Twin Reinforced Concrete Box Culvert Standards

Index for Twin 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

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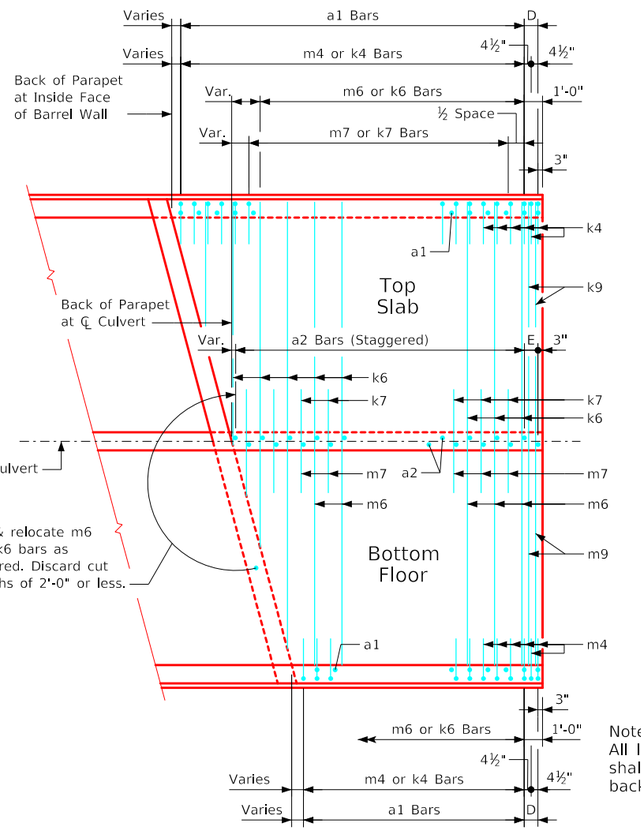
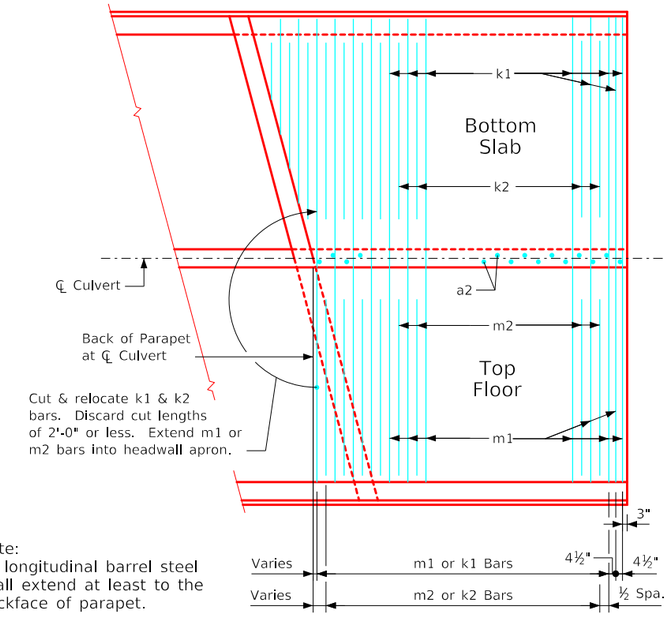


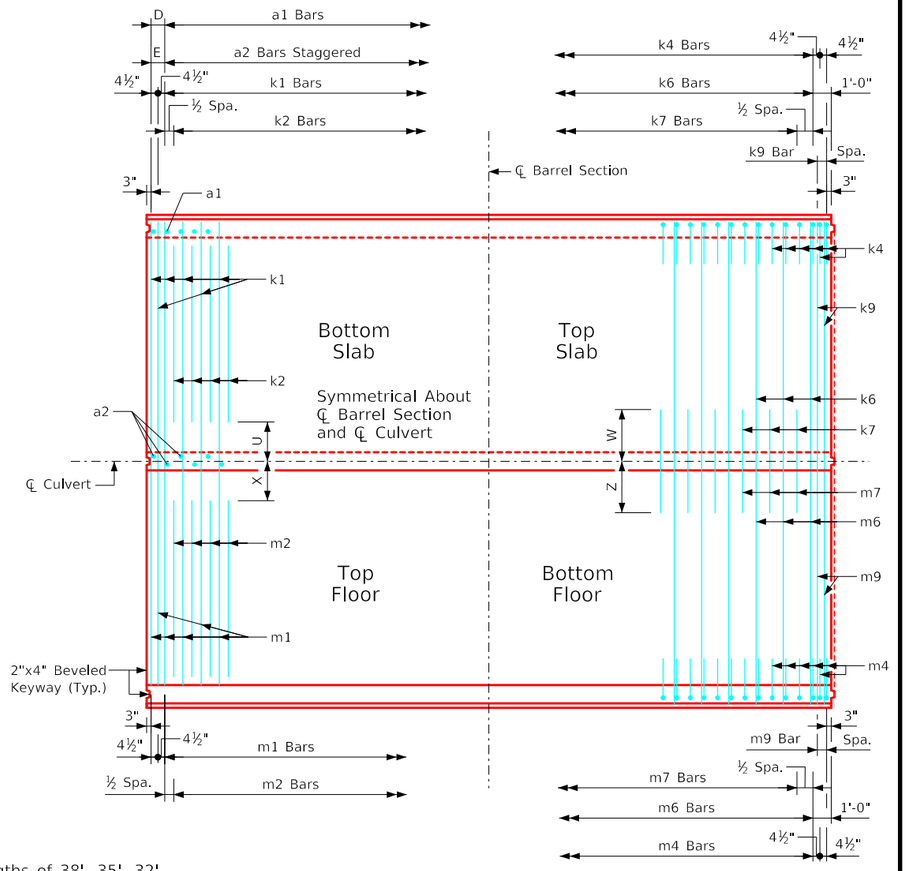
Note:
All longitudinal barrel steel shall extend at least to the backface of parapet.



End Section Plan Views

(Keyways not shown)

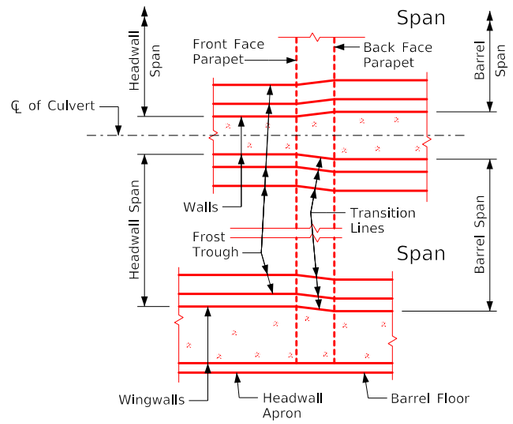
Note:
End section details shown are for a 15° skew barrel. Use for skews of 30° & 45° by increasing the number of transverse reinforcing bars required to be cut and relocated.



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.

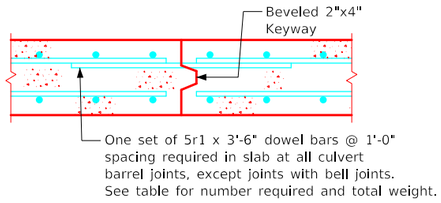
Standard Section Plan View

(Keyway is to be omitted when bell joints are used)



Transition Wall Details

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



Top Slab Construction Joint Detail

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

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Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Typical Culvert Barrel Details

TWRCB G3-20

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Variable Dimensions and Quantities for Twin 8' x 4' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	4	13	10	9	9	9	0'-0	5'-2	2'-3	5'-7
1	8	4	11	10	9	9	9	0'-1	5'-5	1'-11	4'-0
2	8	4	8	10	9	9	9	1'-0	4'-7	2'-4	3'-8
3	8	4	8	10	9	9	9	1'-1	3'-7	1'-8	3'-1
4	8	4	8	10	9	9	9	1'-5	3'-2	1'-9	2'-11
5-7	8	4	8	10	9	9	9	1'-8	3'-1	1'-10	3'-1
8-10	8	4	8	10	9	9	9	2'-1	2'-11	2'-6	3'-1
11-13	8	4	8.5	10.5	9	9	9	2'-1	3'-0	2'-1	2'-10
14-16	8	4	9.5	12	9	9	9	1'-10	3'-0	1'-10	2'-11
17-19	8	4	10.5	12	9	9	9	1'-8	3'-0	1'-6	3'-0
20-22	8	4	12	13.5	9	9	9	1'-5	3'-0	1'-3	3'-1
23-25	8	4	13	15	9	9	9	1'-1	3'-1	1'-2	3'-2

Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	5	12	5'-10	6	9	5'-10	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
1	4	9	5'-8	6	9	5'-8	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
2	5	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
3	4	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
4	4	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
5-7	4	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
8-10	4	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
11-13	4	9	5'-6	6	9	5'-6	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
14-16	4	12	5'-8	6	9	5'-8	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
17-19	4	12	5'-9	6	9	5'-9	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
20-22	4	12	6'-0	6	9	6'-0	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14
23-25	4	9	6'-3	6	9	6'-3	4	6	16	4	6	9	4	12	14	4	18	14	4	12	18	4	18	14

	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	12	17'-11	4	12	8'-11	4	6	6'-4	3'-2	3'-2	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	4	12	17'-11	4	12	8'-10	4	6	6'-0	3'-0	3'-0	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	6	18	17'-11	5	18	7'-4	4	6	5'-6	2'-9	2'-9	5	18	17'-11	6	18	9'-2	6	4.5	17'-11
3	4	12	17'-11	4	12	7'-3	4	6	5'-6	2'-9	2'-9	4	12	17'-11	4	12	7'-2	4	4.5	17'-11
4	4	12	17'-11	4	12	6'-7	4	6	5'-6	2'-9	2'-9	4	12	17'-11	4	12	6'-4	4	4.5	17'-11
5-7	4	12	17'-11	4	12	6'-1	4	6	5'-6	2'-9	2'-9	4	12	17'-11	5	12	6'-2	5	4.5	17'-11
8-10	6	18	17'-11	5	18	5'-5	4	6	5'-0	2'-3	2'-9	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	5	12	17'-11	4	12	5'-6	4	6	4'-11	2'-2	2'-9	4	12	17'-11	6	12	6'-0	6	4.5	17'-11
14-16	5	12	17'-11	4	12	6'-3	4	6	4'-11	2'-1	2'-10	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	5	12	17'-11	4	12	6'-7	4	6	4'-10	1'-11	2'-11	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
20-22	5	12	17'-11	4	12	7'-4	4	6	4'-11	1'-11	3'-0	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
23-25	4	9	17'-11	4	9	7'-10	5	12	5'-7	2'-1	3'-6	5	12	17'-11	6	12	6'-2	6	4.5	17'-11

Bar List

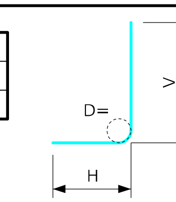
	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	18'-5	4	12	5'-2	4	6	9'-3	5'-0	4'-3	4	18	18'-5	6	18	11'-2	6	4.5	18'-5
1	6	18	18'-5	5	18	5'-9	4	6	8'-6	4'-3	4'-3	4	12	18'-5	4	12	8'-0	4	4.5	18'-5
2	5	12	18'-5	4	12	5'-2	4	6	6'-9	2'-6	4'-3	5	18	18'-5	5	18	7'-4	5	4.5	18'-5
3	4	12	18'-5	4	12	6'-5	4	6	6'-8	2'-5	4'-3	4	12	18'-5	4	12	6'-2	4	4.5	18'-5
4	4	12	18'-5	4	12	6'-3	4	6	6'-7	2'-4	4'-3	4	12	18'-5	4	12	5'-10	4	4.5	18'-5
5-7	4	12	18'-5	4	12	6'-2	4	6	6'-7	2'-4	4'-3	5	18	18'-5	6	18	6'-2	6	4.5	18'-5
8-10	5	12	18'-5	4	12	4'-8	4	6	6'-6	2'-3	4'-3	5	18	18'-5	7	18	6'-2	7	4.5	18'-5
11-13	5	12	18'-5	4	12	5'-8	4	6	6'-6	2'-2	4'-4	4	9	18'-5	5	9	5'-8	5	4.5	18'-5
14-16	5	12	18'-5	4	12	6'-4	4	6	6'-5	2'-0	4'-5	4	9	18'-5	5	9	5'-10	5	4.5	18'-5
17-19	4	9	18'-5	4	9	6'-11	4	6	6'-5	2'-0	4'-5	5	12	18'-5	6	12	6'-0	6	4.5	18'-5
20-22	4	9	18'-5	4	9	7'-8	4	6	6'-7	2'-0	4'-7	5	12	18'-5	6	12	6'-2	6	4.5	18'-5
23-25	4	9	18'-5	4	9	7'-10	5	12	6'-9	2'-1	4'-8	5	12	18'-5	6	12	6'-4	6	4.5	18'-5

Quantities

	Concrete (CY/FT)				Steel
Fill	Slab	Floor	Walls	Total	(LB/FT)
0	0.789	0.638	0.299	1.726	215.29
1	0.676	0.638	0.299	1.613	205.16
2	0.507	0.638	0.299	1.444	212.71
3	0.507	0.638	0.299	1.444	185.66
4	0.507	0.638	0.299	1.444	183.63
5-7	0.507	0.638	0.299	1.444	190.16
8-10	0.507	0.638	0.299	1.444	210.53
11-13	0.536	0.667	0.299	1.502	211.58
14-16	0.592	0.753	0.299	1.644	218.11
17-19	0.648	0.753	0.299	1.700	223.24
20-22	0.733	0.840	0.299	1.872	227.24
23-25	0.789	0.927	0.299	2.015	228.53

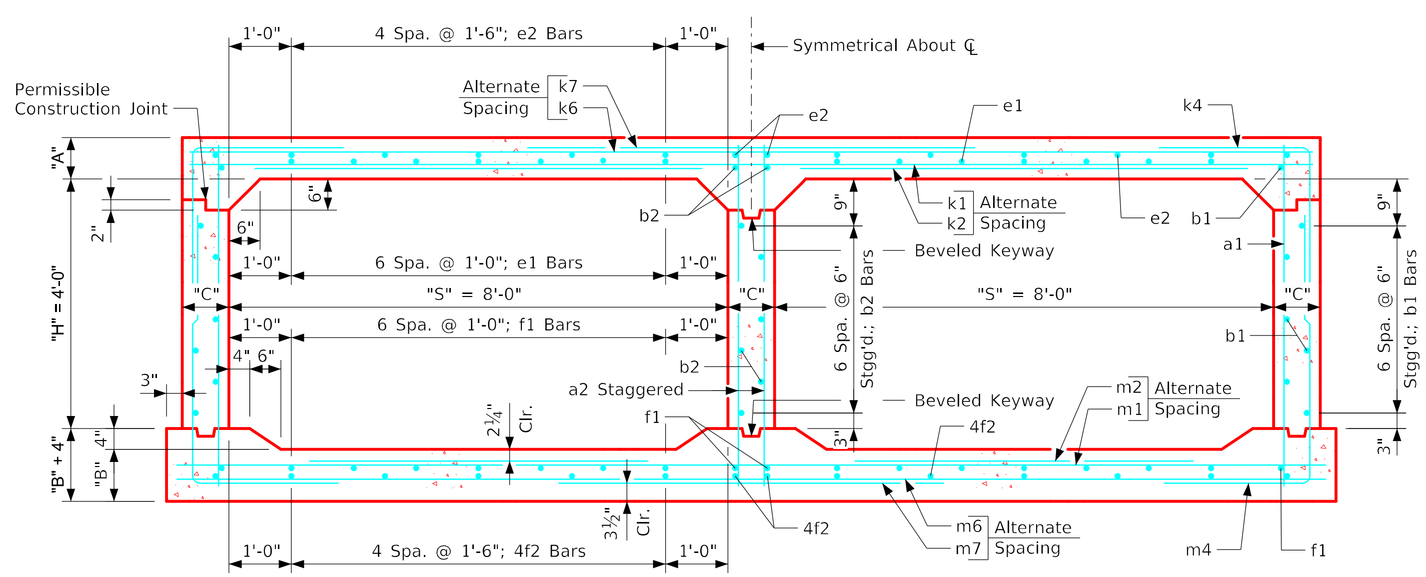
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 8' x 4' Barrel Section

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.

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Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
8' x 4' Barrel Sections

TWRCB 8-4-20

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Variable Dimensions and Quantities for Twin 8' x 5' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	5	13	10	9	9	9	0'-0	5'-2	2'-2	5'-7
1	8	5	11	10	9	9	9	0'-0	5'-5	2'-3	4'-7
2	8	5	8	10	9	9	9	1'-3	4'-10	2'-0	3'-11
3	8	5	8	10	9	9	9	1'-1	3'-8	1'-8	3'-2
4	8	5	8	10	9	9	9	1'-4	3'-3	1'-8	3'-0
5-7	8	5	8	10	9	9	9	1'-8	3'-2	1'-9	3'-1
8-10	8	5	8	10	9	9	9	2'-0	2'-11	2'-5	3'-2
11-13	8	5	8.5	11	9	9	9	2'-1	2'-10	2'-0	2'-11
14-16	8	5	9.5	12	9	9	9	1'-10	3'-0	1'-11	3'-3
17-19	8	5	10.5	12.5	9	9	9	1'-8	3'-0	1'-7	3'-3
20-22	8	5	12	14	9	9	9	1'-6	3'-0	1'-4	3'-3
23-25	8	5	13	15	9	9	9	1'-1	3'-1	1'-2	3'-2

Bar List

Fill	a1			a2			b1			b2			e1			e2			f1			f2		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	5	12	6'-10	6	9	6'-10	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
1	4	9	6'-8	6	9	6'-8	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
2	4	9	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
3	4	12	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
4	4	9	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
5-7	4	9	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
8-10	4	12	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
11-13	4	12	6'-6	6	9	6'-6	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
14-16	4	12	6'-8	6	9	6'-8	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
17-19	4	12	6'-10	6	9	6'-10	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
20-22	4	12	7'-1	6	9	7'-1	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14
23-25	4	12	7'-3	6	9	7'-3	4	6	20	4	6	11	4	12	14	4	18	14	4	12	18	4	18	14

Fill	k1			k2			k4					k6			k7			k9		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	12	17'-11	4	12	8'-11	4	6	8'-7	5'-5	3'-2	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	4	12	17'-11	4	12	8'-11	4	6	8'-2	5'-2	3'-0	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	5	12	17'-11	4	12	6'-10	4	6	5'-6	2'-9	2'-9	5	18	17'-11	6	18	9'-8	6	4.5	17'-11
3	4	12	17'-11	4	12	7'-4	4	6	5'-6	2'-9	2'-9	4	12	17'-11	4	12	7'-4	4	4.5	17'-11
4	4	12	17'-11	4	12	6'-8	5	12	5'-8	2'-7	3'-1	4	12	17'-11	4	12	6'-6	4	4.5	17'-11
5-7	4	12	17'-11	4	12	6'-3	5	12	5'-7	2'-6	3'-1	4	12	17'-11	5	12	6'-4	5	4.5	17'-11
8-10	6	18	17'-11	5	18	5'-7	4	6	5'-6	2'-9	2'-9	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	5	12	17'-11	4	12	5'-7	4	6	5'-0	2'-3	2'-9	4	9	17'-11	5	9	5'-8	5	4.5	17'-11
14-16	5	12	17'-11	4	12	6'-3	4	6	5'-0	2'-2	2'-10	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	5	12	17'-11	4	12	6'-7	4	6	5'-0	2'-1	2'-11	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
20-22	5	12	17'-11	4	12	7'-3	4	6	5'-2	2'-1	3'-1	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
23-25	4	9	17'-11	4	9	7'-10	4	6	5'-4	2'-2	3'-2	5	12	17'-11	6	12	6'-2	6	4.5	17'-11

Bar List

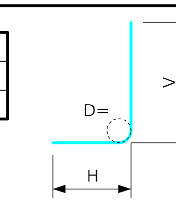
Fill	m1			m2			m4					m6			m7			m9		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	18'-5	4	12	5'-6	4	6	10'-6	5'-3	5'-3	5	18	18'-5	6	18	11'-2	6	4.5	18'-5
1	5	12	18'-5	4	12	5'-4	4	6	10'-6	5'-3	5'-3	5	18	18'-5	5	18	9'-2	5	4.5	18'-5
2	5	12	18'-5	4	12	5'-8	4	6	8'-1	2'-10	5'-3	4	18	18'-5	6	18	7'-10	6	4.5	18'-5
3	4	12	18'-5	4	12	6'-7	4	6	7'-9	2'-6	5'-3	4	12	18'-5	4	12	6'-4	4	4.5	18'-5
4	4	12	18'-5	4	12	6'-3	5	12	7'-10	2'-7	5'-3	4	12	18'-5	4	12	6'-0	4	4.5	18'-5
5-7	4	12	18'-5	4	12	6'-2	5	12	7'-9	2'-6	5'-3	5	18	18'-5	6	18	6'-2	6	4.5	18'-5
8-10	5	12	18'-5	4	12	4'-11	4	6	7'-7	2'-4	5'-3	5	18	18'-5	7	18	6'-4	7	4.5	18'-5
11-13	5	12	18'-5	4	12	5'-10	4	6	7'-6	2'-2	5'-4	4	9	18'-5	5	9	5'-10	5	4.5	18'-5
14-16	5	12	18'-5	4	12	6'-4	4	6	7'-7	2'-2	5'-5	5	18	18'-5	8	18	6'-6	8	4.5	18'-5
17-19	4	9	18'-5	4	9	6'-11	4	6	7'-7	2'-1	5'-6	5	18	18'-5	8	18	6'-6	8	4.5	18'-5
20-22	4	9	18'-5	4	9	7'-8	4	6	7'-9	2'-2	5'-7	5	18	18'-5	8	18	6'-6	8	4.5	18'-5
23-25	4	9	18'-5	4	9	7'-10	4	6	7'-10	2'-2	5'-8	5	12	18'-5	6	12	6'-4	6	4.5	18'-5

Quantities

Fill	Concrete (CY/FT) Slab	Floor	Walls	Total	Steel (LB/FT)
0	0.789	0.638	0.382	1.809	237.82
1	0.676	0.638	0.382	1.696	225.53
2	0.507	0.638	0.382	1.527	220.95
3	0.507	0.638	0.382	1.527	196.47
4	0.507	0.638	0.382	1.527	191.71
5-7	0.507	0.638	0.382	1.527	197.92
8-10	0.507	0.638	0.382	1.527	222.95
11-13	0.536	0.696	0.382	1.614	221.92
14-16	0.592	0.753	0.382	1.727	232.05
17-19	0.648	0.782	0.382	1.812	233.11
20-22	0.733	0.869	0.382	1.984	237.00
23-25	0.789	0.927	0.382	2.098	241.13

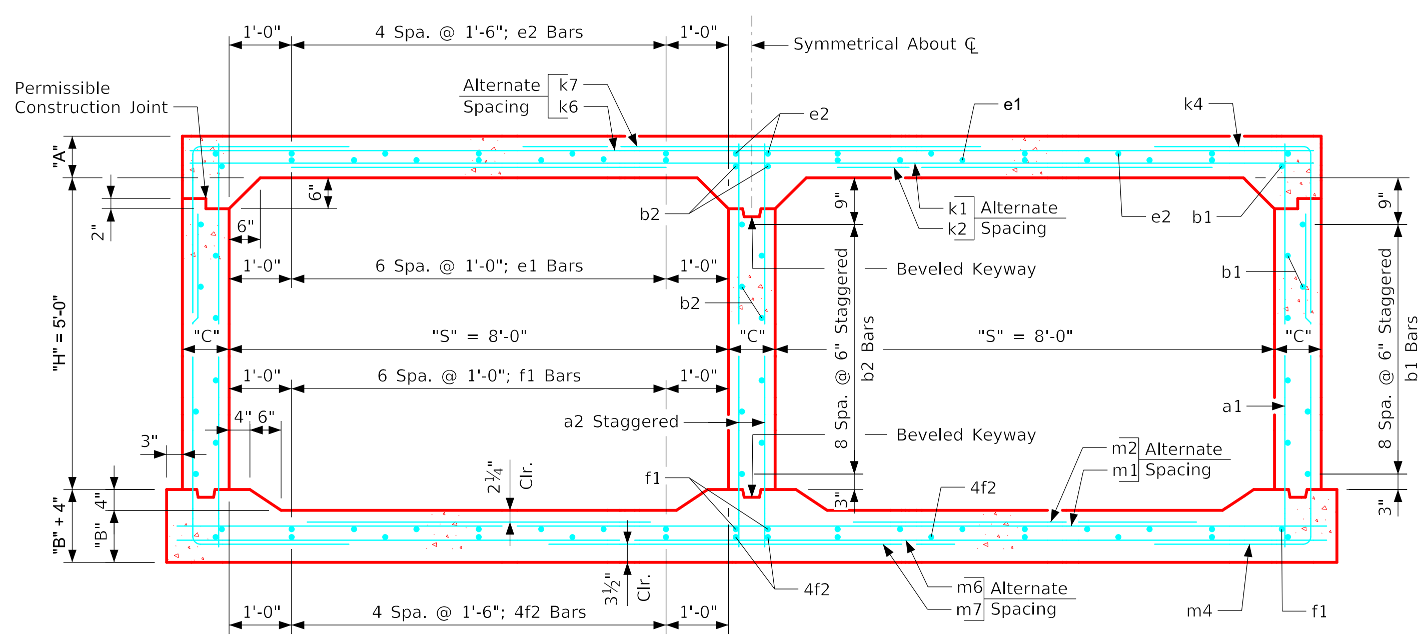
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 8' x 5' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
8' x 5' Barrel Sections

TWRCB 8-5-20

Variable Dimensions and Quantities for Twin 8' x 6' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	6	13	10.5	9	9	9	0'-0	5'-2	2'-0	5'-5
1	8	6	11	10	9	9	9	0'-0	5'-5	2'-2	5'-7
2	8	6	8	10	9	9	9	1'-2	5'-1	1'-11	4'-0
3	8	6	8	10	9	9	9	1'-7	3'-10	2'-3	3'-2
4	8	6	8	10	9	9	9	1'-4	3'-4	1'-8	3'-0
5-7	8	6	8	10	9	9	9	1'-8	3'-2	1'-9	3'-1
8-10	8	6	8	10	9	9	9	2'-0	2'-11	2'-5	2'-11
11-13	8	6	8.5	11	9	9	9	2'-1	2'-10	2'-2	2'-11
14-16	8	6	9.5	11.5	9	9	9	1'-9	3'-0	1'-7	3'-0
17-19	8	6	10.5	13	9	9	9	1'-10	2'-11	1'-8	3'-3
20-22	8	6	12	14.5	9	9	9	1'-5	3'-0	1'-7	3'-3
23-25	8	6	13	15	9	9	9	1'-1	3'-1	1'-3	3'-2

Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	9	7'-10	6	9	7'-10	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
1	4	9	7'-8	6	9	7'-8	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
2	4	9	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
3	4	12	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
4	4	9	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
5-7	4	12	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
8-10	4	12	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
11-13	4	12	7'-6	6	9	7'-6	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
14-16	4	9	7'-8	6	9	7'-8	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
17-19	4	12	7'-10	6	9	7'-10	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
20-22	4	12	8'-1	6	9	8'-1	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14
23-25	4	12	8'-3	6	9	8'-3	4	6	24	4	6	13	4	12	14	4	18	14	4	12	18	4	18	14

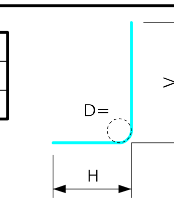
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	12	17'-11	4	12	8'-11	4	6	8'-6	5'-5	3'-1	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	5	18	17'-11	5	18	8'-11	4	6	8'-2	5'-2	3'-0	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	5	12	17'-11	4	12	7'-0	4	6	6'-2	3'-1	3'-1	5	18	17'-11	6	18	10'-2	6	4.5	17'-11
3	6	18	17'-11	5	18	6'-3	4	6	5'-8	2'-10	2'-10	4	12	17'-11	4	12	7'-8	4	4.5	17'-11
4	4	12	17'-11	4	12	6'-10	5	12	6'-2	3'-1	3'-1	4	12	17'-11	4	12	6'-8	4	4.5	17'-11
5-7	4	12	17'-11	4	12	6'-4	4	6	5'-6	2'-9	2'-9	4	12	17'-11	5	12	6'-4	5	4.5	17'-11
8-10	6	18	17'-11	5	18	5'-9	4	6	5'-6	2'-9	2'-9	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	5	12	17'-11	4	12	5'-7	4	6	5'-6	2'-9	2'-9	4	9	17'-11	5	9	5'-8	5	4.5	17'-11
14-16	5	12	17'-11	4	12	6'-4	4	6	5'-2	2'-4	2'-10	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	5	12	17'-11	4	12	6'-5	4	6	5'-2	2'-3	2'-11	5	12	17'-11	6	12	5'-10	6	4.5	17'-11
20-22	6	18	17'-11	5	18	7'-5	4	6	5'-4	2'-4	3'-0	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
23-25	4	9	17'-11	4	9	7'-10	4	6	5'-6	2'-4	3'-2	5	12	17'-11	6	12	6'-2	6	4.5	17'-11

Bar List / Quantities

	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
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	(LB/FT)
0	5	12	18'-5	4	12	5'-9	4	6	11'-6	5'-2	6'-4	5	18	18'-5	5	18	10'-10	5	4.5	18'-5	0.789	0.667	0.465	1.921	241.66
1	5	12	18'-5	4	12	5'-6	4	6	11'-3	5'-0	6'-3	4	18	18'-5	6	18	11'-2	6	4.5	18'-5	0.676	0.638	0.465	1.779	238.26
2	5	12	18'-5	4	12	5'-10	4	6	9'-7	3'-4	6'-3	5	18	18'-5	6	18	8'-0	6	4.5	18'-5	0.507	0.638	0.465	1.610	240.13
3	6	18	18'-5	5	18	5'-4	4	6	9'-0	2'-9	6'-3	4	12	18'-5	4	12	6'-4	4	4.5	18'-5	0.507	0.638	0.465	1.610	220.95
4	4	12	18'-5	4	12	6'-4	5	12	9'-0	2'-9	6'-3	4	12	18'-5	4	12	6'-0	4	4.5	18'-5	0.507	0.638	0.465	1.610	203.63
5-7	4	12	18'-5	4	12	6'-3	4	6	8'-10	2'-7	6'-3	5	18	18'-5	6	18	6'-2	6	4.5	18'-5	0.507	0.638	0.465	1.610	211.55
8-10	5	12	18'-5	4	12	5'-0	4	6	8'-8	2'-5	6'-3	5	12	18'-5	5	12	5'-10	5	4.5	18'-5	0.507	0.638	0.465	1.610	235.26
11-13	5	12	18'-5	4	12	5'-8	4	6	8'-8	2'-4	6'-4	4	9	18'-5	5	9	5'-10	5	4.5	18'-5	0.536	0.696	0.465	1.697	233.61
14-16	5	12	18'-5	5	12	6'-9	4	6	8'-9	2'-4	6'-5	5	12	18'-5	6	12	6'-0	6	4.5	18'-5	0.592	0.725	0.465	1.782	253.05
17-19	5	12	18'-5	4	12	6'-9	4	6	8'-9	2'-3	6'-6	5	18	18'-5	8	18	6'-6	8	4.5	18'-5	0.648	0.811	0.465	1.924	244.11
20-22	5	12	18'-5	4	12	7'-4	4	6	9'-0	2'-4	6'-8	5	18	18'-5	8	18	6'-6	8	4.5	18'-5	0.733	0.898	0.465	2.096	249.05
23-25	6	18	18'-5	6	18	7'-9	4	6	9'-1	2'-5	6'-8	5	12	18'-5	6	12	6'-4	6	4.5	18'-5	0.789	0.927	0.465	2.181	257.76

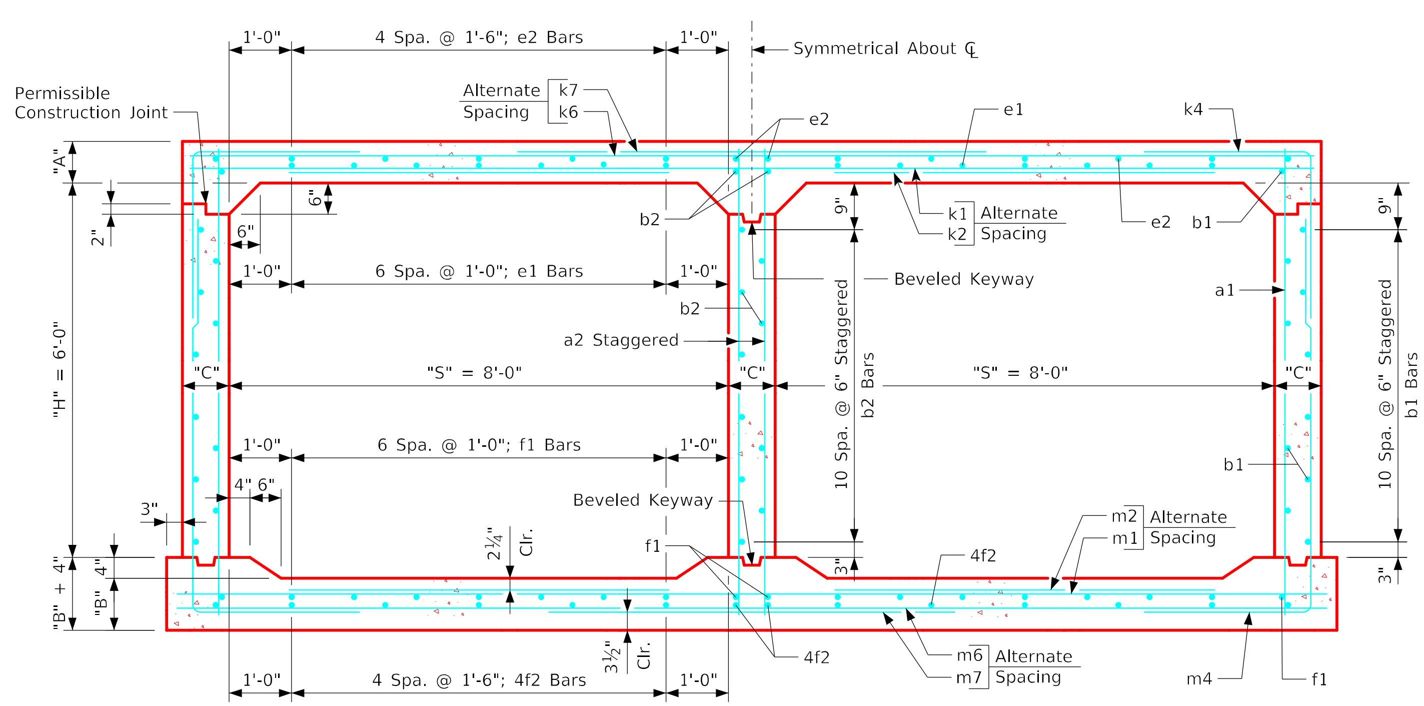
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 8' x 6' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
8' x 6' Barrel Sections

TWRCB 8-6-20

Variable Dimensions and Quantities for Twin 8' x 7' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	7	13	10.5	9	9	9	0'-0	5'-2	1'-11	5'-7
1	8	7	11	10	9	9	9	0'-0	5'-5	1'-11	5'-7
2	8	7	8	10	9	9	9	0'-10	5'-7	1'-11	4'-1
3	8	7	8	10	9	9	9	1'-7	3'-11	2'-6	3'-4
4	8	7	8	10	9	9	9	1'-6	3'-4	1'-8	3'-1
5-7	8	7	8	10	9	9	9	1'-8	3'-2	2'-7	3'-2
8-10	8	7	8	10	9	9	9	1'-11	2'-11	2'-4	3'-0
11-13	8	7	8.5	11	9	9	9	2'-0	2'-10	2'-1	2'-11
14-16	8	7	9.5	12	9	9	9	1'-9	3'-0	1'-7	3'-3
17-19	8	7	10.5	13	9	9	9	1'-10	2'-11	1'-8	3'-3
20-22	8	7	12	14.5	9	9	9	1'-4	3'-0	1'-6	3'-3
23-25	8	7	13	15.5	9	9	9	1'-0	3'-1	1'-2	3'-3

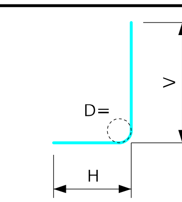
Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	9	8'-10	6	9	8'-10	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
1	4	9	8'-8	6	9	8'-8	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
2	4	9	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
3	4	12	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
4	4	12	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
5-7	4	12	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
8-10	4	9	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
11-13	4	9	8'-6	6	9	8'-6	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
14-16	4	9	8'-8	6	9	8'-8	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
17-19	4	9	8'-10	6	9	8'-10	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
20-22	4	9	9'-1	6	9	9'-1	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14
23-25	4	9	9'-3	6	9	9'-3	4	6	28	4	6	15	4	12	14	4	18	14	4	12	18	4	18	14

	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	18	17'-11	5	18	8'-11	4	6	8'-6	5'-5	3'-1	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	5	18	17'-11	5	18	8'-11	4	6	8'-2	5'-2	3'-0	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	4	9	17'-11	4	9	7'-8	4	6	6'-7	3'-10	2'-9	5	18	17'-11	6	18	11'-2	6	4.5	17'-11
3	6	18	17'-11	5	18	6'-4	4	6	6'-0	3'-3	2'-9	4	12	17'-11	4	12	7'-10	4	4.5	17'-11
4	4	12	17'-11	4	12	6'-8	4	6	6'-2	3'-1	3'-1	4	12	17'-11	4	12	6'-8	4	4.5	17'-11
5-7	4	12	17'-11	4	12	6'-6	4	6	5'-10	2'-11	2'-11	4	12	17'-11	5	12	6'-4	5	4.5	17'-11
8-10	6	18	17'-11	5	18	5'-9	4	6	5'-6	2'-9	2'-9	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	5	12	17'-11	4	12	5'-9	4	6	5'-6	2'-9	2'-9	4	9	17'-11	5	9	5'-8	5	4.5	17'-11
14-16	5	12	17'-11	4	12	6'-4	4	6	5'-8	2'-10	2'-10	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	5	12	17'-11	4	12	6'-5	4	6	5'-4	2'-5	2'-11	5	12	17'-11	6	12	5'-10	6	4.5	17'-11
20-22	6	18	17'-11	5	18	7'-6	4	6	5'-6	2'-6	3'-0	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
23-25	4	9	17'-11	4	9	7'-11	4	6	5'-8	2'-7	3'-1	5	12	17'-11	6	12	6'-2	6	4.5	17'-11

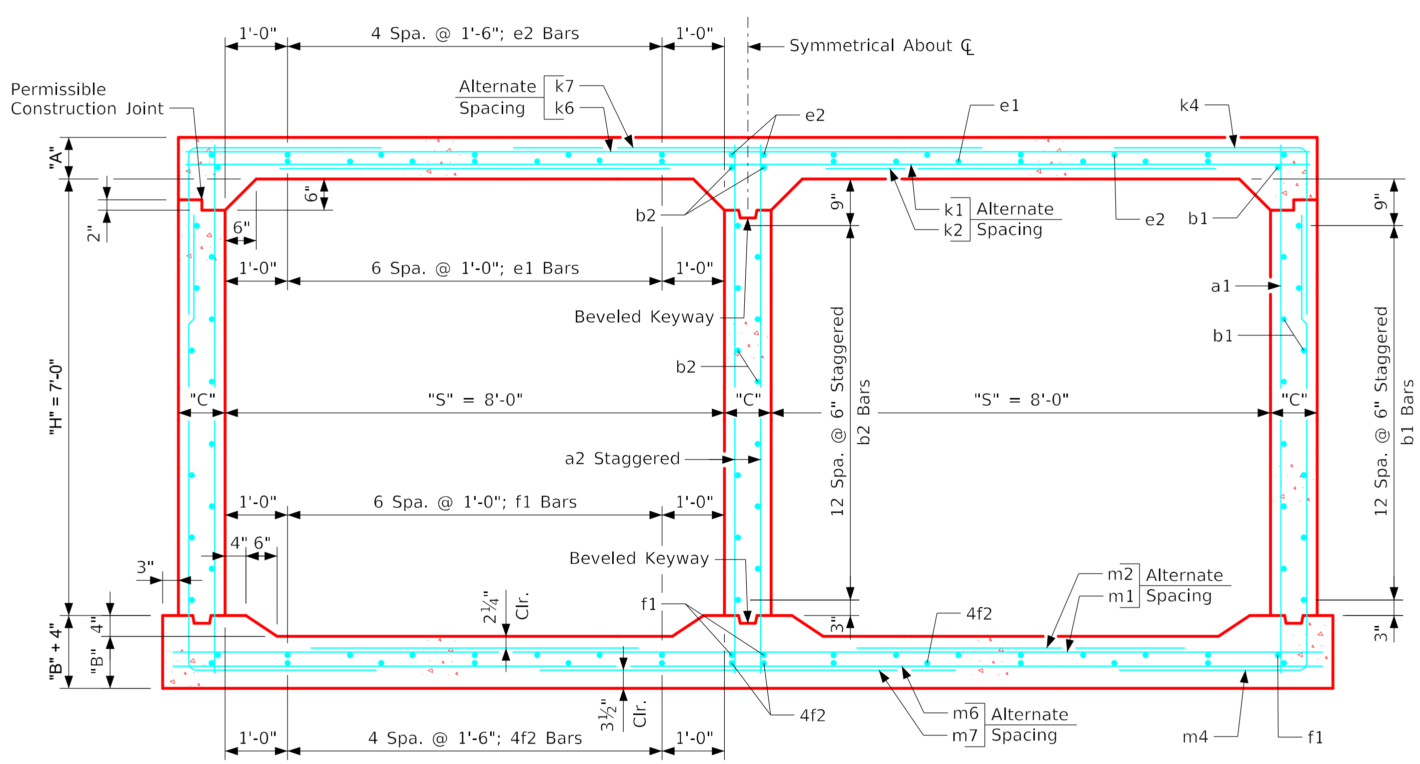
	Bar List																					Quantities				
	m1			m2			m4					m6			m7			m9				Concrete (CY/FT)				Steel
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L		Slab	Floor	Walls	Total	(LB/FT)
0	5	12	18'-5	4	12	5'-10	4	6	12'-4	5'-0	7'-4	4	18	18'-5	6	18	11'-2	6	4.5	18'-5		0.789	0.667	0.549	2.005	253.45
1	5	12	18'-5	4	12	5'-10	4	6	12'-3	5'-0	7'-3	5	18	18'-5	6	18	11'-2	6	4.5	18'-5		0.676	0.638	0.549	1.863	253.74
2	5	12	18'-5	4	12	5'-10	4	6	11'-2	3'-11	7'-3	5	18	18'-5	6	18	8'-2	6	4.5	18'-5		0.507	0.638	0.549	1.694	255.08
3	5	12	18'-5	4	12	4'-10	4	6	10'-5	3'-2	7'-3	5	18	18'-5	5	18	6'-8	5	4.5	18'-5		0.507	0.638	0.549	1.694	233.79
4	4	12	18'-5	4	12	6'-5	4	6	10'-3	3'-0	7'-3	5	18	18'-5	5	18	6'-2	5	4.5	18'-5		0.507	0.638	0.549	1.694	219.74
5-7	5	12	18'-5	4	12	4'-6	4	6	10'-1	2'-10	7'-3	5	18	18'-5	6	18	6'-4	6	4.5	18'-5		0.507	0.638	0.549	1.694	228.82
8-10	5	12	18'-5	4	12	5'-2	4	6	9'-11	2'-8	7'-3	4	12	18'-5	6	12	6'-0	6	4.5	18'-5		0.507	0.638	0.549	1.694	246.68
11-13	5	12	18'-5	4	12	5'-10	4	6	9'-11	2'-7	7'-4	4	9	18'-5	5	9	5'-10	5	4.5	18'-5		0.536	0.696	0.549	1.781	248.32
14-16	4	9	18'-5	4	9	6'-10	4	6	10'-0	2'-7	7'-5	5	18	18'-5	8	18	6'-6	8	4.5	18'-5		0.592	0.753	0.549	1.894	258.84
17-19	5	12	18'-5	4	12	6'-9	4	6	10'-0	2'-6	7'-6	5	18	18'-5	8	18	6'-6	8	4.5	18'-5		0.648	0.811	0.549	2.008	259.05
20-22	5	12	18'-5	4	12	7'-5	4	6	10'-3	2'-7	7'-8	5	18	18'-5	8	18	6'-6	8	4.5	18'-5		0.733	0.898	0.549	2.180	264.29
23-25	4	9	18'-5	4	9	7'-10	4	6	10'-5	2'-8	7'-9	5	18	18'-5	8	18	6'-6	8	4.5	18'-5		0.789	0.956	0.549	2.294	265.97

Bent Bar Detail



k4 & m4

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



Twin 8' x 7' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
8' x 7' Barrel Sections

TWRCB 8-7-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 8-7-20 - THIS SHEET ISSUED 07-2020.

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

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	8	13	10.5	9	9	9	0'-0	5'-2	1'-11	5'-7
1	8	8	11.5	10.5	9	9	9	0'-0	5'-5	1'-11	5'-5
2	8	8	8	10	9	9	9	1'-0	5'-7	1'-7	4'-2
3	8	8	8	10	9	9	9	1'-6	4'-0	2'-5	3'-6
4	8	8	8	10	9	9	9	1'-6	3'-5	2'-6	3'-3
5-7	8	8	8	10	9	9	9	1'-7	3'-3	2'-6	3'-0
8-10	8	8	8	10	9	9	9	2'-1	2'-11	2'-4	3'-0
11-13	8	8	8.5	11	9	9	9	2'-0	2'-10	2'-1	2'-11
14-16	8	8	9.5	12	9	6	9	1'-9	3'-0	1'-7	3'-3
17-19	8	8	10.5	12.5	9	6	9	1'-10	2'-11	1'-6	3'-0
20-22	8	8	12	14.5	9	6	9	1'-4	3'-0	1'-6	3'-3
23-25	8	8	13.5	15.5	9.5	6	6	1'-2	3'-2	1'-1	3'-3

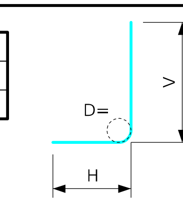
Fill	Bar List																					
	a1			a2			b1			b2			e1			e2			f1			
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	NO.	Size	Sp.	NO.	Size	Sp.	NO.	Size	Sp.	NO.	Size	Sp.	NO.	
0	5	12	9'-10	6	9	9'-10	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
1	4	9	9'-9	6	9	9'-9	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
2	5	12	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
3	4	12	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
4	4	12	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
5-7	4	12	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
8-10	4	9	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
11-13	5	12	9'-6	6	9	9'-6	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
14-16	4	6	9'-8	6	9	9'-8	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
17-19	4	6	9'-10	6	9	9'-10	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
20-22	4	6	10'-1	6	9	10'-1	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	
23-25	4	6	10'-4	5	6	10'-4	4	6	32	4	6	17	4	12	14	4	18	14	4	12	18	

Fill	Bar List																						
	f2			k1			k2			k4					k6			k7			k9		
	Size	Sp.	NO.	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	18	14	5	18	17'-11	5	18	8'-11	4	6	8'-6	5'-5	3'-1	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	4	18	14	4	12	17'-11	4	12	8'-11	4	6	8'-2	5'-2	3'-0	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	4	18	14	4	9	17'-11	4	9	7'-7	4	6	7'-9	5'-0	2'-9	5	18	17'-11	6	18	11'-2	6	4.5	17'-11
3	4	18	14	6	18	17'-11	5	18	6'-6	4	6	6'-6	3'-9	2'-9	4	12	17'-11	4	12	8'-0	4	4.5	17'-11
4	4	18	14	4	12	17'-11	4	12	6'-9	4	6	6'-2	3'-5	2'-9	4	12	17'-11	4	12	6'-10	4	4.5	17'-11
5-7	4	18	14	4	12	17'-11	4	12	6'-7	4	6	6'-0	3'-3	2'-9	4	12	17'-11	5	12	6'-6	5	4.5	17'-11
8-10	4	18	14	6	18	17'-11	5	18	5'-7	4	6	5'-10	2'-11	2'-11	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	4	18	14	5	12	17'-11	4	12	5'-9	4	6	5'-8	2'-10	2'-10	4	9	17'-11	5	9	5'-8	5	4.5	17'-11
14-16	4	18	14	5	12	17'-11	4	12	6'-4	4	6	5'-8	2'-10	2'-10	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	4	18	14	5	12	17'-11	4	12	6'-5	4	6	5'-10	2'-11	2'-11	5	12	17'-11	6	12	5'-10	6	4.5	17'-11
20-22	4	18	14	6	18	17'-11	5	18	7'-4	4	6	6'-0	3'-0	3'-0	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
23-25	4	18	14	6	18	18'-0	5	18	7'-10	6	12	6'-10	2'-11	3'-11	5	18	18'-0	8	18	6'-4	8	4.5	18'-0

Fill	Bar List																			Quantities				
	m1			m2			m4					m6			m7			m9		Concrete (CY/FT)				Steel
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	12	18'-5	4	12	6'-2	4	6	13'-4	5'-0	8'-4	5	18	18'-5	6	18	11'-2	6	4.5	18'-5	0.789	0.667	0.632	2.088	272.29
1	5	12	18'-5	4	12	5'-10	4	6	13'-6	5'-2	8'-4	5	18	18'-5	5	18	10'-10	5	4.5	18'-5	0.705	0.667	0.632	2.004	259.05
2	4	9	18'-5	4	9	6'-8	4	6	12'-11	4'-8	8'-3	5	18	18'-5	6	18	8'-4	6	4.5	18'-5	0.507	0.638	0.632	1.777	274.32
3	5	12	18'-5	4	12	5'-3	4	6	11'-9	3'-6	8'-3	4	18	18'-5	6	18	7'-0	6	4.5	18'-5	0.507	0.638	0.632	1.777	245.58
4	5	12	18'-5	4	12	4'-9	4	6	11'-7	3'-4	8'-3	4	18	18'-5	6	18	6'-6	6	4.5	18'-5	0.507	0.638	0.632	1.777	234.74
5-7	5	12	18'-5	4	12	4'-9	4	6	11'-5	3'-2	8'-3	4	12	18'-5	5	12	6'-0	5	4.5	18'-5	0.507	0.638	0.632	1.777	239.16
8-10	5	12	18'-5	4	12	5'-2	4	6	11'-2	2'-11	8'-3	4	12	18'-5	6	12	6'-0	6	4.5	18'-5	0.507	0.638	0.632	1.777	258.55
11-13	5	12	18'-5	4	12	6'-0	4	6	11'-3	2'-11	8'-4	4	9	18'-5	5	9	5'-10	5	4.5	18'-5	0.536	0.696	0.632	1.864	263.68
14-16	4	9	18'-5	4	9	6'-10	4	6	11'-4	2'-11	8'-5	5	18	18'-5	8	18	6'-6	8	4.5	18'-5	0.592	0.753	0.632	1.977	278.71
17-19	4	9	18'-5	4	9	7'-3	4	6	11'-3	2'-9	8'-6	5	12	18'-5	6	12	6'-0	6	4.5	18'-5	0.648	0.782	0.632	2.062	281.63
20-22	5	12	18'-5	4	12	7'-5	4	6	11'-7	2'-11	8'-8	5	18	18'-5	8	18	6'-6	8	4.5	18'-5	0.733	0.898	0.632	2.263	285.68
23-25	4	9	18'-6	4	9	8'-0	6	12	11'-9	3'-0	8'-9	5	18	18'-6	8	18	6'-6	8	4.5	18'-6	0.824	0.964	0.667	2.455	300.18

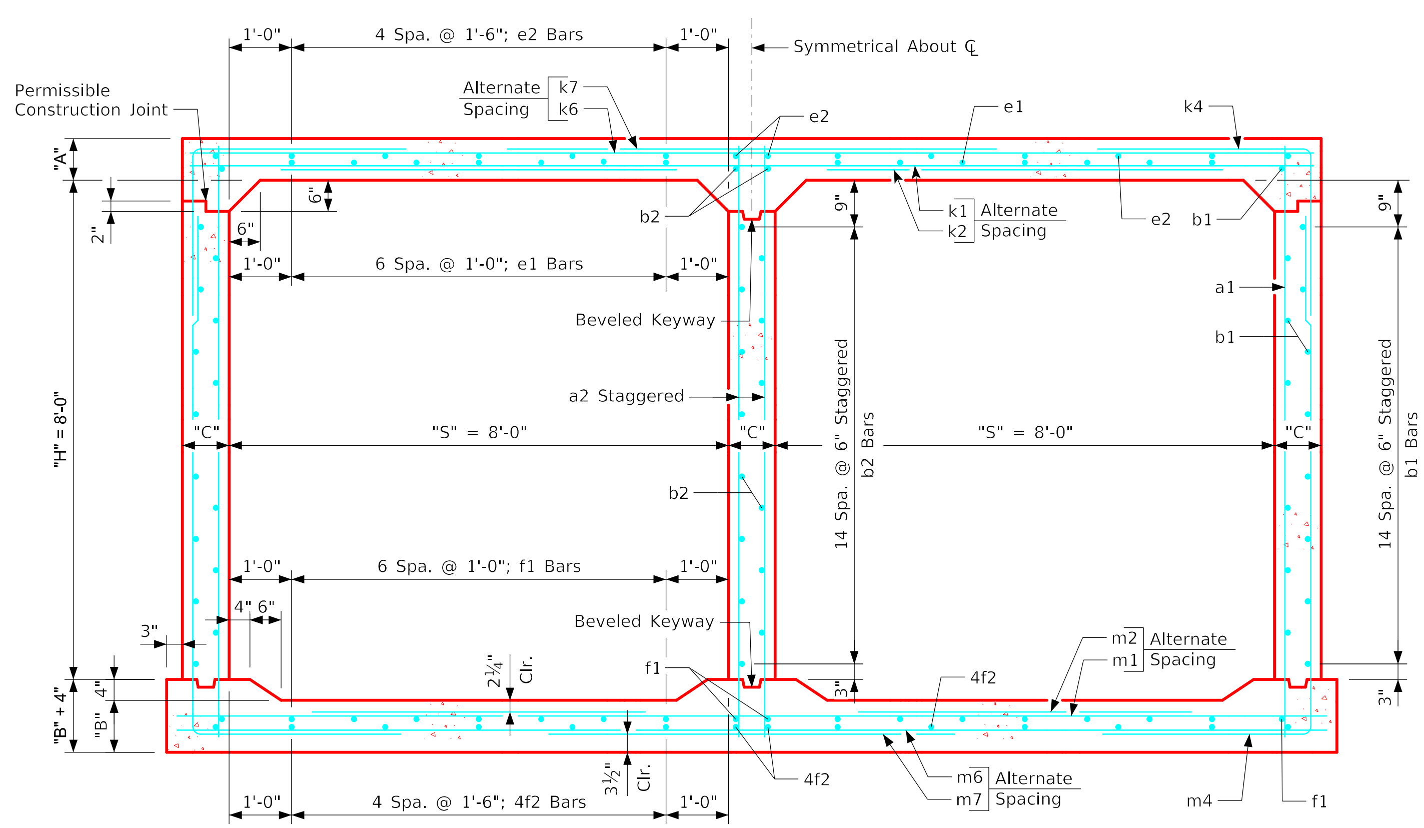
Bent Bar Detail

Bars	D
4	3"
6	4½"



k4 & m4

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



Twin 8' x 8' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel
Details
8' x 8' Barrel Sections

