

REVISED 10-12 - DELETED THE REFERENCE TO THE DESIGN MANUAL IN NOTE 19 PERTAINING TO DETAILS IN THE DESIGN MANUAL.  
 REVISED 01-2016 - UPDATED NOTE 17 PERTAINING TO CONCRETE FORMS. (OLD NOTE: REMAINING IN PLACE 5 DAYS OR LONGER, EXCEPT MIN. CONC. FLEXURAL STRENGTH BEFORE REMOVAL SHALL BE 575 PSI).  
 REVISED 07-2016 - ADDED THE DESIGN VERTICAL AND HORIZONTAL EARTH PRESSURES AND RENUMBERED THE GENERAL NOTES. CHANGED DISTANCE IN NOTE #20 FROM 20 INCHES TO 18.  
 ENGLISHLRFDDESIGNEDSINGLECULVERTS.DGN - RCB G1-12 - THIS SHEET ISSUED 04-12.



# SINGLE REINFORCED CONCRETE BOX CULVERT STANDARDS

## GENERAL NOTES:

- THE RCB CULVERT SECTIONS ARE DESIGNED FOR HL-93 LIVE LOAD AND EARTH FILLS OF VARYING HEIGHTS.
- VERTICAL EARTH PRESSURE,  $E_v = 0.120$  kcf.  
HORIZONTAL EARTH PRESSURE,  $E_{hmax} = 0.060$  kcf MAX,  $E_{hmin} = 0.030$  kcf.
- THE RCB CULVERT SECTIONS ARE DESIGNED FOR CLASS 1 EXPOSURE CONDITIONS EXCEPT: CLASS 2 EXPOSURE CONDITION IS UTILIZED FOR THE SLAB DESIGN IN O'FILL INSTANCES.
- ALL SLAB AND FLOOR REINFORCING STEEL IS TO BE SUPPORTED AT INTERVALS OF NOT MORE THAN 3'-0 IN EITHER DIRECTION AS OUTLINED IN THE STANDARD SPECIFICATIONS.
- THE CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR EDGE OR END OF REINFORCING BAR TO BE 2" UNLESS OTHERWISE NOTED.
- EXCEPT FOR DOWEL BARS 5r1 IN SLAB, LONGITUDINAL REINFORCING IS NOT TO EXTEND THRU THE CONSTRUCTION JOINTS.
- FLOOR OF BARREL IS TO BE FINISHED SMOOTH. SIDES OF FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.
- THE PERMISSIBLE CONSTRUCTION JOINT AT THE TOP OF THE WALLS MAY BE LOWERED AT THE CONTRACTOR'S OPTION WITH ENGINEER'S APPROVAL.
- THE REINFORCEMENT SUPPLIED FOR THIS STRUCTURE SHALL BE GRADE 60 REINFORCEMENT IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE DESIGN STRESSES ARE BASED ON GRADE 60 REINFORCEMENT.
- THE VERTICAL BARS IN THE WALLS MAY BE SPLICED ABOVE THE FOOTING AT THE CONTRACTOR'S OPTION AS FOLLOWS:

BAR SIZE NUMBER	4	5	6	7	8	9
MINIMUM SPLICE LENGTH	17"	21"	25"	31"	41"	51"

THIS SPLICE, IF USED, WILL BE AT THE CONTRACTOR'S EXPENSE.

- REINFORCING BAR CLEARANCES WILL BE AS FOLLOWS:  
 EDGE CLEARANCES: 2" EXCEPT  
 TOP OF FLOOR 2 1/4" TO NEAR TRANSVERSE REINFORCING BAR  
 BOTTOM OF FLOOR 3 1/2" TO NEAR TRANSVERSE REINFORCING BAR  
 END CLEARANCES:  
 VERTICAL TOP 2"  
 VERTICAL BOTTOM 3" OR 3 1/2" IF OVERALL HEIGHT OF THE CULVERT IS NOT TO A FULL INCH  
 TRANSVERSE 2"
- ALL CONSTRUCTION JOINTS SHALL BE FORMED WITH A BEVELED KEYWAY EXCEPT AT BELL JOINTS.
- ALL BEVELED KEYWAYS SHALL BE CENTERED.
- KEYWAY SIZE SHALL BE 2x4 EXCEPT AS FOLLOWS:  
KEYWAY BETWEEN THE FLOOR AND WALL SHALL BE 2x6 WHEN THE WALL IS GREATER THAN 10 INCHES WIDE.
- KEYWAY DIMENSIONS SHOWN ON THE PLANS ARE BASED ON NOMINAL DIMENSIONS UNLESS STATED OTHERWISE. IN ADDITION, THE BEVEL USED ON THE KEYWAY SHALL BE LIMITED TO A MAXIMUM OF 10 DEGREES FROM VERTICAL.
- IF O'OF FILL IS SPECIFIED, DETAILS FOR PAVING NOTCH AND REFERENCE TO EPOXY COATING OF SLAB REINFORCING STEEL, IF APPLICABLE, SHALL BE INCLUDED IN THE FINAL PLANS.
- ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE NOTED OR SHOWN.
- SEE CURRENT STANDARD SPECIFICATIONS REGARDING CONCRETE FORM REMOVAL.
- THESE CULVERT STANDARDS LABEL ALL REINFORCING STEEL WITH ENGLISH NOTATION (50r IS 5/8 INCH DIAMETER BAR). ENGLISH REINFORCING STEEL RECEIVED IN THE FIELD MAY DISPLAY THE FOLLOWING "BAR DESIGNATION". THE "BAR DESIGNATION" IS THE STAMPED IMPRESSION ON THE REINFORCING BARS, AND IS EQUIVALENT TO THE BAR DIAMETER IN MILLIMETERS.

ENGLISH SIZE	4	5	6	7	8	9
BAR DESIGNATION	13	16	19	22	25	29

- IN THE EVENT THE SLAB THICKNESS AT THE BARREL END SECTION EXCEEDS 18 INCHES, THE CULVERT PARAPET SHALL EXTEND A MINIMUM OF 6 INCHES ABOVE THE TOP OF THE CULVERT SLAB. REFER TO THE CULVERT DESIGN MANUAL FOR INSTRUCTIONS. THESE DETAILS ARE TO BE INCLUDED IN THE DESIGN PLANS TO ADDRESS THESE SITUATIONS.

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RCB G1-12	TYPICAL CULVERT BARREL DETAILS
RCB G2-12	CULVERT BARREL DETAILS, 3 x 3 BARREL SECTIONS
RCB 3-3-12	CULVERT BARREL DETAILS, 4 x 4 BARREL SECTIONS
RCB 4-4-12	CULVERT BARREL DETAILS, 5 x 3 BARREL SECTIONS
RCB 5-3-12	CULVERT BARREL DETAILS, 5 x 4 BARREL SECTIONS
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RCB 5-5-12	CULVERT BARREL DETAILS, 5 x 6 BARREL SECTIONS
RCB 5-6-12	CULVERT BARREL DETAILS, 6 x 3 BARREL SECTIONS
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RCB 12-10-12	CULVERT BARREL DETAILS, 12 x 11 BARREL SECTIONS
RCB 12-11-12	CULVERT BARREL DETAILS, 12 x 12 BARREL SECTIONS
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PWH 0-1-12	PARALLEL WING HDWLS., 0° SKEW, CROSS SECTION DETAILS
PWH 0-2-12	PARALLEL WING HDWLS., 0° SKEW, WINGWALL ELEV. & BOTT. APRON REINF.
PWH 0-3-12	PARALLEL WING HDWLS., 0° SKEW, TOP APRON REINF.
PWH 0-4-12	PARALLEL WING HDWLS., 0° SKEW, QUANTITY TABULATION, 12'-0 SPAN
PWH 0-5-12	PARALLEL WING HDWLS., 0° SKEW, QUANTITY TABULATION, 10'-0 SPAN
PWH 0-6-12	PARALLEL WING HDWLS., 0° SKEW, QUANTITY TABULATION, 8'-0 SPAN
PWH 0-7-12	PARALLEL WING HDWLS., 0° SKEW, QUANTITY TABULATION, 6'-0 SPAN
PWH 0-8-12	PARALLEL WING HDWLS., 0° SKEW, QUANTITY TABULATION, 5'-0, 4'-0, & 3'-0 SPANS
PWH 0-9-12	PARALLEL WING HDWLS., 15° SKEW, DIMENSION TABLE
PWH 15-1-12	PARALLEL WING HDWLS., 15° SKEW, CROSS SECTION DETAILS
PWH 15-2-12	PARALLEL WING HDWLS., 15° SKEW, WINGWALL ELEV. & BOTT. APRON REINF.
PWH 15-3-12	PARALLEL WING HDWLS., 15° SKEW, TOP APRON REINF.
PWH 15-4-12	PARALLEL WING HDWLS., 15° SKEW, QUANTITY TABULATION, 12'-0 SPAN
PWH 15-5-12	PARALLEL WING HDWLS., 15° SKEW, QUANTITY TABULATION, 10'-0 SPAN
PWH 15-6-12	PARALLEL WING HDWLS., 15° SKEW, QUANTITY TABULATION, 8'-0 SPAN
PWH 15-7-12	PARALLEL WING HDWLS., 15° SKEW, QUANTITY TABULATION, 6'-0 SPAN
PWH 15-8-12	PARALLEL WING HDWLS., 15° SKEW, QUANTITY TABULATION, 5'-0 SPAN
PWH 15-9-12	PARALLEL WING HDWLS., 30° SKEW, DIMENSION TABLE
PWH 30-1-12	PARALLEL WING HDWLS., 30° SKEW, CROSS SECTION DETAILS
PWH 30-2-12	PARALLEL WING HDWLS., 30° SKEW, WINGWALL ELEV. & BOTT. APRON REINF.
PWH 30-3-12	PARALLEL WING HDWLS., 30° SKEW, TOP APRON REINF.
PWH 30-4-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 12'-0 SPAN
PWH 30-5-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 10'-0 SPAN
PWH 30-6-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 8'-0 SPAN
PWH 30-7-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 6'-0 SPAN
PWH 30-8-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 5'-0 SPAN
PWH 30-9-12	PARALLEL WING HDWLS., 30° SKEW, QUANTITY TABULATION, 5'-0 SPAN

## INDEX FOR SINGLE CULVERT STANDARDS (CONT'D):

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PWH 45-2-12	PARALLEL WING HDWLS., 45° SKEW, CROSS SECTION DETAILS
PWH 45-3-12	PARALLEL WING HDWLS., 45° SKEW, WINGWALL ELEV. & BOTT. APRON REINF.
PWH 45-4-12	PARALLEL WING HDWLS., 45° SKEW, TOP APRON REINF.
PWH 45-5-12	PARALLEL WING HDWLS., 45° SKEW, QUANTITY TABULATION, 12'-0 SPAN
PWH 45-6-12	PARALLEL WING HDWLS., 45° SKEW, QUANTITY TABULATION, 10'-0 SPAN
PWH 45-7-12	PARALLEL WING HDWLS., 45° SKEW, QUANTITY TABULATION, 8'-0 SPAN
PWH 45-8-12	PARALLEL WING HDWLS., 45° SKEW, QUANTITY TABULATION, 6'-0 SPAN
PWH 45-9-12	PARALLEL WING HDWLS., 45° SKEW, QUANTITY TABULATION, 5'-0 SPAN
CBJ 1-12	CULVERT BELL JOINTS, 3', 4' & 5' SPANS
CBJ 2-12	CULVERT BELL JOINTS, 6' & 8' SPANS
CBJ 3-12	CULVERT BELL JOINTS, 10' & 12' SPANS
CBJ 4-12	CULVERT BELL JOINTS, ALL SPANS

## SPECIFICATIONS:

DESIGN:  
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 5TH ED., SERIES OF 2010.

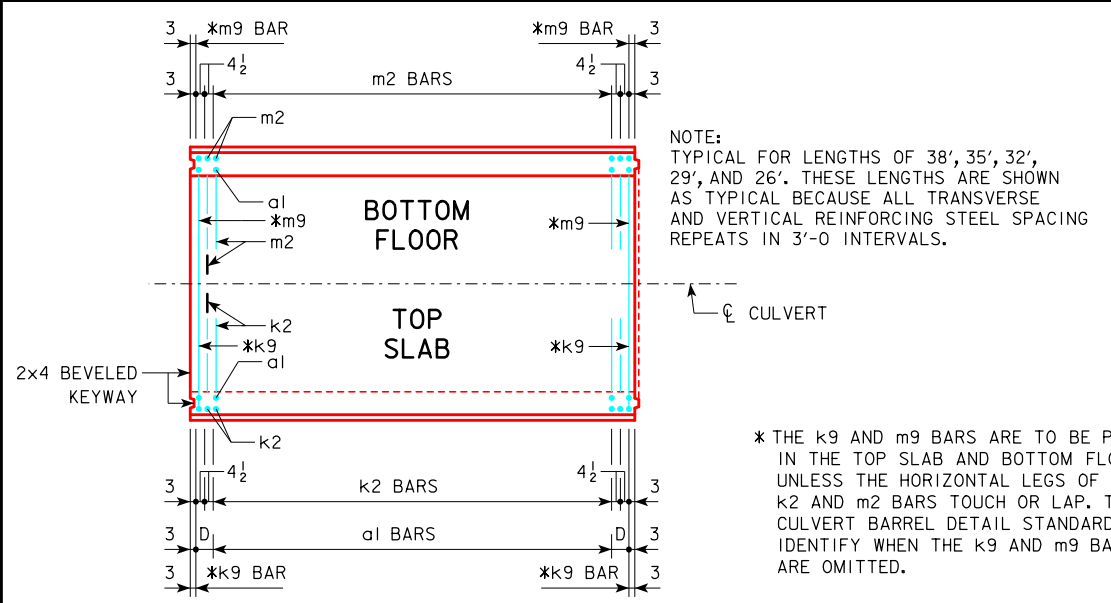
CONSTRUCTION:  
IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, CURRENT SERIES, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS

## DESIGN STRESSES:

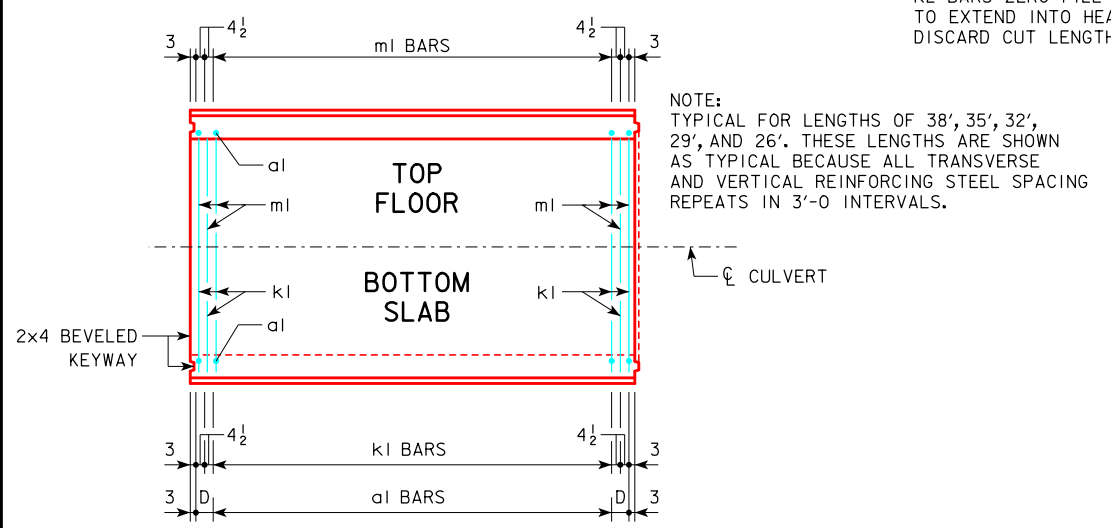
DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 5TH ED., SERIES OF 2010: REINFORCING STEEL IN ACCORDANCE WITH AASHTO LRFD SECTION 5, GRADE 60. CONCRETE IN ACCORDANCE WITH AASHTO LRFD SECTION 5,  $f'_c = 4.0$  KSI.

07-2016 LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN <b>SINGLE REINFORCED CONCRETE BOX CULVERTS</b> APRIL, 2012
		<b>INDEX &amp; GENERAL NOTES</b>
		<b>RCB G1-12</b>

REVISED 07-14 - TRANSITION WALL DETAILS.  
 REVISED 03-2016 - ADDED SKEWED TRANSITION WALL DETAILS.  
 REVISED 12-2016 - EDITED KEYWAY NOTES IN PLAN VIEWS AND CORRECTED TYPPOS.  
 ENGLISHLRFDDESIGNEDSINGLECULVERTS.DGN - RCB G2-12 - THIS SHEET ISSUED 04-12.



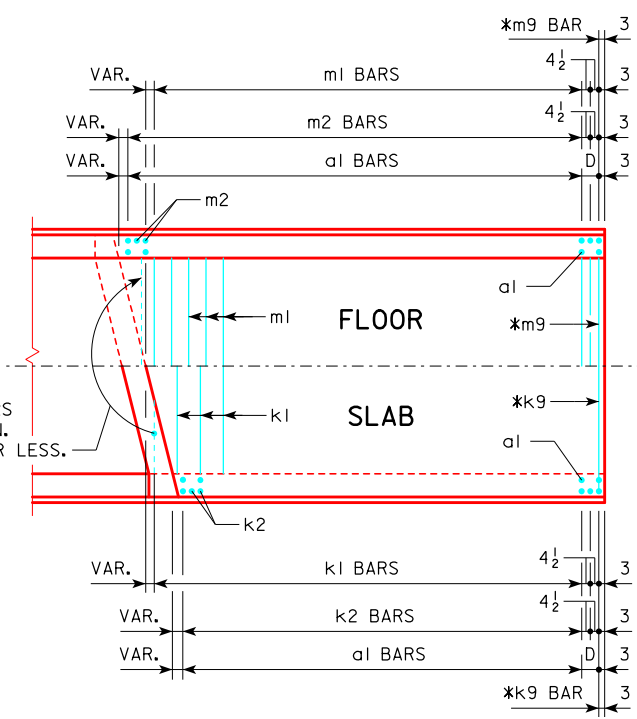
**STANDARD SECTION PLAN VIEW**  
 (KEYWAY IS TO BE OMITTED WHEN BELL JOINTS ARE USED)



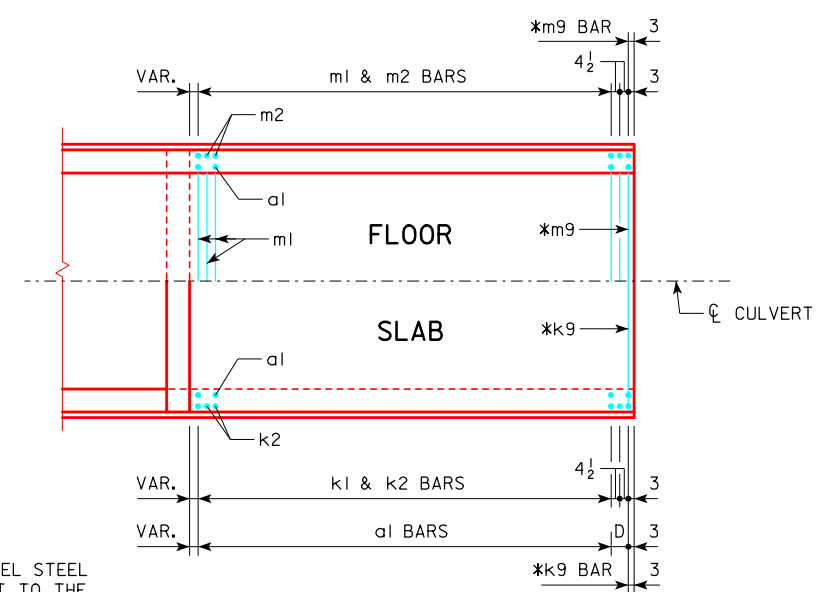
**STANDARD SECTION PLAN VIEW**  
 (KEYWAY IS TO BE OMITTED WHEN BELL JOINTS ARE USED)

\* THE k9 AND m9 BARS ARE TO BE PLACED IN THE TOP SLAB AND BOTTOM FLOOR UNLESS THE HORIZONTAL LEGS OF THE k2 AND m2 BARS TOUCH OR LAP. THE CULVERT BARREL DETAIL STANDARDS IDENTIFY WHEN THE k9 AND m9 BARS ARE OMITTED.

CUT & RELOCATE BARS AS REQUIRED. k1 BARS ALL FILLS & k2 BARS ZERO FILL ONLY. m1 BARS TO EXTEND INTO HEADWALL APRON. DISCARD CUT LENGTHS OF 2'-0 OR LESS.



