STANDARD DRAWINGS FOR SPLICED GIRDERS

INTRODUCTION

THESE PLANS ARE INTENDED TO SERVE AS THE BASIS FOR STANDARDIZING THE DESIGN, DETAILING, FABRICATION, AND ERECTION OF PLANT-CAST PRECAST, PRETENSIONED CONCRETE GIRDERS THAT HAVE BEEN SEGMENTED FOR TRANSPORTATION PURPOSES AND ASSEMBLED AT OR NEAR THE PROJECT SITE USING POST-TENSIONING TECHNOLOGY. THE SCOPE OF THIS PHASE OF THE DEVELOPMENT OF SPLICED GIRDER STANDARDS IS LIMITED TO THE SEGMENTATION OF A SINGLE PRISMATIC GIRDER OF A SINGLE SPAN OF A BRIDGE. SEGMENTATION IS ASSUMED TO RESULT IN THREE PIECES OF VARYING LENGTH. ASSEMBLY OF THE SEGMENTS IS ASSUMED TO TAKE PLACE ON THE GROUND AT OR NEAR THE JOB SITE OR, ALTERNATIVELY, ON FALSEWORK IN THE GIRDER'S FINAL POSITION IN THE BRIDGE.

WHILE THESE STANDARDS HAVE BEEN DEVELOPED TO BE APPLICABLE FOR A TYPICAL RANGE OF VARIATION OF PROJECT PARAMETERS, IT SHOULD BE RECOGNIZED THAT THE DESIGN CRITERIA AND THE PARTICULAR GEOMETRY FOR A BRIDGE PROJECT MAY NECESSITATE THAT THE DETAILS CONTAINED HEREIN BE ADAPTED TO CONFORM TO THE SPECIFICS OF THE PROJECT. PROPER ENGINEERING JUDGMENT MUST BE USED IN ALL CASES.

GENERAL NOTES

1. SPECIFICATIONS
   PENNDOT DESIGN MANUAL, PART 4 (DM-4)
   AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 3RD ED. 2004.
   PENNDOT SPECIFICATIONS, PUBLICATION 408/2007.

1.1 DESIGN CRITERIA:

- FOR THE BEAM PRESTRESSING SEGMENT DESIGN, USE APPROPRIATE CONSTRUCTION LOAD OF AASHTO SECTION 5.14.2.3.2 AS THE DESIGN LOAD. THE BEAM SEGMENT DESIGN IS SPECIFIED IN AASHTO SECTION 5.14.13.3.
- DESIGN THE BEAMS AND POST-TENSIONING WITH PENNDOT APPROVED SOFTWARE.
- ~~BEAMS SHALL BE DESIGNED AS SIMPLE SPAN FOR NON-COMPOSITE DEAD LOADS AND CONTINUOUS FOR COMPOSITE DEAD LOADS AND LIVE LOAD. DO NOT DESIGN FOR FULL CONTINUITY WITHOUT THE PRIOR APPROVAL OF THE CHIEF BRIDGE ENGINEER.~~
- THE MAXIMUM RATIO OF THE SPAN LENGTH TO STRUCTURE DEPTH (GIRDER + DECK) SHALL BE 30.

APPROVED METHOD IS TO DESIGN IN ACCORDANCE WITH DM4 5.14.1.2.7eP WHICH STATES:
- A SIMPLE SPAN ANALYSIS FOR NON-COMPOSITE DEAD LOAD AND
- THE MORE CRITICAL OF EITHER A CONTINUOUS SPAN ANALYSIS ASSUMING FULL CONTINUITY, OR A SIMPLE SPAN ANALYSIS ASSUMING COMPLETE LOSS OF CONTINUITY FOR COMPOSITE DEAD LOAD AND LIVE LOAD (WITHOUT CREEP AND SHRINKAGE EFFECTS)

USE OF FULL CONTINUITY DESIGN PER DM4 5.14.1.2.7dP AND DM4 5.14.1.2.7eP MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER AT THE T.S.&L. STAGE.

2. MATERIALS

2.1 CONCRETE

MINIMUM 28-DAY STRENGTH:
GIRDER SEGMENTS: 8.0 KSI
CLOSURE POURS: 8.0 KSI

2.2 REINFORCING STEEL

GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A 615/A 615M-96A, A 996/A 996M OR 706/A 706M-96-B.

MINIMUM LAP AND EMBEDMENT LENGTH OF 30 DIAMETERS OR IN ACCORDANCE WITH AASHTO, AS MODIFIED BY DM-4, WHICHEVER IS GREATER.

2.3 PRESTRESSING STEEL

2.3.1 PRETENSIONING

UNCOATED 7-WIRE LOW-RELAXATION STRANDS MEETING THE REQUIREMENTS OF ASTM A416 GRADE 270, MODULUS OF ELASTICITY 28,000 KSI SHALL BE USED.

2.3.2 POST-TENSIONING

2.3.2.1 GENERAL

UNCOATED 7-WIRE LOW-RELAXATION STRANDS MEETING THE REQUIREMENTS OF ASTM A416 GRADE 270, MODULUS OF ELASTICITY 28,000 KSI SHALL BE USED.
MODULUS OF ELASTICITY: 28,000 KIPS
MAXIMUM JACKING STRESS: 216 KSI (DM-4, TABLE 5.9.3-1)
MAXIMUM ANCHORING STRESS AS ANCHORAGE: 189 KSI
ANCHOR SET: 3/8"
FRICTION COEFFICIENT: 0.25
WOBBLE COEFFICIENT: 0.0002 RAD/FT

2.3.2.2 ACCEPTANCE TESTING OF SPECIAL ANCHORAGE DEVICES.

SPECIAL ANCHORAGE DEVICES SHALL COMPLY WITH THE TESTING REQUIREMENTS OF ARTICLE 10.3.2.3 OF THE AASHTO LRFD CONSTRUCTION SPECIFICATIONS.

2.4 DUCTS

USE CORRUGATED PLASTIC POST-TENSIONING DUCTS WHERE APPLICABLE. CORRUGATED GALVANIZED STEEL DUCTS MUST BE USED WHEN REQUIRED TO MEET AASHTO ALLOWABLE RADIUS LIMITS.

2.4.1 PLASTIC DUCTS

CORRUGATED DUCT MANUFACTURED FROM NON-COLORED, UNFILLED POLYPROPYLENE MEETING THE REQUIREMENTS OF ASTM D4101 "STANDARD SPECIFICATION FOR POLYPROPYLENE PLASTIC INJECTION AND EXTRUSION MATERIALS" WITH A CELL CLASSIFICATION RANGE OF PP0340B14541 TO PP0340B67884 SHALL BE USED. THE DUCT SHALL BE WHITE IN COLOR CONTAINING ANTIOXIDANT(S) WITH A MINIMUM OXIDATION INDUCTION TIME (OIT) ACCORDING TO ASTM D 3895 OF 20 MINUTES AND CONTAINING A NON-YELLOWING LIGHT STABILIZER. THE MAXIMUM DIAMETER OF THE DUCT SHALL BE 3 ¼" WITH A WALL THICKNESS OF 0.10". THE AREA OF THE DUCT SHALL BE AT LEAST TWICE THE NET AREA OF THE PRESTRESSING STEEL IN THE DUCT.

CARE SHALL BE USED IN HANDLING AND INSTALLING DUCTS DURING THE FABRICATION PROCESS. DUCT ENDS SHALL BE CAPPED DURING CONCRETING OPERATIONS AND DURING SHIPPING TO PROTECT AGAINST INFILTRATION OF FOREIGN MATTER. DUCTS SHALL BE PROTECTED FROM DAMAGE AND SHIELDED FROM PROLONGED EXPOSURE TO SUNLIGHT DURING STORAGE, SHIPPING, AND DURING THE SEGMENT ASSEMBLY PROCESS.

2.4.2 METAL DUCTS

METAL DUCTS SHALL BE CORRUGATED GRADE 60 GALVANIZED IN CONFORMANCE WITH ASTM A653. DUCT WALLS SHALL HAVE A MINIMUM THICKNESS OF 24 GAUGE.

2.5 GROUT

ONLY GROUTS LISTED IN PENNDOT BULLETIN 15, APPROVED CONSTRUCTION MATERIALS SHALL BE USED.

3. DESIGN

3.1 GIRDER SHAPE AND SIZE

PENNDOT BULB TEE GIRDERS SERVE AS THE BASIS FOR THESE STANDARDS. PENNDOT GIRDER TYPE 33/95.5 WAS USED TO DEVELOP THE DRAWINGS AND DETAILS CONTAINED HEREIN. HOWEVER, THESE DETAILS ARE GENERALLY APPLICABLE TO SHORTER MEMBERS OF THIS GIRDER FAMILY WITH AN 8' OR THICKER WEB AND WITH BULB AND FLANGE GEOMETRIES THAT CAN ACCOMMODATE THE REQUIRED REINFORCEMENT.

3.2 SEGMENT DESIGN

GIRDER SEGMENTS SHALL BE DESIGNED TO RESIST BEAM SELF-WEIGHT PLUS HANDLING AND CONSTRUCTION LOADS AS PER THE SPECIFICATIONS. PRETENSIONING IS ASSUMED TO BE THE PRIMARY FLEXURAL REINFORCEMENT FOR THE SEGMENTS. STRAND PATTERN PROFILES SHALL BE STRAIGHT.

3.3 ASSEMBLED GIRDER

PRIMARY FLEXURAL REINFORCEMENT RESISTING LOADS APPLIED TO THE GIRDER IN ITS FINAL CONFIGURATION IS ASSUMED TO BE POST-TENSIONING. DETAILS AND DUCT LAYOUTS SHOWN IN THESE STANDARDS ARE PRESENTED AS TYPICAL. THE ACTUAL NUMBER, SIZE, AND LAYOUT OF TENDONS ARE PROJECT-SPECIFIC. MINIMUM DUCT SPACING SHALL BE 5", THE OUTER DUCT DIAMETER PLUS 1.5 TIMES MAXIMUM AGGREGATE SIZE, OR THE OUTER DUCT DIAMETER PLUS 2", WHICHEVER IS GREATER. SIZE AND SPACING OF NON-PRESTRESSED REINFORCEMENT SHALL BE AS PER PROJECT REQUIREMENTS.

CONSTRUCTION AND WIND LOADS AND ALL OTHER LOADS THAT ACT ON THE GIRDERS THAT MAY CAUSE LATERAL-TORSIONAL INSTABILITY SHALL BE CONSIDERED IN THE DESIGN OF THE GIRDER AND THE DESIGN OF THE CONSTRUCTION AND ERECTION SCHEMES.

TEMPORARY PRESTRESSING MAY BE NECESSARY FOR THE HANDLING AND ERECTING OF GIRDERS (SEE SHEET 5).

3.4 ANCHORAGE ZONES

LOCAL ZONE REINFORCEMENT SHALL BE DESIGNED BY THE POST-TENSIONING SYSTEM SUPPLIER. GENERAL ZONE REINFORCEMENT SHALL BE DESIGNED BY THE ENGINEER.

4. SEGMENT FABRICATION

4.1 FABRICATION TOLERANCES - SEE PUBLICATION 408, SECTION 1107

4.2 FORMING

METAL SIDE FORMS SHALL BE USED FOR SEGMENT FABRICATION. CARE SHALL BE TAKEN TO ENSURE THAT SEGMENT ENDS AND ALL EXTENDED STRANDS, REINFORCEMENT, AND DUCTS MATCH TO THE CORRESPONDING ENDS OF ADJACENT SEGMENTS.

4.3 DUCTS

MAXIMUM SPACING OF SUPPORT BARS FOR THE POST-TENSIONING DUCTS SHALL BE 2'-0". DUCTS SHALL BE AIR-TESTED PRIOR TO CONCRETE PLACEMENT. UPON COMPLETION OF CONCRETE PLACEMENT, POST-TENSIONING DUCTS SHALL BE DEMONSTRATED TO BE FREE AND CLEAR OF ANY OBSTRUCTIONS OR DAMAGE AND ARE ABLE TO ACCEPT THE INTENDED POST-TENSIONING TENDONS BY PASSING A TORPEDO THROUGH THE DUCTS. TORPEDO HAVING THE SAME CROSS-SECTIONAL SHAPE AS THE DUCT AND BE ¼" SMALLER ALL AROUND THAN THE CLEAR, NOMINAL INSIDE DIMENSIONS OF THE DUCT.

4.4 PRETENSIONING

GIRDER LENGTHS SHALL BE INCREASED AS NECESSARY TO COMPENSATE FOR SHORTENING DUE TO PRETENSIONING AND POST-TENSIONING AND SHRINKAGE.

EXCEPT FOR EXTENDED STRANDS AS SHOWN, CUT ALL REMAINING STRANDS 1" BELOW SURFACE OF GIRDER END AND PAINT WITH AN APPROVED EPOXY RESIN.

