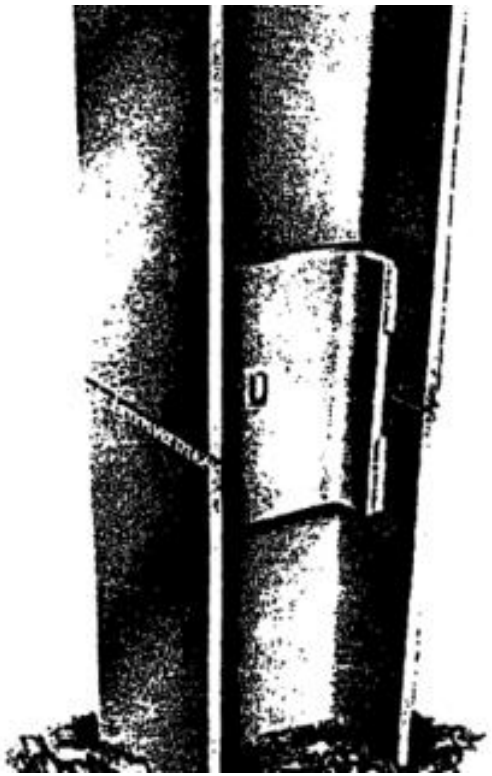


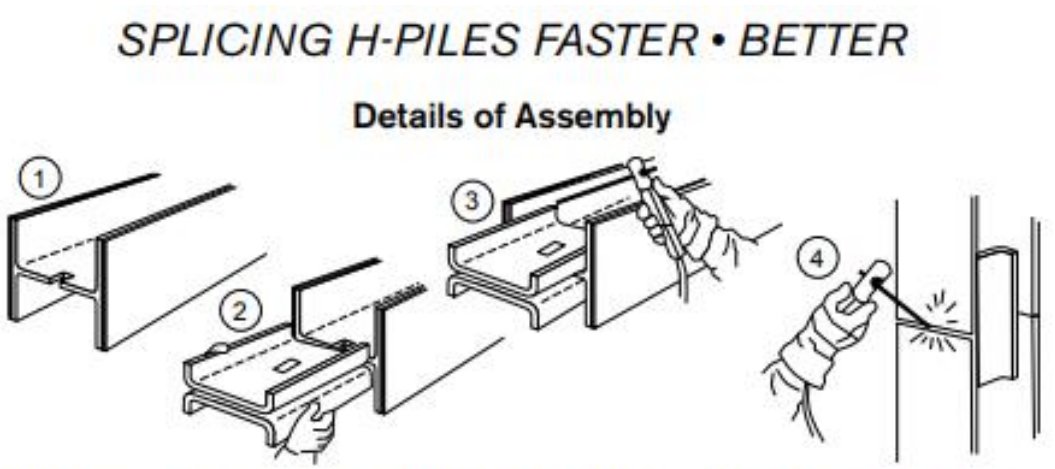
NCDOT Approved Products List



Steel Pile Splicer

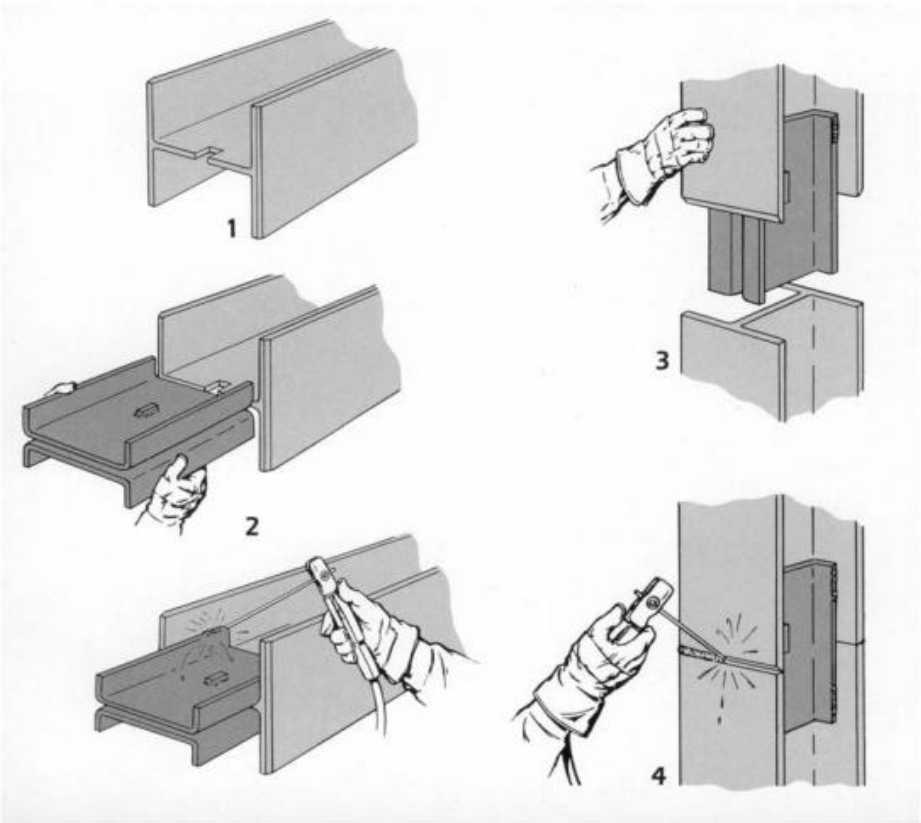
Steel Pile Splicer





1. With pile on the ground, scarf the outside edge of each flange of the H and torch cut a 7/8" x 2-1/8" notch in the web.
2. Set splicer on H to one-half of length. Splicer can be put on the driven length.
3. Make a 5/16" x 2-1/2" fillet weld along each corner. Total of 4.
4. Set length to be added in position. Die-formed tapers provide for quick entry and close positioning. Place partial penetration groove weld along the full width of each flange and 4 fillet welds at each remaining corner. (E70 welding rod recommended.)