**TYPICAL SKEW**



**0° SKEW**

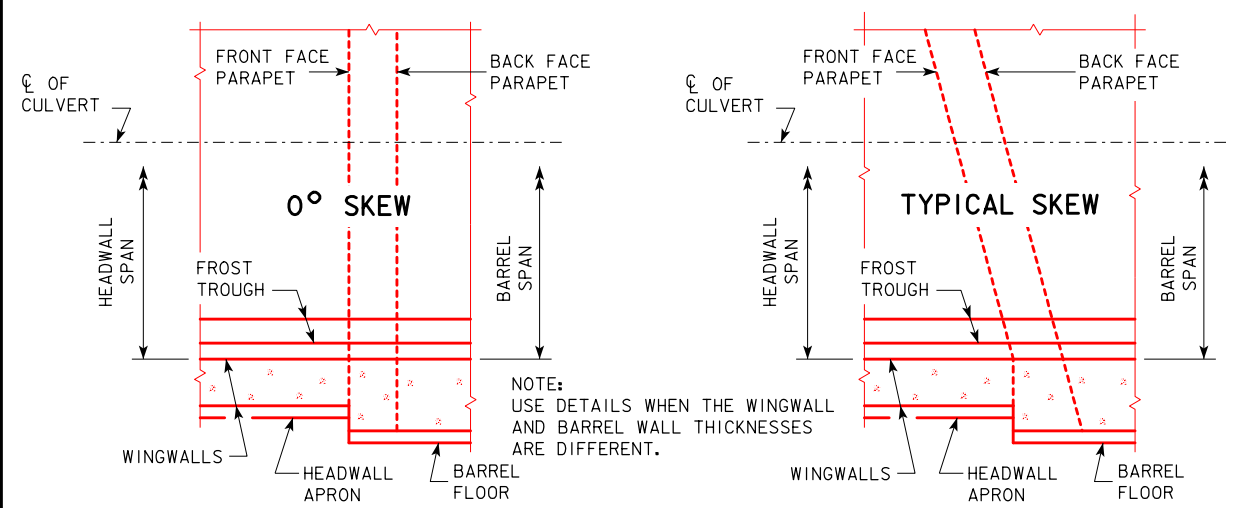
**END SECTION PLAN VIEWS**  
 (KEYWAYS NOT SHOWN)

NOTE: END SECTION DETAILS SHOWN ARE FOR A 15° SKEW BARREL. USE FOR SKEWS OF 30° & 45° BY INCREASING THE NUMBER OF TRANSVERSE REINFORCING BARS REQUIRED TO BE CUT AND RELOCATED.

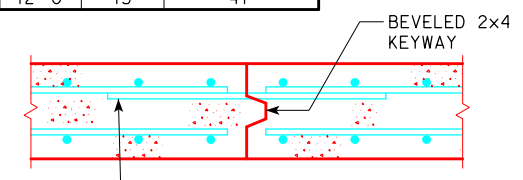
**5r1 BARS - ONE CONST. JT.**

SPAN	NO.	WEIGHT (LB)
3'-0	4	15
4'-0	5	18
5'-0	6	22
6'-0	7	26
8'-0	9	33
10'-0	11	40
12'-0	13	47

NOTE: DIMENSIONS LISTED ON THIS SHEET TO BE USED IN CONJUNCTION WITH DIMENSIONS AND QUANTITIES FOR BARREL SECTION SHEETS.



**TRANSITION WALL DETAILS**



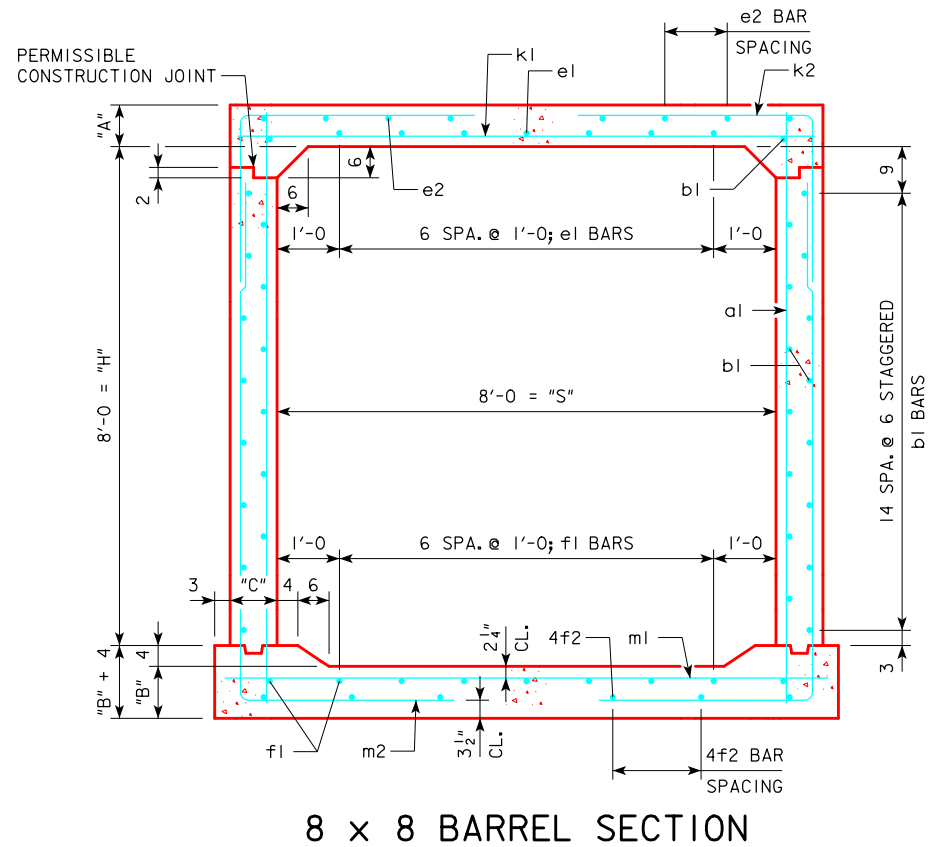
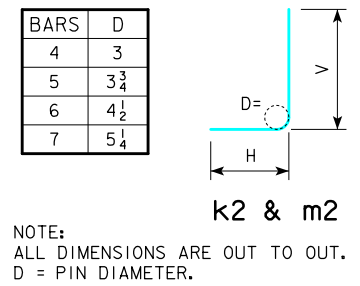
**TOP SLAB CONSTRUCTION JOINT DETAIL**

12-2016 LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN <b>SINGLE REINFORCED CONCRETE BOX CULVERTS</b> APRIL, 2012	
		<b>TYPICAL CULVERT BARREL DETAILS</b>	
		<b>RCB G2-12</b>	

## VARIABLE DIMENSIONS AND QUANTITIES FOR 8 x 8 BARREL SECTIONS

DIMENSIONS								BAR LIST																											QUANTITIES															
								a1			b1			e1			e2			f1			f2			k1			k2			k9			m1			m2			m9			CONCRETE (CY/FT)				STEEL (LB/FT)		
FILL	S	H	A	B	C	D		SIZE	SP.	L	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	L	SIZE	SP.	L	SIZE	SP.	L	SIZE	SP.	L	SIZE	SP.	L	SIZE	SP.	L	SLAB	FLOOR	WALLS	TOTAL	(LB/FT)					
0	8	8	12.5	11	9	9		4	9	9'-10	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	5	12	8'-9	5'-6	3'-3	--	--	5	6	9'-8	6	12	14'-0	5'-8	8'-4	--	--	0.399	0.376	0.424	1.199	167.26
1	8	8	10.5	11	9	9		4	9	9'-8	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	6	9	9'-2	4	6	8'-7	5'-6	3'-1	--	--	5	6	9'-8	4	6	13'-10	5'-6	8'-4	--	--	0.340	0.376	0.424	1.140	162.61
2	8	8	8	10	9	9		5	12	9'-5	4	6	32	5	12	7	4	13	8	4	12	9	4	13	8	7	9	9'-2	5	9	8'-4	5'-6	2'-10	--	--	6	6	9'-8	5	9	12'-11	4'-8	8'-3	--	--	0.267	0.345	0.424	1.036	182.47
3	8	8	8	10	9	9		5	12	9'-5	4	6	32	4	12	7	4	13	8	4	12	9	4	13	8	5	6	9'-2	5	9	7'-9	4'-11	2'-10	--	--	6	6	9'-8	5	9	12'-2	3'-11	8'-3	5	9'-8	0.267	0.345	0.424	1.036	169.76
4-7	8	8	8	10	9	9		4	9	9'-5	4	6	32	4	12	7	4	12	8	4	12	9	4	17	6	6	9	9'-2	4	6	6'-7	3'-9	2'-10	4	9'-2	5	6	9'-8	4	6	11'-8	3'-5	8'-3	4	9'-8	0.267	0.345	0.424	1.036	147.61
8-10	8	8	8	10	9	9		5	12	9'-5	4	6	32	4	12	7	4	14	6	4	12	9	4	14	6	5	6	9'-2	5	9	6'-0	3'-0	3'-0	5	9'-2	7	9	9'-8	5	9	11'-3	3'-0	8'-3	5	9'-8	0.267	0.345	0.424	1.036	158.00
11-15	8	8	8	10	9	9		4	12	9'-5	4	6	32	4	12	7	4	13	6	4	12	9	4	12	6	6	6	9'-2	5	6	5'-8	2'-10	2'-10	5	9'-2	6	6	9'-8	5	6	10'-11	2'-8	8'-3	5	9'-8	0.267	0.345	0.424	1.036	181.05
16-20	8	8	9	10.5	9	9		4	9	9'-6	4	6	32	4	12	7	4	12	6	4	12	9	4	13	6	8	9	9'-2	6	9	5'-11	2'-8	3'-3	6	9'-2	7	6	9'-8	6	9	11'-1	2'-9	8'-4	6	9'-8	0.296	0.361	0.424	1.081	203.63
21-25	8	8	10	12.5	9.5	9		4	12	9'-9	4	6	32	4	12	7	4	11	6	4	12	9	4	12	6	7	6	9'-3	5	6	5'-7	2'-7	3'-0	5	9'-3	7	6	9'-9	5	6	11'-2	2'-8	8'-6	5	9'-9	0.329	0.427	0.447	1.203	203.63
26-30	8	8	11	13.5	10.5	9		5	12	9'-11	4	6	32	4	12	7	4	12	6	4	12	9	4	12	6	7	6	9'-5	5	6	5'-10	2'-9	3'-1	5	9'-5	7	6	9'-11	5	6	11'-5	2'-10	8'-7	5	9'-11	0.367	0.465	0.496	1.328	215.03
31-35	8	8	12.5	15	11.5	6		4	6	10'-2	4	6	32	4	12	7	4	12	6	4	12	9	4	13	6	7	6	9'-7	6	9	6'-5	2'-10	3'-7	6	9'-7	7	6	10'-1	6	9	11'-8	3'-0	8'-8	6	10'-1	0.421	0.522	0.542	1.485	225.63
36-40	8	8	13.5	16	12.5	9		6	9	10'-4	4	6	32	4	12	7	4	12	6	4	12	9	4	13	6	7	6	9'-9	6	9	6'-8	3'-0	3'-8	6	9'-9	7	6	10'-3	6	9	11'-10	3'-1	8'-9	6	10'-3	0.462	0.565	0.589	1.616	243.29
41-45	8	8	14.5	17	13.5	9		6	12	10'-6	4	6	32	4	12	7	4	14	6	4	12	9	4	13	6	7	6	9'-11	5	6	6'-10	3'-5	3'-5	5	9'-11	7	6	10'-5	5	6	12'-1	3'-3	8'-10	5	10'-5	0.503	0.608	0.636	1.747	237.39
46-50	8	8	15	18	14	9		6	9	10'-8	4	6	32	4	12	7	4	14	6	4	12	9	4	14	6	9	9	10'-0	5	6	6'-10	3'-5	3'-5	5	10'-0	9	9	10'-6	5	6	12'-3	3'-4	8'-11	5	10'-6	0.524	0.647	0.659	1.830	261.74
51-55	8	8	16	18.5	15	9		4	9	10'-9	4	6	32	4	12	7	4	13	6	4	12	9	4	14	6	9	9	10'-2	7	9	7'-8	3'-4	4'-4	7	10'-2	9	9	10'-8	7	9	12'-5	3'-5	9'-0	7	10'-8	0.566	0.675	0.706	1.947	274.53

### BENT BAR DETAIL



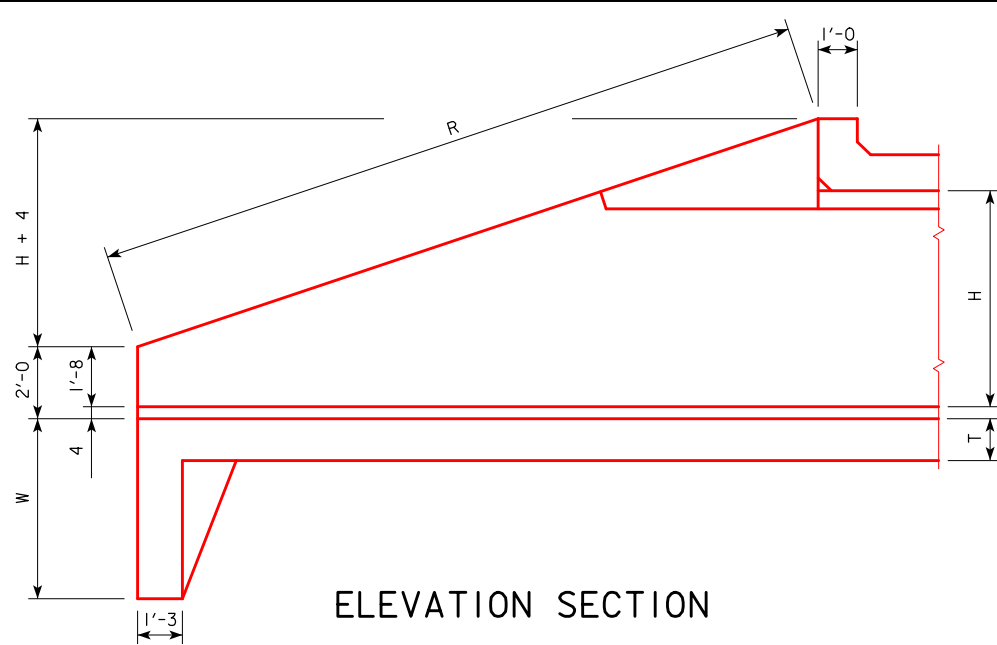
### NOTES:

- DIMENSIONS LISTED ON THIS SHEET TO BE USED IN CONJUNCTION WITH SHEET RCB G2-12.
- THE K2 AND M2 BARS HORIZONTAL LEGS MAY LAP IN LOW FILL SITUATIONS.
- DIMENSIONS "A", "B", "C", "D", AND "SP." LISTED IN THE BAR LIST ARE IN INCHES.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN <b>SINGLE REINFORCED CONCRETE BOX CULVERTS</b> APRIL, 2012
<b>CULVERT BARREL DETAILS</b> 8 x 8 BARREL SECTIONS		<b>RCB 8-8-12</b>

ENGLISHLRFD\DESIGNED\CULVERTS.DGN - RCB 8-8-12 - THIS SHEET ISSUED 04-12.

REVISED 12-2016: REMOVED NOTE STATING LOCATION FOR HEADWALL NOTES. ENGLISHLRFD\DESIGNED\INGLECULVERTS.DGN - PWH 0-1-12 - THIS SHEET ISSUED 04-12.



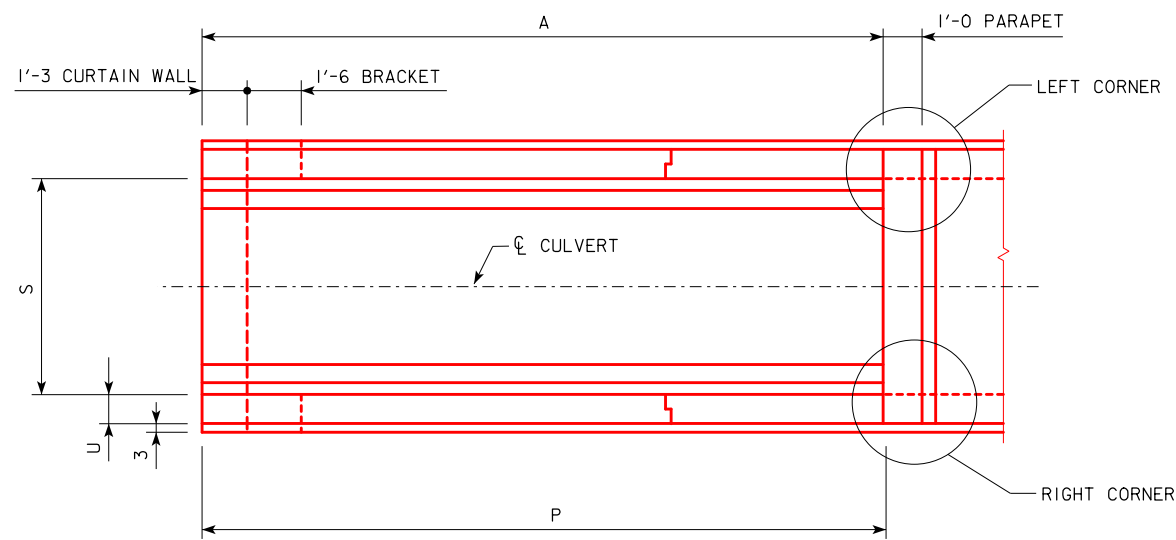
ELEVATION SECTION

		DIMENSION TABLE																	
S x H	12' x 12'	12' x 11'	12' x 10'	12' x 9'	12' x 8'	12' x 7'	12' x 6'	12' x 5'	12' x 4'	10' x 12'	10' x 11'	10' x 10'	10' x 9'	10' x 8'	10' x 7'	10' x 6'	10' x 5'	10' x 4'	S x H
A	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
H	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	12'-0	11'-0	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
P	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	37'-0	34'-0	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	P
R	39'-0 <sup>1/16</sup>	35'-10 <sup>1/8</sup>	32'-8 <sup>1/8</sup>	29'-6 <sup>3/16</sup>	26'-4 <sup>1/4</sup>	23'-2 <sup>5/16</sup>	20'-0 <sup>3/8</sup>	16'-10 <sup>7/16</sup>	13'-8 <sup>1/2</sup>	39'-0 <sup>1/16</sup>	35'-10 <sup>1/8</sup>	32'-8 <sup>1/8</sup>	29'-6 <sup>3/16</sup>	26'-4 <sup>1/4</sup>	23'-2 <sup>5/16</sup>	20'-0 <sup>3/8</sup>	16'-10 <sup>7/16</sup>	13'-8 <sup>1/2</sup>	R
S	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	12'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	10'-0	S
T	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	T
U	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	U
W	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	5'-0	4'-9	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W
M	14'-0	13'-0	11'-0	10'-0	9'-0	8'-0	7'-0	-	-	14'-0	13'-0	11'-0	10'-0	9'-0	8'-0	-	-	-	M
B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
C	6	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	C
D	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
E	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	E

		DIMENSION TABLE																		
S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	4' x 4'	3' x 3'	S x H
A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	13'-0	10'-0	A
H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	8'-0	7'-0	6'-0	5'-0	4'-0	3'-0	6'-0	5'-0	4'-0	3'-0	4'-0	3'-0	H
P	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	25'-0	22'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	13'-0	10'-0	P
R	32'-8 <sup>1/8</sup>	29'-6 <sup>3/16</sup>	26'-4 <sup>1/4</sup>	23'-2 <sup>5/16</sup>	20'-0 <sup>3/8</sup>	16'-10 <sup>7/16</sup>	13'-8 <sup>1/2</sup>	26'-4 <sup>1/4</sup>	23'-2 <sup>5/16</sup>	20'-0 <sup>3/8</sup>	16'-10 <sup>7/16</sup>	13'-8 <sup>1/2</sup>	10'-6 <sup>1/2</sup>	20'-0 <sup>3/8</sup>	16'-10 <sup>7/16</sup>	13'-8 <sup>1/2</sup>	10'-6 <sup>1/2</sup>	13'-8 <sup>1/2</sup>	10'-6 <sup>1/2</sup>	R
S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	5'-0	5'-0	5'-0	5'-0	4'-0	3'-0	S
T	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	T
U	10	10	10	9	9	9	9	10	9	9	9	9	9	9	9	9	9	9	9	U
W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	4'-0	3'-9	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W
M	11'-0	10'-0	9'-0	8'-0	-	-	-	9'-0	8'-0	-	-	-	-	-	-	-	-	-	-	M
B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
C	6	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	C
D	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D
E	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E

**NOTES:**

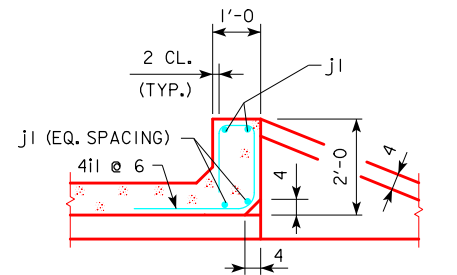
- SEE DRAWING RCB-G1-12 AND RCB-G2-12 FOR GENERAL NOTES, SPECIFICATIONS, AND DESIGN STRESSES.
- SEE DRAWING PWH 0-2-12 THRU 0-4-12 FOR LOCATION OF CERTAIN DIMENSIONS TABULATED.