TWRCB
8-8-20

Variable Dimensions and Quantities for Twin 8' x 9' Barrel Sections

Dimensions

FILL	S	H	A	B	C	D	E	U	W	X	Z
0	8	9	13	11	9	9	9	0'-0	5'-2	1'-11	5'-7
1	8	9	11.5	10.5	9	9	9	0'-0	5'-5	1'-11	5'-7
2	8	9	8	10	9	9	9	0'-10	5'-7	1'-8	5'-7
3	8	9	8	10	9	9	9	1'-6	4'-5	2'-4	3'-6
4	8	9	8	10	9	9	9	1'-6	3'-6	2'-5	3'-3
5-7	8	9	8	10	9	9	9	1'-7	3'-3	2'-5	2'-11
8-10	8	9	8	10	9	9	9	2'-1	2'-11	2'-3	2'-11
11-13	8	9	8.5	11	9	9	9	2'-0	2'-10	2'-0	3'-3
14-16	8	9	9.5	12.5	9	9	9	1'-10	3'-0	1'-11	3'-0
17-19	8	9	10.5	12.5	9	9	9	1'-10	2'-11	1'-6	3'-0
20-22	8	9	12	14.5	10	9	9	1'-5	3'-2	1'-6	3'-2
23-25	8	9	13	15.5	11	9	9	1'-3	3'-2	1'-1	3'-3

Bar List

	a1			a2			b1			b2			e1			e2		
FILL	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	5	12	10'-11	6	9	10'-11	4	6	36	4	6	19	4	12	14	4	18	14
1	5	12	10'-9	6	9	10'-9	4	6	36	4	6	19	4	12	14	4	18	14
2	5	12	10'-5	6	9	10'-5	4	6	36	4	6	19	5	12	14	4	18	14
3	4	9	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	14	4	18	14
4	4	9	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	14	4	18	14
5-7	4	9	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	14	4	18	14
8-10	4	12	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	14	4	18	14
11-13	4	12	10'-6	6	9	10'-6	4	6	36	4	6	19	4	12	14	4	18	14
14-16	4	12	10'-9	6	9	10'-9	4	6	36	4	6	19	4	12	14	4	18	14
17-19	4	12	10'-10	6	9	10'-10	4	6	36	4	6	19	4	12	14	4	18	14
20-22	4	12	11'-1	7	9	11'-1	4	6	36	4	6	19	4	12	14	4	18	14
23-25	4	9	11'-3	7	9	11'-3	4	6	36	4	6	19	4	12	14	4	18	14

	f1			f2			k1			k2			k4				
FILL	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V
0	4	12	18	4	18	14	5	18	17'-11	5	18	8'-11	4	6	8'-7	5'-5	3'-2
1	4	12	18	4	18	14	5	18	17'-11	5	18	8'-11	4	6	8'-2	5'-2	3'-0
2	4	12	18	4	18	14	6	18	17'-11	6	18	7'-9	4	6	7'-9	5'-0	2'-9
3	4	12	18	4	18	14	6	18	17'-11	5	18	6'-7	4	6	7'-0	4'-3	2'-9
4	4	12	18	4	18	14	4	12	17'-11	4	12	6'-10	4	6	6'-8	3'-11	2'-9
5-7	4	12	18	4	18	14	4	12	17'-11	4	12	6'-8	4	6	6'-6	3'-9	2'-9
8-10	4	12	18	4	18	14	6	18	17'-11	5	18	5'-7	6	9	7'-0	3'-6	3'-6
11-13	4	12	18	4	18	14	5	12	17'-11	4	12	5'-9	5	6	6'-6	3'-3	3'-3
14-16	4	12	18	4	18	14	5	12	17'-11	4	12	6'-3	5	6	6'-4	3'-2	3'-2
17-19	4	12	18	4	18	14	5	12	17'-11	4	12	6'-5	5	6	6'-6	3'-3	3'-3
20-22	4	12	18	4	18	14	6	18	18'-2	5	18	7'-3	5	6	6'-10	3'-5	3'-5
23-25	4	12	18	4	18	14	5	12	18'-5	4	12	7'-7	6	9	7'-2	3'-3	3'-11

	k6			k7			k9		
FILL	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	12	17'-11	4	12	10'-4	4	4.5	17'-11
1	4	18	17'-11	5	18	10'-10	5	4.5	17'-11
2	5	18	17'-11	6	18	11'-2	6	4.5	17'-11
3	4	12	17'-11	4	12	8'-10	4	4.5	17'-11
4	4	12	17'-11	4	12	7'-0	4	4.5	17'-11
5-7	4	12	17'-11	5	12	6'-6	5	4.5	17'-11
8-10	5	12	17'-11	5	12	5'-10	5	4.5	17'-11
11-13	4	9	17'-11	5	9	5'-8	5	4.5	17'-11
14-16	5	12	17'-11	6	12	6'-0	6	4.5	17'-11
17-19	5	12	17'-11	6	12	5'-10	6	4.5	17'-11
20-22	5	18	18'-2	8	18	6'-4	8	4.5	18'-2
23-25	5	18	18'-5	8	18	6'-4	8	4.5	18'-5

Bar List

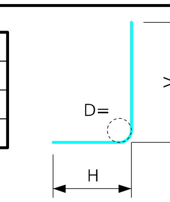
	m1			m2			m4					m6			m7			m9		
FILL	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	18'-5	4	12	6'-2	4	6	14'-4	5'-0	9'-4	4	18	18'-5	6	18	11'-2	6	4.5	18'-5
1	5	12	18'-5	4	12	6'-2	4	6	14'-4	5'-0	9'-4	4	18	18'-5	6	18	11'-2	6	4.5	18'-5
2	5	12	18'-5	5	12	6'-5	4	6	14'-3	5'-0	9'-3	5	18	18'-5	6	18	11'-2	6	4.5	18'-5
3	5	12	18'-5	4	12	5'-4	4	6	13'-3	4'-0	9'-3	5	18	18'-5	6	18	7'-0	6	4.5	18'-5
4	5	12	18'-5	4	12	4'-11	4	6	13'-0	3'-9	9'-3	5	18	18'-5	6	18	6'-6	6	4.5	18'-5
5-7	5	12	18'-5	4	12	4'-11	4	6	12'-10	3'-7	9'-3	4	9	18'-5	4	9	5'-10	4	4.5	18'-5
8-10	5	12	18'-5	4	12	5'-6	6	9	12'-9	3'-6	9'-3	4	9	18'-5	5	9	5'-10	5	4.5	18'-5
11-13	5	12	18'-5	4	12	6'-1	5	6	12'-7	3'-3	9'-4	5	18	18'-5	8	18	6'-6	8	4.5	18'-5
14-16	5	12	18'-5	4	12	6'-5	5	6	12'-10	3'-4	9'-6	4	9	18'-5	5	9	6'-0	5	4.5	18'-5
17-19	4	9	18'-5	4	9	7'-0	5	6	12'-7	3'-1	9'-6	5	12	18'-5	6	12	6'-0	6	4.5	18'-5
20-22	5	12	18'-8	4	12	7'-3	5	6	12'-11	3'-3	9'-8	4	9	18'-8	5	9	6'-4	5	4.5	18'-8
23-25	4	9	18'-11	4	9	8'-2	6	9	13'-1	3'-4	9'-9	5	18	18'-11	8	18	6'-6	8	4.5	18'-11

Quantities

	Concrete (CY/FT)				Steel
FILL	Slab	Floor	Walls	Total	(LB/FT)
0	0.789	0.696	0.715	2.200	279.16
1	0.705	0.667	0.715	2.087	274.87
2	0.507	0.638	0.715	1.860	304.74
3	0.507	0.638	0.715	1.860	268.03
4	0.507	0.638	0.715	1.860	256.63
5-7	0.507	0.638	0.715	1.860	258.61
8-10	0.507	0.638	0.715	1.860	301.26
11-13	0.536	0.696	0.715	1.947	301.89
14-16	0.592	0.782	0.715	2.089	305.82
17-19	0.648	0.782	0.715	2.145	310.21
20-22	0.746	0.912	0.795	2.453	320.50
23-25	0.817	0.984	0.876	2.677	331.55

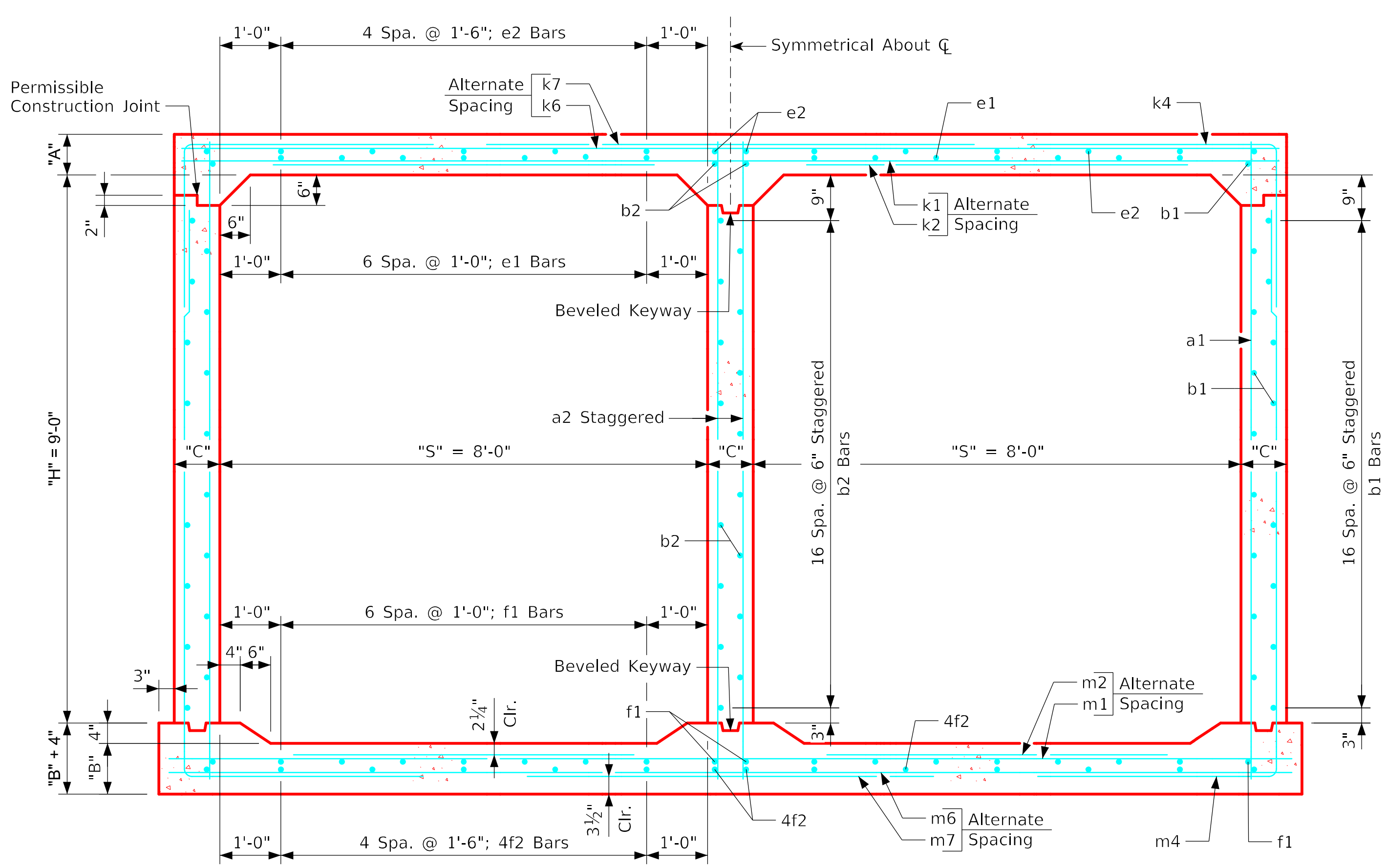
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 8' x 9' Barrel Section

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.

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 8-9-20 - THIS SHEET ISSUED 07-2020.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel
Details
8' x 9' Barrel Sections

TWRCB
8-9-20

Variable Dimensions and Quantities for Twin 8' x 10' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	8	10	13	11	10	6	9	0'-0	5'-3	1'-11	5'-8
1	8	10	11	10.5	10	6	9	0'-7	5'-5	1'-11	5'-8
2	8	10	8	10	10	6	9	1'-0	5'-8	1'-7	4'-1
3	8	10	8	10	10	9	9	1'-7	4'-3	2'-4	3'-5
4	8	10	8	10	10	9	9	1'-6	3'-5	2'-5	3'-3
5-7	8	10	8	10	10	9	9	1'-7	3'-4	2'-6	3'-0
8-10	8	10	8	10	10	9	9	2'-1	2'-11	2'-3	3'-0
11-13	8	10	8.5	11	10	9	9	2'-0	3'-0	2'-0	2'-11
14-16	8	10	9.5	12	10.5	9	9	1'-11	2'-10	1'-7	3'-3
17-19	8	10	10	13	10.5	9	9	1'-10	2'-11	1'-10	3'-3
20-22	8	10	12.5	14.5	11.5	9	9	1'-7	3'-0	1'-6	3'-2
23-25	8	10	13.5	15.5	12	9	9	1'-2	3'-1	1'-0	3'-3

Bar List	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	6	11'-11	7	9	11'-11	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
1	4	6	11'-8	7	9	11'-8	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
2	4	6	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
3	5	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
4	5	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
5-7	4	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
8-10	4	9	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
11-13	4	9	11'-6	7	9	11'-6	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
14-16	5	12	11'-8	7	9	11'-8	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
17-19	4	9	11'-10	7	9	11'-10	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
20-22	5	12	12'-2	7	9	12'-2	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14
23-25	5	12	12'-4	7	9	12'-4	4	6	40	4	6	21	4	12	14	4	18	14	4	12	18	4	18	14

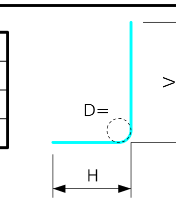
Bar List	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	12	18'-2	4	12	9'-1	4	6	8'-7	5'-5	3'-2	4	12	18'-2	4	12	10'-6	4	4.5	18'-2
1	6	18	18'-2	5	18	8'-6	4	6	8'-2	5'-3	2'-11	4	18	18'-2	5	18	10'-10	5	4.5	18'-2
2	4	9	18'-2	4	9	7'-7	4	6	7'-9	5'-0	2'-9	5	18	18'-2	6	18	11'-4	6	4.5	18'-2
3	6	18	18'-2	5	18	6'-6	4	6	7'-7	4'-10	2'-9	4	12	18'-2	4	12	8'-6	4	4.5	18'-2
4	4	12	18'-2	4	12	6'-10	4	6	7'-0	4'-3	2'-9	4	12	18'-2	4	12	6'-10	4	4.5	18'-2
5-7	4	12	18'-2	4	12	6'-5	6	9	7'-10	4'-4	3'-6	5	18	18'-2	6	18	6'-8	6	4.5	18'-2
8-10	6	18	18'-2	5	18	5'-6	6	9	7'-8	3'-10	3'-10	5	12	18'-2	5	12	5'-10	5	4.5	18'-2
11-13	5	12	18'-2	4	12	5'-9	5	6	7'-0	3'-6	3'-6	4	12	18'-2	6	12	6'-0	6	4.5	18'-2
14-16	5	12	18'-3	4	12	6'-0	5	6	6'-10	3'-5	3'-5	4	9	18'-3	5	9	5'-8	5	4.5	18'-3
17-19	5	12	18'-3	4	12	6'-3	5	6	6'-6	3'-3	3'-3	5	12	18'-3	6	12	5'-10	6	4.5	18'-3
20-22	6	18	18'-6	5	18	7'-0	5	6	7'-2	3'-7	3'-7	4	12	18'-6	6	12	6'-0	6	4.5	18'-6
23-25	6	18	18'-8	5	18	7'-10	6	9	7'-10	3'-11	3'-11	4	12	18'-8	6	12	6'-2	6	4.5	18'-8

Bar List	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	18'-8	4	12	6'-3	4	6	15'-4	5'-0	10'-4	4	18	18'-8	6	18	11'-4	6	4.5	18'-8
1	5	12	18'-8	4	12	6'-2	4	6	15'-4	5'-0	10'-4	4	18	18'-8	6	18	11'-4	6	4.5	18'-8
2	4	9	18'-8	4	9	6'-9	4	6	15'-5	5'-2	10'-3	5	18	18'-8	6	18	8'-2	6	4.5	18'-8
3	5	12	18'-8	4	12	5'-5	4	6	14'-6	4'-3	10'-3	5	18	18'-8	6	18	6'-10	6	4.5	18'-8
4	5	12	18'-8	4	12	5'-0	4	6	14'-3	4'-0	10'-3	5	18	18'-8	6	18	6'-6	6	4.5	18'-8
5-7	5	12	18'-8	4	12	4'-10	6	9	14'-4	4'-1	10'-3	4	12	18'-8	5	12	6'-0	5	4.5	18'-8
8-10	5	12	18'-8	4	12	5'-4	6	9	14'-0	3'-9	10'-3	4	12	18'-8	6	12	6'-0	6	4.5	18'-8
11-13	5	12	18'-8	4	12	5'-11	5	6	13'-11	3'-7	10'-4	4	9	18'-8	5	9	5'-10	5	4.5	18'-8
14-16	4	9	18'-9	4	9	6'-11	5	6	14'-0	3'-7	10'-5	5	18	18'-9	8	18	6'-6	8	4.5	18'-9
17-19	5	12	18'-9	4	12	6'-8	5	6	13'-11	3'-5	10'-6	5	18	18'-9	8	18	6'-6	8	4.5	18'-9
20-22	5	12	19'-0	4	12	7'-4	5	6	14'-3	3'-7	10'-8	4	9	19'-0	5	9	6'-4	5	4.5	19'-0
23-25	4	9	19'-2	4	9	8'-4	6	9	14'-5	3'-8	10'-9	4	9	19'-2	5	9	6'-6	5	4.5	19'-2

Quantities	Concrete (CY/FT)				Steel
Fill	Slab	Floor	Walls	Total	(LB/FT)
0	0.803	0.707	0.887	2.397	304.55
1	0.689	0.678	0.887	2.254	306.74
2	0.518	0.649	0.887	2.054	312.71
3	0.518	0.649	0.887	2.054	293.58
4	0.518	0.649	0.887	2.054	281.79
5-7	0.518	0.649	0.887	2.054	310.03
8-10	0.518	0.649	0.887	2.054	328.29
11-13	0.546	0.707	0.887	2.140	325.92
14-16	0.609	0.770	0.934	2.313	336.71
17-19	0.638	0.829	0.934	2.401	336.87
20-22	0.795	0.932	1.022	2.749	341.37
23-25	0.861	0.999	1.067	2.927	348.16

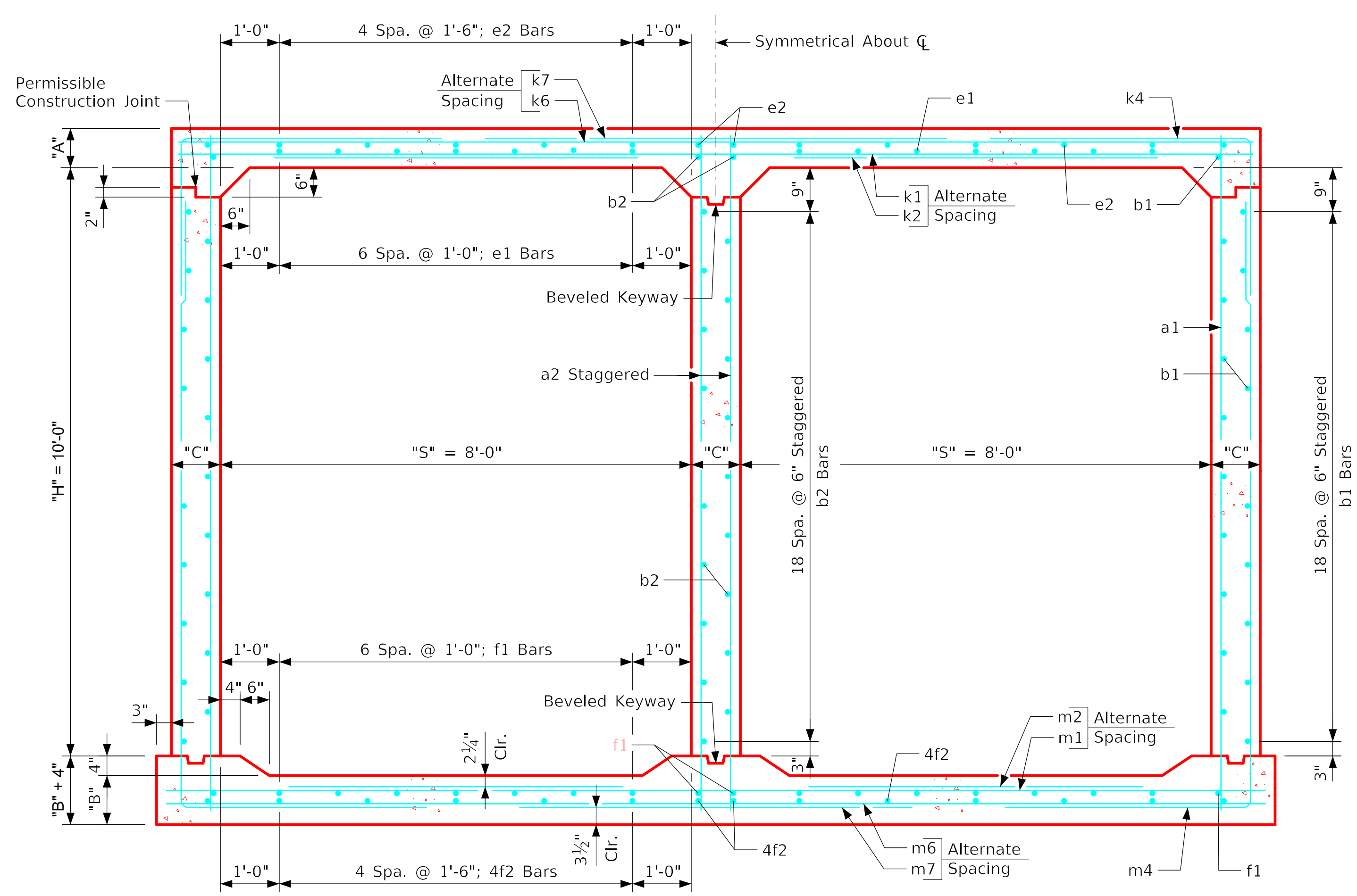
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 8' x 10' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
8' x 10' Barrel Sections

TWRCB 8-10-20

Variable Dimensions and Quantities for Twin 10' x 4' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	4	13	11	9	9	9	0'-0	6'-2	2'-4	5'-5
1	10	4	12.5	11	9	9	9	0'-8	6'-2	2'-5	4'-10
2	10	4	9	10	9	9	9	0'-11	5'-5	2'-2	4'-3
3	10	4	8	10	9	6	9	1'-6	4'-2	2'-9	3'-11
4	10	4	8	10	9	6	9	2'-2	3'-10	2'-9	3'-9
5-7	10	4	8	10	9	6	9	2'-6	3'-9	2'-6	3'-10
8-10	10	4	9	11	9	6	9	2'-1	3'-8	2'-2	3'-8
11-13	10	4	11	12.5	9	9	9	1'-11	3'-6	2'-1	3'-6
14-16	10	4	12.5	14.5	9	9	9	1'-9	3'-8	1'-10	3'-8
17-19	10	4	13.5	15.5	9	9	9	1'-6	3'-9	2'-3	3'-9
20-22	10	4	14.5	16.5	9	9	9	1'-5	3'-9	1'-11	3'-10
23-25	10	4	16	18	9	9	9	1'-8	3'-11	1'-9	4'-0

Bar List

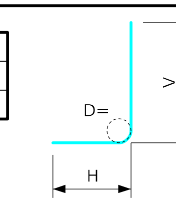
	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	5'-11	6	9	5'-11	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
1	4	12	5'-10	6	9	5'-10	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
2	4	12	5'-6	7	9	5'-6	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
3	4	6	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
4	4	6	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
5-7	4	6	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
8-10	4	6	5'-7	6	9	5'-7	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
11-13	5	12	5'-10	6	9	5'-10	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
14-16	4	12	6'-2	6	9	6'-2	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
17-19	4	12	6'-4	6	9	6'-4	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
20-22	4	12	6'-6	6	9	6'-6	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16
23-25	4	9	6'-9	6	9	6'-9	4	6	16	4	6	9	4	12	18	4	18	16	4	12	22	4	18	16

	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	21'-11	5	18	10'-11	4	6	6'-4	3'-2	3'-2	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	6	18	21'-11	5	18	10'-3	4	6	6'-2	3'-1	3'-1	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
2	6	18	21'-11	6	18	9'-11	5	6	6'-4	3'-2	3'-2	5	18	21'-11	7	18	10'-10	7	4.5	21'-11
3	6	18	21'-11	6	18	8'-6	5	6	6'-2	3'-1	3'-1	5	12	21'-11	5	12	8'-4	5	4.5	21'-11
4	5	12	21'-11	4	12	6'-11	5	6	6'-2	3'-1	3'-1	5	12	21'-11	5	12	7'-8	5	4.5	21'-11
5-7	5	12	21'-11	4	12	6'-8	4	6	5'-8	2'-10	2'-10	5	12	21'-11	6	12	7'-6	6	4.5	21'-11
8-10	4	9	21'-11	4	9	7'-8	4	6	5'-8	2'-10	2'-10	4	12	21'-11	7	12	7'-4	7	4.5	21'-11
11-13	4	9	21'-11	4	9	8'-5	4	6	5'-1	2'-2	2'-11	5	9	21'-11	5	9	7'-0	5	4.5	21'-11
14-16	6	18	21'-11	6	18	9'-1	4	6	5'-3	2'-2	3'-1	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	5	12	21'-11	5	12	9'-5	4	6	5'-4	2'-2	3'-2	5	9	21'-11	6	9	7'-6	6	4.5	21'-11
20-22	5	12	21'-11	5	12	9'-6	4	6	5'-6	2'-3	3'-3	5	9	21'-11	6	9	7'-6	6	4.5	21'-11
23-25	5	9	21'-11	4	9	9'-3	5	12	6'-4	2'-7	3'-9	5	9	21'-11	6	9	7'-10	6	4.5	21'-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	12	22'-5	4	12	7'-2	5	6	10'-5	6'-1	4'-4	4	9	22'-5	4	9	10'-10	4	4.5	22'-5	0.950	0.831	0.299	2.080	272.97
1	5	12	22'-5	4	12	7'-0	5	6	8'-2	3'-10	4'-4	5	18	22'-5	6	18	9'-8	6	4.5	22'-5	0.915	0.831	0.299	2.045	259.71
2	5	12	22'-5	5	12	7'-5	5	6	7'-2	2'-11	4'-3	5	18	22'-5	7	18	8'-6	7	4.5	22'-5	0.675	0.761	0.299	1.735	292.68
3	5	12	22'-5	4	12	6'-3	4	6	7'-1	2'-10	4'-3	5	18	22'-5	7	18	7'-10	7	4.5	22'-5	0.606	0.761	0.299	1.666	272.55
4	5	12	22'-5	4	12	6'-2	4	6	7'-0	2'-9	4'-3	5	18	22'-5	7	18	7'-6	7	4.5	22'-5	0.606	0.761	0.299	1.666	263.29
5-7	5	12	22'-5	5	12	6'-9	4	6	7'-0	2'-9	4'-3	5	18	22'-5	8	18	7'-8	8	4.5	22'-5	0.606	0.761	0.299	1.666	266.66
8-10	5	12	22'-5	5	12	7'-7	4	6	6'-10	2'-6	4'-4	4	12	22'-5	7	12	7'-4	7	4.5	22'-5	0.675	0.831	0.299	1.805	264.66
11-13	5	12	22'-5	5	12	8'-1	4	6	6'-9	2'-3	4'-6	4	9	22'-5	6	9	7'-0	6	4.5	22'-5	0.812	0.937	0.299	2.048	273.63
14-16	5	12	22'-5	5	12	8'-11	4	6	6'-10	2'-2	4'-8	4	9	22'-5	6	9	7'-4	6	4.5	22'-5	0.915	1.077	0.299	2.291	281.05
17-19	5	9	22'-5	4	9	8'-3	4	6	6'-11	2'-2	4'-9	5	12	22'-5	7	12	7'-6	7	4.5	22'-5	0.984	1.147	0.299	2.430	297.97
20-22	5	9	22'-5	4	9	9'-1	4	6	7'-1	2'-3	4'-10	5	9	22'-5	6	9	7'-8	6	4.5	22'-5	1.053	1.218	0.299	2.570	307.16
23-25	5	9	22'-5	4	9	9'-3	5	12	7'-2	2'-3	4'-11	5	9	22'-5	6	9	8'-0	6	4.5	22'-5	1.156	1.323	0.299	2.778	312.79

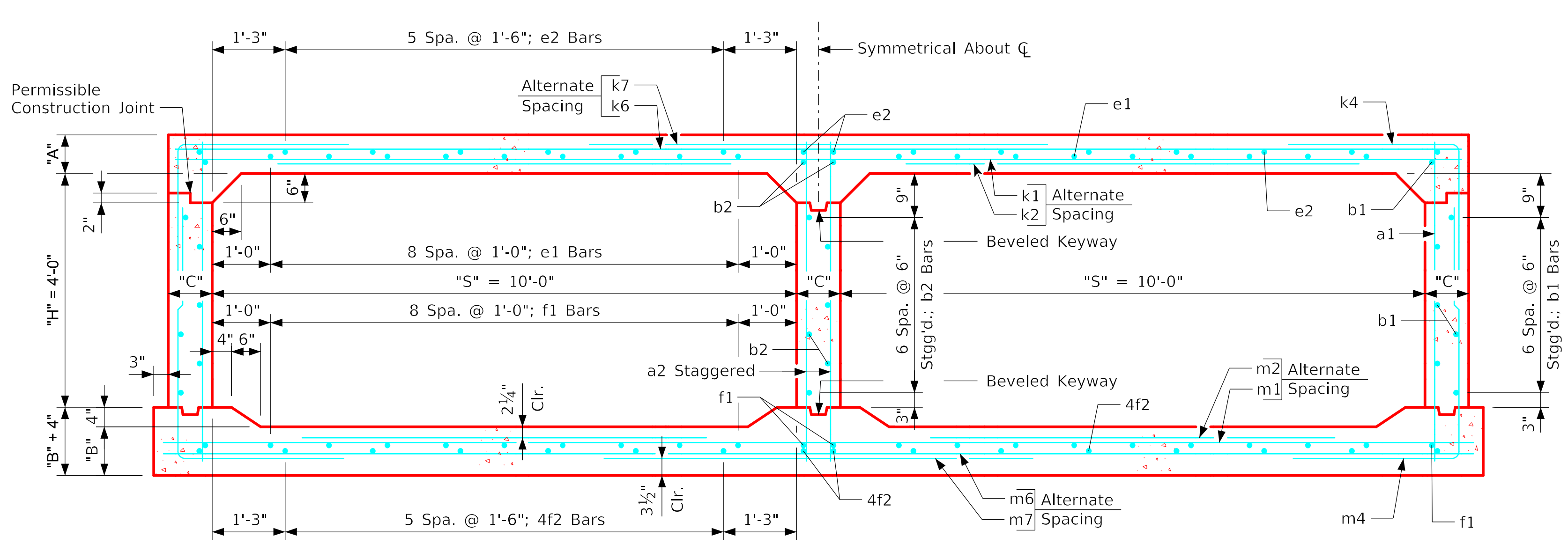
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 10' x 4' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 4' Barrel Sections

TWRCB 10-4-20

Variable Dimensions and Quantities for Twin 10' x 5' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	5	13	11	9	9	9	0'-1	6'-2	2'-0	6'-2
1	10	5	12.5	11	9	9	9	0'-8	6'-2	2'-4	4'-10
2	10	5	9	10	9	9	9	1'-2	5'-5	2'-2	4'-1
3	10	5	8	10	9	6	9	1'-9	4'-5	2'-4	4'-0
4	10	5	8	10	9	6	9	1'-10	3'-10	2'-4	3'-10
5-7	10	5	8	10	9	6	9	2'-2	3'-9	2'-6	3'-7
8-10	10	5	9	11	9	6	9	2'-2	3'-5	2'-1	3'-5
11-13	10	5	11	12.5	9	9	9	1'-9	3'-7	2'-2	3'-8
14-16	10	5	12.5	14.5	9	9	9	1'-8	3'-8	2'-0	3'-8
17-19	10	5	14	16	9	9	9	1'-6	3'-9	1'-7	3'-10
20-22	10	5	15	16.5	9	9	9	1'-5	3'-10	1'-10	3'-10
23-25	10	5	16.5	18	9	9	9	1'-8	3'-11	1'-9	4'-0

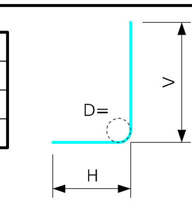
	Bar List																						
	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	6'-11	6	9	6'-11	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
1	4	12	6'-10	6	9	6'-10	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
2	4	12	6'-6	6	9	6'-6	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
3	4	6	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
4	4	6	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
5-7	4	6	6'-5	6	9	6'-5	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
8-10	4	6	6'-7	6	9	6'-7	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
11-13	5	12	6'-10	6	9	6'-10	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
14-16	4	12	7'-2	6	9	7'-2	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
17-19	4	12	7'-5	6	9	7'-5	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
20-22	4	12	7'-6	6	9	7'-6	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16
23-25	4	12	7'-9	6	9	7'-9	4	6	20	4	6	11	4	12	18	4	18	16	4	12	22	4	18	16

	Bar List																		
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	21'-11	5	18	10'-10	5	9	7'-0	3'-6	3'-6	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	6	18	21'-11	5	18	10'-3	4	6	6'-6	3'-3	3'-3	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
2	5	12	21'-11	5	12	9'-6	5	6	6'-4	3'-2	3'-2	5	12	21'-11	5	12	10'-10	5	4.5	21'-11
3	5	12	21'-11	5	12	8'-0	5	6	6'-2	3'-1	3'-1	4	12	21'-11	6	12	8'-10	6	4.5	21'-11
4	4	9	21'-11	4	9	7'-9	4	6	5'-10	2'-11	2'-11	5	12	21'-11	5	12	7'-8	5	4.5	21'-11
5-7	4	9	21'-11	4	9	7'-5	4	6	5'-8	2'-10	2'-10	5	12	21'-11	6	12	7'-6	6	4.5	21'-11
8-10	5	12	21'-11	5	12	7'-6	4	6	5'-8	2'-10	2'-10	5	9	21'-11	5	9	6'-10	5	4.5	21'-11
11-13	6	18	21'-11	6	18	8'-8	4	6	5'-2	2'-3	2'-11	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
14-16	6	18	21'-11	6	18	9'-3	4	6	5'-4	2'-3	3'-1	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	5	12	21'-11	5	12	9'-5	4	6	5'-6	2'-3	3'-3	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
20-22	5	12	21'-11	5	12	9'-6	4	6	5'-7	2'-4	3'-3	5	9	21'-11	6	9	7'-8	6	4.5	21'-11
23-25	5	9	21'-11	4	9	9'-3	4	6	5'-9	2'-4	3'-5	5	9	21'-11	6	9	7'-10	6	4.5	21'-11

	Bar List																			Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
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	(LB/FT)
0	4	9	22'-5	4	9	7'-10	6	9	11'-9	6'-5	5'-4	4	9	22'-5	4	9	12'-4	4	4.5	22'-5	0.950	0.831	0.382	2.163	289.68
1	5	12	22'-5	4	12	7'-2	5	6	9'-8	4'-4	5'-4	4	12	22'-5	5	12	9'-8	5	4.5	22'-5	0.915	0.831	0.382	2.128	273.03
2	5	12	22'-5	5	12	7'-6	5	6	8'-3	3'-0	5'-3	5	12	22'-5	5	12	8'-2	5	4.5	22'-5	0.675	0.761	0.382	1.818	304.05
3	4	9	22'-5	4	9	7'-2	4	6	8'-2	2'-11	5'-3	5	18	22'-5	7	18	8'-0	7	4.5	22'-5	0.606	0.761	0.382	1.749	280.84
4	4	9	22'-5	4	9	7'-1	4	6	8'-1	2'-10	5'-3	5	18	22'-5	7	18	7'-8	7	4.5	22'-5	0.606	0.761	0.382	1.749	264.71
5-7	5	12	22'-5	5	12	6'-10	4	6	8'-0	2'-9	5'-3	5	12	22'-5	6	12	7'-2	6	4.5	22'-5	0.606	0.761	0.382	1.749	279.97
8-10	5	12	22'-5	5	12	7'-8	4	6	7'-10	2'-6	5'-4	5	9	22'-5	5	9	6'-10	5	4.5	22'-5	0.675	0.831	0.382	1.888	298.00
11-13	5	12	22'-5	5	12	8'-1	4	6	7'-10	2'-4	5'-6	5	12	22'-5	7	12	7'-4	7	4.5	22'-5	0.812	0.937	0.382	2.131	292.37
14-16	5	12	22'-5	5	12	8'-10	4	6	8'-0	2'-4	5'-8	5	12	22'-5	7	12	7'-4	7	4.5	22'-5	0.915	1.077	0.382	2.374	296.95
17-19	5	12	22'-5	5	12	9'-5	4	6	8'-1	2'-4	5'-9	5	12	22'-5	7	12	7'-8	7	4.5	22'-5	1.018	1.182	0.382	2.582	301.16
20-22	5	9	22'-5	4	9	9'-2	4	6	8'-2	2'-4	5'-10	5	9	22'-5	6	9	7'-8	6	4.5	22'-5	1.087	1.218	0.382	2.687	318.13
23-25	5	9	22'-5	4	9	9'-3	4	6	8'-4	2'-5	5'-11	5	9	22'-5	6	9	8'-0	6	4.5	22'-5	1.190	1.323	0.382	2.895	325.05

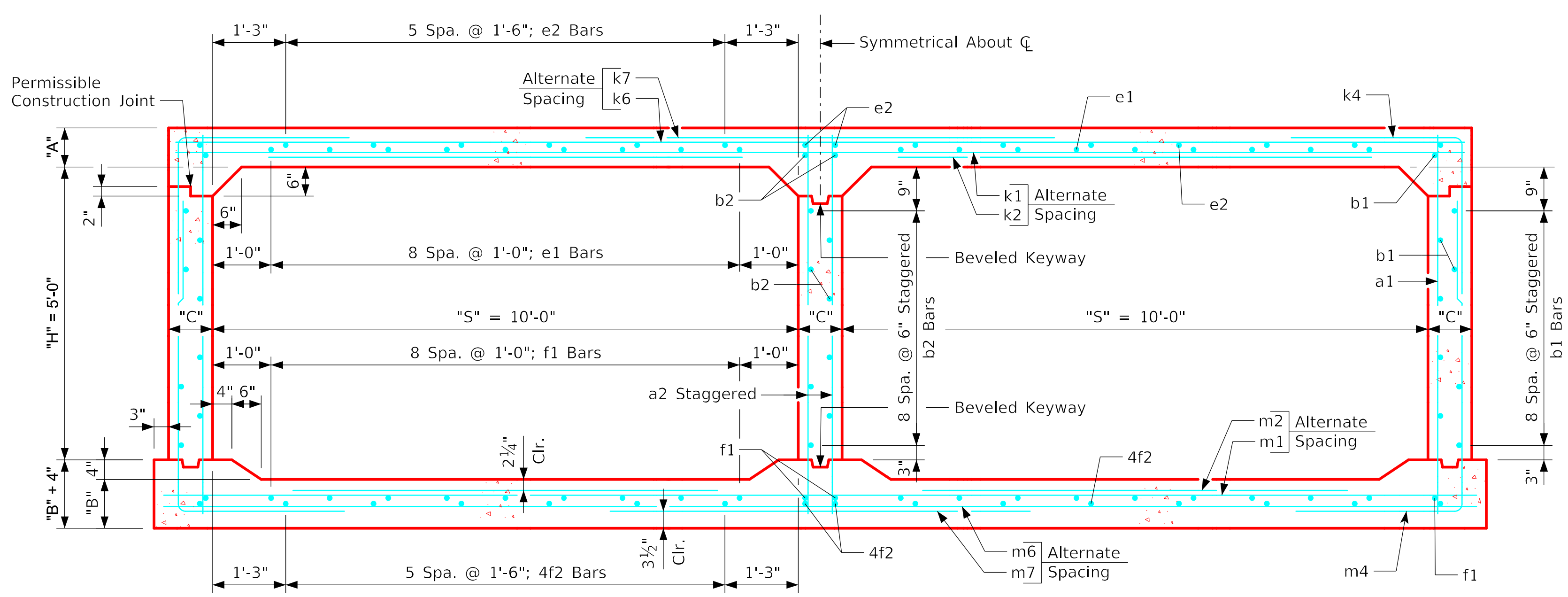
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 10' x 5' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 5' Barrel Sections

TWRCB 10-5-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-5-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 10' x 6' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	6	13	11	9	9	9	0'-0	6'-2	2'-1	6'-9
1	10	6	12.5	11	9	6	9	0'-8	6'-2	2'-0	4'-11
2	10	6	9	10	9	9	9	1'-1	5'-8	2'-1	4'-4
3	10	6	8	10	9	6	9	1'-8	4'-6	2'-3	4'-0
4	10	6	8	10	9	6	9	1'-11	3'-11	2'-4	3'-7
5-7	10	6	8	10	9	6	9	2'-2	3'-10	2'-5	3'-9
8-10	10	6	9	11	9	6	9	2'-2	3'-5	2'-1	3'-7
11-13	10	6	11	13	9	9	9	1'-10	3'-7	2'-0	3'-7
14-16	10	6	12.5	14.5	9	9	9	1'-8	3'-8	1'-11	3'-8
17-19	10	6	14	16	9	9	9	1'-6	3'-9	1'-7	3'-10
20-22	10	6	15	17	9	9	9	1'-5	3'-10	1'-6	3'-11
23-25	10	6	16.5	18	9	9	9	1'-8	3'-11	1'-8	4'-0

Bar List

	a1			a2			b1			b2			e1			e2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	7'-11	6	9	7'-11	4	6	24	4	6	13	4	12	18	4	18	16
1	4	6	7'-10	6	9	7'-10	4	6	24	4	6	13	4	12	18	4	18	16
2	4	12	7'-6	6	9	7'-6	4	6	24	4	6	13	4	12	18	4	18	16
3	4	6	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	18	4	18	16
4	4	6	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	18	4	18	16
5-7	4	6	7'-5	6	9	7'-5	4	6	24	4	6	13	4	12	18	4	18	16
8-10	4	6	7'-7	6	9	7'-7	4	6	24	4	6	13	4	12	18	4	18	16
11-13	4	9	7'-11	6	9	7'-11	4	6	24	4	6	13	4	12	18	4	18	16
14-16	4	9	8'-2	6	9	8'-2	4	6	24	4	6	13	4	12	18	4	18	16
17-19	4	9	8'-5	6	9	8'-5	4	6	24	4	6	13	4	12	18	4	18	16
20-22	4	12	8'-7	6	9	8'-7	4	6	24	4	6	13	4	12	18	4	18	16
23-25	4	12	8'-9	6	9	8'-9	4	6	24	4	6	13	4	12	18	4	18	16

	f1			f2			k1			k2		
Fill	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L
0	4	12	22	4	18	16	6	18	21'-11	5	18	10'-11
1	4	12	22	4	18	16	6	18	21'-11	5	18	10'-3
2	4	12	22	4	18	16	5	12	21'-11	5	12	9'-8
3	4	12	22	4	18	16	5	12	21'-11	5	12	8'-2
4	4	12	22	4	18	16	6	18	21'-11	6	18	7'-10
5-7	4	12	22	4	18	16	4	9	21'-11	4	9	7'-6
8-10	4	12	22	4	18	16	5	12	21'-11	5	12	7'-9
11-13	4	12	22	4	18	16	6	18	21'-11	6	18	8'-8
14-16	4	12	22	4	18	16	6	18	21'-11	6	18	9'-3
17-19	4	12	22	4	18	16	5	12	21'-11	5	12	9'-5
20-22	4	12	22	4	18	16	5	12	21'-11	5	12	9'-6
23-25	4	12	22	4	18	16	5	9	21'-11	4	9	9'-3

	k4					k6			k7			k9		
Fill	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	6	9'-7	6'-5	3'-2	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	4	6	9'-6	6'-5	3'-1	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
2	5	6	6'-4	3'-2	3'-2	5	12	21'-11	5	12	11'-4	5	4.5	21'-11
3	5	6	6'-2	3'-1	3'-1	4	12	21'-11	6	12	9'-0	6	4.5	21'-11
4	4	6	5'-10	2'-11	2'-11	5	12	21'-11	5	12	7'-10	5	4.5	21'-11
5-7	4	6	5'-10	2'-11	2'-11	5	12	21'-11	6	12	7'-8	6	4.5	21'-11
8-10	4	6	5'-8	2'-10	2'-10	5	9	21'-11	5	9	6'-10	5	4.5	21'-11
11-13	4	6	5'-6	2'-6	3'-0	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
14-16	4	6	5'-6	2'-5	3'-1	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	4	6	5'-9	2'-6	3'-3	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
20-22	4	6	5'-10	2'-6	3'-4	5	12	21'-11	7	12	7'-8	7	4.5	21'-11
23-25	4	6	5'-11	2'-6	3'-5	5	12	21'-11	7	12	7'-10	7	4.5	21'-11

Bar List

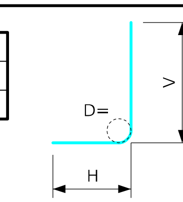
	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	22'-5	5	12	7'-8	5	6	12'-8	6'-4	6'-4	5	18	22'-5	7	18	13'-6	7	4.5	22'-5
1	4	9	22'-5	4	9	7'-10	4	6	11'-3	4'-11	6'-4	4	9	22'-5	4	9	9'-10	4	4.5	22'-5
2	5	12	22'-5	5	12	7'-7	5	6	9'-6	3'-3	6'-3	4	12	22'-5	6	12	8'-8	6	4.5	22'-5
3	5	12	22'-5	5	12	7'-5	4	6	9'-3	3'-0	6'-3	5	18	22'-5	7	18	8'-0	7	4.5	22'-5
4	4	9	22'-5	4	9	7'-5	4	6	9'-2	2'-11	6'-3	5	12	22'-5	5	12	7'-2	5	4.5	22'-5
5-7	5	12	22'-5	5	12	7'-3	4	6	9'-1	2'-10	6'-3	4	12	22'-5	7	12	7'-6	7	4.5	22'-5
8-10	5	12	22'-5	5	12	7'-9	4	6	8'-11	2'-7	6'-4	4	9	22'-5	6	9	7'-2	6	4.5	22'-5
11-13	5	12	22'-5	5	12	8'-4	4	6	9'-0	2'-6	6'-6	5	9	22'-5	5	9	7'-2	5	4.5	22'-5
14-16	5	12	22'-5	5	12	8'-11	4	6	9'-2	2'-6	6'-8	5	12	22'-5	7	12	7'-4	7	4.5	22'-5
17-19	5	12	22'-5	5	12	9'-5	4	6	9'-3	2'-6	6'-9	5	12	22'-5	7	12	7'-8	7	4.5	22'-5
20-22	5	12	22'-5	5	12	9'-6	4	6	9'-4	2'-6	6'-10	5	12	22'-5	7	12	7'-10	7	4.5	22'-5
23-25	5	9	22'-5	4	9	9'-4	4	6	9'-5	2'-6	6'-11	5	9	22'-5	6	9	8'-0	6	4.5	22'-5

Quantities

	Concrete (CY/FT)				Steel (LB/FT)
Fill	Slab	Floor	Walls	Total	
0	0.950	0.831	0.465	2.246	319.68
1	0.915	0.831	0.465	2.211	290.63
2	0.675	0.761	0.465	1.901	314.87
3	0.606	0.761	0.465	1.832	299.87
4	0.606	0.761	0.465	1.832	285.71
5-7	0.606	0.761	0.465	1.832	290.55
8-10	0.675	0.831	0.465	1.971	305.11
11-13	0.812	0.972	0.465	2.249	302.92
14-16	0.915	1.077	0.465	2.457	311.55
17-19	1.018	1.182	0.465	2.665	315.92
20-22	1.087	1.253	0.465	2.805	314.32
23-25	1.190	1.323	0.465	2.978	330.26

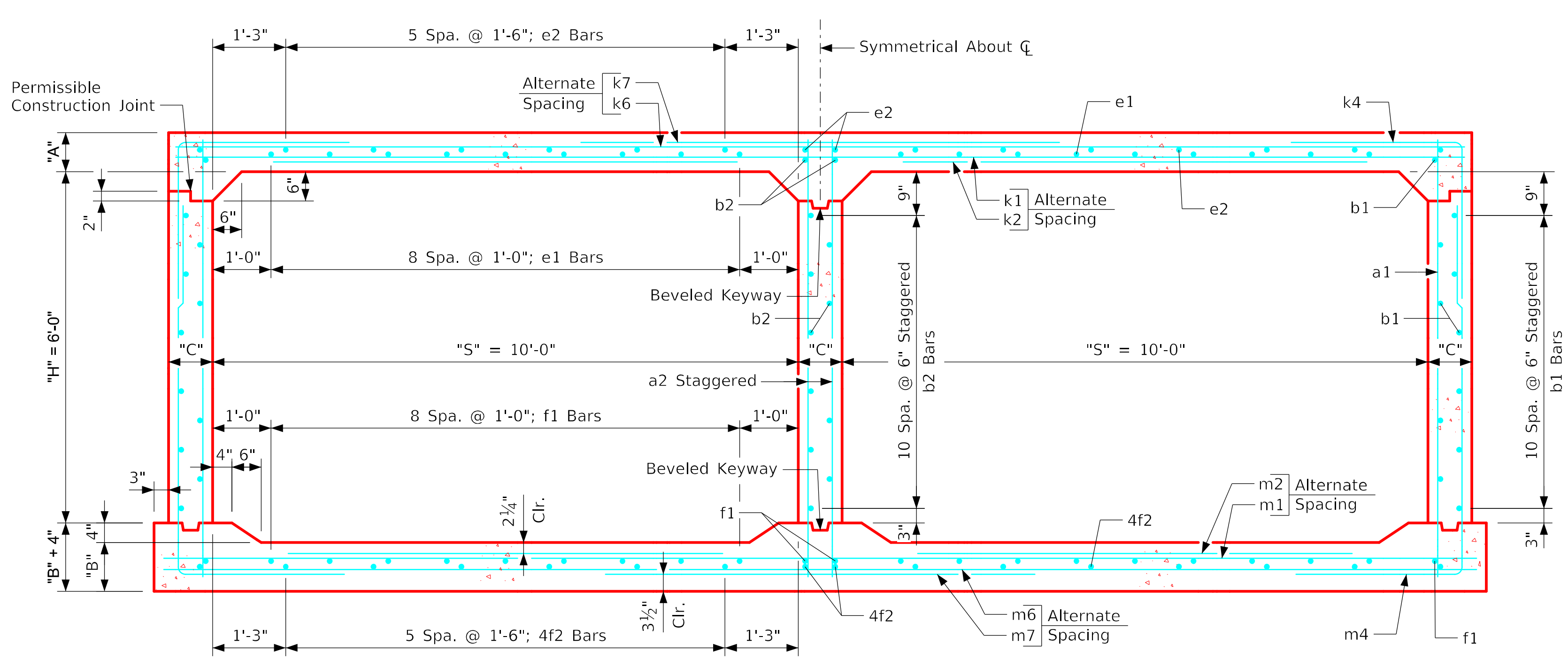
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 10' x 6' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 6' Barrel Sections

TWRCB 10-6-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 10' x 7' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	7	13	11.5	9	6	9	0'-0	6'-2	1'-9	6'-2
1	10	7	12.5	11	9	6	9	0'-7	6'-5	2'-2	5'-5
2	10	7	9	10	9	9	9	1'-11	5'-11	3'-0	4'-4
3	10	7	8	10	9	6	9	1'-8	4'-7	2'-2	3'-10
4	10	7	8	10	9	6	9	1'-10	4'-1	2'-6	3'-9
5-7	10	7	8	10	9	6	9	2'-3	3'-10	2'-5	3'-9
8-10	10	7	9	11.5	9	6	9	2'-2	3'-5	2'-2	3'-8
11-13	10	7	11	13	9	9	9	1'-11	3'-7	2'-0	3'-7
14-16	10	7	12.5	14.5	9	9	9	1'-8	3'-8	1'-11	3'-8
17-19	10	7	14	16	9	9	9	1'-5	3'-9	1'-7	3'-10
20-22	10	7	15	17	9	9	9	1'-5	3'-9	1'-11	3'-11
23-25	10	7	16	18.5	9	9	9	1'-7	3'-10	1'-8	4'-0

Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	6	8'-11	6	9	8'-11	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
1	4	6	8'-10	6	9	8'-10	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
2	4	12	8'-6	6	9	8'-6	4	6	28	4	6	15	5	12	18	4	18	16	4	12	22	4	18	16
3	4	6	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
4	4	6	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
5-7	4	6	8'-5	6	9	8'-5	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
8-10	4	6	8'-7	6	9	8'-7	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
11-13	5	12	8'-11	6	9	8'-11	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
14-16	5	12	9'-2	6	9	9'-2	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
17-19	5	12	9'-5	6	9	9'-5	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
20-22	4	9	9'-7	6	9	9'-7	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16
23-25	4	9	9'-9	6	9	9'-9	4	6	28	4	6	15	4	12	18	4	18	16	4	12	22	4	18	16