4.5 SURFACE TREATMENTS

4.5.1. TOP OF GIRDER

THE TOP SURFACE OF THE GIRDER FLANGE SHALL RECEIVE A RAKED FINISH TO ¼" AMPLITUDE.

4.5.2 SEGMENT ENDS

SEGMENT ENDS OF CLOSURE POURS SHALL HAVE A ~~SHEAR KEY~~ SAWTOOTH FIGURATION AS DETAILED ON SHEET 2 & 5.

5. SEGMENT ASSEMBLY

5.1 SEGMENT HANDLING

SEGMENTS SHALL ONLY BE HANDLED, HAULED, AND STORED IN AN UPRIGHT POSITION. ONLY LIFTING LOOPS OR DEVICES PROVIDED AT ENDS SHALL BE USED TO HANDLE THE SEGMENTS.

5.2 SEGMENT ALIGNMENT

SEGMENTS SHALL BE SET ON TIMBER SUPPORTS, FOUNDED ON LEVEL GROUND CAPABLE OF SAFELY SUPPORTING THE REQUIRED BEARING PRESSURES. CARE SHALL BE TAKEN TO ENSURE PROPER ALIGNMENT OF SEGMENTS. ALIGNMENT TOLERANCES SHALL BE AS FOLLOWS:

VERTICAL: 1/8"
HORIZONTAL: 1/8"
TRANSVERSE: 1/8"

5.3 CLOSURE POUR

ALIGNMENT OF GIRDER SEGMENTS SHALL BE CHECKED IMMEDIATELY PRIOR TO PLACEMENT OF CLOSURE POUR CONCRETE.

5.4 POST-TENSIONING

GIRDERS SHALL NOT BE STRESSED UNTIL THE GIRDER AND CLOSURE POUR MEET THEIR DESIGN STRENGTHS.

CONDUCT POST TENSIONING OPERATIONS IN ACCORDANCE WITH PUBLICATION 408, SECTION 1108.

5.5 GROUTING

GROUTING OPERATION SHALL BE COMMENCED PROMPTLY AFTER COMPLETION OF POST-TENSIONING OPERATION.

5.6 ANCHORAGE PROTECTION

PERMANENT GROUT END CAPS SHALL BE INSTALLED AND GROUTED IN ACCORDANCE WITH POST-TENSIONING SUPPLIER'S RECOMMENDATIONS. ANCHORAGE RECESSES IN END GIRDER END SEGMENTS SHALL BE FILLED WITH EPOXY-MODIFIED MORTAR.

UPON COMPLETION AND INSPECTION OF GROUTING OPERATION, ANCHORAGE BLOCK-OUTS SHALL BE FILLED WITH EXPOXY-MODIFIED GROUT.

6. HANDLING & ERECTION OF ASSEMBLED GIRDER

STABILITY OF GIRDERS IS TO BE MAINTAINED BY THE CONTRACTOR DURING ERECTION, UNTIL ALL GIRDERS AND DIAPHRAGMS ARE IN PLACE. ERECTION LOADS INCLUDING SELF WEIGHT OF THE GIRDERS, WIND LOADING AND CONSTRUCTION LIVE LOAD EFFECTS ARE TO BE EVALUATED BY THE CONTRACTOR FOR STABILITY, STRESSES AND DEFLECTIONS ON THE GIRDERS DURING ANY STAGE OF ERECTION.

LIFTING MEANS AND HARDWARE SHALL BE DESIGNED BY THE CONTRACTOR AND SHALL BE INCLUDED IN THE SHOP DRAWINGS. EXTREME CAUTION SHALL BE EXERCISED IN ALL LIFTING, HANDLING, AND PLACING OPERATIONS OF GIRDERS. ADEQUATE BRACING SHALL BE USED TO ENSURE STABILITY AT ALL TIMES AGAINST TIPPING, LATERAL DEFLECTION, AND LATERAL BUCKLING. CONSTRUCTION LOADS AND WIND LOADS AND ALL OTHER LOADS THAT ACT ON THE GIRDERS TO CAUSE VERTICAL AND LATERAL INSTABILITY SHALL BE CONSIDERED IN THE DESIGN OF THE ERECTION SCHEME. CAUTION SHOULD BE EXERCISED WHEN SETTING GIRDERS ON BEARINGS TO ENSURE THAT GIRDER SWEEP IS NOT AMPLIFIED BY INADEQUATE ROTATIONAL RESISTANCE OF BEARINGS. TRANSVERSE BRACING SHOULD BE SECURELY INSTALLED BETWEEN GIRDERS PRIOR TO REMOVAL OF CRANE LOAD FROM GIRDER ENDS. ADDITIONAL INTERMEDIATE CROSS BRACING SHOULD BE INSTALLED ONCE THE GIRDER ENDS ARE SECURE.

INDEX OF DRAWINGS	
SHEET NO.	TITLE
1	OVERVIEW
2	GIRDER DIMENSIONS
3	PRESTRESSING – END SEGMENT
4	PRESTRESSING – MID SEGMENT
5	PRESTRESSING – MISCELLANEOUS
6	END SEGMENT REINFORCEMENT
7	MID SEGMENT REINFORCEMENT
8	SEGMENT ASSEMBLY – GROUND
9	ERECTION SCHEME – FALSEWORK
10	GROUT SPECIFICATIONS
11	GROUT SPECIFICATIONS
12	GROUT SPECIFICATIONS

PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
RECOMMENDED
Thomas P Macioce
CHIEF BRIDGE ENGINEER

DEC. 21 2010

CORRECTIONS MADE BY BRIDGE QUALITY ASSURANCE DIVISION ON 12-10-2010

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L. ERIKSSON ENGINEER PE 057230
08-31-10

PENNDOT DRAWING 09-601-BQAD

MARK	DESCRIPTION	BY	CHK'D	RECM'D	DATE
REVISIONS					

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)
Eriksson technologies
813.989.3317
TAMPA, FL
LRFD.COM

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

DATE: 08/31/10
SCALE: N/A
DWN: CWS | CK'D: RLE
JOB NO:

SPLICED PRESTRESSED
CONCRETE GIRDER STANDARDS

OVERVIEW OF SYSTEM, INSTRUCTIONS
& GENERAL NOTES

SHEET NO: 1

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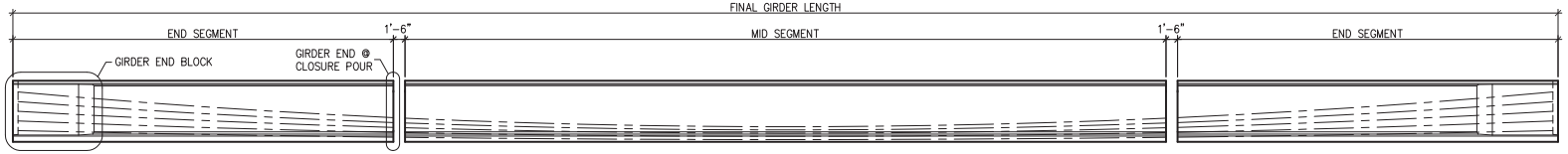
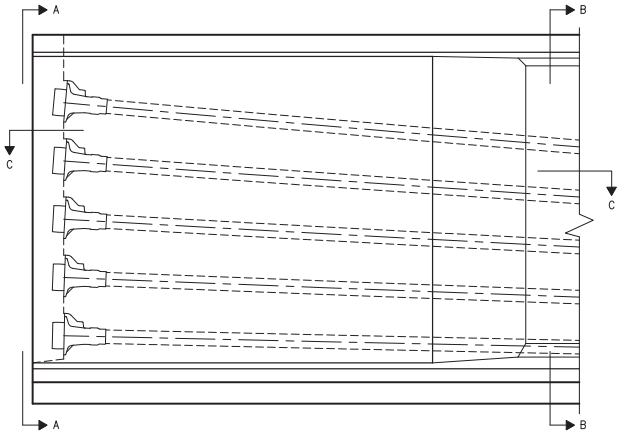


TYPICAL GIRDER ELEVATION

SCALE: 1/16"=1'-0"



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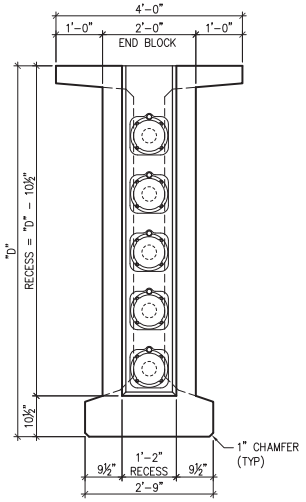
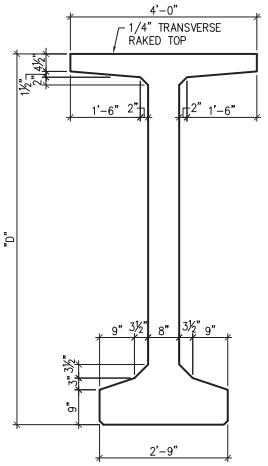
GIRDER END BLOCK

SCALE: 3/8"=1'-0"



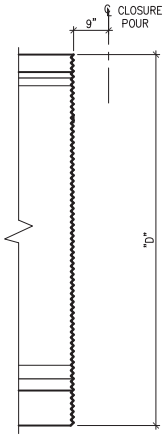
VIEW A-A

SCALE: 3/8"=1'-0"



TYPICAL SECTION SECTION B-B

SCALE: 3/8"=1'-0"



GIRDER END @ CLOSURE POUR

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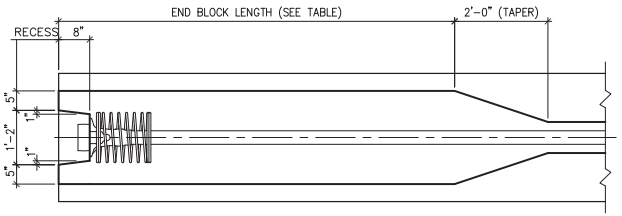

(REINFORCING NOT SHOWN FOR CLARITY)

END BLOCK SECTION C-C

SCALE: 3/8"=1'-0"

END BLOCK DIMENSIONS		
GIRDER DEPTH	END BLOCK LENGTH	TAPER LENGTH
95.5	8'-6"	2'-0"
87.5	8'-0"	2'-0"
79.5	7'-0"	2'-0"
71.5	6'-6"	2'-0"
63.5	6'-0"	2'-0"
55.5	6'-0"	2'-0"

PA SPLICED BULB-TEE GIRDERS						
TYPE	DEPTH "D" in	AREA in^2	I_{xx} in^4	y_b in	I_{yy} in^4	WT. klf
BT95.5	95.5	1266	1,521,445	46.02	80,687	1.319
BT87.5	87.5	1202	1,222,412	42.15	80,345	1.252
BT79.5	79.5	1138	961,802	38.30	80,004	1.185
BT71.5	71.5	1074	737,558	34.47	79,663	1.119
BT63.5	63.5	1010	547,622	30.66	79,321	1.052
BT55.5	55.5	946	389,933	26.88	78,980	0.985

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PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA PROFESSIONAL ENGINEER ROY L ERIKSSON PENNSYLVANIA

08-31-10

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COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
GIRDER DIMENSIONS		SHEET NO: 2

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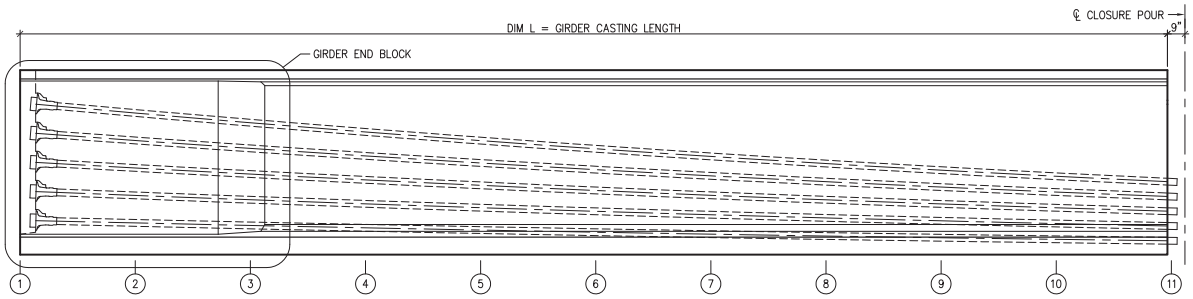
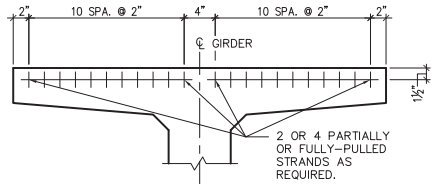


ELEVATION
SCALE: 3/16"=1'-0"

POST-TENSIONING GEOMETRY - END SEGMENT											
POINT	1	2	3	4	5	6	7	8	9	10	11
DISTANCE FROM END (ft)											
TENDON	TENDON HEIGHT (in)										
1											
2											
3											
4											
5											



