



Twin Reinforced Concrete Box Culvert Standards

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		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

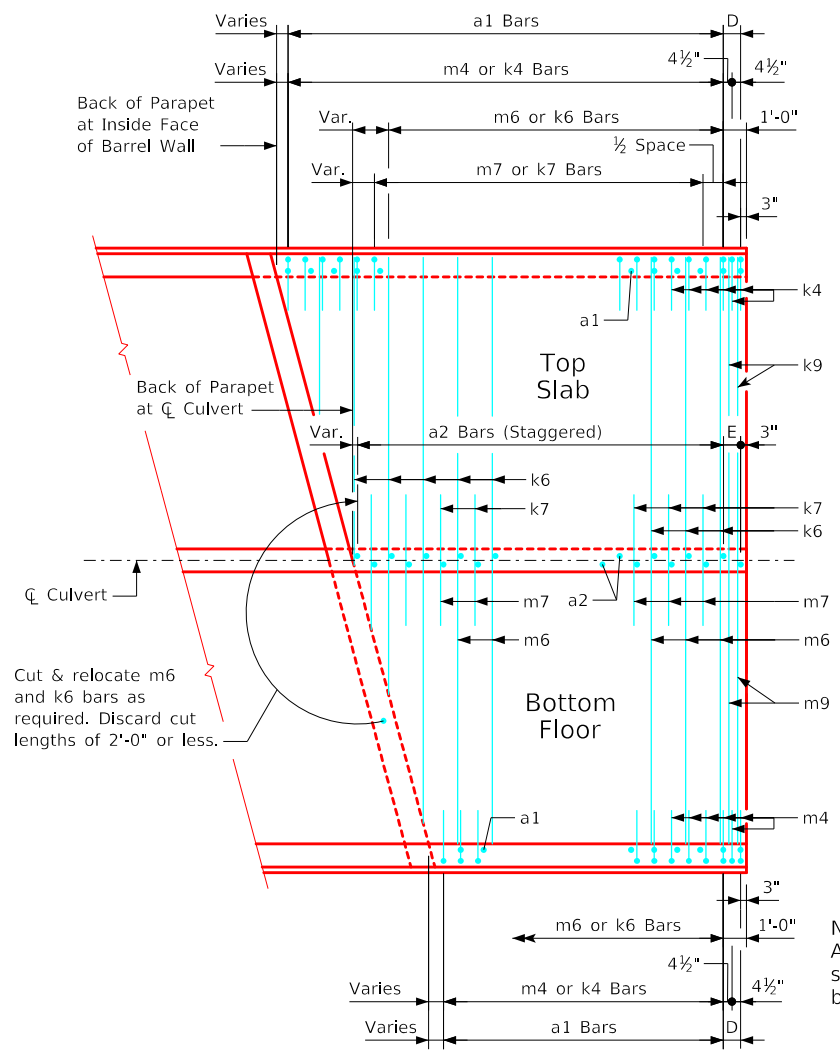
Design Stresses:

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

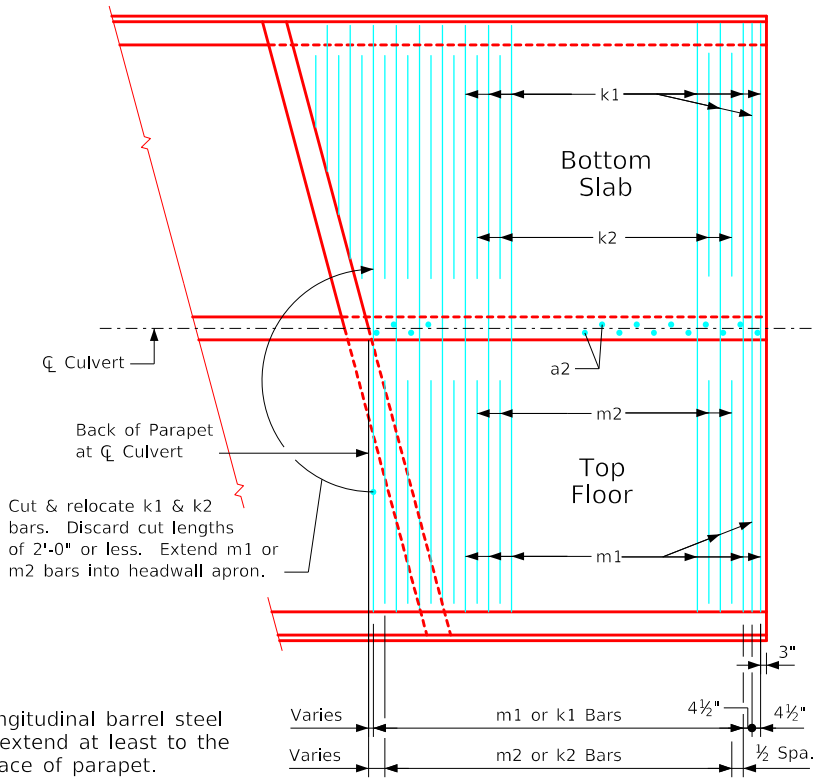
ENGLISHLRFDSTWNCULVERTS.DGN - TWRCB G3-20 - THIS SHEET ISSUED 07-2020.