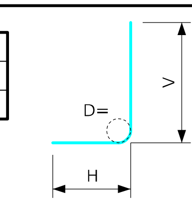
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	21'-11	5	18	10'-11	4	6	9'-6	6'-5	3'-1	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	6	18	21'-11	5	18	10'-4	4	6	9'-3	6'-2	3'-1	5	18	21'-11	5	18	12'-10	5	4.5	21'-11
2	5	9	21'-11	4	9	7'-10	5	6	6'-10	3'-8	3'-2	5	12	21'-11	5	12	11'-10	5	4.5	21'-11
3	5	12	21'-11	5	12	8'-3	5	6	6'-8	3'-4	3'-4	4	12	21'-11	6	12	9'-2	6	4.5	21'-11
4	6	18	21'-11	6	18	8'-0	4	6	6'-2	3'-1	3'-1	4	12	21'-11	6	12	8'-2	6	4.5	21'-11
5-7	5	12	21'-11	5	12	7'-3	4	6	6'-0	3'-0	3'-0	5	12	21'-11	6	12	7'-8	6	4.5	21'-11
8-10	5	12	21'-11	5	12	7'-10	4	6	5'-8	2'-10	2'-10	5	9	21'-11	5	9	6'-10	5	4.5	21'-11
11-13	6	18	21'-11	6	18	8'-7	4	6	6'-0	3'-0	3'-0	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
14-16	6	18	21'-11	6	18	9'-3	4	6	6'-2	3'-1	3'-1	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	5	12	21'-11	5	12	9'-6	4	6	6'-0	2'-9	3'-3	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
20-22	5	12	21'-11	5	12	9'-6	4	6	6'-1	2'-9	3'-4	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
23-25	5	9	21'-11	4	9	9'-4	4	6	6'-1	2'-9	3'-4	5	9	21'-11	6	9	7'-8	6	4.5	21'-11

Bar List / Quantities

	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
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	(LB/FT)
0	6	18	22'-5	6	18	8'-7	4	6	13'-10	6'-5	7'-5	4	9	22'-5	4	9	12'-4	4	4.5	22'-5	0.950	0.866	0.549	2.365	317.55
1	5	12	22'-5	5	12	7'-7	4	6	12'-11	5'-7	7'-4	4	9	22'-5	4	9	10'-10	4	4.5	22'-5	0.915	0.831	0.549	2.295	312.47
2	5	9	22'-5	4	9	6'-2	5	6	10'-11	3'-8	7'-3	4	9	22'-5	5	9	8'-8	5	4.5	22'-5	0.675	0.761	0.549	1.985	344.34
3	5	12	22'-5	5	12	7'-6	4	6	10'-6	3'-3	7'-3	5	12	22'-5	5	12	7'-8	5	4.5	22'-5	0.606	0.761	0.549	1.916	316.89
4	5	12	22'-5	5	12	7'-2	4	6	10'-4	3'-1	7'-3	4	12	22'-5	6	12	7'-6	6	4.5	22'-5	0.606	0.761	0.549	1.916	298.21
5-7	5	12	22'-5	5	12	7'-3	4	6	10'-3	3'-0	7'-3	4	12	22'-5	7	12	7'-6	7	4.5	22'-5	0.606	0.761	0.549	1.916	308.74
8-10	5	12	22'-5	5	12	8'-0	4	6	10'-2	2'-9	7'-5	4	12	22'-5	7	12	7'-4	7	4.5	22'-5	0.675	0.866	0.549	2.090	314.97
11-13	5	12	22'-5	5	12	8'-5	4	6	10'-3	2'-9	7'-6	4	9	22'-5	6	9	7'-2	6	4.5	22'-5	0.812	0.972	0.549	2.333	312.92
14-16	5	12	22'-5	5	12	9'-0	4	6	10'-5	2'-9	7'-8	5	12	22'-5	7	12	7'-4	7	4.5	22'-5	0.915	1.077	0.549	2.541	327.87
17-19	5	12	22'-5	5	12	9'-5	4	6	10'-6	2'-9	7'-9	5	12	22'-5	7	12	7'-8	7	4.5	22'-5	1.018	1.182	0.549	2.749	331.16
20-22	5	9	22'-5	4	9	9'-1	4	6	10'-8	2'-10	7'-10	5	9	22'-5	6	9	7'-10	6	4.5	22'-5	1.087	1.253	0.549	2.889	339.45
23-25	5	9	22'-5	4	9	9'-4	4	6	10'-10	2'-10	8'-0	5	9	22'-5	6	9	8'-0	6	4.5	22'-5	1.156	1.358	0.549	3.063	351.53

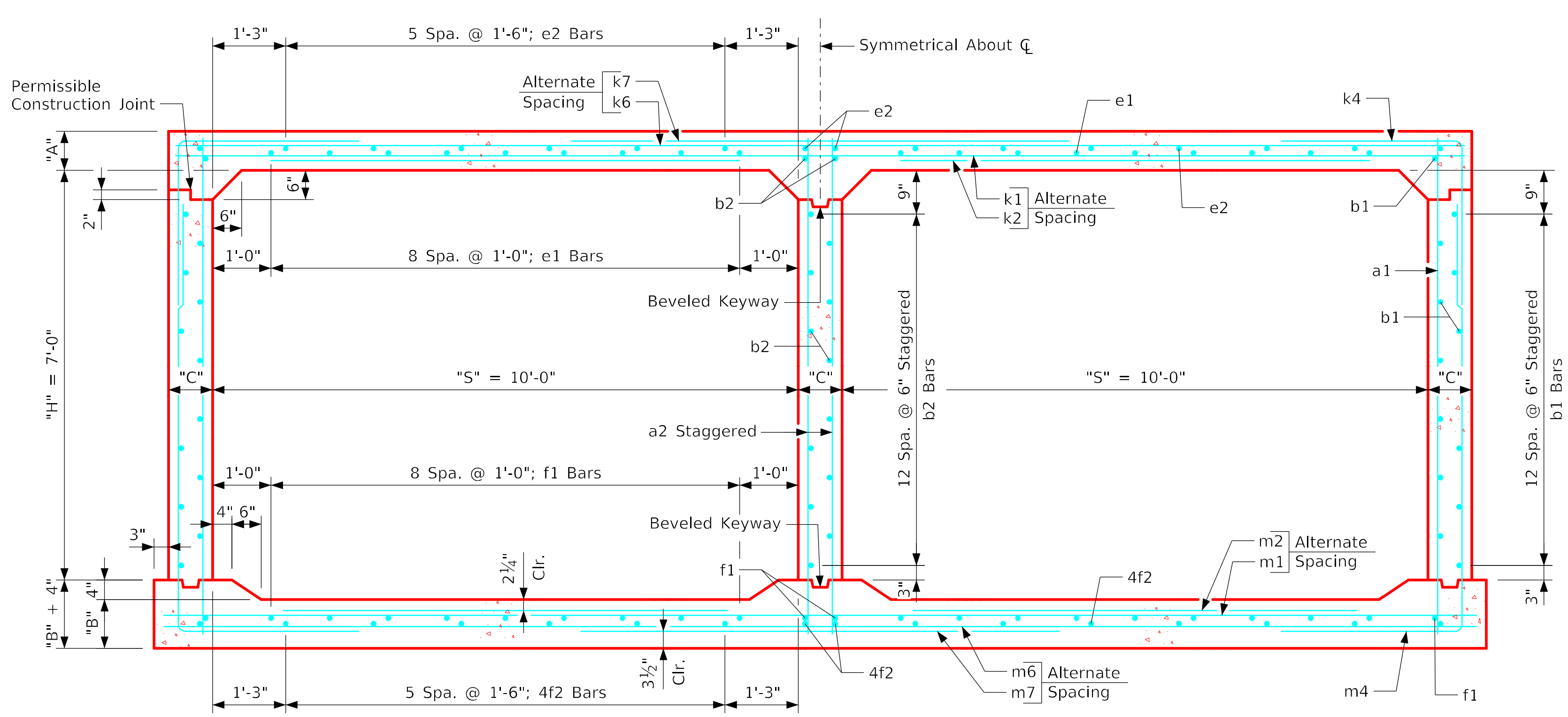
Bent Bar Detail

Bars	D
4	3"
5	3¾"



k4 & m4

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



Twin 10' x 7' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 7' Barrel Sections

TWRCB 10-7-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-7-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 10' x 8' Barrel Sections

Fill	Dimensions S	H	A	B	C	D	E	U	W	X	Z
0	10	8	13	11.5	9	6	9	0'-1	6'-2	2'-1	6'-2
1	10	8	12.5	11	9	9	9	0'-7	6'-5	2'-1	6'-9
2	10	8	9	10	9	9	9	1'-10	6'-5	2'-11	4'-5
3	10	8	8	10	9	6	9	1'-10	4'-9	2'-2	4'-0
4	10	8	8	10	9	6	9	2'-1	4'-2	2'-2	3'-8
5-7	10	8	8	10	9	9	9	2'-3	3'-11	2'-2	3'-9
8-10	10	8	9	11.5	9	6	9	2'-2	3'-6	2'-1	3'-6
11-13	10	8	11	13.5	9	6	9	1'-11	3'-7	2'-1	3'-8
14-16	10	8	12.5	14.5	9	9	9	1'-7	3'-8	1'-11	3'-8
17-19	10	8	14	16	9	6	9	1'-6	3'-9	1'-6	3'-10
20-22	10	8	15	17	9	6	9	1'-4	3'-9	1'-11	3'-11
23-25	10	8	16	18.5	9.5	6	6	1'-7	3'-10	1'-8	4'-0

Bar List

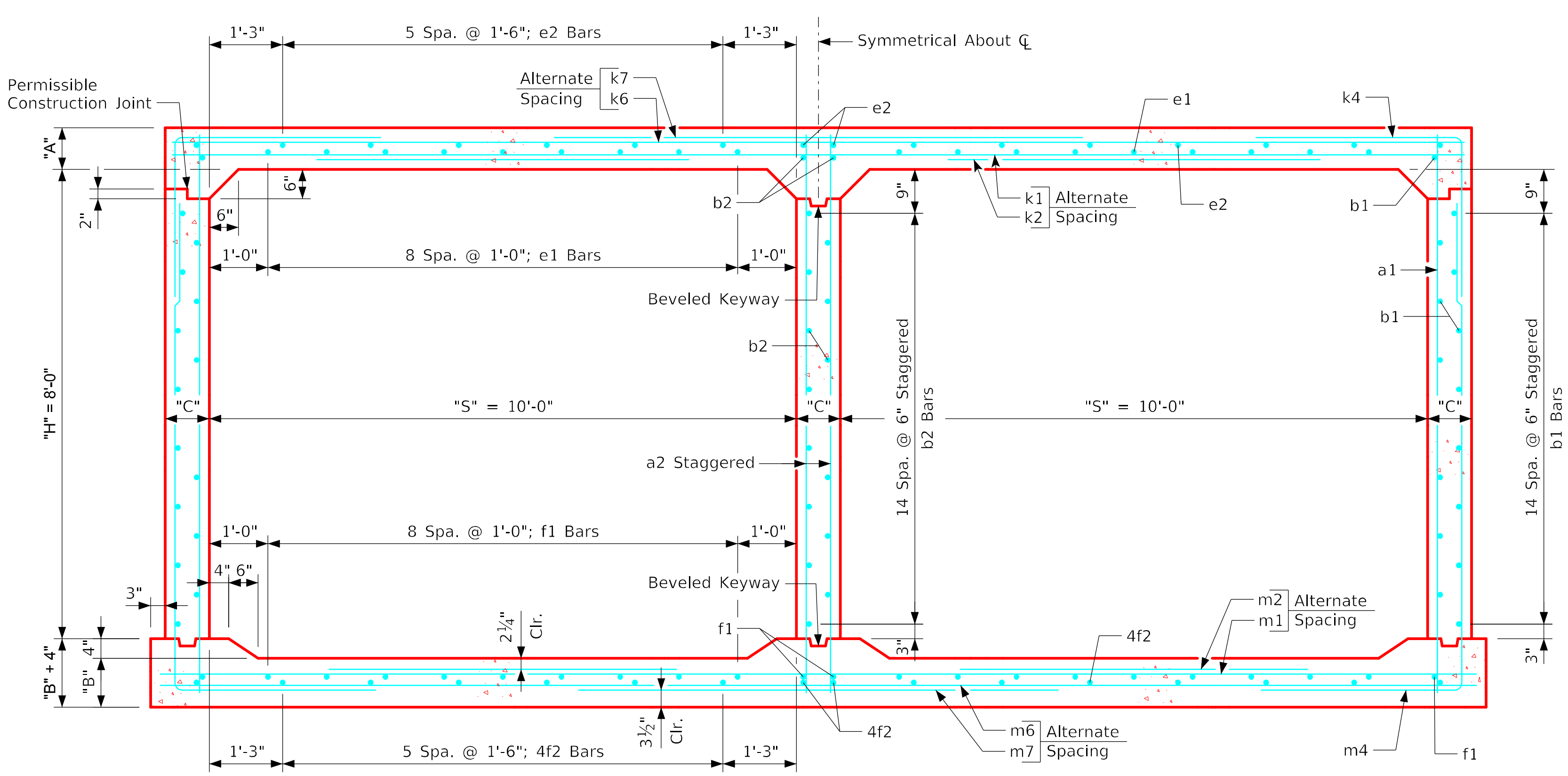
	a1			a2			b1			b2			e1		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	6	9'-11	6	9	9'-11	4	6	32	4	6	17	4	12	18
1	4	12	9'-10	6	9	9'-10	4	6	32	4	6	17	4	12	18
2	4	12	9'-6	6	9	9'-6	4	6	32	4	6	17	5	12	18
3	4	6	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	18
4	4	6	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	18
5-7	4	12	9'-5	6	9	9'-5	4	6	32	4	6	17	4	12	18
8-10	4	6	9'-7	6	9	9'-7	4	6	32	4	6	17	4	12	18
11-13	4	6	9'-11	6	9	9'-11	4	6	32	4	6	17	4	12	18
14-16	4	12	10'-2	6	9	10'-2	4	6	32	4	6	17	4	12	18
17-19	4	6	10'-5	6	9	10'-5	4	6	32	4	6	17	4	12	18
20-22	4	6	10'-7	6	9	10'-7	4	6	32	4	6	17	4	12	18
23-25	4	6	10'-9	5	6	10'-9	4	6	32	4	6	17	4	12	18

	e2			f1			f2			k1			k2		
Fill	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L
0	4	18	16	4	12	22	4	18	16	6	18	21'-11	5	18	10'-10
1	4	18	16	4	12	22	4	18	16	6	18	21'-11	5	18	10'-4
2	4	18	16	4	12	22	4	18	16	5	9	21'-11	4	9	8'-0
3	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	8'-2
4	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-9
5-7	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-4
8-10	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-10
11-13	4	18	16	4	12	22	4	18	16	6	18	21'-11	6	18	8'-7
14-16	4	18	16	4	12	22	4	18	16	6	18	21'-11	6	18	9'-4
17-19	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	9'-5
20-22	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	9'-7
23-25	4	18	16	4	12	22	4	18	16	5	9	22'-0	4	9	9'-5

	k4					k6			k7			k9		
Fill	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	6	9'-6	6'-5	3'-1	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	4	6	9'-3	6'-2	3'-1	5	18	21'-11	5	18	12'-10	5	4.5	21'-11
2	5	6	7'-5	4'-3	3'-2	5	12	21'-11	5	12	12'-10	5	4.5	21'-11
3	5	6	6'-9	3'-8	3'-1	4	12	21'-11	6	12	9'-6	6	4.5	21'-11
4	4	6	6'-3	3'-6	2'-9	4	12	21'-11	6	12	8'-4	6	4.5	21'-11
5-7	6	9	7'-0	3'-6	3'-6	5	12	21'-11	6	12	7'-10	6	4.5	21'-11
8-10	4	6	6'-0	3'-0	3'-0	5	9	21'-11	5	9	7'-0	5	4.5	21'-11
11-13	4	6	5'-10	2'-11	2'-11	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
14-16	5	6	6'-4	2'-11	3'-5	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	6	12	7'-0	3'-0	4'-0	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
20-22	6	12	7'-1	3'-0	4'-1	5	12	21'-11	7	12	7'-6	7	4.5	21'-11
23-25	6	12	7'-2	3'-0	4'-2	5	9	22'-0	6	9	7'-8	6	4.5	22'-0

	Bar List m1			m2			m4					m6		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L
0	5	12	22'-5	5	12	8'-1	4	6	14'-10	6'-5	8'-5	4	9	22'-5
1	5	12	22'-5	5	12	8'-0	5	6	14'-6	6'-2	8'-4	5	18	22'-5
2	5	9	22'-5	4	9	6'-4	5	6	12'-4	4'-1	8'-3	4	9	22'-5
3	5	12	22'-5	5	12	7'-7	4	6	11'-10	3'-7	8'-3	4	12	22'-5
4	5	12	22'-5	5	12	7'-6	4	6	11'-8	3'-5	8'-3	4	9	22'-5
5-7	5	12	22'-5	5	12	7'-7	6	9	11'-8	3'-5	8'-3	4	12	22'-5
8-10	5	12	22'-5	5	12	8'-2	4	6	11'-5	3'-0	8'-5	5	9	22'-5
11-13	5	12	22'-5	5	12	8'-4	4	6	11'-7	3'-0	8'-7	5	9	22'-5
14-16	5	12	22'-5	5	12	9'-0	5	6	11'-8	3'-0	8'-8	5	12	22'-5
17-19	5	12	22'-5	5	12	9'-6	6	12	11'-10	3'-1	8'-9	5	12	22'-5
20-22	5	9	22'-5	4	9	9'-1	6	12	11'-11	3'-1	8'-10	5	9	22'-5
23-25	5	9	22'-6	4	9	9'-5	6	12	12'-1	3'-1	9'-0	5	9	22'-6

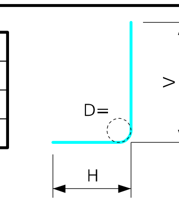
	m7			m9			Quantities: Concrete (CY/FT)				Steel
Fill	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	4	9	12'-4	4	4.5	22'-5	0.950	0.866	0.632	2.448	328.05
1	7	18	13'-6	7	4.5	22'-5	0.915	0.831	0.632	2.378	343.08
2	5	9	8'-10	5	4.5	22'-5	0.675	0.761	0.632	2.068	361.95
3	6	12	8'-0	6	4.5	22'-5	0.606	0.761	0.632	1.999	326.63
4	5	9	7'-4	5	4.5	22'-5	0.606	0.761	0.632	1.999	313.87
5-7	7	12	7'-6	7	4.5	22'-5	0.606	0.761	0.632	1.999	340.42
8-10	5	9	7'-0	5	4.5	22'-5	0.675	0.866	0.632	2.173	336.63
11-13	5	9	7'-4	5	4.5	22'-5	0.812	1.007	0.632	2.451	335.18
14-16	7	12	7'-4	7	4.5	22'-5	0.915	1.077	0.632	2.624	359.53
17-19	7	12	7'-8	7	4.5	22'-5	1.018	1.182	0.632	2.832	361.21
20-22	6	9	7'-10	6	4.5	22'-5	1.087	1.253	0.632	2.972	372.97
23-25	6	9	8'-0	6	4.5	22'-6	1.164	1.367	0.667	3.198	386.84



Twin 10' x 8' Barrel Section

Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 8' Barrel Sections

TWRCB 10-8-20

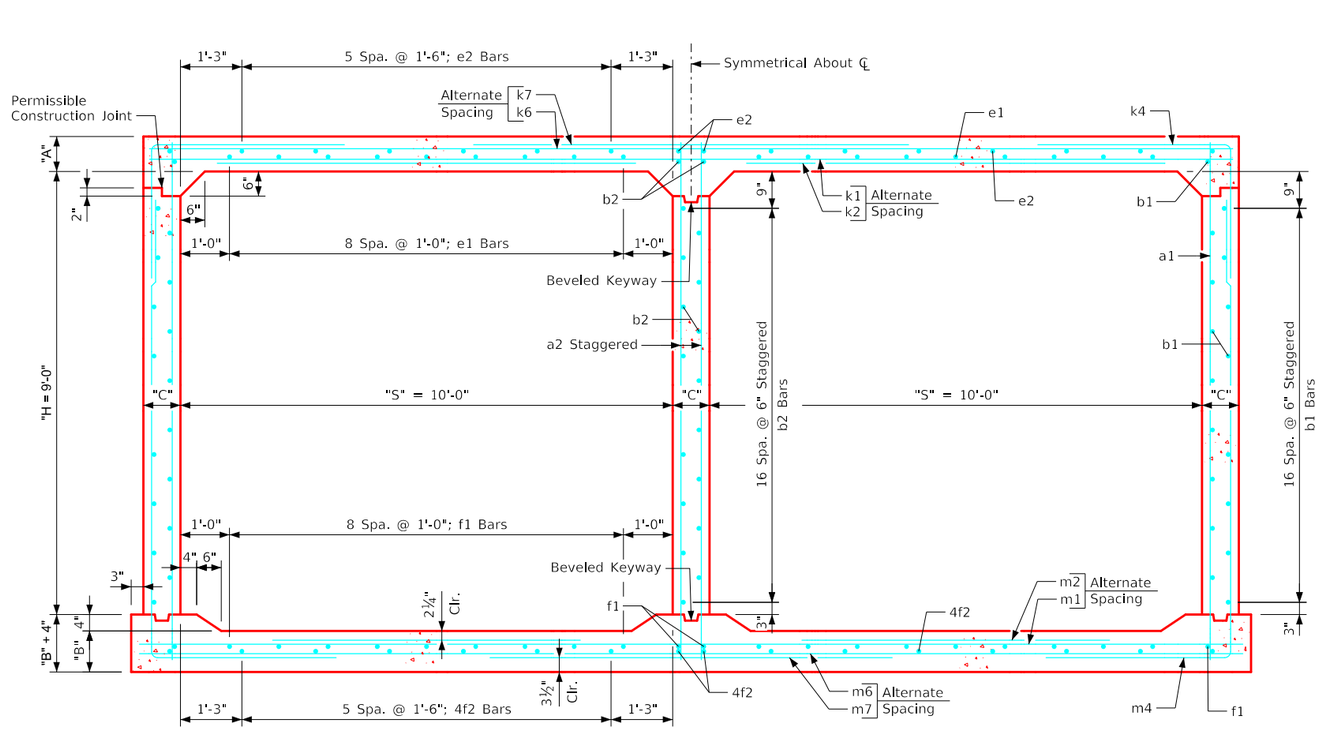
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-8-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 10' x 9' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	9	13	11.5	9	9	9	0'-0	6'-2	2'-1	6'-9
1	10	9	12.5	11.5	9	9	9	0'-6	6'-5	2'-1	6'-2
2	10	9	9	10	9	9	9	1'-10	6'-5	2'-10	4'-10
3	10	9	8	10	9	9	9	2'-7	4'-10	2'-2	3'-11
4	10	9	8	10	9	9	9	2'-1	4'-3	2'-2	3'-8
5-7	10	9	8	10	9	9	9	2'-2	4'-1	3'-2	3'-7
8-10	10	9	9	11.5	9	9	9	2'-2	3'-7	2'-1	3'-6
11-13	10	9	11	13.5	9	9	9	1'-10	3'-7	2'-0	3'-7
14-16	10	9	12.5	15	9	9	9	1'-8	3'-8	1'-11	3'-9
17-19	10	9	14	16	10	9	9	1'-7	3'-9	2'-2	3'-10
20-22	10	9	14.5	17	10.5	9	9	1'-7	3'-9	1'-10	3'-11
23-25	10	9	16.5	18.5	11	9	9	1'-2	3'-11	1'-8	4'-0

Bar List																																									
	a1			a2			b1			b2			e1			e2			f1			f2			k1			k2			k4					k6			k7			k9		
Fill	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	4	12	10'-11	6	9	10'-11	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	6	18	21'-11	5	18	10'-11	4	6	9'-6	6'-5	3'-1	4	12	21'-11	4	12	12'-4	4	4.5	21'-11
1	4	12	10'-11	6	9	10'-11	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	6	18	21'-11	5	18	10'-5	6	12	10'-4	6'-6	3'-10	5	18	21'-11	5	18	12'-10	5	4.5	21'-11
2	4	12	10'-6	6	9	10'-6	4	6	36	4	6	19	5	12	18	4	18	16	4	12	22	4	18	16	5	9	21'-11	4	9	8'-2	5	6	9'-8	6'-6	3'-2	5	12	21'-11	5	12	12'-10	5	4.5	21'-11
3	4	12	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	9	21'-11	4	9	6'-6	5	6	7'-2	4'-1	3'-1	4	12	21'-11	6	12	9'-8	6	4.5	21'-11
4	4	12	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-9	6	9	7'-6	4'-0	3'-6	4	12	21'-11	6	12	8'-6	6	4.5	21'-11
5-7	4	12	10'-5	6	9	10'-5	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-5	5	6	7'-4	3'-8	3'-8	4	12	21'-11	7	12	8'-2	7	4.5	21'-11
8-10	4	12	10'-7	6	9	10'-7	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	21'-11	5	12	7'-11	5	6	6'-8	3'-4	3'-4	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
11-13	4	12	10'-11	6	9	10'-11	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	6	18	21'-11	6	18	8'-8	5	6	6'-8	3'-4	3'-4	4	9	21'-11	6	9	7'-2	6	4.5	21'-11
14-16	4	12	11'-2	6	9	11'-2	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	6	18	21'-11	6	18	9'-3	5	6	7'-0	3'-6	3'-6	5	12	21'-11	7	12	7'-4	7	4.5	21'-11
17-19	4	9	11'-5	7	9	11'-5	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-2	5	12	9'-5	6	9	7'-4	3'-4	4'-0	5	12	22'-2	7	12	7'-6	7	4.5	22'-2
20-22	4	12	11'-6	7	9	11'-6	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-3	5	12	9'-6	6	9	7'-5	3'-4	4'-1	5	12	22'-3	7	12	7'-6	7	4.5	22'-3
23-25	4	9	11'-10	7	9	11'-10	4	6	36	4	6	19	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	10'-0	6	9	7'-7	3'-5	4'-2	5	12	22'-5	7	12	7'-10	7	4.5	22'-5

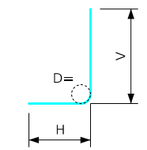
Bar List																									Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	12	22'-5	5	12	8'-2	5	6	15'-7	6'-2	9'-5	5	18	22'-5	7	18	13'-6	7	4.5	22'-5	0.950	0.866	0.715	2.531	354.84
1	5	12	22'-5	5	12	8'-1	7	12	15'-10	6'-5	9'-5	4	9	22'-5	4	9	12'-4	4	4.5	22'-5	0.915	0.866	0.715	2.496	361.68
2	6	12	22'-5	5	12	6'-7	5	6	13'-10	4'-7	9'-3	5	18	22'-5	8	18	9'-8	8	4.5	22'-5	0.675	0.761	0.715	2.151	396.03
3	5	12	22'-5	5	12	7'-8	5	6	13'-2	3'-11	9'-3	4	9	22'-5	5	9	7'-10	5	4.5	22'-5	0.606	0.761	0.715	2.082	352.24
4	5	12	22'-5	5	12	7'-8	6	9	13'-1	3'-10	9'-3	4	9	22'-5	5	9	7'-4	5	4.5	22'-5	0.606	0.761	0.715	2.082	347.32
5-7	5	9	22'-5	4	9	5'-9	5	6	12'-10	3'-7	9'-3	5	9	22'-5	5	9	7'-2	5	4.5	22'-5	0.606	0.761	0.715	2.082	363.16
8-10	5	12	22'-5	5	12	8'-3	5	6	12'-9	3'-4	9'-5	5	9	22'-5	5	9	7'-0	5	4.5	22'-5	0.675	0.866	0.715	2.256	361.71
11-13	5	12	22'-5	5	12	8'-5	5	6	12'-11	3'-4	9'-7	5	9	22'-5	5	9	7'-2	5	4.5	22'-5	0.812	1.007	0.715	2.534	365.37
14-16	5	12	22'-5	5	12	9'-1	5	6	13'-0	3'-4	9'-8	4	9	22'-5	6	9	7'-6	6	4.5	22'-5	0.915	1.112	0.715	2.742	370.63
17-19	5	9	22'-8	4	9	8'-5	6	9	13'-2	3'-5	9'-9	5	12	22'-8	7	12	7'-8	7	4.5	22'-8	1.033	1.198	0.795	3.026	397.08
20-22	5	9	22'-9	4	9	9'-2	6	9	13'-3	3'-5	9'-10	5	12	22'-9	7	12	7'-10	7	4.5	22'-9	1.076	1.275	0.837	3.188	395.50
23-25	5	9	22'-11	4	9	9'-7	6	9	13'-5	3'-5	10'-0	5	12	22'-11	7	12	8'-0	7	4.5	22'-11	1.224	1.390	0.876	3.490	406.74



Twin 10' x 9' Barrel Section

Bent Bar Detail

Bars	D
4	3"
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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 9' Barrel Sections

TWRCB 10-9-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 10' x 10' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	10	13	12	10	9	9	0'-0	6'-3	1'-8	6'-3
1	10	10	12.5	11.5	10	9	9	0'-6	6'-5	2'-1	6'-3
2	10	10	9	10	10	9	9	1'-10	6'-5	2'-8	4'-7
3	10	10	8	10	10	9	9	1'-10	4'-9	2'-2	3'-10
4	10	10	8	10	10	9	9	2'-1	4'-2	2'-2	3'-7
5-7	10	10	8	10	10	9	9	2'-3	3'-11	3'-2	3'-9
8-10	10	10	9	11.5	10	9	9	2'-2	3'-9	2'-1	3'-5
11-13	10	10	11	13.5	10	9	9	1'-10	3'-6	2'-0	3'-7
14-16	10	10	12.5	15	10.5	9	9	1'-10	3'-7	1'-11	3'-9
17-19	10	10	14	16	11	6	9	1'-6	3'-9	2'-2	3'-10
20-22	10	10	14.5	17	11.5	9	9	1'-7	3'-9	1'-11	3'-11
23-25	10	10	16.5	18	12	6	9	1'-1	3'-11	1'-7	4'-0

Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	12'-0	7	9	12'-0	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
1	4	12	11'-11	7	9	11'-11	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
2	4	12	11'-6	7	9	11'-6	4	6	40	4	6	21	5	12	18	4	18	16	4	12	22	4	18	16
3	4	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
4	4	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
5-7	4	12	11'-5	7	9	11'-5	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
8-10	4	12	11'-7	7	9	11'-7	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
11-13	4	9	11'-11	7	9	11'-11	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
14-16	4	9	12'-2	7	9	12'-2	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
17-19	4	6	12'-5	7	9	12'-5	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
20-22	4	9	12'-6	7	9	12'-6	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16
23-25	4	6	12'-9	7	9	12'-9	4	6	40	4	6	21	4	12	18	4	18	16	4	12	22	4	18	16

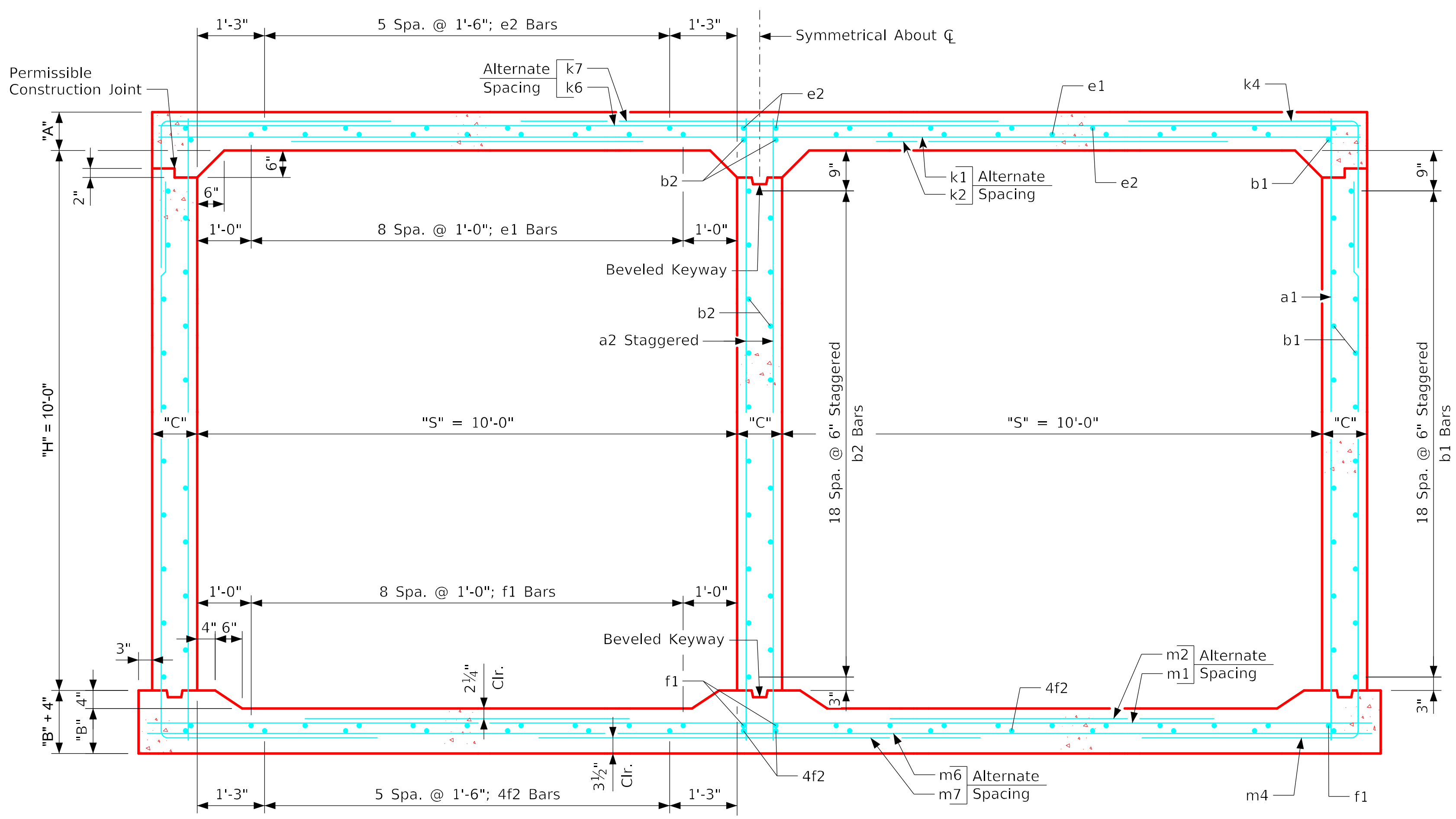
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	22'-2	5	18	11'-1	6	12	10'-4	6'-5	3'-11	4	12	22'-2	4	12	12'-6	4	4.5	22'-2
1	6	18	22'-2	5	18	10'-7	5	6	10'-1	6'-8	3'-5	5	18	22'-2	5	18	12'-10	5	4.5	22'-2
2	5	9	22'-2	4	9	8'-1	5	6	9'-10	6'-8	3'-2	5	12	22'-2	5	12	12'-10	5	4.5	22'-2
3	5	12	22'-2	5	12	8'-2	5	6	7'-7	4'-6	3'-1	4	12	22'-2	6	12	9'-6	6	4.5	22'-2
4	5	12	22'-2	5	12	7'-10	5	6	7'-3	4'-2	3'-1	4	12	22'-2	6	12	8'-4	6	4.5	22'-2
5-7	5	12	22'-2	5	12	7'-4	5	6	7'-1	4'-0	3'-1	5	12	22'-2	6	12	7'-10	6	4.5	22'-2
8-10	5	12	22'-2	5	12	7'-7	6	9	7'-8	3'-10	3'-10	4	12	22'-2	7	12	7'-6	7	4.5	22'-2
11-13	6	18	22'-2	6	18	8'-8	6	9	7'-6	3'-9	3'-9	5	9	22'-2	5	9	7'-0	5	4.5	22'-2
14-16	6	18	22'-3	6	18	8'-10	5	6	7'-4	3'-8	3'-8	4	9	22'-3	6	9	7'-2	6	4.5	22'-3
17-19	6	18	22'-5	6	18	9'-8	6	9	8'-0	4'-0	4'-0	4	9	22'-5	6	9	7'-6	6	4.5	22'-5
20-22	5	12	22'-6	5	12	9'-7	5	6	7'-4	3'-8	3'-8	5	12	22'-6	7	12	7'-6	7	4.5	22'-6
23-25	5	12	22'-8	5	12	10'-3	6	9	7'-11	3'-8	4'-3	4	9	22'-8	6	9	7'-10	6	4.5	22'-8

Bar List

	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	22'-8	6	18	8'-10	7	12	16'-10	6'-5	10'-5	4	9	22'-8	4	9	12'-6	4	4.5	22'-8
1	5	12	22'-8	5	12	8'-1	5	6	16'-10	6'-5	10'-5	4	9	22'-8	4	9	12'-6	4	4.5	22'-8
2	5	9	22'-8	4	9	6'-8	5	6	14'-11	4'-8	10'-3	5	18	22'-8	8	18	9'-2	8	4.5	22'-8
3	5	12	22'-8	5	12	7'-8	5	6	14'-5	4'-2	10'-3	4	9	22'-8	5	9	7'-8	5	4.5	22'-8
4	5	12	22'-8	5	12	7'-7	5	6	14'-3	4'-0	10'-3	4	9	22'-8	5	9	7'-2	5	4.5	22'-8
5-7	5	9	22'-8	4	9	5'-8	5	6	14'-1	3'-10	10'-3	4	12	22'-8	7	12	7'-6	7	4.5	22'-8
8-10	5	12	22'-8	5	12	8'-2	6	9	14'-3	3'-10	10'-5	5	9	22'-8	5	9	6'-10	5	4.5	22'-8
11-13	5	12	22'-8	5	12	8'-5	6	9	14'-4	3'-9	10'-7	5	9	22'-8	5	9	7'-2	5	4.5	22'-8
14-16	5	12	22'-9	5	12	9'-0	5	6	14'-5	3'-9	10'-8	4	9	22'-9	6	9	7'-6	6	4.5	22'-9
17-19	5	9	22'-11	4	9	8'-5	6	9	14'-6	3'-9	10'-9	5	12	22'-11	7	12	7'-8	7	4.5	22'-11
20-22	5	9	23'-0	4	9	8'-11	5	6	14'-8	3'-10	10'-10	5	12	23'-0	7	12	7'-10	7	4.5	23'-0
23-25	5	9	23'-2	4	9	9'-9	6	9	14'-8	3'-9	10'-11	5	9	23'-2	6	9	8'-0	6	4.5	23'-2

Quantities

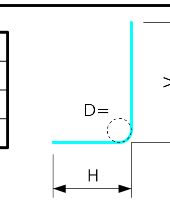
	Concrete (CY/FT)				Steel
Fill	Slab	Floor	Walls	Total	(LB/FT)
0	0.964	0.914	0.887	2.765	383.53
1	0.929	0.878	0.887	2.694	389.50
2	0.686	0.772	0.887	2.345	411.76
3	0.616	0.772	0.887	2.275	373.37
4	0.616	0.772	0.887	2.275	368.11
5-7	0.616	0.772	0.887	2.275	377.79
8-10	0.686	0.878	0.887	2.451	384.82
11-13	0.825	1.020	0.887	2.732	401.47
14-16	0.936	1.132	0.934	3.002	394.61
17-19	1.048	1.211	0.978	3.237	421.32
20-22	1.091	1.291	1.022	3.404	416.24
23-25	1.240	1.372	1.067	3.679	435.63



Twin 10' x 10' 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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 10' Barrel Sections

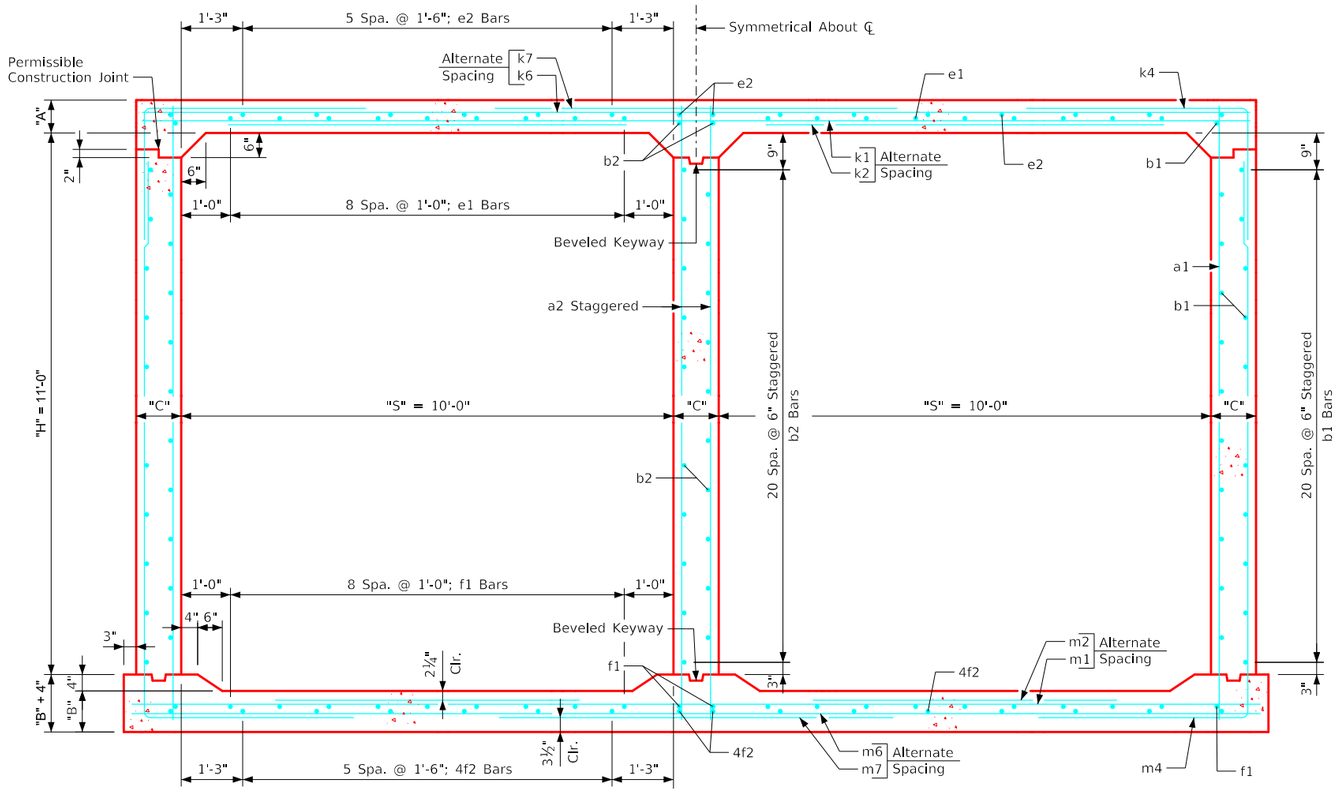
TWRCB 10-10-20

Variable Dimensions and Quantities for Twin 10' x 11' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	11	13	12	11	9	9	0'-1	6'-3	1'-9	6'-3
1	10	11	12.5	12	11	9	9	0'-10	6'-3	1'-11	6'-6
2	10	11	9	10.5	11	9	9	1'-3	6'-6	2'-10	4'-4
3	10	11	8	10	11	9	9	1'-8	4'-6	2'-2	3'-9
4	10	11	8	10	11	9	9	2'-2	3'-11	2'-3	3'-7
5-7	10	11	8	10	11	9	9	2'-3	3'-10	3'-2	3'-9
8-10	10	11	9	11.5	11	9	9	2'-3	3'-8	2'-1	3'-8
11-13	10	11	11	13.5	11	6	9	1'-11	3'-8	2'-1	3'-8
14-16	10	11	12.5	14.5	11.5	9	9	1'-9	3'-7	1'-10	3'-8
17-19	10	11	13.5	16	12.5	6	9	1'-8	3'-8	2'-2	3'-10
20-22	10	11	14.5	17	12.5	9	9	1'-5	3'-9	1'-11	3'-11
23-25	10	11	16	18	13	9	6	1'-8	3'-10	1'-8	4'-0

Bar List																																								
	a1			a2			b1			b2			e1			e2			f1			f2			k1			k2			k4					k6			k7			k9		
Fill	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	4	12	13'-0	7	9	13'-0	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	6	18	22'-5	5	18	11'-1	6	9	10'-6	6'-7	3'-11	4	12	22'-5	4	12	12'-6	4	4.5	22'-5
1	4	9	12'-11	7	9	12'-11	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	6	18	22'-5	5	18	10'-4	6	9	10'-6	6'-7	3'-11	4	12	22'-5	4	12	12'-6	4	4.5	22'-5
2	4	9	12'-6	7	9	12'-6	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	9'-9	6	9	10'-3	6'-8	3'-7	5	12	22'-5	5	12	13'-0	5	4.5	22'-5
3	4	9	12'-5	7	9	12'-5	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	8'-4	6	9	8'-6	5'-0	3'-6	5	12	22'-5	5	12	9'-0	5	4.5	22'-5
4	4	9	12'-5	7	9	12'-5	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	7'-6	6	9	8'-2	4'-8	3'-6	5	12	22'-5	5	12	7'-10	5	4.5	22'-5
5-7	4	9	12'-5	7	9	12'-5	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	7'-5	5	6	7'-4	4'-3	3'-1	5	12	22'-5	6	12	7'-8	6	4.5	22'-5
8-10	5	12	12'-7	7	9	12'-7	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-5	5	12	7'-7	6	9	7'-8	4'-1	3'-7	4	12	22'-5	7	12	7'-4	7	4.5	22'-5
11-13	4	6	12'-11	7	9	12'-11	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	6	18	22'-5	6	18	8'-5	6	9	8'-2	4'-1	4'-1	4	12	22'-5	7	12	7'-4	7	4.5	22'-5
14-16	5	9	13'-2	7	9	13'-2	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	6	18	22'-6	6	18	9'-0	6	9	8'-2	4'-1	4'-1	5	9	22'-6	5	9	7'-2	5	4.5	22'-6
17-19	4	6	13'-4	7	9	13'-4	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-9	5	12	9'-2	5	6	7'-8	4'-1	3'-7	4	9	22'-9	6	9	7'-4	6	4.5	22'-9
20-22	6	12	13'-6	7	9	13'-6	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	12	22'-9	5	12	9'-10	5	6	8'-2	4'-1	4'-1	5	12	22'-9	7	12	7'-6	7	4.5	22'-9
23-25	6	9	13'-9	6	6	13'-9	4	6	44	4	6	23	4	12	18	4	18	16	4	12	22	4	18	16	5	9	22'-11	4	9	9'-5	6	9	8'-4	4'-2	4'-2	5	12	22'-11	7	12	7'-8	7	4.5	22'-11

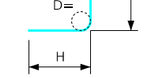
Bar List																							Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	18	22'-11	6	18	8'-10	6	9	18'-0	6'-7	11'-5	4	9	22'-11	4	9	12'-6	4	4.5	22'-11	0.978	0.924	1.080	2.982	404.26
1	4	9	22'-11	4	9	8'-5	6	9	18'-1	6'-8	11'-5	4	12	22'-11	5	12	13'-0	5	4.5	22'-11	0.943	0.924	1.080	2.947	399.61
2	5	9	22'-11	4	9	6'-5	6	9	16'-5	5'-1	11'-4	4	12	22'-11	6	12	8'-8	6	4.5	22'-11	0.697	0.816	1.080	2.593	418.13
3	5	12	22'-11	5	12	7'-8	6	9	15'-10	4'-7	11'-3	4	9	22'-11	5	9	7'-6	5	4.5	22'-11	0.627	0.780	1.080	2.487	399.26
4	5	12	22'-11	5	12	7'-7	6	9	15'-7	4'-4	11'-3	4	9	22'-11	5	9	7'-2	5	4.5	22'-11	0.627	0.780	1.080	2.487	393.39
5-7	5	9	22'-11	4	9	5'-8	5	6	15'-4	4'-1	11'-3	4	12	22'-11	7	12	7'-6	7	4.5	22'-11	0.627	0.780	1.080	2.487	398.58
8-10	5	12	22'-11	5	12	8'-2	6	9	15'-6	4'-1	11'-5	4	12	22'-11	7	12	7'-4	7	4.5	22'-11	0.697	0.888	1.080	2.665	400.39
11-13	5	12	22'-11	5	12	8'-4	6	9	15'-9	4'-2	11'-7	4	12	22'-11	7	12	7'-4	7	4.5	22'-11	0.837	1.032	1.080	2.949	413.79
14-16	5	12	23'-0	5	12	9'-1	6	9	15'-9	4'-1	11'-8	4	9	23'-0	6	9	7'-4	6	4.5	23'-0	0.950	1.111	1.129	3.190	431.55
17-19	5	9	23'-3	4	9	8'-6	5	6	15'-11	4'-2	11'-9	5	12	23'-3	7	12	7'-8	7	4.5	23'-3	1.035	1.234	1.227	3.496	436.42
20-22	5	9	23'-3	4	9	9'-0	5	6	16'-0	4'-2	11'-10	5	12	23'-3	7	12	7'-10	7	4.5	23'-3	1.106	1.307	1.227	3.640	453.21
23-25	5	9	23'-5	4	9	9'-6	6	9	16'-0	4'-1	11'-11	5	9	23'-5	6	9	8'-0	6	4.5	23'-5	1.221	1.388	1.275	3.884	483.53



Twin 10' x 11' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"



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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

10' x 11' Barrel Sections

TWRCB 10-11-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-11-20 - THIS SHEET ISSUED 07-2020.