Steel Pile Splicer

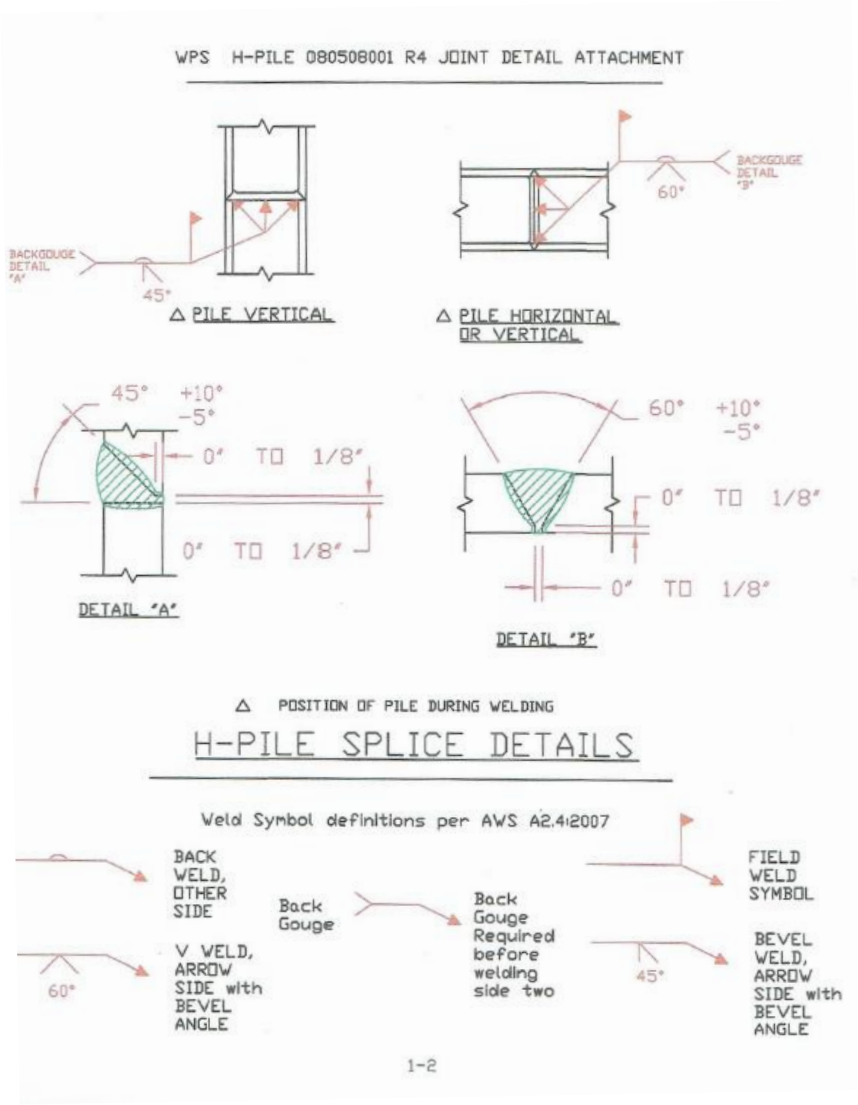


HP 300... EASY TO USE

1. Notch the end of upper length of H-pile (to accommodate the HP 300 spacer bar).
2. Fit the HP 300 splice over notched end of H-pile, and weld corners.
3. Place the upper section into position onto the lower section.
4. To compete the splice, weld along the outside of the flanges and along the lower corners of the splice.

Steel Pile Splicer

NCDOT Approved Welding Procedure



Buildups
20^{th}, 40^{th}, 60^{th} Points

Buildups are used to:

- Grade SIP Forms
- Grade Overhangs
- Grade Screed
- Check Dry Run for Deck Pour

Buildups
20th, 40th, 60th Points

Structure Design Manual – Construction Elevations (updated 2016):

Bottom of slab elevations above the centerline of each girder are used to set the forms for the buildups. Provide bottom of slab elevations for all interior and exterior beams/girders at the following intervals based on span lengths:

- ≤ 100 feet (30.5 m) – 20th points.
- > 100 feet (30.5 m) and ≤ 200 feet (61 m) – 40th points.
- > 200 feet (61 m) – 60th points.

