



Twin Reinforced Concrete Box Culvert Standards

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LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		Standard Design Twin Reinforced Concrete Box Culverts July, 2020	
		Index of Sheets	TWRCB G1-20



Twin Reinforced Concrete Box Culvert Standards

General Notes:

- 1. The RCB culvert sections are designed for HL-93 live load and earth fills of varying heights.
- 2. Vertical earth pressure, EV=0.120 kcf.
Horizontal earth pressure, EHmax = 0.060 kcf max, EHmin = 0.030 kcf.
- 3. The RCB culvert sections are designed for Class 1 exposure conditions except:
Class 2 exposure condition is utilized for the slab design in 0' fill instances.
- 4. 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.
- 5. The clear distance from face of concrete to near edge or end of reinforcing bar to be 2" unless otherwise noted.
- 6. Except for dowel bars 5r1 in slab, longitudinal reinforcing is not to extend thru the construction joints.
- 7. Floor of barrel is to be finished smooth. Sides of footing are to be formed to insure correct line and grade.
- 8. The permissible construction joint at the top of the walls may be lowered at the Contractor's option with Engineer's approval.
- 9. The reinforcement supplied for this structure shall be Grade 60 reinforcement in accordance with the Standard Specifications. The design stresses are based on ASTM A706 Grade 60 reinforcement.
- 10. 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	20"	24"	29"	34"	38"	47"

This splice, if used, will be at the Contractor's expense.

- 11. Reinforcing bar clearances will be as follows:
Edge clearances: 2" except
Top of floor 2¼" to near transverse reinforcing bar
Bottom of floor 3½" to near transverse reinforcing bar
End clearances:
Vertical top 2"
Vertical bottom 3" or 3½" if overall height of the culvert is not to a full inch
Transverse 2"
12. All construction joints shall be formed with a beveled keyway except at bell joints.
- 13. All beveled keyways shall be centered.
- 14. Keyway size shall be 2"x4" except as follows:
Keyway between the floor and wall shall be 2"x6" when the wall is greater than 10 inches wide.
- 15. 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.
- 16. If 0' 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.
- 17. All dimensions are in feet and inches unless otherwise noted or shown.
- 18. See current Standard Specifications regarding concrete form removal.
- 19. These culvert standards label all reinforcing steel with English notation (5a1 is ⅝ 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

- 20. 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.

Specifications:

Design:
AASHTO LRFD Bridge Design Specifications, 8th Ed., Series of 2017.

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

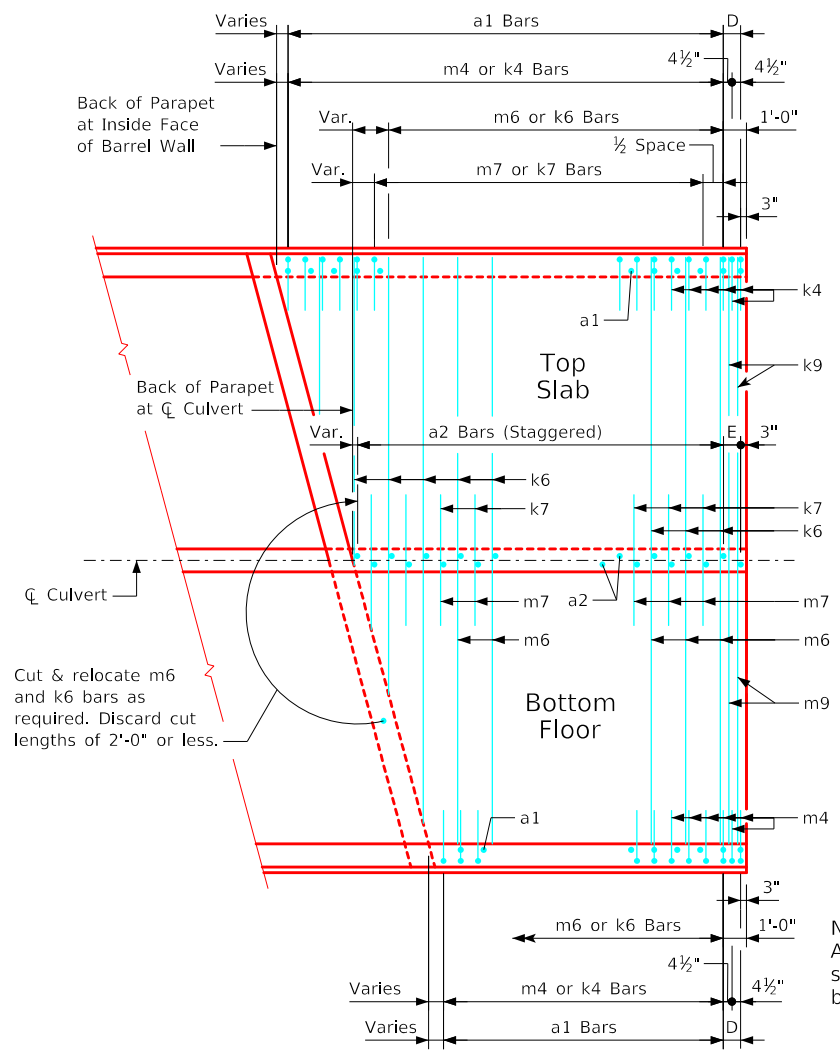
Design Stresses:

Design stresses for the following materials are in accordance with the AASHTO LRFD Bridge Design Specifications, 8th Ed., Series of 2017:
Reinforcing steel in accordance with AASHTO LRFD Section 5, Grade 60.
Concrete in accordance with AASHTO LRFD Section 5, f'c = 4.0 ksi.

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		Standard Design Twin Reinforced Concrete Box Culverts July, 2020	
		General Notes & Specifications	TWRCB G2-20

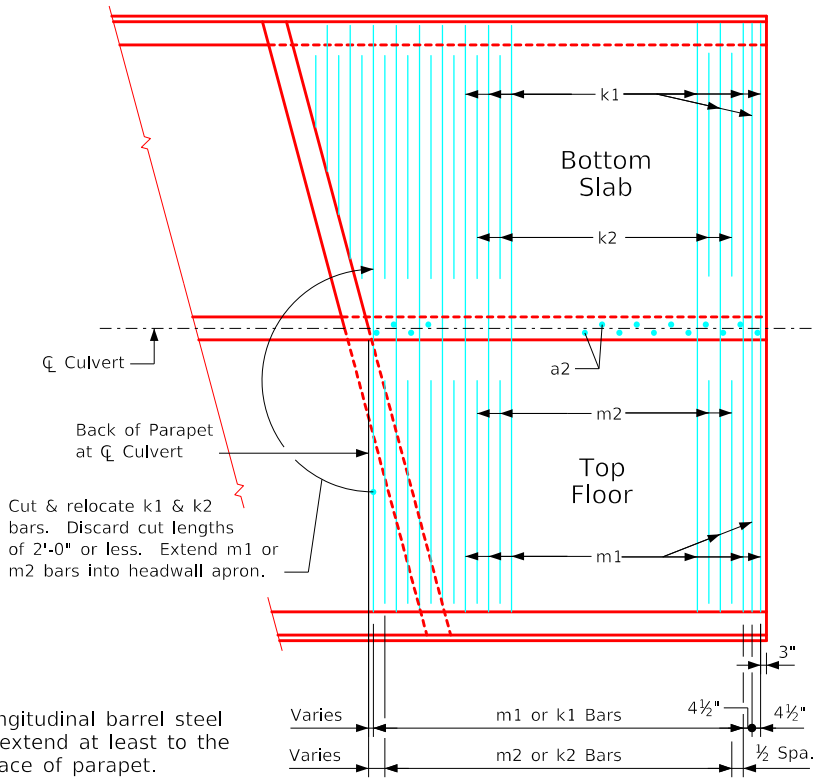
ENGLISHLRFDSTWNCULVERTS.DGN - TWRCB G3-20 - THIS SHEET ISSUED 07-2020.



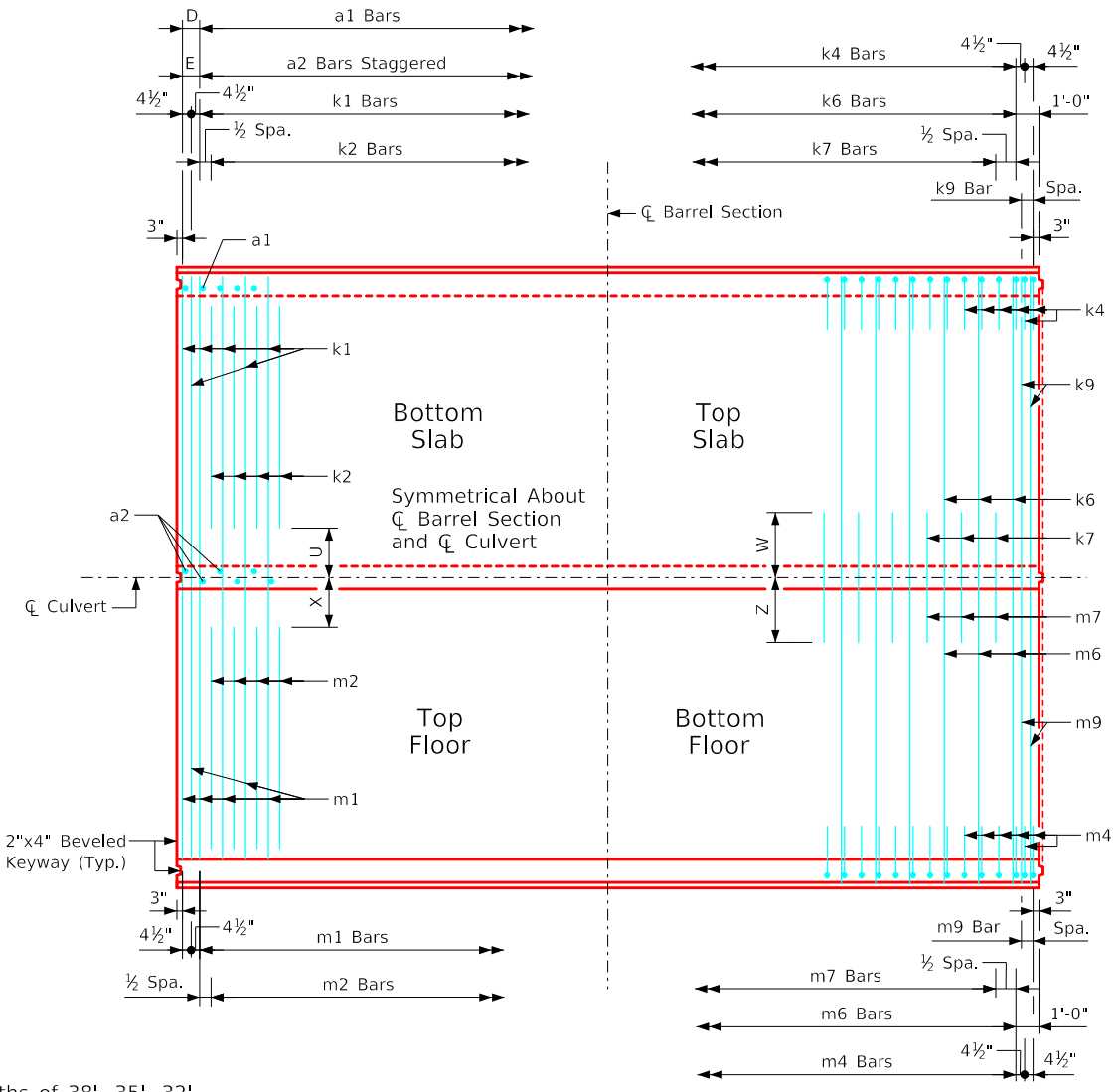
Note:
All longitudinal barrel steel shall extend at least to the backface of parapet.