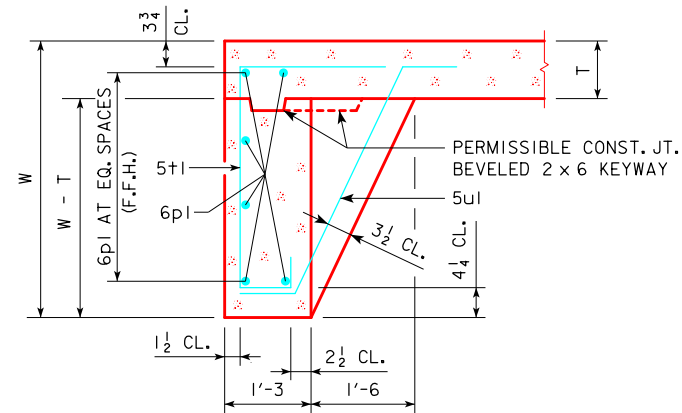
PLAN VIEW

12-2016 LATEST REVISION DATE  <i>Norman L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
	STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS <b>PARALLEL WING HEADWALLS</b>	
	APRIL, 2012	
<b>DIMENSION TABLE</b> 0° SKEW		<b>PWH 0-1-12</b>

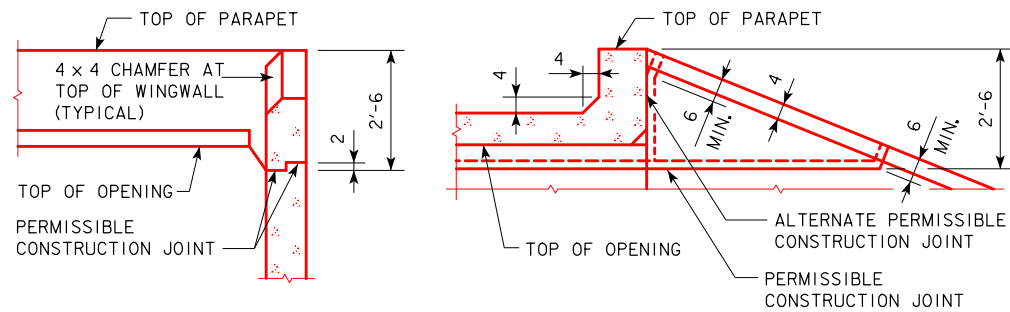
REVISED 12-2016: ADDED CURTAIN WALL CLASS 20 EXCAVATION DETAIL. ENGLISHLRFD\DESIGNED\SINGLE\CULVERTS.DGN - PWH 0-2-12 - THIS SHEET ISSUED 04-12.



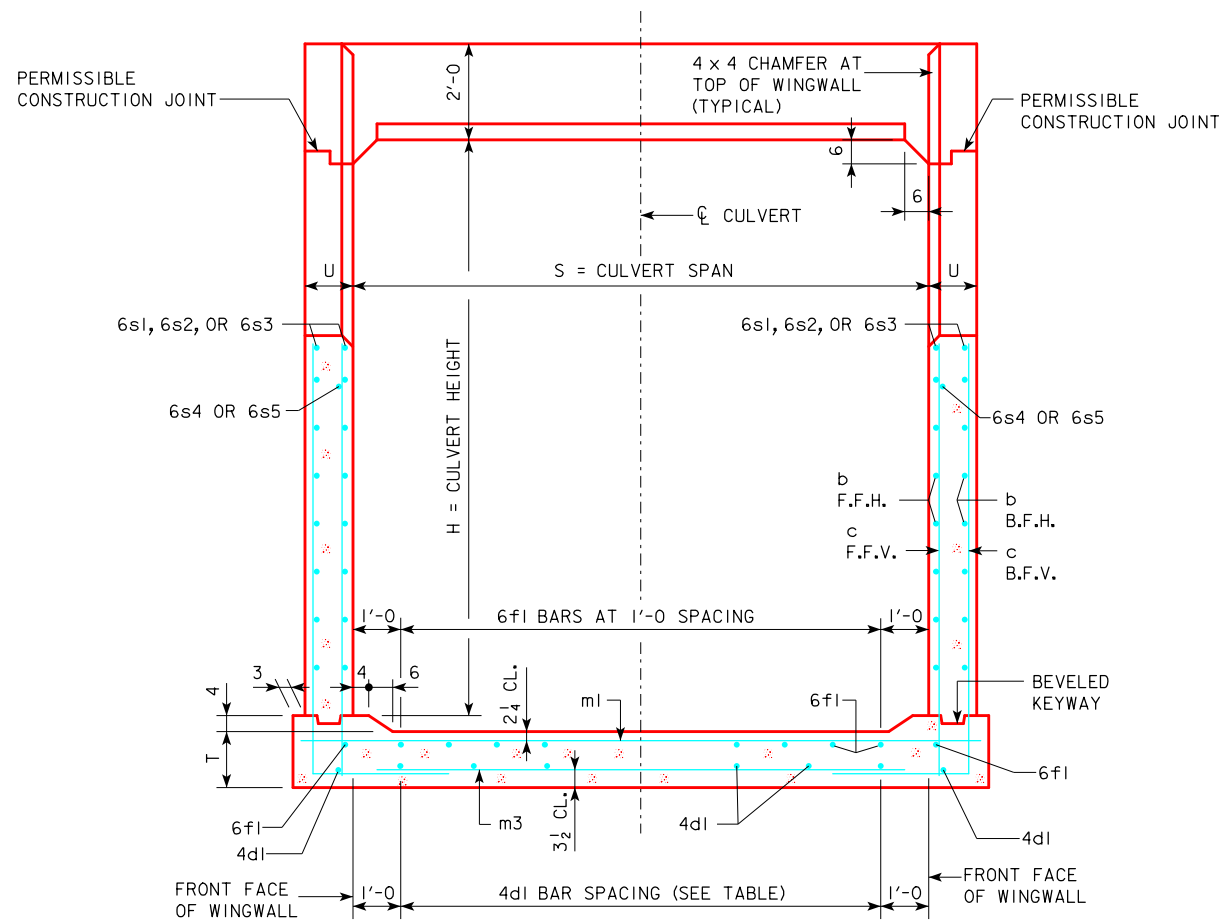
SECTION THRU PARAPET



SECTION THRU CURTAIN WALL

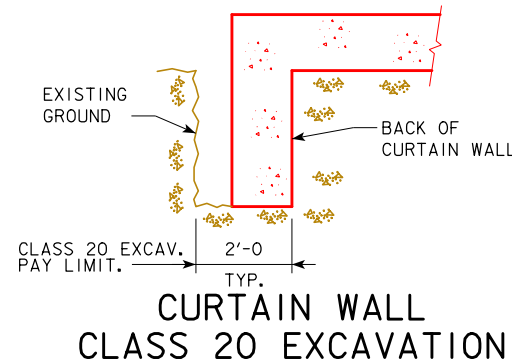


TOP OF WINGWALL DETAILS

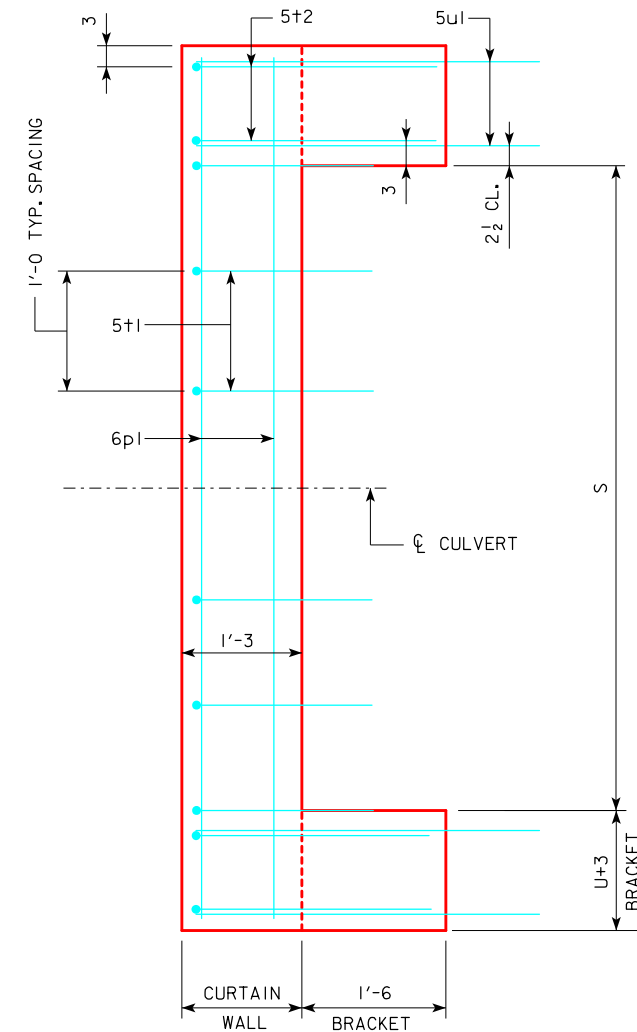


TYPICAL CROSS SECTION - THRU HEADWALL

4dI BAR SPACING		
SPAN	SPACING	NO. OF BARS
3'-0	1 SPA. AT 1'-0	4
4'-0	2 SPA. AT 1'-0	5
5'-0	2 SPA. AT 1'-6	5
6'-0	3 SPA. AT 1'-4	6
8'-0	4 SPA. AT 1'-6	7
10'-0	6 SPA. AT 1'-4	9
12'-0	8 SPA. AT 1'-3	11



CURTAIN WALL CLASS 20 EXCAVATION



CURTAIN WALL DETAIL - PLAN VIEW

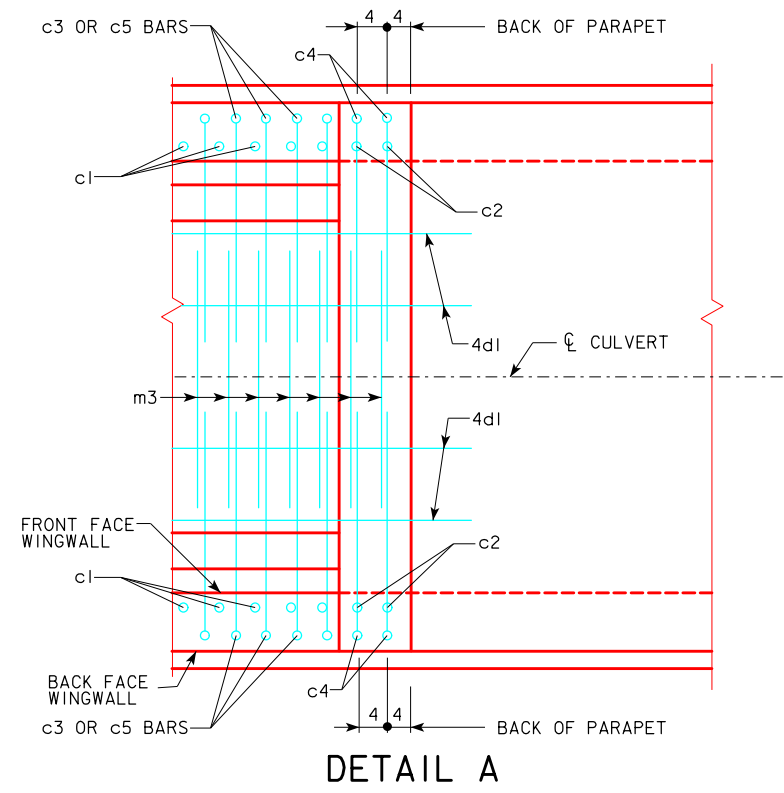
APRON IS NOT SHOWN

**NOTES:**

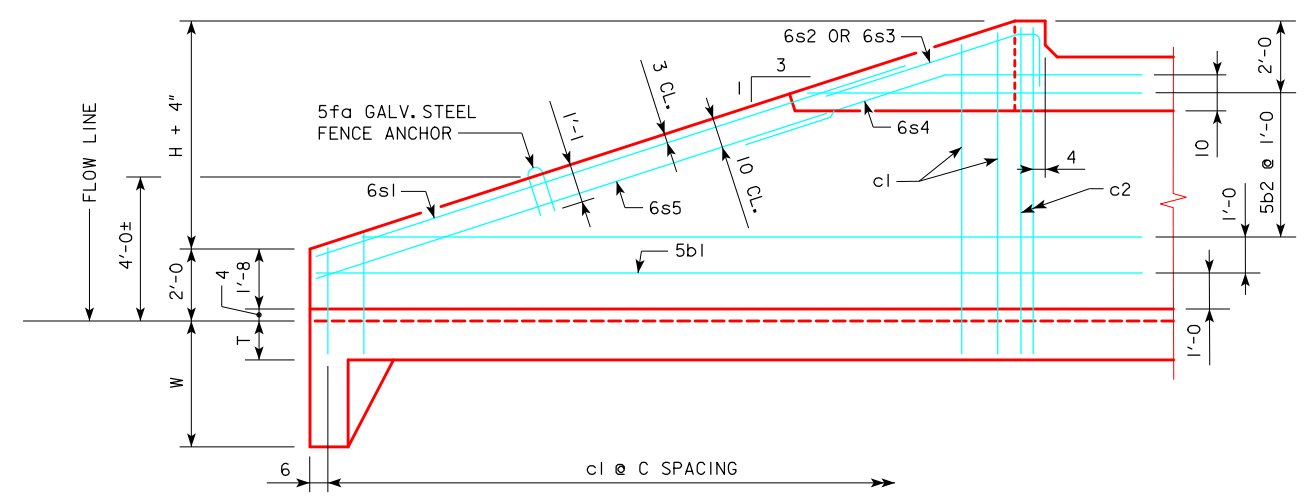
1. SEE DRAWING RCB-G1-12 AND RCB-G2-12 FOR GENERAL NOTES, SPECIFICATIONS, AND DESIGN STRESSES.
2. FOR DIMENSION TABLE SEE DRAWING PWH 0-1-12.

12-2016 LATEST REVISION DATE	<i>Harmon L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS <b>PARALLEL WING HEADWALLS</b> APRIL, 2012	
CROSS SECTION DETAILS		PWH 0-2-12	
0° SKEW			

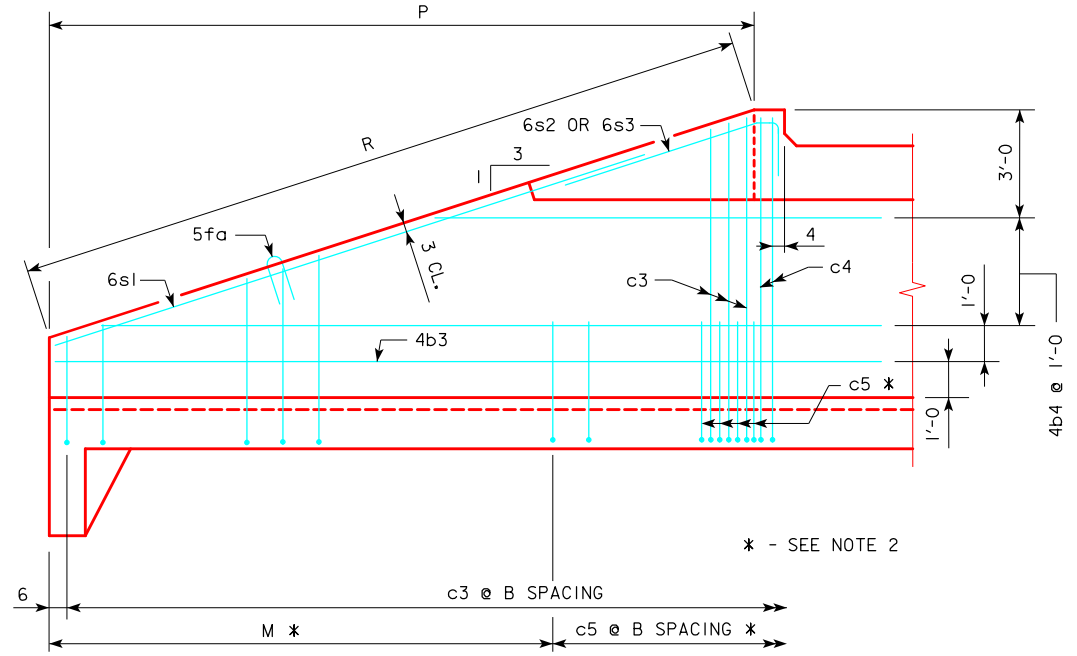
REVISED 07-2016 - CHANGED 10" VERTICAL DIMENSION FROM PERMISSIBLE WALL CONSTRUCTION JOINT TO 6s4 BAR. (DIMENSION WAS 1'-8" VERTICAL FROM TOP OF PARAPET TO 6s4 BAR.) ENGLISHLRFD\SIGNED\SINGLE\CULVERTS.DGN - PWH 0-3-12 - THIS SHEET ISSUED 04-12.