No more than 5' between any buildup

DEAD LOAD DEFLECTION TABLE FOR GIRDERS

DEAD LOAD DEFLECTION TABLE FOR GIRDERS

0.6"Ø CFRP STRANDS	SPAN G																																									
	GIRDERS 1-3																																										
FORTIETH POINTS	0.000	0.025	0.050	0.075	0.100	0.125	0.150	0.175	0.200	0.225	0.250	0.275	0.300	0.325	0.350	0.375	0.400	0.425	0.450	0.475	0.500	0.525	0.550	0.575	0.600	0.625	0.650	0.675	0.700	0.725	0.750	0.775	0.800	0.825	0.850	0.875	0.900	0.925	0.950	0.975	0.000
CAMBER (GIRDER ALONE IN PLACE)	0.000	0.011	0.022	0.033	0.044	0.052	0.060	0.068	0.076	0.082	0.088	0.093	0.099	0.102	0.106	0.109	0.112	0.113	0.114	0.115	0.116	0.115	0.114	0.113	0.112	0.109	0.106	0.102	0.099	0.093	0.088	0.082	0.076	0.068	0.060	0.052	0.044	0.033	0.022	0.011	0.000
*DEFLECTION DUE TO SUPERIMPOSED D.L.	0.000	0.002	0.004	0.005	0.007	0.009	0.011	0.012	0.014	0.015	0.017	0.018	0.019	0.020	0.021	0.022	0.023	0.023	0.023	0.024	0.024	0.024	0.023	0.023	0.023	0.022	0.021	0.020	0.019	0.018	0.017	0.015	0.014	0.012	0.011	0.009	0.007	0.005	0.004	0.002	0.000
FINAL CAMBER	0	1/8"	1/4"	5/16"	7/16"	1/2"	5/8"	11/16"	3/4"	13/16"	7/8"	7/8"	15/16"	1"	1"	1 1/16"	1 1/16"	1 1/16"	1 1/16"	1 1/8"	1 1/8"	1 1/8"	1 1/16"	1 1/16"	1 1/16"	1 1/16"	1"	1"	15/16"	7/8"	7/8"	13/16"	3/4"	11/16"	5/8"	1/2"	7/16"	5/16"	1/4"	1/8"	0
	GIRDER 4																																									
FORTIETH POINTS	0.000	0.025	0.050	0.075	0.100	0.125	0.150	0.175	0.200	0.225	0.250	0.275	0.300	0.325	0.350	0.375	0.400	0.425	0.450	0.475	0.500	0.525	0.550	0.575	0.600	0.625	0.650	0.675	0.700	0.725	0.750	0.775	0.800	0.825	0.850	0.875	0.900	0.925	0.950	0.975	0.000
CAMBER (GIRDER ALONE IN PLACE)	0.000	0.013	0.026	0.038	0.051	0.060	0.068	0.077	0.085	0.091	0.097	0.103	0.109	0.113	0.116	0.119	0.123	0.124	0.125	0.129	0.127	0.126	0.125	0.124	0.123	0.119	0.116	0.113	0.109	0.103	0.097	0.091	0.085	0.077	0.068	0.060	0.051	0.038	0.026	0.013	0.000
*DEFLECTION DUE TO SUPERIMPOSED D.L.	0.000	0.003	0.006	0.009	0.012	0.015	0.018	0.020	0.023	0.026	0.028	0.030	0.033	0.034	0.035	0.037	0038	0.039	0.039	0.040	0.040	0.040	0.039	0.039	0038	0.037	0.035	0.034	0.033	0.030	0.028	0.026	0.023	0.020	0.018	0.015	0.012	0.009	0.006	0.003	0.000
FINAL CAMBER	0	1/8"	1/4"	3/8"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	15/16"	7/8"	15/16"	15/16"	15/16"	1"	1"	1"	1"	1 1/16"	1 1/16"	1 1/16"	1"	1"	1"	1"	15/16"	15/16"	15/16"	7/8"	15/16"	13/16"	3/4"	11/16"	5/8"	9/16"	1/2"	3/8"	1/4"	1/8"	0

CAMBER (GIRDER ALONE IN PLACE) (FT.)	0.000		0.055		0.109		0.160		0.206		0.247		0.282		0.310		0.330		0.343		0.347		0.343		0.330		0.310		0.282		0.247		0.206		0.160		0.109		0.055		0.000
*DEFLECTION DUE TO SUPERIMPOSED D.L. (FT.)	0.000		0.041		0.082		0.120		0.155		0.186		0.212		0.233		0.248		0.258		0.261		0.258		0.248		0.233		0.212		0.186		0.155		0.120		0.082		0.041		0.000
FINAL CAMBER (IN.)	0		3/16"		5/16"		1/2"		5/8"		3/4"		13/16"		15/16"		1"		1"		1 1/16"		1"		1"		15/16"		13/16"		3/4"		5/8"		1/2"		5/16"		3/16"		0.000

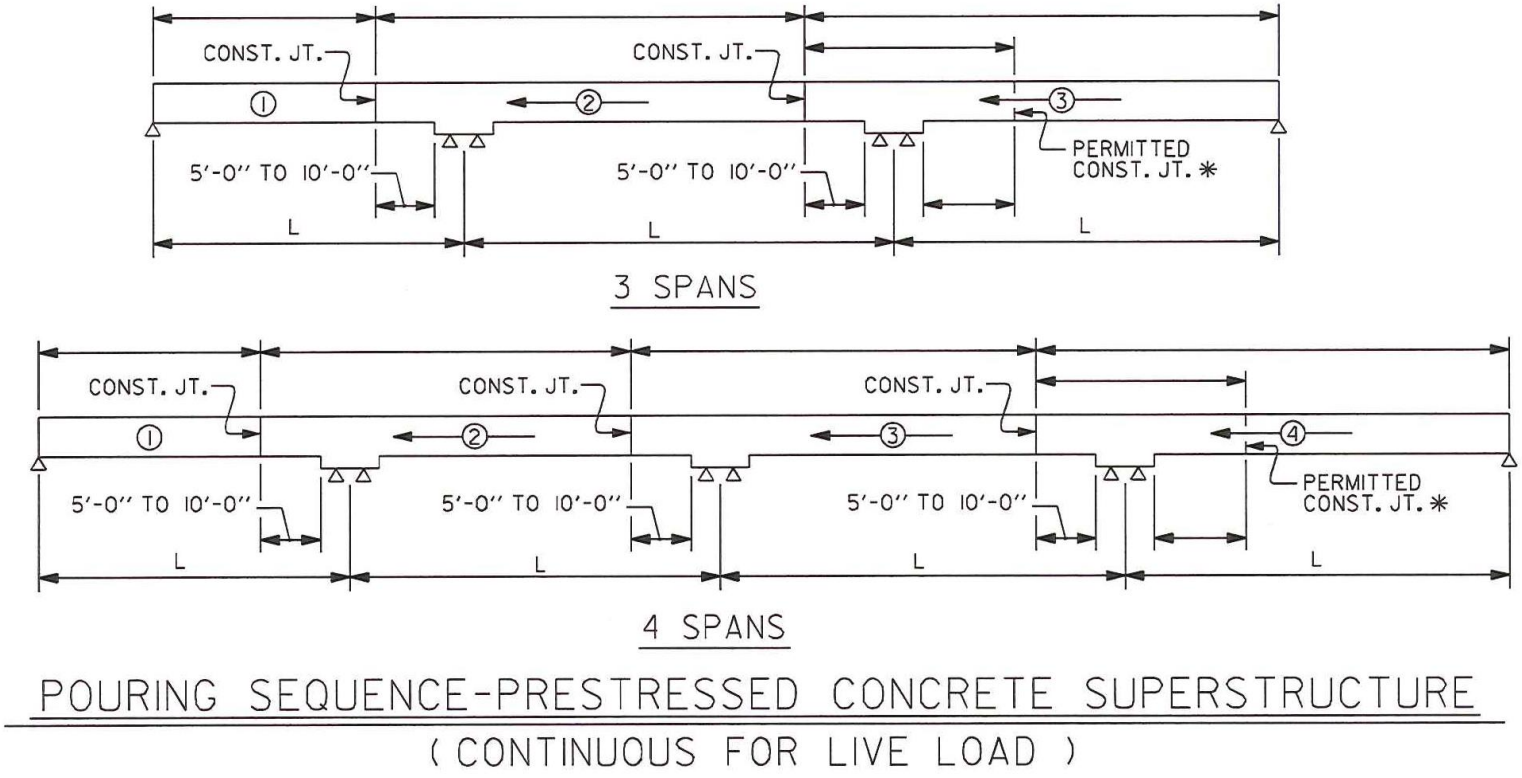
* INCLUDES WEIGHT OF DECK SLAB, BUILD-UPS, DIAPHRAGMS, BARRIERS, AND FUTURE WEARING SURFACE.