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.

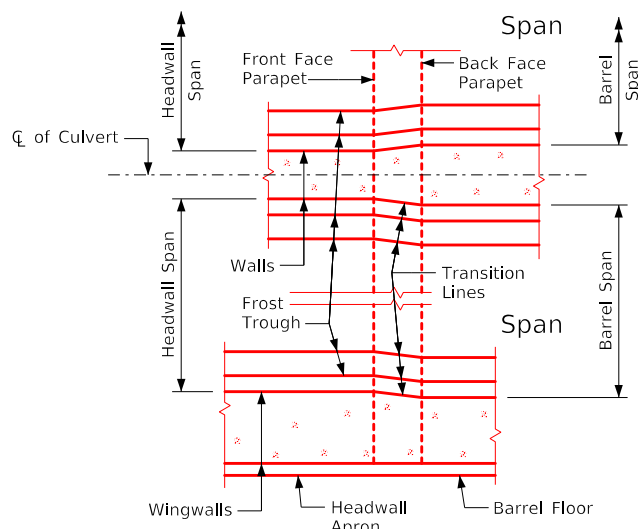


Note:
Typical for lengths of 38', 35', 32', 29', and 26'. These lengths are shown as typical because all transverse and vertical reinforcing steel spacing repeats in 3'-0" intervals.



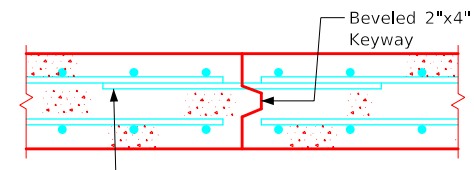
Standard Section Plan View
(Keyway is to be omitted when bell joints are used)

Note:
Dimensions listed on this sheet to be used in conjunction with dimensions and quantities for barrel section sheets.



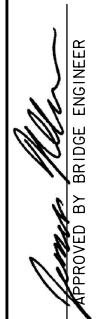
Transition Wall Details

5r1 Bars - One Const. Jt.		
Span	No.	Weight (LB)
8'-0"	18	66
10'-0"	22	80
12'-0"	26	95



One set of 5r1 x 3'-6" dowel bars @ 1'-0" spacing required in slab at all culvert barrel joints, except joints with bell joints. See table for number required and total weight.

Top Slab Construction Joint Detail

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		Typical Culvert Barrel Details	TWRCB G3-20

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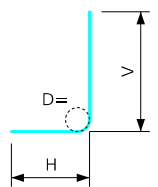
Variable Dimensions and Quantities for Twin 12' x 8' Barrel Sections

Dimensions												Bar List																																											
												a1			a2			b1			b2			e1			e2			f1			f2			k1			k2			k4					k6			k7			k9		
Fill	S	H	A	B	C	D	E	U	W	X	Z	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	12	8	14	12	9	9	9	0'0	7'2	3'0	7'5	4	12	10'1	6	9	10'1	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	6	18	25'11	6	18	12'11	5	9	11'0	7'5	3'7	4	9	25'11	4	9	14'4	4	4.5	25'11
1	12	8	13.5	12	9	9	9	0'7	7'2	3'1	6'7	4	12	10'0	6	9	10'0	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	6	18	25'11	6	18	12'4	6	12	11'5	7'5	4'0	4	9	25'11	4	9	14'4	4	4.5	25'11
2	12	8	10	10.5	9	9	9	1'10	7'1	2'10	5'0	5	12	9'7	6	9	9'7	4	6	32	4	6	17	5	12	22	4	17	20	4	12	26	4	17	20	6	12	25'11	5	12	10'4	6	9	7'10	4'2	3'8	4	12	25'11	7	12	14'2	7	4.5	25'11
3	12	8	9.5	10	9	9	9	2'7	5'7	3'4	4'6	4	9	9'6	6	9	9'6	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	6	12	25'11	5	12	8'10	6	9	7'6	3'9	3'9	4	12	25'11	7	12	11'2	7	4.5	25'11
4	12	8	9	10	9	9	9	2'9	4'10	3'4	4'3	4	9	9'6	6	9	9'6	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'11	4	9	8'6	6	9	7'2	3'7	3'7	5	9	25'11	5	9	9'8	5	4.5	25'11
5-7	12	8	10	11.5	9	9	9	2'3	4'8	3'4	4'3	4	12	9'8	6	9	9'8	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	5	12	25'11	5	12	9'10	5	6	6'10	3'5	3'5	5	12	25'11	7	12	9'4	7	4.5	25'11
8-10	12	8	11.5	13	9	9	9	3'0	4'3	3'4	4'2	4	12	9'11	6	9	9'11	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'11	4	9	8'7	5	6	6'10	3'5	3'5	5	9	25'11	6	9	8'6	6	4.5	25'11
11-13	12	8	13	15	9	9	9	2'10	4'3	3'0	4'3	4	12	10'3	6	9	10'3	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'11	4	9	9'2	5	6	6'6	3'0	3'6	4	9	25'11	7	9	8'6	7	4.5	25'11
14-16	12	8	14.5	17	9	6	9	2'6	4'4	2'7	4'5	4	6	10'6	6	9	10'6	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	7	18	25'11	6	18	10'4	6	12	7'1	3'0	4'1	5	12	25'11	8	12	8'8	8	4.5	25'11
17-19	12	8	16.5	18.5	9	6	9	2'3	4'5	2'4	4'7	4	6	10'10	6	9	10'10	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	6	12	25'11	5	12	10'8	6	12	7'3	3'1	4'2	5	12	25'11	8	12	8'10	8	4.5	25'11
20-22	12	8	18	20	9.5	6	6	1'8	4'7	1'8	4'8	4	6	11'1	5	6	11'1	4	6	32	4	6	17	4	12	22	4	17	20	4	12	26	4	17	20	6	12	26'0	5	12	11'4	6	12	7'6	3'2	4'4	5	9	26'0	7	9	9'2	7	4.5	26'0
23-25	12	8	20	21.5	10	6	9	1'7	4'8	1'6	4'10	4	6	11'4	7	9	11'4	4	6	32	4	6	17	4	12	22	4	17	20	5	12	26	4	17	20	6	12	26'2	5	12	11'6	4	6	7'4	3'8	3'8	4	9	26'2	7	9	9'4	7	4.5	26'2