DETAIL A



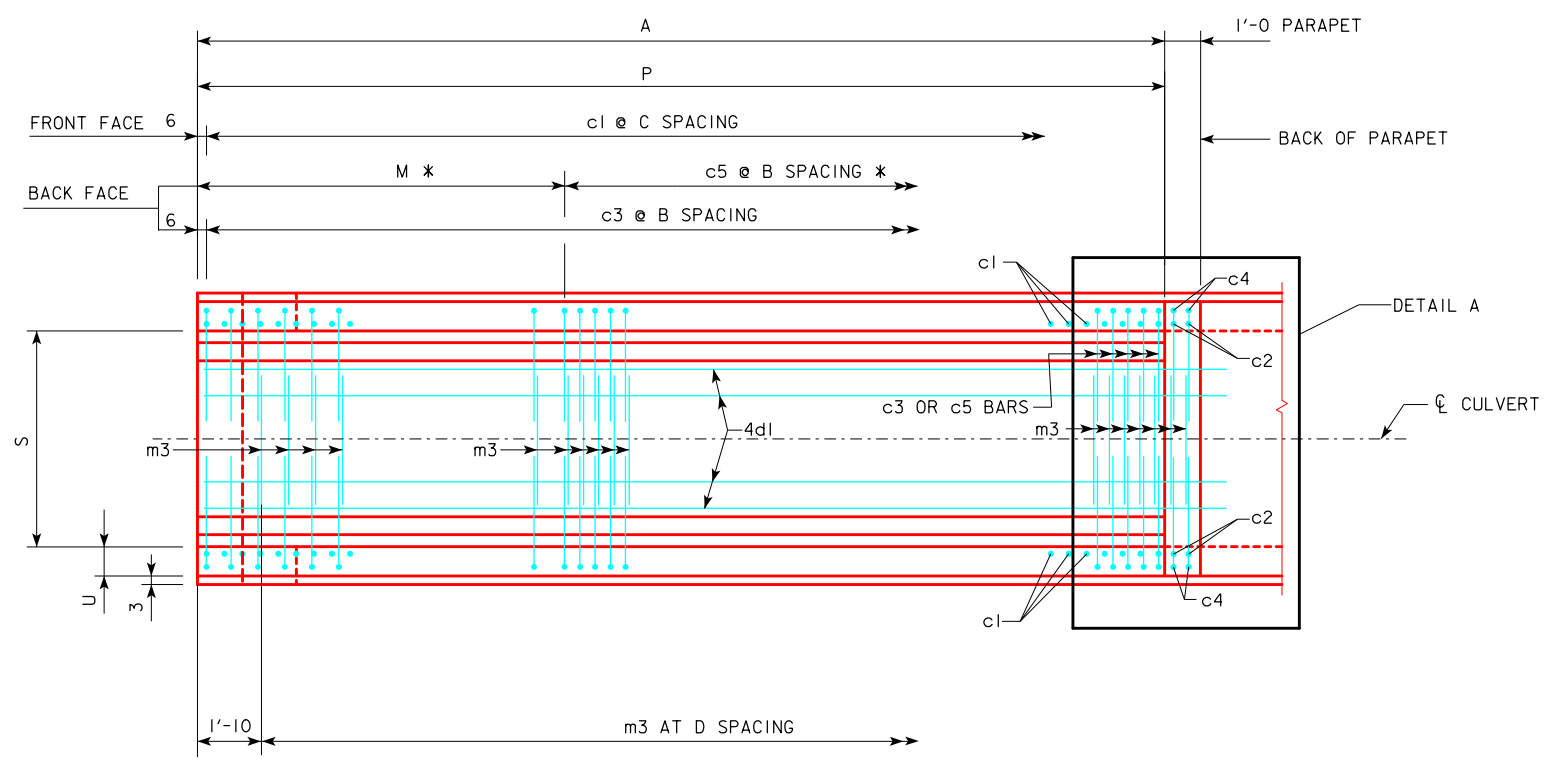
TYPICAL VIEW - FRONT FACE WINGWALL REINFORCING



TYPICAL VIEW - BACK FACE WINGWALL REINFORCING

NOTES :

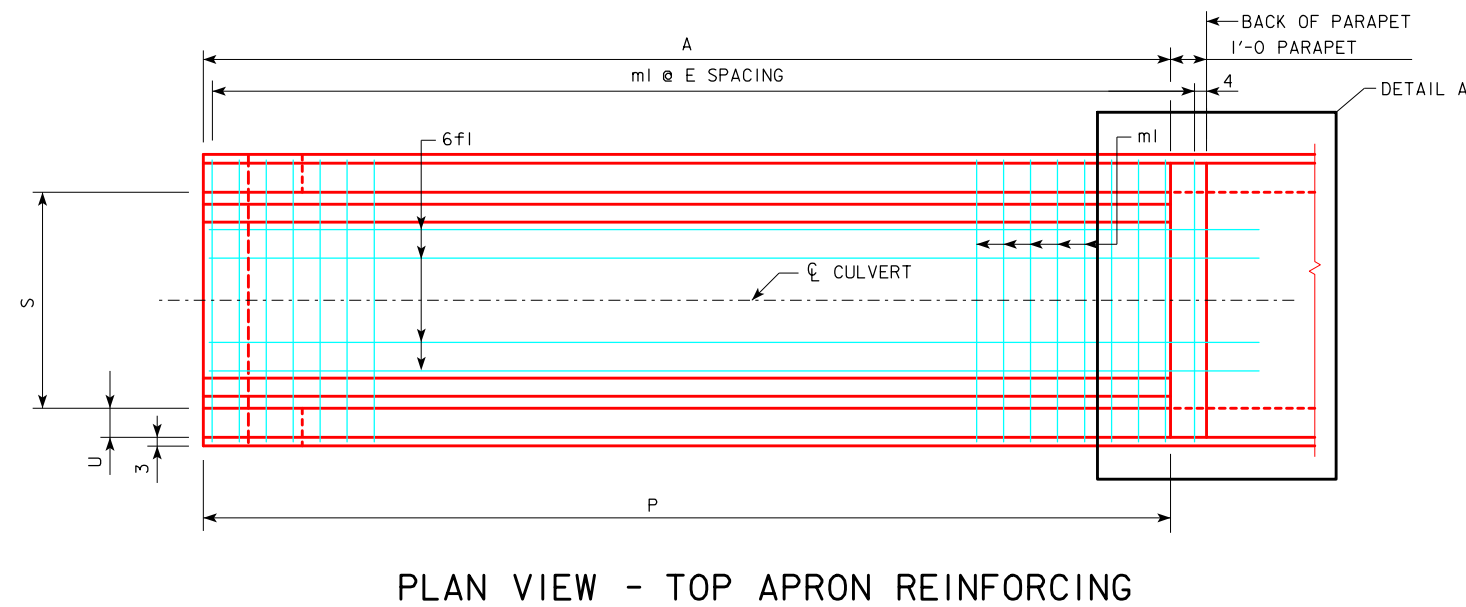
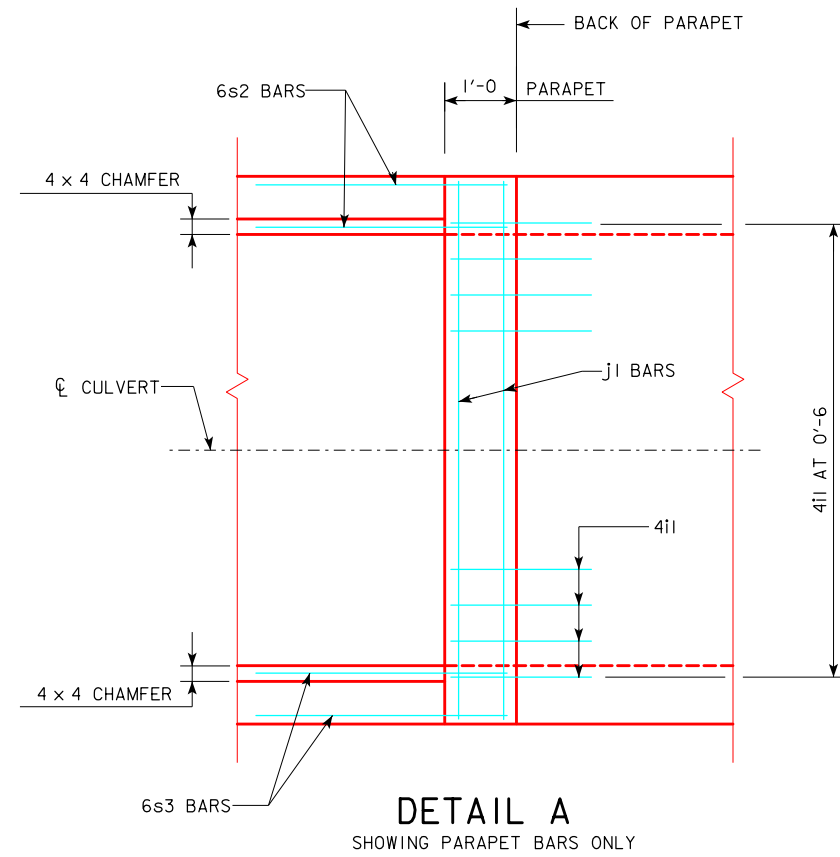
1. BAR SPACINGS AND POSITIONS SHOWN ARE SIMILAR FOR ALL SIZES OF HEADWALLS IN THIS STANDARD.
2. NOT APPLICABLE FOR THE FOLLOWING HEADWALL SIZES: 12x5, 12x4, 10x6, 10x5, 10x4, 8x6, 8x5, 8x4, 6x6, 6x5, 6x4, 6x3, 5x6, 5x5, 5x4, 5x3, 4x4 AND 3x3.
3. FOR HEADWALL DIMENSIONS AND BAR SPACING SEE DRAWING PWH 0-1-12.
4. WINGWALL BARS CONSISTENTLY REFERENCED FROM END OF WING FOR ALL WINGWALLS.
5. APRON m3 BARS ARE TO BE CENTERED ON CULVERT.
6. B.F.V. (c4) AND F.F.V. (c2) BARS ARE APPROXIMATELY 4" FROM THE BACK OF PARAPET FOR ALL HEADWALLS.



PLAN VIEW - BOTTOM APRON REINFORCING


07-2016 LATEST REVISION DATE  <i>Norman L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
	STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS <b>PARALLEL WING HEADWALLS</b>	
	APRIL, 2012	
<b>WINGWALL ELEVATIONS &amp; BOTTOM APRON REINFORCING</b> 0° SKEW		<b>PWH 0-3-12</b>

ENGLISHLRFD\IGNED\INGLECULVERTS.DGN - PWH 0-4-12 - THIS SHEET ISSUED 04-12.



**NOTES :**

1. BAR SPACINGS AND POSITIONS SHOWN ARE SIMILAR FOR ALL SIZES OF HEADWALLS IN THIS STANDARD.
2. FOR HEADWALL DIMENSIONS AND BAR SPACING SEE DRAWING PWH 0-1-12.
3. TOP TRANSVERSE APRON BARS ARE REFERENCED APPROXIMATELY 4" FROM THE BACK OF THE PARAPET FOR ALL HEADWALLS.

LATEST REVISION DATE  <i>Norman L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - SINGLE REINFORCED CONCRETE BOX CULVERTS <b>PARALLEL WING HEADWALLS</b>	
	APRIL, 2012	
	<b>PARAPET REINFORCING &amp; TOP APRON REINFORCING</b> 0° SKEW	<b>PWH 0-4-12</b>







# SINGLE PRECAST REINFORCED CONCRETE BOX CULVERT STANDARDS

## GENERAL NOTES:

1. THE PRECAST RCB CULVERT SECTIONS ARE DESIGNED FOR HL-93 LIVE LOAD AND EARTH FILLS OF VARYING HEIGHTS.
2. VERTICAL EARTH PRESSURE,  $E_v=0.120$  kcf. HORIZONTAL EARTH PRESSURE,  $E_{hmax} = 0.060$  kcf MAX,  $E_{hmin} = 0.030$  kcf.
3. THE PRECAST RCB CULVERT SECTIONS ARE DESIGNED FOR CLASS 2 EXPOSURE CONDITIONS.
4. THE CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR EDGE OR END OF REINFORCING BAR TO BE  $1\frac{1}{2}$ " MIN. AND 2" MAX. UNLESS OTHERWISE NOTED.
5. THE REINFORCEMENT SUPPLIED FOR THIS STRUCTURE SHALL BE PLAIN AND/OR DEFORMED WELDED WIRE REINFORCEMENT (WWR)  $F_y = 65$  ksi, AND/OR GRADE 60 REINFORCING STEEL IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE REINFORCEMENT AREAS ARE BASED ON WELDED WIRE REINFORCEMENT. IF REINFORCING BARS ARE SUBSTITUTED FOR WELDED WIRE REINFORCEMENT, THE REINFORCEMENT AREAS SHALL BE INCREASED BY 8%. THE BARREL SECTIONS IN THESE STANDARDS WERE DESIGNED WITH PLAIN WWR,  $F_y = 65$  ksi.
6. ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE NOTED OR SHOWN.
7. ANY OF THE FOLLOWING COMBINATIONS OF REINFORCEMENT MAY BE USED:
  - A. 1 OR 2 LAYERS OF WELDED WIRE REINFORCEMENT OR
  - B. 1 LAYER OF WELDED WIRE REINFORCEMENT AND 1 LAYER OF REINFORCEMENT BARS OR
  - C. 1 LAYER OF REINFORCEMENT BARS.
 THE REINFORCEMENT SHALL BE DEVELOPED IN ACCORDANCE WITH AASHTO LRFD SPECIFICATIONS.
8. THE MAXIMUM SIZE OF REINFORCEMENT BARS SHALL BE #6, EXCEPT FOR PARAPET REINFORCEMENT AS DETAILED.
9. THE MAXIMUM WELDED WIRE REINFORCEMENT SIZE SHALL BE A W23/D23 PER LAYER (MAXIMUM OF 2 LAYERS).
10. THE SPACING CENTER TO CENTER OF THE TRANSVERSE WIRES OR BARS SHALL NOT BE LESS THAN 2" NOR MORE THAN 4". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES OR BARS SHALL NOT BE MORE THAN 8".
11. WELDING WILL NOT BE ALLOWED ON REINFORCEMENT BARS OR WELDED WIRE REINFORCEMENT, EXCEPT THAT THE ORIGINAL WELDING REQUIRED TO MANUFACTURE THE WIRE REINFORCEMENT IS ACCEPTABLE.
12. WHEN REINFORCEMENT IS CUT, ADDITIONAL REINFORCEMENT SHALL BE ADDED ON BOTH SIDES OF THE CUT MEMBER TO REPLACE OR EXCEED THE CUT REINFORCEMENT.
13. BOXCAR SOFTWARE VERSION 3.1 WAS USED FOR THE DESIGN OF THE BARREL SECTIONS FOR THESE STANDARDS.
14. THESE CULVERT STANDARDS LABEL ALL REINFORCING STEEL WITH ENGLISH NOTATION (#3 IS  $\frac{3}{8}$  INCH DIAMETER BAR). ENGLISH REINFORCING STEEL RECEIVED AT THE PRECAST PLANT MAY DISPLAY THE FOLLOWING "BAR DESIGNATION". THE "BAR DESIGNATION" IS THE STAMPED IMPRESSION ON THE REINFORCING BARS, AND IS EQUIVALENT TO THE BAR DIAMETER IN MILLIMETERS.
 

ENGLISH SIZE	3	4	5	6	7	8	9	10	11
BAR DESIGNATION	10	13	16	19	22	25	29	32	36
15. THE FIRST PRECAST BARREL SECTION ADJACENT TO THE OUTLET PRECAST END SECTION MAY BE A DOUBLE GROOVE BARREL TO FACILITATE PLACEMENT OF OUTLET END SECTIONS AND ALLOW INLET AND OUTLET END SECTIONS TO BE SIMILAR.

## INDEX FOR PRECAST CULVERT STANDARDS:

PRCB G1-13	INDEX & GENERAL NOTES
PRCB G2-13	TYPICAL CULVERT BARREL DETAILS
PRCB 6-13	CULVERT BARREL DETAILS, 6' SPANS
PRCB 8-13	CULVERT BARREL DETAILS, 8' SPANS
PRCB 10-13	CULVERT BARREL DETAILS, 10' SPANS
PRCB 12-13	CULVERT BARREL DETAILS, 12' SPANS
PES 1-13-T1	TYPE 1 END SECTION DETAILS, UP TO 7.5° SKEWS
PES 1-13-T3	TYPE 3 END SECTION DETAILS, UP TO 7.5° SKEWS
PES 2-13-T3	TYPE 3 END SECTION DETAILS, 7.5° TO 45° SKEWS
PES 3-13-T3	TYPE 3 LINTEL BEAM DETAILS, 0° TO 45° SKEWS
PES 4-13	ALTERNATE CURTAIN WALL DETAILS
PEP 1-13	EMBANKMENT PROTECTION DETAILS, 0° TO 45° SKEWS

## SPECIFICATIONS:

DESIGN:  
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 5TH ED., SERIES OF 2010.

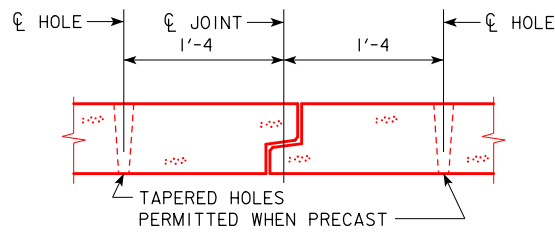
CONSTRUCTION:  
IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, CURRENT SERIES, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS.

## DESIGN STRESSES:

DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 5TH ED., SERIES OF 2010:  
BAR REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION 5, GRADE 60.  
WELDED WIRE REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION 5.  
CONCRETE IN ACCORDANCE WITH AASHTO LRFD SECTION 5,  $f'_c$  FOR BARREL SECTIONS AS NOTED ON CULVERT BARREL DETAIL STANDARDS, FOR END SECTION DESIGN  $f'_c = 5$  ksi.

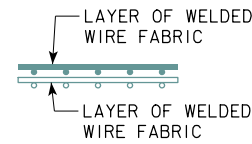
REVISED 07-2016 - ADDED THE DESIGN VERTICAL AND HORIZONTAL EARTH PRESSURES AND RENUMBERED THE GENERAL NOTES. ENGLISH SIGNED PRECAST CULVERTS.DGN - PRCB G1-13 - THIS SHEET ISSUED 01-13.

07-2016 LATEST REVISION DATE   APPROVED BY BRIDGE ENGINEER		
	STANDARD DESIGN <b>SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS</b> JANUARY, 2013	
	INDEX AND GENERAL NOTES	PRCB G1-13



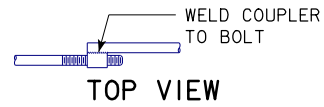
**TYPICAL TIE LAYOUT**

NOTE:  
HOLES SHALL BE CAST OR DRILLED 1'-4 FROM CENTERLINE OF JOINTS AS SHOWN ABOVE, UNLESS FORMS ARE SET UP FOR 1'-4 SPACING FROM OUTSIDE OF JOINT.

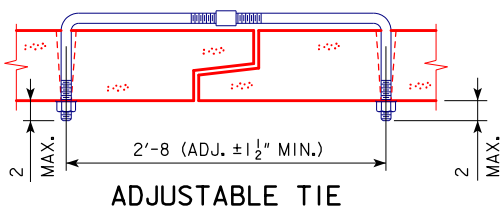


**FABRIC LAYER DETAIL**

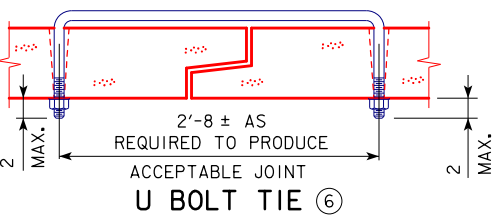
NOTE:  
WHEN MORE THAN ONE LAYER OF WELDED WIRE FABRIC IS USED TO OBTAIN THE REQUIRED REINFORCEMENT AREAS, THE WIRES OF THE WELDED WIRE FABRIC SHALL BE PLACED AS SHOWN.



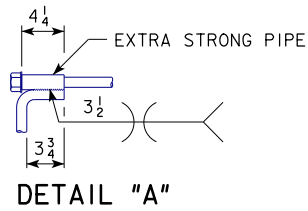
**TOP VIEW**



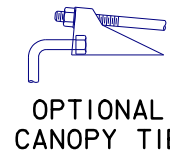
**ADJUSTABLE TIE**



**U BOLT TIE ⑥**

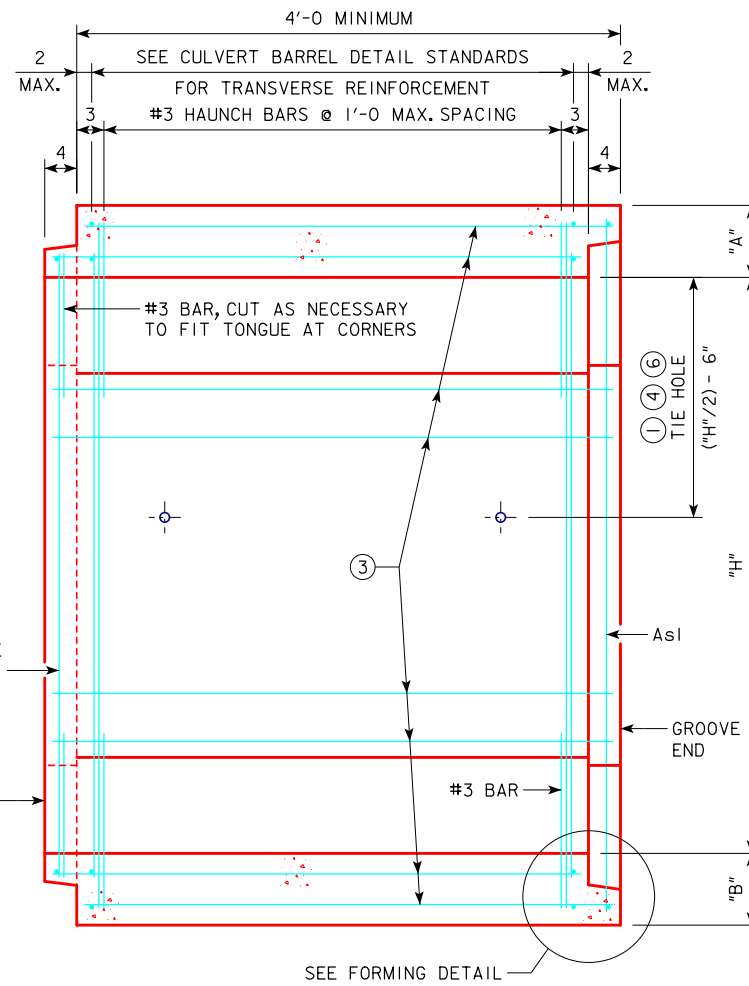


**DETAIL "A"**



**OPTIONAL CANOPY TIE**

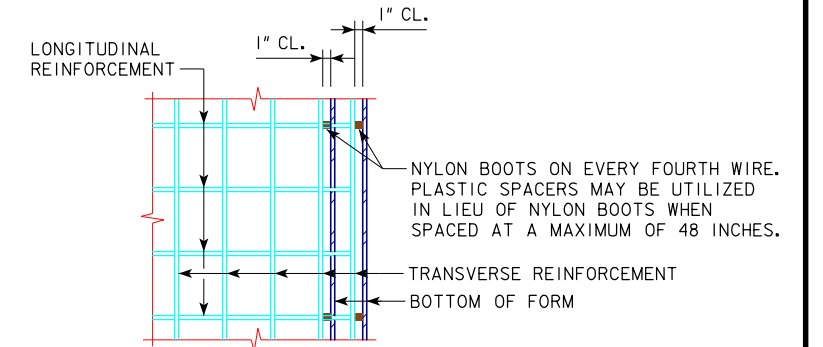
\* THE CONNECTIONS SHALL BE PLACED AT THE DOWNSTREAM END WHEN THE CONNECTIONS ARE PLACED INSIDE OF STRUCTURE.