Until 2020, the SDM did not require the deflection tables to follow this same guidance

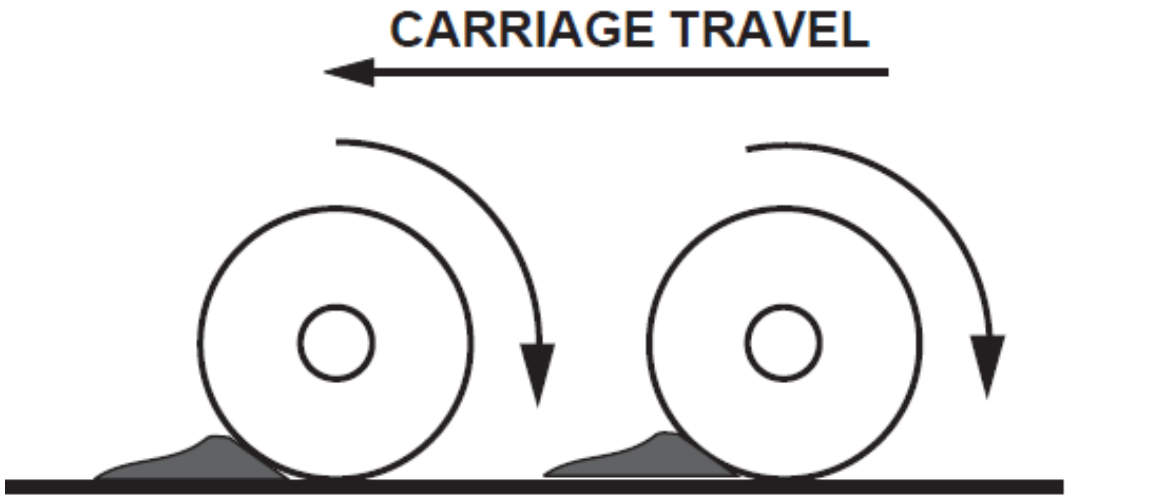
Buildups
20^{th}, 40^{th}, 60^{th} Points

- New plans should have deflection tables match construction elevation intervals
- Existing projects (Depends on span length)
  - Concrete girders – interpolate to calculate deflections
  - Steel girders – Designer may have to provide
  - Discuss with ACE or RBCE if questions
- Formal revisions are not necessary. Spreadsheets are OK.
- Exterior Girders are the most important
  - Affects ride
  - Every buildup on exterior girders should be checked when doing dry runs

Deck Pour Sequences



What is a “finishing pass”?



Screed Setup Rules For Skews
(in order of importance)