ALLOWABLE FLANGE STRAND LOCATIONS
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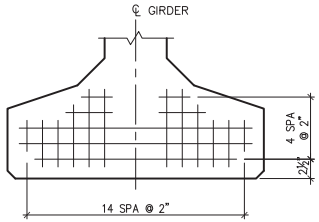
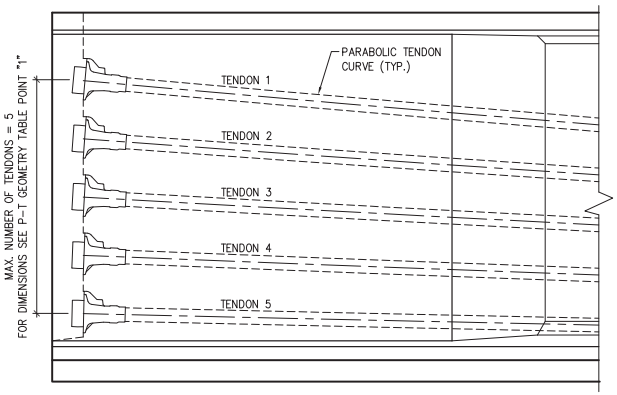


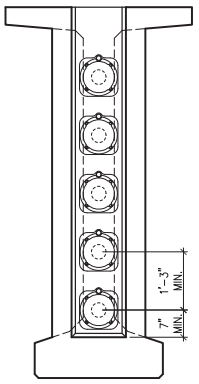
STRAND PATTERN
SCALE: 3/4"=1'-0"

NOTES:

1. POST-TENSIONING WORK SHALL BE IN ACCORDANCE WITH PENNDOT SPECIFICATIONS, PUBLICATION 408/2007, SECTION 1108 -POST-TENSIONING OPERATIONS.
2. TENDON HEIGHTS ARE MEASURED FROM BOTTOM OF FORM TO CENTERLINE OF DUCT.
3. ALL POST-TENSIONING COMPONENTS SHALL BE PENNDOT APPROVED.
4. DUCT COUPLINGS SHALL BE POSITIVELY SEALED TO PROHIBIT THE INTRUSION OF CEMENTITIOUS MATERIAL INTO THE DUCTS.
5. ANCHOR CASTING GROUT OUTLET SHALL BE POSITIONED AT HIGH POINT OF INSTALLED CASTING.



(SPIRALS NOT SHOWN FOR CLARITY)
GIRDER END BLOCK
SCALE: 3/8"=1'-0"



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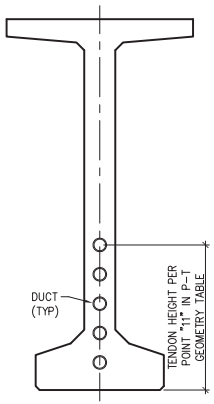

DUCTS @ LOW POINT
SCALE: 3/8"=1'-0"

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COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER PE 047230 PENNSYLVANIA
08-31-10

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COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
PRESTRESSING - END SEGMENT		SHEET NO: 3

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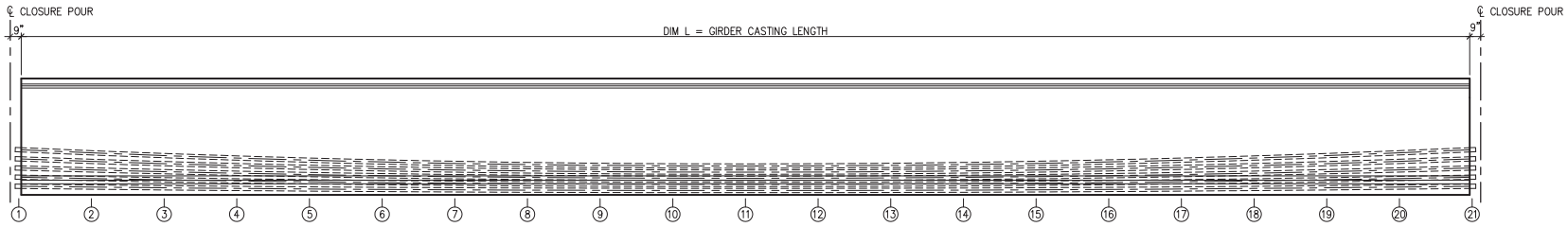
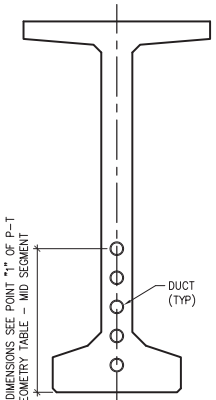
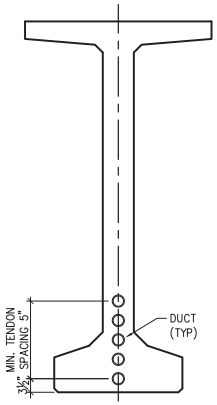


ELEVATION
SCALE: 1/8"=1'-0"

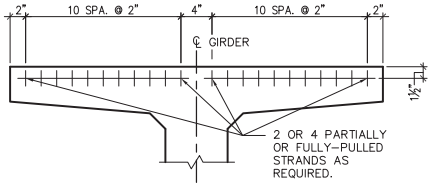
POST-TENSIONING GEOMETRY - MID SEGMENT																					
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
DISTANCE FROM END (ft)																					
TENDON	TENDON HEIGHT (in)																				
1																					
2																					
3																					
4																					
5																					



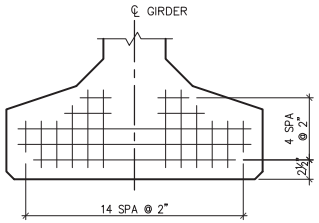
DUCTS @ GIRDER ENDS
SCALE: 3/8"=1'-0"



DUCTS @ GIRDER MID-POINT
SCALE: 3/8"=1'-0"



ALLOWABLE FLANGE STRAND LOCATIONS
SCALE: 3/4"=1'-0"



STRAND PATTERN
SCALE: 3/4"=1'-0"

NOTES:

1. PRETENSIONING STRANDS:
ASTM A416, GRADE 270, LOW-RELAXATION
MODULUS OF ELASTICITY: 28,000 KSI

DEC. 21 2010

PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER PE 097230 PENNSYLVANIA

08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
PRETRESSING - MID SEGMENT		SHEET NO: 4

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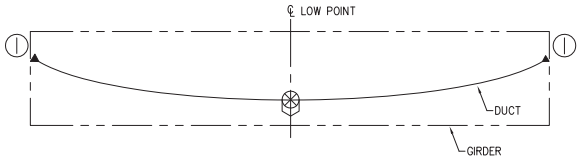
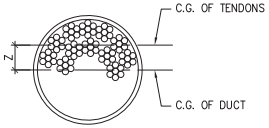


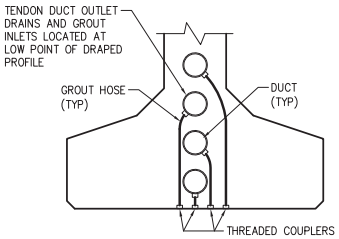
GROUT VENT PLACEMENT DIAGRAM
NOT TO SCALE

LEGEND	
①	GROUT OUTLET
⊗	GROUT INLET/DRAIN

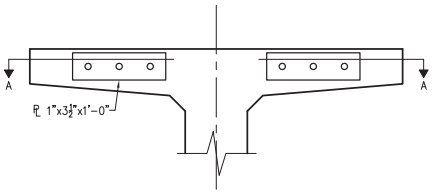


TENDON	DUCT I.D. (IN)	Z (IN)
7 – 0.6 STRANDS	2.32	0.36
12 – 0.6 STRANDS	3.00	0.48

TENDON ECCENTRICITY
NOT TO SCALE

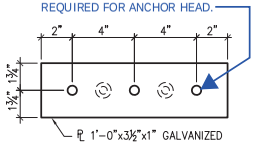


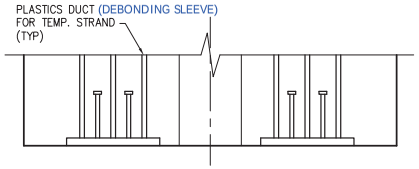
GROUT VENT PLACEMENT DIAGRAM
SCALE: 3/4"=1'-0"



TEMPORARY TOP STRANDS
SCALE: 3/4"=1'-0"

HOLE DIAMETER AS REQUIRED BASED ON DIAMETER OF PLASTIC DUCT AND STRAND ANCHOR HEAD. SEAL PLASTIC DUCT TO ANCHOR PLATE AND COUNTER SINK HOLE AS REQUIRED FOR ANCHOR HEAD.





SECTION A–A
SCALE: 3/4"=1'-0"

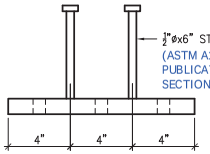
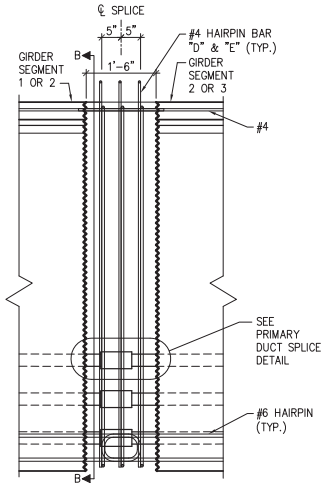


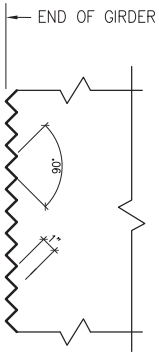
PLATE DETAIL
SCALE:1-1/2"=1'-0"

NOTE: TEMPORARY TOP STRANDS SHALL NOT BE REMOVED UNTIL GIRDER HAS BEEN SET IN ITS FINAL LOCATION IN THE BRIDGE AND HAS BEEN ADEQUATELY BRACED. CHUCKS FOR TEMPORARY STRANDS MAY BE REMOVED USING AN ACETYLENE TORCH, EXERCISING EXTREME SAFETY PRECAUTIONS. AFTER DETENSIONING TOP TEMPORARY STRANDS, DUCTS SHALL BE SEALED AT EACH END WITH APPROVED CAULKING. USE A CAULK LISTED IN BULLETIN 15, SECTION 705.8(b).

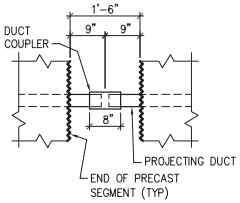


(BEAM REINFORCEMENT NOT SHOWN FOR CLARITY)

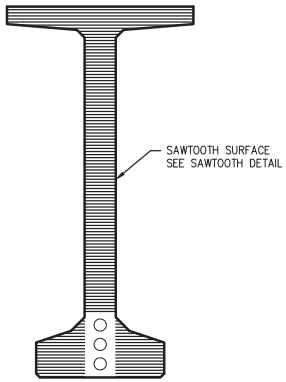
DUCT SPLICE @ CLOSURE POUR
SCALE: 3/8"=1'-0"



SAWTOOTH DETAIL
SCALE: 1 1/2"=1'-0"



DUCT SPLICE DETAIL
SCALE: 3/8"=1'-0"



VIEW B–B
SCALE: 3/8" = 1'-0"

CORRECTIONS MADE BY BRIDGE QUALITY ASSURANCE DIVISION ON 12-10-2010

DEC. 21 2010 PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER PE 097230

08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 11/16/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
PRESTRESSING – MISCELLANEOUS		SHEET NO: 5