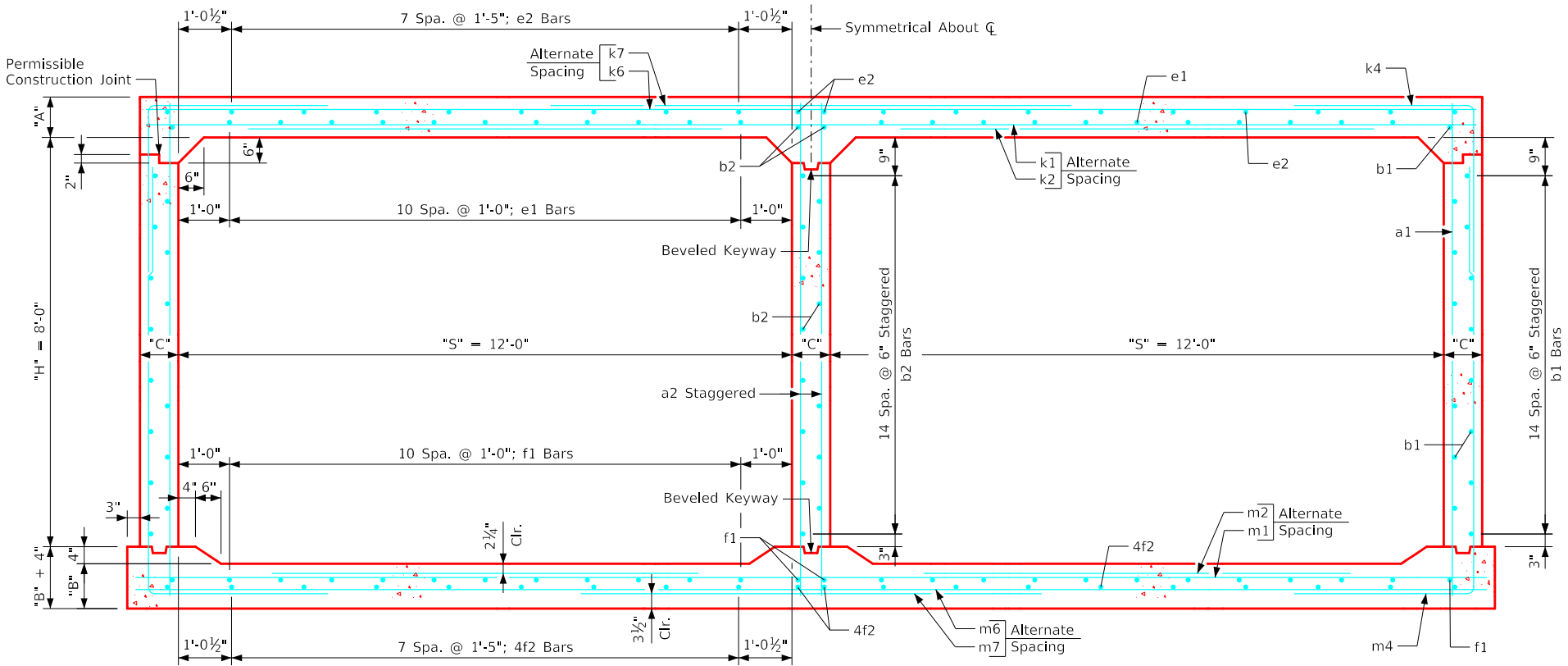
	Bar List																				Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	
0	5	9	26'-5	4	9	8'-4	6	9	15'-11	7'-6	8'-5	4	9	26'-5	5	9	14'-10	5	4.5	26'-5	1.191	1.050	0.632	2.873	411.66
1	5	9	26'-5	4	9	8'-2	7	12	14'-8	6'-3	8'-5	4	12	26'-5	6	12	13'-2	6	4.5	26'-5	1.151	1.050	0.632	2.833	407.92
2	5	9	26'-5	5	9	8'-6	6	9	12'-5	4'-1	8'-4	5	9	26'-5	5	9	10'-0	5	4.5	26'-5	0.867	0.926	0.632	2.425	448.26
3	6	12	26'-5	5	12	7'-4	6	9	11'-11	3'-8	8'-3	5	12	26'-5	7	12	9'-0	7	4.5	26'-5	0.826	0.885	0.632	2.343	419.00
4	6	12	26'-5	5	12	7'-4	6	9	11'-9	3'-6	8'-3	5	9	26'-5	6	9	8'-6	6	4.5	26'-5	0.786	0.885	0.632	2.303	421.82
5-7	6	12	26'-5	5	12	7'-10	5	6	11'-10	3'-5	8'-5	5	9	26'-5	6	9	8'-6	6	4.5	26'-5	0.867	1.008	0.632	2.507	415.05
8-10	6	12	26'-5	5	12	8'-5	5	6	11'-8	3'-2	8'-6	5	9	26'-5	6	9	8'-4	6	4.5	26'-5	0.989	1.132	0.632	2.753	424.79
11-13	6	12	26'-5	5	12	9'-1	5	6	11'-9	3'-1	8'-8	4	9	26'-5	7	9	8'-6	7	4.5	26'-5	1.110	1.297	0.632	3.039	416.74
14-16	6	12	26'-5	5	12	10'-2	6	12	11'-11	3'-1	8'-10	4	9	26'-5	7	9	8'-10	7	4.5	26'-5	1.232	1.463	0.632	3.327	431.21
17-19	6	12	26'-5	5	12	10'-8	6	12	12'-2	3'-2	9'-0	5	12	26'-5	8	12	9'-2	8	4.5	26'-5	1.394	1.586	0.632	3.612	444.76
20-22	7	18	26'-6	7	18	11'-5	6	12	12'-4	3'-3	9'-1	5	9	26'-6	7	9	9'-4	7	4.5	26'-6	1.524	1.720	0.667	3.911	472.76
23-25	7	18	26'-8	7	18	11'-7	4	6	12'-7	3'-4	9'-3	5	9	26'-8	7	9	9'-8	7	4.5	26'-8	1.697	1.854	0.702	4.253	471.08

Bent Bar Detail

Bars	D
4	3"
5	3 3/4"
6	4 1/2"
7	5 1/4"



Note:
All dimensions are out to out.
D = pin diameter.



Twin 12' x 8' Barrel Section

Notes:

- Dimensions listed on this sheet to be used in conjunction with Sheet TWRCB G3-20.
- Fill, dimensions "S" and "H" are in feet.
- Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
- Dimensions "L", "H", "V" are in feet and inches.

LATEST REVISION DATE

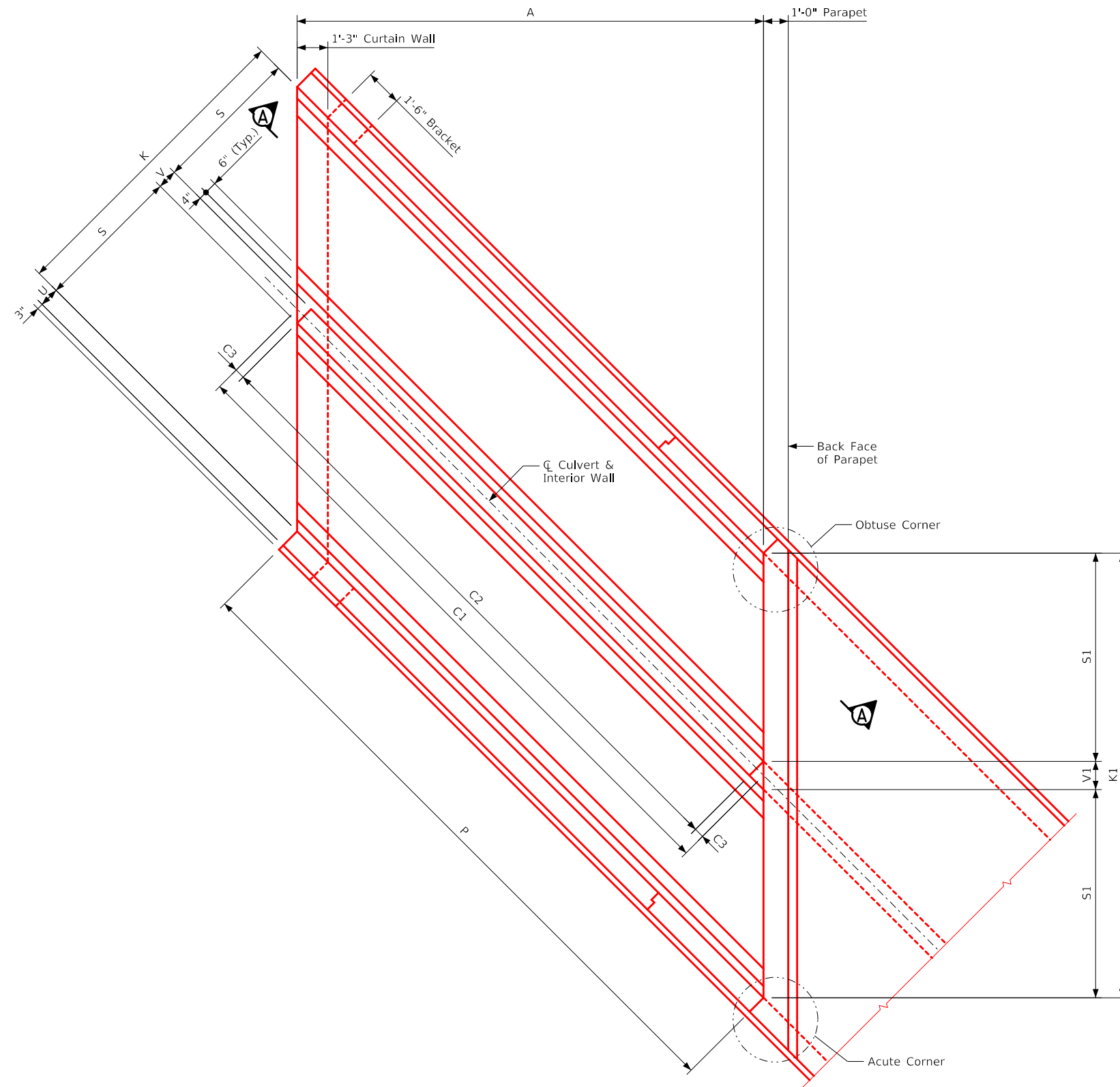

APPROVED BY BRIDGE ENGINEER


Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel
Details
12' x 8' Barrel Sections

TWRCB
12-8-20

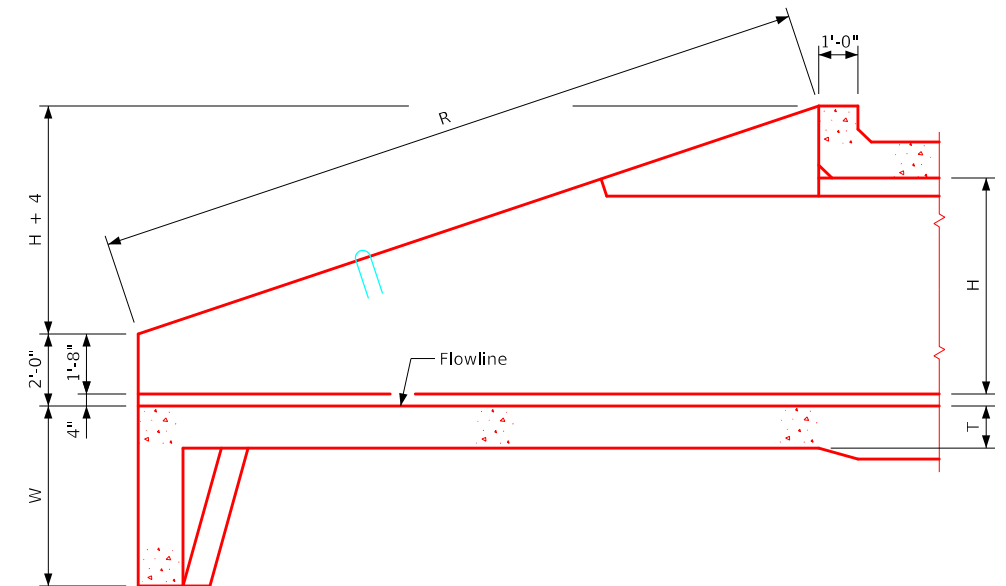
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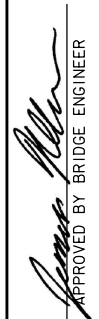
Plan View

Notes:

1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets TWPWH 45-2-20 for dimensions table.
3. Dimensions are in feet and inches unless otherwise noted.