1. Finish from leading edge to trailing edge
2. Finish up the superelevation
3. Finish downhill

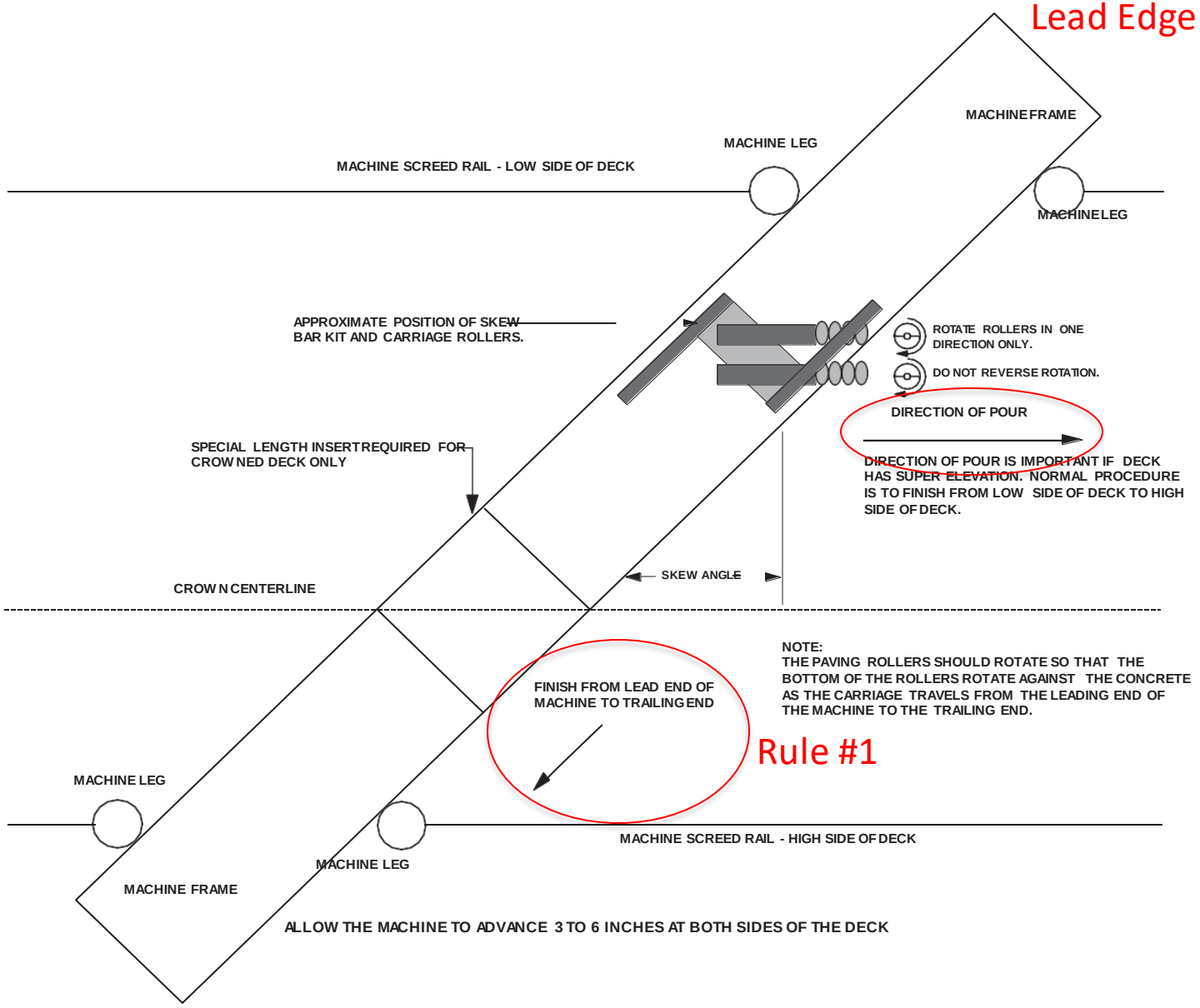