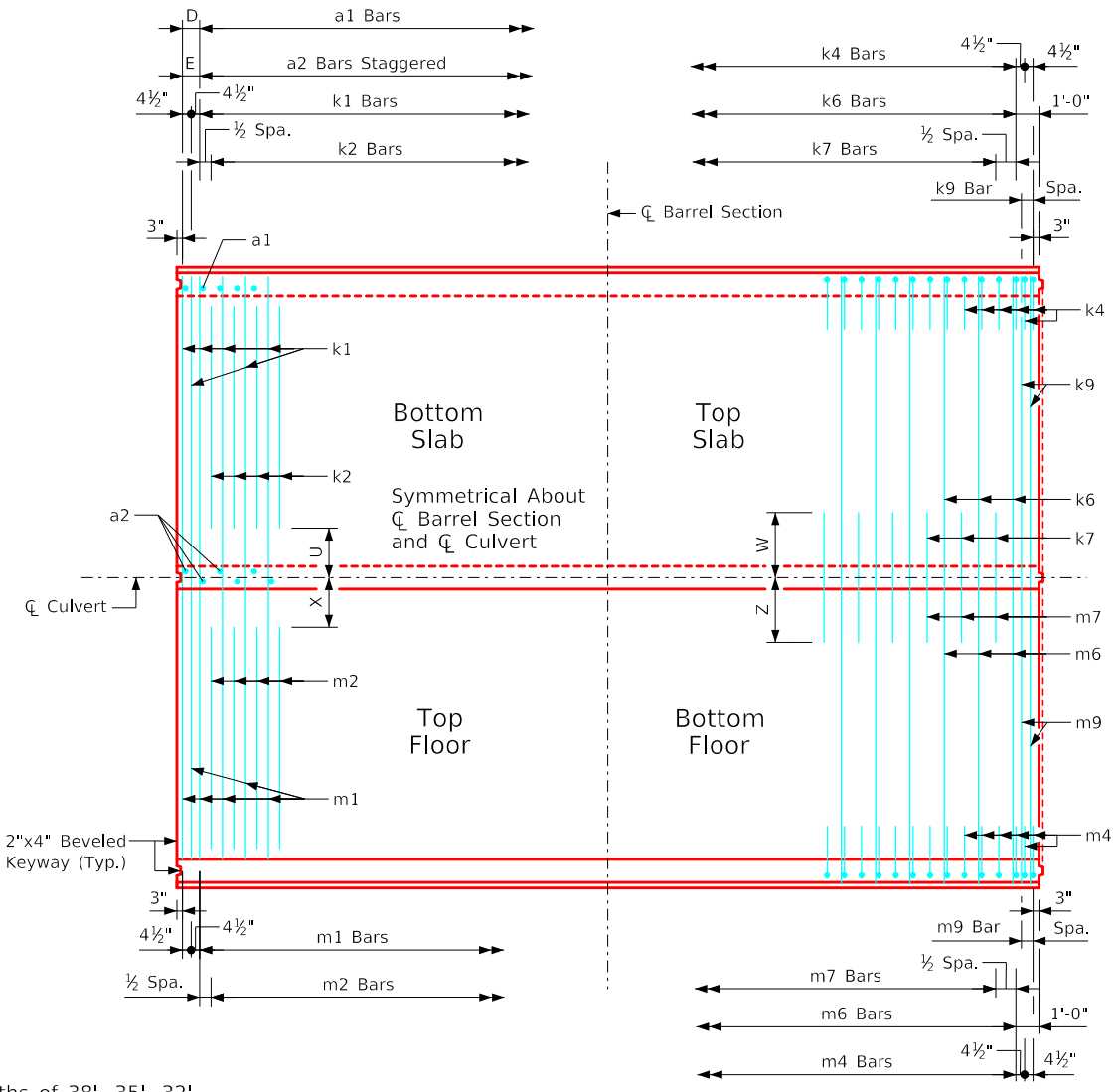
Note:
All longitudinal barrel steel shall extend at least to the backface of parapet.