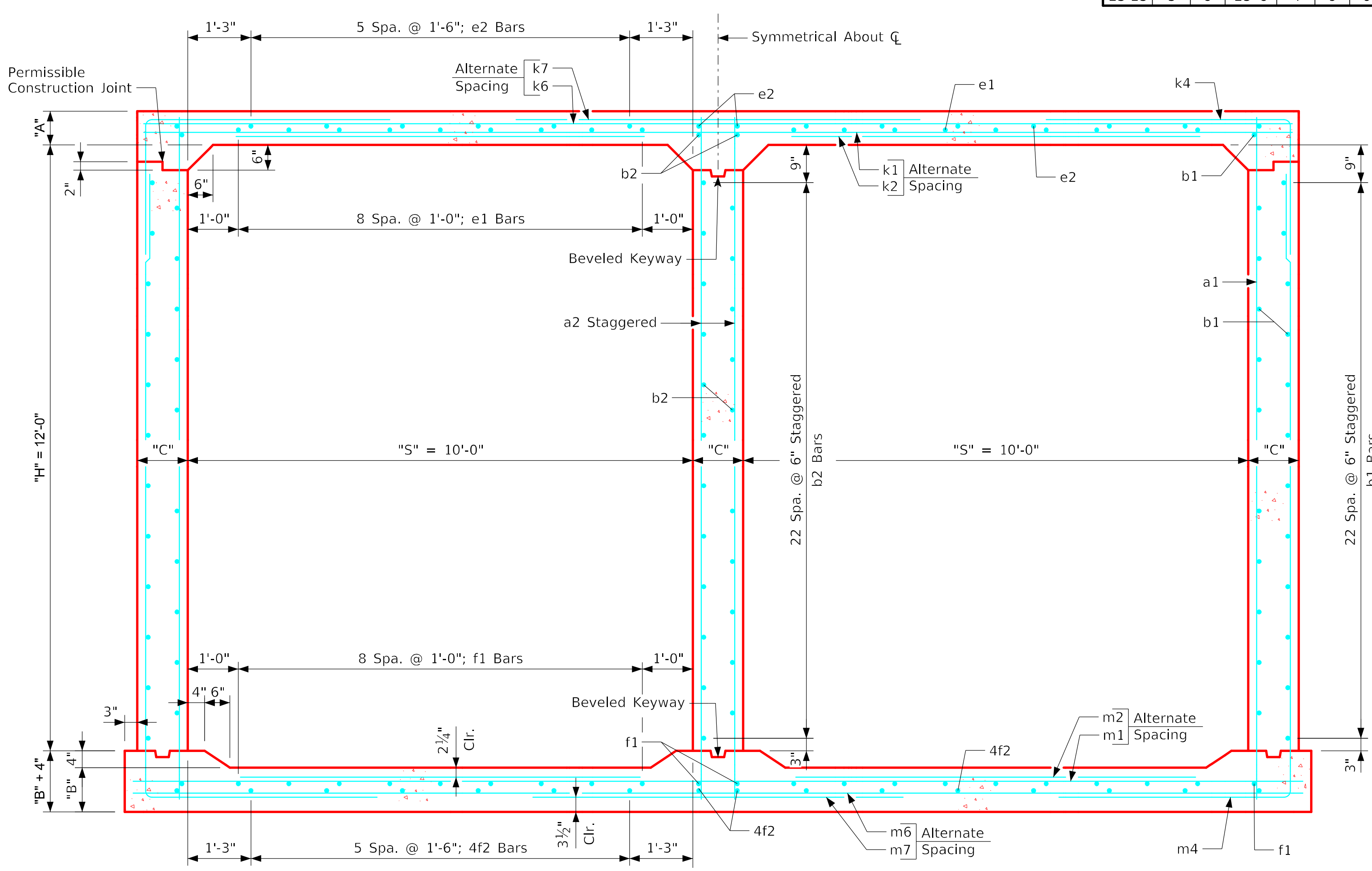
Variable Dimensions and Quantities for Twin 10' x 12' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	10	12	13	12.5	12	9	9	0'-2	6'-4	1'-8	6'-6
1	10	12	12.5	12	12	9	9	0'-10	6'-4	1'-11	5'-1
2	10	12	9	10.5	12	6	9	1'-3	6'-11	2'-1	4'-1
3	10	12	8	10	12	9	9	1'-8	4'-4	2'-2	3'-8
4	10	12	8	10	12	6	9	1'-11	3'-11	2'-3	3'-6
5-7	10	12	8	10	12	9	9	2'-4	3'-10	3'-2	3'-8
8-10	10	12	9	11.5	12	9	9	2'-3	3'-7	2'-1	3'-8
11-13	10	12	10	13.5	12	9	9	2'-1	3'-5	2'-1	3'-8
14-16	10	12	12	14.5	12.5	9	9	1'-9	3'-7	1'-11	3'-8
17-19	10	12	13.5	16	13.5	9	6	1'-9	3'-8	2'-1	3'-10
20-22	10	12	14.5	17	13.5	9	6	1'-5	3'-9	2'-0	3'-11
23-25	10	12	16	18.5	14.5	6	9	1'-4	3'-10	1'-7	4'-1

	Bar List																						
	a1			a2			b1			b2			e1			e2			f1			f2	
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	9	14'-0	7	9	14'-0	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
1	5	12	13'-11	7	9	13'-11	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
2	4	6	13'-6	7	9	13'-6	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
3	5	12	13'-5	7	9	13'-5	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
4	4	6	13'-5	7	9	13'-5	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
5-7	4	9	13'-5	7	9	13'-5	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
8-10	5	12	13'-7	7	9	13'-7	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
11-13	5	12	13'-10	7	9	13'-10	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
14-16	6	12	14'-1	7	9	14'-1	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
17-19	6	9	14'-4	6	6	14'-4	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
20-22	6	9	14'-6	6	6	14'-6	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16
23-25	4	6	14'-9	8	9	14'-9	4	6	48	4	6	25	4	12	18	4	18	16	4	12	22	4	18	16

	Bar List																			
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	22'-8	5	18	11'-2	6	9	10'-6	6'-7	3'-11	4	12	22'-8	4	12	12'-8	4	4.5	22'-8
1	6	18	22'-8	5	18	10'-6	6	9	10'-6	6'-7	3'-11	4	12	22'-8	4	12	12'-8	4	4.5	22'-8
2	5	12	22'-8	5	12	9'-8	6	9	10'-5	6'-10	3'-7	5	18	22'-8	7	18	13'-10	7	4.5	22'-8
3	5	12	22'-8	5	12	8'-4	5	6	8'-3	5'-2	3'-1	5	12	22'-8	5	12	8'-8	5	4.5	22'-8
4	6	18	22'-8	6	18	8'-1	5	6	7'-11	4'-10	3'-1	5	12	22'-8	5	12	7'-10	5	4.5	22'-8
5-7	5	12	22'-8	5	12	7'-3	5	6	7'-8	4'-7	3'-1	5	12	22'-8	6	12	7'-8	6	4.5	22'-8
8-10	5	12	22'-8	5	12	7'-7	7	9	8'-5	4'-6	3'-11	5	12	22'-8	6	12	7'-2	6	4.5	22'-8
11-13	5	12	22'-8	5	12	7'-11	7	9	8'-10	4'-5	4'-5	5	9	22'-8	5	9	6'-10	5	4.5	22'-8
14-16	6	18	22'-9	6	18	9'-0	5	6	7'-9	4'-4	3'-5	4	9	22'-9	6	9	7'-2	6	4.5	22'-9
17-19	5	12	23'-0	5	12	9'-1	5	6	8'-0	4'-5	3'-7	4	9	23'-0	6	9	7'-4	6	4.5	23'-0
20-22	5	12	23'-0	5	12	9'-7	5	6	8'-1	4'-5	3'-8	4	9	23'-0	6	9	7'-6	6	4.5	23'-0
23-25	5	12	23'-3	5	12	10'-3	8	12	9'-4	4'-5	4'-11	4	9	23'-3	6	9	7'-8	6	4.5	23'-3

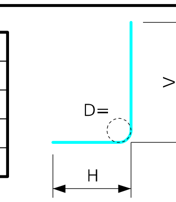
	Bar List																			Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)			Steel
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	6	18	23'-2	6	18	9'-0	6	9	19'-4	6'-10	12'-6	4	12	23'-2	5	12	13'-0	5	4.5	23'-2	0.992	0.973	1.289	3.254	423.71
1	4	9	23'-2	4	9	8'-6	6	9	20'-3	7'-10	12'-5	4	9	23'-2	4	9	10'-2	4	4.5	23'-2	0.956	0.936	1.289	3.181	423.13
2	5	12	23'-2	5	12	8'-2	6	9	17'-6	5'-2	12'-4	4	12	23'-2	6	12	8'-2	6	4.5	23'-2	0.708	0.828	1.289	2.825	441.58
3	5	12	23'-2	5	12	7'-9	5	6	16'-11	4'-8	12'-3	4	9	23'-2	5	9	7'-4	5	4.5	23'-2	0.637	0.791	1.289	2.717	417.55
4	5	12	23'-2	5	12	7'-7	5	6	16'-8	4'-5	12'-3	4	9	23'-2	5	9	7'-0	5	4.5	23'-2	0.637	0.791	1.289	2.717	419.97
5-7	5	9	23'-2	4	9	5'-9	6	6	16'-8	4'-5	12'-3	4	12	23'-2	7	12	7'-4	7	4.5	23'-2	0.637	0.791	1.289	2.717	445.79
8-10	5	12	23'-2	5	12	7'-11	7	9	16'-11	4'-6	12'-5	4	12	23'-2	7	12	7'-4	7	4.5	23'-2	0.708	0.900	1.289	2.897	460.13
11-13	5	12	23'-2	5	12	8'-5	7	9	17'-1	4'-6	12'-7	4	12	23'-2	7	12	7'-4	7	4.5	23'-2	0.779	1.045	1.289	3.113	471.47
14-16	5	12	23'-3	5	12	8'-9	5	6	17'-1	4'-5	12'-8	4	9	23'-3	6	9	7'-4	6	4.5	23'-3	0.928	1.125	1.342	3.395	444.13
17-19	5	9	23'-6	4	9	8'-8	5	6	17'-3	4'-6	12'-9	4	9	23'-6	6	9	7'-8	6	4.5	23'-6	1.049	1.250	1.449	3.748	472.16
20-22	5	9	23'-6	4	9	9'-0	5	6	17'-5	4'-7	12'-10	5	12	23'-6	7	12	7'-10	7	4.5	23'-6	1.121	1.323	1.449	3.893	481.79
23-25	5	9	23'-9	4	9	9'-9	8	12	17'-6	4'-6	13'-0	5	12	23'-9	7	12	8'-2	7	4.5	23'-9	1.246	1.451	1.556	4.253	523.66



Twin 10' x 12' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



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.

LATEST REVISION DATE

[illegible]
APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
10' x 12' Barrel Sections

TWRCB 10-12-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 10-12-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 12' x 4' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	4	14	11.5	9	9	9	0'-0	7'-7	2'-7	5'-6
1	12	4	13	11.5	9	9	9	0'-9	7'-2	2'-7	5'-4
2	12	4	10	10	9	6	9	2'-2	6'-0	3'-5	4'-6
3	12	4	9	10	9	9	9	2'-9	5'-1	3'-8	4'-4
4	12	4	8.5	10	9	9	9	2'-10	4'-6	3'-8	4'-1
5-7	12	4	9	10.5	9	9	9	3'-1	4'-4	3'-6	4'-1
8-10	12	4	11	12.5	9	9	9	2'-5	4'-2	3'-3	4'-1
11-13	12	4	12.5	14.5	9	6	9	2'-10	4'-3	2'-11	4'-3
14-16	12	4	14.5	16.5	9	9	9	2'-4	4'-4	2'-7	4'-5
17-19	12	4	16	18	9	9	9	2'-3	4'-5	2'-4	4'-6
20-22	12	4	18	20	9	9	9	1'-9	4'-7	1'-11	4'-8
23-25	12	4	19.5	21.5	9.5	9	6	1'-8	4'-9	1'-9	4'-10

Bar List

	a1			a2			b1			b2			e1			e2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	5	12	6'-0	7	9	6'-0	4	6	16	4	6	9	4	12	22	4	17	20
1	4	9	5'-11	7	9	5'-11	4	6	16	4	6	9	4	12	22	4	17	20
2	4	6	5'-7	7	9	5'-7	4	6	16	4	6	9	4	12	22	4	17	20
3	5	12	5'-6	6	9	5'-6	4	6	16	4	6	9	4	12	22	4	17	20
4	5	12	5'-5	6	9	5'-5	4	6	16	4	6	9	4	12	22	4	17	20
5-7	5	12	5'-6	6	9	5'-6	4	6	16	4	6	9	4	12	22	4	17	20
8-10	4	12	5'-10	6	9	5'-10	4	6	16	4	6	9	4	12	22	4	17	20
11-13	4	6	6'-2	6	9	6'-2	4	6	16	4	6	9	4	12	22	4	17	20
14-16	4	9	6'-6	6	9	6'-6	4	6	16	4	6	9	4	12	22	4	17	20
17-19	4	12	6'-9	6	9	6'-9	4	6	16	4	6	9	4	12	22	4	17	20
20-22	4	12	7'-1	6	9	7'-1	4	6	16	4	6	9	4	12	22	4	17	20
23-25	4	9	7'-4	5	6	7'-4	4	6	16	4	6	9	4	12	22	4	17	20

	f1			f2			k1			k2		
Fill	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L
0	4	12	26	4	17	20	6	18	25'-11	6	18	12'-11
1	4	12	26	4	17	20	6	18	25'-11	6	18	12'-2
2	4	12	26	4	17	20	5	9	25'-11	4	9	9'-10
3	4	12	26	4	17	20	5	9	25'-11	4	9	8'-6
4	4	12	26	4	17	20	5	9	25'-11	4	9	8'-0
5-7	4	12	26	4	17	20	5	9	25'-11	4	9	7'-8
8-10	4	12	26	4	17	20	5	12	25'-11	5	12	9'-7
11-13	4	12	26	4	17	20	5	9	25'-11	4	9	9'-1
14-16	4	12	26	4	17	20	5	9	25'-11	4	9	10'-3
17-19	4	12	26	4	17	20	6	12	25'-11	5	12	10'-8
20-22	4	12	26	4	17	20	6	12	25'-11	5	12	11'-2
23-25	5	12	26	4	17	20	6	12	26'-0	5	12	11'-4

	k4					k6			k7			k9		
Fill	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	9	6'-7	2'-7	4'-0	5	18	25'-11	6	18	15'-2	6	4.5	25'-11
1	6	9	6'-11	3'-0	3'-11	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	5	6	6'-8	3'-4	3'-4	5	12	25'-11	6	12	12'-0	6	4.5	25'-11
3	6	9	7'-2	3'-7	3'-7	4	12	25'-11	7	12	10'-2	7	4.5	25'-11
4	6	9	7'-2	3'-7	3'-7	4	9	25'-11	6	9	9'-0	6	4.5	25'-11
5-7	6	9	7'-2	3'-7	3'-7	5	9	25'-11	6	9	8'-8	6	4.5	25'-11
8-10	5	6	5'-10	2'-6	3'-4	5	9	25'-11	6	9	8'-4	6	4.5	25'-11
11-13	4	6	5'-5	2'-4	3'-1	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	4	6	5'-7	2'-4	3'-3	5	12	25'-11	8	12	8'-8	8	4.5	25'-11
17-19	4	6	5'-10	2'-5	3'-5	5	9	25'-11	7	9	8'-10	7	4.5	25'-11
20-22	4	6	6'-1	2'-6	3'-7	5	9	25'-11	7	9	9'-2	7	4.5	25'-11
23-25	5	12	6'-7	2'-7	4'-0	5	9	26'-0	7	9	9'-6	7	4.5	26'-0

Bar List

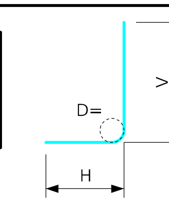
	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	26'-5	5	12	8'-11	6	9	9'-6	4'-9	4'-9	4	12	26'-5	6	12	11'-0	6	4.5	26'-5
1	5	12	26'-5	5	12	8'-10	6	9	8'-2	3'-9	4'-5	5	12	26'-5	5	12	10'-8	5	4.5	26'-5
2	6	12	26'-5	5	12	7'-0	5	6	7'-8	3'-5	4'-3	5	9	26'-5	5	9	9'-0	5	4.5	26'-5
3	5	9	26'-5	4	9	6'-6	6	9	7'-7	3'-4	4'-3	4	12	26'-5	7	12	8'-8	7	4.5	26'-5
4	5	9	26'-5	4	9	6'-7	6	9	7'-7	3'-4	4'-3	5	9	26'-5	5	9	8'-2	5	4.5	26'-5
5-7	6	12	26'-5	5	12	6'-11	6	9	7'-6	3'-2	4'-4	5	9	26'-5	6	9	8'-2	6	4.5	26'-5
8-10	5	9	26'-5	4	9	8'-1	5	6	7'-1	2'-7	4'-6	5	9	26'-5	6	9	8'-2	6	4.5	26'-5
11-13	5	9	26'-5	4	9	9'-0	4	6	7'-1	2'-5	4'-8	4	9	26'-5	7	9	8'-6	7	4.5	26'-5
14-16	6	12	26'-5	5	12	9'-11	4	6	7'-3	2'-5	4'-10	4	9	26'-5	7	9	8'-10	7	4.5	26'-5
17-19	6	12	26'-5	5	12	10'-8	4	6	7'-4	2'-5	4'-11	5	9	26'-5	7	9	9'-0	7	4.5	26'-5
20-22	6	12	26'-5	5	12	11'-1	4	6	7'-7	2'-6	5'-1	5	9	26'-5	7	9	9'-4	7	4.5	26'-5
23-25	6	12	26'-6	5	12	11'-4	5	12	7'-10	2'-7	5'-3	5	9	26'-6	7	9	9'-8	7	4.5	26'-6

Quantities

	Concrete (CY/FT)				Steel (LB/FT)
Fill	Slab	Floor	Walls	Total	
0	1.191	1.008	0.299	2.498	346.39
1	1.110	1.008	0.299	2.417	341.32
2	0.867	0.885	0.299	2.051	374.39
3	0.786	0.885	0.299	1.970	342.68
4	0.745	0.885	0.299	1.929	352.55
5-7	0.786	0.926	0.299	2.011	376.87
8-10	0.948	1.091	0.299	2.338	359.34
11-13	1.070	1.256	0.299	2.625	344.42
14-16	1.232	1.421	0.299	2.952	358.53
17-19	1.353	1.545	0.299	3.197	388.00
20-22	1.515	1.710	0.299	3.524	394.03
23-25	1.646	1.844	0.315	3.805	406.63

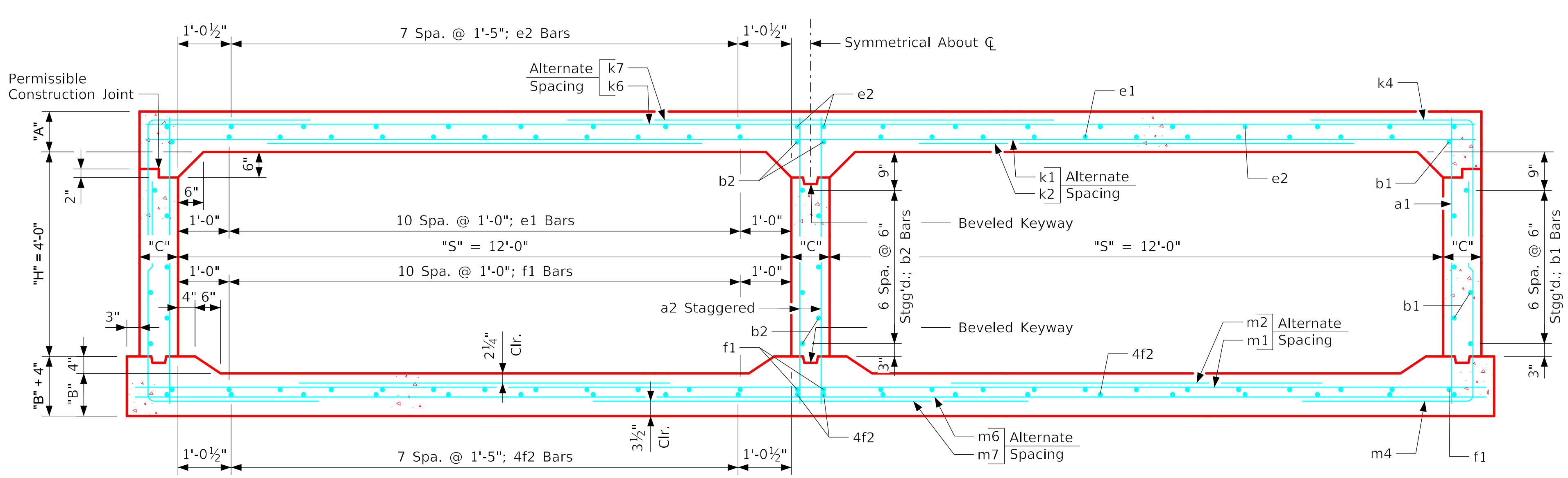
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 12' x 4' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
12' x 4' Barrel Sections

TWRCB 12-4-20

Variable Dimensions and Quantities for Twin 12' x 5' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	5	14	12	9	9	9	0'-2	7'-7	2'-6	6'-0
1	12	5	13.5	11.5	9	9	9	0'-8	7'-2	2'-7	5'-6
2	12	5	10	10	9	6	9	2'-1	6'-2	3'-4	4'-7
3	12	5	9	10	9	9	9	2'-8	5'-2	3'-7	4'-5
4	12	5	9	10	9	9	9	2'-11	4'-9	3'-7	4'-1
5-7	12	5	9.5	11	9	9	9	2'-3	4'-7	3'-4	4'-2
8-10	12	5	11	13	9	9	9	3'-0	4'-2	3'-2	4'-1
11-13	12	5	12.5	14.5	9	6	9	2'-10	4'-3	3'-0	4'-3
14-16	12	5	14.5	16.5	9	9	9	2'-3	4'-4	2'-7	4'-5
15-19	12	5	16	18	9	9	9	2'-3	4'-5	2'-4	4'-6
20-22	12	5	18	20	9	9	9	1'-9	4'-7	1'-10	4'-8
23-25	12	5	19.5	21.5	9	9	9	1'-7	4'-8	1'-9	4'-10

	Bar List																							
	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	7'-1	7	9	7'-1	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
1	4	9	7'-0	7	9	7'-0	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
2	4	6	6'-7	7	9	6'-7	4	6	20	4	6	11	5	12	22	4	17	20	4	12	26	4	17	20
3	4	9	6'-6	6	9	6'-6	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
4	4	9	6'-6	6	9	6'-6	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
5-7	4	12	6'-7	6	9	6'-7	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
8-10	4	12	6'-11	6	9	6'-11	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
11-13	4	6	7'-2	6	9	7'-2	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
14-16	4	9	7'-6	6	9	7'-6	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
15-19	4	12	7'-9	6	9	7'-9	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
20-22	4	12	8'-1	6	9	8'-1	4	6	20	4	6	11	4	12	22	4	17	20	4	12	26	4	17	20
23-25	4	9	8'-4	6	9	8'-4	4	6	20	4	6	11	4	12	22	4	17	20	5	12	26	4	17	20

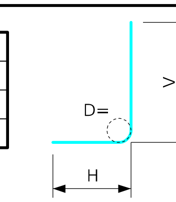
	Bar List																			
	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	25'-11	6	18	12'-9	5	9	6'-8	3'-1	3'-7	5	18	25'-11	6	18	15'-2	6	4.5	25'-11
1	6	18	25'-11	6	18	12'-3	6	9	7'-0	3'-1	3'-11	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	6	12	25'-11	5	12	10'-1	6	9	7'-4	3'-8	3'-8	5	12	25'-11	6	12	12'-4	6	4.5	25'-11
3	5	9	25'-11	4	9	8'-5	6	9	7'-2	3'-7	3'-7	4	12	25'-11	7	12	10'-4	7	4.5	25'-11
4	5	9	25'-11	4	9	8'-0	6	9	7'-2	3'-7	3'-7	4	12	25'-11	7	12	9'-6	7	4.5	25'-11
5-7	5	12	25'-11	5	12	9'-6	5	6	6'-6	3'-3	3'-3	5	12	25'-11	7	12	9'-2	7	4.5	25'-11
8-10	5	9	25'-11	4	9	8'-4	5	6	5'-10	2'-6	3'-4	5	9	25'-11	6	9	8'-4	6	4.5	25'-11
11-13	5	9	25'-11	4	9	9'-0	4	6	5'-6	2'-5	3'-1	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	7	18	25'-11	6	18	10'-6	4	6	5'-8	2'-5	3'-3	5	12	25'-11	8	12	8'-8	8	4.5	25'-11
15-19	6	12	25'-11	5	12	10'-8	4	6	5'-11	2'-6	3'-5	5	9	25'-11	7	9	8'-10	7	4.5	25'-11
20-22	6	12	25'-11	5	12	11'-2	4	6	6'-2	2'-7	3'-7	5	9	25'-11	7	9	9'-2	7	4.5	25'-11
23-25	6	12	25'-11	5	12	11'-4	5	12	6'-8	2'-8	4'-0	5	9	25'-11	7	9	9'-4	7	4.5	25'-11

	Bar List																			
	m1			m2			m4					m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	12	26'-5	5	12	9'-1	6	9	10'-10	5'-5	5'-5	5	12	26'-5	5	12	12'-0	5	4.5	26'-5
1	5	12	26'-5	5	12	8'-11	6	9	9'-6	4'-1	5'-5	4	12	26'-5	6	12	11'-0	6	4.5	26'-5
2	6	12	26'-5	5	12	7'-2	6	9	8'-9	3'-6	5'-3	4	9	26'-5	6	9	9'-2	6	4.5	26'-5
3	5	9	26'-5	4	9	6'-9	6	9	8'-7	3'-4	5'-3	4	12	26'-5	7	12	8'-10	7	4.5	26'-5
4	5	9	26'-5	4	9	6'-9	6	9	8'-7	3'-4	5'-3	4	9	26'-5	6	9	8'-2	6	4.5	26'-5
5-7	5	9	26'-5	4	9	7'-5	5	6	8'-5	3'-1	5'-4	5	9	26'-5	6	9	8'-4	6	4.5	26'-5
8-10	5	9	26'-5	4	9	8'-4	5	6	8'-1	2'-7	5'-6	5	9	26'-5	6	9	8'-2	6	4.5	26'-5
11-13	6	12	26'-5	5	12	8'-10	4	6	8'-1	2'-5	5'-8	4	9	26'-5	7	9	8'-6	7	4.5	26'-5
14-16	6	12	26'-5	5	12	10'-0	4	6	8'-3	2'-5	5'-10	4	9	26'-5	7	9	8'-10	7	4.5	26'-5
17-19	6	12	26'-5	5	12	10'-8	4	6	8'-5	2'-6	5'-11	5	9	26'-5	7	9	9'-0	7	4.5	26'-5
20-22	6	12	26'-5	5	12	11'-2	4	6	8'-8	2'-7	6'-1	5	9	26'-5	7	9	9'-4	7	4.5	26'-5
23-25	6	12	26'-5	5	12	11'-3	5	12	8'-11	2'-8	6'-3	5	9	26'-5	7	9	9'-8	7	4.5	26'-5

	Quantities				
	Concrete (CY/FT)				Steel (LB/FT)
Fill	Slab	Floor	Walls	Total	
0	1.191	1.050	0.382	2.623	352.16
1	1.151	1.008	0.382	2.541	353.26
2	0.867	0.885	0.382	2.134	401.18
3	0.786	0.885	0.382	2.053	353.71
4	0.786	0.885	0.382	2.053	353.87
5-7	0.826	0.967	0.382	2.175	368.18
8-10	0.948	1.132	0.382	2.462	375.26
11-13	1.070	1.256	0.382	2.708	362.58
14-16	1.232	1.421	0.382	3.035	374.76
17-19	1.353	1.545	0.382	3.280	398.55
20-22	1.515	1.710	0.382	3.607	404.71
23-25	1.637	1.834	0.382	3.853	415.42

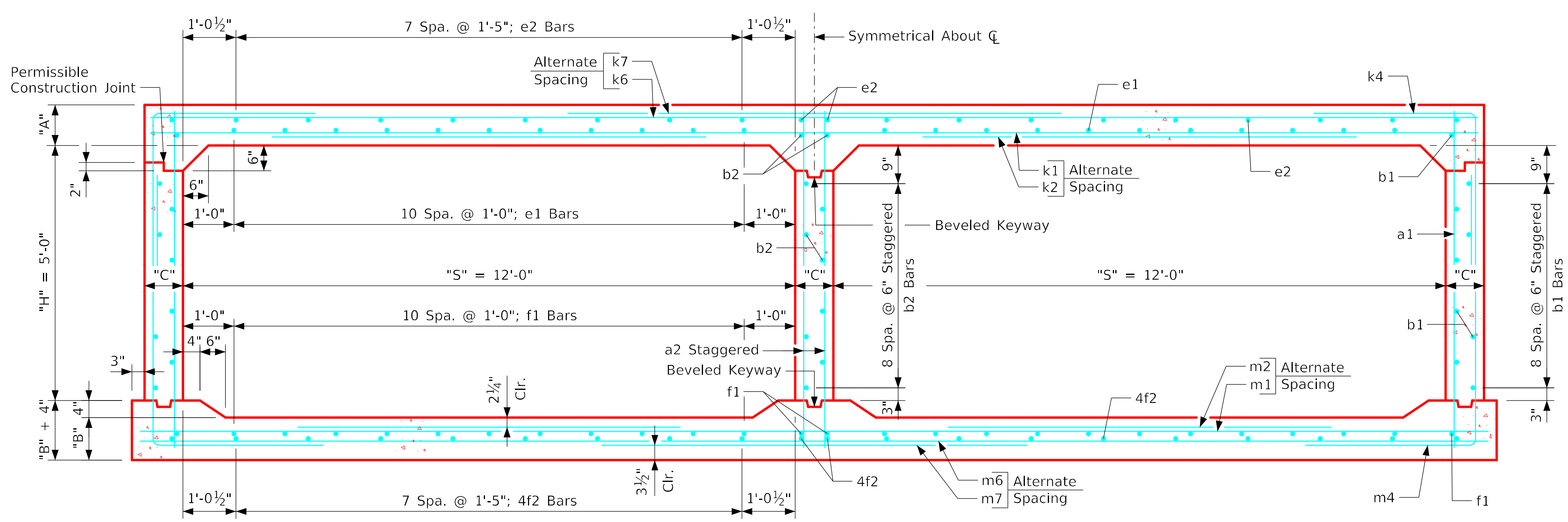
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 12' x 5' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
12' x 5' Barrel Sections

TWRCB 12-5-20

Variable Dimensions and Quantities for Twin 12' x 6' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	6	14	12	9	9	9	0'-2	7'-5	2'-6	6'-5
1	12	6	13.5	11.5	9	9	9	0'-8	7'-2	2'-6	5'-7
2	12	6	10	10	9	6	9	2'-0	6'-5	3'-2	4'-7
3	12	6	9	10	9	9	9	2'-7	5'-4	3'-6	4'-4
4	12	6	9	10	9	9	9	2'-10	4'-8	3'-6	4'-3
5-7	12	6	9.5	11	9	9	9	3'-1	4'-6	3'-3	4'-2
8-10	12	6	11	13	9	9	9	3'-0	4'-2	3'-3	4'-2
11-13	12	6	13	15	9	9	9	2'-11	4'-3	2'-11	4'-3
14-16	12	6	14.5	16.5	9	9	9	2'-4	4'-4	2'-6	4'-5
17-19	12	6	16	18.5	9	9	9	2'-3	4'-5	2'-2	4'-7
20-22	12	6	18	20	9	9	9	1'-9	4'-7	1'-7	4'-8
23-25	12	6	19.5	21.5	9	9	9	1'-7	4'-8	1'-9	4'-10

Bar List

Fill	a1			a2			b1			b2			e1		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	8'-1	6	9	8'-1	4	6	24	4	6	13	4	12	22
1	4	9	8'-0	6	9	8'-0	4	6	24	4	6	13	4	12	22
2	4	6	7'-7	6	9	7'-7	4	6	24	4	6	13	5	12	22
3	4	9	7'-6	6	9	7'-6	4	6	24	4	6	13	4	12	22
4	4	9	7'-6	6	9	7'-6	4	6	24	4	6	13	4	12	22
5-7	4	12	7'-7	6	9	7'-7	4	6	24	4	6	13	4	12	22
8-10	4	12	7'-11	6	9	7'-11	4	6	24	4	6	13	4	12	22
11-13	5	12	8'-3	6	9	8'-3	4	6	24	4	6	13	4	12	22
14-16	4	9	8'-6	6	9	8'-6	4	6	24	4	6	13	4	12	22
17-19	4	9	8'-9	6	9	8'-9	4	6	24	4	6	13	4	12	22
20-22	4	12	9'-1	6	9	9'-1	4	6	24	4	6	13	4	12	22
23-25	4	12	9'-4	6	9	9'-4	4	6	24	4	6	13	4	12	22

Fill	e2			f1			f2			k1			k2		
	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L
0	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-9
1	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-3
2	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	10'-3
3	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	8'-8
4	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-3
5-7	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-0
8-10	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-5
11-13	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	9'-2
14-16	4	17	20	4	12	26	4	17	20	7	18	25'-11	6	18	10'-5
17-19	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	10'-8
20-22	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	11'-2
23-25	4	17	20	5	12	26	4	17	20	6	12	25'-11	5	12	11'-4

Fill	k4					k6			k7			k9		
	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	9	7'-2	3'-7	3'-7	4	12	25'-11	5	12	14'-10	5	4.5	25'-11
1	5	9	7'-2	3'-7	3'-7	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	6	9	7'-4	3'-8	3'-8	5	12	25'-11	6	12	12'-10	6	4.5	25'-11
3	6	9	7'-2	3'-7	3'-7	4	12	25'-11	7	12	10'-8	7	4.5	25'-11
4	6	9	7'-2	3'-7	3'-7	5	9	25'-11	5	9	9'-4	5	4.5	25'-11
5-7	5	6	6'-6	3'-3	3'-3	5	9	25'-11	6	9	9'-0	6	4.5	25'-11
8-10	5	6	6'-0	2'-8	3'-4	5	9	25'-11	6	9	8'-4	6	4.5	25'-11
11-13	4	6	5'-8	2'-6	3'-2	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	4	6	5'-9	2'-6	3'-3	5	12	25'-11	8	12	8'-8	8	4.5	25'-11
17-19	4	6	5'-11	2'-7	3'-4	5	9	25'-11	7	9	8'-10	7	4.5	25'-11
20-22	4	6	6'-3	2'-8	3'-7	5	9	25'-11	7	9	9'-2	7	4.5	25'-11
23-25	4	6	6'-5	2'-9	3'-8	5	9	25'-11	7	9	9'-4	7	4.5	25'-11

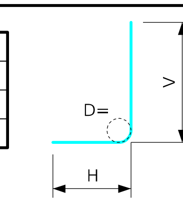
Bar List

Fill	m1			m2			m4				
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V
0	5	12	26'-5	5	12	9'-5	6	9	12'-4	5'-11	6'-5
1	5	12	26'-5	5	12	9'-0	6	9	11'-0	4'-7	6'-5
2	5	9	26'-5	5	9	7'-10	6	9	9'-9	3'-6	6'-3
3	6	12	26'-5	5	12	7'-0	6	9	9'-8	3'-5	6'-3
4	6	12	26'-5	5	12	7'-0	6	9	9'-7	3'-4	6'-3
5-7	6	12	26'-5	5	12	7'-9	5	6	9'-6	3'-2	6'-4
8-10	5	9	26'-5	4	9	8'-5	5	6	9'-2	2'-8	6'-6
11-13	5	9	26'-5	4	9	9'-2	4	6	9'-3	2'-7	6'-8
14-16	6	12	26'-5	5	12	10'-2	4	6	9'-5	2'-7	6'-10
17-19	6	12	26'-5	5	12	10'-10	4	6	9'-8	2'-8	7'-0
20-22	7	18	26'-5	7	18	11'-5	4	6	9'-10	2'-9	7'-1
23-25	6	12	26'-5	5	12	11'-3	4	6	10'-1	2'-10	7'-3

Fill	m6			m7			m9			Quantities: Concrete (CY/FT)				Steel (LB/FT)
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	
0	5	12	26'-5	5	12	12'-10	5	4.5	26'-5	1.191	1.050	0.465	2.706	361.66
1	4	12	26'-5	6	12	11'-2	6	4.5	26'-5	1.151	1.008	0.465	2.624	354.13
2	4	9	26'-5	6	9	9'-2	6	4.5	26'-5	0.867	0.885	0.465	2.217	412.39
3	5	9	26'-5	5	9	8'-8	5	4.5	26'-5	0.786	0.885	0.465	2.136	390.61
4	5	12	26'-5	7	12	8'-6	7	4.5	26'-5	0.786	0.885	0.465	2.136	388.76
5-7	5	9	26'-5	6	9	8'-4	6	4.5	26'-5	0.826	0.967	0.465	2.258	397.00
8-10	5	9	26'-5	6	9	8'-4	6	4.5	26'-5	0.948	1.132	0.465	2.545	388.53
11-13	5	9	26'-5	6	9	8'-6	6	4.5	26'-5	1.110	1.297	0.465	2.872	370.21
14-16	4	9	26'-5	7	9	8'-10	7	4.5	26'-5	1.232	1.421	0.465	3.118	386.08
17-19	5	12	26'-5	8	12	9'-2	8	4.5	26'-5	1.353	1.586	0.465	3.404	406.26
20-22	5	9	26'-5	7	9	9'-4	7	4.5	26'-5	1.515	1.710	0.465	3.690	421.26
23-25	5	9	26'-5	7	9	9'-8	7	4.5	26'-5	1.637	1.834	0.465	3.936	428.84

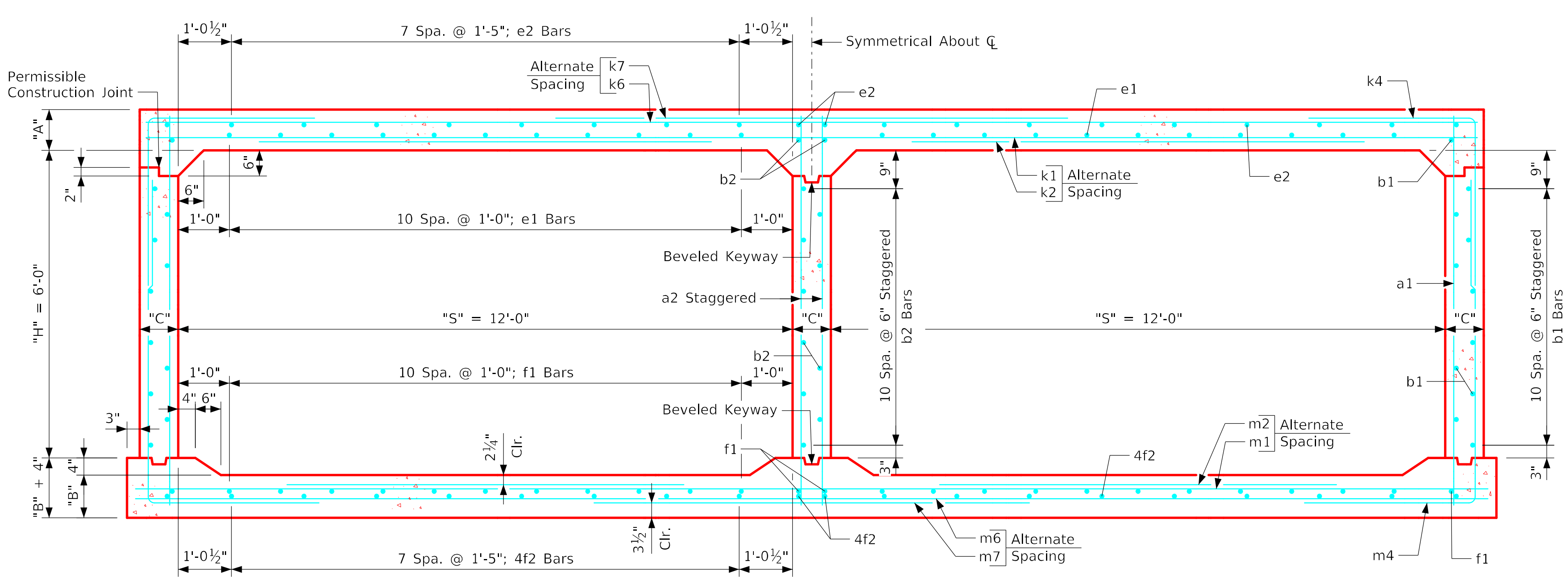
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 12' x 6' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel
Details
12' x 6' Barrel Sections

TWRCB
12-6-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 12-6-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 12' x 7' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	7	14	12	9	9	9	0'-1	7'-5	3'-1	6'-10
1	12	7	13.5	12	9	9	9	0'-8	7'-2	2'-6	6'-1
2	12	7	10	10	9	6	9	1'-11	6'-8	2'-9	4'-10
3	12	7	9.5	10	9	9	9	2'-8	5'-5	3'-5	4'-4
4	12	7	9	10	9	9	9	2'-10	4'-9	3'-5	4'-4
5-7	12	7	10	11	9	9	9	2'-3	4'-8	3'-3	4'-2
8-10	12	7	11	13	9	9	9	3'-0	4'-2	3'-4	4'-2
11-13	12	7	13	15	9	6	9	2'-10	4'-3	3'-1	4'-3
14-16	12	7	14.5	16.5	9	6	9	2'-4	4'-4	2'-6	4'-5
17-19	12	7	16.5	18.5	9	9	9	2'-3	4'-6	2'-2	4'-7
20-22	12	7	18	20	9	9	9	1'-8	4'-7	1'-7	4'-8
23-25	12	7	19.5	21.5	9	9	9	1'-7	4'-8	1'-9	4'-10

Bar List

Fill	a1			a2			b1			b2			e1		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	9'-1	6	9	9'-1	4	6	28	4	6	15	4	12	22
1	4	12	9'-0	6	9	9'-0	4	6	28	4	6	15	4	12	22
2	4	6	8'-7	6	9	8'-7	4	6	28	4	6	15	5	12	22
3	4	9	8'-6	6	9	8'-6	4	6	28	4	6	15	4	12	22
4	4	9	8'-6	6	9	8'-6	4	6	28	4	6	15	4	12	22
5-7	4	12	8'-8	6	9	8'-8	4	6	28	4	6	15	4	12	22
8-10	4	12	8'-11	6	9	8'-11	4	6	28	4	6	15	4	12	22
11-13	4	6	9'-3	6	9	9'-3	4	6	28	4	6	15	4	12	22
14-16	4	6	9'-6	6	9	9'-6	4	6	28	4	6	15	4	12	22
17-19	5	12	9'-10	6	9	9'-10	4	6	28	4	6	15	4	12	22
20-22	5	12	10'-1	6	9	10'-1	4	6	28	4	6	15	4	12	22
23-25	4	9	10'-4	6	9	10'-4	4	6	28	4	6	15	4	12	22

Fill	e2			f1			f2			k1			k2		
	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	L	Size	Sp.	L
0	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-10
1	4	17	20	4	12	26	4	17	20	6	18	25'-11	6	18	12'-3
2	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	10'-2
3	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	9'-0
4	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-4
5-7	4	17	20	4	12	26	4	17	20	5	12	25'-11	5	12	9'-9
8-10	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	8'-6
11-13	4	17	20	4	12	26	4	17	20	5	9	25'-11	4	9	9'-2
14-16	4	17	20	4	12	26	4	17	20	7	18	25'-11	6	18	10'-5
17-19	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	10'-8
20-22	4	17	20	4	12	26	4	17	20	6	12	25'-11	5	12	11'-3
23-25	4	17	20	5	12	26	4	17	20	6	12	25'-11	5	12	11'-4

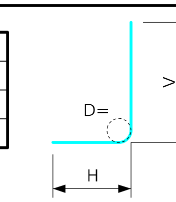
Fill	k4					k6			k7			k9		
	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	6	10'-5	7'-2	3'-3	4	12	25'-11	5	12	14'-10	5	4.5	25'-11
1	4	6	10'-7	7'-5	3'-2	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	6	9	7'-4	3'-8	3'-8	5	12	25'-11	6	12	13'-4	6	4.5	25'-11
3	6	9	7'-4	3'-8	3'-8	5	12	25'-11	6	12	10'-10	6	4.5	25'-11
4	6	9	7'-2	3'-7	3'-7	5	9	25'-11	5	9	9'-6	5	4.5	25'-11
5-7	5	6	6'-6	3'-3	3'-3	5	12	25'-11	7	12	9'-4	7	4.5	25'-11
8-10	5	6	6'-2	2'-10	3'-4	5	9	25'-11	6	9	8'-4	6	4.5	25'-11
11-13	4	6	6'-4	3'-2	3'-2	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	4	6	6'-0	2'-9	3'-3	5	12	25'-11	8	12	8'-8	8	4.5	25'-11
17-19	4	6	6'-3	2'-10	3'-5	5	12	25'-11	8	12	9'-0	8	4.5	25'-11
20-22	4	6	6'-5	2'-10	3'-7	5	9	25'-11	7	9	9'-2	7	4.5	25'-11
23-25	4	6	6'-7	2'-11	3'-8	5	9	25'-11	7	9	9'-4	7	4.5	25'-11

Fill	Bar List: m1			m2			m4					m6			m7			m9		
	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	5	9	26'-5	4	9	8'-1	5	6	14'-3	6'-10	7'-5	4	12	26'-5	6	12	13'-8	6	4.5	26'-5
1	5	12	26'-5	5	12	9'-6	5	6	12'-10	5'-5	7'-5	5	12	26'-5	5	12	12'-2	5	4.5	26'-5
2	5	9	26'-5	5	9	8'-5	6	9	11'-0	3'-9	7'-3	5	12	26'-5	7	12	9'-8	7	4.5	26'-5
3	6	12	26'-5	5	12	7'-2	6	9	10'-9	3'-6	7'-3	4	9	26'-5	6	9	8'-8	6	4.5	26'-5
4	6	12	26'-5	5	12	7'-2	6	9	10'-8	3'-5	7'-3	5	12	26'-5	7	12	8'-8	7	4.5	26'-5
5-7	6	12	26'-5	5	12	7'-10	5	6	10'-7	3'-3	7'-4	5	9	26'-5	6	9	8'-4	6	4.5	26'-5
8-10	6	12	26'-5	5	12	8'-4	5	6	10'-5	2'-11	7'-6	5	9	26'-5	6	9	8'-4	6	4.5	26'-5
11-13	6	12	26'-5	5	12	8'-11	4	6	10'-6	2'-10	7'-8	4	9	26'-5	7	9	8'-6	7	4.5	26'-5
14-16	6	12	26'-5	5	12	10'-3	4	6	10'-8	2'-10	7'-10	5	12	26'-5	8	12	8'-10	8	4.5	26'-5
17-19	6	12	26'-5	5	12	10'-10	4	6	10'-10	2'-10	8'-0	5	12	26'-5	8	12	9'-2	8	4.5	26'-5
20-22	7	18	26'-5	7	18	11'-5	4	6	11'-0	2'-11	8'-1	5	9	26'-5	7	9	9'-4	7	4.5	26'-5
23-25	6	12	26'-5	5	12	11'-3	4	6	11'-3	3'-0	8'-3	5	9	26'-5	7	9	9'-8	7	4.5	26'-5

Fill	Quantities: Concrete (CY/FT)				Steel (LB/FT)
	Slab	Floor	Walls	Total	
0	1.191	1.050	0.549	2.790	387.24
1	1.151	1.050	0.549	2.750	379.53
2	0.867	0.885	0.549	2.301	435.26
3	0.826	0.885	0.549	2.260	394.00
4	0.786	0.885	0.549	2.220	402.08
5-7	0.867	0.967	0.549	2.383	400.53
8-10	0.948	1.132	0.549	2.629	408.71
11-13	1.110	1.297	0.549	2.956	389.55
14-16	1.232	1.421	0.549	3.202	411.76
17-19	1.394	1.586	0.549	3.529	414.95
20-22	1.515	1.710	0.549	3.774	440.13
23-25	1.637	1.834	0.549	4.020	444.18

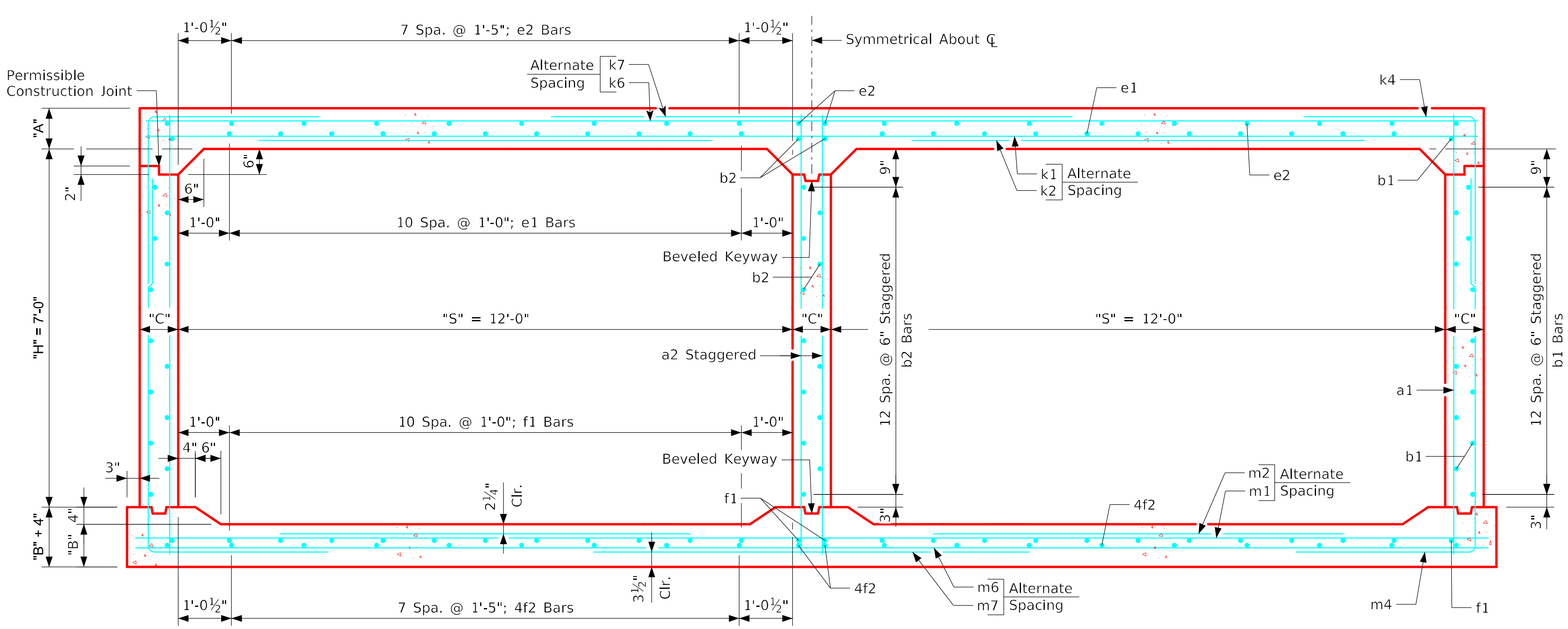
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"



k4 & m4

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



Twin 12' x 7' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
12' x 7' Barrel Sections

TWRCB 12-7-20

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

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	8	14	12	9	9	9	0'-0	7'-2	3'-0	7'-5
1	12	8	13.5	12	9	9	9	0'-7	7'-2	3'-1	6'-7
2	12	8	10	10.5	9	9	9	1'-10	7'-1	2'-10	5'-0
3	12	8	9.5	10	9	9	9	2'-7	5'-7	3'-4	4'-6
4	12	8	9	10	9	9	9	2'-9	4'-10	3'-4	4'-3
5-7	12	8	10	11.5	9	9	9	2'-3	4'-8	3'-4	4'-3
8-10	12	8	11.5	13	9	9	9	3'-0	4'-3	3'-4	4'-2
11-13	12	8	13	15	9	9	9	2'-10	4'-3	3'-0	4'-3
14-16	12	8	14.5	17	9	6	9	2'-6	4'-4	2'-7	4'-5
17-19	12	8	16.5	18.5	9	6	9	2'-3	4'-5	2'-4	4'-7
20-22	12	8	18	20	9.5	6	6	1'-8	4'-7	1'-8	4'-8
23-25	12	8	20	21.5	10	6	9	1'-7	4'-8	1'-6	4'-10

Bar List													
	a1			a2			b1			b2			
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	
0	4	12	10'-1	6	9	10'-1	4	6	32	4	6	17	
1	4	12	10'-0	6	9	10'-0	4	6	32	4	6	17	
2	5	12	9'-7	6	9	9'-7	4	6	32	4	6	17	
3	4	9	9'-6	6	9	9'-6	4	6	32	4	6	17	
4	4	9	9'-6	6	9	9'-6	4	6	32	4	6	17	
5-7	4	12	9'-8	6	9	9'-8	4	6	32	4	6	17	
8-10	4	12	9'-11	6	9	9'-11	4	6	32	4	6	17	
11-13	4	12	10'-3	6	9	10'-3	4	6	32	4	6	17	
14-16	4	6	10'-6	6	9	10'-6	4	6	32	4	6	17	
17-19	4	6	10'-10	6	9	10'-10	4	6	32	4	6	17	
20-22	4	6	11'-1	5	6	11'-1	4	6	32	4	6	17	
23-25	4	6	11'-4	7	9	11'-4	4	6	32	4	6	17	

Bar List												
	e1			e2			f1			f2		
Fill	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	22	4	17	20	4	12	26	4	17	20
1	4	12	22	4	17	20	4	12	26	4	17	20
2	5	12	22	4	17	20	4	12	26	4	17	20
3	4	12	22	4	17	20	4	12	26	4	17	20
4	4	12	22	4	17	20	4	12	26	4	17	20
5-7	4	12	22	4	17	20	4	12	26	4	17	20
8-10	4	12	22	4	17	20	4	12	26	4	17	20
11-13	4	12	22	4	17	20	4	12	26	4	17	20
14-16	4	12	22	4	17	20	4	12	26	4	17	20
17-19	4	12	22	4	17	20	4	12	26	4	17	20
20-22	4	12	22	4	17	20	4	12	26	4	17	20
23-25	4	12	22	4	17	20	5	12	26	4	17	20

Bar List											
	k1			k2			k4				
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V
0	6	18	25'-11	6	18	12'-11	5	9	11'-0	7'-5	3'-7
1	6	18	25'-11	6	18	12'-4	6	12	11'-5	7'-5	4'-0
2	6	12	25'-11	5	12	10'-4	6	9	7'-10	4'-2	3'-8
3	6	12	25'-11	5	12	8'-10	6	9	7'-6	3'-9	3'-9
4	5	9	25'-11	4	9	8'-6	6	9	7'-2	3'-7	3'-7
5-7	5	12	25'-11	5	12	9'-10	5	6	6'-10	3'-5	3'-5
8-10	5	9	25'-11	4	9	8'-7	5	6	6'-10	3'-5	3'-5
11-13	5	9	25'-11	4	9	9'-2	5	6	6'-6	3'-0	3'-6
14-16	7	18	25'-11	6	18	10'-4	6	12	7'-1	3'-0	4'-1
17-19	6	12	25'-11	5	12	10'-8	6	12	7'-3	3'-1	4'-2
20-22	6	12	26'-0	5	12	11'-4	6	12	7'-6	3'-2	4'-4
23-25	6	12	26'-2	5	12	11'-6	4	6	7'-4	3'-8	3'-8

Bar List									
	k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
1	4	9	25'-11	4	9	14'-4	4	4.5	25'-11
2	4	12	25'-11	7	12	14'-2	7	4.5	25'-11
3	4	12	25'-11	7	12	11'-2	7	4.5	25'-11
4	5	9	25'-11	5	9	9'-8	5	4.5	25'-11
5-7	5	12	25'-11	7	12	9'-4	7	4.5	25'-11
8-10	5	9	25'-11	6	9	8'-6	6	4.5	25'-11
11-13	4	9	25'-11	7	9	8'-6	7	4.5	25'-11
14-16	5	12	25'-11	8	12	8'-8	8	4.5	25'-11
17-19	5	12	25'-11	8	12	8'-10	8	4.5	25'-11
20-22	5	9	26'-0	7	9	9'-2	7	4.5	26'-0
23-25	4	9	26'-2	7	9	9'-4	7	4.5	26'-2

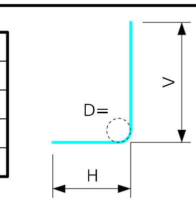
Bar List										
	m1			m2			m4			
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V
0	5	9	26'-5	4	9	8'-4	6	9	15'-11	7'-6	8'-5
1	5	9	26'-5	4	9	8'-2	7	12	14'-8	6'-3	8'-5
2	5	9	26'-5	5	9	8'-6	6	9	12'-5	4'-1	8'-4
3	6	12	26'-5	5	12	7'-4	6	9	11'-11	3'-8	8'-3
4	6	12	26'-5	5	12	7'-4	6	9	11'-9	3'-6	8'-3
5-7	6	12	26'-5	5	12	7'-10	5	6	11'-10	3'-5	8'-5
8-10	6	12	26'-5	5	12	8'-5	5	6	11'-8	3'-2	8'-6
11-13	6	12	26'-5	5	12	9'-1	5	6	11'-9	3'-1	8'-8
14-16	6	12	26'-5	5	12	10'-2	6	12	11'-11	3'-1	8'-10
17-19	6	12	26'-5	5	12	10'-8	6	12	12'-2	3'-2	9'-0
20-22	7	18	26'-6	7	18	11'-5	6	12	12'-4	3'-3	9'-1
23-25	7	18	26'-8	7	18	11'-7	4	6	12'-7	3'-4	9'-3

Bar List									
	m6			m7			m9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	4	9	26'-5	5	9	14'-10	5	4.5	26'-5
1	4	12	26'-5	6	12	13'-2	6	4.5	26'-5
2	5	9	26'-5	5	9	10'-0	5	4.5	26'-5
3	5	12	26'-5	7	12	9'-0	7	4.5	26'-5
4	5	9	26'-5	6	9	8'-6	6	4.5	26'-5
5-7	5	9	26'-5	6	9	8'-6	6	4.5	26'-5
8-10	5	9	26'-5	6	9	8'-4	6	4.5	26'-5
11-13	4	9	26'-5	7	9	8'-6	7	4.5	26'-5
14-16	4	9	26'-5	7	9	8'-10	7	4.5	26'-5
17-19	5	12	26'-5	8	12	9'-2	8	4.5	26'-5
20-22	5	9	26'-6	7	9	9'-4	7	4.5	26'-6
23-25	5	9	26'-8	7	9	9'-8	7	4.5	26'-8

