

REVISED 10-2021: Updated Note 10 & 12 and added Note 14. Updated As4 Reinforcing Table for H = 13' & 14'.  
 REVISED 01-2023: Added note to burr threads of Concrete Box Ties.  
 ENGLISHIGNEDPRECASTCULVERTS.DGN - PES 8-20-T3 SZ - THIS SHEET ISSUED 12-2020.

Dimens.		Ah & As3 Reinforcement				
Span S (FT)	Section Ht. H (FT)	Required Ah (IN <sup>2</sup> /FT)			Required As3 (IN <sup>2</sup> /FT)	
		15° Skew	30° Skew	45° Skew		
14	4	0.24	0.24	0.24	0.24	
	5	0.24	0.24	0.24	0.24	
	6	0.24	0.24	0.24	0.24	
	7	0.24	0.24	0.24	0.24	
	8	0.25	0.26	0.28	0.28	
	9	0.37	0.40	0.42	0.36	
	10	0.53	0.57	0.60	0.45	
	11	0.73	0.78	0.83	0.55	
	12	0.97	1.05	1.10	0.68	
	13	1.06	1.13	1.20	0.86	
	14	1.32	1.42	1.50	1.03	
	16	4	0.24	0.24	0.24	0.24
		5	0.24	0.24	0.24	0.24
		6	0.24	0.24	0.24	0.24
7		0.24	0.24	0.24	0.24	
8		0.25	0.26	0.28	0.30	
9		0.37	0.40	0.42	0.38	
10		0.53	0.57	0.60	0.47	
11		0.73	0.78	0.83	0.58	
12		0.97	1.05	1.10	0.71	
13		1.06	1.14	1.20	0.89	
14		1.33	1.42	1.50	1.07	

Note: "H" is the largest vertical dimension of the section.

Length LL				
Span S (FT)	Tc (IN.)	As4 Reinforcement		
		15° Skew	30° Skew	45° Skew
14	8	4'-7"	6'-11"	10'-6"
	9	4'-7"	7'-0"	10'-7"
16	8	4'-10"	7'-6"	11'-6"
	9	4'-10"	7'-7"	11'-7"

As4 Reinf. (IN <sup>2</sup> /FT)			
Section Ht. H (FT)	As4 Reinforcement		
	15° Skew	30° Skew	45° Skew
10 or Less	0.20	0.20	0.20
11	0.20	0.21	0.22
12	0.25	0.27	0.29
13	0.32	0.34	0.36
14	0.40	0.42	0.45

Note:  
 As4 is inside face wall steel for the first section adjacent to the barrel only. "H" is the largest vertical dimension of the section. For all other sections, As4 = 0.20 IN<sup>2</sup>/FT

Length N				
Span S (FT)	Tc (IN.)	As4 Reinforcement		
		15° Skew	30° Skew	45° Skew
14	8	6'-5"	11'-0"	17'-6"
	9	6'-5"	11'-1"	17'-7"
16	8	7'-0"	12'-1"	19'-6"
	9	7'-0"	12'-2"	19'-7"

Length P				
Span S (FT)	Tc (IN.)	As4 Reinforcement		
		15° Skew	30° Skew	45° Skew
14	8	2'-1"	4'-5"	7'-8"
	9	2'-1"	4'-6"	7'-9"
16	8	2'-4"	5'-0"	8'-8"
	9	2'-4"	5'-1"	8'-9"

Note:  
 Dimensions shown in tables are rounded to the nearest whole inch.

Length L			
Rise R (FT)	As4 Reinforcement		
	15° Skew	30° Skew	45° Skew
4	9'-3"	9'-11"	12'-2"
5	12'-4"	13'-5"	16'-5"
6	15'-5"	16'-10"	20'-8"
7	18'-6"	20'-4"	24'-11"
8	21'-8"	23'-9"	29'-1"
9	24'-9"	27'-3"	33'-4"
10	27'-10"	30'-9"	37'-7"
11	30'-11"	34'-2"	41'-10"
12	34'-1"	37'-8"	46'-1"
13	37'-2"	41'-1"	50'-4"
14	40'-3"	44'-7"	54'-7"

"L" - Based on 3:1 foreslope normal to  $\phi$  of roadway.

Note: See sheet PES 7-20-T3 for details used in conjunction with this sheet.

### 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 sheets PRCB G1-20 & PRCB G2-20 for additional notes and details.
- Refer to "Fabric Layer Detail" on sheet PRCB G2-20 for multiple WWR layers.
- Burr threads of Concrete Box Ties without damaging galvanizing to prevent nut rotation after tightening is complete.

- 8½" @ 15° ; 10½" @ 30° ; 1'-2" @ 45°
- Culvert ties are to be 1 inch dia. rods.
- For skew angles over 7°30' up to 22°30', use a 15° skew end section. For skew angles over 22°30' up to 37°30', use a 30° skew end section. For skew angles over 37°30' up to 45°, use a 45° skew 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.
- Use tongue on inlet end section and groove on outlet end section.
- End of wall may be cut square as shown or follow the skew.
- Joint "Option A": Provide joint in walls and floor. Terminate joint at haunch. See "Detail A" on Sheet PES 7-20-T3.
- Joint "Option B": Provide continuous joint in walls, floor and haunch.
- For the first section adjacent to the barrel, see As4 table.
- 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 B and shall be designed according to the AASHTO LRFD Bridge Design Specifications, Section 5.
- Wall thickness (Tc) shall be 8 inches when the Section Height (H) is less than or equal to 12 feet. For "H" equal to 13 to 14 feet, wall thickness shall be 9 inches.
- Optional eyebolts shall conform to ASTM A307. Eyebolts and nuts shall be galvanized in accordance with ASTM A153. The eye of the eyebolt shall be cast flush with the concrete surface.
- Bottom slab thickness may be increased up to 2" max, provided cover is 1½" min. to 2" max.

### Dowel Setting Note (Fence Anchor):

The 5fa bars or eyebolt may be set as dowels in drilled holes. Holes shall be drilled to the depth required to achieve bar embedment as shown in the "Elevation" or "Detail C". 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 2½ 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.

01-2023 LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design <b>Single Precast Reinforced Concrete Box Culverts</b> December, 2020	
		<b>Type 3 End Section Details</b>	<b>PES 8-20-T3</b>
		For Skews of 7.5° to 45°; 14'-16' Spans Sheet 2 of 2	