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.

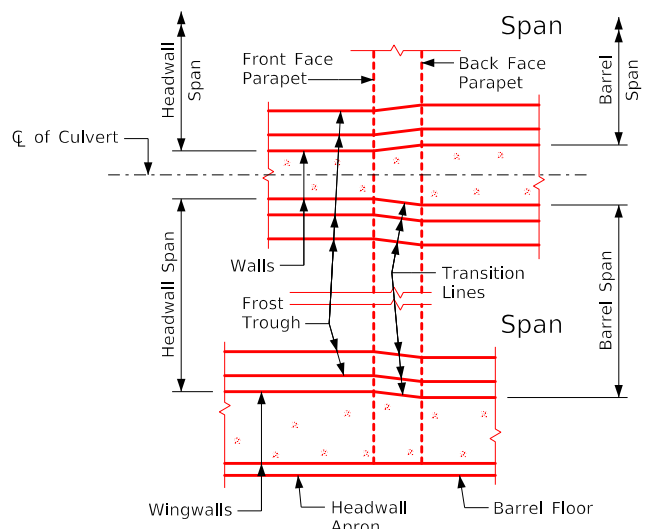


Note:
Typical for lengths of 38', 35', 32', 29', and 26'. These lengths are shown as typical because all transverse and vertical reinforcing steel spacing repeats in 3'-0" intervals.



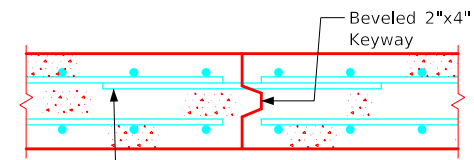
Standard Section Plan View
(Keyway is to be omitted when bell joints are used)