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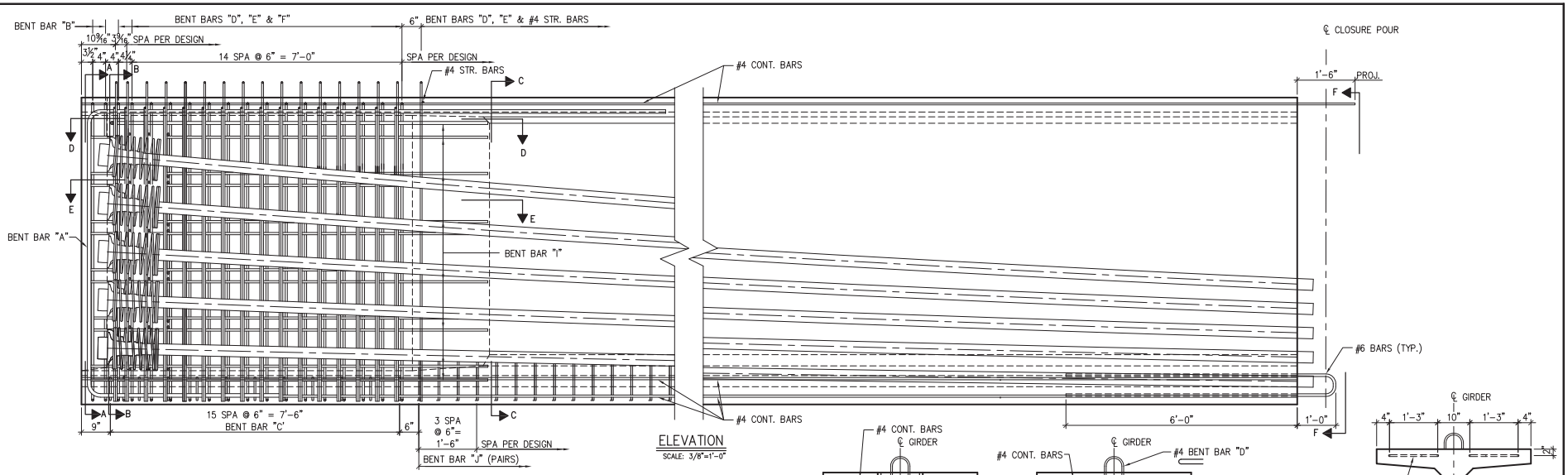
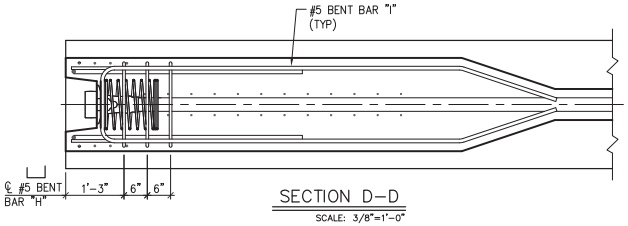
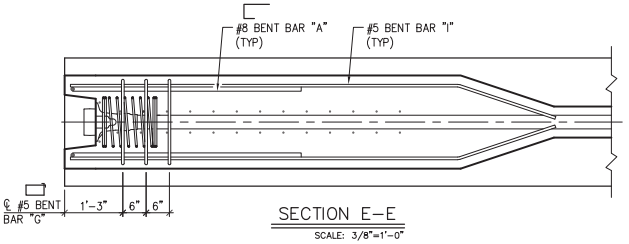


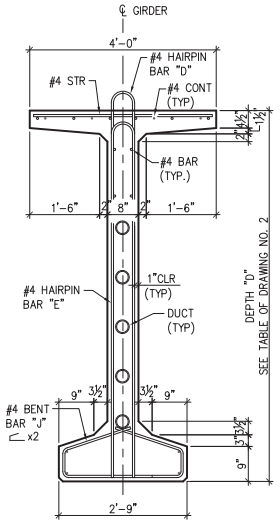
ELEVATION
SCALE: 3/8"=1'-0"



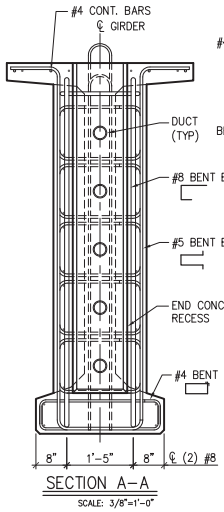
SECTION D-D
SCALE: 3/8"=1'-0"



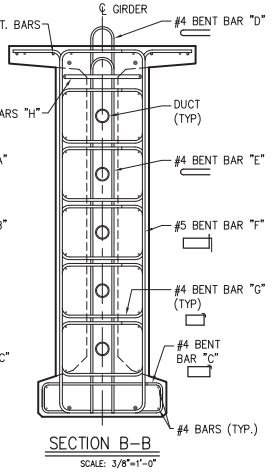
SECTION E-E
SCALE: 3/8"=1'-0"



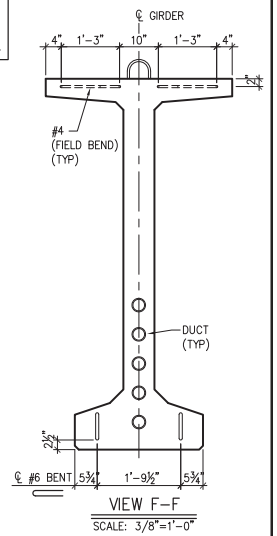
TYPICAL SECTION
SECTION C-C
SCALE: 3/8"=1'-0"



SECTION A-A
SCALE: 3/8"=1'-0"



SECTION B-B
SCALE: 3/8"=1'-0"



VIEW F-F
SCALE: 3/8"=1'-0"

DEC. 21 2010 PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON PENNSYLVANIA
08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
END SEGMENT REINFORCEMENT		SHEET NO: 6

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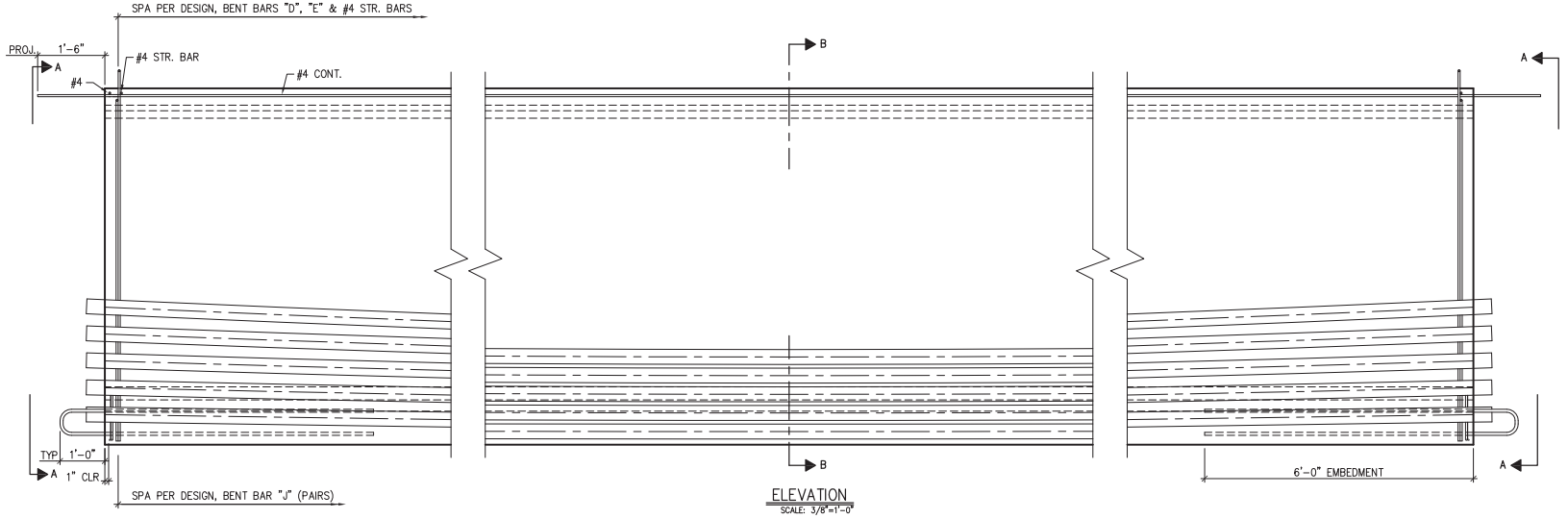
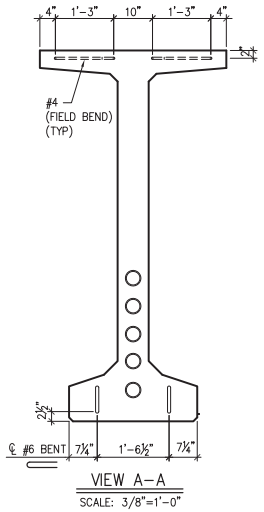
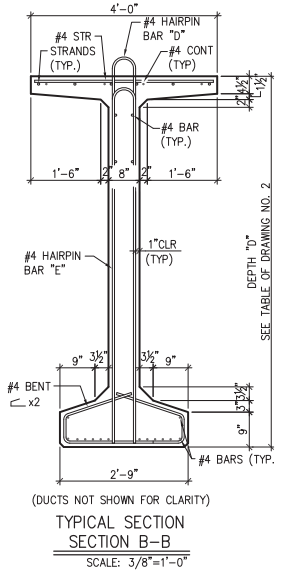


ELEVATION
SCALE: 3/8"=1'-0"



VIEW A–A
SCALE: 3/8"=1'-0"



(DUCTS NOT SHOWN FOR CLARITY)

TYPICAL SECTION
SECTION B–B
SCALE: 3/8"=1'-0"

DEC. 21 2010

PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ROY L ERIKSSON
ENGINEER
PENNSYLVANIA
08.31.10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: AS SHOWN
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
MID SEGMENT REINFORCEMENT		SHEET NO: 7

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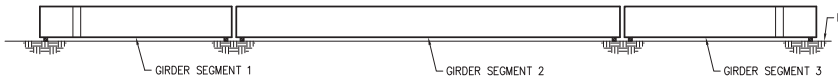
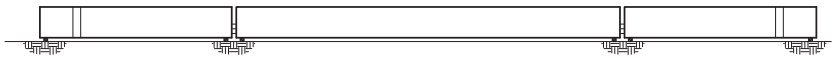
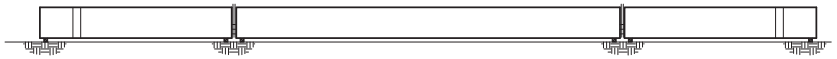


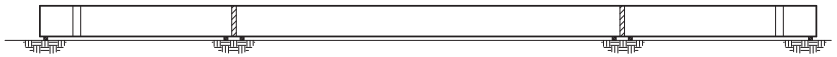
STAGE 1:
PLACE GIRDER SEGMENTS ON DUNAGE.



STAGE 2:
SPLICE DUCTS



STAGE 3:
PLACE REINFORCING STEEL IN CLOSURE POURS.



STAGE 4:
CAST AND CURE CLOSURE POURS.

NOTES:
- FOR SEGMENT ALIGNMENT AND TOLERANCE, SEE SHEET SG-1 AND SG-2.
- FOR HANDLING AND ERECTION OF THE SEGMENT AND GIRDER, SEE SHEET SG-1, NOTE 6.

STAGE 5:
INSTALL AND STRESS PT TENDONS IN THE ORDER AND AT THE BEAM END(S) REQUIRED BY CALCULATION.

STAGE 6:
INSTALL GROUT CAPS.

STAGE 7:
GROUT PT TENDONS AND GROUT CAPS.

STAGE 8:
PATCH ENDS WITH EPOXY-MODIFIED GROUT. COAT EXPOSED ENDS WITH ELASTOMERIC SYSTEM.

DEC. 21 2010 PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER NJ 07232 PENNSYLVANIA
08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: N/A
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
SEGMENT ASSEMBLY – GROUND		SHEET NO: 8

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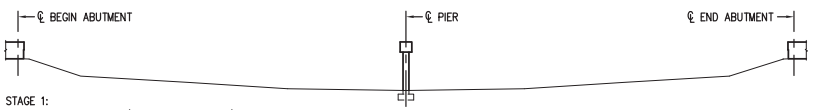
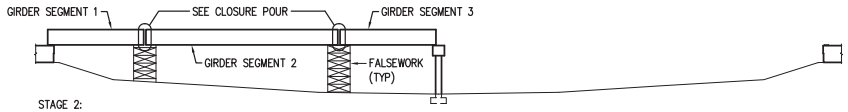
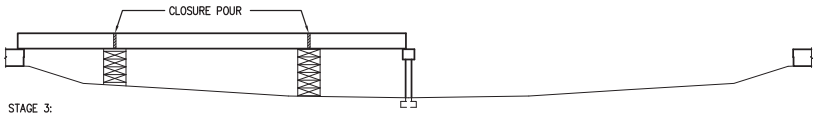


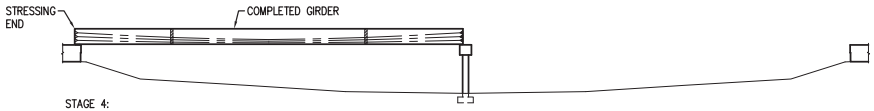
STAGE 1:
CONSTRUCT ABUTMENTS (WITHOUT BACKWALLS) AND INTERMEDIATE PIER.



STAGE 2:
ERECT TEMPORARY FALSEWORK AND GIRDER SEGMENTS FOR SPAN 1.
INSTALL TEMPORARY CROSS BRACING FOR SPAN 1.

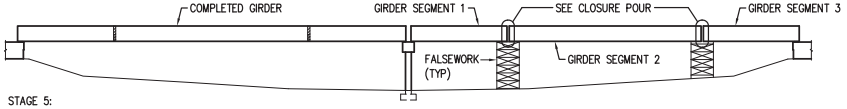


STAGE 3:
PLACE REINFORCING STEEL IN CLOSURE POURS FOR SPAN 1.
CAST AND CURE CLOSURE POURS FOR SPAN 1.