Figure 2 - Paving Skewed decks

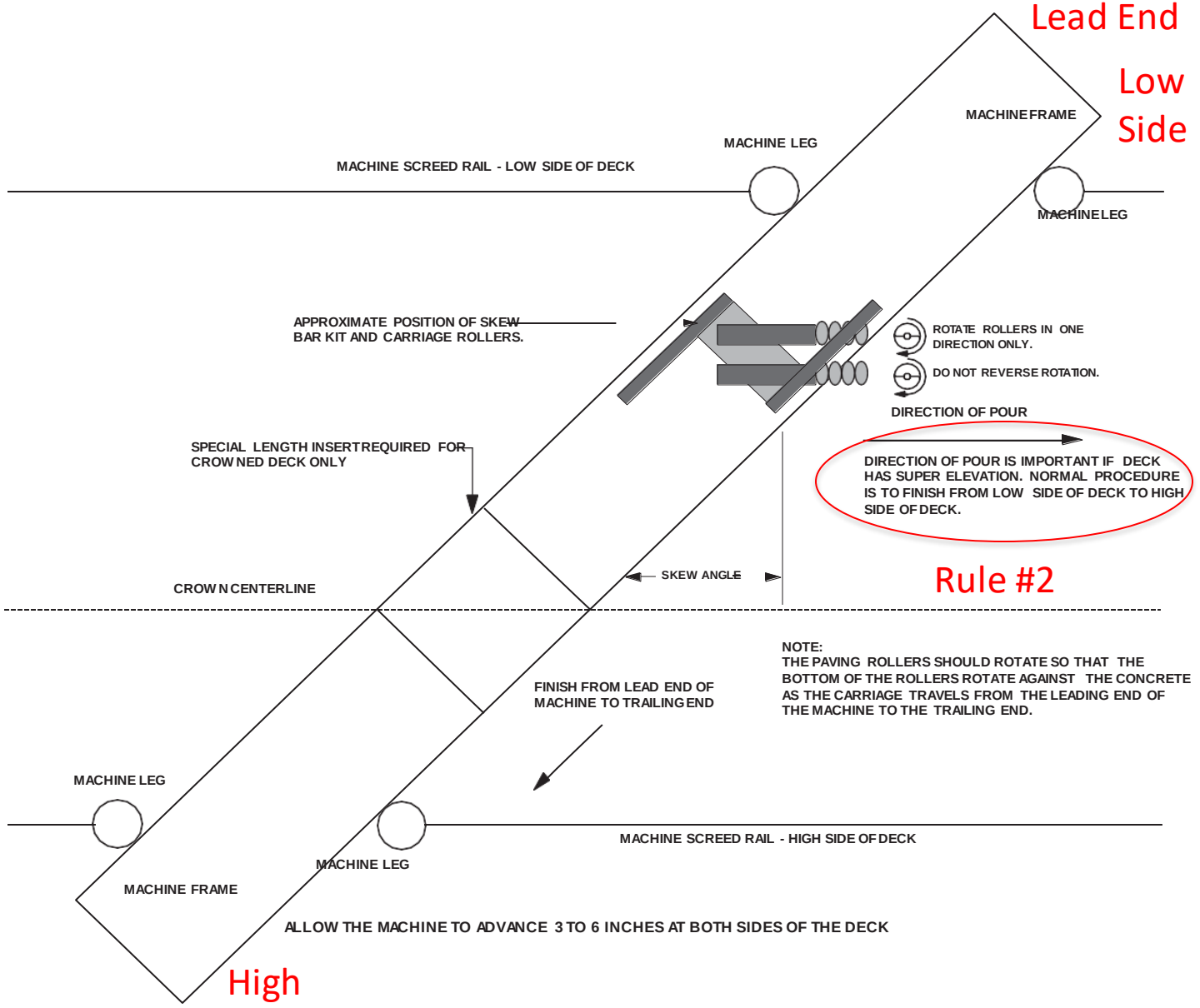
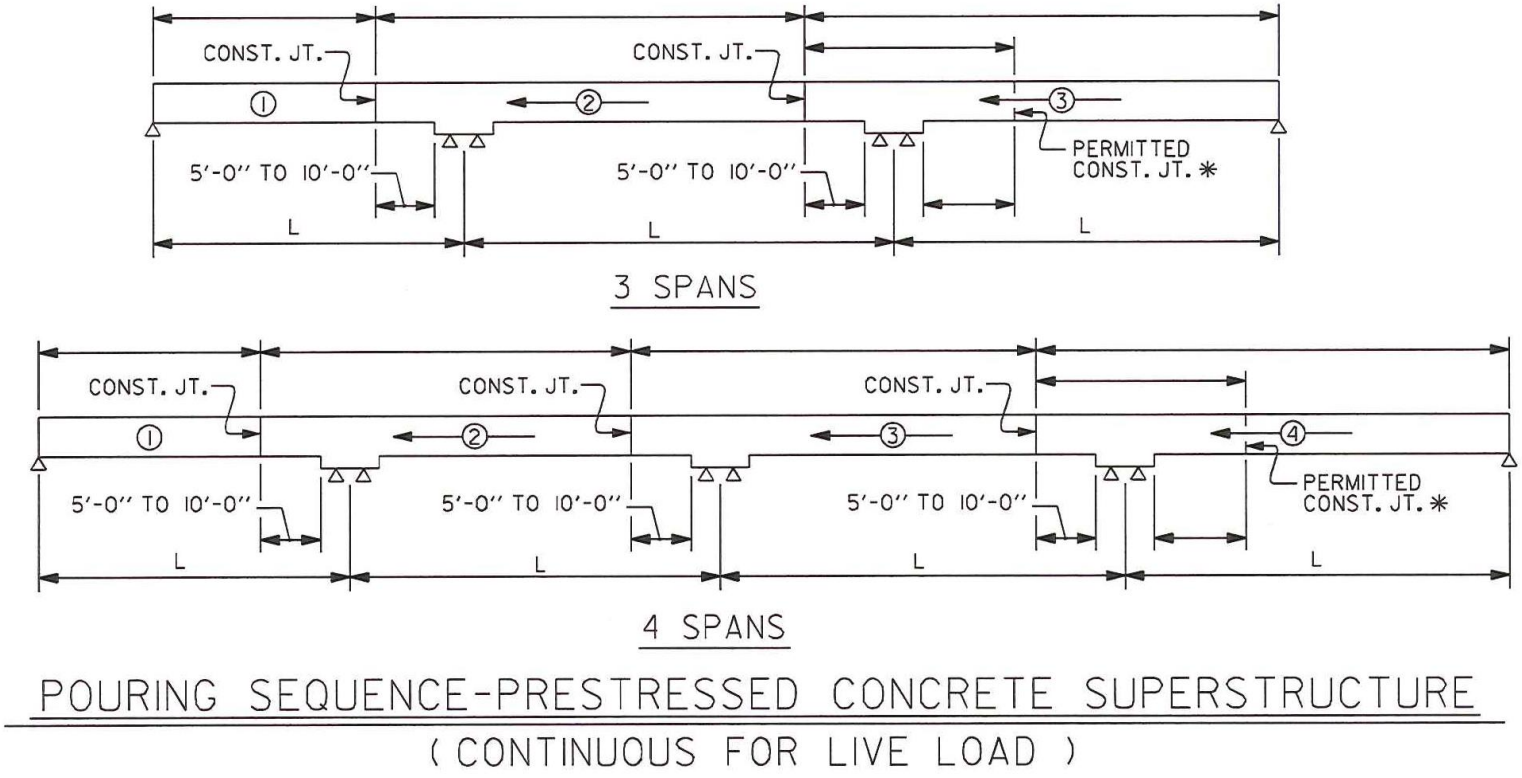
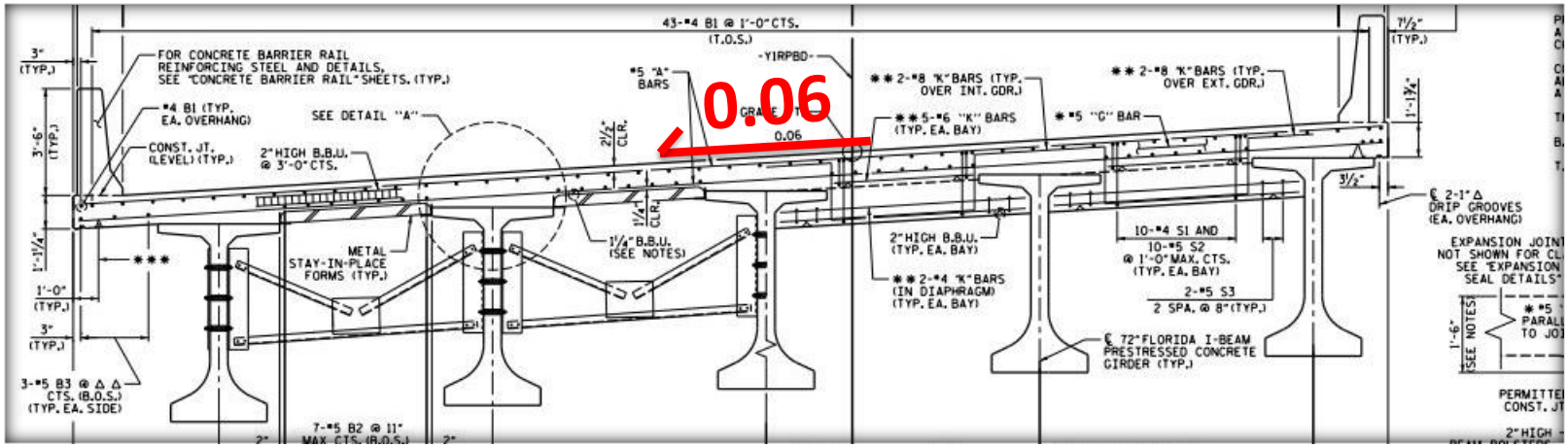