Elevation Section A-A

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls July, 2020	
		Dimension Table 45° Skew	TWPWH 45-1-20

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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	
Headwall Dimensions	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
	C1	52'-3 ³ / ₈	48'-1	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	52'-3 ³ / ₈	48'-1	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	C1
	C2	51'-3 ³ / ₈	47'-1	43'-0 ¹ / ₈	38'-9 ¹ / ₈	34'-6 ¹ / ₄	30'-4 ³ / ₈	26'-1 ¹ / ₂	21'-10 ¹ / ₂	17'-7 ⁵ / ₈	51'-3 ³ / ₈	47'-1	43'-0 ¹ / ₈	38'-9 ¹ / ₈	34'-6 ¹ / ₄	30'-4 ³ / ₈	26'-1 ¹ / ₂	21'-10 ¹ / ₂	17'-7 ⁵ / ₈	C2
	C3	6	6	5	5	5	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂	6	6	5	5	5	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂	6	C3
	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
	K	25'-0	25'-0	24'-10	24'-10	24'-10	24'-9	24'-9	24'-9	24'-9	21'-0	21'-0	20'-10	20'-10	20'-10	20'-9	20'-9	20'-9	20'-9	K
	K1	35'-4 ¹ / ₄	35'-4 ¹ / ₄	35'-1 ³ / ₈	35'-1 ³ / ₈	35'-1 ³ / ₈	35'-0	35'-0	35'-0	35'-0	29'-8 ¹ / ₂	29'-8 ¹ / ₂	29'-5 ¹ / ₂	29'-5 ¹ / ₂	29'-5 ¹ / ₂	29'-4 ¹ / ₄	29'-4 ¹ / ₄	29'-4 ¹ / ₄	29'-4 ¹ / ₄	K1
	P	52'-3 ³ / ₈	48'-1	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	52'-3 ³ / ₈	48'-1	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	P
	R	53'-9 ¹ / ₈	49'-4 ³ / ₄	45'-0 ¹ / ₂	40'-8 ¹ / ₄	36'-3 ³ / ₈	31'-11 ¹ / ₈	27'-7 ¹ / ₄	23'-3	18'-10 ⁵ / ₈	53'-9 ¹ / ₈	49'-4 ³ / ₄	45'-0 ¹ / ₂	40'-8 ¹ / ₄	36'-3 ³ / ₈	31'-11 ¹ / ₈	27'-7 ¹ / ₄	23'-3	18'-10 ⁵ / ₈	R
	R1	52'-5 ¹ / ₈	48'-1 ¹ / ₈	43'-11 ¹ / ₄	39'-7	35'-2 ³ / ₄	30'-11 ³ / ₈	26'-7 ¹ / ₈	22'-2 ¹ / ₈	17'-10 ⁵ / ₈	52'-5 ¹ / ₈	48'-1 ¹ / ₈	43'-11 ¹ / ₄	39'-7	35'-2 ³ / ₄	30'-11 ³ / ₈	26'-7 ¹ / ₈	22'-2 ¹ / ₈	17'-10 ⁵ / ₈	R1
	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
	S1	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	16'-11 ¹ / ₈	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	14'-1 ³ / ₄	S1
	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
	V	1'-0	1'-0	10	10	10	9	9	9	9	1'-0	1'-0	10	10	10	9	9	9	9	V
	V1	1'-5	1'-5	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-5	1'-5	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	V1
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	
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	B	
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	1'-0	C	
	D	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	D	
	E	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	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'	S x H	
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	C1	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	C1
	C2	43'-0 ¹ / ₈	38'-9 ¹ / ₈	34'-6 ¹ / ₄	30'-4 ³ / ₈	26'-1 ¹ / ₂	21'-10 ¹ / ₂	17'-7 ⁵ / ₈	C2
	C3	5	5	5	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂	4 ¹ / ₂	C3
	H	10'-0	9'-0	8'-0	7'-0	6'-0	5'-0	4'-0	H
	K	16'-10	16'-10	16'-10	16'-9	16'-9	16'-9	16'-9	K
	K1	23'-9 ⁵ / ₈	23'-9 ⁵ / ₈	23'-9 ⁵ / ₈	23'-8 ¹ / ₄	23'-8 ¹ / ₄	23'-8 ¹ / ₄	23'-8 ¹ / ₄	K1
	P	43'-10 ¹ / ₈	39'-7 ¹ / ₈	35'-4 ¹ / ₄	31'-1 ³ / ₈	26'-10 ¹ / ₂	22'-7 ¹ / ₂	18'-4 ⁵ / ₈	P
	R	45'-0 ¹ / ₂	40'-8 ¹ / ₄	36'-3 ³ / ₈	31'-11 ¹ / ₈	27'-7 ¹ / ₄	23'-3	18'-10 ⁵ / ₈	R
	R1	43'-11 ¹ / ₄	39'-7	35'-2 ³ / ₄	30'-11 ³ / ₈	26'-7 ¹ / ₈	22'-2 ¹ / ₈	17'-10 ⁵ / ₈	R1
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	S
	S1	11'-3 ³ / ₄	11'-3 ³ / ₄	11'-3 ³ / ₄	11'-3 ³ / ₄	11'-3 ³ / ₄	11'-3 ³ / ₄	11'-3 ³ / ₄	S1
	T	11	11	11	11	11	11	11	T
	U	10	10	10	9	9	9	9	U
	V	10	10	10	9	9	9	9	V
	V1	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-2 ¹ / ₈	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	1'-0 ³ / ₄	V1
W	4'-6	4'-3	4'-0	3'-9	3'-6	3'-6	3'-6	W	
Bar Spacing	B	1'-0	1'-0	1'-0	1'-0	1'-0	9	9	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	9	9	E

Notes:

- 1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
- 2. See Sheets TWPWH 45-1-20 and Sheets TWPWH 45-3-20 thru 45-6-20 for location of certain dimensions tabulated.
- 3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE



APPROVED BY BRIDGE ENGINEER



Standard Design - Twin Reinforced Concrete Box Culverts

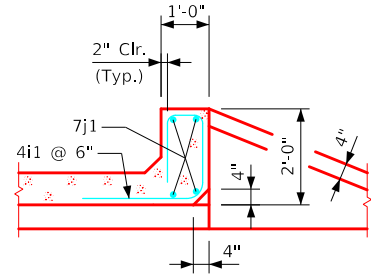
Parallel Wing Headwalls

July, 2020

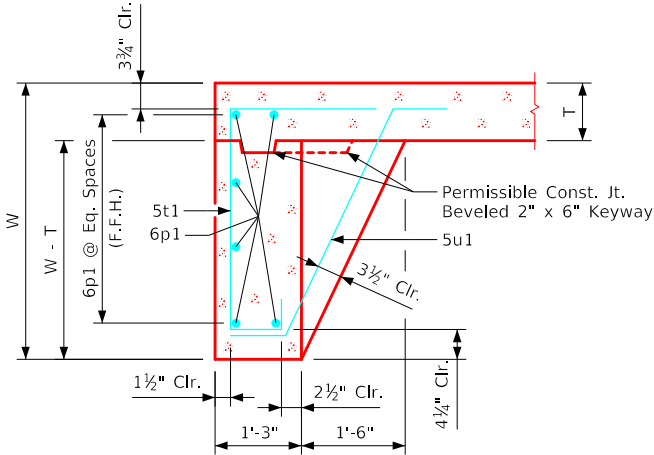
Dimension Table
45° Skew

TWPWH
45-2-20

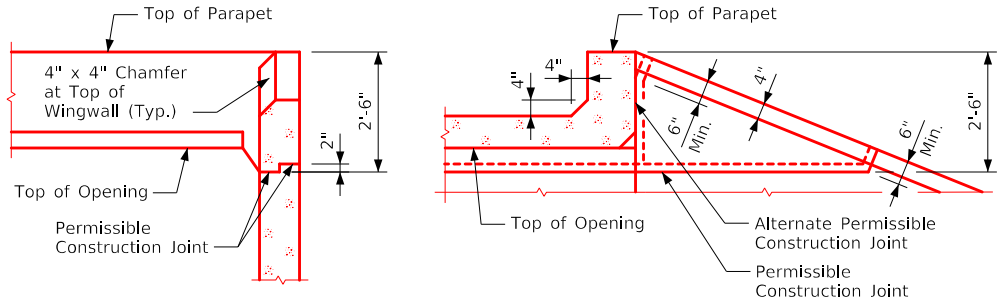
Revised 08-2022: Changed chamfer at top of Interior Wall to 3/4" x 3/4" (was 4" x 4").
ENGLISHLRFDSTWINGCULVERTS.DGN - TWPWH 45-3-19 - THIS SHEET ISSUED 07-2020.