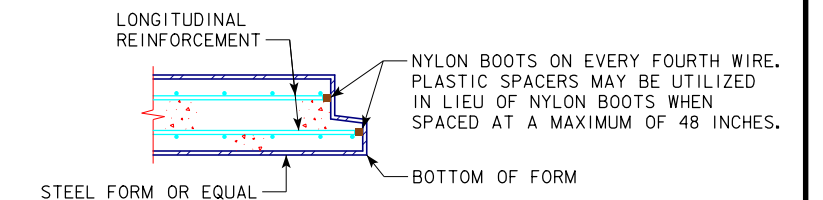
**LONGITUDINAL BARREL SECTION**  
(REINFORCEMENT BAR OPTION SHOWN)

**NOTES:**

- ① CULVERT TIES ARE TO BE 1" φ RODS. SEE THIS SHEET FOR CONNECTION DETAILS.
- ② HAUNCH SIZES ARE TO BE 12" VERTICAL, 12" HORIZONTAL ON ALL BOX SIZES.
- ③ LONGITUDINAL REINFORCEMENT DENOTED AS As5 & As6 MUST BE PLACED IN SLAB, FLOOR, AND WALLS AND MUST BE 0.06 IN<sup>2</sup>/FT. MIN.
- ④ REFER TO APPLICABLE END SECTION DETAIL SHEET FOR BARREL TO END SECTION CONNECTION TIE HOLE LOCATIONS.
- ⑤ OPTIONAL SQUARED CORNERS WITH 3/4" TO 2" CHAMFER.
- ⑥ U BOLT TIES ARE REQUIRED FOR BIKE, PEDESTRIAN AND CATTLE PATHS WITH NUTS ON FILL SIDE.

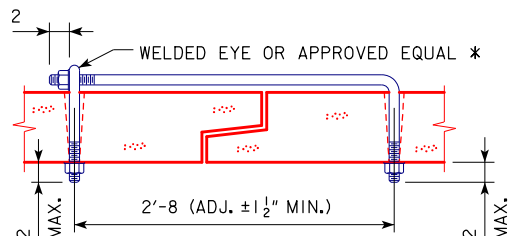


**PLAN**

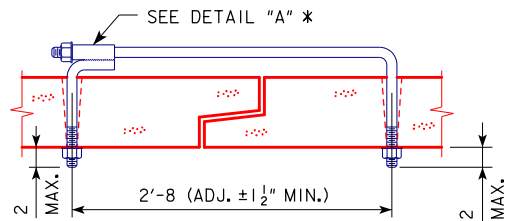


**SECTION**

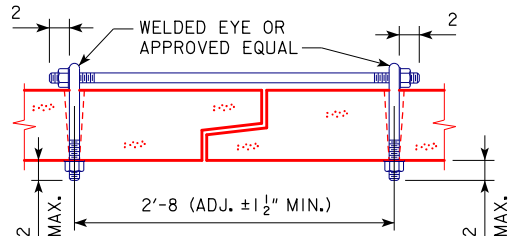
**FORMING DETAIL**



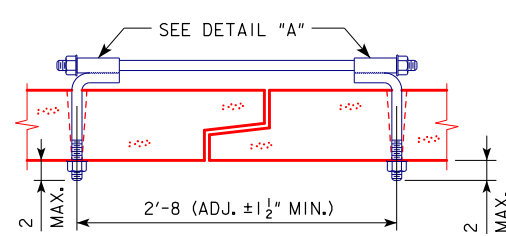
**EYE BOLT TIE**



**WELDED PIPE TIE**

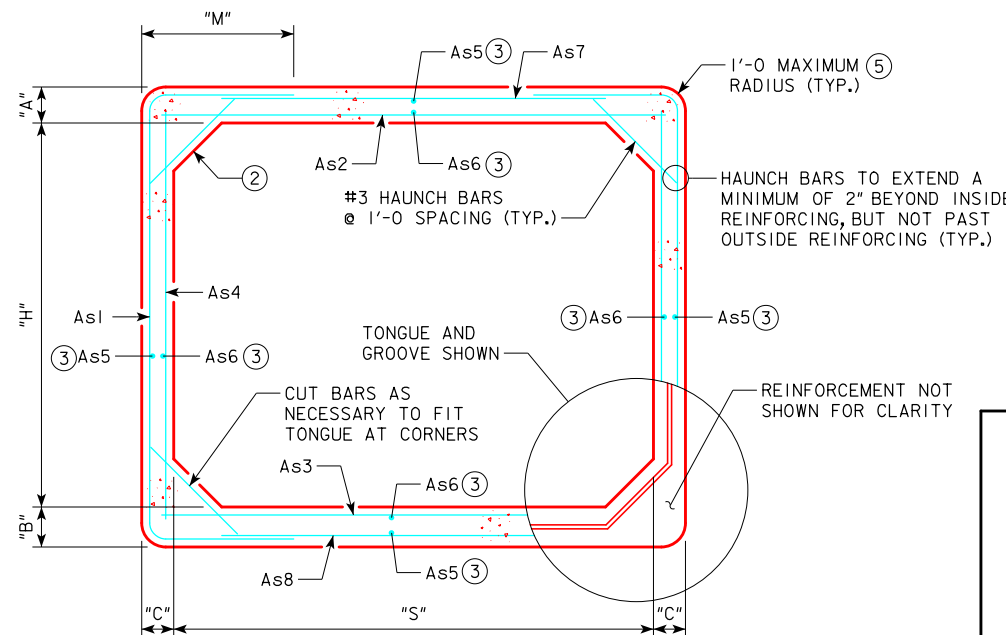


**DOUBLE EYE BOLT TIE**

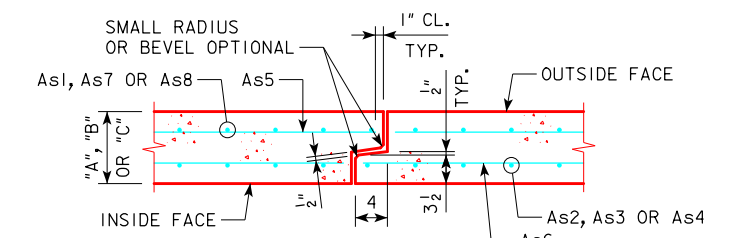


**DOUBLE WELDED PIPE TIE**

**APPROVED CONCRETE BOX TIES**



**TRANSVERSE BARREL SECTION**  
(REINFORCEMENT BAR OPTION SHOWN)



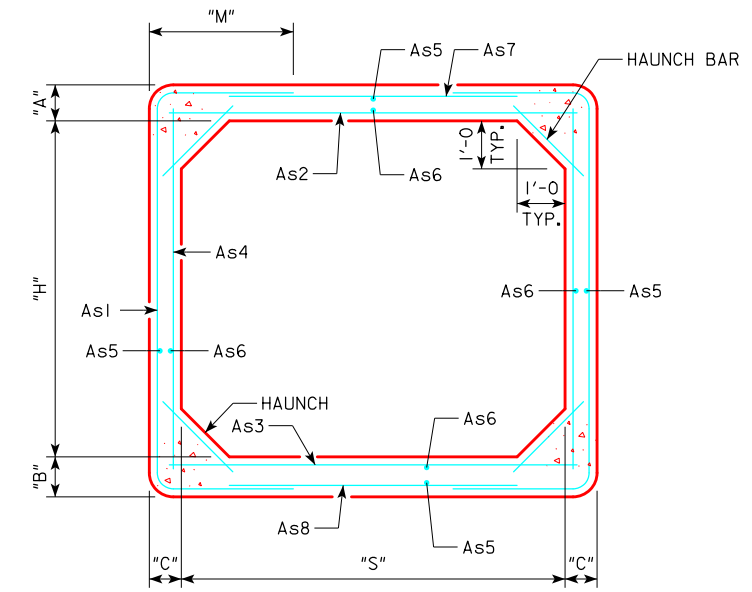
**TONGUE AND GROOVE JOINT DETAIL**

REVISED 07-2016 - CORRECTED TYPES. ENGLISH SIGNED PRECAST CULVERTS.DGN - PRCB G2-13 - THIS SHEET ISSUED 01-13.

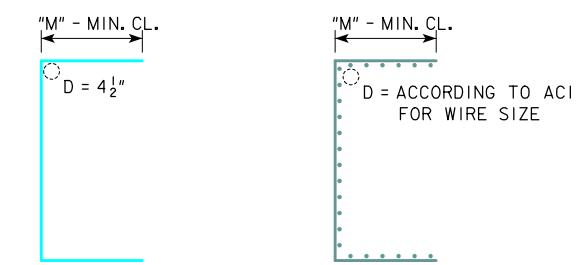
07-2016 LATEST REVISION DATE  <i>Norman L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
	STANDARD DESIGN <b>SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS</b> JANUARY, 2013	
	<b>TYPICAL CULVERT BARREL DETAILS</b>	<b>PRCB G2-13</b>

## VARIABLE DIMENSIONS AND QUANTITIES FOR 8' SPAN BARREL SECTIONS

DIMENSIONS									REINFORCEMENT REQUIREMENTS (IN <sup>2</sup> /FT)										WEIGHT (LB/FT)	
SIZE	CLASS	f'c (ksi)	FILL	S	H	A	B	C	As1		As2		As3		As4		As7/As8			
									AREA	LENGTH	M	AREA	LENGTH	AREA	LENGTH	AREA	LENGTH	AREA	LENGTH	
8x4	1	5.0	2-9	8	4	9	10	8	0.47	10'-9"	2'-10"	0.42	8'-6"	0.40	8'-6"	0.20	4'-6"	0.24	5'-4"	3320
	2	5.0	10-19	8	4	9	10	8	0.65	10'-9"	2'-10"	0.66	8'-6"	0.67	8'-6"	0.20	4'-6"	0.24	5'-4"	3320
	3	5.0	20-25	8	4	9	10	8	0.85	10'-9"	2'-10"	0.83	8'-6"	0.85	8'-6"	0.20	4'-6"	0.24	5'-4"	3320
8x5	1	5.0	2-9	8	5	9	10	8	0.41	11'-9"	2'-10"	0.46	8'-6"	0.46	8'-6"	0.20	5'-6"	0.24	5'-4"	3520
	2	5.0	10-19	8	5	9	10	8	0.57	11'-9"	2'-10"	0.72	8'-6"	0.74	8'-6"	0.20	5'-6"	0.24	5'-4"	3520
	3	5.0	20-25	8	5	9	10	8	0.74	11'-9"	2'-10"	0.91	8'-6"	0.94	8'-6"	0.20	5'-6"	0.24	5'-4"	3520
8x6	1	5.0	2-9	8	6	9	10	8	0.37	12'-9"	2'-10"	0.50	8'-6"	0.50	8'-6"	0.20	6'-6"	0.24	5'-4"	3720
	2	5.0	10-19	8	6	9	10	8	0.51	12'-9"	2'-10"	0.76	8'-6"	0.79	8'-6"	0.20	6'-6"	0.24	5'-4"	3720
	3	5.0	20-25	8	6	9	10	8	0.66	12'-9"	2'-10"	0.96	8'-6"	0.99	8'-6"	0.20	6'-6"	0.24	5'-4"	3720
8x7	1	5.0	2-10	8	7	9	10	8	0.34	13'-9"	2'-10"	0.53	8'-6"	0.54	8'-6"	0.20	7'-6"	0.24	5'-4"	3920
	2	5.0	11-19	8	7	9	10	8	0.47	13'-9"	2'-10"	0.79	8'-6"	0.82	8'-6"	0.20	7'-6"	0.24	5'-4"	3920
	3	5.0	20-25	8	7	9	10	8	0.60	13'-9"	2'-10"	1.00	8'-6"	1.02	8'-6"	0.20	7'-6"	0.24	5'-4"	3920
8x8	1	5.0	2-10	8	8	9	10	8	0.31	14'-9"	2'-10"	0.56	8'-6"	0.57	8'-6"	0.20	8'-6"	0.24	5'-4"	4120
	2	5.0	11-19	8	8	9	10	8	0.43	14'-9"	2'-10"	0.81	8'-6"	0.84	8'-6"	0.20	8'-6"	0.24	5'-4"	4120
	3	5.0	20-25	8	8	9	10	8	0.56	14'-9"	2'-10"	1.01	8'-6"	1.04	8'-6"	0.20	8'-6"	0.24	5'-4"	4120
8x9	1	5.0	2-11	8	9	9	10	8	0.30	15'-9"	2'-10"	0.59	8'-6"	0.60	8'-6"	0.20	9'-6"	0.24	5'-4"	4320
	2	5.0	12-19	8	9	9	10	8	0.42	16'-1"	3'-0"	0.81	8'-6"	0.85	8'-6"	0.22	9'-6"	0.24	5'-0"	4320
	3	5.0	20-25	8	9	9	10	8	0.54	16'-5"	3'-2"	1.01	8'-6"	1.05	8'-6"	0.26	9'-6"	0.24	5'-0"	4320
8x10	1	5.0	2-11	8	10	9	10	8	0.31	17'-1"	3'-0"	0.61	8'-6"	0.63	8'-6"	0.25	10'-6"	0.24	5'-0"	4520
	2	5.0	12-20	8	10	9	10	8	0.48	17'-1"	3'-0"	0.84	8'-6"	0.88	8'-6"	0.34	10'-6"	0.24	5'-0"	4520
	3	5.0	21-25	8	10	9	10	9	0.51	17'-5"	3'-2"	0.94	8'-6"	0.99	8'-6"	0.34	10'-6"	0.24	5'-0"	4810



**TYPICAL BARREL SECTION**



**REINFORCEMENT BARS      WELDED WIRE REINFORCEMENT**

### BENT BAR DETAILS

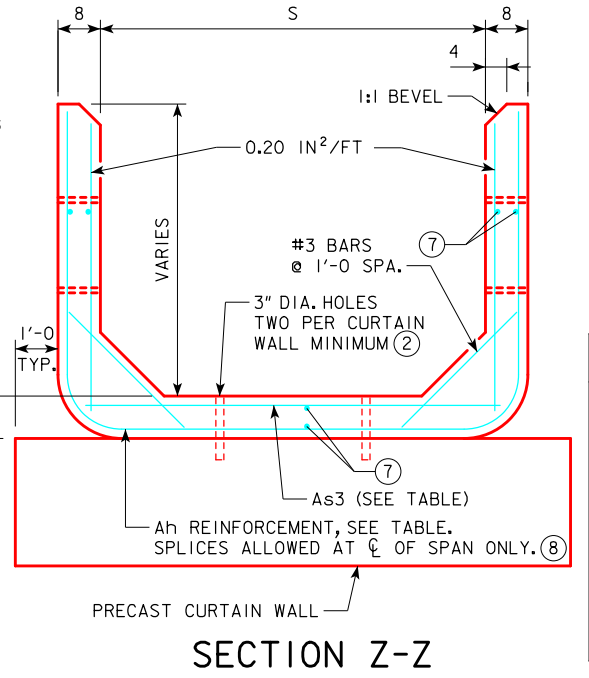
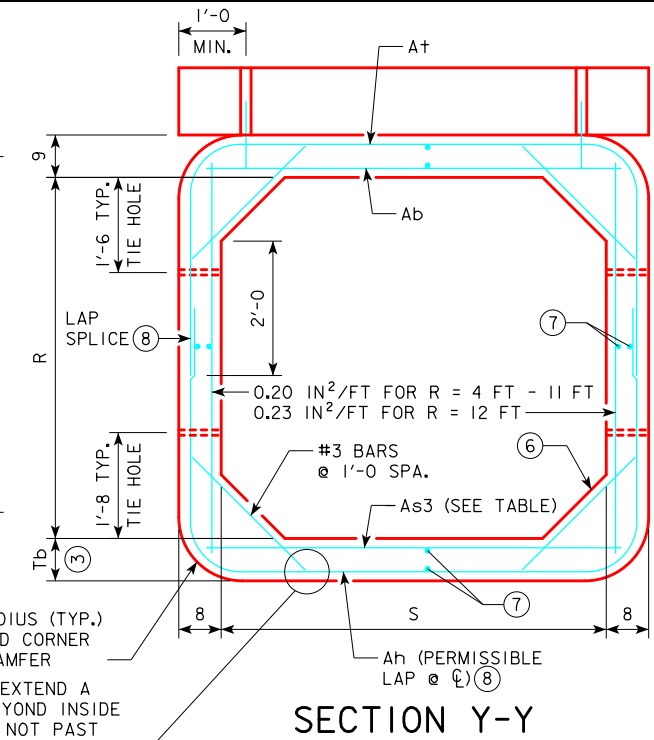
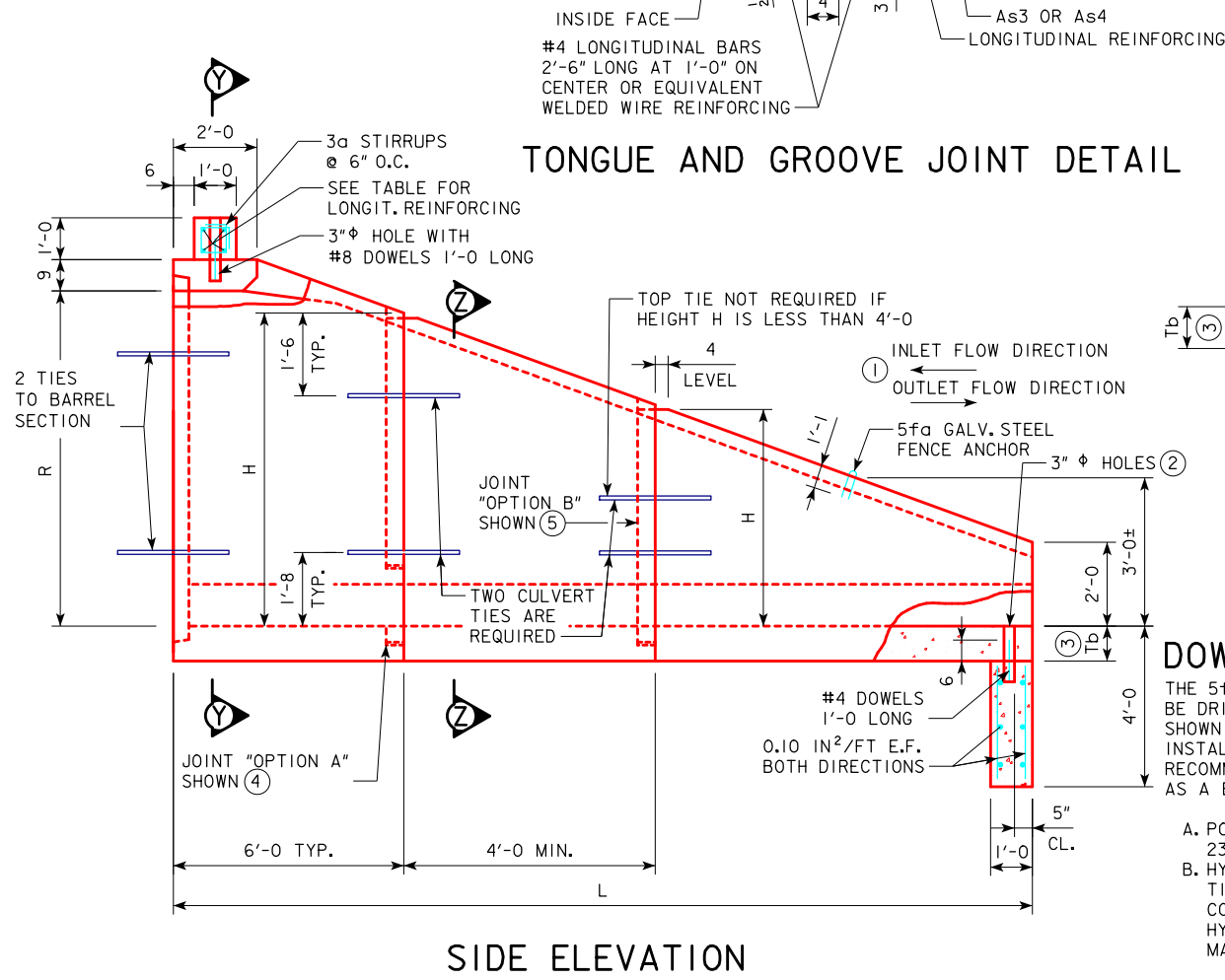
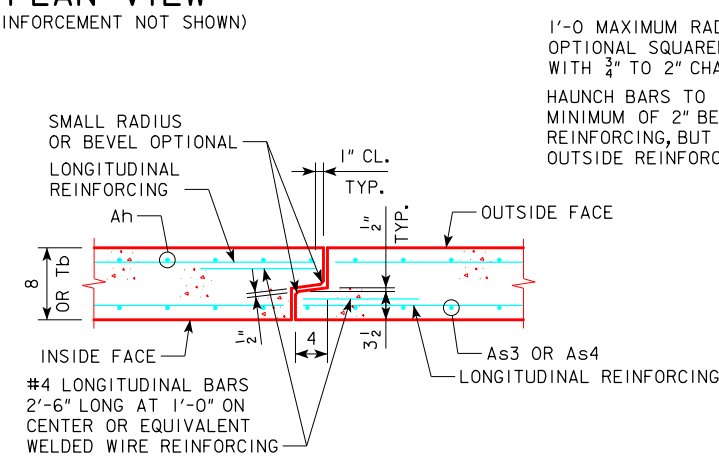
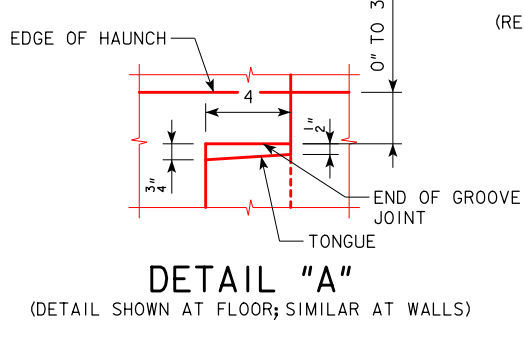
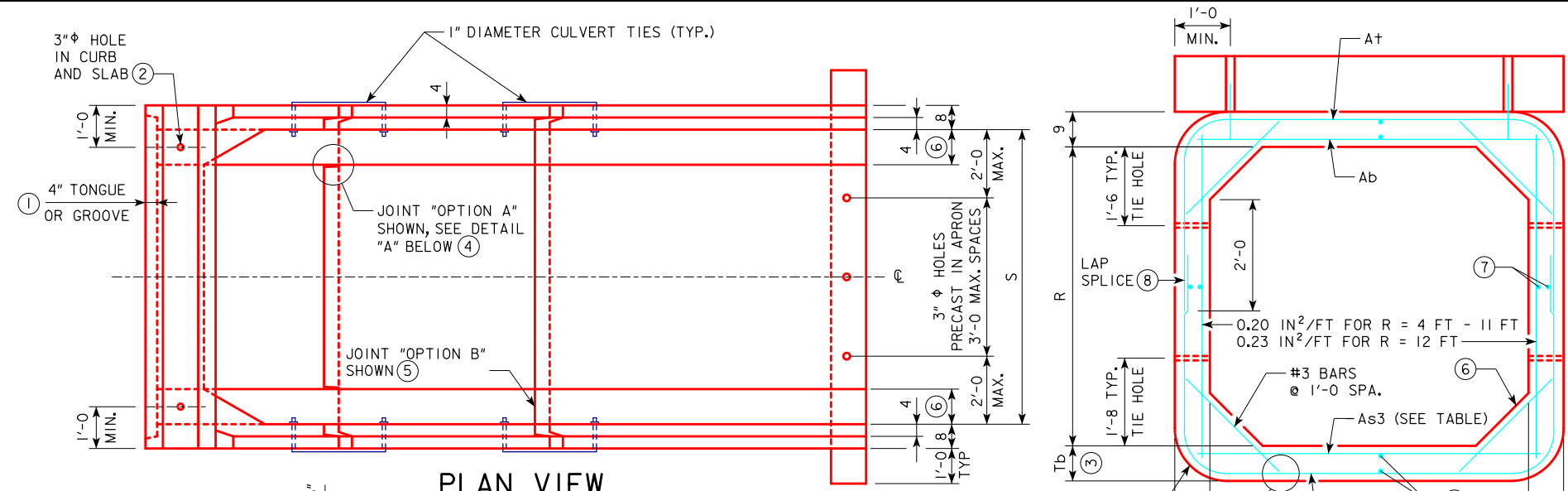
ALL DIMENSIONS ARE OUT TO OUT.  
D = PIN DIAMETER (MIN.).  
PIN DIAMETER MAY BE INCREASED IF NEEDED TO MAINTAIN CLEAR COVER.