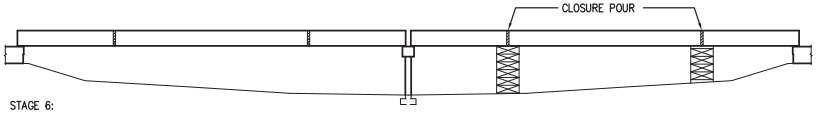


STAGE 4:
INSTALL, STRESS AND GROUT PT TENDONS AND GROUT CAPS IN GIRDERS FOR SPAN 1.
PATCH ENDS WITH EPOXY-MODIFIED GROUT. COAT EXPOSED ENDS WITH ELASTOMERIC SYSTEM.

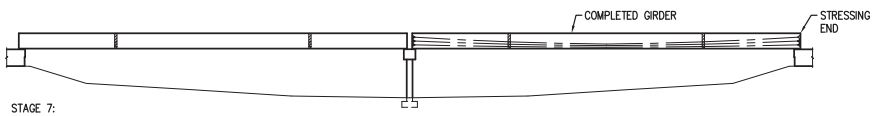
NOTES:
- SUBMIT FALSEWORK CALCULATION AND DRAWING IN ACCORDANCE WITH PUBLICATION 408, SECTION 105.03(C).



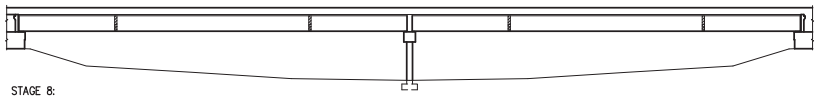
STAGE 5:
ERECT TEMPORARY FALSEWORK AND GIRDER SEGMENTS FOR SPAN 2.
INSTALL TEMPORARY CROSS BRACING FOR SPAN 2.



STAGE 6:
PLACE REINFORCING STEEL IN CLOSURE POURS FOR SPAN 2.
CAST AND CURE CLOSURE POURS FOR SPAN 2.



STAGE 7:
INSTALL, STRESS AND GROUT PT TENDONS AND GROUT CAPS IN GIRDERS FOR SPAN 2.
PATCH ENDS WITH EPOXY-MODIFIED GROUT. COAT EXPOSED ENDS WITH ELASTOMERIC SYSTEM.



STAGE 8:
FORM AND INSTALL STEEL AND CAST DIAPHRAGMS, BACKWALLS, DECK AND BARRIERS AS REQUIRED.

DEC. 21 2010

PENNDOT DRAWING 09-601-BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER PE 07232 PENNSYLVANIA

08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: N/A
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
ERECTION SCHEME – FALSEWORK		SHEET NO: 9

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GROUT SPECIFICATIONS

DESCRIPTION – THIS WORK IS GROUTING OF POST–TENSIONING TENDONS IN CONCRETE STRUCTURES. THIS SPECIFICATION APPLIES TO ALL GROUTED POST–TENSIONING OPERATIONS IN BRIDGE SUPERSTRUCTURE AND SUBSTRUCTURE, INCLUDING BOX–GIRDERS, I–GIRDERS, SEGMENTAL GIRDERS, SPLICED GIRDERS, PIER CAPS, AND PIERS.

FOR GROUTING, ONLY PREPACKAGED GROUTS USED WITHIN 150 DAYS OF MANUFACTURE MAY BE USED. A PREPACKAGED GROUT IS ANY DRY BLEND OF THE LISTED MATERIALS FOUND IN CEMENT GROUT PRODUCED AND PACKAGED BY A COMMERCIAL GROUT MANUFACTURER. PROVIDE PREPACKAGED GROUT IN PLASTIC–LINED OR COATED BAGS. PRINT ON EACH BAG: APPLICATION, DATE OF MANUFACTURE, LOT NUMBER AND MIXING INSTRUCTIONS, INCLUDING THE MINIMUM AND MAXIMUM WATER CONTENT. IN ADDITION, SUBMIT TEST VALUES FOR ALL REQUIREMENTS IN THIS SECTION AT BOTH THE MINIMUM AND MAXIMUM WATER CONTENT TO THE DEPARTMENT

MATERIAL

(A) CEMENT

1. PORTLAND CEMENT. TYPE I OR II CEMENT CONFORMING TO AASHTO M–85, STANDARD SPECIFICATION FOR PORTLAND CEMENT. FOR VERTICAL GROUT APPLICATIONS ONLY, TYPE III CEMENT MAY BE PERMITTED ONLY UPON THE RECOMMENDATION OF THE GROUTING SPECIALIST OR THE SUBCONTRACTOR WHEN ACCOMPANIED BY ACCEPTABLE TESTS OF GROUT AND GROUTING PROCEDURES.

2. BLENDED CEMENT. CONFORMING TO AASHTO M–240, STANDARD SPECIFICATION FOR BLENDED HYDRAULIC CEMENTS.

(B) WATER

SECTION 720.1. LESS THAN 500 PPM OF CHLORIDE IONS WITHOUT PRESENCE OF ORGANIC MATERIALS.

(C) MINERAL ADDITIVES

1. FLY ASH. CLASS 'C' OR CLASS 'F' FLY ASH IN ACCORDANCE WITH AASHTO M–295, COAL FLY ASH OR CALCINED NATURAL POZZOLAN FOR USE AS A MINERAL ADMIXTURE IN PORTLAND CEMENT CONCRETE. THE AMOUNT OF FLY ASH GENERALLY VARIES BETWEEN 10% – 30% OF THE PORTLAND CEMENT BY WEIGHT (MASS). SUBMIT A MATERIAL SAFETY DATA SHEET (MSDS). CERTIFY AS SPECIFIED IN SECTION 106.03 (B) 3.

2. GROUND GRANULATED BLAST FURNACE SLAG. GRADE 120 SLAG IN ACCORDANCE WITH AASHTO M–302, GROUND GRANULATED BLAST FURNACE SLAG FOR USE IN CONCRETE AND MORTARS. THE AMOUNT OF SLAG GENERALLY VARIES BETWEEN 30% – 55% OF THE PORTLAND CEMENT CONTENT BY WEIGHT (MASS). CERTIFY AS SPECIFIED IN SECTION 106.03 (B) 3.

3. SILICA FUME. AASHTO M–307 "SILICA FUME FOR USE IN HYDRAULIC CEMENT CONCRETE AND MORTAR." THE AMOUNT OF SILICA FUME GENERALLY VARIES BETWEEN 3% – 10% OF THE PORTLAND CEMENT BY WEIGHT (MASS). IF USED, SHOW THAT SILICA FUME PARTICLES DO NOT AGGLOMERATE THROUGH THE EVALUATION OF THE HARDENED GROUT. CERTIFY AS SPECIFIED IN SECTION 106.03 (B) 3.

(D) CHEMICAL ADMIXTURES

1. SET CONTROLLING. TYPE D – WATER–REDUCING AND RETARDING ADMIXTURES, TYPE E – NON–CHLORIDE WATER–REDUCING AND ACCELERATING ADMIXTURES, TYPE F – WATER REDUCING HIGH–RANGE ADMIXTURES, AND TYPE G – WATER–REDUCING HIGH–RANGE AND RETARDING ADMIXTURES IN ACCORDANCE WITH AASHTO M–194, STANDARD SPECIFICATION FOR CHEMICAL ADMIXTURES FOR CONCRETE. USE TYPES F AND G ONLY UP TO 3 LITERS PER 100 KG (45 OZ PER 100 LB) OF PORTLAND CEMENT.

2. ANTI–BLEED. USE IN GROUT IF NECESSARY TO SATISFY THE TESTING REQUIREMENTS UNDER QUALITY CONTROL. USE NON–CORROSIVE ADMIXTURES.

3. EXPANSIVE AGENTS. USE ONLY INERT GAS FORMING ADMIXTURES. AVOID ANY GAS FORMING SYSTEM THAT PRODUCES HYDROGEN, CARBON DIOXIDE, OXYGEN OR AIR. WHEN INERT GAS IS FORMED, THE LEVEL OF VERTICAL HEIGHT CHANGE SHALL BE NO GREATER THAN 2.0% UP TO 3 HOURS CONFORMING TO ATSM C940, STANDARD TEST METHOD FOR EXPANSION AND BLEEDING OF FRESHLY MIXED GROUTS FOR PRE–PLACED AGGREGATE CONCRETE IN THE LABORATORY. IF THE CEMENT SOURCE OR COMPOSITION CHANGES, RETEST THE MATERIAL.

4. CORROSION INHIBITORS. CORROSION INHIBITORS ARE PROHIBITED.

(E) AGGREGATE , TYPE A,

FINE AGGREGATE WITH A MAXIMUM SIZE OF 1 MM (.039 IN), CONFORMING TO ASTM C33, STANDARD SPECIFICATION FOR CONCRETE AGGREGATES, EXCEPT FOR GRADATION. FROM A SOURCE LISTED IN BULLETIN 14 OR APPROVED BY MTD.

TESTING AND ACCEPTANCE

(A) TESTING FACILITIES AND EQUIPMENT

PROVIDE SUFFICIENT THERMOMETERS AND EQUIPMENT NEEDED FOR REQUIRED TESTS. HAVE BACK–UP EQUIPMENT AVAILABLE TO ENSURE THAT NO TESTS ARE MISSED. PROVIDE SUFFICIENT INCIDENTAL EQUIPMENT SUCH AS BUCKETS, SCOOPS, ETC., AS NEEDED. PROPERLY MAINTAIN ALL EQUIPMENT USED FOR TESTING. HAVE SCALES, BALANCES, AND THE COMPRESSION MACHINE CALIBRATED AT LEAST ONCE PER YEAR BY AN INDEPENDENT AGENCY ACCEPTABLE TO THE DEPARTMENT. RE–CALIBRATE THE COMPRESSION MACHINE WHEN RELOCATED. MAINTAIN ACCURATE RECORDS OF CALIBRATION. IF THE COMPRESSION MACHINE IS OUT OF TOLERANCE OR MALFUNCTIONS, RETURN IT TO WORKING ORDER WITHIN 24 HOURS OR SUPPLY A BACK–UP MACHINE UNTIL THE PROBLEM IS CORRECTED.

(B) PRE–QUALIFICATION TESTING

PREQUALIFY ALL PREPACKAGED GROUTS IN ACCORDANCE WITH THE REQUIREMENTS OF TABLE A: PERFORMANCE REQUIREMENTS FOR INCLUSION IN BULLETIN 15.

SUBMIT TEST REPORT OF PREPACKAGED GROUTS SHOWING CONFORMANCE TO TABLE A: PERFORMANCE REQUIREMENTS AT THE MAXIMUM AND MINIMUM ALLOWABLE WATER–CEMENTITIOUS MATERIALS RATIO AS STATED ON THE BAG. RETEST AND CERTIFY PREPACKAGED GROUTS A MINIMUM OF EVERY 2 YEARS OR WHEN REQUESTED BY THE ENGINEER. SUBMIT SEPARATE TEST REPORTS FOR EACH PLANT PRODUCING GROUT. ALSO RETEST PREPACKAGED GROUTS WHEN THERE IS A CHANGE OF MATERIAL OR MATERIAL SOURCE. USE GROUT FROM ONE PLANT FOR ANY GIVEN PROJECT LOCATION. STATE ON THE BAG THE METHOD OF FLOW CONE TESTING (STANDARD OR MODIFIED) USED TO TEST GROUT FLUIDITY. ONCE A PREPACKAGED GROUT IS PREQUALIFIED WITHIN THE TWO YEAR PERIOD, THE ONLY TESTING REQUIRED FROM THE LIST BELOW FOR A SPECIFIC PROJECT LOCATION IS QUALITY CONTROL TESTING AS GIVEN IN SECTION (1). ALL GROUTS SHOULD BE USED WITHIN THE SPECIFIED SHELF–LIFE AS GIVEN BY THE MANUFACTURER.

1. SETTING TIME TEST. ASTM C953, STANDARD TEST METHOD FOR TIME OF SETTING OF GROUTS FOR PREPLACED AGGREGATE CONCRETE IN THE LABORATORY. FOR STIFFER PASTE MIXES, FOLLOW AASHTO T–131, STANDARD TEST METHOD FOR TIME OF SETTING OF HYDRAULIC CEMENT BY VICAT NEEDLE.

2. GROUT STRENGTH TEST. ASTM C942, STANDARD TEST METHOD FOR COMPRESSIVE STRENGTH OF GROUTS FOR PREPLACED–AGGREGATE CONCRETE IN THE LABORATORY. IF THE GROUT IS EXPANSIVE, COVER CUBES WITH WEIGHTED PLATES SUFFICIENT TO CONTAIN THE EXPANSION DURING CURE.