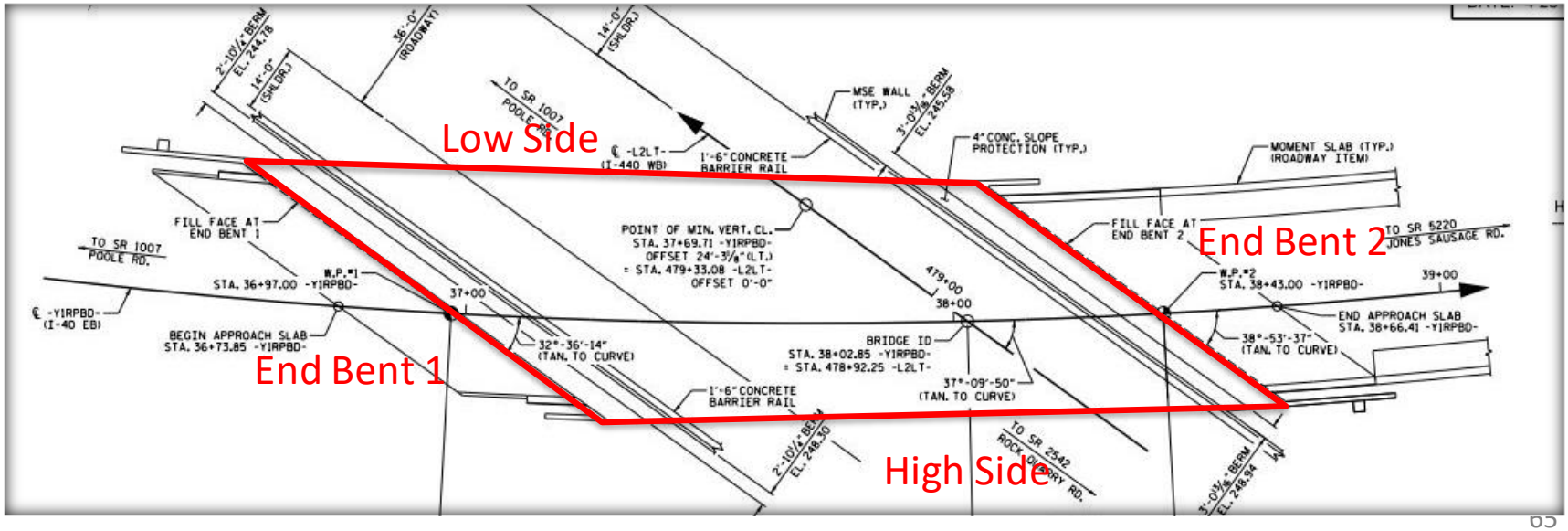
Figure 2 - Paving Skewed decks

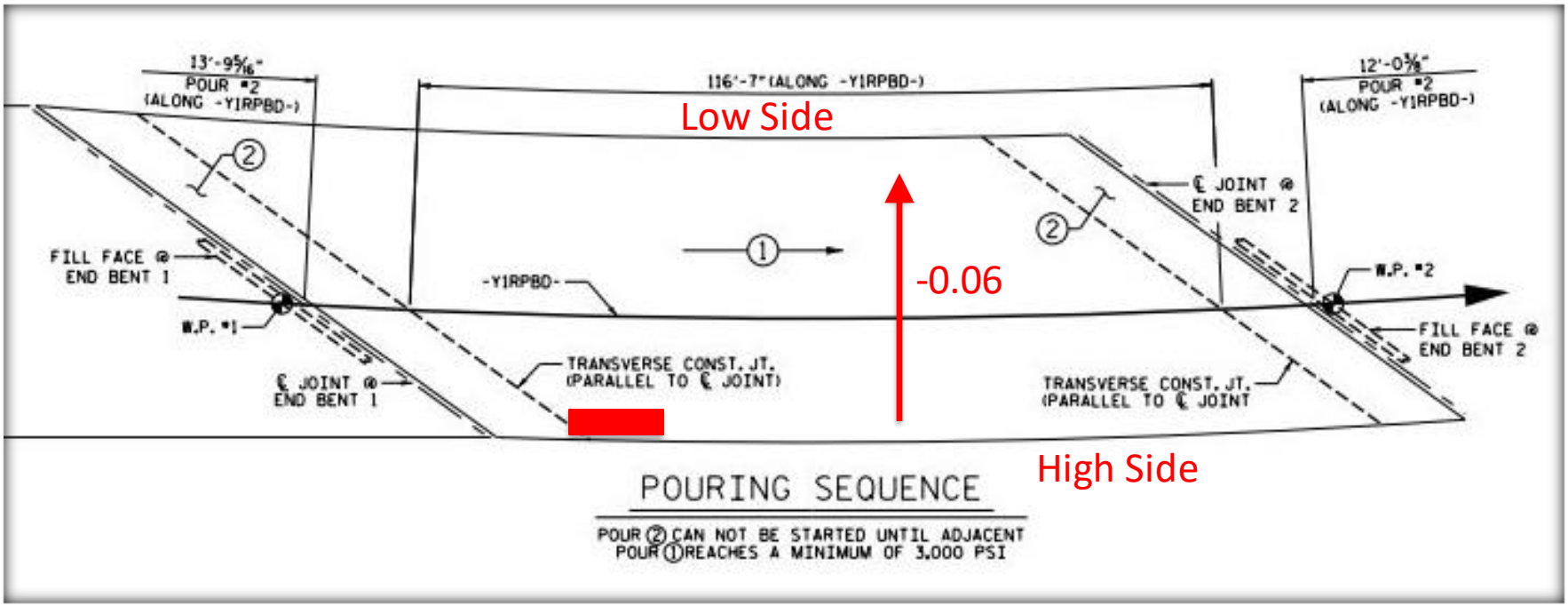
Pour Sequences



Pour Sequence Example



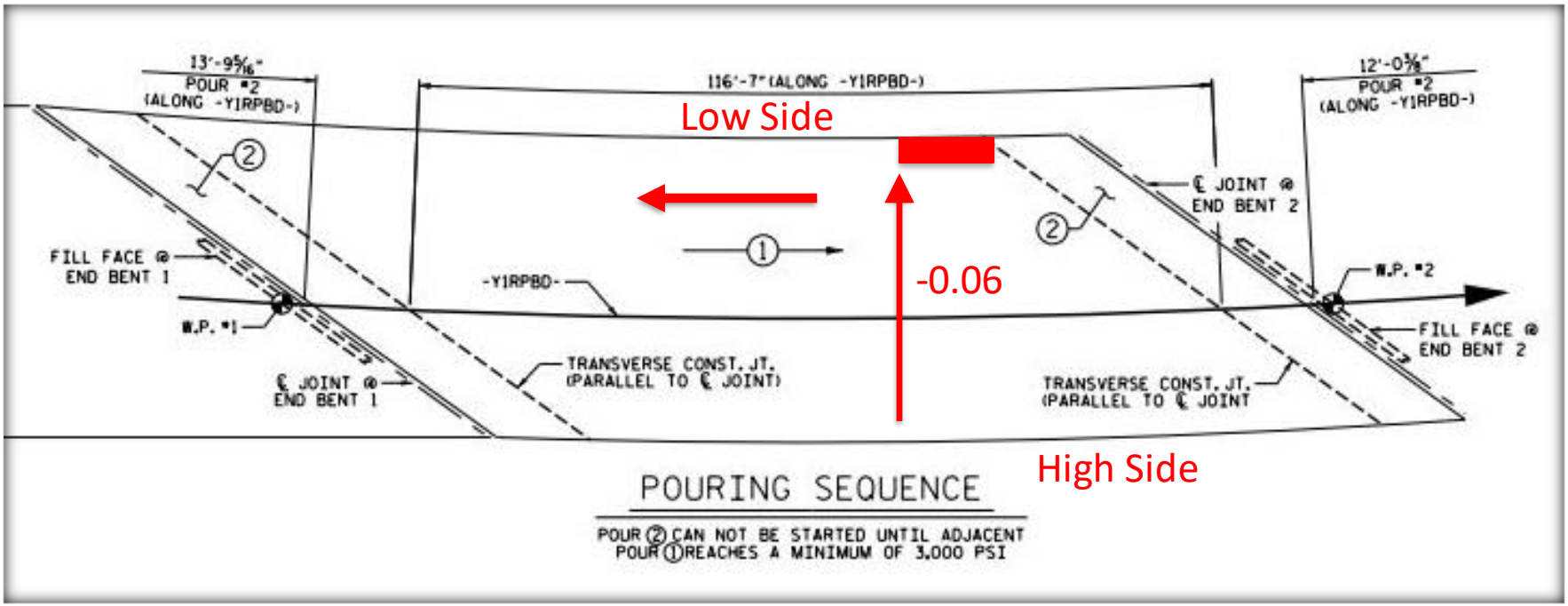




Is the Pour Direction Correct?

1) Finish from leading edge of skew to trailing edge ✓

2) Finish from low side of super to high side ✗



Is the Pour Direction Correct?

1) Finish from leading edge of skew to trailing edge ✓

2) Finish from low side of super to high side ✓

Screed Setup Rules For Skews
(in order of importance)

1. ✓ Finish from leading edge to trailing edge
2. ✓ Finish up the superelevation
3. Finish downhill
   - Change from Past (Design Manual Has Been Updated)
   - Least Important of the 3 Rules

Rip Rap Slope Protection

- Forthcoming special provision or plan note will require top 10’ of Class II rip rap slope protection to have Class B rip rap blended with it.
- Requested by contractors so that workers will have better footing to walk around top of slope protection when going back to do work at, or near, the end bents.
- Rip rap slope protection line item will still be paid by the ton but will also include the Class B line item.