### NOTES:

1. DIMENSIONS "A", "B" & "C" LISTED IN THE BAR LIST ARE IN INCHES.
2. LONGITUDINAL REINFORCEMENT DENOTED AS As5 AND As6 MUST BE PLACED IN SLAB, FLOOR, AND WALLS AND MUST BE 0.06 IN<sup>2</sup>/FT MINIMUM.
3. ALL REINFORCEMENT LENGTHS AND AREAS ARE MINIMUM REQUIREMENTS.
4. IF REINFORCING BARS ARE SUBSTITUTED FOR WELDED WIRE REINFORCING, DIMENSION "M" AND/OR LENGTH OF THE As7/As8 REINFORCEMENT SHALL BE ADJUSTED TO ENSURE ADEQUATE LAP LENGTH IS PROVIDED.
5. WEIGHT OF SECTIONS ASSUMES A DENSITY OF 150 PCF AND SQUARED CORNERS.
6. SEE PRCB G1-13 AND G2-13 FOR ADDITIONAL INFORMATION AND NOTES.

ENGLISHIGNEDPRECASTCULVERTS.DGN - PRCB 8-13 - THIS SHEET ISSUED 01-13.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	STANDARD DESIGN <b>SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS</b> JANUARY, 2013
<b>CULVERT BARREL DETAILS</b> 8' SPAN BARREL SECTIONS		<b>PRCB 8-13</b>



**CONSTRUCTION NOTES:**

- PRECAST BOX CULVERT END SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH DETAILS AND NOTES, AS SHOWN BELOW:
- REINFORCING FOR PRECAST END SECTIONS & CURTAIN WALLS SHALL BE WELDED WIRE REINFORCING (WWR) MEETING THE REQUIREMENTS OF AASHTO LRFD SECTION 5. THE CONCRETE COVER OVER THE REINFORCING STEEL SHALL NOT BE LESS THAN 1.5 INCHES OR GREATER THAN 2.0 INCHES.
- REFER TO SHEET PRCB G1-13 FOR ADDITIONAL NOTES.
- REFER TO FABRIC DETAIL ON SHEET PRCB G2-13 FOR MULTIPLE WWR LAYERS.
- (1) USE TONGUE ON INLET END SECTION AND GROOVE ON OUTLET END SECTION.
  - (2) FILL HOLES WITH GROUT. GROUT SHALL CONSIST OF 1 PART CEMENT AND 2 PARTS SAND. USE AIR ENTRAINED PORTLAND CEMENT. GROUT MIX SHALL HAVE A MAXIMUM SLUMP OF 4 INCHES.
  - (3) THICKNESS OF FLOOR, Tb = 8 IN. FOR 6' SPAN, Tb = 10 IN. FOR ALL OTHER SPANS.
  - (4) JOINT "OPTION A": PROVIDE JOINT IN WALLS AND FLOOR. TERMINATE JOINT AT HAUNCH. SEE DETAIL "A" ON THIS SHEET.
  - (5) JOINT "OPTION B": PROVIDE JOINT IN WALLS, FLOOR AND HAUNCH.
  - (6) HAUNCH DIMENSION TO MATCH BARREL HAUNCH SIZE.
  - (7) MINIMUM LONGITUDINAL REINFORCEMENT SHALL BE 0.06 SQ. INCHES PER PERIPHERAL FOOT ON ALL FACES OF THE END SECTION, EXCEPT IN THE TONGUE AND GROOVE AREA.
  - (8) LAP SPLICES SHALL BE CLASS C AND SHALL BE DESIGNED ACCORDING TO THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

**A+ & Ab REINF.**

SPAN S (FT)	A+ (IN <sup>2</sup> /FT)	Ab (IN <sup>2</sup> /FT)
6	0.22	0.33
8	0.24	0.46
10	0.31	0.59
12	0.38	0.74

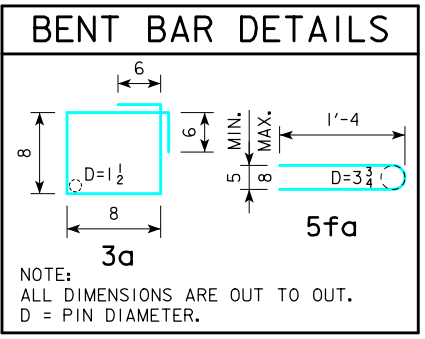
**DIMENS. Ah & As3 REINF.**

SPAN S (FT)	SECTION HT. H (FT)	Ah (IN <sup>2</sup> /FT)	BOTTOM SLAB THICK. (IN)		
			REQUIRED As3 (IN <sup>2</sup> /FT)		
6	3	0.20	0.20	---	
	4	0.20	0.20	---	
	5	0.20	0.20	---	
	6	0.20	0.20	---	
	7	0.31	0.23	---	
	8	0.46	0.31	---	
	8	4	0.24	---	0.24
		5	0.24	---	0.24
6	6	0.24	---	0.24	
	7	0.24	---	0.24	
8	8	0.34	---	0.24	
	9	0.49	---	0.29	
10	10	0.67	---	0.37	
	4	0.24	---	0.24	
5	5	0.24	---	0.24	
	6	0.24	---	0.24	
7	7	0.24	---	0.24	
	8	0.24	---	0.24	
9	9	0.36	---	0.31	
	10	0.51	---	0.40	
11	11	0.70	---	0.50	
	12	0.94	---	0.62	
12	4	0.24	---	0.24	
	5	0.24	---	0.24	
6	6	0.24	---	0.24	
	7	0.24	---	0.24	
8	8	0.24	---	0.26	
	9	0.34	---	0.34	
10	10	0.49	---	0.42	
	11	0.67	---	0.53	
12	12	0.90	---	0.65	

NOTE: H IS THE LARGEST VERTICAL DIMENSION OF THE SECTION.

**PARAPET LONGIT. REINFORCING**

SPAN S (FT)	REQUIRED BAR SIZE
6'	#5
8'	#6
10'	#6
12'	#7



**APRON DIMENS.**

BOX RISE R (FT)	APRON LENGTH L (FT)
3	7'-3"
4	10'-3"
5	13'-3"
6	16'-3"
7	19'-3"
8	22'-3"
9	25'-3"
10	28'-3"
11	31'-3"
12	34'-3"

**DOWEL SETTING NOTE :**

THE 5fa BARS MAY BE SET AS DOWELS IN DRILLED HOLES. HOLES SHALL BE DRILLED TO THE DEPTH REQUIRED TO ACHIEVE BAR EMBEDMENT AS SHOWN IN THE "SIDE ELEVATION" DETAIL. THE DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. EITHER OF THE FOLLOWING SYSTEMS MAY BE USED AS A BONDING AGENT:

A. POLYMER GROUT SYSTEM SHALL BE IN ACCORDANCE WITH ARTICLE 2301.03, E, OF THE STANDARD SPECIFICATIONS.

B. HYDRAULIC CEMENT GROUT SYSTEMS. DRILLED HOLES ARE TO BE 2 1/2 TIMES THE DOWEL DIAMETER AND ARE TO BE BLOWN CLEAN WITH COMPRESSED AIR IMMEDIATELY PRIOR TO PLACING GROUT. THE HYDRAULIC CEMENT GROUT SHALL BE ONE OF THOSE APPROVED IN MATERIALS I.M. 491.13.

07-2016  
LATEST REVISION DATE

*Norman L. Mc Donald*  
APPROVED BY BRIDGE ENGINEER

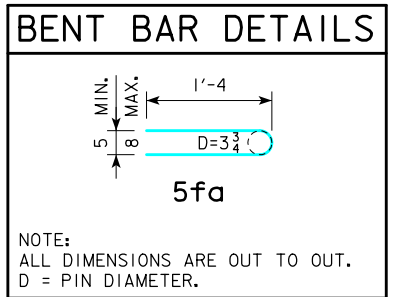
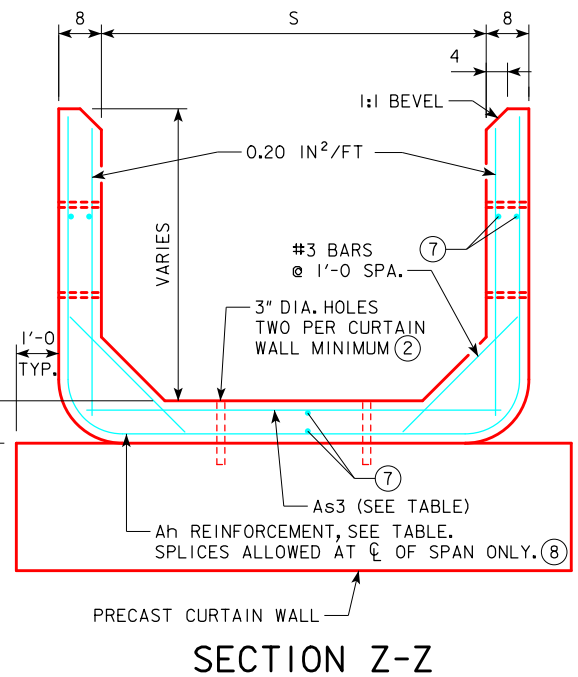
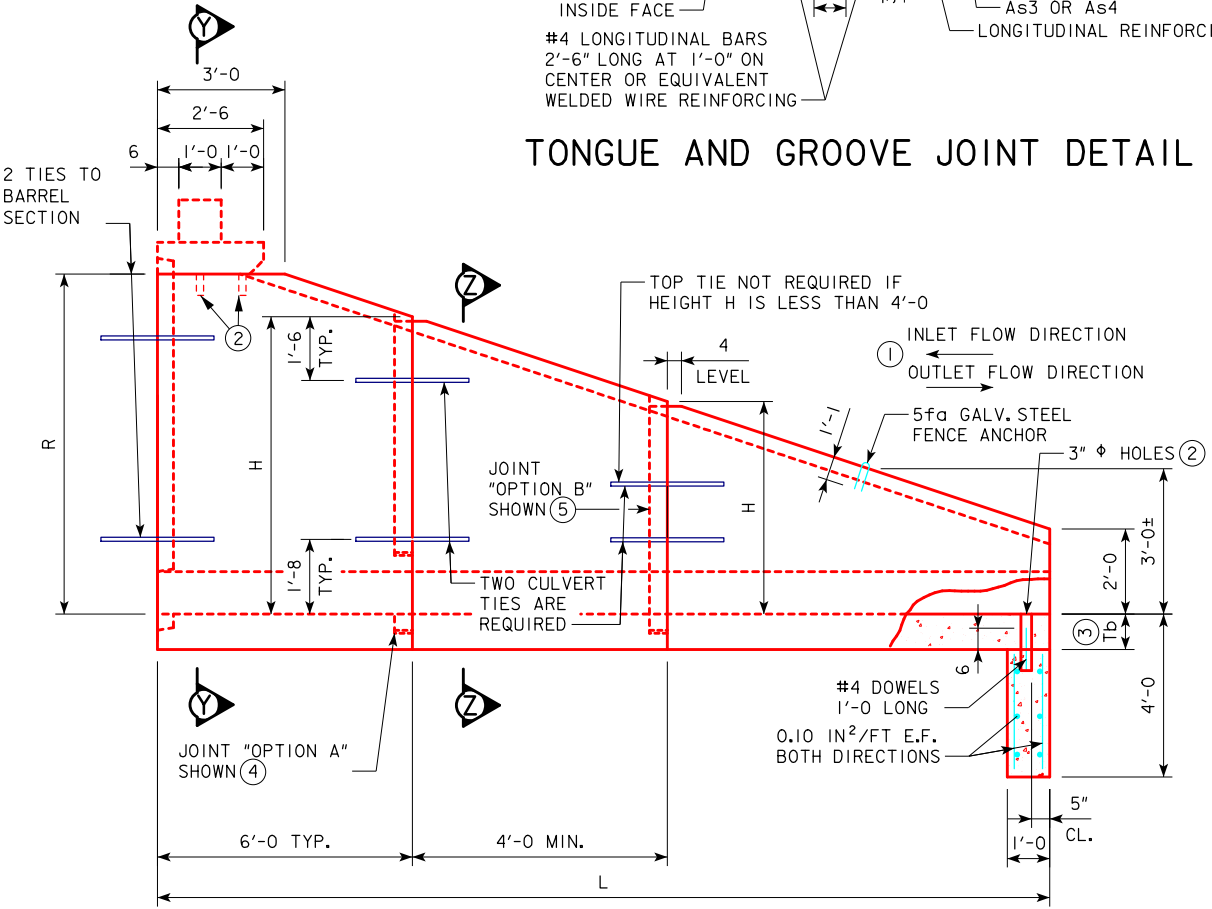
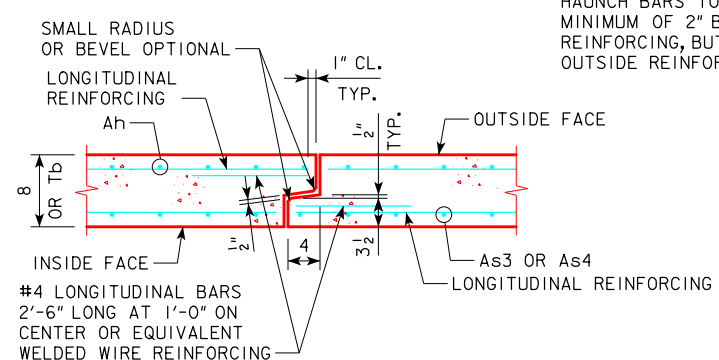
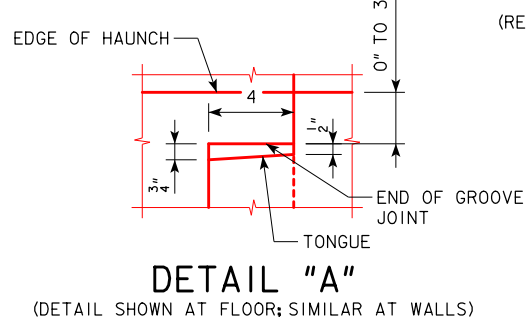
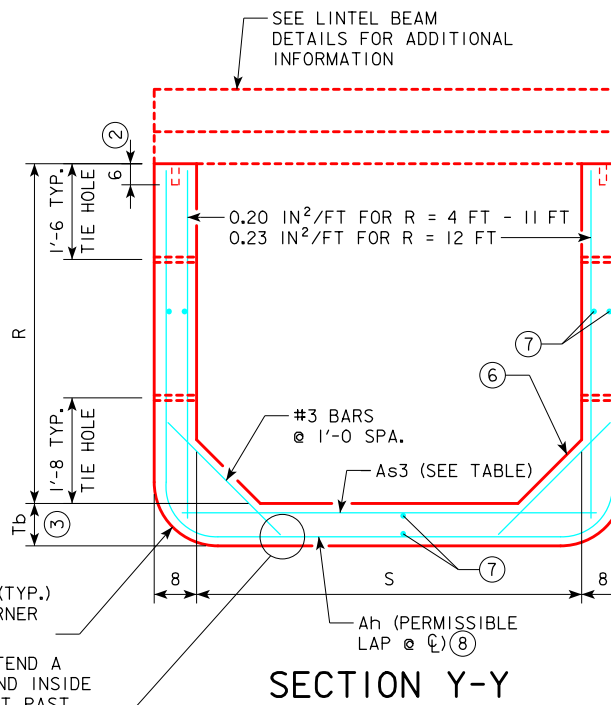
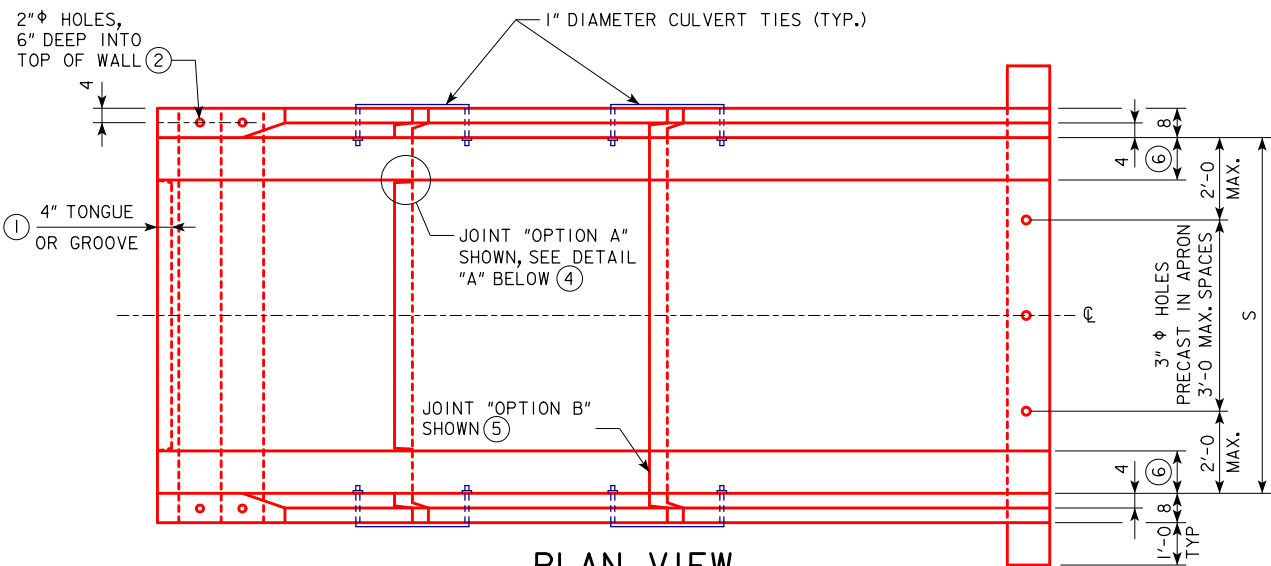


STANDARD DESIGN  
**SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS**  
JANUARY, 2013

**TYPE I END SECTION DETAILS**  
FOR SKEWS UP TO 7.5°

**PES 1-13-T1**

REVISED 05-13 - ADDED 3' RISE TO THE APRON DIMENSIONS INFORMATION TABLE.  
REVISED 07-2016 - CORRECTED TYPES.  
ENGLISH SIGNED PRECAST CULVERTS.DGN - PES 1-13-T1 - THIS SHEET ISSUED 01-13.