3. PERMEABILITY TEST. MODIFIED VERSION OF AASHTO T–277, TEST METHOD FOR ELECTRICAL INDICATION OF CONCRETE'S ABILITY TO RESIST CHLORIDE ION PENETRATION. USE A VOLTAGE OF 30 V.

4. VOLUME CHANGE TEST – ASTM C1090, STANDARD TEST METHOD FOR MEASURING CHANGES IN HEIGHT OF CYLINDRICAL SPECIMEN FROM HYDRAULIC–CEMENT GROUT.

5. THIXOTROPIC GROUT PUMPABILITY AND FLUIDITY TEST – MODIFIED VERSION OF ASTM C939. FILL THE FLOW CONE TO THE TOP WITH GROUT AND MEASURE THE EFFLUX TIME TO FILL ONE LITER.

6. WICK INDUCED BLEED TEST – MODIFIED VERSION OF ASTM C940. INCLUDE ONE STRAND IN THE CONTAINER AND RUN THE TEST AT A NOMINAL AMBIENT ROOM TEMPERATURE OF APPROXIMATELY 20° C (70° F) AS PER THE GUIDE SPECIFICATION FOR GROUTING OF POST – TENSIONED STRUCTURES PUBLISHED BY THE POST – TENSIONING INSTITUTE.

7. SCHUPACK PRESSURE BLEED TEST – FOLLOW APPENDIX C OF GUIDE SPECIFICATION FOR GROUTING OF POST – TENSIONED STRUCTURES, PUBLISHED BY THE POST – TENSIONING INSTITUTE.

8. ACCELERATED CORROSION TEST (ACT) – FOLLOW APPENDIX B OF THE GUIDE SPECIFICATION FOR GROUTING OF POST – TENSIONED STRUCTURES, PUBLISHED BY THE POST – TENSIONING INSTITUTE.

9. API MUD BALANCE TEST – API RECOMMENDED PRACTICE 13B–1, STANDARD PROCEDURES FOR FIELD TESTING WATER–BASED DRILLING FLUIDS. THE MUD BALANCE APPARATUS SHOULD BE NON–REACTIVE WITH THE GROUT.

10. CHLORIDE ION CONTENT – AASHTO T–260, STANDARD TEST METHOD FOR ACID SOLUBLE CHLORIDE IN MORTAR AND CONCRETE.

TABLE A: PERFORMANCE REQUIREMENTS

TEST	PERFORMANCE CRITERIA	TEST METHOD
SETTING TIME TEST	MIN. 3 HOURS; MAX 12 HOURS	ASTM C953*
GROUT STRENGTH TEST (AVERAGE OF 3 CUBES)	≥ 21 MPA (3,000 PSI) AT 7 DAYS, ≥ 35 MPA (5,000 PSI) AT 28 DAYS	ASTM C942
PERMEABILITY TEST (AT 28 DAYS)	MAX. 2,500 COULOMBS AT 30V AFTER 6 HOURS	MODIFIED AASHTO T–277
VOLUME CHANGE TEST	0.0% TO +0.1% AT 24 HOURS MAX. +0.2% AT 28 DAYS	ASTM C1090
THIXOTROPIC FLUIDITY TEST**	5 TO 20 SEC., IMMEDIATELY AFTER MIXING MAX. 30 SEC. 30 MIN AFTER MIXING WITH REMIXING FOR 30 SEC.	MODIFIED ASTM C939
WICK INDUCED BLEED TEST (AT 3 HOURS)	MAX. 0.0%	MODIFIED ASTM C940
SCHUPACK PRESSURE BLEED TEST	SEE TABLE B	
ACCELERATED CORROSION TEST (AVERAGE TIME TO CORROSION)	>0.45 W/CM, PLAIN GROUT USING SAME EQUIPMENT APPENDIX B GUIDE SPECIFICATION FOR GROUTING OF POST–TENSIONED STRUCTURES, PUBLISHED BY THE POST–TENSIONING INSTITUTE.	
API MUD BALANCE TEST	VALUE > 1.9	
CHLORIDE ION CONTENT	MAX. 0.08% BY WEIGHT OF CEMENTITIOUS MATERIAL	AASHTO T–260

*FOR STIFFER PASTE MIXES, FOLLOW AASHTO T–131.
**MEET EITHER THE STANDARD ASTM C939 FLOW CONE TEST OR THE MODIFIED TEST. ENSURE THAT THE BAG OF PREPACKAGED GROUT STATES WHICH TEST SHOULD BE USED.

CORRECTIONS MADE BY BRIDGE QUALITY ASSURANCE DIVISION ON 12-10-2010

TABLE B: SCHUPACK PRESSURE TEST LIMITS
(BLEED UNDER PRESSURE LIMITS)

VERTICAL RISE, X (M)	SCHUPACK PRESSURE (KPA)	MAX % BLEED (% OF SAMPLE VOLUME)
0 ≤ X ≤ 0.6	140	4
0.6 < X ≤ 1.8	220	2
1.8 < X ≤ 6.1	360	0
6.1 < X < 30.0	700	0
VERTICAL RISE, X (FT)	**SCHUPACK PRESSURE (PSI)**	**MAX% BLEED (% OF SAMPLE VOLUME)**
0 ≤ X ≤ 2	20	4
2 < X ≤ 6	30	2
6 < X ≤ 20	50	0
20 < X < 100	100	0

NOTE: PRESSURE VALUES IN TABLE B ARE NOT HARD CONVERSIONS. REPORT RESULTS IN THE UNITS OF THE PRESSURE GAUGE USED.

(C) MATERIALS CERTIFICATION

PROVIDE WRITTEN CERTIFICATION FROM THE SOURCE OR THE MANUFACTURER OF ALL INGREDIENTS THAT ARE USED IN THE PREPARATION OF THE GROUT THAT THESE INGREDIENTS CONFORM TO THE MATERIAL SECTION OF THIS SPECIFICATION.

CONSTRUCTION

(A) GROUT TECHNICIAN

PROVIDE, AND ASSIGN TO THE WORK, AN AMERICAN SEGMENTAL BRIDGE INSTITUTE (ASBI) CERTIFIED GROUT TECHNICIAN TO CONTROL THE QUALITY OF THE MATERIALS USED, TO PERFORM REQUIRED GROUT TESTS, AND TO CONTROL THE OPERATIONS SO THAT THE GROUT COMPLIES WITH SPECIFICATIONS AT THE POINT OF PLACEMENT.

THE INSPECTOR DOES NOT ASSUME, BY ACT OR BY WORD, ANY RESPONSIBILITY FOR BATCH CONTROL ADJUSTMENTS; CALCULATIONS; OR FOR SETTING OF ANY DIALS, GAUGES, SCALES, OR METERS. FAILURE OF THE INSPECTOR TO REJECT GROUT DOES NOT RELIEVE THE CONTRACTOR'S OBLIGATION TO PROVIDE GROUT MEETING SPECIFICATIONS.

(B) INLETS AND OUTLETS

PROVIDE THE MINIMUM INNER DIAMETER OF INLETS AND OUTLETS WITH AT LEASE 20 MM (3/4 IN) FOR STRAND TENDONS AND 10 MM (3/8 IN) FOR SINGLE BAR TENDONS. PLACE INLETS AND OUTLETS AT LOCATIONS RECOMMENDED BY THE DESIGN OR CONSTRUCTION ENGINEER AND AT THE FOLLOWING LOCATIONS:

- AT THE ANCHORAGE AREA OF THE TENDON.
- AT THE HIGH POINTS OF THE DUCT, WHEN THE VERTICAL DISTANCE BETWEEN THE HIGHEST AND LOWEST POINT IS MORE THAN 0.5 M (20 IN)
- AN ADDITIONAL OUTLET AT A SHORT DISTANCE DOWNSTREAM (AT APPROXIMATELY THE LOCATION WHERE THERE HAS BEEN A VERTICAL DROP OF A DISTANCE EQUAL TO ONE DUCT DIAMETER) OF A HIGH POINT OUTLET.
- AT MAJOR CHANGES IN THE CROSS–SECTION OF THE DUCT, SUCH AS COUPLERS AND ANCHORAGES.
- AT ALL LOW POINTS (FREE – DRAINING).
- PRIMARY INLET: AT OR NEAR THE LOWEST POINT OF THE TENDON. USE A TWO LEVER–ACTION BALL VALVE.

PROVIDE INLETS AND OUTLETS WITH POSITIVE SHUT–OFFS AND CHECK TO BE SURE THEY CAN BE PROPERLY OPENED AND CLOSED.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

DEC. 21 2010 PENNDOT DRAWING 09–601–BQAD

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L. ERIKSSON ENGINEER PE 047204

08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: N/A
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
GROUT SPECIFICATIONS		SHEET NO: 10

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(C) GROUTING EQUIPMENT

PROVIDE GROUTING EQUIPMENT THAT WILL GROUT THE LONGEST TENDON ON THE PROJECT IN LESS THAN 30 MINUTES ONCE MIXING BEGINS AND THAT WILL PROVIDE A CONTINUOUS SUPPLY OF HOMOGENOUS GROUT (UNLESS WAIVED BY THE ENGINEER FOR PROJECTS WITH VERY LARGE TENDONS). PLACE A SCREEN BETWEEN THE MIXER AND THE PUMP, OR BETWEEN THE MIXER AND THE STORAGE HOPPER. PROVIDE A BACKUP GROUT MIXER AND PUMP. WHERE WATER IS NOT SUPPLIED THROUGH THE PUBLIC WATER SUPPLY SYSTEM, PROVIDE A WATER STORAGE TANK OF SUFFICIENT CAPACITY AND PROVIDE APPROVED PRESSURIZED FLUSHING EQUIPMENT.

1. MIXER. USE THE MIXER TYPE PLANNED FOR PUMPING IN A FIELD TRIAL TO ENSURE PROPERTIES SIMILAR TO THOSE FROM PREQUALIFICATION TESTING WILL BE ACHIEVED AND TO DETERMINE OPTIMUM MIXING TIME.

- HIGH–SHEAR OR COLLOIDAL MIXER. MINIMUM 1,500 RPM.

2. STORAGE HOPPER. EQUIP THE STORAGE HOPPER WITH AN AGITATOR. KEEP THE STORAGE HOPPER PARTIALLY FULL AT ALL TIMES WHILE PUMPING TO AVOID PUMPING AIR INTO THE TENDON. IF AN ADDITIONAL STORAGE HOPPER IS NEEDED, PLACE IT BETWEEN THE MIXER AND PUMP AND EQUIP IT WITH AN AGITATOR.

3. SCREEN. MAXIMUM SCREEN OPENING OF 5 MM (0.188 IN).

4. GROUT INJECTION EQUIPMENT. USE EQUIPMENT WITH A SYSTEM THAT CAN RECIRCULATE THE GROUT WHILE GROUTING HAS TEMPORARILY STOPPED. PLACE A VALVE ON THE EQUIPMENT THAT CAN LOCK OFF THE TENDON UNDER PRESSURE ONCE THE DUCT IS COMPLETELY GROUTED.

- PUMP, USE A POSITIVE PRESSURE PUMP THAT CAN MAINTAIN AN OUTLET PRESSURE OF AT LEAST 1 MPA (145 PSI) USE A PUMP WITH SEALS TO KEEP OIL, AIR, AND OTHER SUBSTANCES OUT OF THE GROUT AND TO PREVENT ANY LOSS OF THE GROUT AND WATER.
- PRESSURE GAUGE. PLACE A PRESSURE GAUGE CAPABLE OF READING NO MORE THAN 2 MPA (OR 300 PSI IF AN ENGLISH SYSTEM GAUGE IS USED) BETWEEN THE PUMPING OUTLET AND THE DUCT INLET.

5. VACUUM GROUTING EQUIPMENT. IF INSPECTION INDICATES THAT REPAIRS ARE NEEDED, PROVIDE VACUUM GROUTING EQUIPMENT AT THE JOB SITE. USE VACUUM GROUTING EQUIPMENT OF THE VOLUMETRIC MEASURING TYPE WITH THE ABILITY TO MEASURE A VOID AND SUPPLY A MEASURED VOLUME OF GROUT TO FILL THE VOID.

6. COMPRESSED AIR. USE OIL–FREE AND WATER–FREE COMPRESSED AIR TO CHECK THE DUCTS FOR LEAKS AND TO EXPEL ANY EXCESS WATER BEFORE THE GROUTING OPERATION BEGINS.

(D) PROTECTION OF TENDONS PRIOR TO GROUTING

1. PRIOR TO INSTALLATION. CAP DUCTS TO PREVENT ENTRANCE OF MOISTURE, CHLORIDES, OR DEBRIS PRIOR TO INSTALLATION OF THE PRESTRESSING STRAND. LEAVE VENTS CLOSED UNTIL AIR TESTING.