Quantities					
	Concrete (CY/FT)				Steel (LB/FT)
Fill	Slab	Floor	Walls	Total	
0	1.191	1.050	0.632	2.873	411.66
1	1.151	1.050	0.632	2.833	407.92
2	0.867	0.926	0.632	2.425	448.26
3	0.826	0.885	0.632	2.343	419.00
4	0.786	0.885	0.632	2.303	421.82
5-7	0.867	1.008	0.632	2.507	415.05
8-10	0.989	1.132	0.632	2.753	424.79
11-13	1.110	1.297	0.632	3.039	416.74
14-16	1.232	1.463	0.632	3.327	431.21
17-19	1.394	1.586	0.632	3.612	444.76
20-22	1.524	1.720	0.667	3.911	472.76
23-25	1.697	1.854	0.702	4.253	471.08

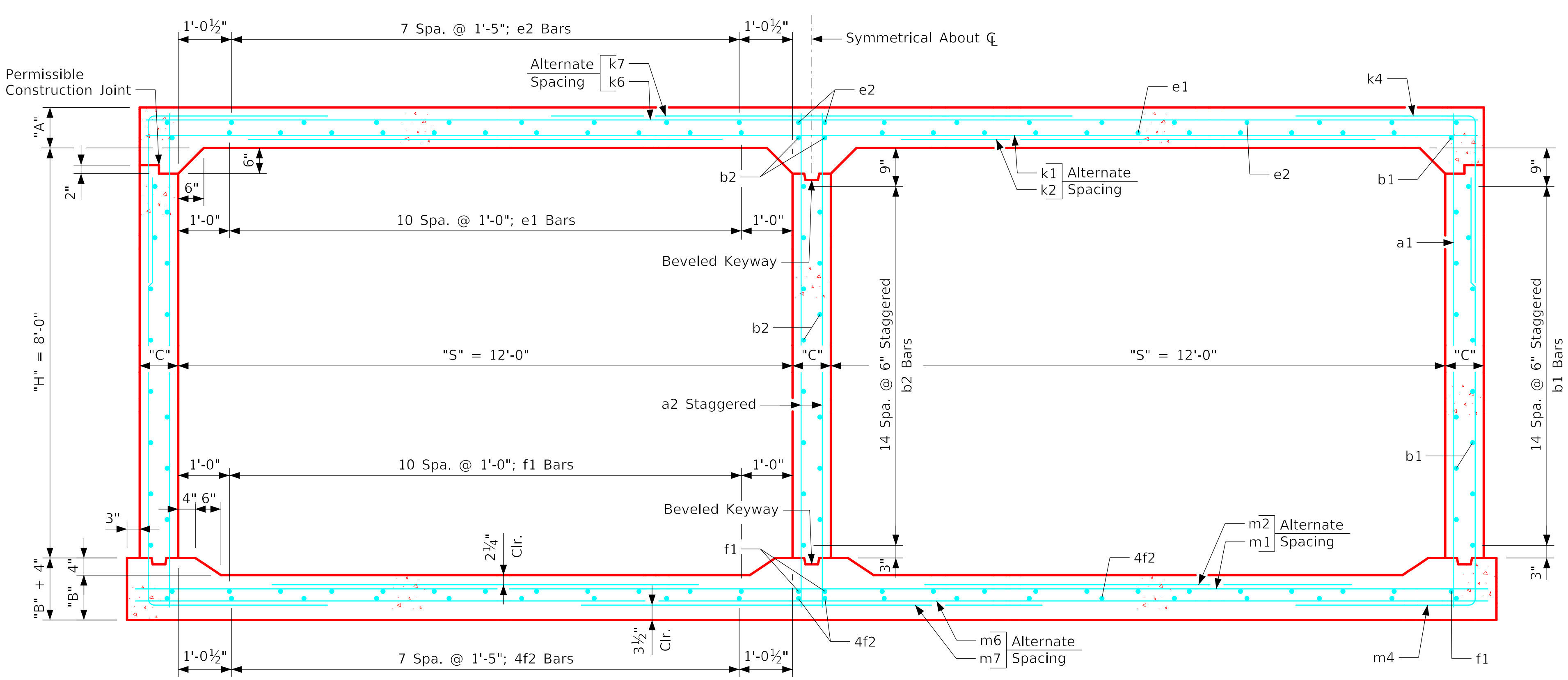
Bent Bar Detail

Bars	D
4	3"
5	3¾"
6	4½"
7	5¼"



k4 & m4

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



Twin 12' x 8' Barrel Section

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete Box Culverts
July, 2020

Culvert Barrel Details
12' x 8' Barrel Sections

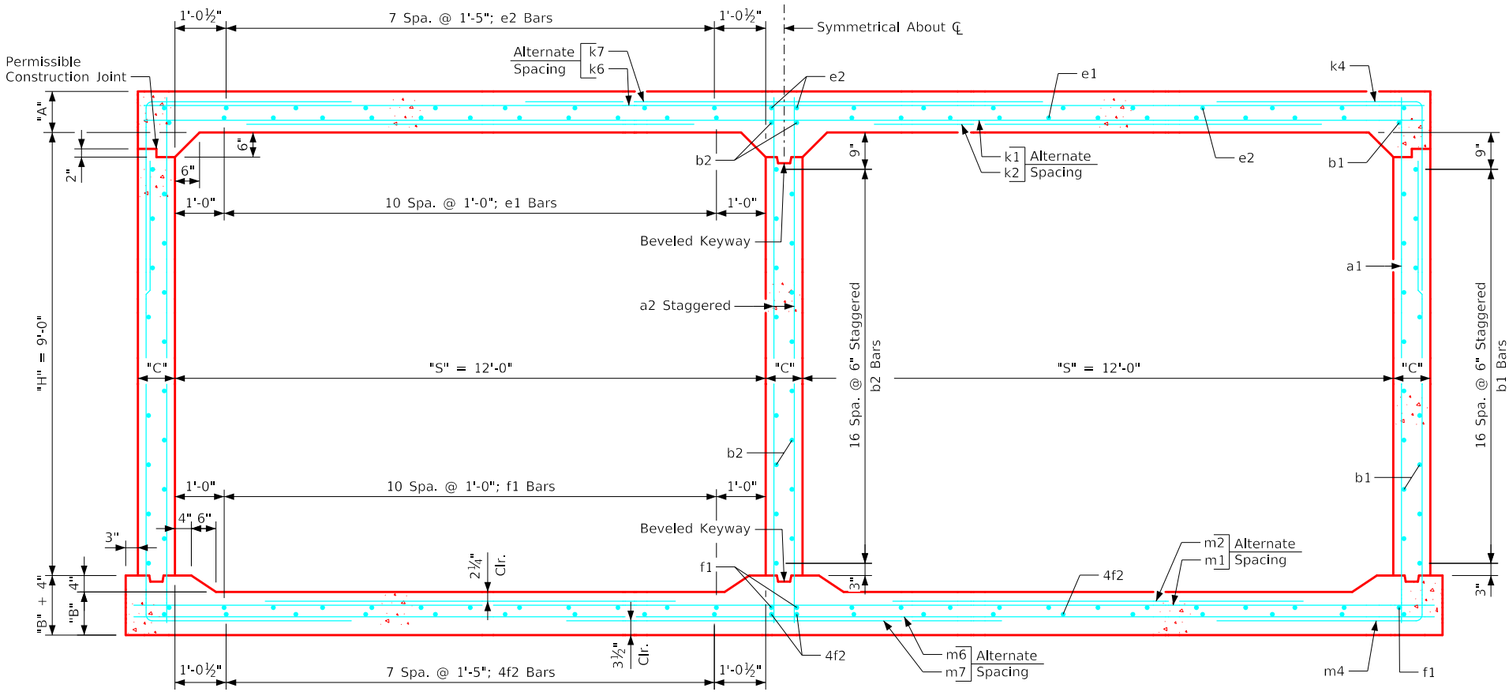
TWRCB 12-8-20

Variable Dimensions and Quantities for Twin 12' x 9' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	9	14	12.5	9	9	9	0'-0	7'-2	3'-0	7'-5
1	12	9	13.5	12	9	9	9	0'-6	7'-2	3'-0	7'-7
2	12	9	10	10.5	9	9	9	1'-6	7'-9	2'-9	5'-1
3	12	9	9	10	9	9	9	2'-5	5'-6	3'-2	4'-7
4	12	9	9	10	9	9	9	2'-8	4'-11	3'-3	4'-3
5-7	12	9	10	11.5	9	9	9	3'-1	4'-9	3'-3	4'-3
8-10	12	9	11.5	13.5	9	9	9	3'-0	4'-3	2'-11	4'-2
11-13	12	9	13	15	9	9	9	2'-10	4'-3	3'-0	4'-3
14-16	12	9	14.5	17	9	9	9	2'-5	4'-4	2'-7	4'-5
17-19	12	9	16.5	18.5	10	9	9	2'-3	4'-6	2'-3	4'-7
20-22	12	9	18.5	20	11	9	9	1'-8	4'-7	1'-10	4'-8
23-25	12	9	20	21.5	11	9	9	1'-7	4'-8	1'-5	4'-10

Bar List																																								
	a1			a2			b1			b2			e1			e2			f1			f2			k1			k2			k4					k6			k7			k9		
Fill	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	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	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	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	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	4	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	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	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	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	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	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
17-19	4	9	11'-10	7	9	11'-10	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	12	26'-2	5	12	10'-8	6	9	7'-7	3'-5	4'-2	4	9	26'-2	7	9	9'-0	7	4.5	26'-2
20-22	4	9	12'-1	7	9	12'-1	4	6	36	4	6	19	4	12	22	4	17	20	4	12	26	4	17	20	6	12	26'-5	5	12	11'-6	6	9	8'-0	3'-7	4'-5	4	9	26'-5	7	9	9'-2	7	4.5	26'-5
23-25	4	9	12'-4	7	9	12'-4	4	6	36	4	6	19	4	12	22	4	17	20	5	12	26	4	17	20	6	12	26'-5	5	12	11'-7	6	9	8'-2	3'-8	4'-6	4	9	26'-5	7	9	9'-4	7	4.5	26'-5

Bar List																									Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
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	(LB/FT)
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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 9' Barrel Sections

TWRCB 12-9-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 12-9-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 12' x 10' Barrel Sections

Dimensions

Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	10	14	12.5	10	9	9	0'-3	7'-5	3'-0	7'-8
1	12	10	13.5	12.5	10	9	9	0'-10	7'-3	2'-5	7'-10
2	12	10	10	10.5	10	6	9	2'-2	7'-2	2'-10	4'-10
3	12	10	9.5	10	10	9	9	2'-8	5'-6	3'-3	4'-6
4	12	10	9	10	10	9	9	2'-9	4'-9	3'-3	4'-2
5-7	12	10	10	11.5	10	9	9	2'-7	4'-8	3'-3	4'-3
8-10	12	10	11	13.5	10	9	9	3'-1	4'-2	3'-1	4'-2
11-13	12	10	13	15	10	6	9	2'-10	4'-3	2'-11	4'-3
14-16	12	10	14.5	17	10.5	9	9	2'-5	4'-4	2'-6	4'-5
17-19	12	10	16.5	18.5	11	6	9	2'-3	4'-6	2'-3	4'-7
20-22	12	10	18.5	20	12	6	9	1'-8	4'-7	1'-10	4'-8
23-25	12	10	20	22	12.5	6	9	1'-5	4'-9	1'-5	4'-11

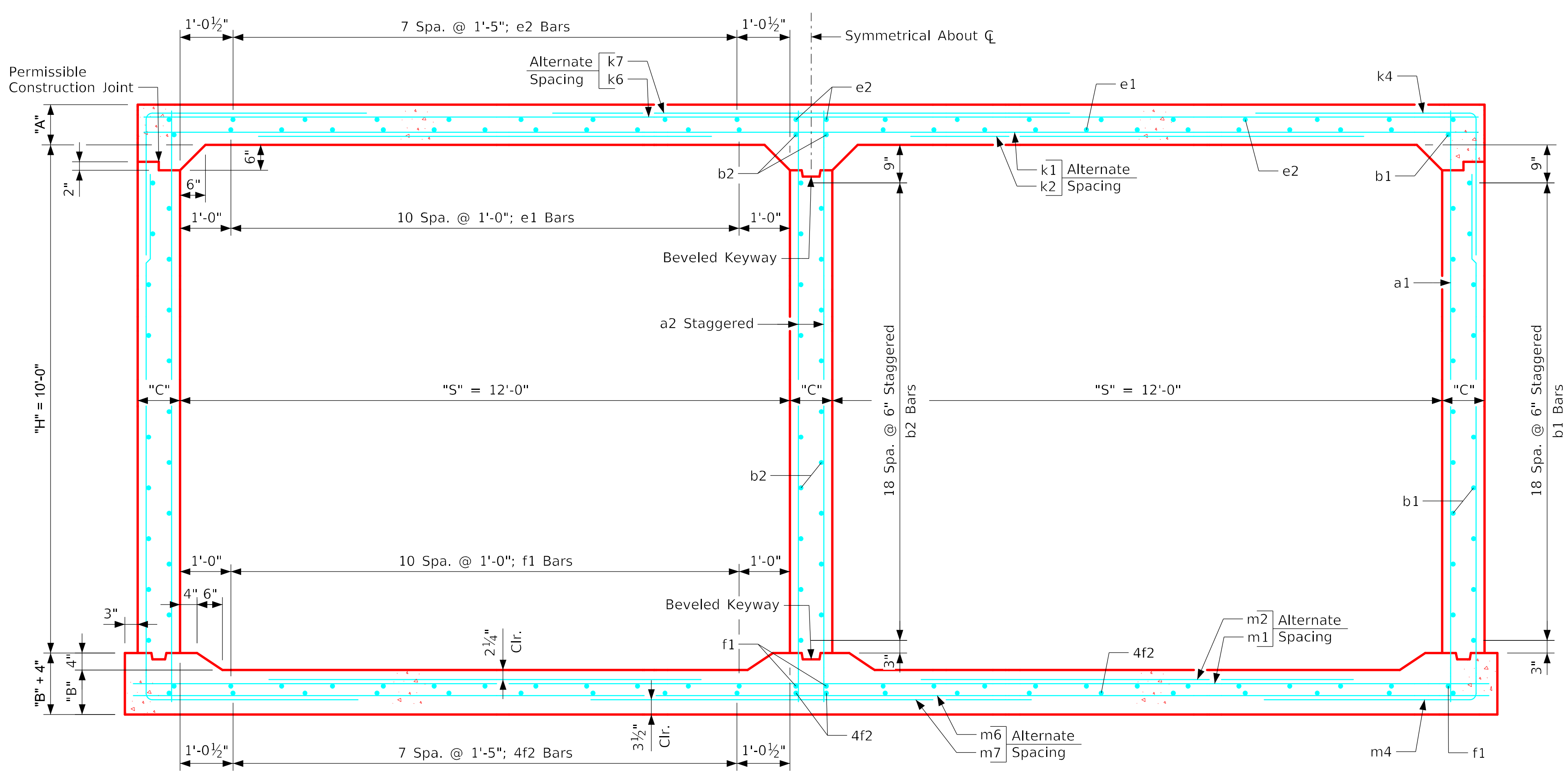
Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	9	12'-1	7	9	12'-1	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
1	4	9	12'-1	7	9	12'-1	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
2	4	6	11'-7	7	9	11'-7	4	6	40	4	6	21	5	12	22	4	17	20	4	12	26	4	17	20
3	4	9	11'-6	7	9	11'-6	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
4	4	9	11'-6	7	9	11'-6	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
5-7	4	12	11'-8	7	9	11'-8	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
8-10	5	12	11'-11	7	9	11'-11	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
11-13	4	6	12'-3	7	9	12'-3	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
14-16	4	9	12'-6	7	9	12'-6	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
17-19	4	6	12'-10	7	9	12'-10	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
20-22	4	6	13'-1	7	9	13'-1	4	6	40	4	6	21	4	12	22	4	17	20	4	12	26	4	17	20
23-25	4	6	13'-5	7	9	13'-5	4	6	40	4	6	21	4	12	22	4	17	20	5	12	26	4	17	20

	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	26'-2	6	18	12'-10	6	9	11'-8	7'-8	4'-0	4	12	26'-2	5	12	14'-10	5	4.5	26'-2
1	6	18	26'-2	6	18	12'-3	6	9	11'-4	7'-5	3'-11	4	9	26'-2	4	9	14'-6	4	4.5	26'-2
2	6	12	26'-2	5	12	10'-0	6	9	9'-1	5'-5	3'-8	5	12	26'-2	6	12	14'-4	6	4.5	26'-2
3	5	9	26'-2	4	9	9'-1	6	9	8'-4	4'-8	3'-8	5	12	26'-2	6	12	11'-0	6	4.5	26'-2
4	5	9	26'-2	4	9	8'-7	6	9	7'-11	4'-4	3'-7	5	9	26'-2	5	9	9'-6	5	4.5	26'-2
5-7	5	12	26'-2	5	12	9'-5	7	12	8'-6	4'-3	4'-3	5	12	26'-2	7	12	9'-4	7	4.5	26'-2
8-10	5	9	26'-2	4	9	8'-5	6	9	7'-6	3'-9	3'-9	5	9	26'-2	6	9	8'-4	6	4.5	26'-2
11-13	5	9	26'-2	4	9	9'-2	6	9	7'-10	3'-11	3'-11	5	9	26'-2	6	9	8'-6	6	4.5	26'-2
14-16	7	18	26'-3	6	18	10'-4	5	6	7'-4	3'-8	3'-8	4	9	26'-3	7	9	8'-8	7	4.5	26'-3
17-19	6	12	26'-5	5	12	10'-7	6	9	8'-4	4'-2	4'-2	4	9	26'-5	7	9	9'-0	7	4.5	26'-5
20-22	6	12	26'-8	5	12	11'-8	6	9	8'-4	3'-11	4'-5	4	9	26'-8	7	9	9'-2	7	4.5	26'-8
23-25	6	12	26'-9	5	12	11'-11	6	9	9'-0	4'-6	4'-6	4	9	26'-9	7	9	9'-6	7	4.5	26'-9

Bar List / Quantities

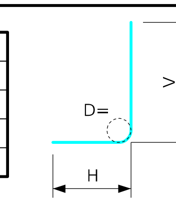
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	(LB/FT)
0	5	9	26'-8	4	9	8'-5	6	9	18'-4	7'-10	10'-6	4	12	26'-8	6	12	15'-4	6	4.5	26'-8	1.206	1.104	0.887	3.197	464.39
1	5	12	26'-8	5	12	9'-9	6	9	18'-2	7'-8	10'-6	5	18	26'-8	7	18	15'-8	7	4.5	26'-8	1.165	1.104	0.887	3.156	460.39
2	5	9	26'-8	5	9	8'-6	6	9	15'-0	4'-8	10'-4	4	9	26'-8	6	9	9'-8	6	4.5	26'-8	0.879	0.937	0.887	2.703	490.37
3	5	9	26'-8	5	9	7'-11	7	9	14'-8	4'-5	10'-3	5	12	26'-8	7	12	9'-0	7	4.5	26'-8	0.838	0.895	0.887	2.620	479.00
4	5	9	26'-8	5	9	7'-11	7	9	14'-6	4'-3	10'-3	5	9	26'-8	6	9	8'-4	6	4.5	26'-8	0.797	0.895	0.887	2.579	485.32
5-7	6	12	26'-8	5	12	7'-11	8	12	14'-9	4'-4	10'-5	5	9	26'-8	6	9	8'-6	6	4.5	26'-8	0.879	1.020	0.887	2.786	482.53
8-10	5	9	26'-8	4	9	8'-10	6	9	14'-5	3'-10	10'-7	5	9	26'-8	6	9	8'-4	6	4.5	26'-8	0.961	1.187	0.887	3.035	465.61
11-13	6	12	26'-8	5	12	9'-2	6	9	14'-5	3'-9	10'-8	4	9	26'-8	7	9	8'-6	7	4.5	26'-8	1.124	1.312	0.887	3.323	479.13
14-16	6	12	26'-9	5	12	10'-3	5	6	14'-8	3'-10	10'-10	4	9	26'-9	7	9	8'-10	7	4.5	26'-9	1.255	1.485	0.934	3.674	474.76
17-19	6	12	26'-11	5	12	10'-10	6	9	14'-10	3'-10	11'-0	5	12	26'-11	8	12	9'-2	8	4.5	26'-11	1.427	1.619	0.978	4.024	503.76
20-22	7	18	27'-2	7	18	11'-6	6	9	15'-1	4'-0	11'-1	5	9	27'-2	7	9	9'-4	7	4.5	27'-2	1.611	1.763	1.067	4.441	524.74
23-25	7	18	27'-3	7	18	12'-0	6	9	15'-4	4'-1	11'-3	5	9	27'-3	7	9	9'-10	7	4.5	27'-3	1.746	1.943	1.111	4.800	544.53



Twin 12' x 10' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel
Details
12' x 10' Barrel Sections

TWRCB
12-10-20

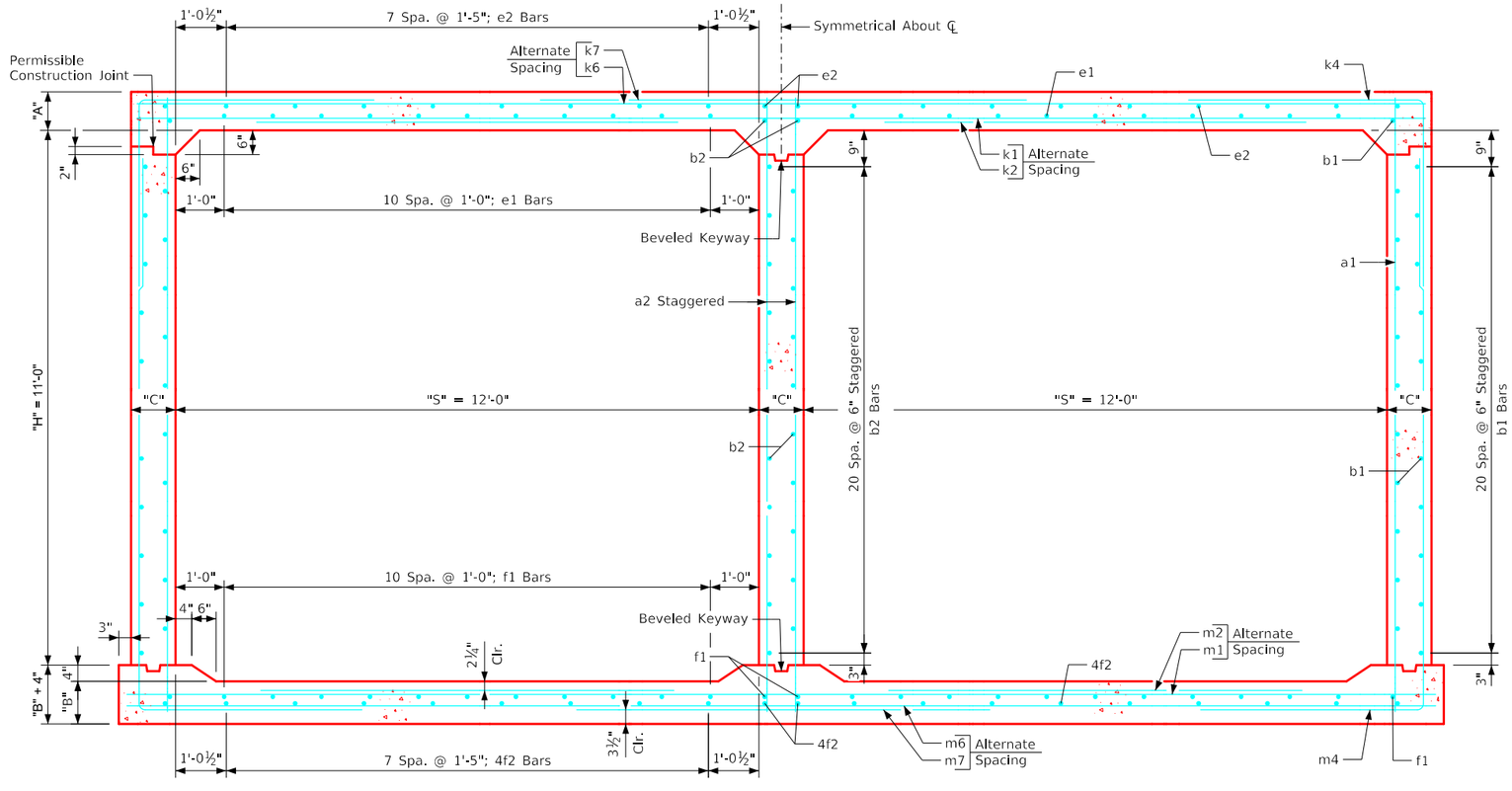
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 12-10-20 - THIS SHEET ISSUED 07-2020.

Variable Dimensions and Quantities for Twin 12' x 11' Barrel Sections

Dimensions											
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	11	14	12.5	11	6	9	0'-3	7'-6	2'-5	6'-1
1	12	11	13	12.5	11	9	9	0'-10	7'-3	2'-5	5'-11
2	12	11	10	10.5	11	9	9	1'-11	7'-1	2'-10	4'-8
3	12	11	9.5	10	11	9	9	2'-8	5'-5	3'-3	4'-5
4	12	11	9	10	11	9	9	2'-10	4'-10	3'-3	4'-2
5-7	12	11	9	11.5	11	9	9	3'-0	4'-5	3'-3	4'-3
8-10	12	11	11	13.5	11	6	9	3'-4	4'-2	3'-1	4'-2
11-13	12	11	12.5	15	11	6	9	2'-9	4'-3	2'-11	4'-3
14-16	12	11	14.5	16.5	11.5	9	9	2'-7	4'-4	2'-7	4'-5
17-19	12	11	16	18.5	12	9	9	2'-2	4'-5	2'-3	4'-7
19-22	12	11	18	20	13	9	6	2'-0	4'-7	1'-9	4'-9
23-25	12	11	19.5	22.5	14	9	9	1'-6	4'-8	1'-5	4'-11

Bar List																																							
	a1			a2			b1			b2			e1			e2			f1			f2			k1			k2			k4					k6			k7			k9		
Fill	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	4	6	13'-1	7	9	13'-1	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	6	18	26'-5	6	18	12'-11	6	12	11'-8	7'-8	4'-0	4	12	26'-5	5	12	15'-0	5	4.5	26'-5
1	4	12	13'-0	7	9	13'-0	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	6	18	26'-5	6	18	12'-4	6	9	11'-6	7'-7	3'-11	4	9	26'-5	4	9	14'-6	4	4.5	26'-5
2	4	12	12'-7	7	9	12'-7	4	6	44	4	6	23	5	12	22	4	17	20	4	12	26	4	17	20	6	12	26'-5	5	12	10'-6	7	9	9'-11	5'-11	4'-0	5	12	26'-5	6	12	14'-2	6	4.5	26'-5
3	4	12	12'-6	7	9	12'-6	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-5	4	9	9'-1	7	9	9'-3	5'-3	4'-0	5	12	26'-5	6	12	10'-10	6	4.5	26'-5
4	5	12	12'-6	7	9	12'-6	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-5	4	9	8'-5	6	9	8'-3	4'-8	3'-7	4	12	26'-5	7	12	9'-8	7	4.5	26'-5
5-7	4	9	12'-7	7	9	12'-7	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-5	4	9	8'-1	5	6	7'-7	4'-5	3'-2	5	9	26'-5	6	9	8'-10	6	4.5	26'-5
8-10	4	6	12'-11	7	9	12'-11	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-5	4	9	8'-1	6	9	8'-4	4'-2	4'-2	5	9	26'-5	6	9	8'-4	6	4.5	26'-5
11-13	4	6	13'-2	7	9	13'-2	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-5	4	9	9'-2	5	6	7'-7	4'-1	3'-6	4	9	26'-5	7	9	8'-6	7	4.5	26'-5
14-16	6	9	13'-6	7	9	13'-6	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	5	9	26'-6	4	9	10'-1	6	9	8'-2	4'-1	4'-1	4	9	26'-6	7	9	8'-8	7	4.5	26'-6
17-19	6	9	13'-9	7	9	13'-9	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	6	12	26'-8	5	12	10'-8	6	9	8'-4	4'-2	4'-2	4	9	26'-8	7	9	8'-10	7	4.5	26'-8
19-22	4	9	14'-1	6	6	14'-1	4	6	44	4	6	23	4	12	22	4	17	20	4	12	26	4	17	20	6	12	26'-11	5	12	11'-5	8	12	9'-4	4'-3	5'-1	4	9	26'-11	7	9	9'-2	7	4.5	26'-11
23-25	6	9	14'-5	8	9	14'-5	4	6	44	4	6	23	4	12	22	4	17	20	5	12	26	4	17	20	6	12	27'-2	5	12	12'-1	5	6	8'-10	4'-5	4'-5	4	9	27'-2	7	9	9'-4	7	4.5	27'-2

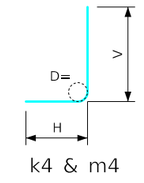
Bar List																									Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	
0	5	12	26'-11	5	12	9'-9	7	12	19'-0	7'-6	11'-6	4	12	26'-11	6	12	12'-2	6	4.5	26'-11	1.221	1.114	1.080	3.415	473.42
1	5	12	26'-11	5	12	9'-9	7	9	18'-10	7'-4	11'-6	5	12	26'-11	5	12	11'-10	5	4.5	26'-11	1.138	1.114	1.080	3.332	493.76
2	5	9	26'-11	5	9	8'-5	7	9	16'-3	4'-11	11'-4	4	9	26'-11	6	9	9'-4	6	4.5	26'-11	0.891	0.946	1.080	2.917	533.03
3	5	9	26'-11	5	9	7'-11	7	9	15'-11	4'-8	11'-3	5	12	26'-11	7	12	8'-10	7	4.5	26'-11	0.849	0.904	1.080	2.833	507.97
4	5	9	26'-11	5	9	7'-11	7	9	15'-9	4'-6	11'-3	5	9	26'-11	6	9	8'-4	6	4.5	26'-11	0.808	0.904	1.080	2.792	498.55
5-7	6	12	26'-11	5	12	7'-11	5	6	15'-10	4'-5	11'-5	5	9	26'-11	6	9	8'-6	6	4.5	26'-11	0.808	1.030	1.080	2.918	483.11
8-10	5	9	26'-11	4	9	8'-9	6	9	15'-10	4'-3	11'-7	5	9	26'-11	6	9	8'-4	6	4.5	26'-11	0.973	1.198	1.080	3.251	491.63
11-13	6	12	26'-11	5	12	9'-2	5	6	15'-10	4'-2	11'-8	4	9	26'-11	7	9	8'-6	7	4.5	26'-11	1.097	1.324	1.080	3.501	489.87
14-16	6	12	27'-0	5	12	10'-2	6	9	16'-0	4'-2	11'-10	4	9	27'-0	7	9	8'-10	7	4.5	27'-0	1.270	1.459	1.129	3.858	517.53
17-19	6	12	27'-2	5	12	10'-10	6	9	16'-2	4'-2	12'-0	5	12	27'-2	8	12	9'-2	8	4.5	27'-2	1.402	1.636	1.178	4.216	538.11
20-22	7	18	27'-5	7	18	11'-9	8	12	16'-4	4'-3	12'-1	5	9	27'-5	7	9	9'-6	7	4.5	27'-5	1.587	1.782	1.275	4.644	577.29
23-25	7	18	27'-8	7	18	12'-2	5	6	16'-10	4'-6	12'-4	4	9	27'-8	7	9	9'-10	7	4.5	27'-8	1.732	2.017	1.373	5.122	581.58



Twin 12' x 11' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Barrel Details

12' x 11' Barrel Sections

TWRCB 12-11-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWRCB 12-11-20 - THIS SHEET ISSUED 07-2020.

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

Dimensions

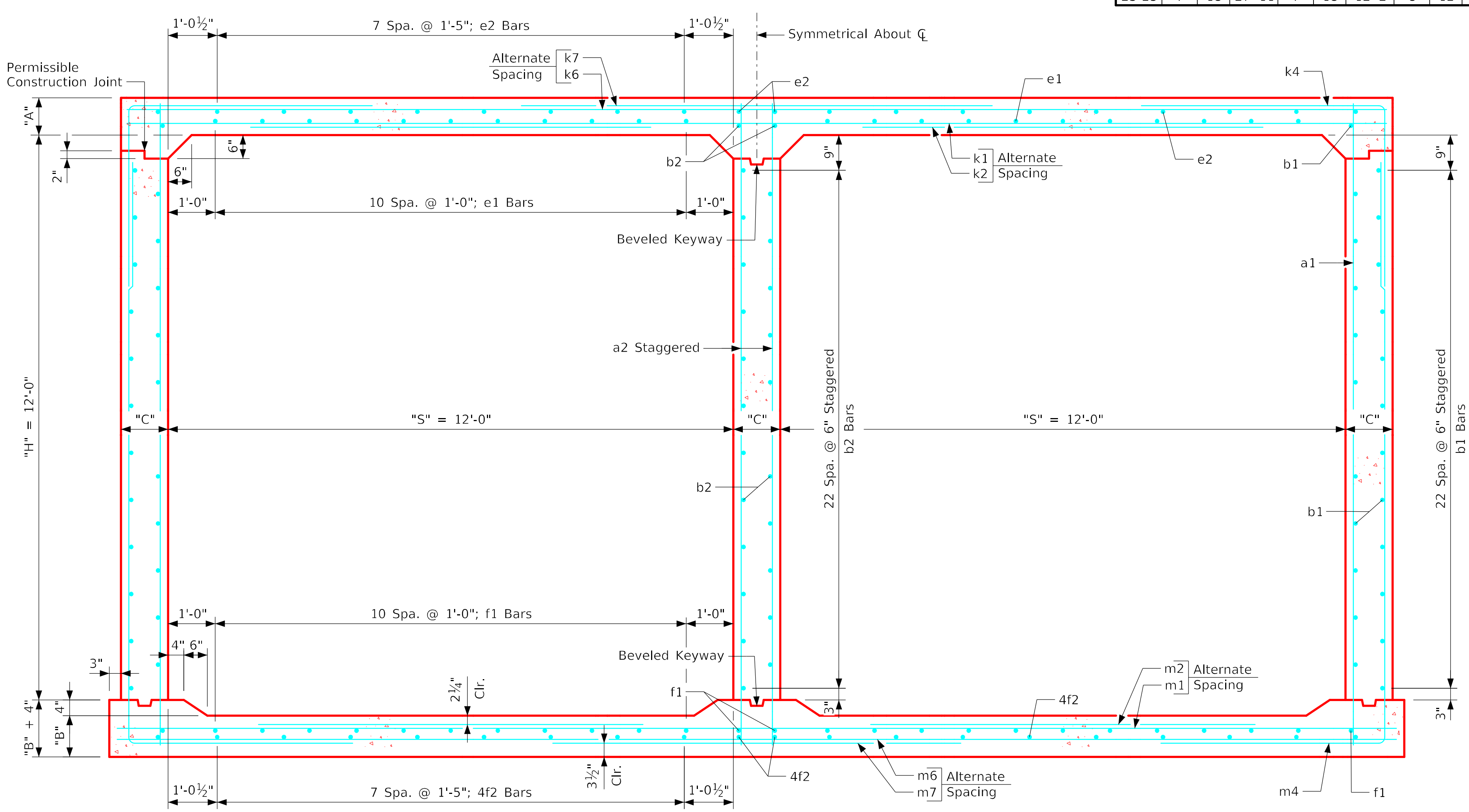
Fill	S	H	A	B	C	D	E	U	W	X	Z
0	12	12	14.5	13	12	9	9	0'-3	7'-9	2'-5	7'-6
1	12	12	13	12.5	12	6	9	0'-10	7'-4	2'-6	5'-7
2	12	12	10	10.5	12	9	9	2'-1	7'-0	2'-10	4'-6
3	12	12	9	10	12	9	9	2'-7	5'-3	3'-3	4'-4
4	12	12	9	10	12	9	9	2'-11	4'-9	3'-3	4'-1
5-7	12	12	9.5	11.5	12	9	9	2'-7	4'-7	3'-3	4'-2
8-10	12	12	11	13.5	12	9	9	2'-6	4'-2	3'-2	4'-2
11-13	12	12	12.5	15	12	9	9	2'-9	4'-2	2'-10	4'-3
14-16	12	12	14	16.5	12.5	9	9	2'-4	4'-3	2'-8	4'-5
17-19	12	12	16	18.5	13.5	9	6	2'-4	4'-5	2'-2	4'-7
20-22	12	12	18	20.5	14	9	9	1'-11	4'-7	1'-9	4'-9
23-25	12	12	19.5	22.5	15	6	9	1'-8	4'-8	1'-7	4'-11

Bar List

	a1			a2			b1			b2			e1			e2			f1			f2		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.	Size	Sp.	No.
0	4	12	14'-2	7	9	14'-2	4	6	48	4	6	25	4	12	22	5	17	20	4	12	26	4	17	20
1	4	6	14'-0	7	9	14'-0	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
2	4	9	13'-7	7	9	13'-7	4	6	48	4	6	25	5	12	22	4	17	20	4	12	26	4	17	20
3	4	9	13'-6	7	9	13'-6	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
4	4	9	13'-6	7	9	13'-6	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
5-7	4	9	13'-8	7	9	13'-8	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
8-10	6	9	13'-11	7	9	13'-11	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
11-13	6	9	14'-2	7	9	14'-2	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
14-16	6	9	14'-5	7	9	14'-5	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
17-19	5	12	14'-9	6	6	14'-9	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
20-22	5	12	15'-1	8	9	15'-1	4	6	48	4	6	25	4	12	22	4	17	20	4	12	26	4	17	20
23-25	4	6	15'-5	8	9	15'-5	4	6	48	4	6	25	4	12	22	4	17	20	5	12	26	4	17	20

	k1			k2			k4					k6			k7			k9		
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L
0	6	18	26'-8	6	18	13'-1	6	9	12'-1	8'-0	4'-1	5	18	26'-8	6	18	15'-6	6	4.5	26'-8
1	6	18	26'-8	6	18	12'-6	6	9	11'-6	7'-7	3'-11	4	9	26'-8	4	9	14'-8	4	4.5	26'-8
2	6	12	26'-8	5	12	10'-4	7	9	10'-4	6'-4	4'-0	5	12	26'-8	6	12	14'-0	6	4.5	26'-8
3	6	12	26'-8	5	12	8'-10	7	9	9'-6	5'-6	4'-0	4	12	26'-8	7	12	10'-6	7	4.5	26'-8
4	5	9	26'-8	4	9	8'-3	7	9	9'-1	5'-1	4'-0	4	12	26'-8	7	12	9'-6	7	4.5	26'-8
5-7	5	12	26'-8	5	12	9'-4	7	9	8'-11	4'-11	4'-0	5	12	26'-8	7	12	9'-2	7	4.5	26'-8
8-10	5	12	26'-8	5	12	9'-8	6	9	8'-3	4'-6	3'-9	5	9	26'-8	6	9	8'-4	6	4.5	26'-8
11-13	5	9	26'-8	4	9	9'-1	6	9	8'-4	4'-5	3'-11	5	9	26'-8	6	9	8'-4	6	4.5	26'-8
14-16	7	18	26'-9	6	18	10'-0	5	6	8'-0	4'-5	3'-7	4	9	26'-9	7	9	8'-6	7	4.5	26'-9
17-19	6	12	27'-0	5	12	10'-5	7	9	9'-0	4'-6	4'-6	4	9	27'-0	7	9	8'-10	7	4.5	27'-0
20-22	6	12	27'-2	5	12	11'-4	6	6	9'-4	4'-8	4'-8	4	9	27'-2	7	9	9'-2	7	4.5	27'-2
23-25	6	12	27'-5	5	12	11'-11	8	12	10'-4	5'-2	5'-2	4	9	27'-5	7	9	9'-4	7	4.5	27'-5

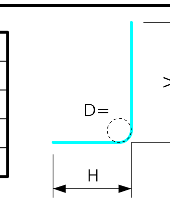
	Bar List																				Quantities				
	m1			m2			m4					m6			m7			m9			Concrete (CY/FT)				Steel (LB/FT)
Fill	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	H	V	Size	Sp.	L	Size	Sp.	L	Size	Sp.	L	Slab	Floor	Walls	Total	
0	5	12	27'-2	5	12	9'-10	7	9	20'-4	7'-10	12'-6	5	12	27'-2	5	12	15'-0	5	4.5	27'-2	1.277	1.169	1.289	3.735	526.89
1	5	12	27'-2	5	12	9'-8	6	9	19'-4	6'-10	12'-6	4	12	27'-2	6	12	11'-2	6	4.5	27'-2	1.152	1.127	1.289	3.568	490.63
2	5	9	27'-2	5	9	8'-5	7	9	17'-6	5'-2	12'-4	4	9	27'-2	6	9	9'-0	6	4.5	27'-2	0.902	0.957	1.289	3.148	556.42
3	5	9	27'-2	5	9	7'-7	7	9	17'-1	4'-10	12'-3	5	12	27'-2	7	12	8'-8	7	4.5	27'-2	0.819	0.915	1.289	3.023	533.18
4	5	9	27'-2	5	9	7'-7	7	9	16'-11	4'-8	12'-3	5	9	27'-2	6	9	8'-2	6	4.5	27'-2	0.819	0.915	1.289	3.023	526.08
5-7	6	12	27'-2	5	12	7'-10	7	9	17'-2	4'-9	12'-5	5	9	27'-2	6	9	8'-4	6	4.5	27'-2	0.861	1.042	1.289	3.192	532.47
8-10	5	9	27'-2	4	9	8'-7	6	9	17'-2	4'-7	12'-7	5	9	27'-2	6	9	8'-4	6	4.5	27'-2	0.986	1.212	1.289	3.487	523.00
11-13	6	12	27'-2	5	12	9'-3	6	9	17'-3	4'-7	12'-8	5	9	27'-2	6	9	8'-6	6	4.5	27'-2	1.111	1.339	1.289	3.739	539.03
14-16	6	12	27'-3	5	12	10'-1	5	6	17'-5	4'-7	12'-10	4	9	27'-3	7	9	8'-10	7	4.5	27'-3	1.243	1.474	1.342	4.059	539.42
17-19	6	12	27'-6	5	12	10'-11	7	9	17'-7	4'-7	13'-0	4	9	27'-6	7	9	9'-2	7	4.5	27'-6	1.427	1.662	1.449	4.538	569.74
20-22	7	18	27'-8	7	18	11'-10	6	6	17'-11	4'-9	13'-2	4	9	27'-8	7	9	9'-6	7	4.5	27'-8	1.605	1.844	1.503	4.952	606.16
23-25	7	18	27'-11	7	18	12'-2	8	12	18'-2	4'-10	13'-4	4	9	27'-11	7	9	9'-10	7	4.5	27'-11	1.752	2.037	1.610	5.399	628.87



Twin 12' x 12' Barrel Section

Bent Bar Detail

Bars	D
5	3¾"
6	4½"
7	5¼"
8	6"



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.

LATEST REVISION DATE

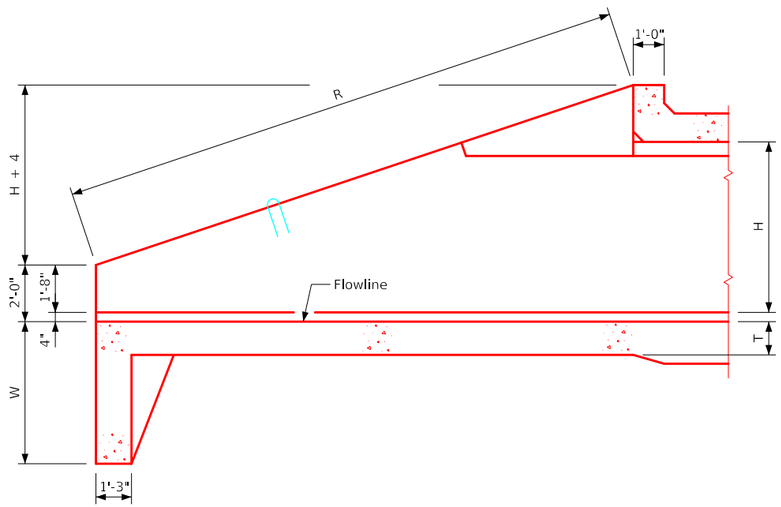
APPROVED BY BRIDGE ENGINEER

IOWA DOT

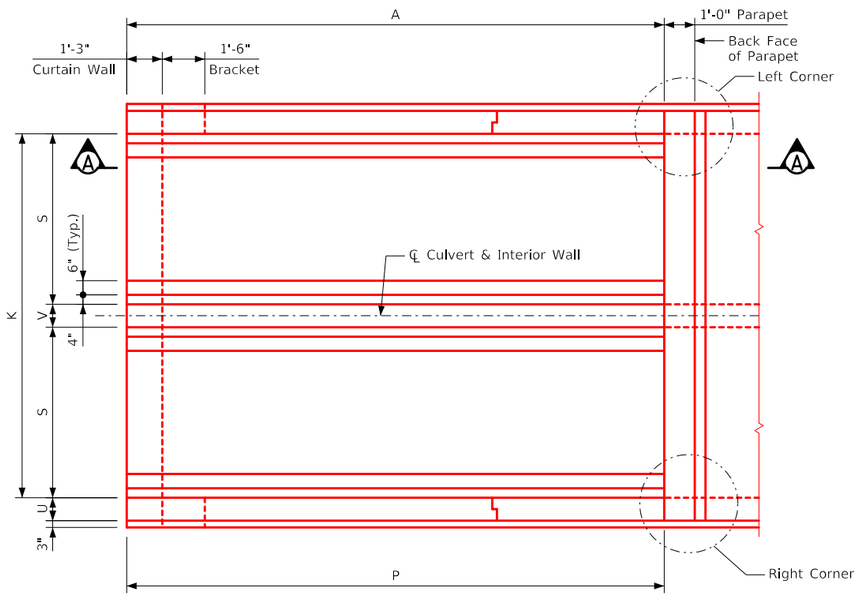
Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

Culvert Barrel Details
12' x 12' Barrel Sections

TWRCB 12-12-20



Elevation Section A-A



Plan View

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
	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
	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	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	39'-0	35'-10⅛	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	R
	R1	38'-7¼	35'-5¼	32'-3⅜	29'-1½	25'-11½	22'-9⅝	19'-7¾	16'-5⅞	13'-4⅛	38'-7¼	35'-5¼	32'-3⅜	29'-1½	25'-11½	22'-9⅝	19'-7¾	16'-5⅞	13'-4⅛	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
	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
	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	1'-0	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	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	9	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'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	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
	P	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	P
	R	32'-8⅛	29'-6⅛	26'-4¼	23'-2¼	20'-0⅜	16'-10⅜	13'-8½	R
	R1	32'-3⅜	29'-1½	25'-11½	22'-9⅝	19'-7¾	16'-5⅞	13'-4⅛	R1
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	S
	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
	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	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	D
	E	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E

Notes:

1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets TWPWH 0-2-20 thru 0-5-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

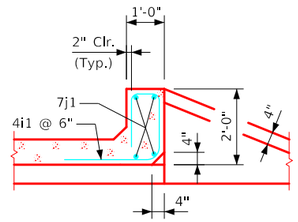
Parallel Wing Headwalls

July, 2020

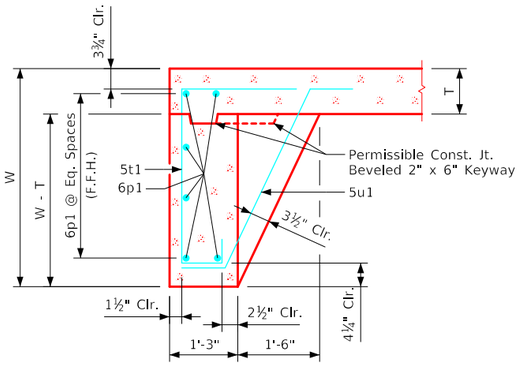
Dimension Table
0° Skew

TWPWH
0-1-20

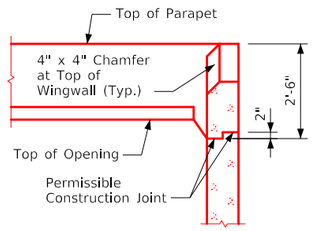
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-1-20 - THIS SHEET ISSUED 07-2020.

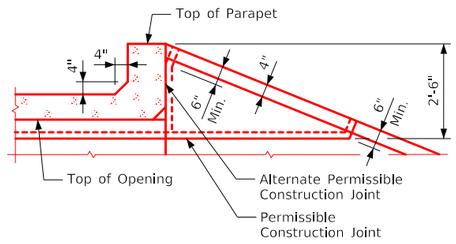


Section thru Parapet

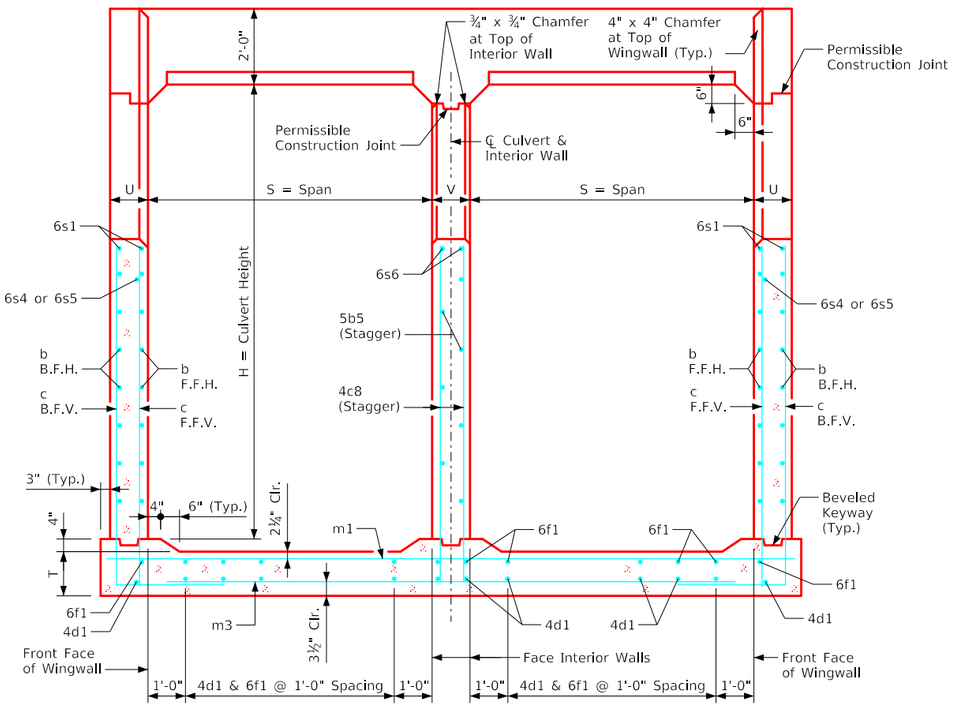


Section thru Curtain Wall

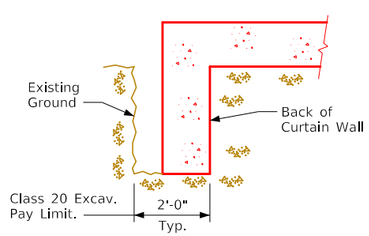




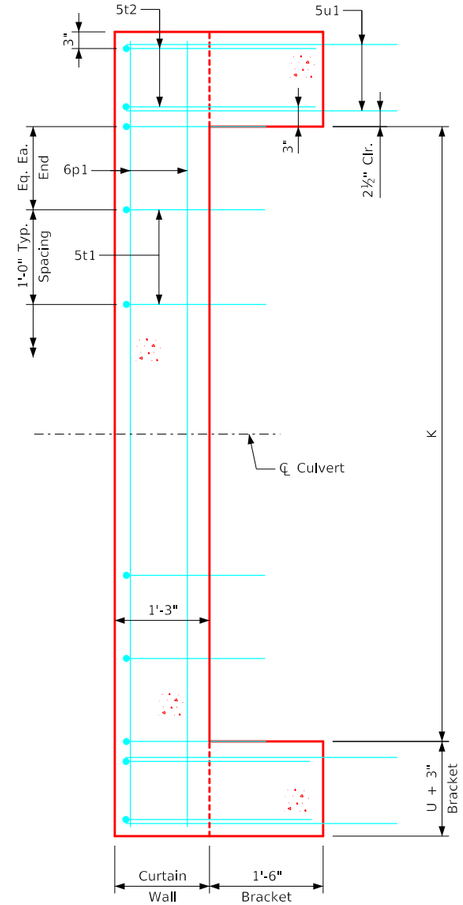
Top of Wingwall Details



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 0-1-20.

August 2022
LATEST REVISION DATE

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Standard Design - Twin Reinforced Concrete Box Culverts

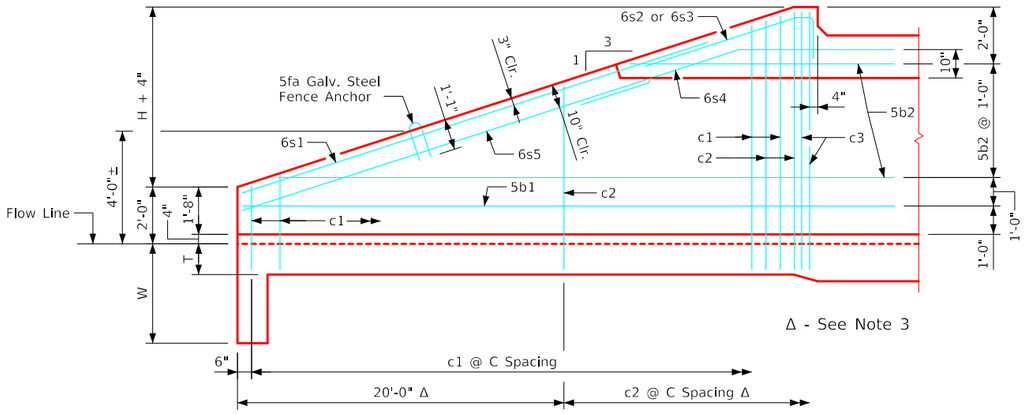
Parallel Wing Headwalls

July, 2020

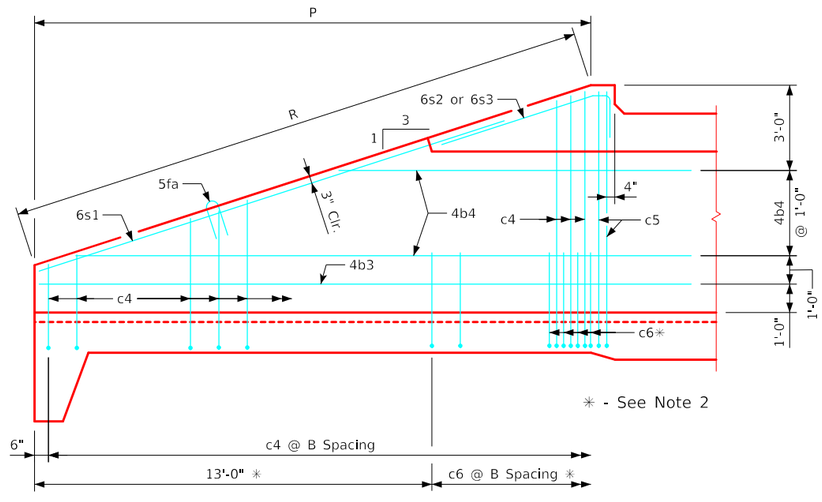
Cross Section Details
0° Skew

TWPWH
0-2-20

Revised 08-2022: Changed chamfer at top of Interior Wall to 3/4" x 3/4" (was 4" x 4").
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-2-20 - THIS SHEET ISSUED 07-2020.