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



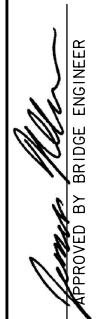
Transition Wall Details

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



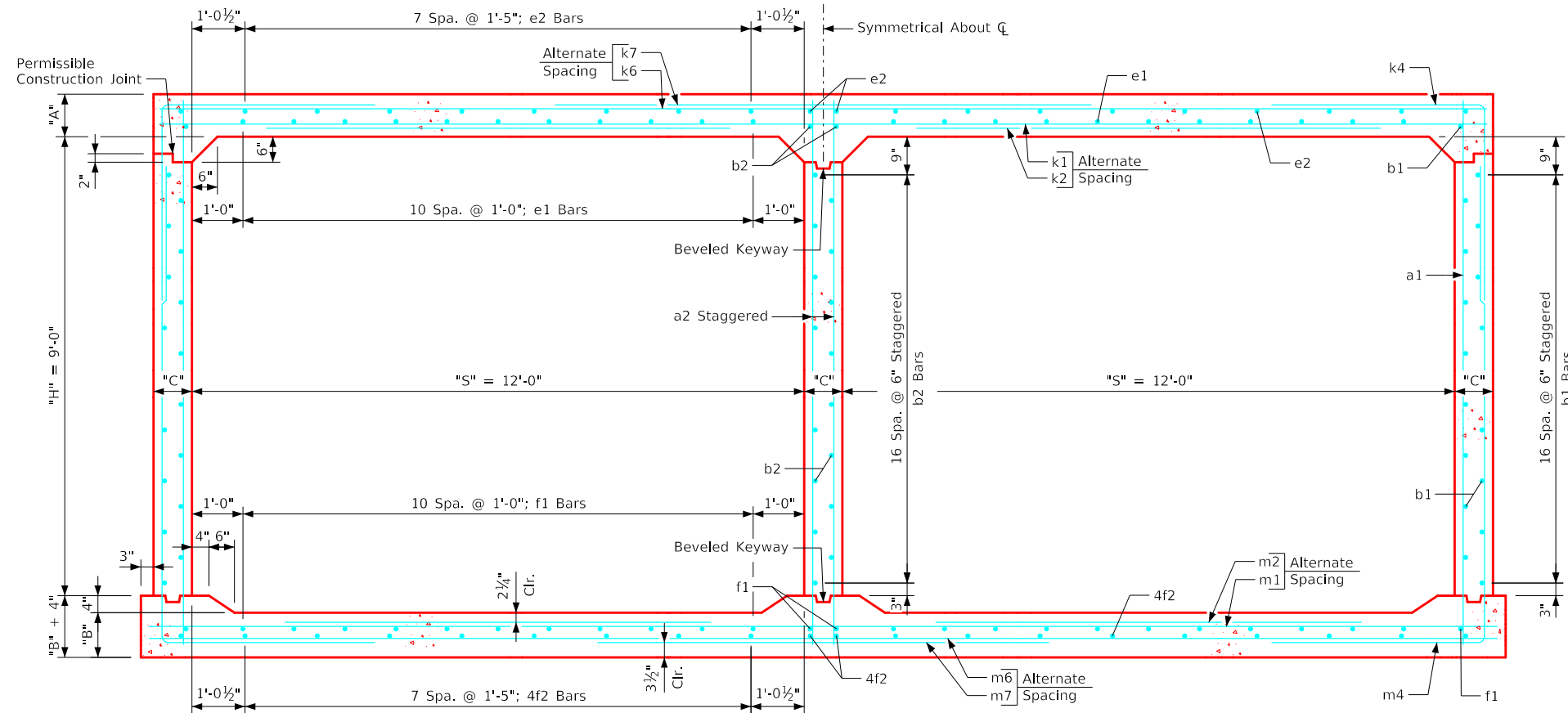
One set of 5r1 x 3'-6" dowel bars @ 1'-0" spacing required in slab at all culvert barrel joints, except joints with bell joints. See table for number required and total weight.

Top Slab Construction Joint Detail

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		Typical Culvert Barrel Details	TWRCB G3-20

Variable Dimensions and Quantities for Twin 12' x 9' 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.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L			
0	12	9	14	12.5	9	9	9	0'-0	7'-2	3'-0	7'-5	4	12	11'-1	6	9	11'-1	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-11	6	12	11'-5	7'-5	4'-0	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
1	12	9	13.5	12	9	9	9	0'-6	7'-2	3'-0	7'-7	4	12	11'-0	6	9	11'-0	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-5	5	6	11'-0	7'-5	3'-7	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	12	9	10	10.5	9	9	9	1'-6	7'-9	2'-9	5'-1	5	12	10'-7	6	9	10'-7	4	6	36	4	6	19	5	12	22	4	17	20	4	12	26	4	17	20	7	18	25'-11	7	18	11'-5	6	9	8'-5	4'-9	3'-8	4	12	25'-11	7	12	15'-6	7	4.5	25'-11
3	12	9	9	10	9	9	9	2'-5	5'-6	3'-2	4'-7	5	12	10'-6	6	9	10'-6	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	9'-2	6	9	7'-10	4'-3	3'-7	5	9	25'-11	5	9	11'-0	5	4.5	25'-11
4	12	9	9	10	9	9	9	2'-8	4'-11	3'-3	4'-3	4	9	10'-6	6	9	10'-6	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	8'-9	6	9	7'-10	3'-11	3'-11	4	9	25'-11	6	9	9'-10	6	4.5	25'-11
5-7	12	9	10	11.5	9	9	9	3'-1	4'-9	3'-3	4'-3	4	9	10'-8	6	9	10'-8	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-2	6	9	7'-6	3'-9	3'-9	5	12	25'-11	7	12	9'-6	7	4.5	25'-11
8-10	12	9	11.5	13.5	9	9	9	3'-0	4'-3	2'-11	4'-2	4	12	11'-0	6	9	11'-0	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-7	5	6	6'-8	3'-4	3'-4	5	9	25'-11	6	9	8'-6	6	4.5	25'-11
11-13	12	9	13	15	9	9	9	2'-10	4'-3	3'-0	4'-3	4	12	11'-3	6	9	11'-3	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	9'-3	6	9	7'-2	3'-3	3'-11	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	12	9	14.5	17	9	9	9	2'-5	4'-4	2'-7	4'-5	4	12	11'-6	6	9	11'-6	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	7	18	25'-11	6	18	10'-5	6	9	7'-5	3'-4	4'-1	5	12	25'-11	8	12	8'-8	8	4.5	25'-11