**CONSTRUCTION NOTES:**

- PRECAST BOX CULVERT END SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH DETAILS AND NOTES, AS SHOWN BELOW:
- REINFORCING FOR PRECAST END SECTIONS & CURTAIN WALLS SHALL BE WELDED WIRE REINFORCING (WWR) MEETING THE REQUIREMENTS OF AASHTO LRFD SECTION 5. THE CONCRETE COVER OVER THE REINFORCING STEEL SHALL NOT BE LESS THAN 1.5 INCHES OR GREATER THAN 2.0 INCHES.
- REFER TO SHEET PRCB G1-13 FOR ADDITIONAL NOTES.
- REFER TO FABRIC DETAIL ON SHEET PRCB G2-13 FOR MULTIPLE WWR LAYERS.
- USE TONGUE ON INLET END SECTION AND GROOVE ON OUTLET END SECTION.
  - FILL HOLES WITH GROUT. GROUT SHALL CONSIST OF 1 PART CEMENT AND 2 PARTS SAND. USE AIR ENTRAINED PORTLAND CEMENT. GROUT MIX SHALL HAVE A MAXIMUM SLUMP OF 4 INCHES.
  - THICKNESS OF FLOOR,  $T_b = 8$  IN. FOR 6' SPAN,  $T_b = 10$  IN. FOR ALL OTHER SPANS.
  - JOINT "OPTION A": PROVIDE JOINT IN WALLS AND FLOOR. TERMINATE JOINT AT HAUNCH. SEE DETAIL "A" ON THIS SHEET.
  - JOINT "OPTION B": PROVIDE JOINT IN WALLS, FLOOR AND HAUNCH.
  - HAUNCH DIMENSION TO MATCH BARREL HAUNCH SIZE.
  - MINIMUM LONGITUDINAL REINFORCEMENT SHALL BE 0.06 SQ. INCHES PER PERIPHERAL FOOT ON ALL FACES OF THE END SECTION, EXCEPT IN THE TONGUE AND GROOVE AREA.
  - LAP SPLICES SHALL BE CLASS C AND SHALL BE DESIGNED ACCORDING TO THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

APRON DIMENS.	
BOX RISE R (FT)	APRON LENGTH L (FT)
3	6
4	9
5	12
6	15
7	18
8	21
9	24
10	27
11	30
12	33

DIMENS. SPAN S (FT)	SECTION HT. H (FT)	Ah (IN <sup>2</sup> /FT)	Ah & As3 REINF.	
			BOTTOM SLAB THICK. (IN)	REQUIRED As3 (IN <sup>2</sup> /FT)
6	3	0.20	8	10
	4	0.20	0.20	---
	5	0.20	0.20	---
	6	0.20	0.20	---
	7	0.31	0.23	---
	8	0.46	0.31	---
8	4	0.24	---	0.24
	5	0.24	---	0.24
	6	0.24	---	0.24
	7	0.24	---	0.24
	8	0.34	---	0.24
	9	0.49	---	0.29
	10	0.67	---	0.37
10	4	0.24	---	0.24
	5	0.24	---	0.24
	6	0.24	---	0.24
	7	0.24	---	0.24
	8	0.24	---	0.24
	9	0.36	---	0.31
	10	0.51	---	0.40
	11	0.70	---	0.50
	12	0.94	---	0.62
12	4	0.24	---	0.24
	5	0.24	---	0.24
	6	0.24	---	0.24
	7	0.24	---	0.24
	8	0.24	---	0.26
	9	0.34	---	0.34
	10	0.49	---	0.42
	11	0.67	---	0.53
	12	0.90	---	0.65

**DOWEL SETTING NOTE :**

THE 5fa BARS MAY BE SET AS DOWELS IN DRILLED HOLES. HOLES SHALL BE DRILLED TO THE DEPTH REQUIRED TO ACHIEVE BAR EMBEDMENT AS SHOWN IN THE "SIDE ELEVATION" DETAIL. THE DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. EITHER OF THE FOLLOWING SYSTEMS MAY BE USED AS A BONDING AGENT:

- POLYMER GROUT SYSTEM SHALL BE IN ACCORDANCE WITH ARTICLE 2301.03, E, OF THE STANDARD SPECIFICATIONS.
- HYDRAULIC CEMENT GROUT SYSTEMS. DRILLED HOLES ARE TO BE 2 1/2 TIMES THE DOWEL DIAMETER AND ARE TO BE BLOWN CLEAN WITH COMPRESSED AIR IMMEDIATELY PRIOR TO PLACING GROUT. THE HYDRAULIC CEMENT GROUT SHALL BE ONE OF THOSE APPROVED IN MATERIALS I.M. 491.13.

07-2016  
LATEST REVISION DATE

*Norman L. Mc Donald*  
APPROVED BY BRIDGE ENGINEER

**IOWADOT** Highway Division

STANDARD DESIGN

**SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS**

JANUARY, 2013

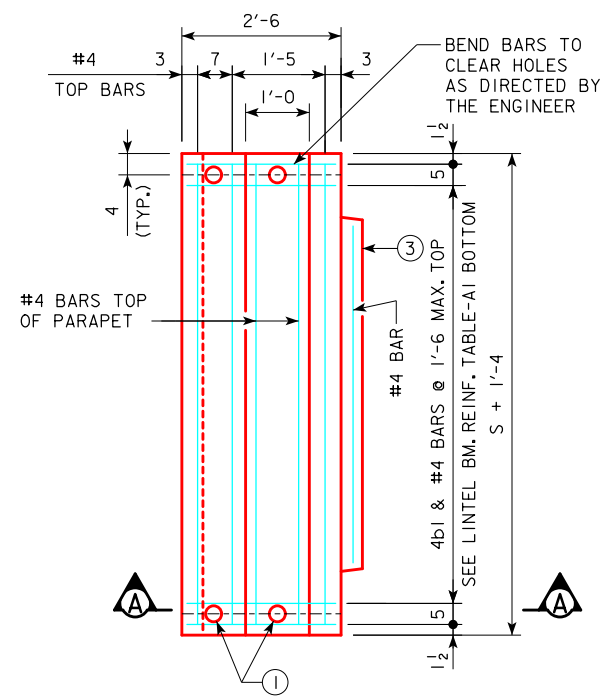
**TYPE 3 END SECTION DETAILS**

**PES 1-13-T3**

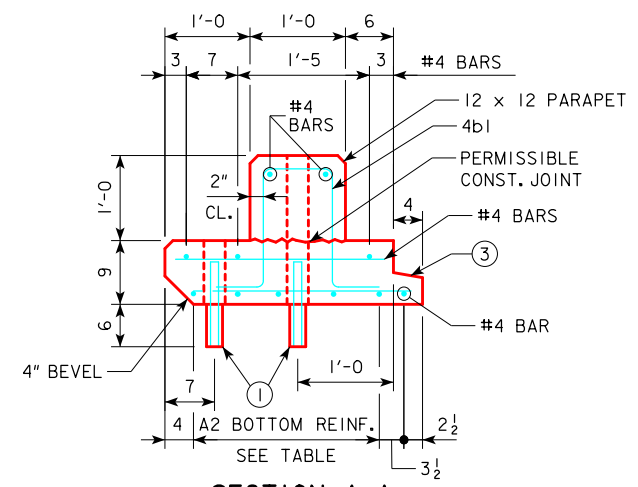
FOR SKEWS UP TO 7.5°

REVISED 05-13 - ADDED THE 3' RISE TO THE APRON DIMENSION INFORMATION TABLE.  
REVISED 07-2016 - CORRECTED TYPES.  
ENGLISH SIGNED PRECAST CULVERTS.DGN - PES 1-13-T3 - THIS SHEET ISSUED 01-13.

REVISED 07-2016 - CORRECTED TYPES. ADDED DIM. "C" ALONG CENTERLINE OF SKEWED LINTEL BEAM. ADDED TABLE FOR LENGTH "G". ENGLISHIGNEDPRECASTCULVERTS.DGN - PES 3-13-T3 - THIS SHEET ISSUED 01-13.

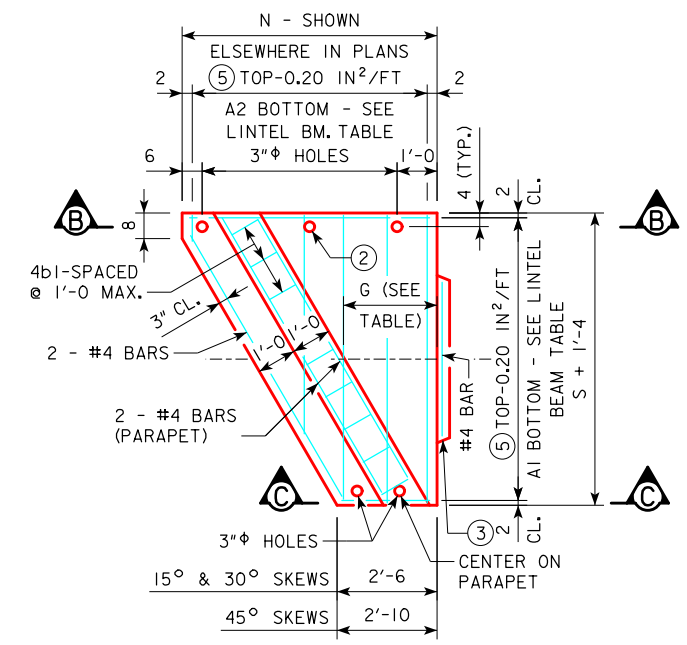


**PLAN OF SQUARE LINTEL BEAM**  
(TONGUE OPTION SHOWN)

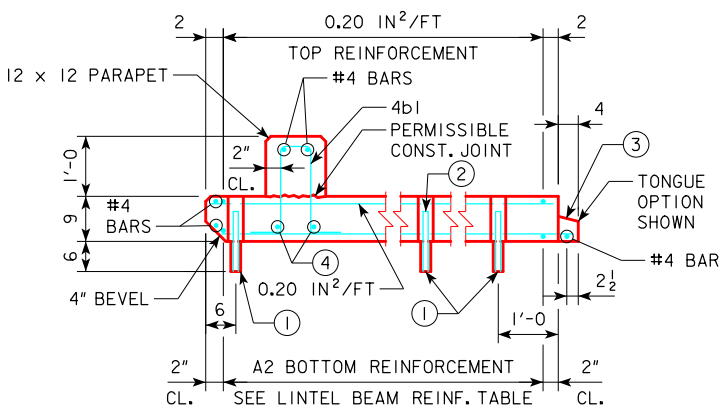


**SECTION A-A**  
(TONGUE OPTION SHOWN)

**0° SKEW LINTEL BEAM**  
(FOR SKEWS UP TO 7°30')



**PLAN VIEW**



**SECTION B-B**

**SKEWED LINTEL BEAM**  
(FOR SKEWS OF 7°30' TO 45°)

LENGTH G				
ALONG BARREL CL. OF SKEWED LINTEL BM.				
SPAN S (FT.)	15° SKEW	30° SKEW	45° SKEW	
6	1'-4 1/16	2'-3 11/16	3'-8 1/16	
8	1'-8 3/16	2'-10 5/8	4'-8 1/16	
10	1'-11 3/8	3'-5 9/16	5'-8 1/16	
12	2'-2 9/16	4'-0 1/2	6'-8 1/16	

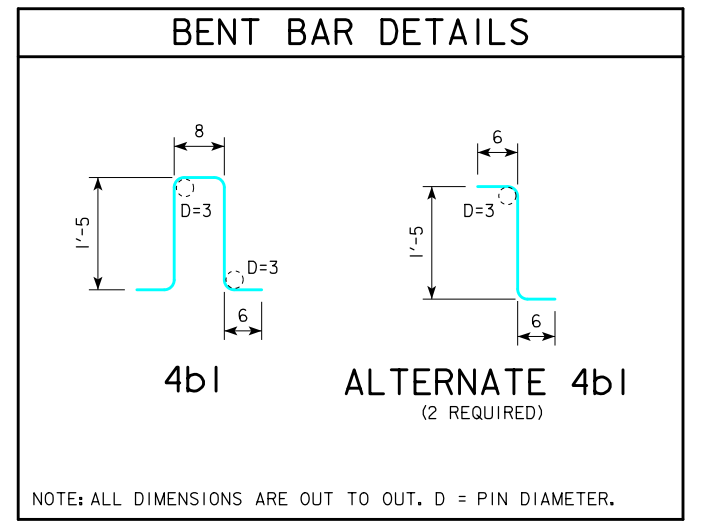
LINTEL BEAM REINFORCEMENT TABLE				
SPAN S (FT.)	BOTTOM REINFORCEMENT			
	WWR OPTION		REBAR OPTION	
	A1 (IN <sup>2</sup> /FT)	A2 (IN <sup>2</sup> /FT)	A1	A2
6	0.13	0.26	#4 @ 12	3 - #4 @ 12
8	0.16	0.32	#4 @ 12	4 - #4 @ 8
10	0.20	0.40	#4 @ 12	3 - #5 @ 12
12	0.25	0.49	#5 @ 12	4 - #5 @ 8

LINTEL BEAM REINFORCEMENT TABLE				
SPAN S (FT.)	BOTTOM REINFORCEMENT			
	WWR OPTION		REBAR OPTION	
	A1 (IN <sup>2</sup> /FT)	A2 (IN <sup>2</sup> /FT)	A1	A2
6	0.25	0.50	#5 @ 12	#5 @ 6
8	0.36	0.72	#6 @ 12	#6 @ 6
10	0.49	0.98	#7 @ 12	#7 @ 6
12	0.65	1.30	#8 @ 12	#8 @ 6

SKEWED PARAPET REINFORCEMENT TABLE				
SPAN S (FT.)	15° SKEW	30° SKEW	45° SKEW	
6	3 - #4	2 - #5	2 - #6	
8	2 - #6	2 - #6	2 - #7	
10	2 - #7	2 - #7	3 - #7	
12	2 - #7	2 - #8	3 - #8	

**NOTES:**

- PRECAST LINTEL BEAMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH PRECAST BARREL AND END SECTION DETAILS AND NOTES, EXCEPT AS MODIFIED BELOW:
- REINFORCING FOR PRECAST LINTELS AND PARAPETS SHALL BE EITHER WELDED WIRE REINFORCING (WWR) MEETING THE REQUIREMENTS OF AASHTO LRFD SECTION 5 OR REINFORCING BARS MEETING THE REQUIREMENTS OF ASTM A615 (60 KSI). WIRE SPACING FOR WWR SHALL NOT EXCEED 2 INCHES FOR PRIMARY STEEL AND 8 INCHES FOR DISTRIBUTION STEEL.
- ① PLACE #8 DOWEL, 1'-0 LONG INTO 2 INCH DIA. HOLE IN THE TOP OF THE WALL SECTION AND 3 INCH DIA. HOLE IN THE LINTEL BEAM. FILL HOLES WITH GROUT.
- ② CAST ADDITIONAL 3 INCH HOLES TO MAINTAIN A 4 FOOT MAXIMUM HOLE SPACING
- ③ CHECK THE LOCATION TO DETERMINE WHETHER A TONGUE OR A GROOVE IS USED. TONGUE AND GROOVE TO TERMINATE AT CULVERT RADIUS.
- ④ SEE SKEWED PARAPET REINFORCEMENT TABLE.
- ⑤ AREAS SHOWN ARE FOR WELDED WIRE FABRIC. IF REBAR IS USED, #4 AT A MAX. OF 11 INCH SPACING SHOULD BE USED.



LATEST REVISION DATE  
07-2016

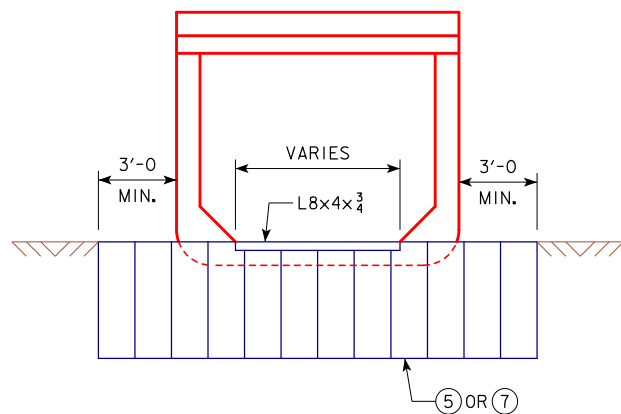
APPROVED BY BRIDGE ENGINEER  
*Norman L. Mc Donald*



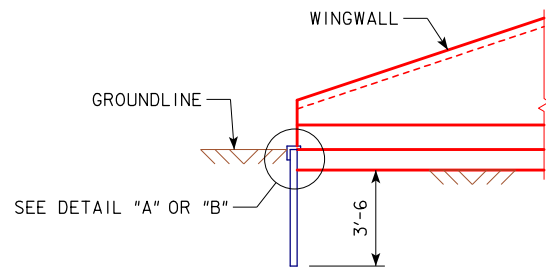
STANDARD DESIGN  
**SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS**  
JANUARY, 2013

**TYPE 3 LINTEL BEAM DETAILS**  
FOR SKEWS 0° TO 45°

**PES 3-13-T3**

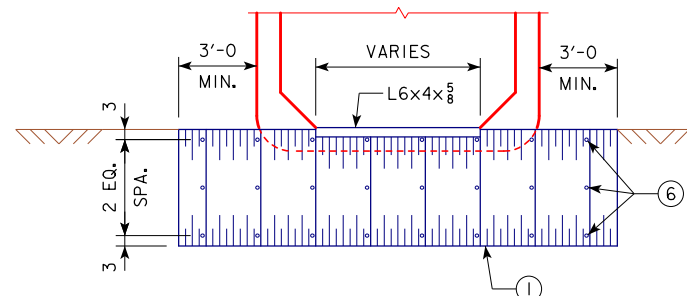


END VIEW

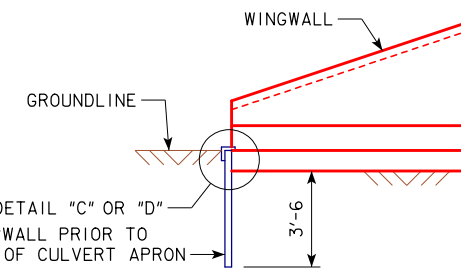


ELEVATION

ALTERNATES 1 & 2 (GALVANIZED STEEL SHEET PILING)