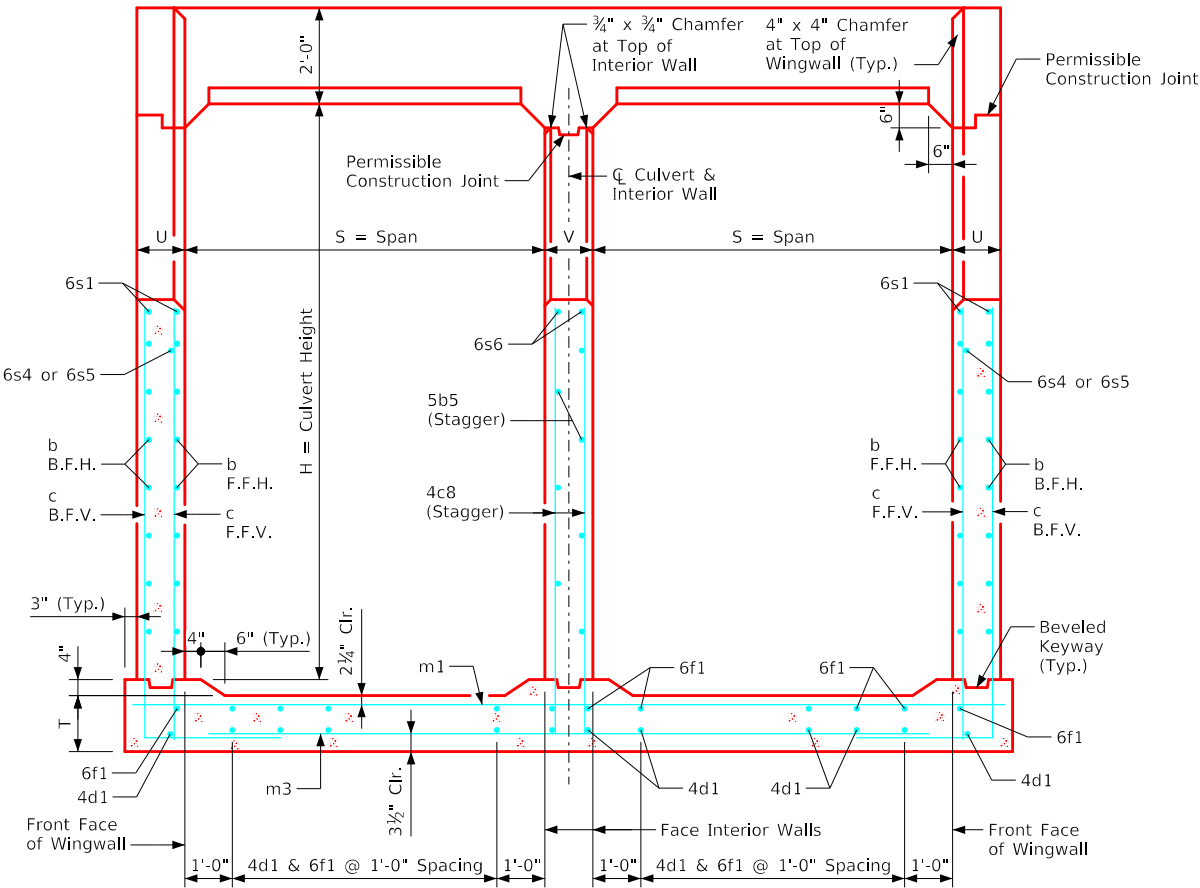
Section thru Parapet



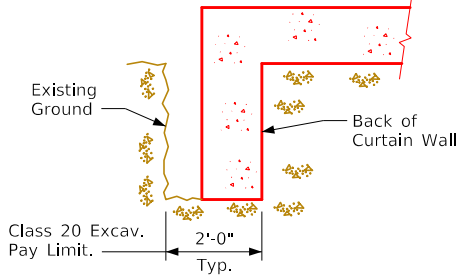
Section thru Curtain Wall



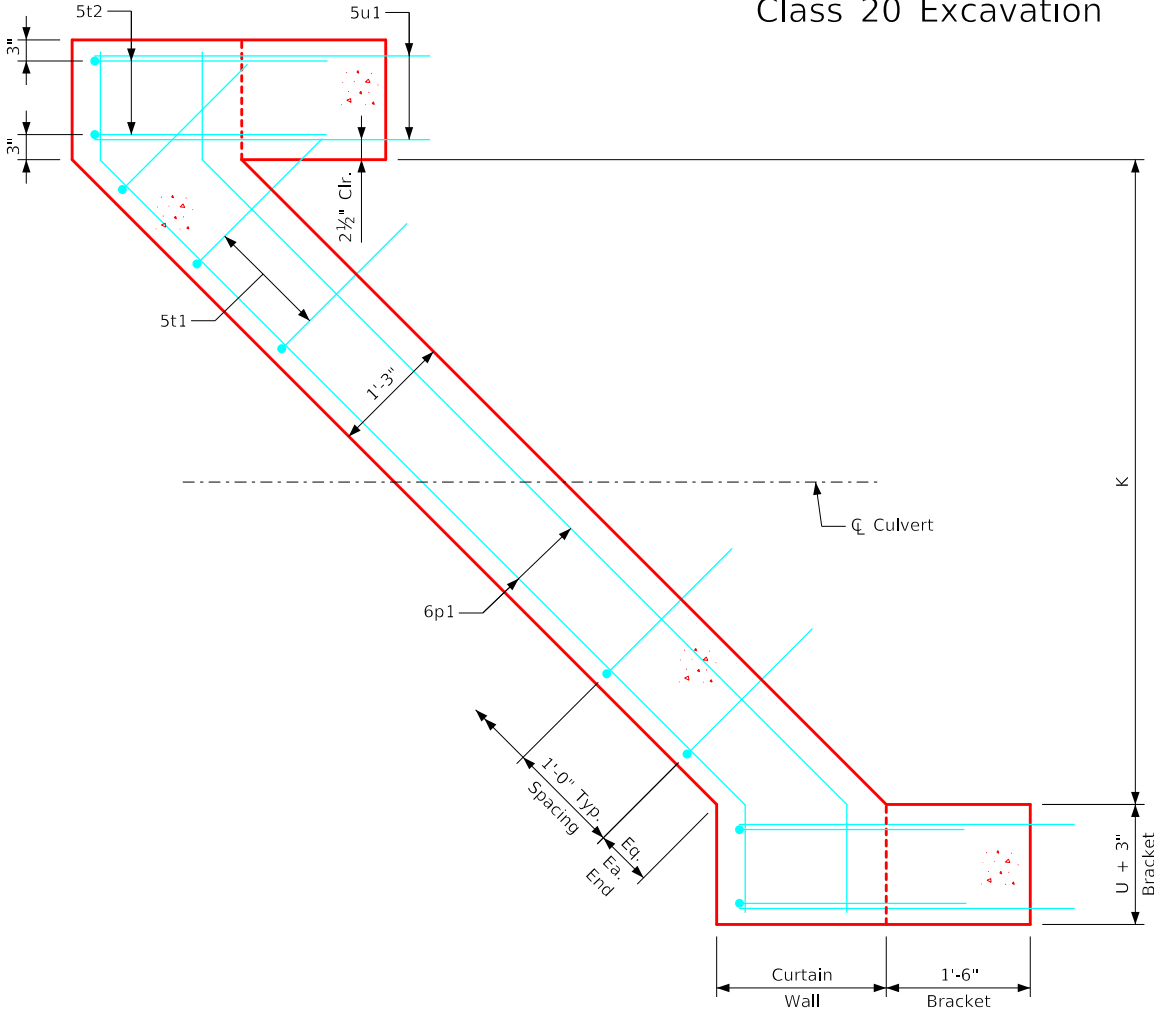
Top of Wingwall Details



Typical Cross Section - thru Headwall



Curtain Wall
Class 20 Excavation

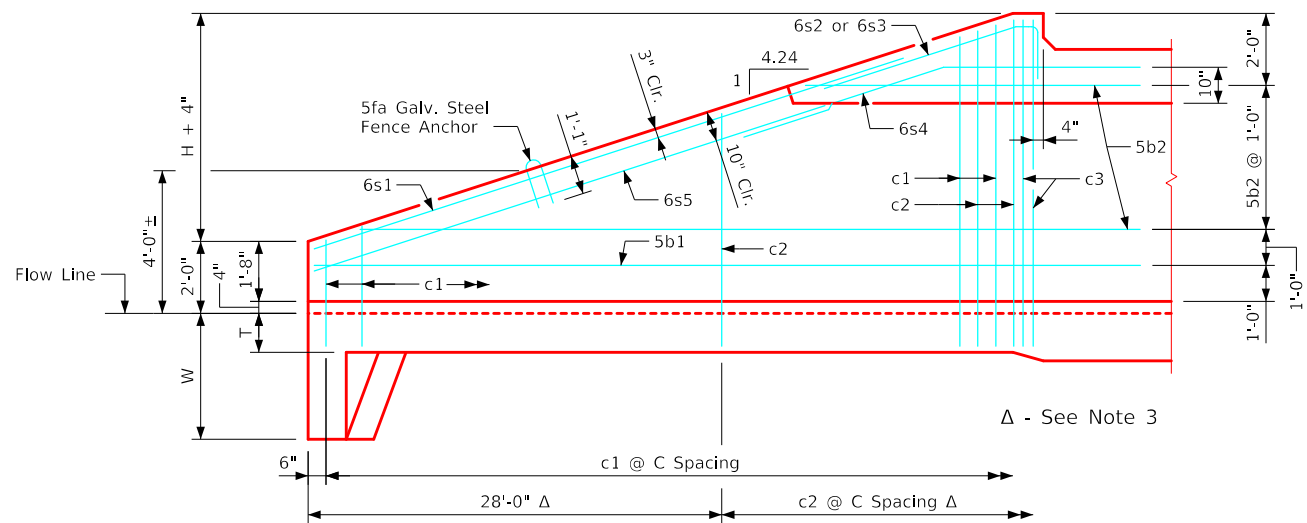


Curtain Wall Detail - Plan View
(Apron is not shown)

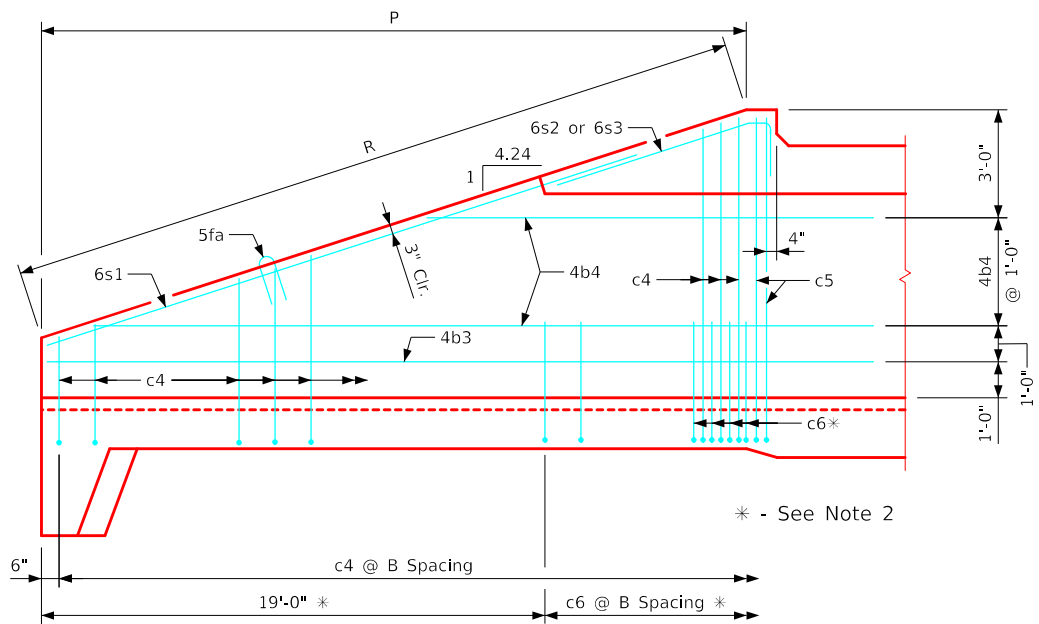
- Notes:
1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
 2. For dimension table see Sheet TWPWH 45-2-20.