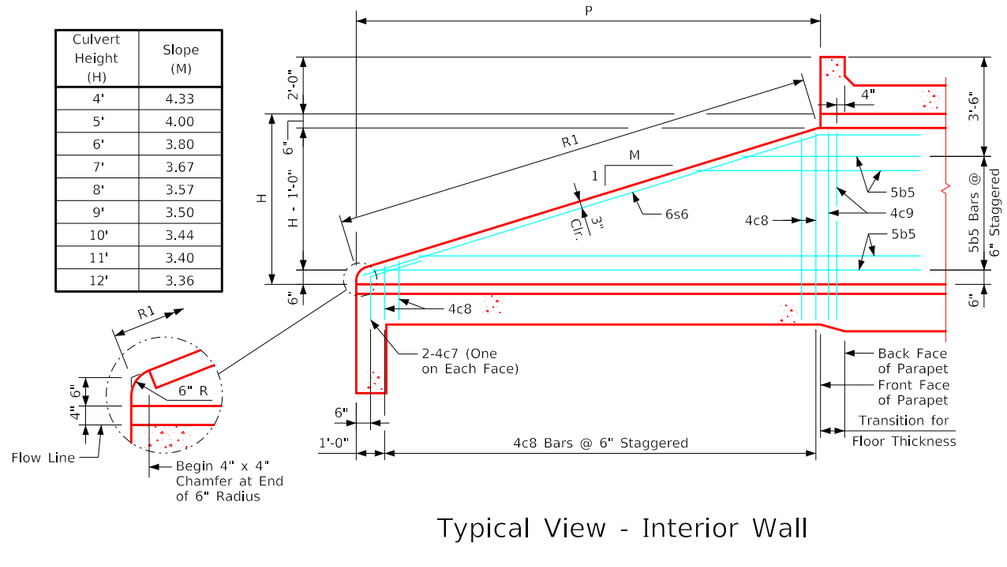


Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Culvert Height (H)	Slope (M)
4'	4.33
5'	4.00
6'	3.80
7'	3.67
8'	3.57
9'	3.50
10'	3.44
11'	3.40
12'	3.36



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 0-1-20.
5. Apron m3 bars are to be centered on ℄ 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

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations
0° Skew

TWPWH
0-3-20

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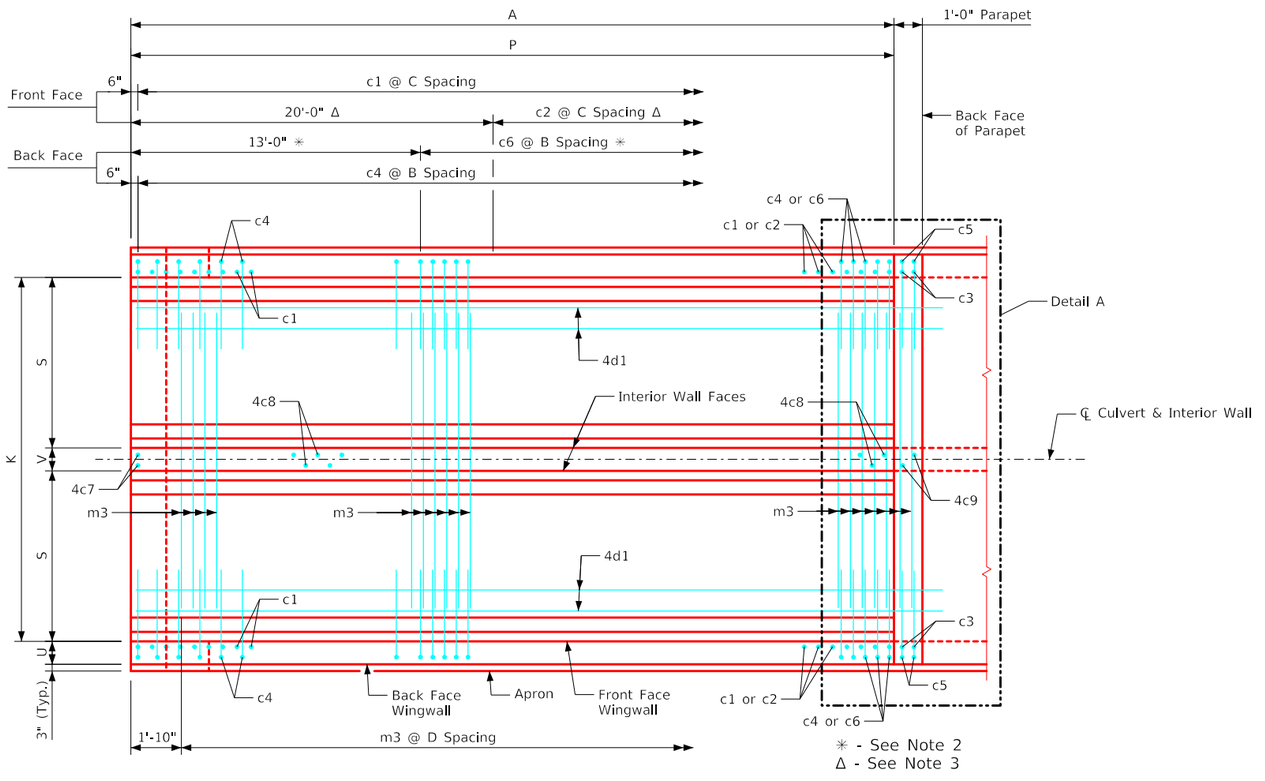
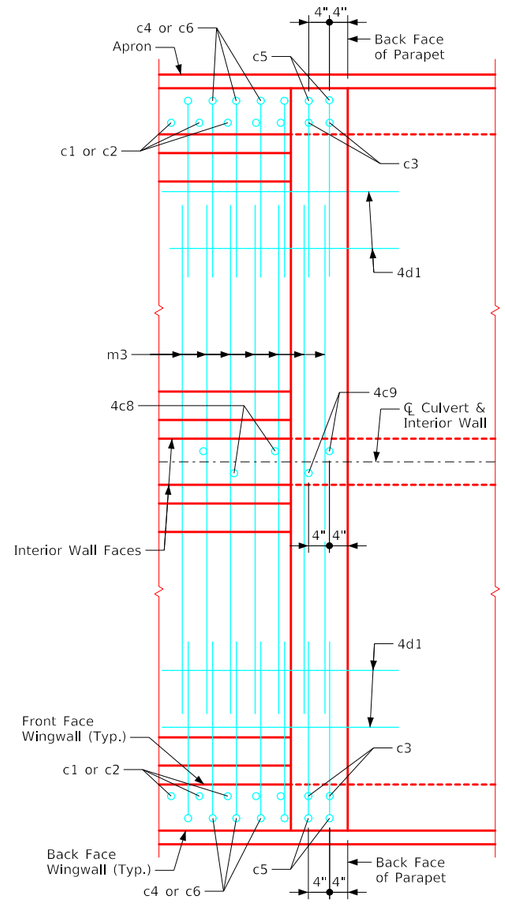


Plan View - Bottom Apron Reinforcing

(Curtain Wall Reinforcing not shown, See Sheet TWPWH 0-2-20)



Detail A

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 0-1-20.
5. Apron m3 bars are to be centered on ℄ 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.

LATEST REVISION DATE

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IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Bottom Apron Reinforcing
0° Skew

TWPWH
0-4-20

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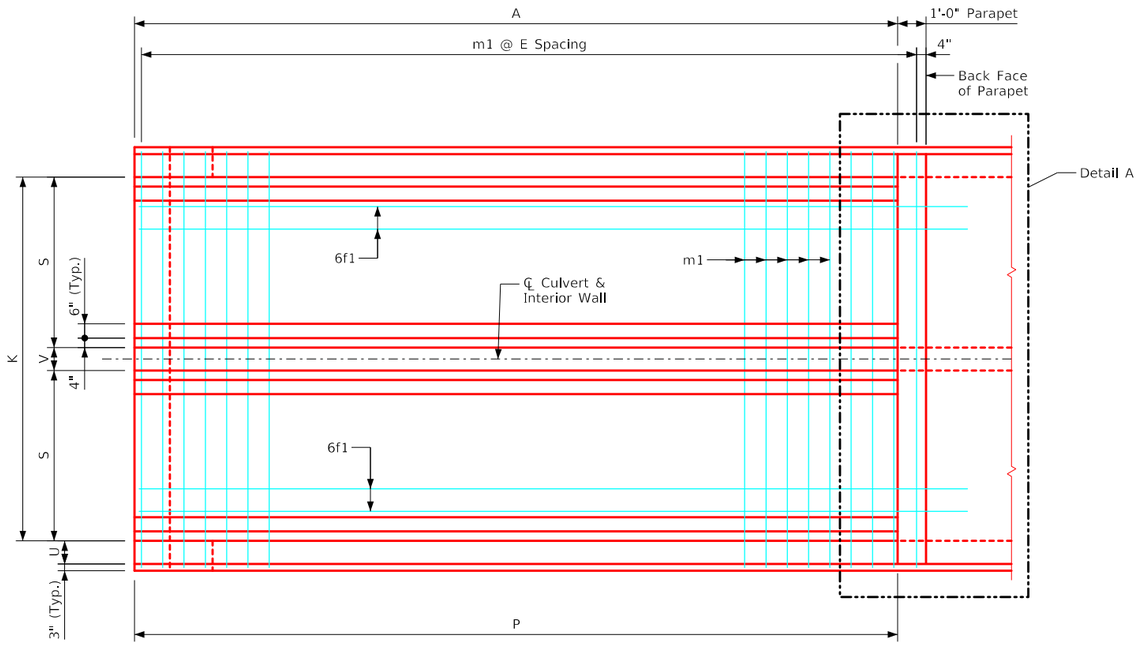
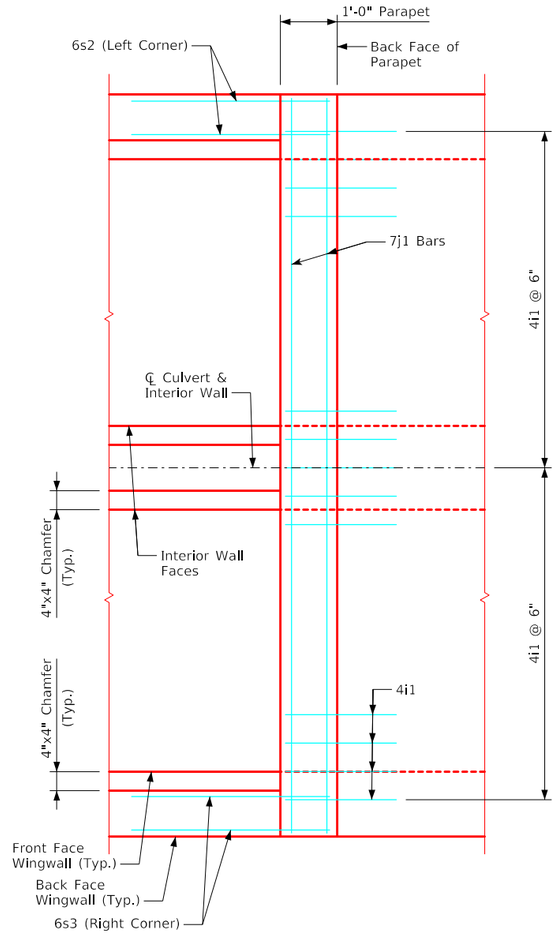


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

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 0-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 0° Skew

TWPWH 0-5-20

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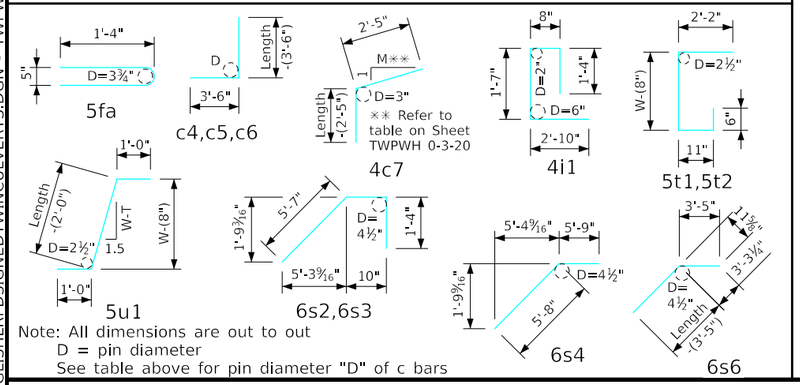
Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

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	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Interior Wall, Both F.H.		5b5	21 Var.	6'-3 to 39'-10	505	5b5	19 Var.	6'-3 to 36'-10	427	5b5	17 Var.	6'-4 to 33'-10	356	5b5	15 Var.	6'-4 to 30'-10	291	5b5	13 Var.	6'-5 to 27'-10	232	5b5	11 Var.	6'-6 to 24'-10	180
Wingwall, F.F.V.		5c1	74 Var.	2 Each 2'-8 to 14'-8	669	5c1	68 Var.	2 Each 2'-8 to 13'-8	579	4c1	62 Var.	2 Each 2'-8 to 12'-8	318	4c1	56 Var.	2 Each 2'-8 to 11'-8	268	4c1	66 Var.	2 Each 2'-8 to 10'-8	294	4c1	58 Var.	2 Each 2'-8 to 9'-8	239
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-2 to 14'-10	451	5c2	30 Var.	2 Each 9'-2 to 13'-10	360	4c2	24 Var.	2 Each 9'-2 to 12'-10	176	4c2	18 Var.	2 Each 9'-2 to 11'-10	126	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		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. (R)		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, B.F.V.		6c4	74 Var.	2 Each 6'-4 to 18'-4	1371	5c4	68 Var.	2 Each 6'-4 to 17'-4	839	5c4	62 Var.	2 Each 6'-4 to 16'-4	733	5c4	56 Var.	2 Each 6'-4 to 15'-4	633	5c4	50 Var.	2 Each 6'-4 to 14'-4	539	5c4	44 Var.	2 Each 6'-4 to 13'-4	451
Wingwall, B.F.V. (L)		6c5	2	18'-7	56	5c5	2	17'-7	37	5c5	2	16'-7	35	5c5	2	15'-7	33	5c5	2	14'-7	30	5c5	2	13'-7	28
Wingwall, B.F.V. (R)		6c5	2	18'-7	56	5c5	2	17'-7	37	5c5	2	16'-7	35	5c5	2	15'-7	33	5c5	2	14'-7	30	5c5	2	13'-7	28
Wingwall, B.F.V.		6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
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	73 Var.	1'-7 to 12'-4	339	4c8	67 Var.	1'-7 to 11'-4	289	4c8	61 Var.	1'-7 to 10'-4	243	4c8	55 Var.	1'-7 to 9'-4	201	4c8	49 Var.	1'-7 to 8'-4	162	4c8	43 Var.	1'-7 to 7'-4	128
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	40'-3	741	4d1	26	37'-3	647	4d1	26	34'-3	595	4d1	26	31'-3	543	4d1	26	28'-3	491	4d1	26	25'-3	439
Apron, Longit., Top		6f1	26	40'-3	1666	6f1	26	37'-3	1455	6f1	26	34'-3	1338	6f1	26	31'-3	1220	6f1	26	28'-3	1103	6f1	26	25'-3	986
Parapet, Vertical		4i1	51	6'-5	219	4i1	51	6'-5	219	4i1	49	6'-5	210	4i1	49	6'-5	210	4i1	49	6'-5	210	4i1	49	6'-5	210
Parapet, Horizontal		7j1	4	26'-8	218	7j1	4	26'-8	218	7j1	4	26'-2	214	7j1	4	26'-2	214	7j1	4	26'-2	214	7j1	4	25'-11	212
Apron, Trans., Top		5m1	51	27'-2	1445	5m1	47	27'-2	1332	5m1	43	26'-8	1196	5m1	39	26'-8	1085	5m1	35	26'-8	973	5m1	31	26'-5	854
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	73	23'-7	1796	5m3	67	23'-7	1648	6m3	31	23'-11	1114	5m3	28	23'-1	674	5m3	25	23'-1	602	5m3	22	22'-10	524
Curtain, Horiz.		6p1	6	27'-2	245	6p1	6	27'-2	245	6p1	6	26'-8	240	6p1	6	26'-8	240	6p1	6	26'-8	240	6p1	5	26'-5	198
Wing Slope, Both F.		6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Interior Wall, Both F.		6s6	2	41'-10	133	6s6	2	38'-8	116	6s6	2	35'-6	107	6s6	2	32'-4	97	6s6	2	29'-2	88	6s6	2	26'-0	78
Curtain, Vert.		5t1	26	7'-11	215	5t1	26	7'-8	208	5t1	25	7'-5	193	5t1	25	7'-2	187	5t1	25	6'-11	180	5t1	25	6'-8	174
Curtain, Vert. Ends		5t2	4	7'-11	33	5t2	4	7'-8	32	5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28
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			12,338 LB				10,436 LB				8641 LB				7384 LB				6517 LB				5666 LB	
	Concrete Parapet Δ	2.7				2.7				2.6				2.6				2.6				2.5			
	Concrete Wingwalls	30.0		85.7 CY		25.6		77.2 CY		17.9		64.3 CY		14.8		57.2 CY		12.0		50.4 CY		8.5		42.4 CY	
	Concrete Apron ✳	53.0				48.9				43.8				39.8				35.8				31.4			

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

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table above for pin diameter "D" of c bars

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.

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

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet TWPWH 0-1-20 for left and right corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
0° Skew

TWPWH
0-6-20
Sheet 1 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-6-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	12' x 6'				12' x 5'				12' x 4'			
		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
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Interior Wall, Both F.H.		5b5	9 Var.	6'-7 to 21'-10	133	5b5	7 Var.	6'-9 to 18'-9	93	5b5	5 Var.	7'-1 to 15'-9	60
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-8 to 8'-8	189	4c1	32 Var.	2 Each 2'-8 to 7'-8	110	4c1	26 Var.	2 Each 2'-8 to 6'-8	81
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (R)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-4 to 12'-4	370	5c4	42 Var.	2 Each 6'-4 to 11'-4	387	5c4	26 Var.	2 Each 6'-4 to 10'-4	226
Wingwall, B.F.V. (L)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V. (R)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5
Interior Wall, Both F.V		4c8	37 Var.	1'-7 to 6'-4	98	4c8	31 Var.	1'-7 to 5'-4	72	4c8	25 Var.	1'-6 to 4'-4	49
Interior Wall, Both F.V		4c9	2	6'-7	9	4c9	2	5'-7	7	4c9	2	4'-7	6
Apron, Longit., Bott.		4d1	26	22'-3	386	4d1	26	19'-3	334	4d1	26	16'-3	282
Apron, Longit., Top		6f1	26	22'-3	869	6f1	26	19'-3	752	6f1	26	16'-3	635
Parapet, Vertical		4i1	49	6'-5	210	4i1	49	6'-5	210	4i1	49	6'-5	210
Parapet, Horizontal		7j1	4	25'-11	212	7j1	4	25'-11	212	7j1	4	25'-11	212
Apron, Trans., Top		5m1	27	26'-5	744	5m1	23	26'-5	634	5m1	19	26'-5	523
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	22'-1	280	4m3	21	22'-1	310	4m3	13	22'-1	192
Curtain, Horiz.		6p1	5	26'-5	198	6p1	5	26'-5	198	6p1	5	26'-5	198
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Interior Wall, Both F.		6s6	2	22'-10	69	6s6	2	19'-8	59	6s6	2	16'-7	50
Curtain, Vert.		5t1	25	6'-5	167	5t1	25	6'-5	167	5t1	25	6'-5	167
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

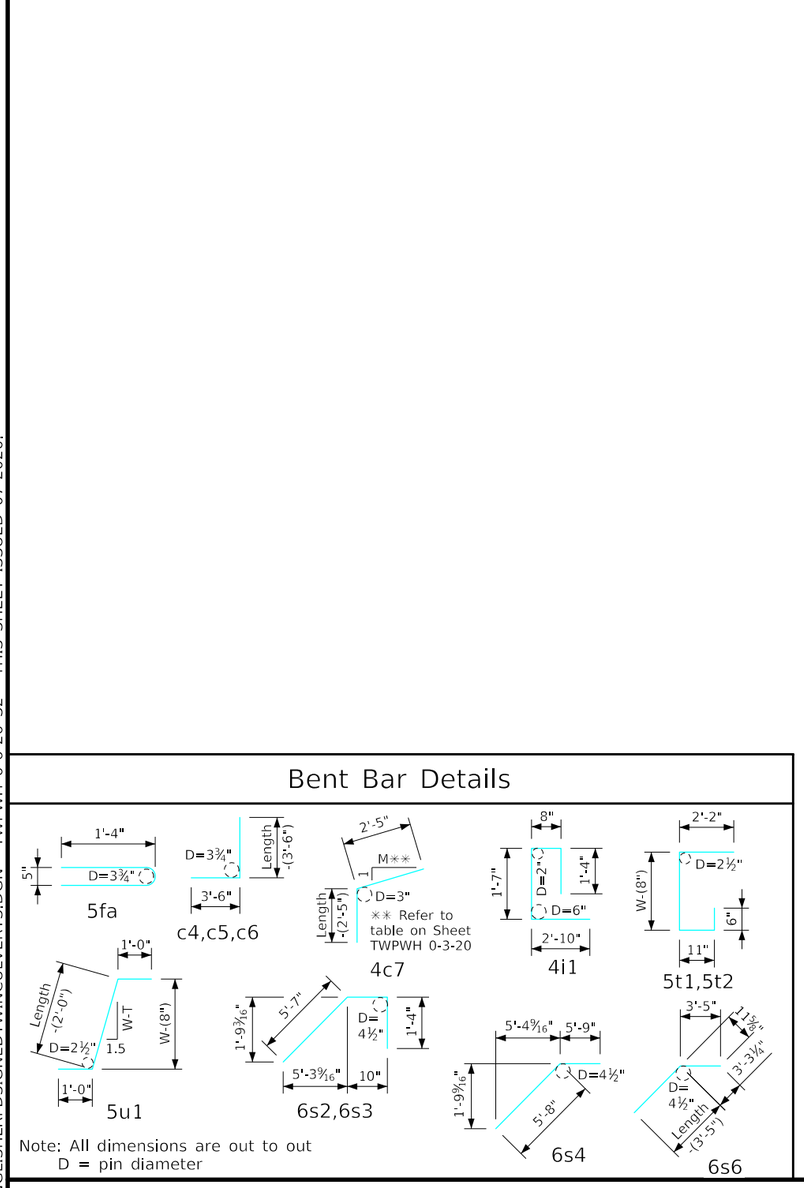
Estimated Quantities One Headwall											
Reinf. Steel			4736 LB		4106 LB		3346 LB				
Concrete	Parapet Δ	2.5	36.4 CY		2.5	30.9 CY		2.5	25.8 CY		
	Wingwalls	6.5			4.7			3.2			
	Apron ✳	27.4			23.7			20.1			

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet TWPWH 0-1-20 for left and right corner locations.

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

Bent Bar Details



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

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
0° Skew

TWPWH
0-6-20
Sheet 2 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-6-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' 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	40'-3	89	5b1	2	37'-3	78	5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53
Wingwall, F.F.H.		5b2	22 Var.	2 Each 8'-10 to 38'-10	547	5b2	20 Var.	2 Each 8'-10 to 35'-10	466	5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204
Wingwall, B.F.H.		4b3	2	40'-3	57	4b3	2	37'-3	50	4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34
Wingwall, B.F.H.		4b4	20 Var.	2 Each 11'-10 to 38'-10	338	4b4	18 Var.	2 Each 11'-10 to 35'-10	287	4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119
Interior Wall, Both F.H.		5b5	21 Var.	6'-3 to 39'-10	505	5b5	19 Var.	6'-3 to 36'-10	427	5b5	17 Var.	6'-4 to 33'-10	356	5b5	15 Var.	6'-4 to 30'-10	291	5b5	13 Var.	6'-5 to 27'-10	232	5b5	11 Var.	6'-6 to 24'-10	180
Wingwall, F.F.V.		5c1	74 Var.	2 Each 2'-7 to 14'-7	662	5c1	68 Var.	2 Each 2'-7 to 13'-7	573	4c1	62 Var.	2 Each 2'-7 to 12'-7	314	4c1	56 Var.	2 Each 2'-7 to 11'-7	265	4c1	66 Var.	2 Each 2'-7 to 10'-7	290	4c1	58 Var.	2 Each 2'-7 to 9'-7	236
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-1 to 14'-9	447	5c2	30 Var.	2 Each 9'-1 to 13'-9	357	4c2	24 Var.	2 Each 9'-1 to 12'-9	175	4c2	18 Var.	2 Each 9'-1 to 11'-9	125	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, F.F.V. (R)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, B.F.V.		6c4	74 Var.	2 Each 6'-3 to 18'-3	1362	5c4	68 Var.	2 Each 6'-3 to 17'-3	833	5c4	62 Var.	2 Each 6'-3 to 16'-3	727	5c4	56 Var.	2 Each 6'-3 to 15'-3	628	5c4	50 Var.	2 Each 6'-3 to 14'-3	535	5c4	44 Var.	2 Each 6'-3 to 13'-3	447
Wingwall, B.F.V. (L)		6c5	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V. (R)		6c5	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V.		6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	73 Var.	1'-6 to 12'-3	335	4c8	67 Var.	1'-6 to 11'-3	285	4c8	61 Var.	1'-6 to 10'-3	239	4c8	55 Var.	1'-6 to 9'-3	197	4c8	49 Var.	1'-6 to 8'-3	160	4c8	43 Var.	1'-6 to 7'-3	126
Interior Wall, Both F.V		4c9	2	12'-6	17	4c9	2	11'-6	15	4c9	2	10'-6	14	4c9	2	9'-6	13	4c9	2	8'-6	11	4c9	2	7'-6	10
Apron, Longit., Bott.		4d1	22	40'-3	627	4d1	22	37'-3	547	4d1	22	34'-3	503	4d1	22	31'-3	459	4d1	22	28'-3	415	4d1	22	25'-3	371
Apron, Longit., Top		6f1	22	40'-3	1410	6f1	22	37'-3	1231	6f1	22	34'-3	1132	6f1	22	31'-3	1033	6f1	22	28'-3	933	6f1	22	25'-3	834
Parapet, Vertical		4i1	43	6'-5	184	4i1	43	6'-5	184	4i1	41	6'-5	176	4i1	41	6'-5	176	4i1	41	6'-5	176	4i1	41	6'-5	176
Parapet, Horizontal		7j1	4	22'-8	185	7j1	4	22'-8	185	7j1	4	22'-2	181	7j1	4	22'-2	181	7j1	4	22'-2	181	7j1	4	21'-11	179
Apron, Trans., Top		5m1	51	23'-2	1232	5m1	47	23'-2	1136	5m1	43	22'-8	1017	5m1	39	22'-8	922	5m1	35	22'-8	827	5m1	31	22'-5	725
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	73	19'-7	1491	5m3	67	19'-7	1369	6m3	31	19'-11	927	5m3	28	19'-1	557	5m3	25	19'-1	498	5m3	22	18'-10	432
Curtain, Horiz.		6p1	6	23'-2	209	6p1	6	23'-2	209	6p1	6	22'-8	204	6p1	6	22'-8	204	6p1	6	22'-8	204	6p1	5	22'-5	168
Wing Slope, Both F.		6s1	4	35'-8	214	6s1	4	32'-7	196	6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	33'-2	100	6s5	2	30'-0	90	6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52
Interior Wall, Both F.		6s6	2	41'-10	133	6s6	2	38'-8	116	6s6	2	35'-6	107	6s6	2	32'-4	97	6s6	2	29'-2	88	6s6	2	26'-0	78
Curtain, Vert.		5t1	22	7'-11	182	5t1	22	7'-8	176	5t1	21	7'-5	162	5t1	21	7'-2	157	5t1	21	6'-11	151	5t1	21	6'-8	146
Curtain, Vert. Ends		5t2	4	7'-11	33	5t2	4	7'-8	32	5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28
Bracket, Vert.		5u1	4	6'-7	27	5u1	4	6'-4	26	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-6	23
Estimated Quantities One Headwall	Reinf. Steel			11,289 LB				9481 LB				7826 LB				6685 LB				5879 LB				5091 LB	
	Concrete Parapet Δ		2.5	75.6 CY			2.5	67.9 CY			2.3	55.7 CY			2.3	49.3 CY			2.3	43.3 CY			2.2	36.1 CY	
	Concrete Wingwalls		30.0				25.6				17.9				14.8				12.0				8.5		
	Concrete Apron ✳		43.1				39.8				35.5				32.2				29.0				25.4		

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

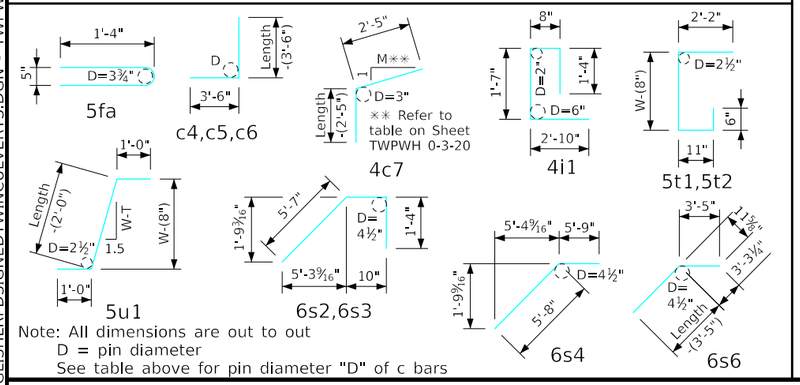
Δ Includes top of wingwall quantities.

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

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

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet TWPWH 0-1-20 for left and right corner locations.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table above for pin diameter "D" of c bars

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
0° Skew

TWPWH
0-7-20
Sheet 1 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-7-20 S1 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

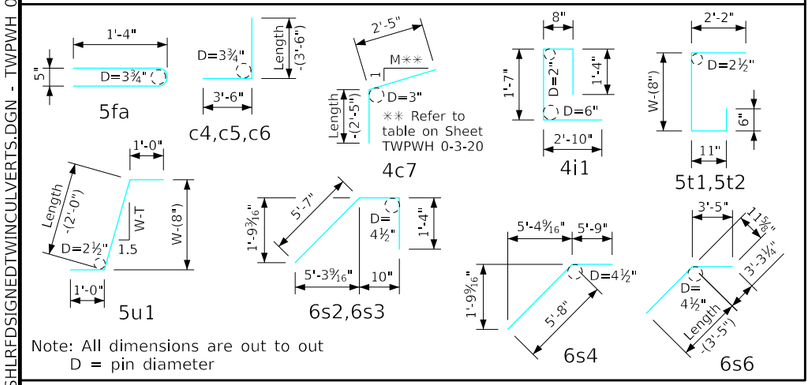
Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Interior Wall, Both F.H.		5b5	9 Var.	6'-7 to 21'-10	133	5b5	7 Var.	6'-9 to 18'-9	93	5b5	5 Var.	7'-1 to 15'-9	60
Wingwall, F.F.V.		4c1	50 Var.	2 Each 2'-7 to 8'-7	186	4c1	32 Var.	2 Each 2'-7 to 7'-7	109	4c1	26 Var.	2 Each 2'-7 to 6'-7	80
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (R)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	38 Var.	2 Each 6'-3 to 12'-3	367	5c4	32 Var.	2 Each 6'-3 to 11'-3	292	5c4	26 Var.	2 Each 6'-3 to 10'-3	224
Wingwall, B.F.V. (L)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V. (R)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	37 Var.	1'-6 to 6'-3	96	4c8	31 Var.	1'-6 to 5'-3	70	4c8	25 Var.	1'-5 to 4'-3	47
Interior Wall, Both F.V		4c9	2	6'-6	9	4c9	2	5'-6	7	4c9	2	4'-6	6
Apron, Longit., Bott.		4d1	22	22'-3	327	4d1	22	19'-3	283	4d1	22	16'-3	239
Apron, Longit., Top		6f1	22	22'-3	735	6f1	22	19'-3	636	6f1	22	16'-3	537
Parapet, Vertical		4i1	41	6'-5	176	4i1	41	6'-5	176	4i1	41	6'-5	176
Parapet, Horizontal		7j1	4	21'-11	179	7j1	4	21'-11	179	7j1	4	21'-11	179
Apron, Trans., Top		5m1	27	22'-5	631	5m1	23	22'-5	538	5m1	19	22'-5	444
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		4m3	19	18'-1	230	4m3	16	18'-1	193	4m3	13	18'-1	157
Curtain, Horiz.		6p1	5	22'-5	168	6p1	5	22'-5	168	6p1	5	22'-5	168
Wing Slope, Both F.		6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Interior Wall, Both F.		6s6	2	22'-10	69	6s6	2	19'-8	59	6s6	2	16'-7	50
Curtain, Vert.		5t1	21	6'-5	141	5t1	21	6'-5	141	5t1	21	6'-5	141
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22
Estimated Quantities One Headwall	Reinf. Steel			4249 LB				3505 LB				2963 LB	
	Concrete: Parapet Δ		2.2	30.9 CY			2.2	26.2 CY			2.2	21.7 CY	
	Concrete: Wingwalls		6.5				4.7				3.2		
	Concrete: Apron ✳		22.2				19.3				16.3		

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.

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet TWPWH 0-1-20 for left and right corner locations.

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

Bent Bar Details



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

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
0° Skew

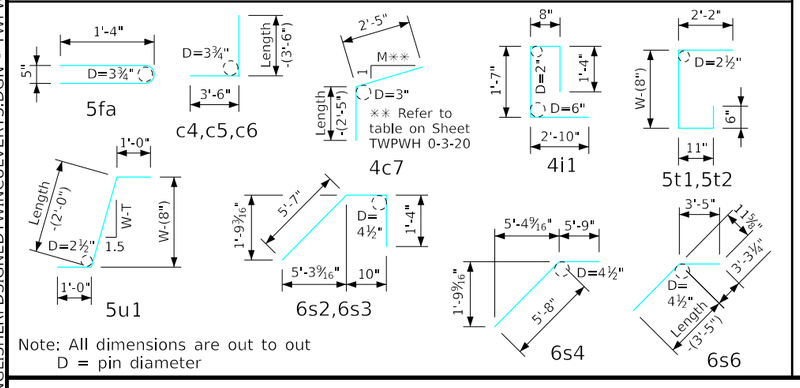
TWPWH
0-7-20
Sheet 2 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 0° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	34'-3	71	5b1	2	31'-3	65	5b1	2	28'-3	59	5b1	2	25'-3	53	5b1	2	22'-3	46	5b1	2	19'-3	40	5b1	2	16'-3	34
Wingwall, F.F.H.		5b2	18 Var.	2 Each 8'-10 to 32'-10	391	5b2	16 Var.	2 Each 8'-10 to 29'-10	323	5b2	14 Var.	2 Each 8'-10 to 26'-10	260	5b2	12 Var.	2 Each 8'-10 to 23'-10	204	5b2	10 Var.	2 Each 8'-10 to 20'-10	155	5b2	8 Var.	2 Each 8'-10 to 17'-10	111	5b2	6 Var.	2 Each 8'-10 to 14'-10	74
Wingwall, B.F.H.		4b3	2	34'-3	46	4b3	2	31'-3	42	4b3	2	28'-3	38	4b3	2	25'-3	34	4b3	2	22'-3	30	4b3	2	19'-3	26	4b3	2	16'-3	22
Wingwall, B.F.H.		4b4	16 Var.	2 Each 11'-10 to 32'-10	239	4b4	14 Var.	2 Each 11'-10 to 29'-10	195	4b4	12 Var.	2 Each 11'-10 to 26'-10	155	4b4	10 Var.	2 Each 11'-10 to 23'-10	119	4b4	8 Var.	2 Each 11'-10 to 20'-10	87	4b4	6 Var.	2 Each 11'-10 to 17'-10	59	4b4	4 Var.	2 Each 11'-10 to 14'-10	36
Interior Wall, Both F.H.		5b5	17 Var.	6'-4 to 33'-10	356	5b5	15 Var.	6'-4 to 30'-10	291	5b5	13 Var.	6'-5 to 27'-10	232	5b5	11 Var.	6'-6 to 24'-10	180	5b5	9 Var.	6'-7 to 21'-10	133	5b5	7 Var.	6'-9 to 18'-9	93	5b5	5 Var.	7'-1 to 15'-9	60
Wingwall, F.F.V.		4c1	62 Var.	2 Each 2'-5 to 12'-5	307	4c1	56 Var.	2 Each 2'-5 to 11'-5	259	4c1	66 Var.	2 Each 2'-5 to 10'-5	283	4c1	58 Var.	2 Each 2'-5 to 9'-5	229	4c1	50 Var.	2 Each 2'-5 to 8'-5	181	4c1	32 Var.	2 Each 2'-5 to 7'-5	105	4c1	26 Var.	2 Each 2'-5 to 6'-5	77
Wingwall, F.F.V.		4c2	24 Var.	2 Each 8'-11 to 12'-7	172	4c2	18 Var.	2 Each 8'-11 to 11'-7	123	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (L)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (R)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		5c4	62 Var.	2 Each 6'-1 to 16'-1	717	5c4	56 Var.	2 Each 6'-1 to 15'-1	618	5c4	50 Var.	2 Each 6'-1 to 14'-1	526	5c4	44 Var.	2 Each 6'-1 to 13'-1	440	5c4	38 Var.	2 Each 6'-1 to 12'-1	360	5c4	32 Var.	2 Each 6'-1 to 11'-1	286	5c4	26 Var.	2 Each 6'-1 to 10'-1	219
Wingwall, B.F.V. (L)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V. (R)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V.		5c6	38	8'-6	337	5c6	32	8'-6	284	5c6	26	8'-6	231	5c6	20	8'-6	177	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5
Interior Wall, Both F.V		4c8	61 Var.	1'-4 to 10'-1	233	4c8	55 Var.	1'-4 to 9'-1	191	4c8	49 Var.	1'-4 to 8'-1	154	4c8	43 Var.	1'-4 to 7'-1	121	4c8	37 Var.	1'-4 to 6'-1	92	4c8	31 Var.	1'-4 to 5'-1	66	4c8	25 Var.	1'-3 to 4'-1	45
Interior Wall, Both F.V		4c9	2	10'-4	14	4c9	2	9'-4	12	4c9	2	8'-4	11	4c9	2	7'-4	10	4c9	2	6'-4	8	4c9	2	5'-4	7	4c9	2	4'-4	6
Apron, Longit., Bott.		4d1	18	34'-3	412	4d1	18	31'-3	376	4d1	18	28'-3	340	4d1	18	25'-3	304	4d1	18	22'-3	268	4d1	18	19'-3	231	4d1	18	16'-3	195
Apron, Longit., Top		6f1	18	34'-3	926	6f1	18	31'-3	845	6f1	18	28'-3	764	6f1	18	25'-3	683	6f1	18	22'-3	602	6f1	18	19'-3	520	6f1	18	16'-3	439
Parapet, Vertical		4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141	4i1	33	6'-5	141
Parapet, Horizontal		7j1	4	18'-2	149	7j1	4	18'-2	149	7j1	4	18'-2	149	7j1	4	17'-11	146	7j1	4	17'-11	146	7j1	4	17'-11	146	7j1	4	17'-11	146
Apron, Trans., Top		5m1	32	18'-8	623	5m1	29	18'-8	565	5m1	26	18'-8	506	5m1	23	18'-5	442	5m1	20	18'-5	384	5m1	17	18'-5	327	5m1	14	18'-5	269
Apron, Trans., Top		m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--	m2	--	--	--
Apron, Trans., Bott.		5m3	61	15'-1	960	5m3	55	15'-1	865	5m3	33	15'-1	519	5m3	22	14'-10	340	4m3	19	14'-1	179	4m3	16	14'-1	151	4m3	13	14'-1	122
Curtain, Horiz.		6p1	6	18'-8	168	6p1	6	18'-8	168	6p1	6	18'-8	168	6p1	5	18'-5	138	6p1	5	18'-5	138	6p1	5	18'-5	138	6p1	5	18'-5	138
Wing Slope, Both F.		6s1	4	29'-5	177	6s1	4	26'-3	158	6s1	4	23'-1	139	6s1	4	19'-11	120	6s1	4	16'-9	101	6s1	4	13'-7	82	6s1	4	10'-5	63
Wing Slope, Both F. (L)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-9	23
Wing Slope, Both F. (R)		6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23	6s3	2	7'-9	23
Wing Slope, F.F.		6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34	6s4	2	11'-5	34
Wing Slope, F.F.		6s5	2	26'-10	81	6s5	2	23'-8	71	6s5	2	20'-6	62	6s5	2	17'-4	52	6s5	2	14'-2	43	6s5	2	11'-0	33	6s5	2	7'-10	24
Interior Wall, Both F.		6s6	2	35'-6	107	6s6	2	32'-4	97	6s6	2	29'-2	88	6s6	2	26'-0	78	6s6	2	22'-10	69	6s6	2	19'-8	59	6s6	2	16'-7	50
Curtain, Vert.		5t1	17	7'-5	132	5t1	17	7'-2	127	5t1	17	6'-11	123	5t1	17	6'-8	118	5t1	17	6'-5	114	5t1	17	6'-5	114	5t1	17	6'-5	114
Curtain, Vert. Ends		5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel			7008 LB				6207 LB				5180 LB				4353 LB				3617 LB				2943 LB				2476 LB	
	Concrete Parapet Δ	2.0		46.0 CY		2.0		40.5 CY		2.0		35.4 CY		1.9		29.1 CY		1.9		24.8 CY		1.9		20.9 CY		1.9		17.3 CY	
	Concrete Wingwalls	17.9				14.8				12.0				8.5				6.5				4.7				3.2			
	Concrete Apron ✳	26.1				23.7				21.4				18.7				16.4				14.3				12.2			

Bent Bar Details



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

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.

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

(L) - Indicates bar located at left corner.
(R) - Indicates bar located at right corner.
Refer to Sheet TWPWH 0-1-20 for left and right corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

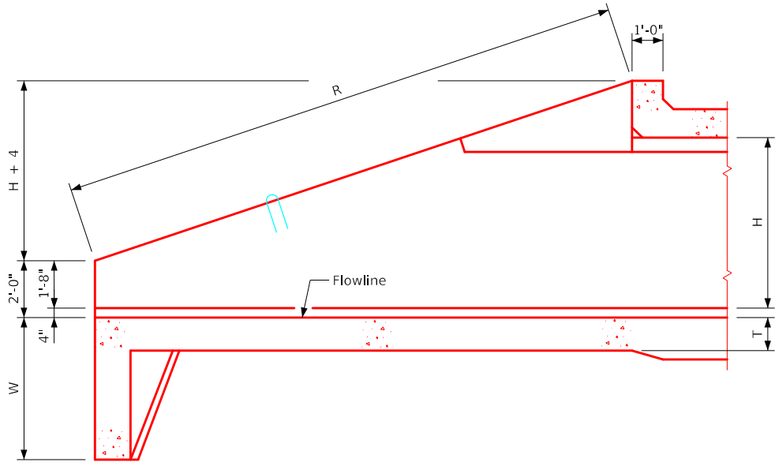
Parallel Wing Headwalls

July, 2020

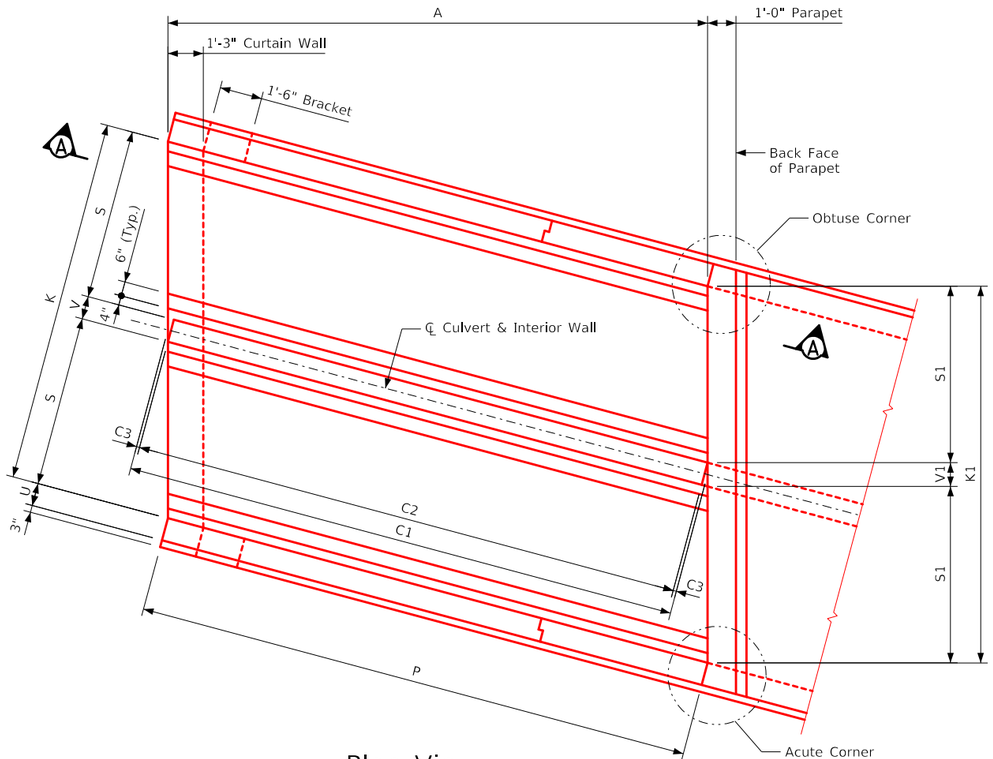
Quantity Tabulation 8'-0" Span 0° Skew

TWPWH 0-8-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 0-8-20 - THIS SHEET ISSUED 07-2020.



Elevation Section A-A



Plan View

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	38'-3⅜	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	38'-3⅜	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	C1
	C2	38'-0⅜	34'-11⅛	31'-10⅜	28'-9⅛	25'-7⅞	22'-6⅞	19'-5½	16'-4¼	13'-3	38'-0⅜	34'-11⅛	31'-10⅜	28'-9⅛	25'-7⅞	22'-6⅞	19'-5½	16'-4¼	13'-3	C2
	C3	1⅝	1⅝	1⅜	1⅜	1⅜	1¼	1¼	1¼	1¼	1⅝	1⅝	1⅜	1⅜	1⅜	1¼	1¼	1¼	1¼	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	25'-10⅝	25'-10⅝	25'-8⅝	25'-8⅝	25'-8⅝	25'-7⅝	25'-7⅝	25'-7⅝	25'-7⅝	21'-8⅞	21'-8⅞	21'-6⅞	21'-6⅞	21'-6⅞	21'-5⅞	21'-5⅞	21'-5⅞	21'-5⅞	K1
	P	38'-3⅜	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	38'-3⅜	35'-2⅜	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	P
	R	40'-2⅞	36'-11¾	33'-1⅜	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	40'-2⅞	36'-11¾	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	R
	R1	39'-7⅛	36'-4	33'-1⅜	29'-10¼	26'-7⅛	23'-4¼	20'-1¼	16'-10⅛	13'-7⅛	39'-7⅛	36'-4	33'-1⅜	29'-10¼	26'-7⅛	23'-4¼	20'-1¼	16'-10⅛	13'-7⅛	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	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	12'-5⅛	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	10'-4¼	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'-0⅜	1'-0⅜	10⅜	10⅜	10⅜	9⅜	9⅜	9⅜	9⅜	1'-0⅜	1'-0⅜	10⅜	10⅜	10⅜	9⅜	9⅜	9⅜	9⅜	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	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	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	9	1'-0	6	6	1'-0	9	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'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	C1	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	C1
	C2	31'-10⅜	28'-9⅛	25'-7⅞	22'-6⅞	19'-5½	16'-4¼	13'-3	C2
	C3	1⅜	1⅜	1⅜	1¼	1¼	1¼	1¼	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	17'-5⅛	17'-5⅛	17'-5⅛	17'-4⅛	17'-4⅛	17'-4⅛	17'-4⅛	K1
	P	32'-1⅛	28'-11⅞	25'-10⅝	22'-9⅜	19'-8	16'-6¾	13'-5½	P
	R	33'-8⅝	30'-5½	27'-2¼	23'-11⅛	20'-8	17'-4⅞	14'-1⅝	R
	R1	33'-1⅜	29'-10¼	26'-7⅛	23'-4¼	20'-1¼	16'-10⅛	13'-7⅛	R1
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	S
	S1	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	8'-3⅜	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	10⅜	10⅜	10⅜	9⅜	9⅜	9⅜	9⅜	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	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	D
	E	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	E

Notes:

1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets TWPWH 15-2-20 thru 15-5-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

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IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Dimension Table
15° Skew

TWPWH
15-1-20

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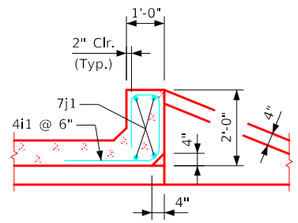
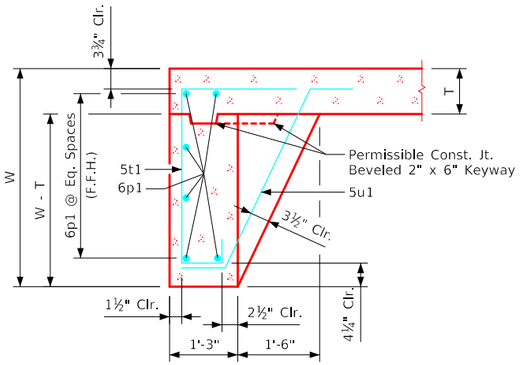
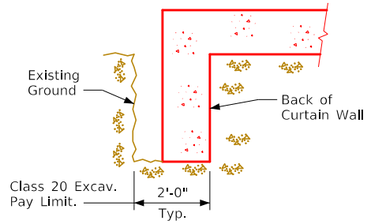


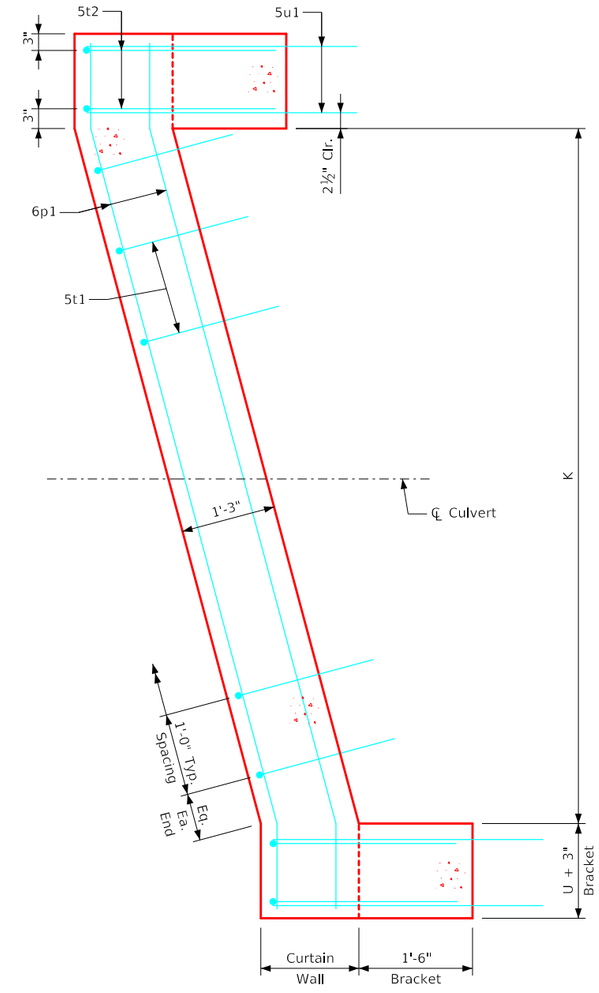
Section thru Parapet



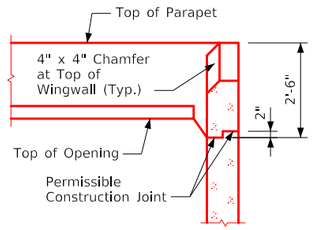
Section thru Curtain Wall

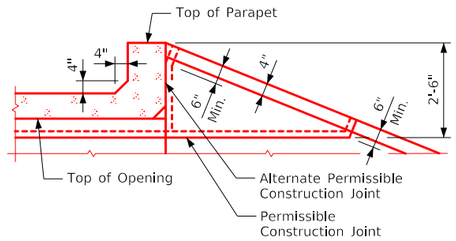


Curtain Wall
Class 20 Excavation



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





Top of Wingwall Details

Typical Cross Section - thru Headwall

Notes:

1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
2. For dimension table see Sheet TWPWH 15-1-20.