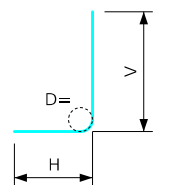
	Bar List																		Quantities						
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)			Steel (LB/FT)	
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls		Total
0	5	9	26'-5	4	9	8'-6	7	12	17'-0	7'-6	9'-6	5	12	26'-5	5	12	14'-10	5	4.5	26'-5	1.191	1.091	0.715	2.997	431.76
1	5	9	26'-5	4	9	8'-5	5	6	16'-9	7'-4	9'-5	4	12	26'-5	6	12	15'-2	6	4.5	26'-5	1.151	1.050	0.715	2.916	434.32
2	5	9	26'-5	5	9	8'-8	6	9	13'-10	4'-6	9'-4	4	9	26'-5	6	9	10'-2	6	4.5	26'-5	0.867	0.926	0.715	2.508	469.92
3	5	9	26'-5	5	9	8'-1	6	9	13'-3	4'-0	9'-3	5	12	26'-5	7	12	9'-2	7	4.5	26'-5	0.786	0.885	0.715	2.386	448.95
4	5	9	26'-5	5	9	8'-0	6	9	13'-1	3'-10	9'-3	5	9	26'-5	6	9	8'-6	6	4.5	26'-5	0.786	0.885	0.715	2.386	442.00
5-7	6	12	26'-5	5	12	8'-0	6	9	13'-1	3'-8	9'-5	5	9	26'-5	6	9	8'-6	6	4.5	26'-5	0.867	1.008	0.715	2.590	437.82
8-10	5	9	26'-5	4	9	9'-0	5	6	13'-0	3'-5	9'-7	5	9	26'-5	6	9	8'-4	6	4.5	26'-5	0.989	1.174	0.715	2.878	431.50
11-13	6	12	26'-5	5	12	9'-1	6	9	13'-0	3'-4	9'-8	4	9	26'-5	7	9	8'-6	7	4.5	26'-5	1.110	1.297	0.715	3.122	431.61
14-16	6	12	26'-5	5	12	10'-2	6	9	13'-3	3'-5	9'-10	4	9	26'-5	7	9	8'-10	7	4.5	26'-5	1.232	1.463	0.715	3.410	450.11
17-19	6	12	26'-8	5	12	10'-10	6	9	13'-6	3'-6	10'-0	5	12	26'-8	8	12	9'-2	8	4.5	26'-8	1.410	1.604	0.795	3.809	473.95
20-22	7	18	26'-11	7	18	11'-5	6	9	13'-8	3'-7	10'-1	5	9	26'-11	7	9	9'-4	7	4.5	26'-11	1.592	1.745	0.876	4.213	495.53
23-25	7	18	26'-11	7	18	11'-10	6	9	13'-11	3'-8	10'-3	5	9	26'-11	7	9	9'-8	7	4.5	26'-11	1.716	1.871	0.876	4.463	510.58



Twin 12' x 9' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"



k4 & m4

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

Notes:

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

ATEST	REVISION	DATE

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Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 9' Barrel Sections

TWRCB
12-9-20



Twin Reinforced Concrete Box Culvert Standards - Flared Wing Headwalls

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 ensure 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.
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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. Dimensions with parenthesis () indicate a reference dimension.
 - 19. See current Standard Specifications regarding concrete form removal.
 - 20. 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

- 21. 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.
- 22. For barrel details used in conjunction with these flared wing headwall standards, see the Twin Reinforced Concrete Box Culvert Standards (TWRCB).

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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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

Standard Design - Twin Reinforced Concrete Box Culverts

Flared Wing Headwalls

February, 2021

Index of Sheets, General Notes & Specifications

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