August 2022 LATEST REVISION DATE	 Standard Design - Twin Reinforced Concrete Box Culverts	Parallel Wing Headwalls	
		July, 2020	
		Cross Section Details 45° Skew	TWPWH 45-3-20

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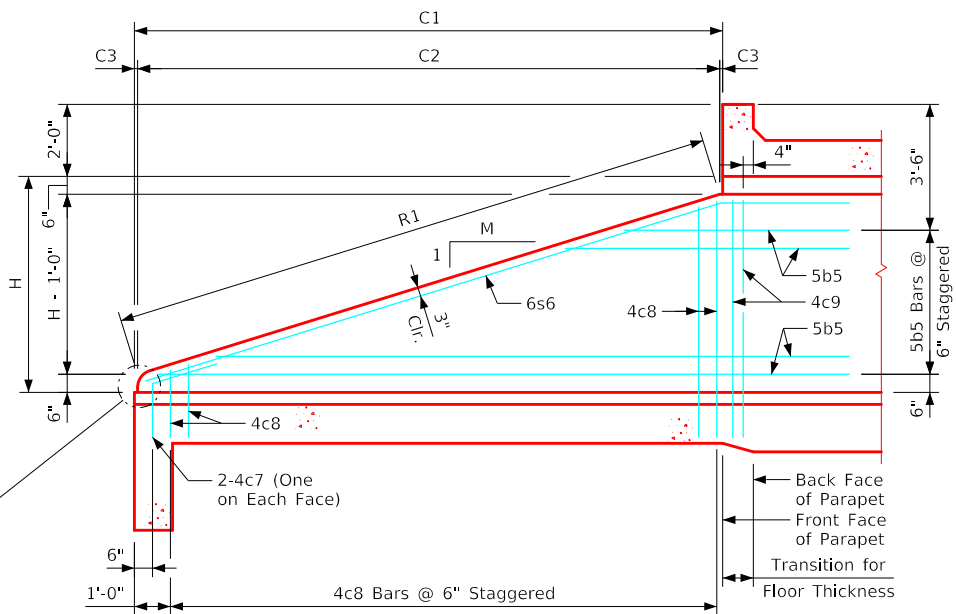
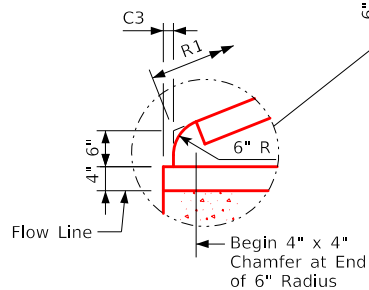


Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Culvert Height (H)	Slope (M)
4'	5.88
5'	5.47
6'	5.23
7'	5.06
8'	4.93
9'	4.85
10'	4.78
11'	4.71
12'	4.67



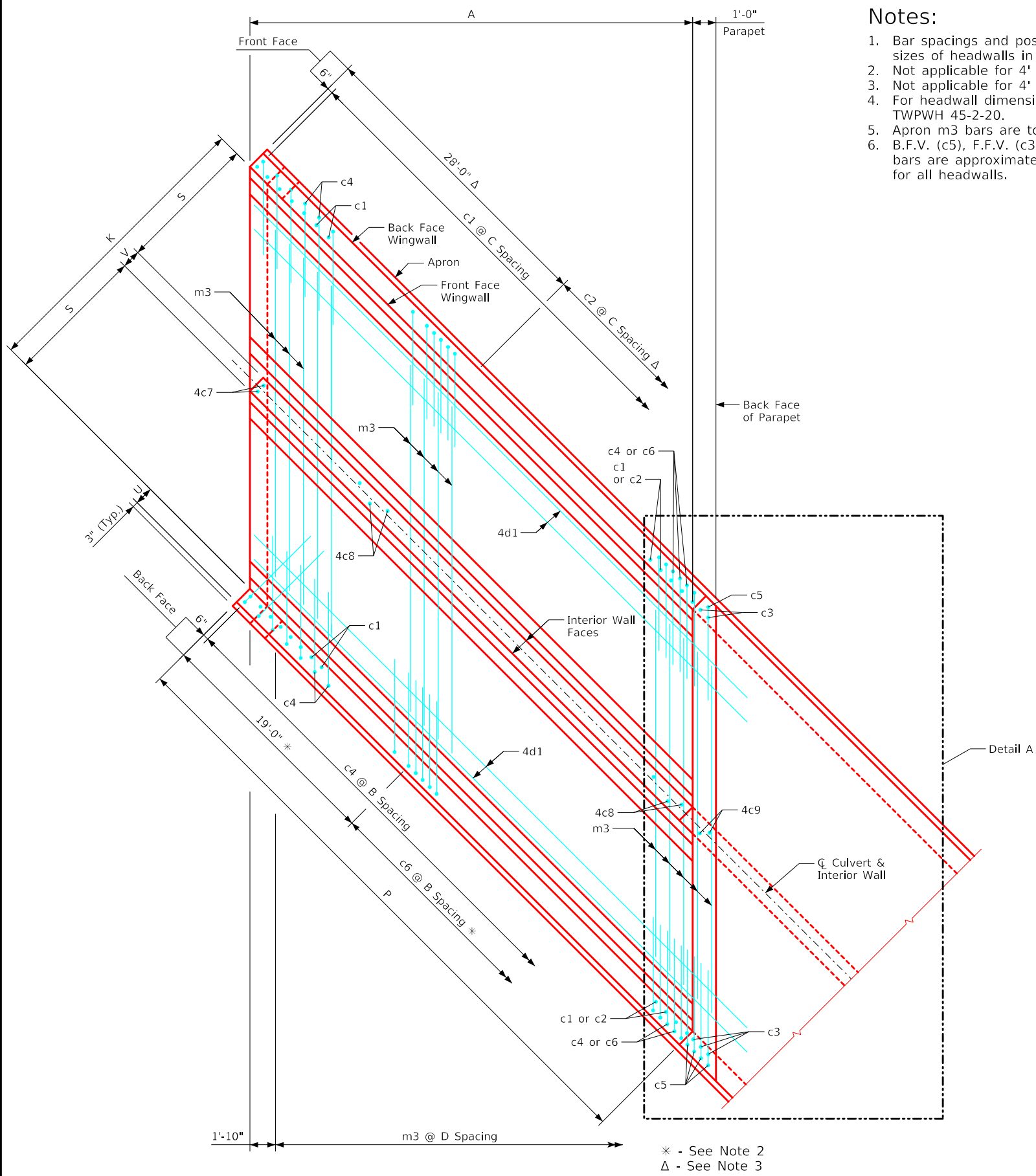
Typical View - Interior Wall

Notes:

1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 4' thru 5' height headwalls.
3. Not applicable for 4' thru 8' height headwalls.
4. For headwall dimensions and bar spacing see Sheet TWPWH 45-2-20.
5. Apron m3 bars are to be centered on $\varnothing$ culvert.
6. B.F.V. (c5) and F.F.V. (c3) and interior wall both F.V. (c9) bars are approximately 4" from the back of parapet for all headwalls.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
Wingwall Elevations 45° Skew		TWPWH 45-4-20	

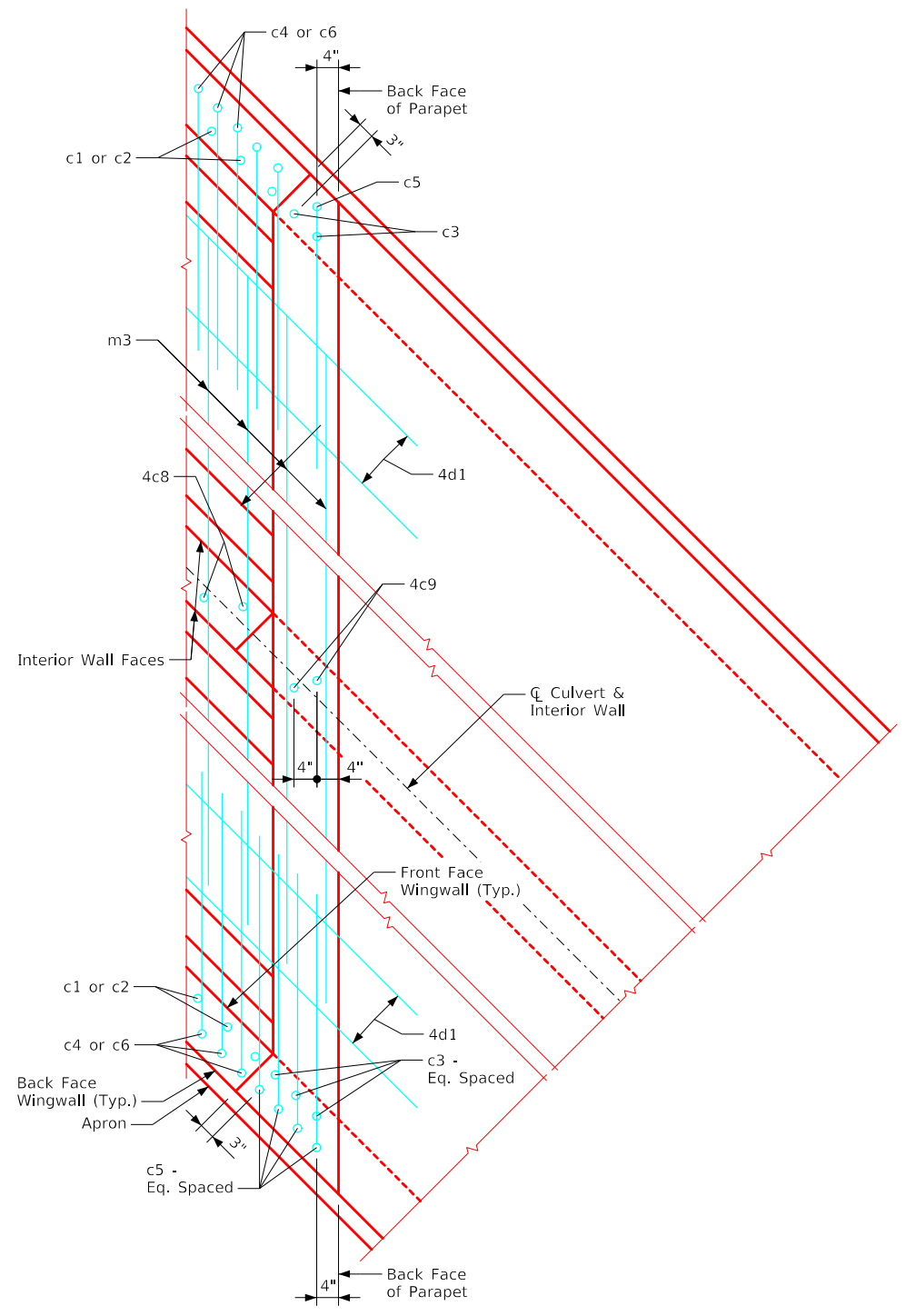
ENGLISHLRFDSTWNCULVERTS.DGN - TWPWH 45-5-20 - THIS SHEET ISSUED 07-2020.