2. AFTER INSTALLATION. PREVENT PRECIPITATION AND DEBRIS FROM ENTERING DUCTS AT ALL TIMES. IF STRAND WILL BE EXPOSED FOR MORE THAN 24 HOURS BETWEEN INSTALLATION AND STRESSING, WRAP STRAND ENDS AND THE ANCHORAGE OPENING WITH PLASTIC AND WATERPROOF TAPE TO PREVENT EXPOSURE TO MOISTURE AND CHLORIDES.

3. AFTER STRESSING. CAP AND COVER ANCHORAGES IMMEDIATELY AFTER STRAND TAILS ARE CUT TO PREVENT ENTRANCE OF MOISTURE OR CHLORIDES. AFTER TENDONS ARE AIR TESTED, CLOSE ALL VENTS AND INSTALL PERMANENT GROUT CAPS. PERMISSIBLE TIME LIMIT FOR EXPOSURE BETWEEN STRESSING AND GROUTING WITHOUT ADDITIONAL CORROSION PROTECTION IS 7 DAYS.

- ADDITIONAL CORROSION PROTECTION. IF THE TENDONS WILL NOT BE GROUTED WITHIN 7 DAYS FROM THE TIME OF STRESSING, ADDITIONAL CORROSION PROTECTION IS REQUIRED. ADDITIONAL PROTECTION MAY INCLUDE CORROSION–INHIBITING MATERIALS APPLIED TO THE STRAND PRIOR TO INSERTION IN THE DUCT, CORROSION INHIBITORS BLOWN INTO THE DUCT AFTER STRESSING, OR OTHER METHODS APPROVED BY THE ENGINEER. MATERIALS APPLIED TO THE STRAND MAY REDUCE BOND. TEST RESULTS SHOWING CORROSION PROTECTION AND DEGREE OF BOND REDUCTION IN PULL–OUT TESTS MUST BE PROVIDED TO THE ENGINEER PRIOR TO APPROVAL OF THE USE OF THE CORROSION – INHIBITING MATERIAL. THE MATERIAL MUST BE COMPATIBLE WITH GROUT. TENDONS SHOULD NOT BE FLUSHED WITH WATER PRIOR TO GROUTING.

(E) GROUTING PLAN

SUBMIT A GROUTING PLAN TO THE ENGINEER FOR REVIEW AND ACCEPTANCE AT LEAST 6 WEEKS PRIOR TO GROUTING. PERFORM A MOCK–UP TEST WITH THE EQUIPMENT AND MATERIALS THAT WILL BE USED ON THE JOB AND SUBMIT RESULTS WITH THE GROUTING PLAN. INCLUDE THE FOLLOWING IN THE GROUTING PLAN:

- NAMES, EXPERIENCE AND QUALIFICATIONS OF GROUTING CREW AND SUPERVISOR: ASBI CERTIFICATION DOCUMENTATION FOR THE TECHNICIAN AND BACKUP.
- TYPE OF EQUIPMENT (TYPE, SPEED, CAPACITY, INCLUDING BACK–UP EQUIPMENT).
- TARGETED FLOW RATE DURING PUMPING AND METHOD OF CONTROLLING RATE.
- TYPE OF GROUT AND WATER CONTENT THAT WILL BE USED FOR INITIAL ON–SITE MIX.
- ESTIMATED QUANTITY OF GROUT FOR EACH TENDON GROUP.
- MATERIALS CERTIFICATION.
- LIST OF ON–SITE TESTING AND FREQUENCY.
- INLET AND VENTING DETAILS (TYPE, LOCATION, SIZE).
- PLANS FOR PROTECTION OF TENDONS PRIOR TO GROUTING (PRIOR TO INSTALLATION AND AFTER INSTALLATION).
- PROVIDE A PLAN (ADDITIONAL PROTECTION) IF TENDONS WILL REMAIN UNGROUTED MORE THAN 7 DAYS.
- AIR TESTING PROCEDURE.
- GROUT MIXING AND PUMPING PROCEDURES.
- ORDER OF TENDON GROUTING.
- DIRECTION OF GROUTING AND SEQUENCE OF VENT SHUTOFF.
- PROCEDURES FOR BLOCKAGES (INCLUDING MEANS OF FLUSHING IF NECESSARY)
- PROCEDURES FOR INSPECTION OF TENDONS AFTER GROUTING.
- PROCEDURES FOR FILLING ANY VOIDS.
- SAMPLE GROUTING RECORD FORMS.
- RESULTS OF TENDON MOCK–UP.

(F) PRE–GROUTING OPERATIONS

STORE GROUT IN A DRY LOCATION. IF STORING IN THE OPEN, THE GROUT MUST BE ON A RAISED PLATFORM WITH ADEQUATE WATERPROOF COVERING. LIMIT ON–SITE STORAGE OF GROUT TO A MAXIMUM PERIOD OF ONE MONTH. GROUT MUST BE USED WITHIN 150 DAYS OF DATE OF MANUFACTURE.

PLACE A PERMANENT PLASTIC END CAP WITH A VENT OVER EACH ANCHOR HEAD IMMEDIATELY AFTER STRAND TAILS ARE CUT.

BEFORE GROUTING BEGINS, CHECK AND PREPARE DUCTS BY BLOWING THROUGH OIL–FREE AND WATER–FREE COMPRESSED AIR. OPEN AND CLOSE EACH VENT IN TURN TO BLOW OUT MOISTURE. THE DUCT SHOULD BE ABLE TO MAINTAIN A PRESSURE OF 140 KPA (20 PSI) WITH ALL VENTS CLOSED. IF THE SYSTEM CANNOT HOLD PRESSURE, LOCATE AND REPAIR LEAKS PRIOR TO GROUTING.

ATTAIN ACCEPTANCE OF THE GROUTING PROCEDURE FROM THE ENGINEER PRIOR TO GROUTING. INCLUDE THE FOLLOWING IN THE PROCEDURE:

- INSPECTION TO ENSURE THAT ALL MATERIALS ARE OF THE SPECIFIED TYPE AND QUANTITY.
- INSPECTION TO ENSURE THAT ALL EQUIPMENT IS IN SATISFACTORY CONDITION.
- INSPECTION OF DUCTS TO ENSURE THAT THEY ARE FREE OF WATER, DEBRIS, AND OTHER OBSTRUCTIONS.
- INSPECTION OF DUCTS TO ENSURE THAT THERE WILL BE NO GROUT LEAKAGE BETWEEN ADJACENT DUCTS IN THE JOINT AREAS OR AT COUPLERS FOR EXTERNAL TENDONS.
- TEMPERATURE MEASUREMENT OF AIR, WATER, AND PREPACKAGED GROUT TO ENSURE THAT THEY ARE WITHIN THE ACCEPTANCE REQUIREMENTS SPECIFIED FOR TEMPERATURE CONSIDERATIONS.
- INSPECTION OF ALL PREPACKAGED GROUT OR CEMENT PACKAGES FOR EVIDENCE OF AGE AND DAMPNESS, SUCH AS LUMPS AND HARDENED PIECES.
- COMMENCE GROUTING OPERATIONS ONLY AFTER THE ENGINEER'S ACCEPTANCE TO PROCEED IS RECEIVED.
- GROUT ONLY WHEN BOTH THE AMBIENT AIR TEMPERATURE AND SUBSTRATE TEMPERATURE ARE AT LEAST 5 DEGREES C (41 DEGREES F) DURING THE GROUTING OPERATION AND FOR 3 HOURS THEREAFTER. ADDITIONALLY, GROUT TEMPERATURE MUST BE MAINTAINED ABOVE 2 DEGREES C (35 DEGREES F) FOR 3 CONSECUTIVE DAYS AFTER GROUTING.

(G) MIXING CONDITIONS

1. HOT WEATHER, EMPLOY HOT–WEATHER MIXING AND PROTECTION METHODS WHEN THE AMBIENT AIR TEMPERATURE EXCEEDS 32° C (90° F). COOL–MIX WATER TO MAINTAIN GROUT TEMPERATURE AT 27° C (80° F) OR BELOW AT THE TIME OF GROUTING. ICE MAY BE NECESSARY AND IF USED SHOULD BE ADDED TO THE MIX WATER TO LOWER THE WATER TEMPERATURE PRIOR TO MIXING. DO NOT ALLOW ICE IN THE GROUT MIXTURE.

2. COLD WEATHER. MAINTAIN A DAILY RECORD OF MINIMUM AND MAXIMUM AMBIENT AIR TEMPERATURES DURING COLD WEATHER. RECORD THE TEMPERATURE OF THE GROUT DRY INGREDIENTS AND THE STRUCTURE SURROUNDING THE DUCTS TO BE GROUTED.

WHEN AMBIENT AIR TEMPERATURE HAS BEEN BELOW 0°C (32° F) AFTER DUCT PLACEMENT AND PRIOR TO GROUTING, BLOW DRY AIR THROUGH THE DUCTS TO EXPEL ANY TRAPPED WATER, FROST, OR ICE. GROUT ONLY WHEN BOTH THE AMBIENT AIR TEMPERATURE AND SUBSTRATE TEMPERATURE ARE AT LEAST 5 DEGREES C (41 DEGREES F) DURING THE GROUTING OPERATION AND FOR 3 HOURS THEREAFTER. ADDITIONALLY, GROUT TEMPERATURE MUST BE MAINTAINED ABOVE 2 DEGREES C (35 DEGREES F) FOR 3 CONSECUTIVE DAYS AFTER GROUTING.

(H) GROUTING OPERATIONS

OPEN ALL VENTS JUST PRIOR TO GROUTING. GROUT TENDONS IN AN UPHILL DIRECTION. UNLESS OTHERWISE APPROVED BY THE ENGINEER (IN CASES WITH UNUSUAL GEOMETRY OR CONSTRUCTION PROBLEMS), START GROUTING FROM NEAR THE LOWEST INLET. MAINTAIN A CONTINUOUS, ONE–WAY FLOW FOR THE DURATION OF A GROUTING STAGE. USE A METHOD OF INJECTING GROUT THAT ENSURES COMPLETE FILLING OF THE DUCTS AND COMPLETE SURROUNDING OF THE STRAND OR BAR WITHIN 30 MINUTES OF THE FIRST ADDITION OF WATER TO THE DRY INGREDIENTS UNLESS OTHERWISE APPROVED BY THE ENGINEER.

INJECT GROUT AT A TARGET RATE BETWEEN 5 M (16.4 FT) AND 15 M (49.2 FT) OF DUCT PER MINUTE UNLESS OTHERWISE APPROVED BY THE ENGINEER. PUMP THE GROUT THROUGH THE DUCT UNTIL THERE IS CONTINUOUS FLOW AT THE FIRST OUTLET. CLOSE THE OUTLET AFTER THE EJECTED GROUT FLOW SHOWS NO VISIBLE POCKETS OF WATER OR AIR AND THE CONSISTENCY OF THE GROUT IS THE SAME AS THAT OF THE GROUT BEING PUMPED. EJECT A MINIMUM OF 1 GALLON OF WASTE GROUT FROM EACH VENT (OUTLET) AND APPROXIMATELY 5 GALLONS FROM THE FINAL OUTLET. IF GROUT CONSISTENCY IS DIFFERENT THAN AT INLET, CONTINUE TO EJECT GROUT UNTIL THE SAME GROUT CONSISTENCY OR FLUIDITY TEST VALUE IS OBTAINED. CLOSE ALL OUTLETS ONE AFTER THE OTHER IN A SIMILAR MANNER IN THE DIRECTION OF THE FLOW WITH THE EXCEPTION OF OUTLETS LOCATED AT INTERMEDIATE CRESTS. CLOSE THE DOWNSTREAM CREST OUTLETS BEFORE THE ASSOCIATED CREST OUTLET.

NORMAL GROUTING OPERATIONS WILL TYPICALLY BE PERFORMED AT APPROXIMATELY 0.5 MPA (75 PSI), AND TYPICALLY WILL NOT EXCEED:

1 MPA (145 PSI) – INTERNAL POLYETHELENE DUCTS, OVAL STEEL DUCTS, FLAT STEEL DUCTS, AND EXTERNAL HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

- 1.7 MPA (245 PSI) – INTERNAL CIRCULAR STEEL DUCTS.

IF THE GROUTING PRESSURE EXCEEDS THE MAXIMUM ALLOWED, CLOSE THE INLET AND INJECT GROUT AT THE NEXT OUTLET THAT HAS JUST BEEN OR IS READY TO BE CLOSED, PROVIDED A ONE–WAY FLOW IS MAINTAINED. FIT THE OUTLET THAT IS TO BE USED AS THE NEW INLET WITH A POSITIVE SHUT–OFF.

TO PREVENT THE UNINTENDED LOSS OF GROUT, AFTER THE TENDON DUCT IS COMPLETELY FILLED WITH GROUT AND ALL OUTLETS HAVE BEEN CLOSED, MAINTAIN THE NORMAL GROUT PRESSURE FOR 1 MINUTE BEFORE THE INLET IS SEALED OFF UNDER PRESSURE.