August 2022
LATEST REVISION DATE

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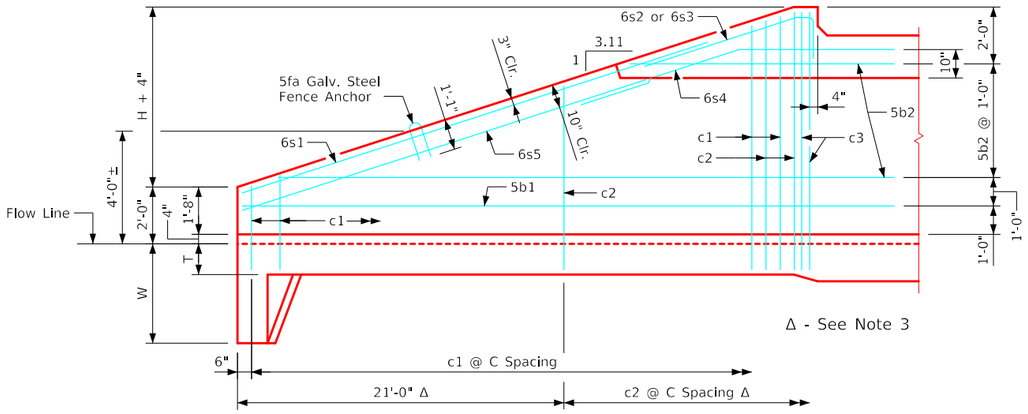
Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

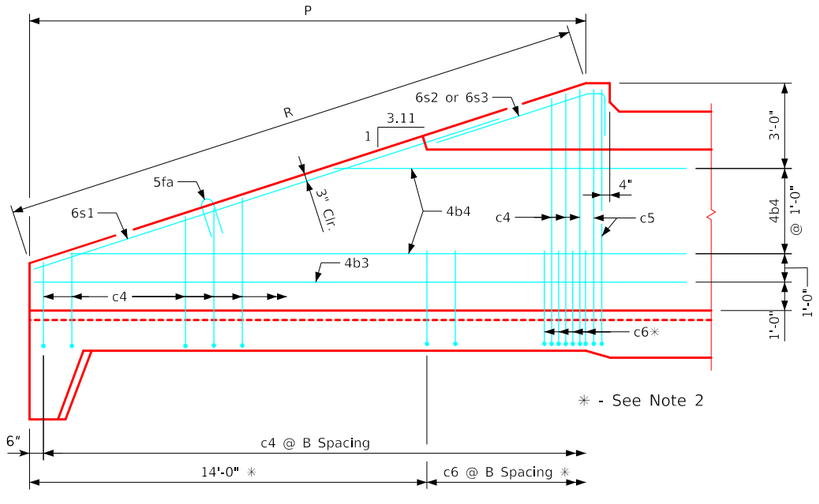
July, 2020

Cross Section Details 15° Skew	TWPWH 15-2-20

Revised 08-2022: Changed chamfer at top of Interior Wall to 3/4" x 3/4" (was 4" x 4").
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 15-2-20 - THIS SHEET ISSUED 07-2020.

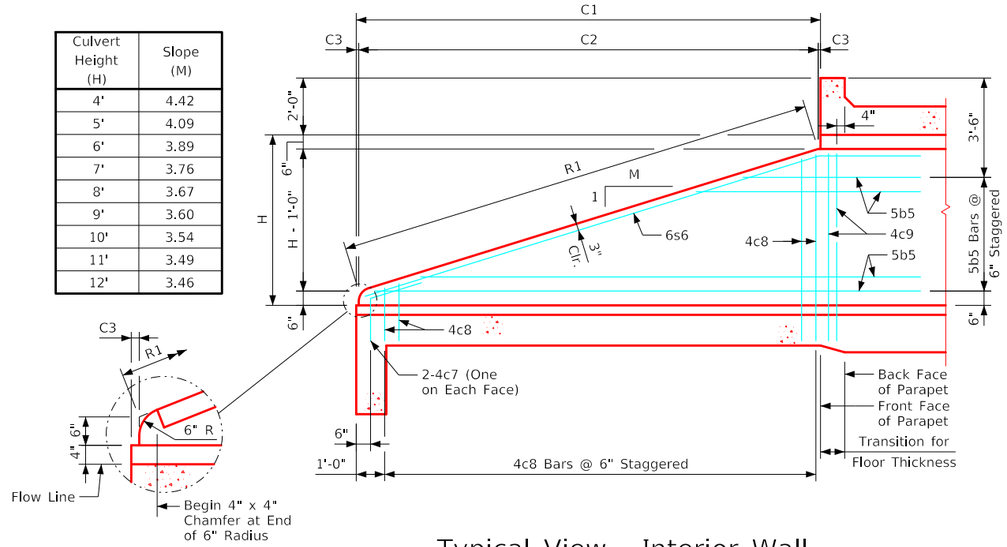


Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Culvert Height (H)	Slope (M)
4'	4.42
5'	4.09
6'	3.89
7'	3.76
8'	3.67
9'	3.60
10'	3.54
11'	3.49
12'	3.46



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 15-1-20.
5. Apron m3 bars are to be centered on ℄ 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.

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations
15° Skew

TWPWH
15-3-20

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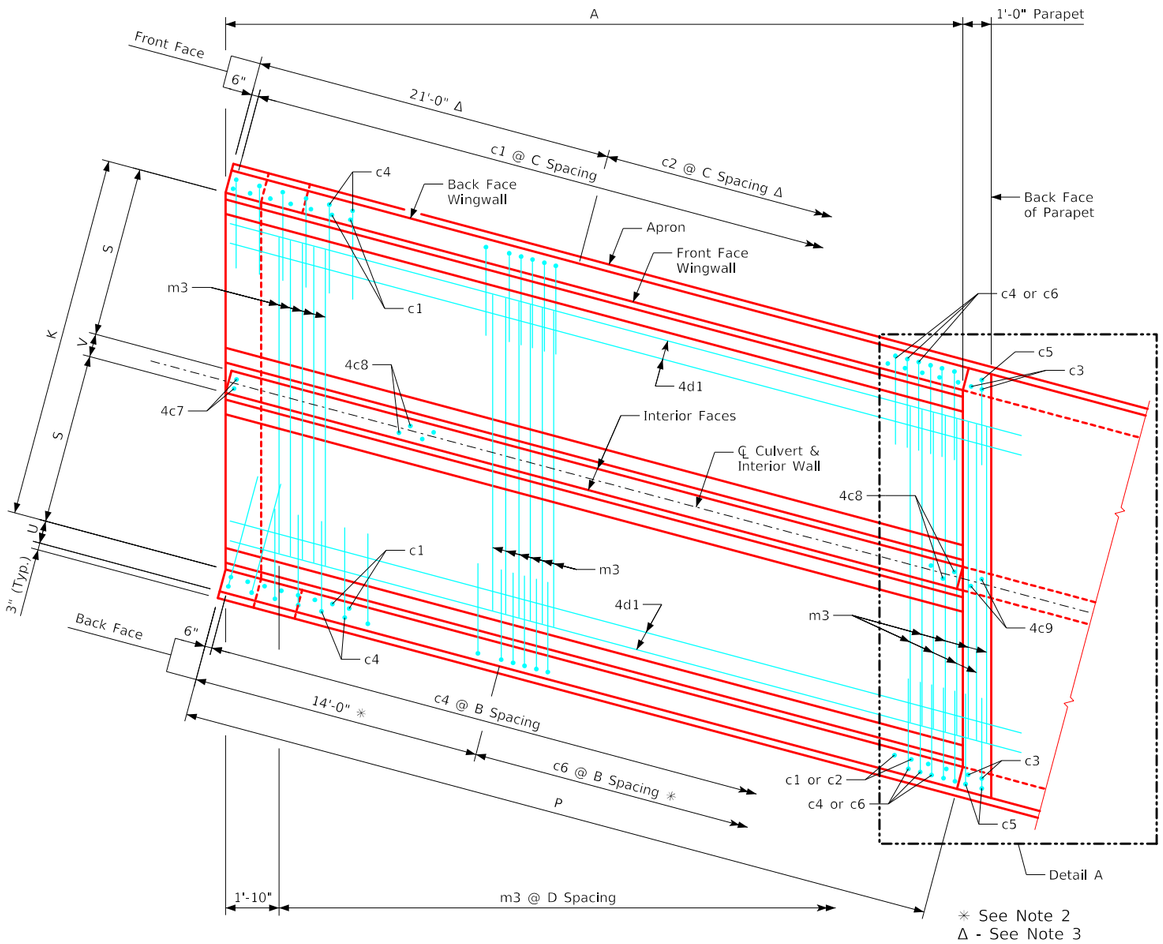
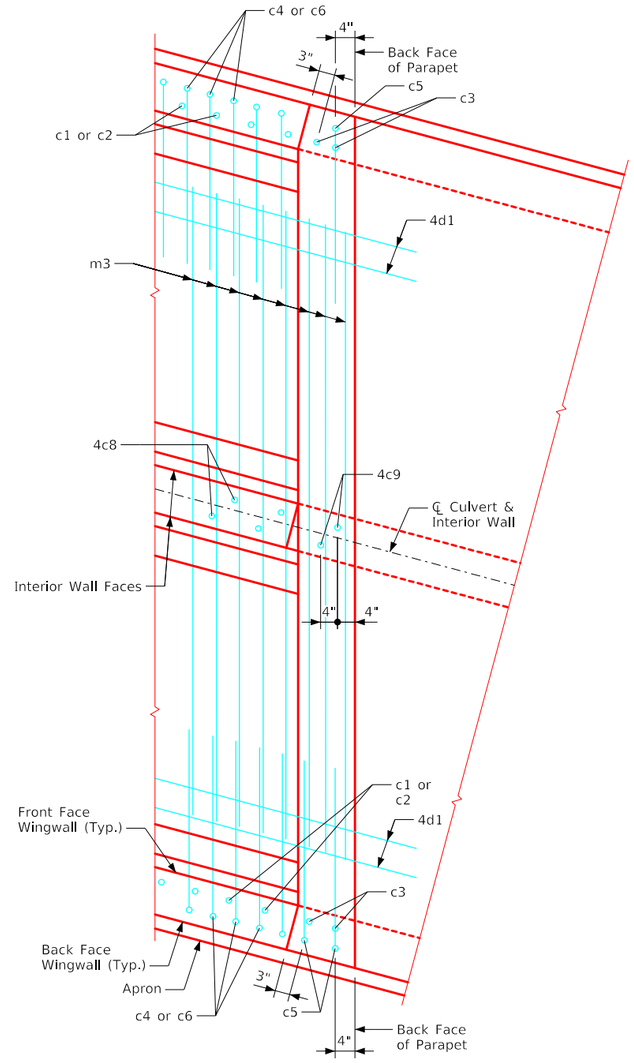


Plan View - Bottom Apron Reinforcing

(Curtain Wall Reinforcing not shown, See Sheet TWPWH 15-2-20)



Detail A

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 15-1-20.
5. Apron m3 bars are to be centered on ℄ 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.

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Bottom Apron Reinforcing
15° Skew

TWPWH
15-4-20

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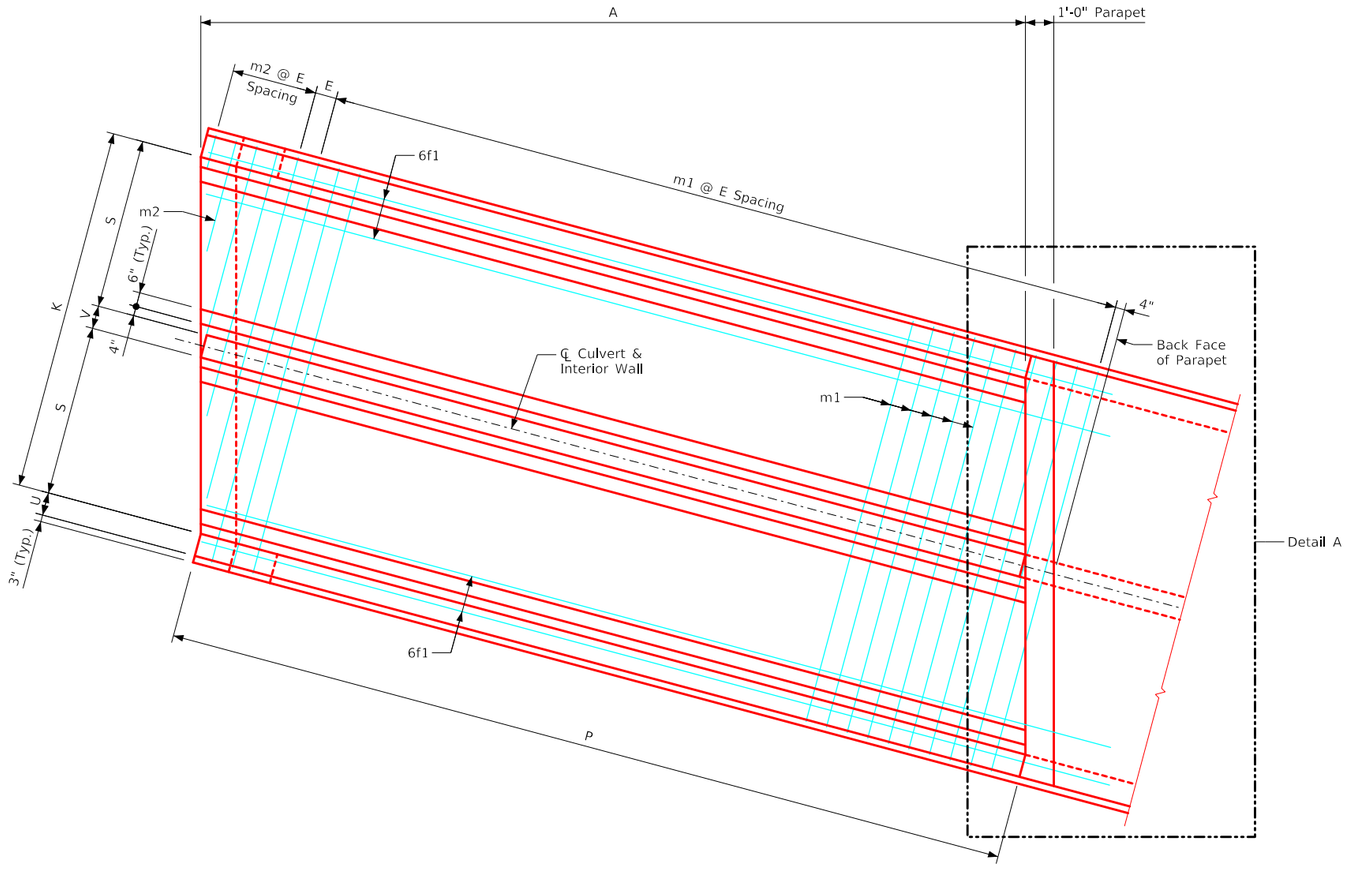
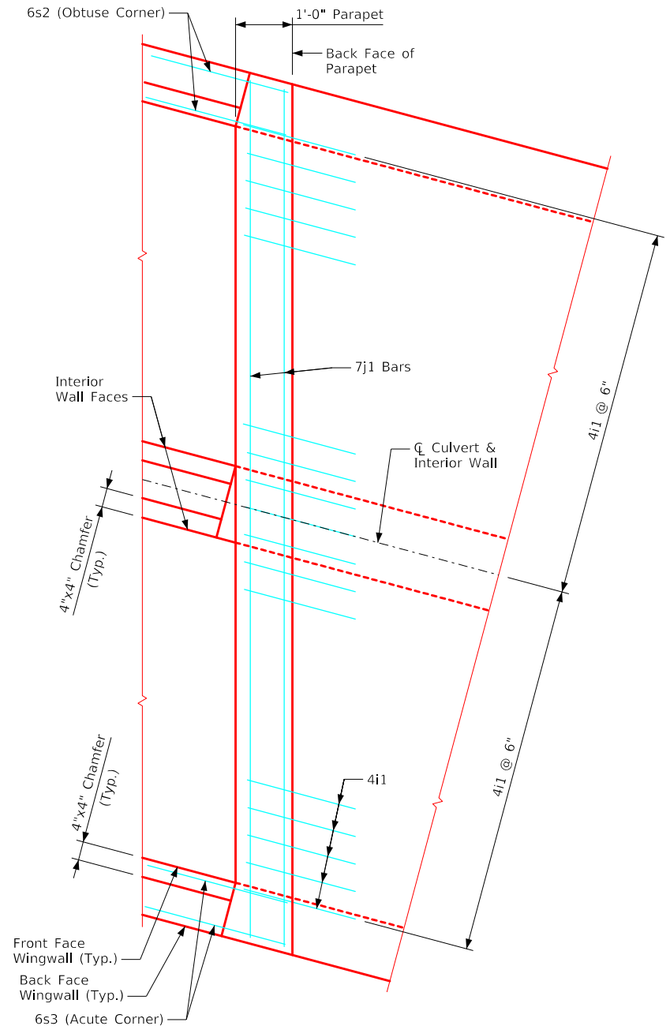


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

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 15-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 15° Skew

TWPWH 15-5-20

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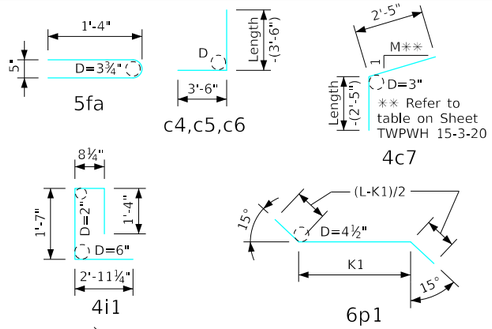
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

Bill of Reinforcing for One Headwall 15° 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	41'-7	92	5b1	2	38'-6	80	5b1	2	35'-5	74	5b1	2	32'-4	67	5b1	2	29'-2	61	5b1	2	26'-1	54
Wingwall, F.F.H.		5b2	22 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	41'-9	59	4b3	2	38'-8	52	4b3	2	35'-6	47	4b3	2	32'-5	43	4b3	2	29'-3	39	4b3	2	26'-2	35
Wingwall, B.F.H.		4b4	20 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Interior Wall, Both F.H.		5b5	21 Var.	6'-7 to 41'-2	525	5b5	19 Var.	6'-8 to 38'-1	443	5b5	17 Var.	6'-8 to 35'-0	369	5b5	15 Var.	6'-8 to 31'-10	301	5b5	13 Var.	6'-9 to 28'-9	241	5b5	11 Var.	6'-10 to 25'-7	186
Wingwall, F.F.V.		5c1	76 Var.	2 Each 2'-8 to 14'-7	684	5c1	70 Var.	2 Each 2'-8 to 13'-7	593	4c1	64 Var.	2 Each 2'-8 to 12'-8	328	4c1	58 Var.	2 Each 2'-8 to 11'-8	278	4c1	68 Var.	2 Each 2'-8 to 10'-8	303	4c1	60 Var.	2 Each 2'-8 to 9'-8	247
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-3 to 14'-9	451	5c2	30 Var.	2 Each 9'-3 to 13'-9	360	4c2	24 Var.	2 Each 9'-3 to 12'-10	177	4c2	16 Var.	2 Each 9'-3 to 11'-6	111	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	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, B.F.V.		6c4	76 Var.	2 Each 6'-4 to 18'-3	1403	5c4	70 Var.	2 Each 6'-4 to 17'-4	864	5c4	64 Var.	2 Each 6'-4 to 16'-4	757	5c4	58 Var.	2 Each 6'-4 to 15'-5	658	5c4	52 Var.	2 Each 6'-4 to 14'-5	563	5c4	46 Var.	2 Each 6'-4 to 13'-5	474
Wingwall, B.F.V. (O)		6c5	1	18'-7	28	5c5	1	17'-7	18	5c5	1	16'-7	17	5c5	1	15'-7	16	5c5	1	14'-7	15	5c5	1	13'-7	14
Wingwall, B.F.V. (A)		6c5	2	18'-7	56	5c5	2	17'-7	37	5c5	2	16'-7	35	5c5	2	15'-7	33	5c5	2	14'-7	30	5c5	2	13'-7	28
Wingwall, B.F.V.		6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	30	8'-6	266	5c6	24	8'-6	213	5c6	18	8'-6	160
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	75 Var.	1'-7 to 12'-3	347	4c8	68 Var.	1'-7 to 11'-2	290	4c8	62 Var.	1'-7 to 10'-2	243	4c8	56 Var.	1'-7 to 9'-3	203	4c8	50 Var.	1'-7 to 8'-3	164	4c8	44 Var.	1'-7 to 7'-3	130
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	41'-7	764	4d1	26	38'-5	667	4d1	26	35'-4	614	4d1	26	32'-3	560	4d1	26	29'-2	507	4d1	26	26'-0	452
Apron, Longit., Top		6f1	26	41'-7	1718	6f1	26	38'-5	1500	6f1	26	35'-4	1380	6f1	26	32'-3	1259	6f1	26	29'-2	1139	6f1	26	26'-0	1015
Parapet, Vertical		4i1	51	6'-7	224	4i1	51	6'-7	224	4i1	49	6'-7	215	4i1	49	6'-7	215	4i1	49	6'-7	215	4i1	49	6'-7	215
Parapet, Horiz.		7j1	4	27'-7	226	7j1	4	27'-7	226	7j1	4	27'-1	221	7j1	4	27'-1	221	7j1	4	27'-1	221	7j1	4	26'-10	219
Apron, Trans., Top		5m1	48	27'-2	1360	5m1	44	27'-2	1247	5m1	39	26'-8	1085	5m1	35	26'-8	973	5m1	31	26'-8	862	5m1	27	26'-5	744
Apron, Trans., Top		5m2	8 Var.	4'-6 to 24'-1	119	5m2	8 Var.	4'-2 to 23'-9	116	5m2	9 Var.	3'-6 to 25'-11	138	5m2	9 Var.	3'-1 to 25'-6	134	5m2	9 Var.	2'-9 to 25'-1	131	5m2	9 Var.	2'-2 to 24'-7	126
Apron, Trans., Bott.		5m3	73	24'-7	1872	5m3	67	24'-7	1718	6m3	31	24'-10	1156	5m3	28	24'-1	703	5m3	25	24'-1	628	5m3	22	23'-10	547
Curtain, Horiz.		6p1	6	28'-0	252	6p1	6	28'-0	252	6p1	6	27'-6	248	6p1	6	27'-6	248	6p1	6	27'-6	248	6p1	5	27'-3	205
Wing Slope, Both F.		6s1	4	36'-8	220	6s1	4	33'-5	201	6s1	4	30'-2	181	6s1	4	26'-11	162	6s1	4	23'-8	142	6s1	4	20'-5	123
Wing Slope, Both F. (O)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	34'-2	103	6s5	2	30'-11	93	6s5	2	27'-8	83	6s5	2	24'-5	73	6s5	2	21'-2	64	6s5	2	17'-11	54
Interior Wall, Both F.		6s6	2	43'-1	137	6s6	2	39'-9	119	6s6	2	36'-7	110	6s6	2	33'-4	100	6s6	2	30'-1	90	6s6	2	26'-10	81
Curtain, Vert.		5t1	26	7'-11	215	5t1	26	7'-8	208	5t1	26	7'-5	201	5t1	26	7'-2	194	5t1	26	6'-11	188	5t1	26	6'-8	181
Curtain, Vert. Ends		5t2	4	7'-11	33	5t2	4	7'-8	32	5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28
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			12,652 LB				10,704 LB				8868 LB				7549 LB				6683 LB				5807 LB	
	Concrete	Parapet Δ	2.8	88.7 CY		2.8		79.9 CY		2.7		66.6 CY		2.7		59.3 CY		2.7		52.1 CY		2.6		43.9 CY	
		Wingwalls	31.0			26.5				18.6				15.4				12.4				8.8			
		Apron ✳	54.9			50.6				45.3				41.2				37.0				32.5			

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 TWPWH 15-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

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IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
15° Skew

TWPWH
15-6-20
Sheet 1 of 2

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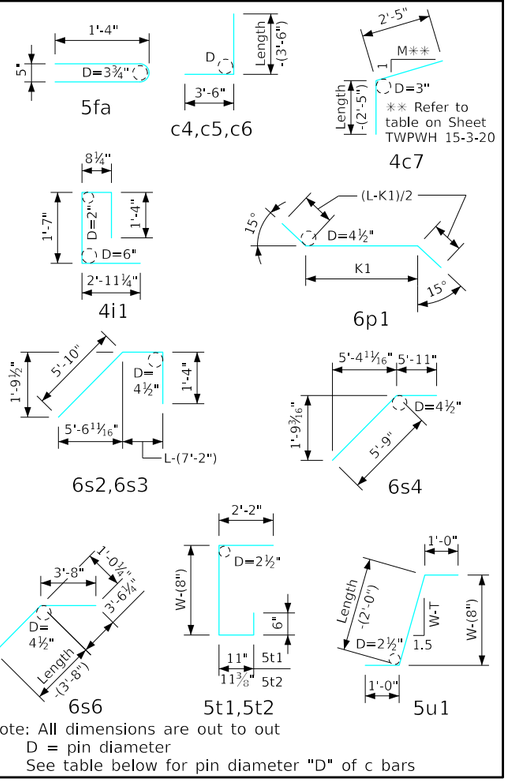
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

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

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Interior Wall, Both F.H.		5b5	9 Var.	6'-11 to 22'-6	138	5b5	7 Var.	7'-1 to 19'-4	96	5b5	5 Var.	7'-4 to 16'-2	61
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-8 to 8'-9	198	4c1	34 Var.	2 Each 2'-8 to 7'-10	119	4c1	26 Var.	2 Each 2'-8 to 6'-6	80
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (A)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-4 to 12'-6	393	5c4	44 Var.	2 Each 6'-4 to 11'-5	407	5c4	36 Var.	2 Each 6'-4 to 10'-6	316
Wingwall, B.F.V. (O)		5c5	1	12'-7	13	5c5	1	11'-7	12	5c5	1	10'-7	11
Wingwall, B.F.V. (A)		5c5	2	12'-7	26	5c5	2	11'-7	24	5c5	2	10'-7	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5
Interior Wall, Both F.V		4c8	37 Var.	1'-7 to 6'-2	96	4c8	31 Var.	1'-7 to 5'-3	71	4c8	25 Var.	1'-6 to 4'-3	48
Interior Wall, Both F.V		4c9	2	6'-7	9	4c9	2	5'-7	7	4c9	2	4'-7	6
Apron, Longit., Bott.		4d1	26	22'-11	398	4d1	26	19'-10	344	4d1	26	16'-8	289
Apron, Longit., Top		6f1	26	22'-11	895	6f1	26	19'-10	775	6f1	26	16'-8	651
Parapet, Vertical		4i1	49	6'-7	215	4i1	49	6'-7	215	4i1	49	6'-7	215
Parapet, Horiz.		7j1	4	26'-10	219	7j1	4	26'-10	219	7j1	4	26'-10	219
Apron, Trans., Top		5m1	23	26'-5	634	5m1	19	26'-5	523	5m1	15	26'-5	413
Apron, Trans., Top		5m2	8 Var.	4'-7 to 24'-2	120	5m2	8 Var.	4'-2 to 23'-9	116	5m2	8 Var.	3'-9 to 23'-5	113
Apron, Trans., Bott.		4m3	19	23'-1	293	4m3	21	23'-1	324	4m3	13	23'-1	200
Curtain, Horiz.		6p1	5	27'-3	205	6p1	5	27'-3	205	6p1	5	27'-3	205
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Interior Wall, Both F.		6s6	2	23'-7	71	6s6	2	20'-4	61	6s6	2	17'-1	51
Curtain, Vert.		5t1	26	6'-5	174	5t1	26	6'-5	174	5t1	26	6'-5	174
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22
Estimated Quantities One Headwall	Reinf. Steel		4847 LB				4219 LB				3494 LB		
	Concrete Parapet Δ		2.6	37.7 CY			2.6	32.1 CY			2.6	26.7 CY	
	Concrete Wingwalls		6.7				4.9				3.3		
	Concrete Apron ✳		28.4				24.6				20.8		

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 TWPWH 15-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
15° Skew

TWPWH
15-6-20
Sheet 2 of 2

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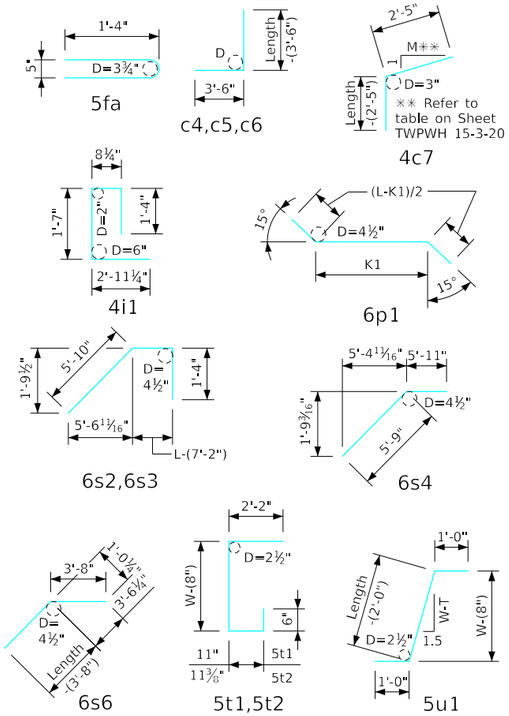
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Location	Shape	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' 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	41'-7	92	5b1	2	38'-6	80	5b1	2	35'-5	74	5b1	2	32'-4	67	5b1	2	29'-2	61	5b1	2	26'-1	54
Wingwall, F.F.H.		5b2	22 Var.	2 Each 9'-2 to 40'-2	571	5b2	20 Var.	2 Each 9'-2 to 37'-1	482	5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212
Wingwall, B.F.H.		4b3	2	41'-9	59	4b3	2	38'-8	52	4b3	2	35'-6	47	4b3	2	32'-5	43	4b3	2	29'-3	39	4b3	2	26'-2	35
Wingwall, B.F.H.		4b4	20 Var.	2 Each 12'-5 to 40'-4	356	4b4	18 Var.	2 Each 12'-5 to 37'-3	299	4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124
Interior Wall, Both F.H.		5b5	21 Var.	6'-7 to 41'-2	525	5b5	19 Var.	6'-8 to 38'-1	443	5b5	17 Var.	6'-8 to 35'-0	369	5b5	15 Var.	6'-8 to 31'-10	301	5b5	13 Var.	6'-9 to 28'-9	241	5b5	11 Var.	6'-10 to 25'-7	186
Wingwall, F.F.V.		5c1	76 Var.	2 Each 2'-7 to 14'-6	677	5c1	70 Var.	2 Each 2'-7 to 13'-6	587	4c1	64 Var.	2 Each 2'-7 to 12'-7	324	4c1	58 Var.	2 Each 2'-7 to 11'-7	274	4c1	68 Var.	2 Each 2'-7 to 10'-7	299	4c1	60 Var.	2 Each 2'-7 to 9'-7	244
Wingwall, F.F.V.		5c2	36 Var.	2 Each 9'-2 to 14'-8	447	5c2	30 Var.	2 Each 9'-2 to 13'-8	357	4c2	24 Var.	2 Each 9'-2 to 12'-9	176	4c2	16 Var.	2 Each 9'-2 to 11'-5	110	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, F.F.V. (A)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, B.F.V.		6c4	76 Var.	2 Each 6'-3 to 18'-2	1394	5c4	70 Var.	2 Each 6'-3 to 17'-3	858	5c4	64 Var.	2 Each 6'-3 to 16'-3	751	5c4	58 Var.	2 Each 6'-3 to 15'-4	653	5c4	52 Var.	2 Each 6'-3 to 14'-4	558	5c4	46 Var.	2 Each 6'-3 to 13'-4	470
Wingwall, B.F.V. (O)		6c5	1	18'-6	28	5c5	1	17'-6	18	5c5	1	16'-6	17	5c5	1	15'-6	16	5c5	1	14'-6	15	5c5	1	13'-6	14
Wingwall, B.F.V. (A)		6c5	2	18'-6	56	5c5	2	17'-6	37	5c5	2	16'-6	34	5c5	2	15'-6	32	5c5	2	14'-6	30	5c5	2	13'-6	28
Wingwall, B.F.V.		6c6	50	8'-6	638	5c6	44	8'-6	390	5c6	38	8'-6	337	5c6	30	8'-6	266	5c6	24	8'-6	213	5c6	18	8'-6	160
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	75 Var.	1'-6 to 12'-2	342	4c8	68 Var.	1'-6 to 11'-1	286	4c8	62 Var.	1'-6 to 10'-1	240	4c8	56 Var.	1'-6 to 9'-2	200	4c8	50 Var.	1'-6 to 8'-2	161	4c8	44 Var.	1'-6 to 7'-2	127
Interior Wall, Both F.V		4c9	2	12'-6	17	4c9	2	11'-6	15	4c9	2	10'-6	14	4c9	2	9'-6	13	4c9	2	8'-6	11	4c9	2	7'-6	10
Apron, Longit., Bott.		4d1	22	41'-7	647	4d1	22	38'-5	565	4d1	22	35'-4	519	4d1	22	32'-3	474	4d1	22	29'-2	429	4d1	22	26'-0	382
Apron, Longit., Top		6f1	22	41'-7	1454	6f1	22	38'-5	1269	6f1	22	35'-4	1168	6f1	22	32'-3	1066	6f1	22	29'-2	964	6f1	22	26'-0	859
Parapet, Vertical		4i1	43	6'-7	189	4i1	43	6'-7	189	4i1	41	6'-7	180	4i1	41	6'-7	180	4i1	41	6'-7	180	4i1	41	6'-7	180
Parapet, Horiz.		7j1	4	23'-5	191	7j1	4	23'-5	191	7j1	4	22'-11	187	7j1	4	22'-11	187	7j1	4	22'-11	187	7j1	4	22'-8	185
Apron, Trans., Top		5m1	48	23'-2	1160	5m1	44	23'-2	1063	5m1	40	22'-8	946	5m1	36	22'-8	851	5m1	32	22'-8	757	5m1	28	22'-5	655
Apron, Trans., Top		5m2	8 Var.	2'-6 to 22'-1	103	5m2	8 Var.	2'-2 to 21'-9	100	5m2	7 Var.	4'-3 to 21'-1	92	5m2	7 Var.	3'-11 to 20'-8	90	5m2	7 Var.	3'-6 to 20'-4	87	5m2	7 Var.	3'-0 to 19'-9	83
Apron, Trans., Bott.		6m3	73	21'-3	2330	5m3	67	20'-5	1427	6m3	31	20'-8	962	5m3	37	19'-11	769	5m3	25	19'-11	519	5m3	22	19'-8	451
Curtain, Horiz.		6p1	6	23'-10	215	6p1	6	23'-10	215	6p1	6	23'-4	210	6p1	6	23'-4	210	6p1	6	23'-4	210	6p1	5	23'-1	173
Wing Slope, Both F.		6s1	4	36'-8	220	6s1	4	33'-5	201	6s1	4	30'-2	181	6s1	4	26'-11	162	6s1	4	23'-8	142	6s1	4	20'-5	123
Wing Slope, Both F. (O)		6s2	2	7'-9	23	6s2	2	7'-9	23	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	34'-2	103	6s5	2	30'-11	93	6s5	2	27'-8	83	6s5	2	24'-5	73	6s5	2	21'-2	64	6s5	2	17'-11	54
Interior Wall, Both F.		6s6	2	43'-1	137	6s6	2	39'-9	119	6s6	2	36'-7	110	6s6	2	33'-4	100	6s6	2	30'-1	90	6s6	2	26'-10	81
Curtain, Vert.		5t1	22	7'-11	182	5t1	22	7'-8	176	5t1	22	7'-5	170	5t1	22	7'-2	164	5t1	22	6'-11	159	5t1	22	6'-8	153
Curtain, Vert. Ends		5t2	4	7'-11	33	5t2	4	7'-8	32	5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28
Bracket, Vert.		5u1	4	6'-7	27	5u1	4	6'-4	26	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-6	23
Estimated Quantities One Headwall	Reinf. Steel			12,348 LB				9721 LB				8029 LB				7019 LB				6024 LB				5214 LB	
	Concrete	Parapet Δ	2.5	78.1 CY		2.5		70.2 CY		2.4		57.7 CY		2.4		51.2 CY		2.4		44.8 CY		2.3		37.4 CY	
		Wingwalls	31.0			26.5				18.6				15.4				12.4				8.8			
		Apron ✳	44.6			41.2				36.7				33.4				30.0				26.3			

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 TWPWH 15-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

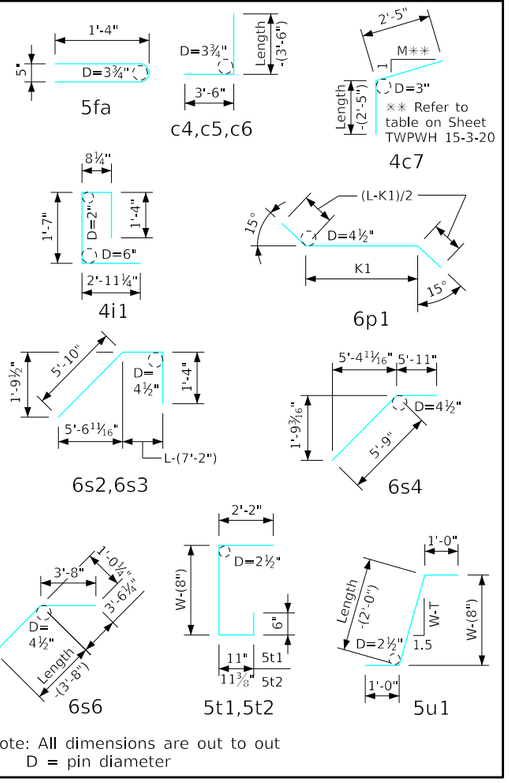
July, 2020

Quantity Tabulation
10'-0" Span
15° Skew

TWPWH
15-7-20
Sheet 1 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 15-7-20 S1 - THIS SHEET ISSUED 07-2020.

Bent Bar Details



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

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Interior Wall, Both F.H.		5b5	9 Var.	6'-11 to 22'-6	138	5b5	7 Var.	7'-1 to 19'-4	96	5b5	5 Var.	7'-4 to 16'-2	61
Wingwall, F.F.V.		4c1	52 Var.	2 Each 2'-7 to 8'-8	195	4c1	34 Var.	2 Each 2'-7 to 7'-9	117	4c1	26 Var.	2 Each 2'-7 to 6'-5	78
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	40 Var.	2 Each 6'-3 to 12'-5	389	5c4	34 Var.	2 Each 6'-3 to 11'-5	313	5c4	26 Var.	2 Each 6'-3 to 10'-2	223
Wingwall, B.F.V. (O)		5c5	1	12'-6	13	5c5	1	11'-6	12	5c5	1	10'-6	11
Wingwall, B.F.V. (A)		5c5	2	12'-6	26	5c5	2	11'-6	24	5c5	2	10'-6	22
Wingwall, B.F.V.		5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	37 Var.	1'-6 to 6'-1	94	4c8	31 Var.	1'-6 to 5'-2	69	4c8	25 Var.	1'-5 to 4'-2	47
Interior Wall, Both F.V		4c9	2	6'-6	9	4c9	2	5'-6	7	4c9	2	4'-6	6
Apron, Longit., Bott.		4d1	22	22'-11	337	4d1	22	19'-10	291	4d1	22	16'-8	245
Apron, Longit., Top		6f1	22	22'-11	757	6f1	22	19'-10	655	6f1	22	16'-8	551
Parapet, Vertical		4i1	41	6'-7	180	4i1	41	6'-7	180	4i1	41	6'-7	180
Parapet, Horiz.		7j1	4	22'-8	185	7j1	4	22'-8	185	7j1	4	22'-8	185
Apron, Trans., Top		5m1	24	22'-5	561	5m1	19	22'-5	444	5m1	15	22'-5	351
Apron, Trans., Top		5m2	7 Var.	2'-7 to 19'-4	80	5m2	8 Var.	2'-2 to 21'-9	100	5m2	7 Var.	4'-7 to 21'-5	95
Apron, Trans., Bott.		4m3	19	18'-11	240	4m3	16	18'-11	202	4m3	13	18'-11	164
Curtain, Horiz.		6p1	5	23'-1	173	6p1	5	23'-1	173	6p1	5	23'-1	173
Wing Slope, Both F.		6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Interior Wall, Both F.		6s6	2	23'-7	71	6s6	2	20'-4	61	6s6	2	17'-1	51
Curtain, Vert.		5t1	22	6'-5	147	5t1	22	6'-5	147	5t1	22	6'-5	147
Curtain, Vert. Ends		5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

Estimated Quantities One Headwall			10' x 6'		10' x 5'		10' x 4'	
Reinf. Steel			4345 LB		3603 LB		3010 LB	
Concrete	Parapet Δ	2.3	32.0 CY		2.3	27.1 CY	2.3	22.5 CY
	Wingwalls	6.7			4.9		3.3	
	Apron ✳	23.0			19.9		16.9	

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 TWPWH 15-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
15° Skew

TWPWH
15-7-20
Sheet 2 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 15-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	35'-5	74	5b1	2	32'-4	67	5b1	2	29'-2	61	5b1	2	26'-1	54	5b1	2	23'-0	48	5b1	2	19'-10	41	5b1	2	16'-9	35
Wingwall, F.F.H.		5b2	18 Var.	2 Each 9'-2 to 34'-0	405	5b2	16 Var.	2 Each 9'-2 to 30'-11	334	5b2	14 Var.	2 Each 9'-2 to 27'-9	270	5b2	12 Var.	2 Each 9'-2 to 24'-8	212	5b2	10 Var.	2 Each 9'-2 to 21'-7	160	5b2	8 Var.	2 Each 9'-2 to 18'-5	115	5b2	6 Var.	2 Each 9'-2 to 15'-4	77
Wingwall, B.F.H.		4b3	2	35'-6	47	4b3	2	32'-5	43	4b3	2	29'-3	39	4b3	2	26'-2	35	4b3	2	23'-1	31	4b3	2	19'-11	27	4b3	2	16'-10	22
Wingwall, B.F.H.		4b4	16 Var.	2 Each 12'-4 to 34'-1	248	4b4	14 Var.	2 Each 12'-4 to 31'-0	203	4b4	12 Var.	2 Each 12'-4 to 27'-11	161	4b4	10 Var.	2 Each 12'-4 to 24'-9	124	4b4	8 Var.	2 Each 12'-4 to 21'-8	91	4b4	6 Var.	2 Each 12'-4 to 18'-6	62	4b4	4 Var.	2 Each 12'-4 to 15'-5	37
Interior Wall, Both F.H.		5b5	17 Var.	6'-8 to 35'-0	369	5b5	15 Var.	6'-8 to 31'-10	301	5b5	13 Var.	6'-9 to 28'-9	241	5b5	11 Var.	6'-10 to 25'-7	186	5b5	9 Var.	6'-11 to 22'-6	138	5b5	7 Var.	7'-1 to 19'-4	96	5b5	5 Var.	7'-4 to 16'-2	61
Wingwall, F.F.V.		4c1	64 Var.	2 Each 2'-5 to 12'-5	317	4c1	58 Var.	2 Each 2'-5 to 11'-5	268	4c1	68 Var.	2 Each 2'-5 to 10'-5	291	4c1	60 Var.	2 Each 2'-5 to 9'-5	237	4c1	52 Var.	2 Each 2'-5 to 8'-6	190	4c1	34 Var.	2 Each 2'-5 to 7'-7	114	4c1	26 Var.	2 Each 2'-5 to 6'-3	75
Wingwall, F.F.V.		4c2	24 Var.	2 Each 9'-0 to 12'-7	173	4c2	16 Var.	2 Each 9'-0 to 11'-3	108	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		5c4	64 Var.	2 Each 6'-1 to 16'-1	740	5c4	58 Var.	2 Each 6'-1 to 15'-2	643	5c4	52 Var.	2 Each 6'-1 to 14'-2	549	5c4	46 Var.	2 Each 6'-1 to 13'-2	462	5c4	40 Var.	2 Each 6'-1 to 12'-3	382	5c4	34 Var.	2 Each 6'-1 to 11'-3	307	5c4	26 Var.	2 Each 6'-1 to 10'-0	218
Wingwall, B.F.V. (O)		5c5	1	16'-4	17	5c5	1	15'-4	16	5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11
Wingwall, B.F.V. (A)		5c5	2	16'-4	34	5c5	2	15'-4	32	5c5	2	14'-4	30	5c5	2	13'-4	28	5c5	2	12'-4	26	5c5	2	11'-4	24	5c5	2	10'-4	22
Wingwall, B.F.V.		5c6	38	8'-6	337	5c6	30	8'-6	266	5c6	24	8'-6	213	5c6	18	8'-6	160	5c6	12	8'-6	106	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5
Interior Wall, Both F.V		4c8	62 Var.	1'-4 to 9'-11	233	4c8	56 Var.	1'-4 to 9'-0	193	4c8	50 Var.	1'-4 to 8'-0	156	4c8	44 Var.	1'-4 to 7'-0	122	4c8	37 Var.	1'-4 to 5'-11	90	4c8	31 Var.	1'-4 to 5'-0	66	4c8	25 Var.	1'-3 to 4'-0	44
Interior Wall, Both F.V		4c9	2	10'-4	14	4c9	2	9'-4	12	4c9	2	8'-4	11	4c9	2	7'-4	10	4c9	2	6'-4	8	4c9	2	5'-4	7	4c9	2	4'-4	6
Apron, Longit., Bott.		4d1	18	35'-4	425	4d1	18	32'-3	388	4d1	18	29'-2	351	4d1	18	26'-0	313	4d1	18	22'-11	276	4d1	18	19'-10	238	4d1	18	16'-8	200
Apron, Longit., Top		6f1	18	35'-4	955	6f1	18	32'-3	872	6f1	18	29'-2	789	6f1	18	26'-0	703	6f1	18	22'-11	620	6f1	18	19'-10	536	6f1	18	16'-8	451
Parapet, Vertical		4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145	4i1	33	6'-7	145
Parapet, Horiz.		7j1	4	18'-9	153	7j1	4	18'-9	153	7j1	4	18'-9	153	7j1	4	18'-6	151	7j1	4	18'-6	151	7j1	4	18'-6	151	7j1	4	18'-6	151
Apron, Trans., Top		5m1	31	18'-8	604	5m1	28	18'-8	545	5m1	25	18'-8	487	5m1	21	18'-5	403	5m1	18	18'-5	346	5m1	15	18'-5	288	5m1	12	18'-5	231
Apron, Trans., Top		5m2	4 Var.	4'-2 to 15'-4	41	5m2	4 Var.	3'-9 to 15'-0	39	5m2	4 Var.	3'-5 to 14'-7	38	5m2	5 Var.	2'-10 to 17'-9	54	5m2	5 Var.	2'-5 to 17'-4	51	5m2	5 Var.	2'-1 to 17'-0	50	5m2	4 Var.	5'-5 to 16'-7	46
Apron, Trans., Bott.		6m3	61	16'-7	1519	5m3	55	15'-9	903	5m3	33	15'-9	542	5m3	22	15'-6	356	4m3	19	14'-9	187	4m3	16	14'-9	158	4m3	13	14'-9	128
Curtain, Horiz.		6p1	6	19'-3	173	6p1	6	19'-3	173	6p1	6	19'-3	173	6p1	5	19'-0	143	6p1	5	19'-0	143	6p1	5	19'-0	143	6p1	5	19'-0	143
Wing Slope, Both F.		6s1	4	30'-2	181	6s1	4	26'-11	162	6s1	4	23'-8	142	6s1	4	20'-5	123	6s1	4	17'-1	103	6s1	4	13'-10	83	6s1	4	10'-7	64
Wing Slope, Both F. (O)		6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24	6s2	2	7'-10	24
Wing Slope, Both F. (A)		6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24	6s3	2	8'-0	24
Wing Slope, F.F.		6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35	6s4	2	11'-8	35
Wing Slope, F.F.		6s5	2	27'-8	83	6s5	2	24'-5	73	6s5	2	21'-2	64	6s5	2	17'-11	54	6s5	2	14'-8	44	6s5	2	11'-4	34	6s5	2	8'-1	24
Interior Wall, Both F.		6s6	2	36'-7	110	6s6	2	33'-4	100	6s6	2	30'-1	90	6s6	2	26'-10	81	6s6	2	23'-7	71	6s6	2	20'-4	61	6s6	2	17'-1	51
Curtain, Vert.		5t1	18	7'-5	139	5t1	18	7'-2	135	5t1	18	6'-11	130	5t1	18	6'-8	125	5t1	18	6'-5	120	5t1	18	6'-5	120	5t1	18	6'-5	120
Curtain, Vert. Ends		5t2	4	7'-5	31	5t2	4	7'-2	30	5t2	4	6'-11	29	5t2	4	6'-8	28	5t2	4	6'-5	27	5t2	4	6'-5	27	5t2	4	6'-5	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel	7720				6355 LB				5316 LB				4466 LB				3707 LB				3041 LB				2523 LB			
	Concrete Parapet Δ	2.1		47.7 CY		2.1		42.1 CY		2.1		36.6 CY		2.0		30.2 CY		2.0		25.6 CY		2.0		21.7 CY		2.0		17.9 CY	
	Concrete Wingwalls	18.6				15.4				12.4				8.8				6.7				4.9				3.3			
	Concrete Apron ✳	27.0				24.6				22.1				19.4				16.9				14.8				12.6			

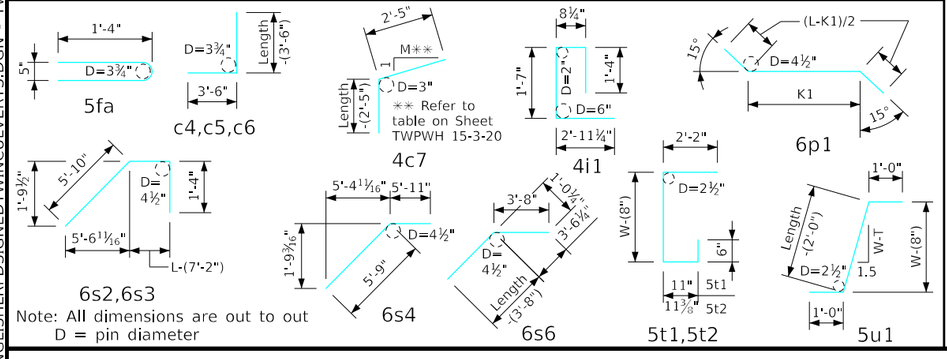
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

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 TWPWH 15-1-20 for acute and obtuse corner locations.

Bent Bar Details



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

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

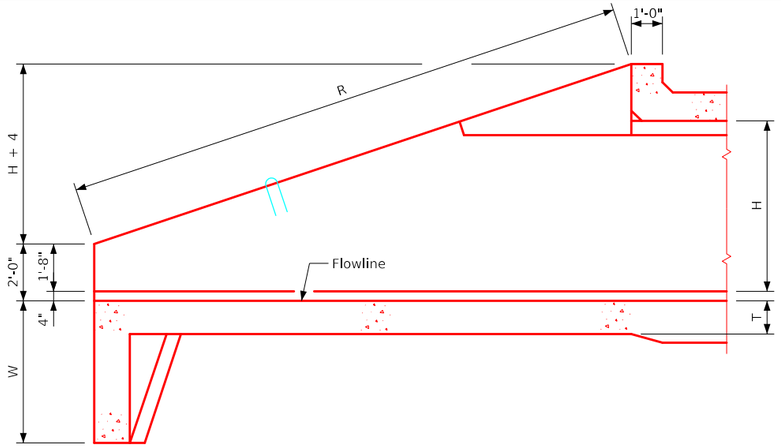
Parallel Wing Headwalls

July, 2020

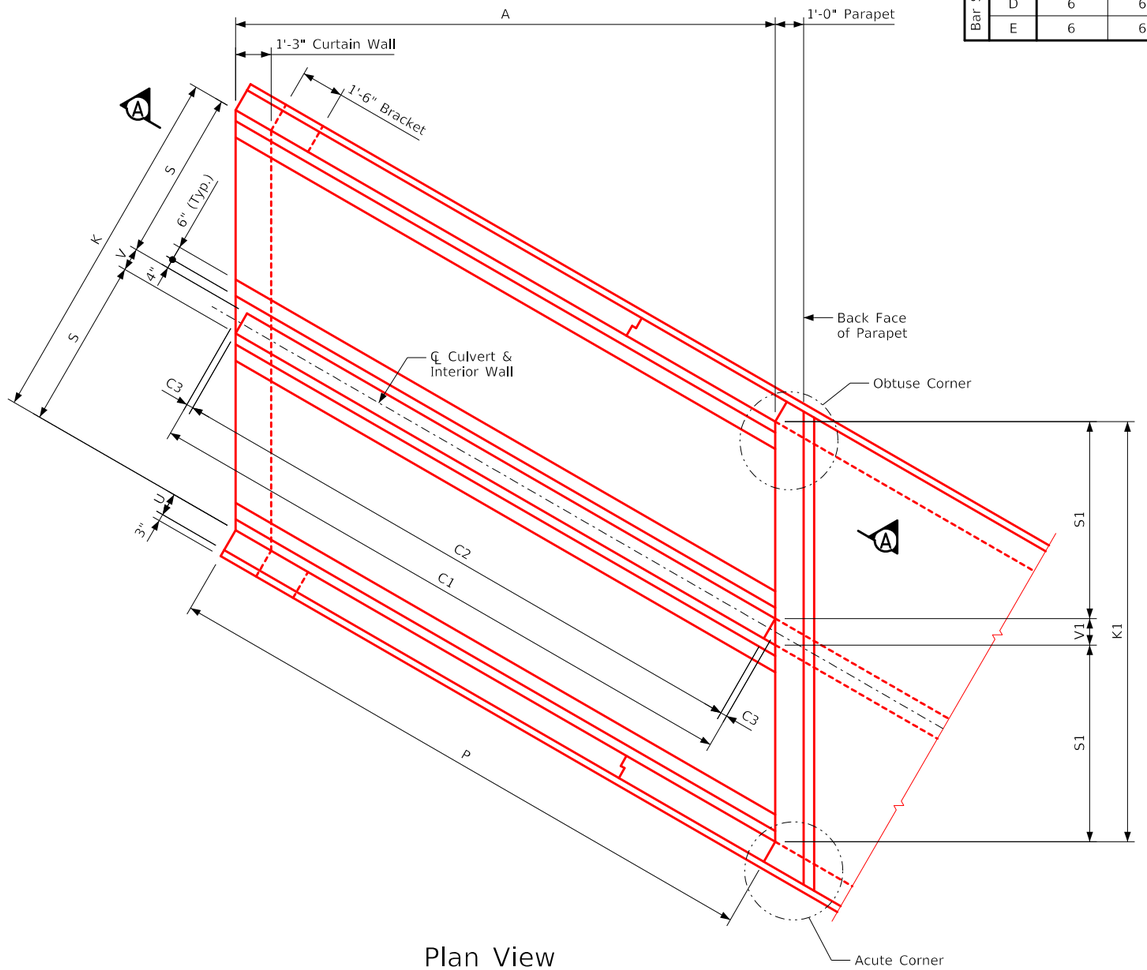
Quantity Tabulation
8'-0" Span
15° Skew

TWPWH
15-8-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 15-8-20 - THIS SHEET ISSUED 07-2020.