Plan View - Bottom Apron Reinforcing
(Curtain Wall Reinforcing not shown, See Sheet TWPWH 45-2-20)

* - See Note 2
Δ - See Note 3

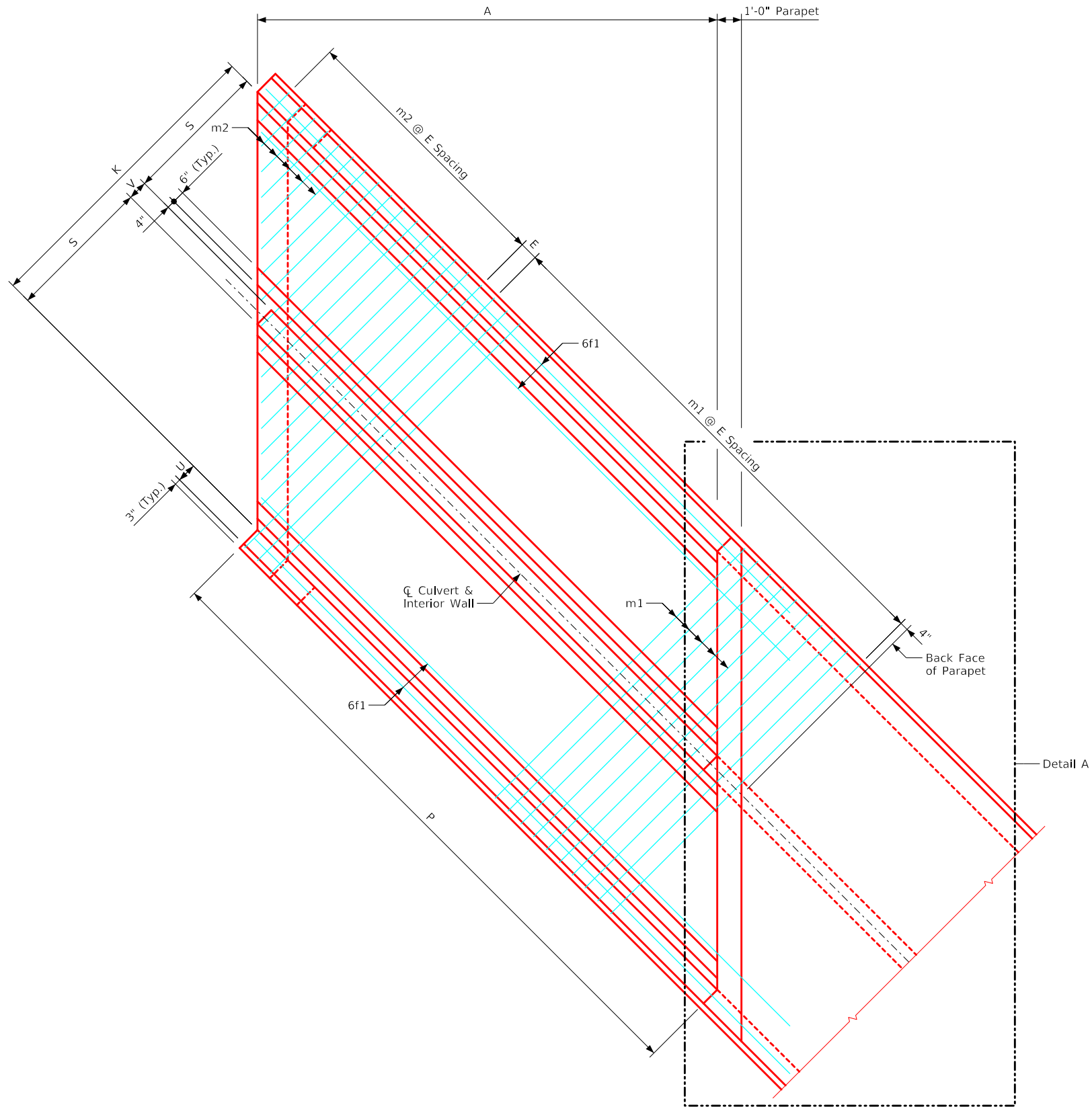
- Notes:
1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
 2. Not applicable for 4' thru 5' height headwalls.
 3. Not applicable for 4' thru 8' height headwalls.
 4. For headwall dimensions and bar spacing see Sheet TWPWH 45-2-20.
 5. Apron m3 bars are to be centered on $\bar{C}$ culvert.
 6. B.F.V. (c5), F.F.V. (c3) and interior wall both F.V. (c9) bars are approximately 4" from the back of parapet for all headwalls.



Detail A

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
		Bottom Apron Reinforcing 45° Skew	TWPWH 45-5-20

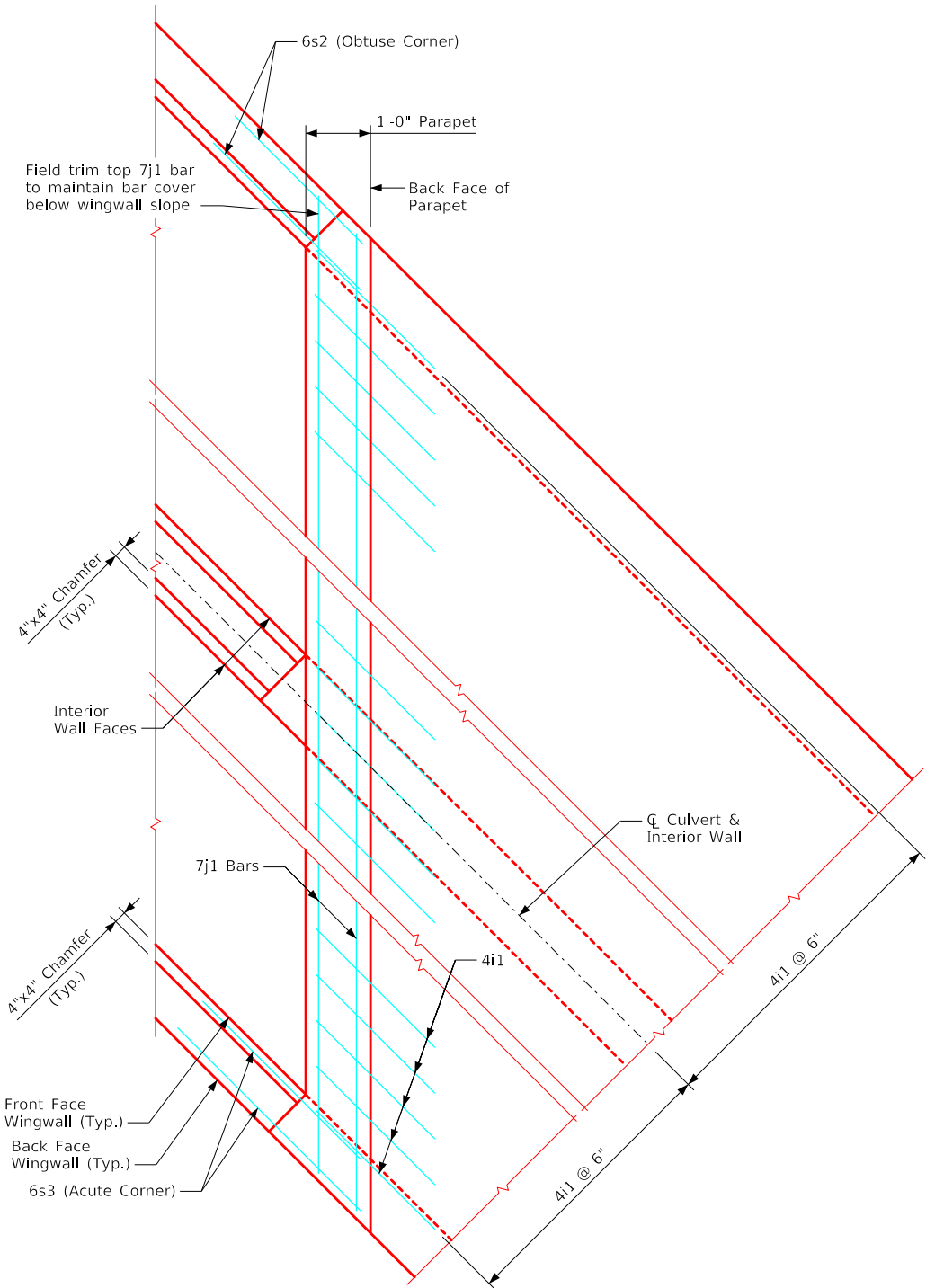
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Plan View - Top Apron Reinforcing
(Wall Reinforcing not shown for clarity)

Notes:

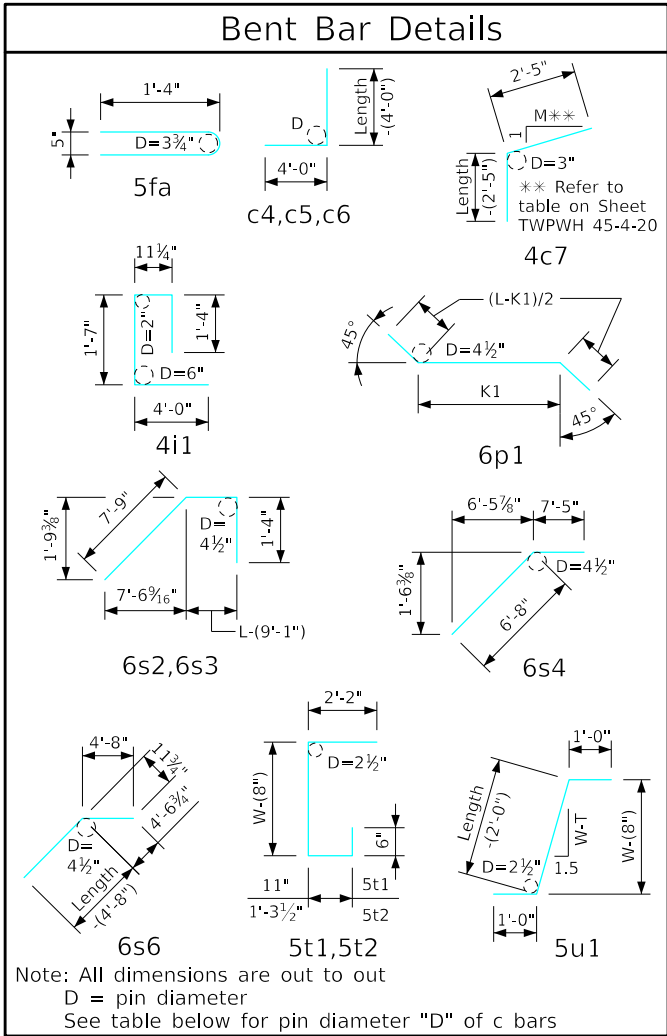
1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. For headwall dimensions and bar spacing see Sheet TWPWH 45-2-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.