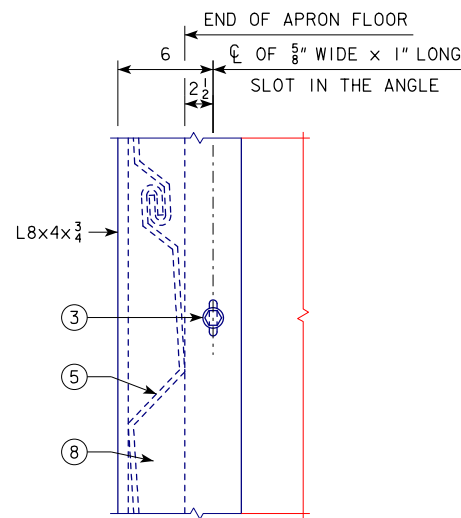


END VIEW

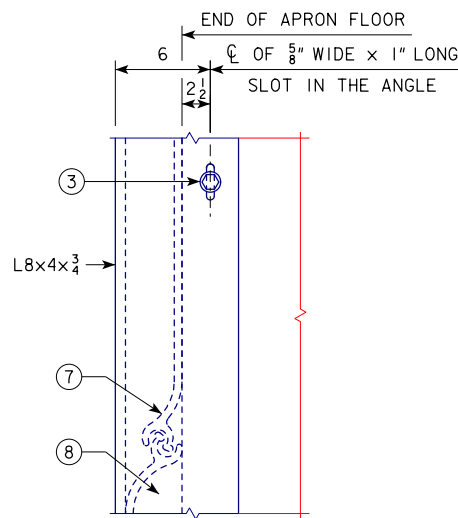


ELEVATION

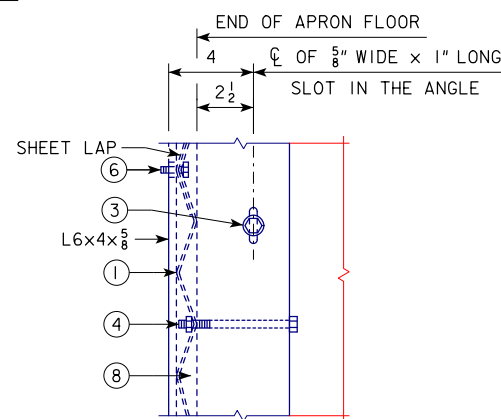
ALTERNATES 3 & 4 (GALVANIZED STEEL SHEETS)



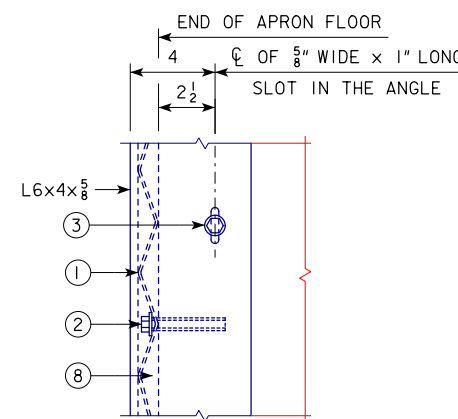
PLAN



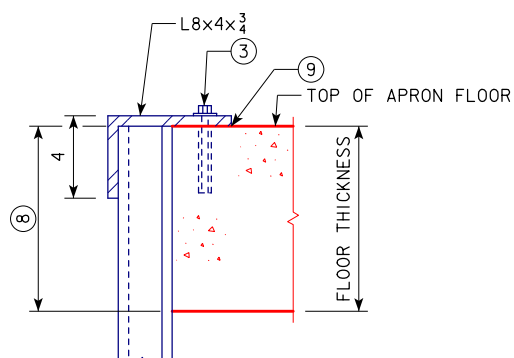
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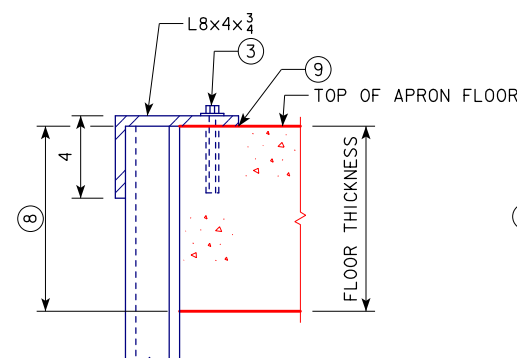
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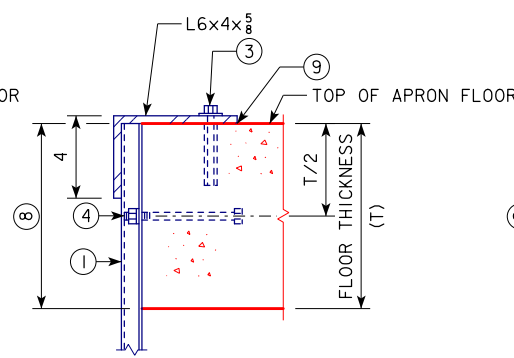
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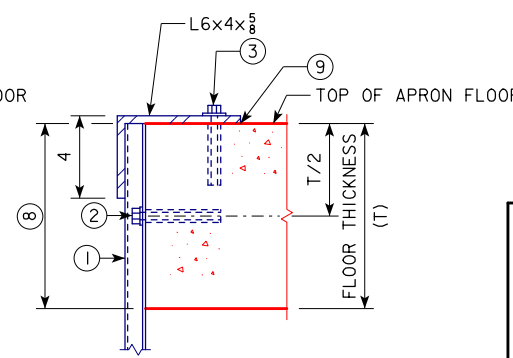
ELEVATION



ELEVATION



ELEVATION



ELEVATION

DETAIL "A"  
ALTERNATE 1  
STEEL SHEET PILING SHOWN

DETAIL "B"  
ALTERNATE 2  
STEEL SHEET PILING SHOWN

DETAIL "C"  
ALTERNATE 3  
ON NEW CONSTRUCTION ONLY

DETAIL "D"  
ALTERNATE 4  
ON NEW OR OLD CONSTRUCTION

NOTES:

USE OF ALTERNATE CURTAIN WALLS SHALL BE APPROVED BY THE ENGINEER.

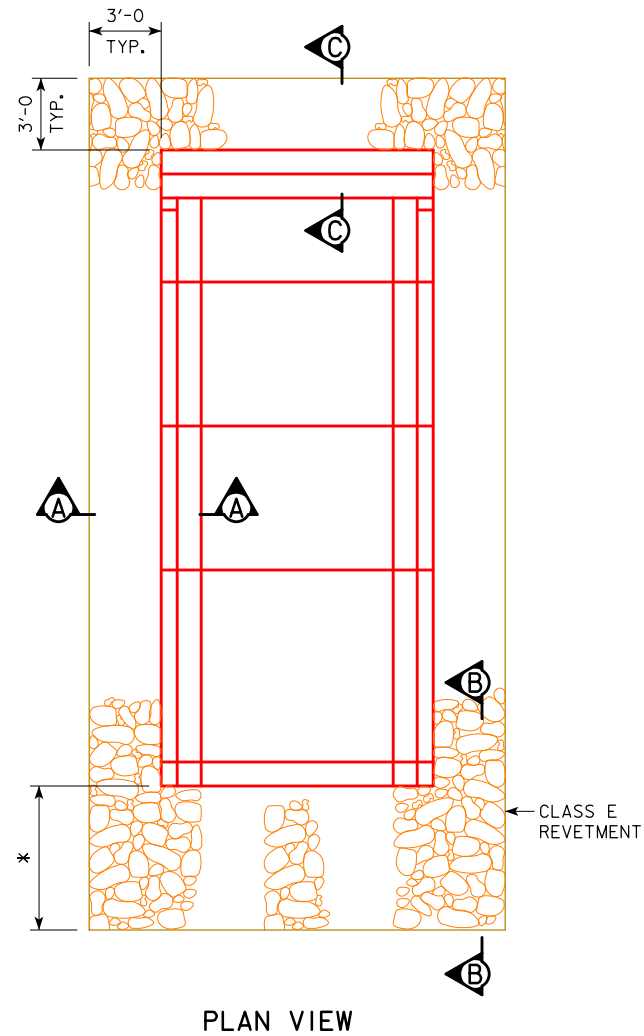
ALL CURTAIN WALL MATERIAL, INCLUDING BOLTS, NUTS, WASHERS, AND ANGLES SHALL BE GALVANIZED.

- ① 2 1/2"x1/2" OR 2"x1/2" CORRUGATED (12 GAGE OR HEAVIER) GALVANIZED STEEL SHEETS.
- ② FASTEN THE STEEL SHEETS TO THE FRONT EDGE OF THE APRON WITH 3/8" Φ x0'-4 BOLTS AND APPROVED ANCHORAGES (10" CENTER TO CENTER, TO THE NEAREST VALLEY).
- ③ FASTEN THE L8x4x3/4 OR L6x4x5/8 WITH 3/8" Φ x0'-4 BOLTS, 1" O.D. WASHER AND AN APPROVED ANCHORAGE (2'-0 SPACING).
- ④ FASTEN THE STEEL SHEETS TO THE FRONT EDGE OF THE APRON WITH 3/8" Φ x0'-5 BOLTS WITH NUT AND LOCK WASHER (10" CENTER TO CENTER, TO THE NEAREST VALLEY).
- ⑤ GALVANIZED CORRUGATED (12 GAUGE OR HEAVIER) STEEL SHEET PILING, INTERLOCKING TYPE A.
- ⑥ 3/8" Φ x0'-1 BOLT WITH NUT, TO LAP STEEL SHEETS.
- ⑦ GALVANIZED STEEL SHEET PILING, SECTION PS 27.5 OR EQUAL.
- ⑧ FILL THE VOIDS AS SHOWN, WITH CONCRETE OR CONCRETE GROUT, AS APPROVED BY THE ENGINEER.
- ⑨ CAULK JOINT BETWEEN TOP OF APRON FLOOR AND ANGLE. CAULKING MATERIAL SHALL BE NEUTRAL CURE AND NON-SAG SILICONE. THREE PRODUCTS MEETING THESE CRITERIA ARE DOW 888, CSL 342 JOINT SEALANT, AND CRAFCO ROAD SAVER SILICONE.

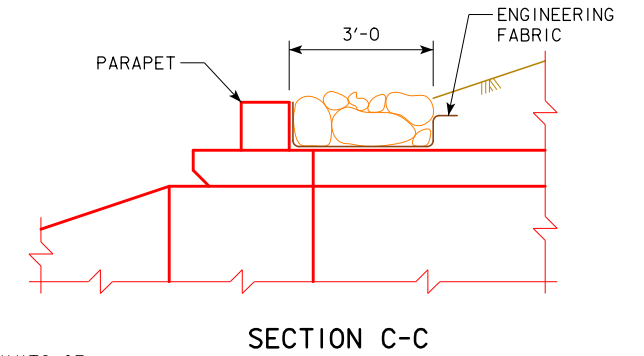
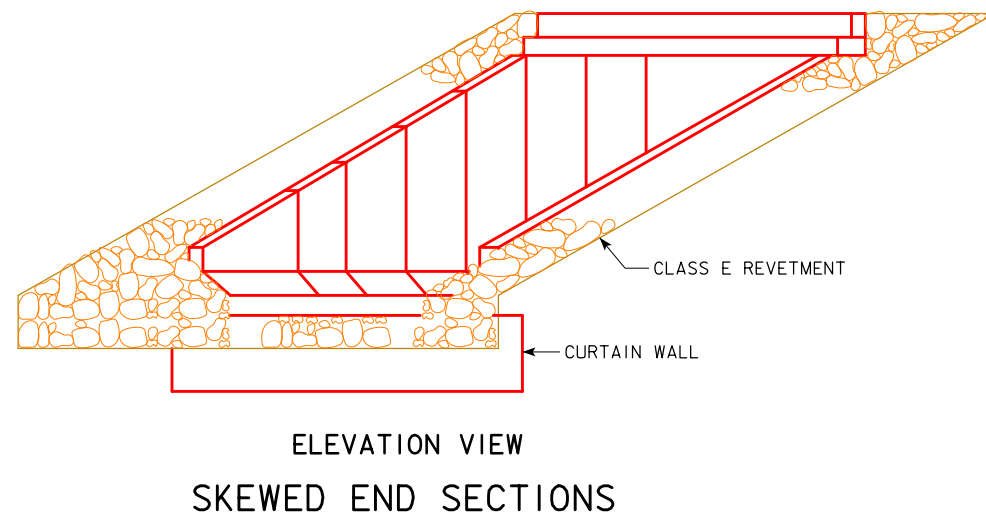
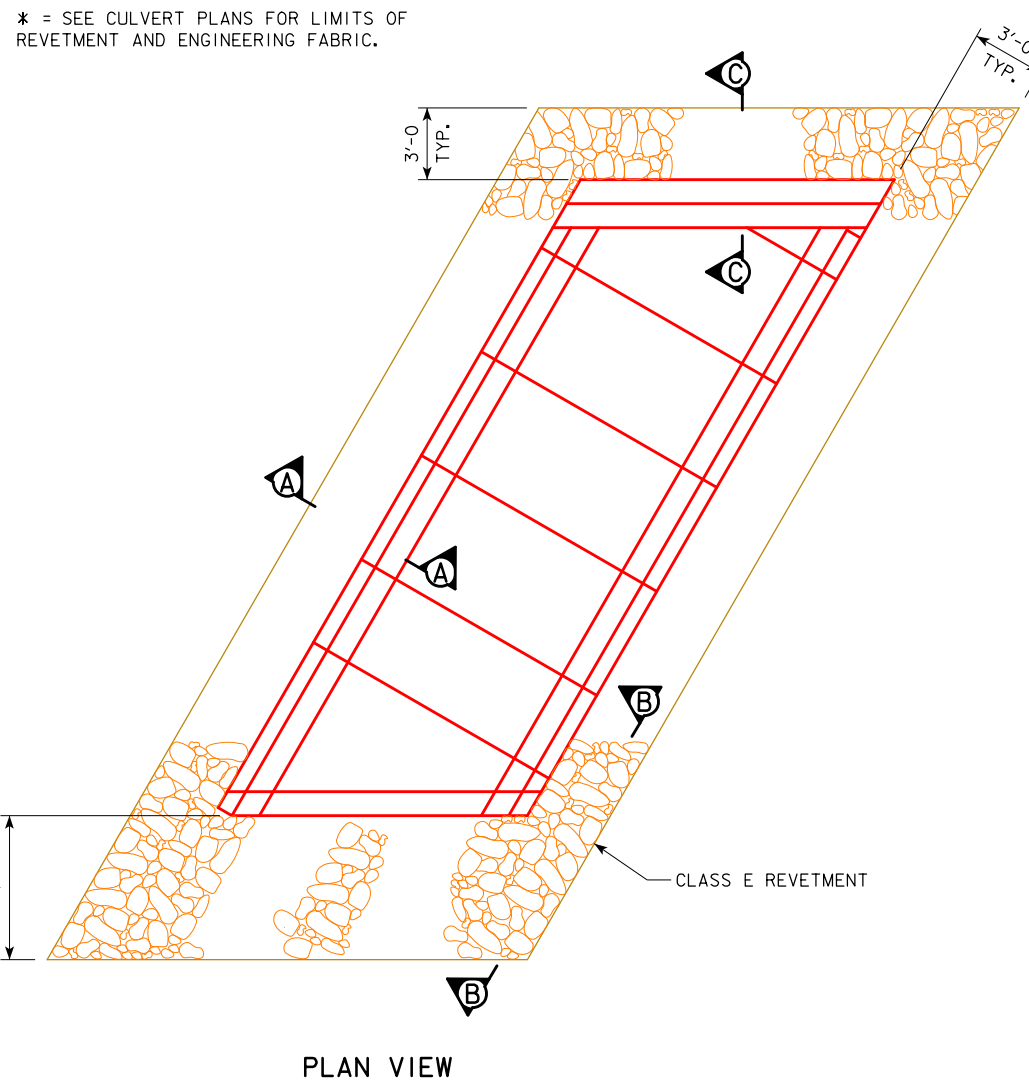
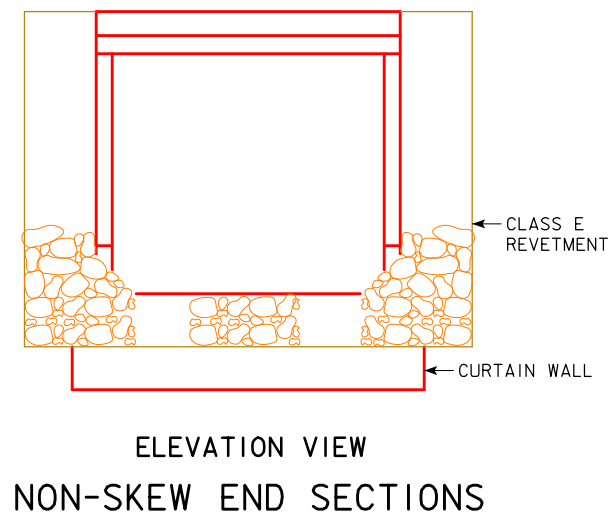
ENGLISHIGNEDPRECASTCULVERTS.DGN - PES 4-13 - THIS SHEET ISSUED 01-13.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN <b>SINGLE PRECAST REINFORCED CONCRETE BOX CULVERTS</b> JANUARY, 2013	
		ALTERNATE CURTAIN WALL DETAILS	PES 4-13
		ALTERNATE CURTAIN WALL DETAILS	

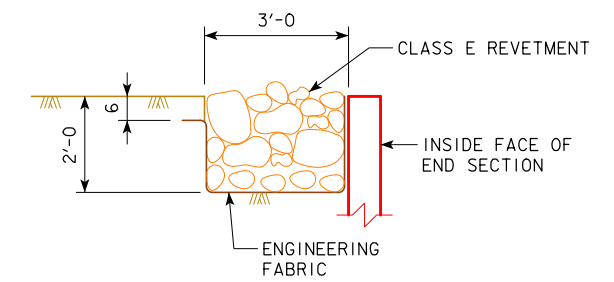
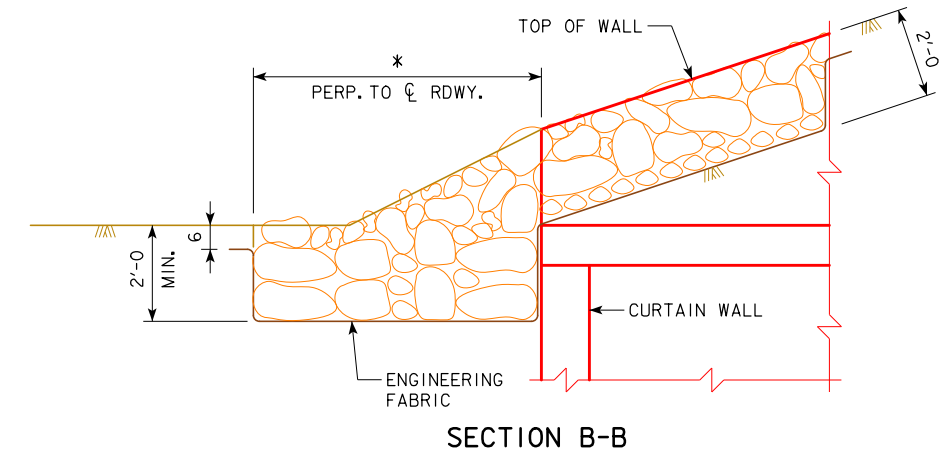
REVISED 10-14 - CHANGED THE AREA OF THE REVETMENT TO INCLUDE THE AREA IN FRONT OF THE APRON, CHANGED THE DEPTH OF REVETMENT TO 2'-0".  
 REVISED 12-15 - ADDED NOTE "SEE CULVERT PLANS FOR LIMITS OF REVETMENT AND ENGINEERING FABRIC."  
 ENGLISH\_SIGNED\_PrecastCulverts.dgn - PEP 1-13 - THIS SHEET ISSUED 01-13.



\* = SEE CULVERT PLANS FOR LIMITS OF REVETMENT AND ENGINEERING FABRIC.



\* = SEE CULVERT PLANS FOR LIMITS OF REVETMENT AND ENGINEERING FABRIC.



TYPICAL DETAILS

CONSTRUCTION NOTES:

CLASS E REVETMENT SHOULD BE USED AND PLACED ACCORDING TO ARTICLE 2507.03 OF THE STANDARD SPECIFICATIONS.

THE ENGINEERING FABRIC SHALL MEET THE MATERIAL REQUIREMENTS IN ACCORDANCE WITH ARTICLE 4196.01, B, 3 OF THE STANDARD SPECIFICATIONS.

12-15 LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN <b>SINGLE PRECAST REINFORCED          CONCRETE BOX CULVERTS</b> JANUARY, 2013	
		<b>EMBANKMENT          PROTECTION DETAILS</b> WITH 0° TO 45° SKEWED END SECTIONS	<b>PEP 1-13</b>