1. VERTICAL GROUTING. PROVIDE A STANDPIPE AT THE UPPER END OF THE TENDON FOR ALL VERTICAL TENDONS TO COLLECT BLEED WATER TO BE REMOVED FROM THE GROUT. IF THE LEVEL OF THE GROUT DROPS BELOW THE HIGHEST POINT IN THE ANCHORAGE DEVICE, ADD ADDITIONAL GROUT TO THE STANDPIPE IMMEDIATELY. REMOVE THE STANDPIPE AFTER THE GROUT HAS HARDENED. GROUTS USED FOR VERTICAL GROUTING MUST MEET THE SCHUPACK PRESSURE TESTING REQUIREMENTS. THE STANDPIPE IS A PRECAUTIONARY MEASURE AND NOT A SUBSTITUTION FOR THESE REQUIREMENTS.

IF THE GROUTING PRESSURE EXCEEDS THE MAXIMUM ALLOWED, CLOSE THE INLET AND INJECT THE GROUT AT THE NEXT HIGHER OUTLET THAT HAS JUST BEEN, OR IS READY TO BE CLOSED, PROVIDED A ONE–WAY FLOW IS MAINTAINED. ALLOW GROUT TO FLOW FROM THE OUTLET UNTIL ALL VISIBLE AIR AND WATER HAVE BEEN REMOVED BEFORE USING THAT OUTLET FOR INJECTION. GROUTING IN LIFTS MAY BE NECESSARY FOR TALL VERTICAL APPLICATIONS AS PER THE FOLLOWING PROCEDURE. GROUT THE STAY IN LIFTS UNLESS A PRIOR MOCK–UP SHOWS THAT THE STAY CAN BE SUCCESSFULLY GROUTED IN ANOTHER MANNER. THE ENGINEER MAY APPROVE GROUTING OF A STAY IN A SINGLE OPERATION IF THE CONTRACTOR SUBMITS INFORMATION WHICH ADEQUATELY ESTABLISHES THAT THE MATERIALS, EQUIPMENT AND PROCEDURE INTENDED FOR USE WILL NOT DAMAGE THE PIPE. THE INFORMATION MUST SHOW THAT THE GROUTING PRESSURE WILL NOT DAMAGE THE POLYETHYLENE PIPE AT –30° C (–22° F) AFTER THE GROUT IS CURED. IF ANY INDICATIONS OF GROUTING IRREGULARITIES APPEAR THAT ARE ATTRIBUTABLE TO SINGLE OPERATION GROUTING, DISCONTINUE THE METHOD AND USE MULTIPLE LIFT GROUTING.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

CORRECTIONS MADE BY BRIDGE QUALITY ASSURANCE DIVISION ON 12-10-2010

PENNDOT DRAWING 09–601–BQAD

DEC. 21 2010

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROY L ERIKSSON ENGINEER NJ 07232 PENNSYLVANIA

08-31-10

CENTRAL ATLANTIC BRIDGE ASSOCIATES (CABA)	Eriksson technologies	813.989.3317 TAMPA, FL LRFD.COM
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
		SCALE: N/A
SPLICED PRESTRESSED CONCRETE GIRDER STANDARDS		DWN: CWS CK'D: RLE
		JOB NO:
GROUT SPECIFICATIONS		SHEET NO: 11

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LIFT METHOD – WATER FLUSHING IS NOT PERMITTED TO CLEAN THE PIPES AND THE WIRE OR STRAND BUNDLES.

DO NOT EXCEED GROUT LIFTS OF 38 M (125 FT) IN HEIGHT FOR HDPE PIPE STAY CABLES. LIMIT THE FIRST GROUT LIFT IN EACH STAY CABLE TO 6 M (20 FT) ABOVE THE DECK. LIMIT THE LAST LIFT OF GROUT TO THE SMALLEST DIMENSION CONSISTENT WITH THE DIMENSIONS OF THE TOWER OR PYLON. THIS MINIMIZES THE POSSIBILITY OF CREATING A GROUT VOID IN THE TOP OF THE PIPE.

INSTALL GROUT PORTS AT THE TIP AND BOTTOM OF EACH GROUT LIFT. BEGIN GROUTING AT THE LOWEST INJECTION PORT WHILE ALL VENTS REMAIN OPEN. MAINTAIN A PUMPING PRESSURE THROUGH THE PIPE UNTIL THE GROUT FLOWS FOR A MINIMUM OF 15 SECONDS OUT THE NEXT VENT HOLE AFTER NO VISIBLE WATER OR AIR ARE EJECTED. NEXT CLOSE THE VENT AND SECURELY CAP THE INJECTION PORT. AFTER THE GROUT HAS HARDENED, DRAIN OFF ANY RESIDUAL WATER ON TOP PRIOR TO BEGINNING THE NEXT GROUTING LIFT. MOVE THE GROUTING OPERATION TO THE NEXT BEGINNING THE NEXT GROUTING LIFT. MOVE THE GROUTING OPERATION TO THE NEXT HIGHER PORT AND REPEAT THE GROUTING PROCESS UNTIL THE ENTIRE STAY CABLE IS FILLED WITH GROUT.

DO NOT EXCEED DIAMETRICAL EXPANSION OF THE HDPE PIPE ABOVE 2% OF THE ORIGINAL NOMINAL DIAMETER. ELIMINATE THE DIAMETRICAL EXPANSION AT THE GROUT INJECTION POINT BY THE USE OF STEEL CLAMPS. SECURELY CLAMP THE PIPE AT THE NEXT INJECTION PORT AFTER THE PREVIOUS GROUT LIFT HARDENS BUT BEFORE PROCEEDING WITH THE NEXT GROUT LIFT.

FIT THE GROUT OUTLET FOR THE TOP LIFT WITH A STANDPIPE AT LEAST 1.2 M (4 FT) HIGH. FILL ANY VOID REMAINING IN THE GROUT COLUMN WITHIN THE STAY CABLE FOLLOWING THE FINAL GROUT LIFT WITH GROUT. BLOW OUT WITH COMPRESSED OIL–FREE AIR ANY ACCUMULATED WATER IN THE UPPERMOST GROUT VENT BEFORE GROUTING EXISTING CAVITY. AFTER AIR–FREE GROUT FLOWS FOR A PERIOD OF 15 SECONDS, CAP THE VENT AND GROUT PORTS.

IMMEDIATELY WASH AWAY GROUT COMING IN CONTACT WITH THE OUTSIDE SURFACE OF THE STAY CABLE OR OTHER COMPONENTS.

WHEN THE GROUTING PROCESS IS COMPLETE, REMOVE GROUT PUMPING PIPES AND VENTS AND PATCH CABLE STAY SHEATHING AS NECESSARY AT VENT HOLES TO ENSURE WATER TIGHTNESS OF THE SHEATHING.

(I) QUALITY CONTROL TESTING

NOTIFY THE DEPARTMENT'S REPRESENTATIVE WHEN QUALITY CONTROL TESTING IS TO BE PERFORMED. THE ASBI CERTIFIED GROUT TECHNICIAN RUNS THE QUALITY CONTROL TESTING. THE PRODUCTION GROUT MEETS OR EXCEEDS THE REQUIREMENTS IN TABLE C.

TABLE C: QUALITY CONTROL TESTING REQUIREMENTS

TEST	FREQUENCY	PERFORMANCE CRITERIA	TEST METHOD
GROUT STRENGTH TEST (AVERAGE OF 3 CUBES)	1 PER DAY	≥ 21 MPA (3,000 PSI) AT 7 DAYS ≥ 35 MPA (5,000 PSI) AT 28 DAYS	ASTM C942
FLUIDITY TEST	1 EVERY* 2 HOURS	WITHIN ± 5 SEC OF VALUES ESTABLISHED DURING LABORATORY TESTING	ASTM C939**
SCHUPACK PRESSURE BLEED TEST	1 PER DAY*	APPENDIX C OF THE "GUIDE SPECIFICATION FOR GROUTING OF POST–TENSIONED STRUCTURES" PUBLISHED BY THE POST–TENSIONING INSTITUTE.	
API MUD BALANCE TEST	2 PER DAY***	MUST BE ≥ ESTABLISHED LAB VALUE	

* TAKEN AT THE INLET.

** USE EITHER THE STANDARD ASTM C939 FLOW CONE TEST OR THE MODIFIED TEST DEPENDING ON WHICH WAS APPROVED AND USED INITIALLY IN THE LABORATORY TESTING.

***OR WHEN THERE IS A VISUAL OR APPARENT CHANGE IN THE CHARACTERISTICS OF THE GROUT. IN ADDITION TO THE TWO PER DAY, TAKE AN ADDITIONAL SAMPLE FORM THE DUCT OUTLET TO ENSURE THAT EXTRA WATER IS NOT PRESENT IN THE TENDON.

(J) POST–GROUTING OPERATIONS

CLEAN ALL EQUIPMENT THOROUGHLY AFTER GROUTING. DO NOT REMOVE OR OPEN THE VALVES, CAPS, AND PIPES AT THE INLET AND OUTLET UNTIL THE GROUT HAS SET. DO NOT SUBJECT GROUTED TENDONS TO VIBRATION FOR A MINIMUM OF 4 HOURS IF A PREQUALIFIED GROUT MEETING THE SECTION TESTING AND ACCEPTANCE (B) PRE–QUALIFICATION TESTING IS USED OR A MINIMUM OF 24 HOURS FOR ALL OTHER GROUTS UNLESS APPROVED BY THE ENGINEER. DO NOT OPEN INLETS, OUTLETS, OR VENTS UNTIL GROUT HAS SET. BEFORE PROTECTION OF END ANCHORAGES IS STARTED, REMOVE ALL MATERIALS USED FOR SEALING THE GROUT CAP CONNECTIONS. AT ANCHORAGES, PLUG ALL INLETS AND OUTLETS WITH PLASTIC OR STAINLESS STEEL THREADED CAPS. REPAIR ANY SPLITS, HOLES, OR OTHER DAMAGE TO EXPOSED DUCTS.

INSPECT THE LEVEL OF GROUT IN THE OUTLETS AND GROUT CAPS AND TOP OFF AS NECESSARY WITH FRESH GROUT AFTER 24 HOURS FROM THE FINISH OF GROUTING. FILL ANY VOIDS IMMEDIATELY WITH FRESH GROUT. USE VACUUM GROUTING PROCEDURES IF REQUIRED BY THE ASBI–CERTIFIED INSPECTOR AND AS REQUIRED BY AASHTO, IF STRANDS ARE EXPOSED.

1. INTERNAL TENDONS. FOR INTERNAL TENDONS SUBJECTED TO AGGRESSIVE ENVIRONMENTS, REMOVE TUBING 25 MM (1 IN.) BELOW CONCRETE SURFACE, SEAL, AND FILL WITH COMPATIBLE CEMENTITOUS – BASED MATERIAL TO FLUSH WITH CONCRETE SURFACE.

2. EXTERNAL TENDONS. SEAL OUTLET AND INLET OPENINGS PERMANENTLY.

3. ANCHORAGES, PROTECT ANCHORAGES TO PERMANENTLY PREVENT ACCESS OF WATER OR OTHER AGGRESSIVE AGENTS. INSTALL A PERMANENT PLASTIC CAP OVER THE ANCHOR HEAD PRIOR TO GROUTING. LEAVE THIS CAP IN PLACE TO FORM PART OF THE PERMANENT PROTECTION FOR THE TENDON. FILL THE CONCRETE BLOCK–OUT WITH LOW PERMEABILITY CONCRETE OR GROUT. COAT EXPOSED GIRDER ENDS WITH APPROVED ELASTOMERIC SYSTEM HAVING THICKNESS OF 30 TO 45 MILS.

(K) RECORD OF GROUTING OPERATION

PROVIDE RECORDS OF GROUTING FOR REVIEW BY THE ENGINEER WITHIN 72 HOURS OF GROUTING. RECORD THE FOLLOWING INFORMATION:

- DATE GROUTED
- NUMBER OF DAYS FROM STRESSING TO GROUTING
- TYPE OF PREPACKAGED GROUT
- TENDON(S) GROUTED
- INJECTION END AND APPLIED GROUTING PRESSURE
- SUMMARY OF ANY PROBLEMS
- CORRECTIVE ACTION TAKEN
- MEASURE OF THE COMPLETE FILLING OF THE DUCT(S) ADJUSTED FOR THE GROUT DISPLACED BY THE PRESTRESSING STRANDS.
- GROUT LOT NUMBER
- GROUT MANUFACTURE DATE
- ASBI–CERTIFIED INSPECTOR PRESENT DURING OPERATION
- QUALITY CONTROL TEST VALUES
- RESULTS OF POST–GROUTING INSPECTION
- AMBIENT AND SUBSTRATE TEMPERATURES

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COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION		DATE: 08/31/10
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GROUT SPECIFICATIONS		SHEET NO: 12

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