Rip Rap Slope Protection

Structure Bulletins

- NCDOT Structure Bulletins
  - https://connect.ncdot.gov/projects/construction/Construction%20Bulletins/Forms/AllItems.aspx

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Western Regional Bridge Construction Engineer
Vacant

Construction Unit Region And Area Engineers

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Divisions 11 & 12
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Division 9
V. G. Davis, PE (Vickie)
1580 Henderson Grove Church Road
Salisbury, NC 28147
CS# 05-31-01
Cell: 704-202-0945

Division 7
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Kernersville, NC 27284
CS# 02-16-44
Cell: 336-215-9170

Division 5
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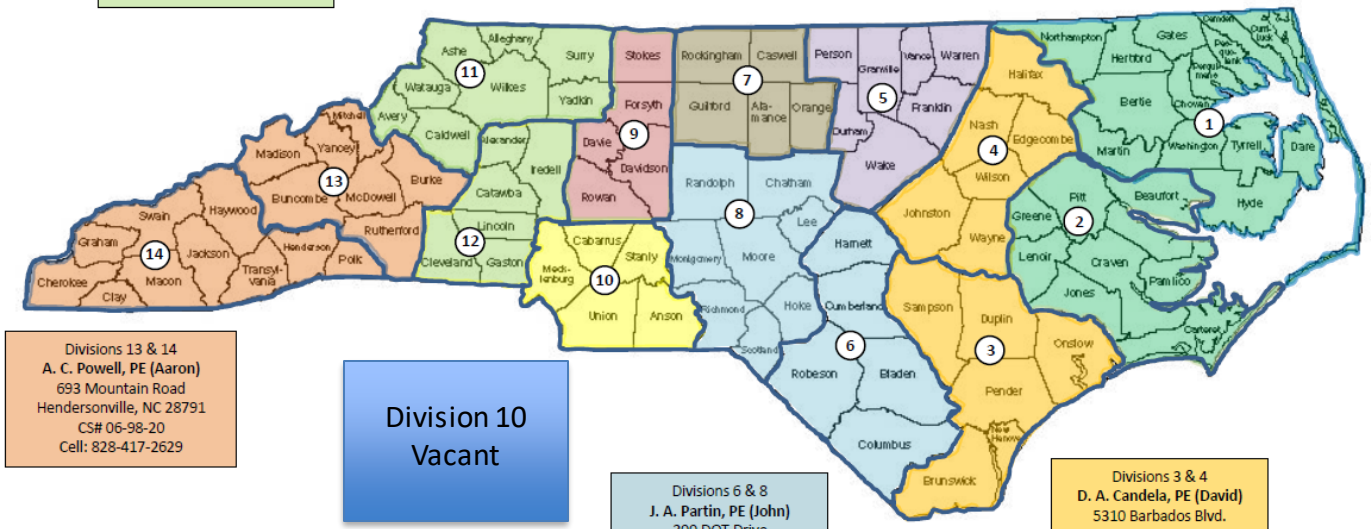
Office: 919-707-2420
Cell: 336-972-4627

Divisions 1 & 2
R. S. Hall, PE (Randy)
209 South Glenburnie Road
New Bern, NC 28560
CS# 16-00-04
Cell: 252-402-9957
Office: 252-514-4759



Divisions 13 & 14
A. C. Powell, PE (Aaron)
693 Mountain Road
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Cell: 828-417-2629

Division 10
Vacant

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Questions?