Detail A
(Showing parapet bars only)

LATEST REVISION DATE			
		Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
		Parapet Reinforcing & Top Apron Reinforcing 45° Skew	TWPWH 45-6-20

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c Bar Pin Diameter	
Bar Size	D
5	3¾"
6	4½"

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height																																
Location		Shape	12' x 12'				12' x 11'				12' x 10'				12' x 9'				12' x 8'				12' x 7'									
			Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.	Bar	No.	Length	Wt.						
Fence Anchor (Galv.)			5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6						
Wingwall, F.F.H.			5b1	2	56'-2	122	5b1	2	51'-11	113	5b1	2	47'-8	104	5b1	2	43'-5	96	5b1	2	39'-2	82	5b1	2	34'-11	73						
Wingwall, F.F.H.			5b2	22 Var.	2 Each 11'-9 to 54'-2	776	5b2	20 Var.	2 Each 11'-9 to 49'-11	658	5b2	18 Var.	2 Each 11'-9 to 45'-9	550	5b2	16 Var.	2 Each 11'-9 to 41'-6	449	5b2	14 Var.	2 Each 11'-9 to 37'-3	358	5b2	12 Var.	2 Each 11'-9 to 33'-0	280						
Wingwall, B.F.H.			4b3	2	56'-9	79	4b3	2	52'-6	73	4b3	2	48'-1	67	4b3	2	43'-10	62	4b3	2	39'-7	53	4b3	2	35'-3	47						
Wingwall, B.F.H.			4b4	20 Var.	2 Each 16'-7 to 54'-9	489	4b4	18 Var.	2 Each 16'-7 to 50'-6	413	4b4	16 Var.	2 Each 16'-5 to 46'-1	340	4b4	14 Var.	2 Each 16'-5 to 41'-10	276	4b4	12 Var.	2 Each 16'-5 to 37'-7	216	4b4	10 Var.	2 Each 16'-4 to 33'-3	166						
Interior Wall, Both F.H.			5b5	21 Var.	8'-9 to 55'-5	720	5b5	19 Var.	8'-9 to 51'-2	606	5b5	17 Var.	8'-8 to 46'-11	500	5b5	15 Var.	8'-9 to 42'-8	407	5b5	13 Var.	8'-10 to 38'-5	320	5b5	11 Var.	8'-10 to 34'-2	247						
Wingwall, F.F.V.			5c1	104 Var.	2 Each 2'-8 to 14'-8	940	5c1	96 Var.	2 Each 2'-8 to 13'-9	822	4c1	88 Var.	2 Each 2'-8 to 12'-9	453	4c1	80 Var.	2 Each 2'-8 to 11'-10	387	4c1	94 Var.	2 Each 2'-8 to 10'-9	421	4c1	82 Var.	2 Each 2'-8 to 9'-9	340						
Wingwall, F.F.V.			5c2	50 Var.	2 Each 9'-1 to 14'-9	621	5c2	42 Var.	2 Each 9'-1 to 13'-10	502	4c2	32 Var.	2 Each 9'-1 to 12'-8	232	4c2	24 Var.	2 Each 9'-1 to 11'-9	167	c2	--	--	--	c2	--	--	--						
Wingwall, F.F.V. (O)			5c3	2	15'-1	31	5c3	2	14'-1	29	4c3	2	13'-1	17	4c3	2	12'-1	16	4c3	2	11'-1	15	4c3	2	10'-1	13						
Wingwall, F.F.V. (A)			5c3	3	15'-1	47	5c3	3	14'-1	44	4c3	3	13'-1	26	4c3	3	12'-1	24	4c3	3	11'-1	22	4c3	3	10'-1	20						
Wingwall, B.F.V.			6c4	104 Var.	2 Each 6'-10 to 18'-10	2005	5c4	96 Var.	2 Each 6'-10 to 17'-11	1239	5c4	88 Var.	2 Each 6'-10 to 16'-11	1090	5c4	80 Var.	2 Each 6'-10 to 16'-0	953	5c4	70 Var.	2 Each 6'-10 to 14'-10	791	5c4	62 Var.	2 Each 6'-10 to 13'-11	671						
Wingwall, B.F.V. (O)			6c5	1	19'-1	29	5c5	1	18'-1	19	5c5	1	17'-1	18	5c5	1	16'-1	17	5c5	1	15'-1	16	5c5	1	14'-1	15						
Wingwall, B.F.V. (A)			6c5	4	19'-1	115	5c5	4	18'-1	75	5c5	4	17'-1	71	5c5	4	16'-1	67	5c5	4	15'-1	63	5c5	4	14'-1	59						
Wingwall, B.F.V.			6c6	68	9'-0	919	6c6	60	9'-0	811	6c6	50	9'-0	676	6c6	42	9'-0	568	5c6	34	9'-0	319	5c6	26	9'-0	244						
Interior Wall, Both F.V			4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5						
Interior Wall, Both F.V			4c8	101 Var.	1'-6 to 12'-3	464	4c8	93 Var.	1'-6 to 11'-3	396	4c8	85 Var.	1'-6 to 10'-4	336	4c8	76 Var.	1'-6 to 9'-3	273	4c8	68 Var.	1'-6 to 8'-4	223	4c8	59 Var.	1'-6 to 7'-3	172						
Interior Wall, Both F.V			4c9	2	12'-7	17	4c9	2	11'-7	15	4c9	2	10'-7	14	4c9	2	9'-7	13	4c9	2	8'-7	11	4c9	2	7'-7	10						
Apron, Longit., Bott.			4d1	26	55'-11	1013	4d1	26	51'-8	939	4d1	26	47'-6	867	4d1	26	43'-3	793	4d1	26	39'-0	677	4d1	26	34'-9	604						
Apron, Longit., Top			6f1	26	55'-11	2278	6f1	26	51'-8	2112	6f1	26	47'-6	1949	6f1	26	43'-3	1783	6f1	26	39'-0	1523	6f1	26	34'-9	1357						
Parapet, Vertical			4i1	51	7'-10	267	4i1	51	7'-10	267	4i1	49	7'-10	256	4i1	49	7'-10	256	4i1	49	7'-10	256	4i1	49	7'-10	256						
Parapet, Horiz.			7j1	4	37'-8	308	7j1	4	37'-8	308	7j1	4	37'-0	303	7j1	4	37'-0	303	7j1	4	37'-0	303	7j1	4	36'-7	299						
Apron, Trans., Top			6m1	82	27'-2	3346	6m1	73	27'-2	2979	6m1	65	26'-8	2603	5m1	57	26'-8	1585	5m1	48	26'-8	1335	5m1	40	26'-5	1102						
Apron, Trans., Top			6m2	48 Var.	2'-3 to 25'-9	1009	6m2	48 Var.	2'-6 to 26'-0	1027	6m2	48 Var.	2'-0 to 25'-6	991	5m2	47 Var.	2'-3 to 25'-3	674	5m2	48 Var.	2'-0 to 25'-6	688	5m2	47 Var.	2'-2 to 25'-2	670						
Apron, Trans., Bott.			6m3	73	34'-6	3783	5m3	67	33'-8	2353	6m3	31	33'-9	1571	6m3	28	33'-9	1419	6m3	25	33'-9	1267	5m3	22	32'-8	750						
Curtain, Horiz.			6p1	6	37'-6	338	6p1	6	37'-6	338	6p1	6	36'-11	333	6p1	6	36'-11	333	6p1	6	36'-11	333	6p1	5	36'-8	275						
Wing Slope, Both F.			6s1	4	48'-4	305	6s1	4	43'-11	278	6s1	4	39'-7	238	6s1	4	35'-3	212	6s1	4	30'-10	185	6s1	4	26'-6	159						
Wing Slope, Both F. (O)			6s2	2	9'-5	28	6s2	2	9'-5	28	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-8	29						
Wing Slope, Both F. (A)			6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31						
Wing Slope, F.F.			6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42						
Wing Slope, F.F.			6s5	2	45'-10	145	6s5	2	41'-6	132	6s5	2	37'-2	112	6s5	2	32'-9	98	6s5	2	28'-5	85	6s5	2	24'-1	72						
Interior Wall, Both F.			6s6	2	56'-11	178	6s6	2	52'-7	165	6s6	2	48'-5	153	6s6	2	44'-0	139	6s6	2	39'-8	119	6s6	2	35'-5	106						
Curtain, Vert.			5t1	36	7'-11	297	5t1	36	7'-8	288	5t1	36	7'-5	278	5t1	36	7'-2	269	5t1	36	6'-11	260	5t1	36	6'-8	250						
Curtain, Vert. Ends			5t2	4	8'-4	35	5t2	4	8'-1	34	5t2	4	7'-10	33	5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30						
Bracket, Vert.			5u1	4	6'-7	27	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-9	24	5u1	4	5'-6	23						
Estimated Quantities One Headwall	Reinf. Steel		20,815 LB				17,174 LB				14,320 LB				11,809 LB				10,109 LB				8423 LB									
	Concrete	Parapet Δ	3.9	121.2 CY				3.9	109.2 CY				3.7	91.0 CY				3.7	80.9 CY				3.7	71.2 CY				3.5	59.9 CY			
		Wingwalls	42.4					36.2					25.4					21.0					12.1									
		Apron *	74.9					69.1					61.9					56.2					44.3									

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

Δ Includes top of wingwall quantities.

* Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.

(A) - Indicates bar located at acute corner.

(O) - Indicates bar located at obtuse corner.

Refer to Sheet TWPVH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron reinforcing steel is to be supported by bar chairs at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
- Clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown. Clearance to the bottom ends of vertical bars shall be 3 inches.
- Concrete quantities are estimated from back of parapet.
- Horizontal tails of bars "b" & "s" estimated to extend 2'-5" beyond back of parapet (into end of barrel). Longitudinal bars "4d1" and "6f1" estimated to project into end section of barrel a minimum of 2'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE		APPROVED BY BRIDGE ENGINEER		
			Standard Design - Twin Reinforced Concrete Box Culverts	
			Parallel Wing Headwalls	
			July, 2020	
			Quantity Tabulation 12'-0" Span 45° Skew	TWPVH 45-7-20 Sheet 1 of 2