Elevation Section A-A



Plan View

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	42'-8⅜	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	42'-8⅜	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	C1
	C2	42'-1⅝	38'-8⅛	35'-3¾	31'-10¼	28'-4⅝	24'-11⅝	21'-6	18'-0½	14'-6⅞	42'-1⅝	38'-8⅛	35'-3¾	31'-10¼	28'-4⅝	24'-11⅝	21'-6	18'-0½	14'-6⅞	C2
	C3	3½	3½	2⅞	2⅞	2⅞	2⅝	2⅝	2⅝	2⅝	3½	3½	2⅞	2⅞	2⅞	2⅝	2⅝	2⅝	2⅝	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	28'-10⅜	28'-10⅜	28'-8	28'-8	28'-8	28'-6⅞	28'-6⅞	28'-6⅞	28'-6⅞	24'-3⅛	24'-3⅛	24'-0¾	24'-0¾	24'-0¾	23'-11⅝	23'-11⅝	23'-11⅝	23'-11⅝	K1
	P	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	42'-8⅝	39'-3⅛	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	P
	R	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	44'-5⅝	40'-10⅜	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	R
	R1	43'-6¾	39'-11½	36'-5⅜	32'-10⅛	29'-2⅞	25'-8⅛	22'-1	18'-5¾	14'-10⅝	43'-6¾	39'-11½	36'-5⅜	32'-10⅛	29'-2⅞	25'-8⅛	22'-1	18'-5¾	14'-10⅝	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	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	13'-10¼	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	11'-6⅝	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'-1⅛	1'-1⅛	11½	11½	11½	10⅜	10⅜	10⅜	10⅜	1'-1⅞	1'-1⅞	11½	11½	11½	10⅜	10⅜	10⅜	10⅜	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	1'-0	9	9	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	1'-0	9	1'-0	B
	C	1'-0	1'-0	1'-0	1'-0	9	9	9	1'-0	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	9	1'-0	6	6	6	6	1'-0	1'-0	1'-0	1'-0	1'-0	D
	E	6	6	6	6	6	6	6	6	6	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'	S x H
Headwall Dimensions	A	31'-0	28'-0	25'-0	22'-0	19'-0	16'-0	13'-0	A
	C1	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	C1
	C2	35'-3¾	31'-10¼	28'-4⅝	24'-11⅝	21'-6	18'-0½	14'-6⅞	C2
	C3	2⅞	2⅞	2⅞	2⅝	2⅝	2⅝	2⅝	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	19'-5¼	19'-5¼	19'-5¼	19'-4⅛	19'-4⅛	19'-4⅛	19'-4⅛	K1
	P	35'-9½	32'-4	28'-10⅜	25'-4⅞	21'-11¼	18'-5¾	15'-0⅛	P
	R	37'-3⅛	33'-7⅞	30'-0½	26'-5¼	22'-10	19'-2¾	15'-7½	R
	R1	36'-5⅜	32'-10⅛	29'-2⅞	25'-8⅛	22'-1	18'-5¾	14'-10⅝	R1
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	S
	S1	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	9'-2⅞	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	11½	11½	11½	10⅜	10⅜	10⅜	10⅜	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	1'-0	1'-0	B
	C	1'-0	1'-0	9	9	9	1'-0	1'-0	C
	D	6	6	9	1'-0	1'-0	1'-0	1'-0	D
	E	1'-0	1'-0	9	1'-0	1'-0	1'-0	1'-0	E

Notes:

1. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
2. See Sheets TWPWH 30-2-20 thru 30-5-20 for location of certain dimensions tabulated.
3. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Dimension Table
30° Skew

TWPWH
30-1-20

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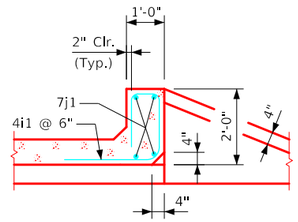
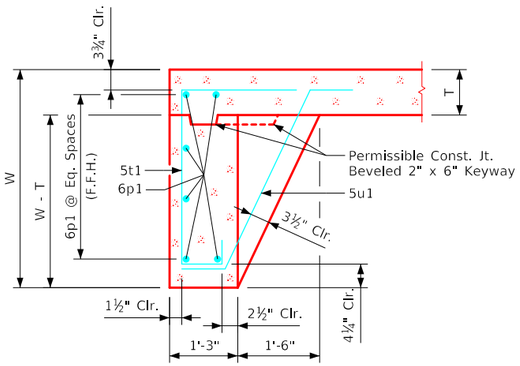
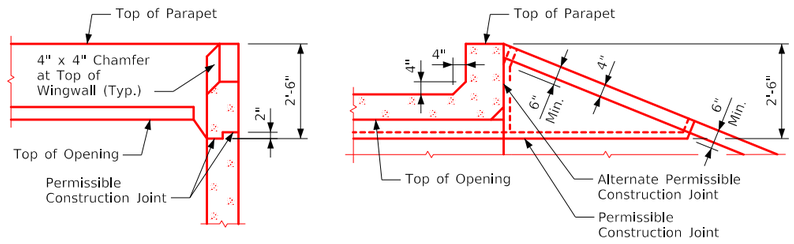


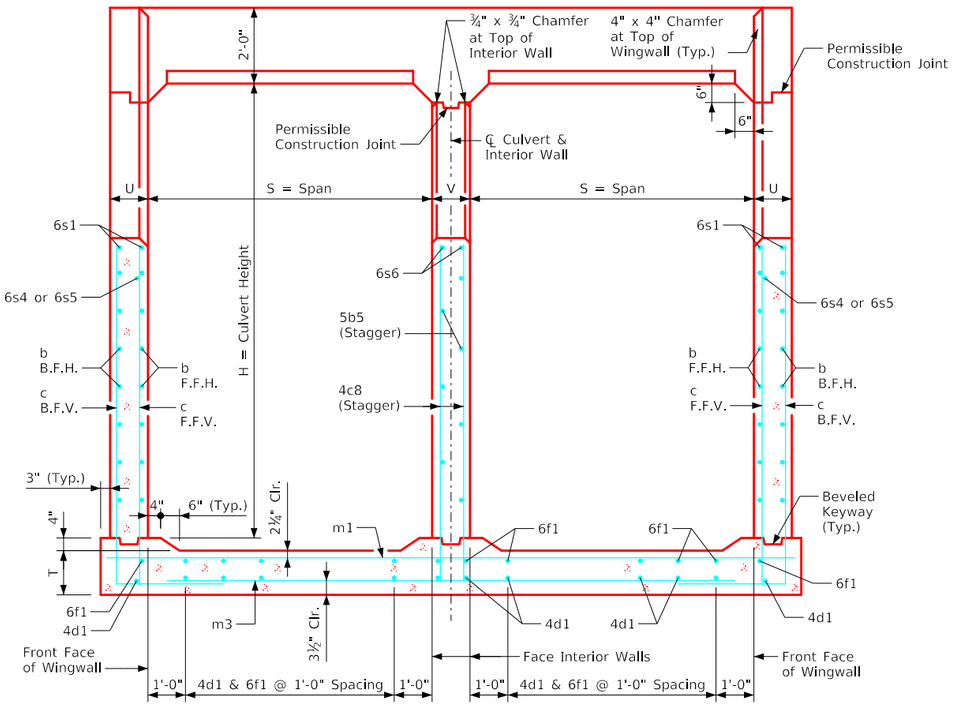
Section thru Parapet



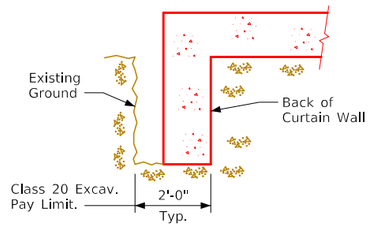
Section thru Curtain Wall



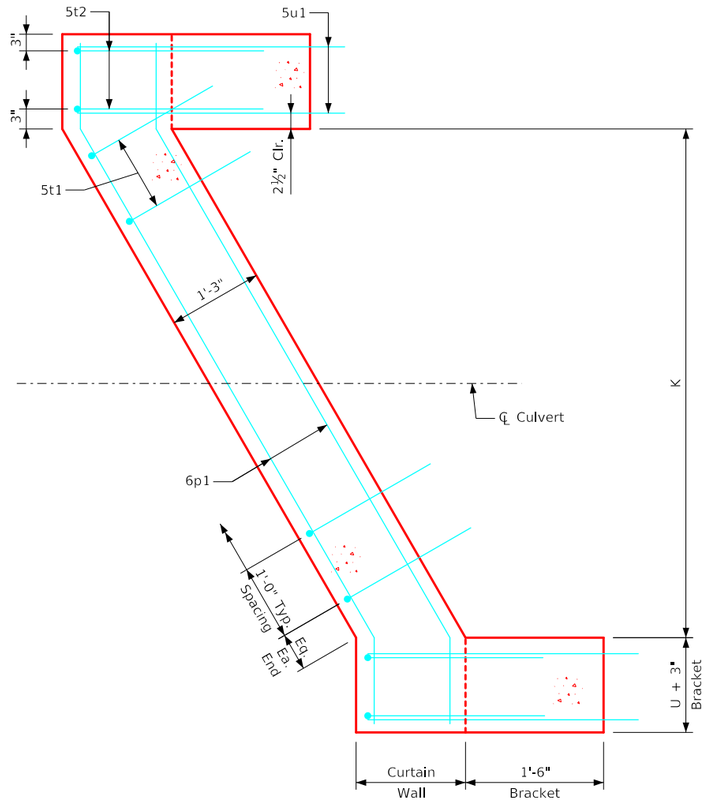
Top of Wingwall Details



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 30-1-20.

August 2022
LATEST REVISION DATE

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Cross Section Details
30° Skew

TWPWH
30-2-20

Revised 08-2022: Changed chamfer at top of Interior Wall to 3/4" x 3/4" (was 4" x 4").
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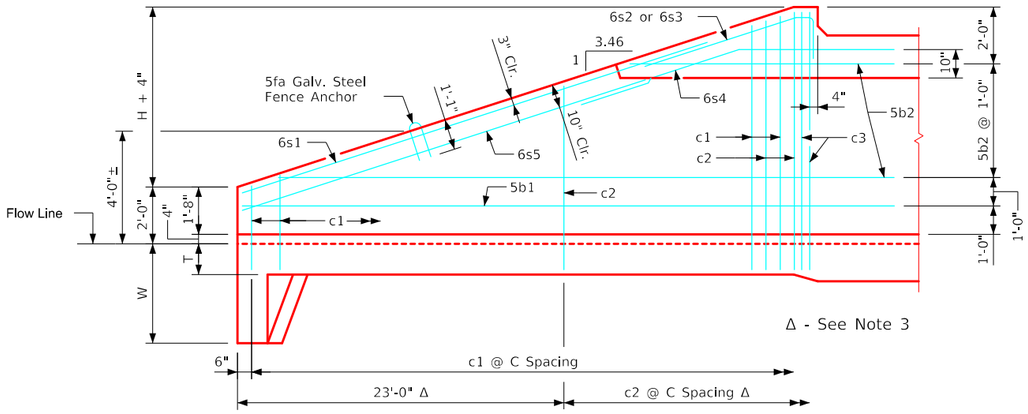
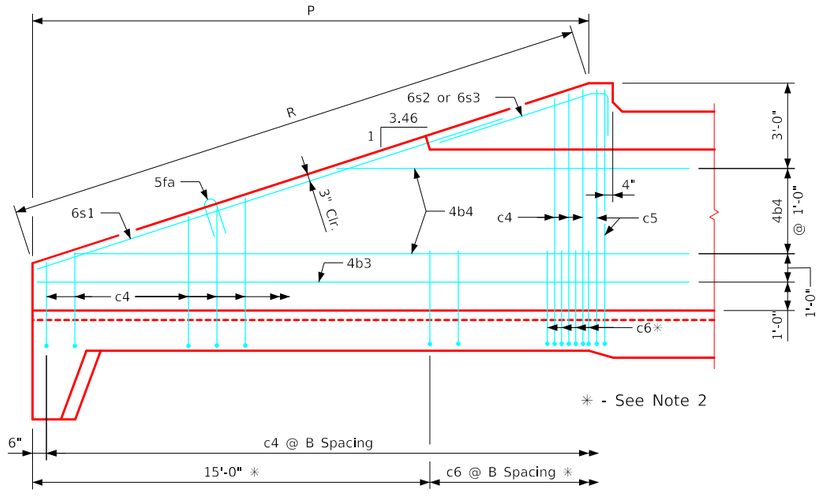
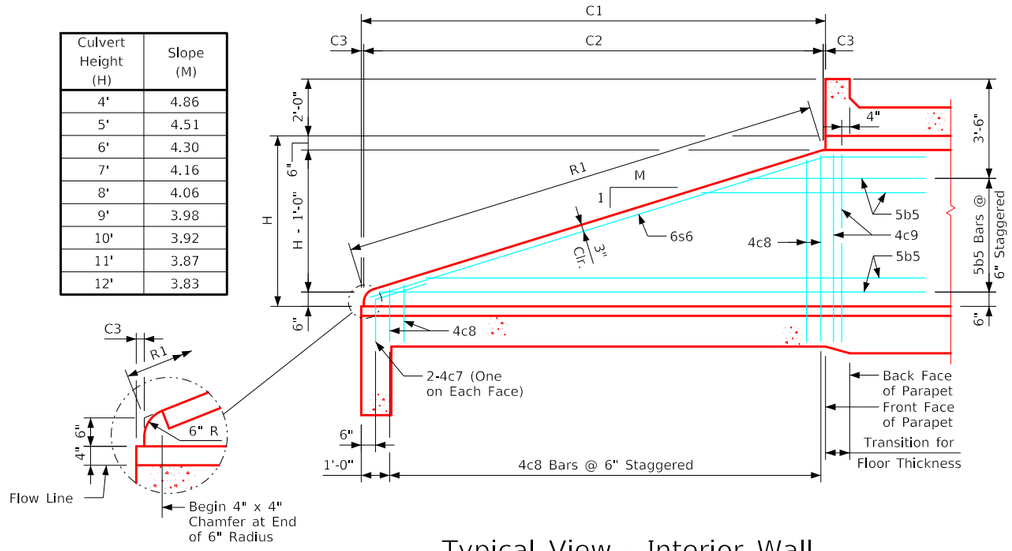


Typical View - Front Face Wingwall Reinforcing



Typical View - Back Face Wingwall Reinforcing

Culvert Height (H)	Slope (M)
4'	4.86
5'	4.51
6'	4.30
7'	4.16
8'	4.06
9'	3.98
10'	3.92
11'	3.87
12'	3.83



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 30-1-20.
5. Apron m3 bars are to be centered on ℄ 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

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations
30° Skew

TWPWH
30-3-20

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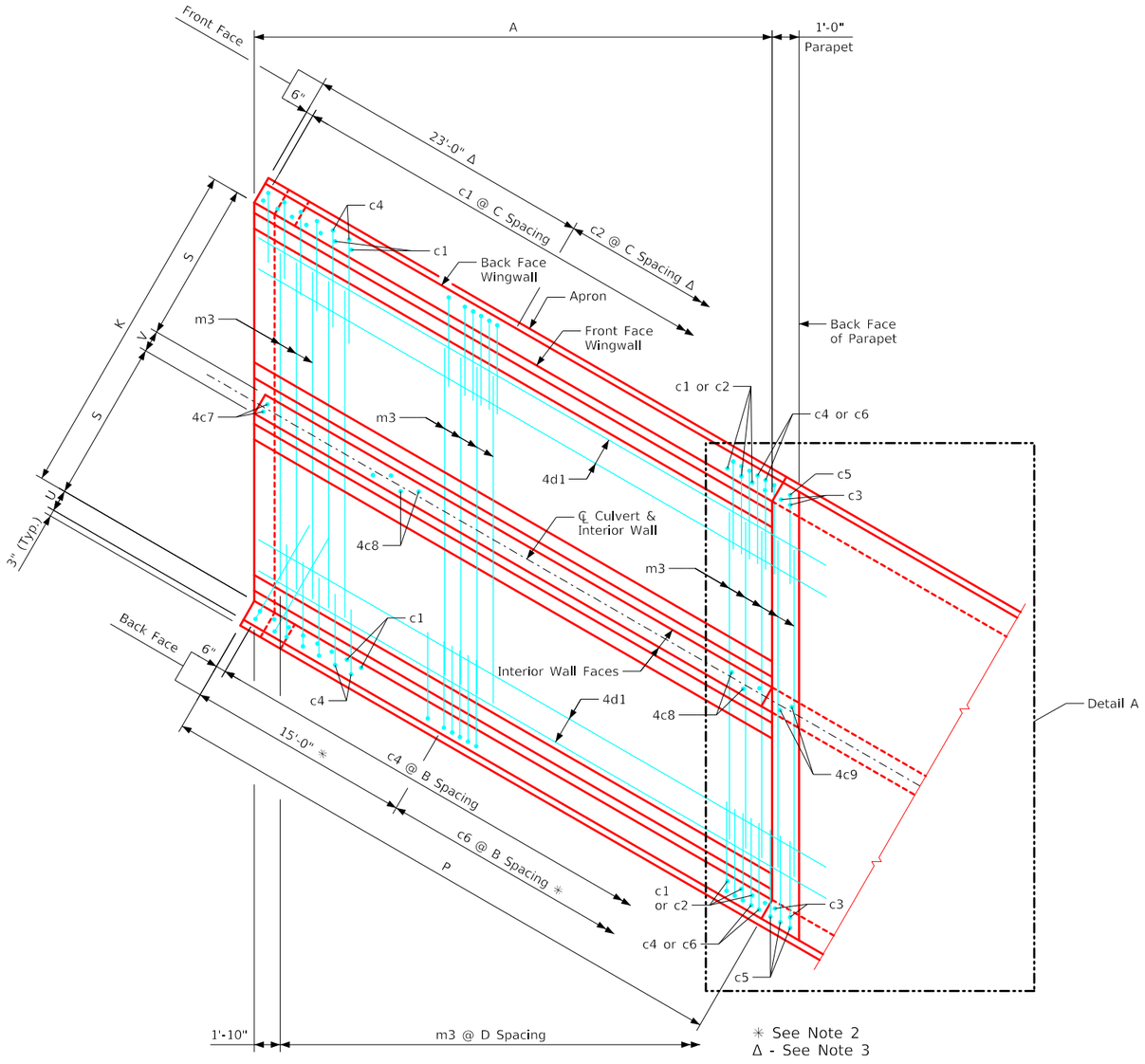
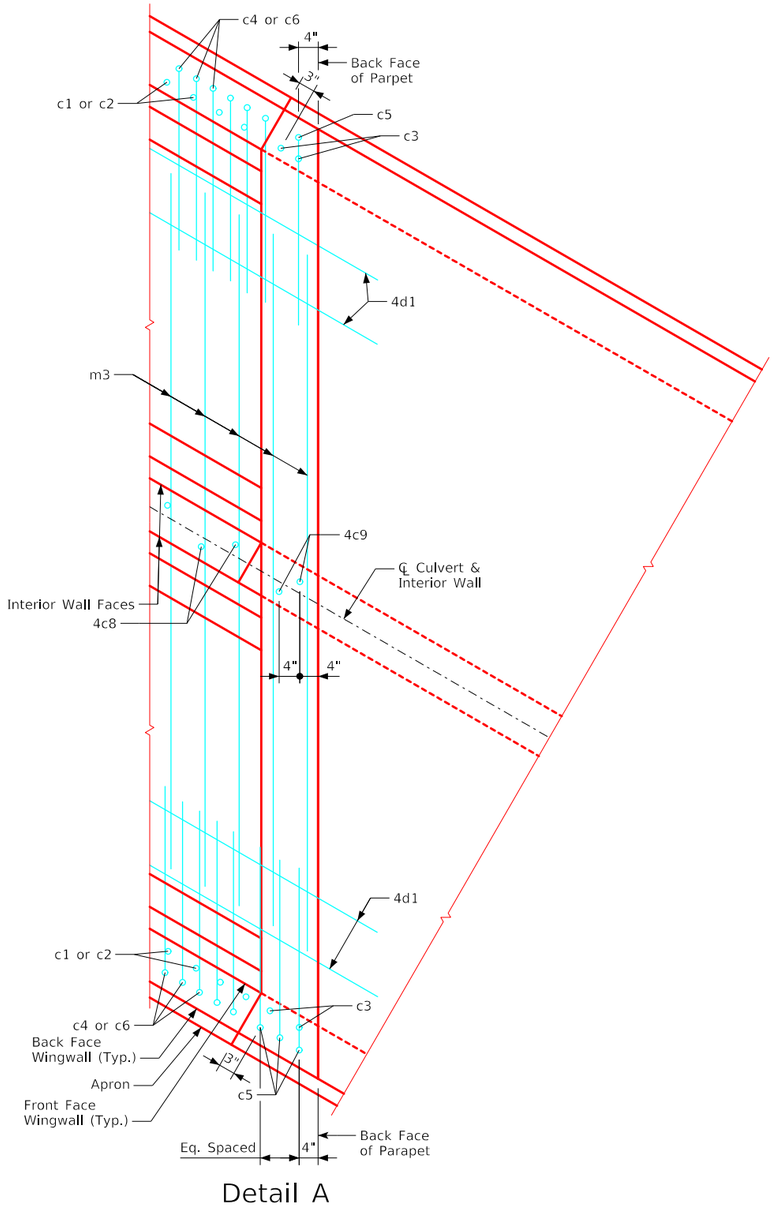


Plan View - Bottom Apron Reinforcing

(Curtain Wall Reinforcing not shown, See Sheet TWPWH 30-2-20)



Detail A

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 30-1-20.
5. Apron m3 bars are to be centered on ℄ 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.

LATEST REVISION DATE

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Bottom Apron Reinforcing 30° Skew	TWPWH 30-4-20

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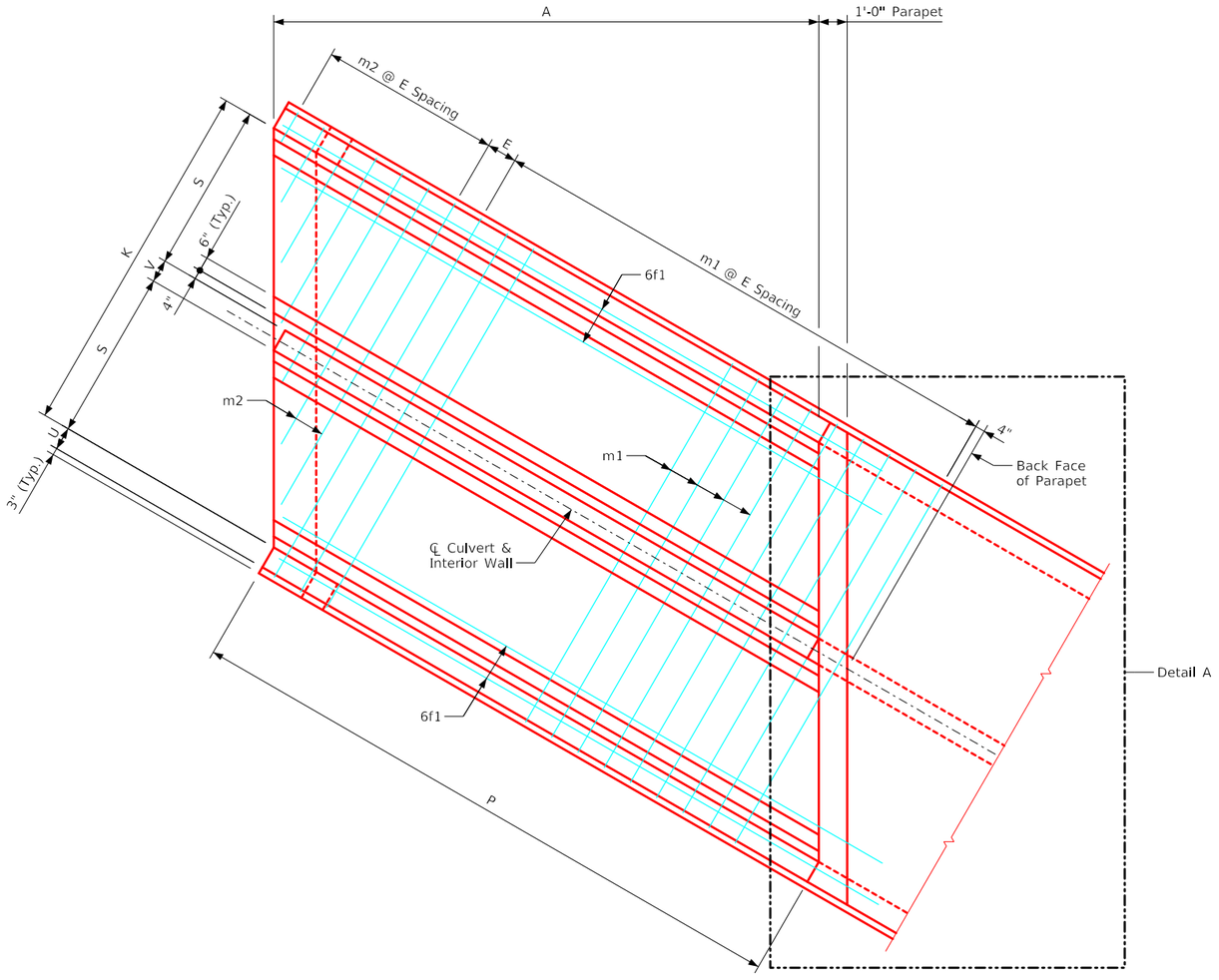
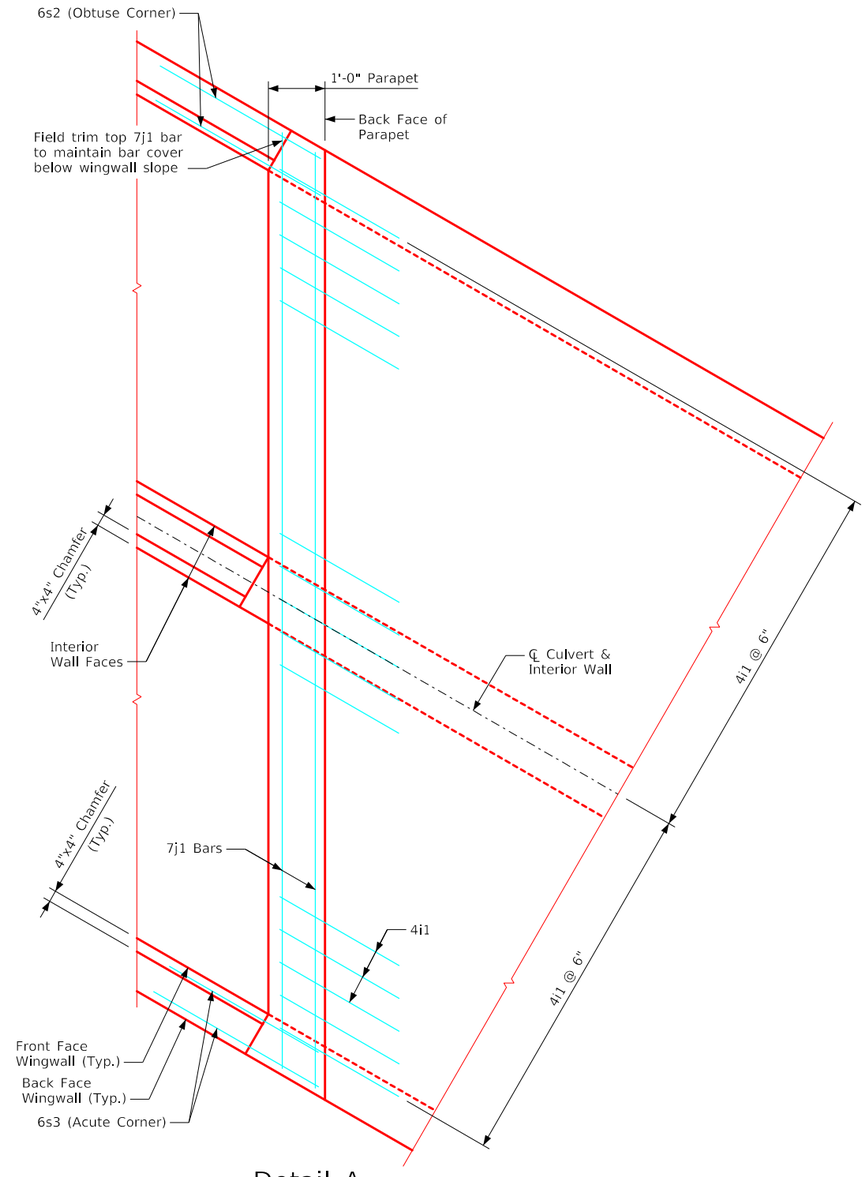


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

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 30-1-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing & Top Apron Reinforcing 30° Skew

TWPWH 30-5-20

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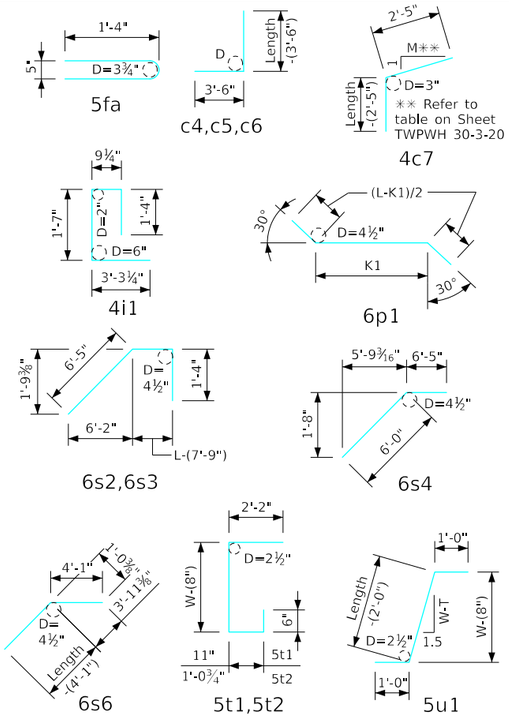
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

Bill of Reinforcing for One Headwall 30° 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	46'-2	101	5b1	2	42'-9	94	5b1	2	39'-3	82	5b1	2	35'-10	75	5b1	2	32'-4	67	5b1	2	28'-11	60
Wingwall, F.F.H.		5b2	22 Var.	2 Each 10'-0 to 44'-7	636	5b2	20 Var.	2 Each 10'-0 to 41'-2	539	5b2	18 Var.	2 Each 10'-0 to 37'-8	447	5b2	16 Var.	2 Each 10'-0 to 34'-3	369	5b2	14 Var.	2 Each 10'-0 to 30'-9	298	5b2	12 Var.	2 Each 10'-0 to 27'-4	234
Wingwall, B.F.H.		4b3	2	46'-6	65	4b3	2	43'-1	61	4b3	2	39'-6	53	4b3	2	36'-1	48	4b3	2	32'-7	44	4b3	2	29'-1	39
Wingwall, B.F.H.		4b4	20 Var.	2 Each 13'-9 to 44'-11	398	4b4	18 Var.	2 Each 13'-9 to 41'-6	335	4b4	16 Var.	2 Each 13'-8 to 37'-11	276	4b4	14 Var.	2 Each 13'-8 to 34'-5	225	4b4	12 Var.	2 Each 13'-8 to 31'-0	179	4b4	10 Var.	2 Each 13'-7 to 27'-6	137
Interior Wall, Both F.H.		5b5	21 Var.	7'-4 to 45'-8	588	5b5	19 Var.	7'-5 to 42'-2	496	5b5	17 Var.	7'-4 to 38'-9	409	5b5	15 Var.	7'-5 to 35'-3	334	5b5	13 Var.	7'-5 to 31'-9	266	5b5	11 Var.	7'-6 to 28'-4	206
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-8 to 14'-9	781	5c1	78 Var.	2 Each 2'-8 to 13'-8	664	4c1	72 Var.	2 Each 2'-8 to 12'-9	371	4c1	64 Var.	2 Each 2'-8 to 11'-7	305	4c1	76 Var.	2 Each 2'-8 to 10'-8	338	4c1	68 Var.	2 Each 2'-8 to 9'-10	284
Wingwall, F.F.V.		5c2	40 Var.	2 Each 9'-2 to 14'-8	497	5c2	34 Var.	2 Each 9'-2 to 13'-9	406	4c2	26 Var.	2 Each 9'-2 to 12'-7	189	4c2	20 Var.	2 Each 9'-2 to 11'-9	140	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	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, B.F.V.		6c4	86 Var.	2 Each 6'-4 to 18'-6	1604	5c4	78 Var.	2 Each 6'-4 to 17'-4	963	5c4	72 Var.	2 Each 6'-4 to 16'-5	854	5c4	64 Var.	2 Each 6'-4 to 15'-4	723	5c4	58 Var.	2 Each 6'-4 to 14'-5	628	5c4	50 Var.	2 Each 6'-4 to 13'-3	511
Wingwall, B.F.V. (O)		6c5	1	18'-7	28	5c5	1	17'-7	18	5c5	1	16'-7	17	5c5	1	15'-7	16	5c5	1	14'-7	15	5c5	1	13'-7	14
Wingwall, B.F.V. (A)		6c5	3	18'-7	84	5c5	3	17'-7	55	5c5	3	16'-7	52	5c5	3	15'-7	49	5c5	3	14'-7	46	5c5	3	13'-7	43
Wingwall, B.F.V.		6c6	56	8'-6	715	5c6	50	8'-6	443	5c6	42	8'-6	372	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195
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	83 Var.	1'-7 to 12'-3	383	4c8	76 Var.	1'-7 to 11'-3	326	4c8	69 Var.	1'-7 to 10'-3	273	4c8	62 Var.	1'-7 to 9'-3	224	4c8	55 Var.	1'-7 to 8'-2	179	4c8	48 Var.	1'-6 to 7'-2	139
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	46'-1	842	4d1	26	42'-7	782	4d1	26	39'-2	680	4d1	26	35'-8	619	4d1	26	32'-3	560	4d1	26	28'-9	499
Apron, Longit., Top		6f1	26	46'-1	1894	6f1	26	42'-7	1757	6f1	26	39'-2	1530	6f1	26	35'-8	1393	6f1	26	32'-3	1259	6f1	26	28'-9	1123
Parapet, Vertical		4i1	51	7'-0	238	4i1	51	7'-0	238	4i1	49	7'-0	229	4i1	49	7'-0	229	4i1	49	7'-0	229	4i1	49	7'-0	229
Parapet, Horiz.		7j1	4	30'-9	251	7j1	4	30'-9	251	7j1	4	30'-2	247	7j1	4	30'-2	247	7j1	4	30'-2	247	7j1	4	29'-11	245
Apron, Trans., Top		5m1	73	27'-2	2068	5m1	66	27'-2	1870	5m1	59	26'-8	1641	5m1	52	26'-8	1446	5m1	45	26'-8	1252	5m1	38	26'-5	1047
Apron, Trans., Top		5m2	28 Var.	2'-0 to 25'-5	400	5m2	28 Var.	2'-1 to 25'-6	403	5m2	27 Var.	2'-9 to 25'-3	394	5m2	28 Var.	2'-0 to 25'-4	399	5m2	28 Var.	2'-0 to 25'-5	400	5m2	28 Var.	2'-0 to 25'-4	399
Apron, Trans., Bott.		5m3	73	27'-10	2119	5m3	67	27'-10	1945	6m3	31	27'-11	1300	6m3	28	27'-11	1174	5m3	25	27'-2	708	5m3	22	26'-11	618
Curtain, Horiz.		6p1	6	31'-0	279	6p1	6	31'-0	279	6p1	6	30'-6	275	6p1	6	30'-6	275	6p1	6	30'-6	275	6p1	5	30'-2	227
Wing Slope, Both F.		6s1	4	40'-4	257	6s1	4	36'-9	221	6s1	4	33'-2	199	6s1	4	29'-6	177	6s1	4	25'-11	156	6s1	4	22'-4	134
Wing Slope, Both F. (O)		6s2	2	8'-3	25	6s2	2	8'-3	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	37'-11	114	6s5	2	34'-3	103	6s5	2	30'-8	92	6s5	2	27'-1	81	6s5	2	23'-5	70	6s5	2	19'-10	60
Interior Wall, Both F.		6s6	2	47'-5	150	6s6	2	43'-10	139	6s6	2	40'-4	128	6s6	2	36'-9	110	6s6	2	33'-1	99	6s6	2	29'-7	89
Curtain, Vert.		5t1	29	7'-11	239	5t1	29	7'-8	232	5t1	29	7'-5	224	5t1	29	7'-2	217	5t1	29	6'-11	209	5t1	29	6'-8	202
Curtain, Vert. Ends		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	5t2	4	6'-10	29
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			14,970 LB				12,852 LB				10,539 LB				9394 LB				7966 LB				6921 LB	
	Concrete	Parapet Δ	3.2	99.0 CY		3.2		89.3 CY		3.0		74.3 CY		3.0		66.0 CY		3.0		58.2 CY		2.9		48.9 CY	
		Wingwalls	34.6			29.6				20.7				17.1				13.9				9.8			
		Apron ✳	61.2			56.5				50.6				45.9				41.3				36.2			

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 TWPWH 30-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
30° Skew

TWPWH
30-6-20
Sheet 1 of 2

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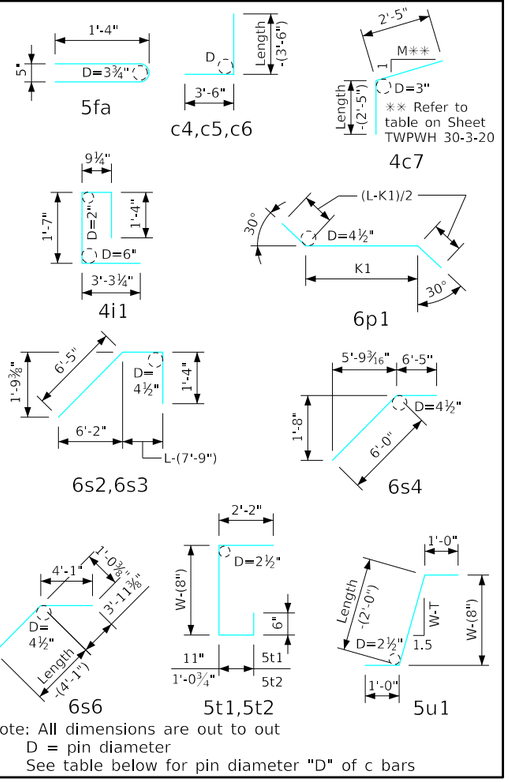
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

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

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Interior Wall, Both F.H.		5b5	9 Var.	7'-7 to 24'-10	152	5b5	7 Var.	7'-9 to 21'-4	106	5b5	5 Var.	8'-1 to 17'-10	68
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-8 to 8'-9	221	4c1	36 Var.	2 Each 2'-8 to 7'-7	123	4c1	30 Var.	2 Each 2'-8 to 6'-8	94
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, F.F.V. (A)		4c3	2	9'-1	12	4c3	2	8'-1	11	4c3	2	7'-1	9
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-4 to 12'-5	430	5c4	48 Var.	2 Each 6'-4 to 11'-4	442	5c4	40 Var.	2 Each 6'-4 to 10'-6	351
Wingwall, B.F.V. (O)		5c5	1	12'-7	13	5c5	1	11'-7	12	5c5	1	10'-7	11
Wingwall, B.F.V. (A)		5c5	3	12'-7	39	5c5	3	11'-7	36	5c5	3	10'-7	33
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5
Interior Wall, Both F.V		4c8	42 Var.	1'-6 to 6'-4	110	4c8	35 Var.	1'-6 to 5'-4	80	4c8	28 Var.	1'-6 to 4'-3	54
Interior Wall, Both F.V		4c9	2	6'-7	9	4c9	2	5'-7	7	4c9	2	4'-7	6
Apron, Longit., Bott.		4d1	26	25'-4	440	4d1	26	21'-10	379	4d1	26	18'-4	318
Apron, Longit., Top		6f1	26	25'-4	989	6f1	26	21'-10	853	6f1	26	18'-4	716
Parapet, Vertical		4i1	49	7'-0	229	4i1	49	7'-0	229	4i1	49	7'-0	229
Parapet, Horiz.		7j1	4	29'-11	245	7j1	4	29'-11	245	7j1	4	29'-11	245
Apron, Trans., Top		5m1	31	26'-5	854	5m1	24	26'-5	661	5m1	17	26'-5	468
Apron, Trans., Top		5m2	28 Var.	2'-0 to 25'-5	400	5m2	28 Var.	2'-1 to 25'-6	403	5m2	28 Var.	2'-2 to 25'-6	404
Apron, Trans., Bott.		4m3	19	26'-1	331	4m3	21	26'-1	366	4m3	13	26'-1	227
Curtain, Horiz.		6p1	5	30'-2	227	6p1	5	30'-2	227	6p1	5	30'-2	227
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Interior Wall, Both F.		6s6	2	25'-11	78	6s6	2	22'-4	67	6s6	2	18'-9	56
Curtain, Vert.		5t1	29	6'-5	194	5t1	29	6'-5	194	5t1	29	6'-5	194
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22
Estimated Quantities One Headwall	Reinf. Steel		5781 LB				5000 LB				4152 LB		
	Concrete Parapet Δ		2.9	42.0 CY			2.9	35.7 CY			2.9	29.8 CY	
	Concrete Wingwalls		7.5				5.4				3.7		
	Concrete Apron ✳		31.6				27.4				23.2		

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 TWPWH 30-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
30° Skew

TWPWH
30-6-20
Sheet 2 of 2

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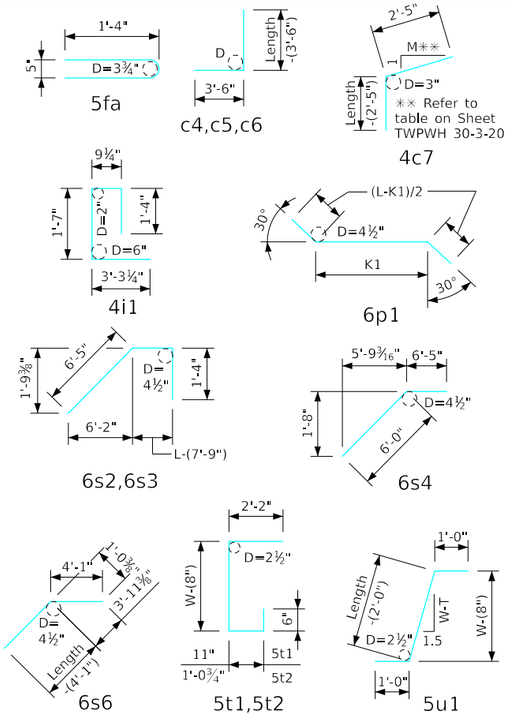
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' 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	46'-2	101	5b1	2	42'-9	94	5b1	2	39'-3	82	5b1	2	35'-10	75	5b1	2	32'-4	67	5b1	2	28'-11	60
Wingwall, F.F.H.		5b2	22 Var.	2 Each 10'-0 to 44'-7	636	5b2	20 Var.	2 Each 10'-0 to 41'-2	539	5b2	18 Var.	2 Each 10'-0 to 37'-8	447	5b2	16 Var.	2 Each 10'-0 to 34'-3	369	5b2	14 Var.	2 Each 10'-0 to 30'-9	298	5b2	12 Var.	2 Each 10'-0 to 27'-4	234
Wingwall, B.F.H.		4b3	2	46'-6	65	4b3	2	43'-1	61	4b3	2	39'-6	53	4b3	2	36'-1	48	4b3	2	32'-7	44	4b3	2	29'-1	39
Wingwall, B.F.H.		4b4	20 Var.	2 Each 13'-9 to 44'-11	398	4b4	18 Var.	2 Each 13'-9 to 41'-6	335	4b4	16 Var.	2 Each 13'-8 to 37'-11	276	4b4	14 Var.	2 Each 13'-8 to 34'-5	225	4b4	12 Var.	2 Each 13'-8 to 31'-0	179	4b4	10 Var.	2 Each 13'-7 to 27'-6	137
Interior Wall, Both F.H.		5b5	21 Var.	7'-4 to 45'-8	588	5b5	19 Var.	7'-5 to 42'-2	496	5b5	17 Var.	7'-4 to 38'-9	409	5b5	15 Var.	7'-5 to 35'-3	334	5b5	13 Var.	7'-5 to 31'-9	266	5b5	11 Var.	7'-6 to 28'-4	206
Wingwall, F.F.V.		5c1	86 Var.	2 Each 2'-7 to 14'-8	774	5c1	78 Var.	2 Each 2'-7 to 13'-7	658	4c1	72 Var.	2 Each 2'-7 to 12'-8	367	4c1	64 Var.	2 Each 2'-7 to 11'-6	301	4c1	76 Var.	2 Each 2'-7 to 10'-7	334	4c1	68 Var.	2 Each 2'-7 to 9'-9	280
Wingwall, F.F.V.		5c2	40 Var.	2 Each 9'-1 to 14'-7	494	5c2	34 Var.	2 Each 9'-1 to 13'-8	403	4c2	26 Var.	2 Each 9'-1 to 12'-6	187	4c2	20 Var.	2 Each 9'-1 to 11'-8	139	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, F.F.V. (A)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, B.F.V.		6c4	86 Var.	2 Each 6'-3 to 18'-5	1593	5c4	78 Var.	2 Each 6'-3 to 17'-3	956	5c4	72 Var.	2 Each 6'-3 to 16'-4	848	5c4	64 Var.	2 Each 6'-3 to 15'-3	718	5c4	58 Var.	2 Each 6'-3 to 14'-4	623	5c4	50 Var.	2 Each 6'-3 to 13'-2	506
Wingwall, B.F.V. (O)		6c5	1	18'-6	28	5c5	1	17'-6	18	5c5	1	16'-6	17	5c5	1	15'-6	16	5c5	1	14'-6	15	5c5	1	13'-6	14
Wingwall, B.F.V. (A)		6c5	3	18'-6	83	5c5	3	17'-6	55	5c5	3	16'-6	52	5c5	3	15'-6	48	5c5	3	14'-6	45	5c5	3	13'-6	42
Wingwall, B.F.V.		6c6	56	8'-6	715	5c6	50	8'-6	443	5c6	42	8'-6	372	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	83 Var.	1'-6 to 12'-2	379	4c8	76 Var.	1'-6 to 11'-2	322	4c8	69 Var.	1'-6 to 10'-2	269	4c8	62 Var.	1'-6 to 9'-2	221	4c8	55 Var.	1'-6 to 8'-1	176	4c8	48 Var.	1'-5 to 7'-1	136
Interior Wall, Both F.V		4c9	2	12'-6	17	4c9	2	11'-6	15	4c9	2	10'-6	14	4c9	2	9'-6	13	4c9	2	8'-6	11	4c9	2	7'-6	10
Apron, Longit., Bott.		4d1	22	46'-1	713	4d1	22	42'-7	661	4d1	22	39'-2	576	4d1	22	35'-8	524	4d1	22	32'-3	474	4d1	22	28'-9	423
Apron, Longit., Top		6f1	22	46'-1	1603	6f1	22	42'-7	1487	6f1	22	39'-2	1294	6f1	22	35'-8	1179	6f1	22	32'-3	1066	6f1	22	28'-9	950
Parapet, Vertical		4i1	43	7'-0	201	4i1	43	7'-0	201	4i1	41	7'-0	192	4i1	41	7'-0	192	4i1	41	7'-0	192	4i1	41	7'-0	192
Parapet, Horiz.		7j1	4	26'-2	214	7j1	4	26'-2	214	7j1	4	25'-7	209	7j1	4	25'-7	209	7j1	4	25'-7	209	7j1	4	25'-3	206
Apron, Trans., Top		5m1	50	23'-2	1208	5m1	46	23'-2	1111	5m1	41	22'-8	969	5m1	36	22'-8	851	5m1	32	22'-8	757	5m1	27	22'-5	631
Apron, Trans., Top		5m2	16 Var.	2'-2 to 21'-8	199	5m2	15 Var.	2'-8 to 20'-11	184	5m2	15 Var.	2'-11 to 21'-1	188	5m2	16 Var.	2'-2 to 21'-7	198	5m2	15 Var.	2'-7 to 20'-10	183	5m2	15 Var.	3'-0 to 21'-2	189
Apron, Trans., Bott.		6m3	73	23'-11	2622	6m3	67	23'-11	2407	6m3	61	23'-5	2145	6m3	55	23'-5	1934	5m3	25	22'-7	589	5m3	22	22'-3	511
Curtain, Horiz.		6p1	6	26'-5	238	6p1	6	26'-5	238	6p1	6	25'-10	233	6p1	6	25'-10	233	6p1	6	25'-10	233	6p1	5	25'-7	192
Wing Slope, Both F.		6s1	4	40'-4	257	6s1	4	36'-9	221	6s1	4	33'-2	199	6s1	4	29'-6	177	6s1	4	25'-11	156	6s1	4	22'-4	134
Wing Slope, Both F. (O)		6s2	2	8'-3	25	6s2	2	8'-3	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	37'-11	114	6s5	2	34'-3	103	6s5	2	30'-8	92	6s5	2	27'-1	81	6s5	2	23'-5	70	6s5	2	19'-10	60
Interior Wall, Both F.		6s6	2	47'-5	150	6s6	2	43'-10	139	6s6	2	40'-4	128	6s6	2	36'-9	110	6s6	2	33'-1	99	6s6	2	29'-7	89
Curtain, Vert.		5t1	25	7'-11	206	5t1	25	7'-8	200	5t1	25	7'-5	193	5t1	25	7'-2	187	5t1	25	6'-11	180	5t1	24	6'-8	167
Curtain, Vert. Ends		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	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	6'-7	27	5u1	4	6'-4	26	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-6	23
Estimated Quantities One Headwall	Reinf. Steel		13,818 LB				11,777 LB				10,002 LB				8888 LB				6697 LB				5780 LB		
	Concrete Parapet Δ		2.8	87.1 CY			2.8	78.3 CY			2.6	64.2 CY			2.6	56.9 CY			2.6	49.9 CY			2.5	41.6 CY	
	Concrete Wingwalls		34.6				29.6				20.7				17.1				13.9				9.8		
	Concrete Apron ✳		49.7				45.9				40.9				37.2				33.4				29.3		

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 TWPWH 30-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

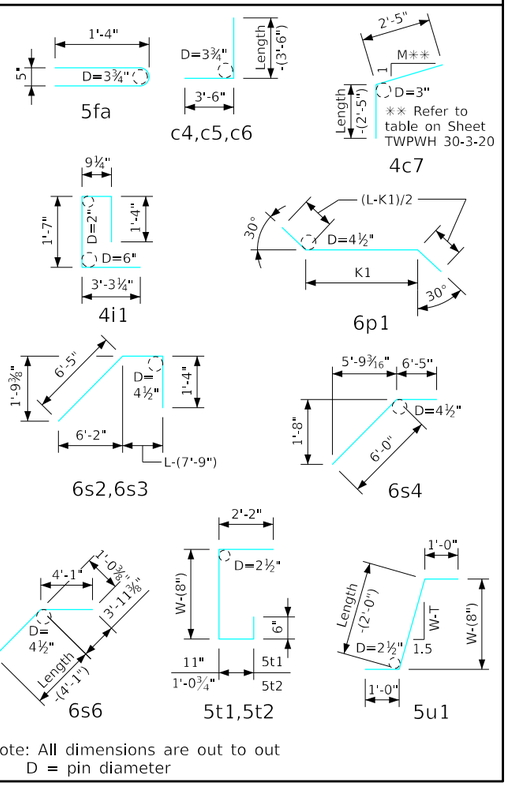
July, 2020

Quantity Tabulation
10'-0" Span
30° Skew

TWPWH
30-7-20
Sheet 1 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 30-7-20 S1 - THIS SHEET ISSUED 07-2020.

Bent Bar Details



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

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Interior Wall, Both F.H.		5b5	9 Var.	7'-7 to 24'-10	152	5b5	7 Var.	7'-9 to 21'-4	106	5b5	5 Var.	8'-1 to 17'-10	68
Wingwall, F.F.V.		4c1	58 Var.	2 Each 2'-7 to 8'-8	218	4c1	36 Var.	2 Each 2'-7 to 7'-6	121	4c1	30 Var.	2 Each 2'-7 to 6'-7	92
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, B.F.V.		5c4	44 Var.	2 Each 6'-3 to 12'-4	426	5c4	48 Var.	2 Each 6'-3 to 11'-3	438	5c4	30 Var.	2 Each 6'-3 to 10'-4	259
Wingwall, B.F.V. (O)		5c5	1	12'-6	13	5c5	1	11'-6	12	5c5	1	10'-6	11
Wingwall, B.F.V. (A)		5c5	3	12'-6	39	5c5	3	11'-6	36	5c5	3	10'-6	33
Wingwall, B.F.V.		5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	42 Var.	1'-5 to 6'-3	108	4c8	35 Var.	1'-5 to 5'-3	78	4c8	28 Var.	1'-5 to 4'-2	52
Interior Wall, Both F.V		4c9	2	6'-6	9	4c9	2	5'-6	7	4c9	2	4'-6	6
Apron, Longit., Bott.		4d1	22	25'-4	372	4d1	22	21'-10	321	4d1	22	18'-4	269
Apron, Longit., Top		6f1	22	25'-4	837	6f1	22	21'-10	721	6f1	22	18'-4	606
Parapet, Vertical		4i1	41	7'-0	192	4i1	41	7'-0	192	4i1	41	7'-0	192
Parapet, Horiz.		7j1	4	25'-3	206	7j1	4	25'-3	206	7j1	4	25'-3	206
Apron, Trans., Top		5m1	23	22'-5	538	5m1	18	22'-5	421	5m1	13	22'-5	304
Apron, Trans., Top		5m2	15 Var.	2'-2 to 20'-4	176	5m2	15 Var.	2'-8 to 20'-11	184	5m2	15 Var.	3'-2 to 21'-4	192
Apron, Trans., Bott.		4m3	19	21'-6	273	4m3	16	21'-6	230	4m3	13	21'-6	187
Curtain, Horiz.		6p1	5	25'-7	192	6p1	5	25'-7	192	6p1	5	25'-7	192
Wing Slope, Both F.		6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Interior Wall, Both F.		6s6	2	25'-11	78	6s6	2	22'-4	67	6s6	2	18'-9	56
Curtain, Vert.		5t1	24	6'-5	161	5t1	24	6'-5	161	5t1	24	6'-5	161
Curtain, Vert. Ends		5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22

Estimated Quantities One Headwall			10' x 6'		10' x 5'		10' x 4'	
Reinf. Steel			4810 LB		4063 LB		3337 LB	
Concrete	Parapet Δ	2.5	35.6 CY		2.5	30.1 CY	2.5	25.0 CY
	Wingwalls	7.5			5.4		3.7	
	Apron ✳	25.6			22.2		18.8	

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 TWPWH 30-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

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IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
30° Skew

TWPWH
30-7-20
Sheet 2 of 2

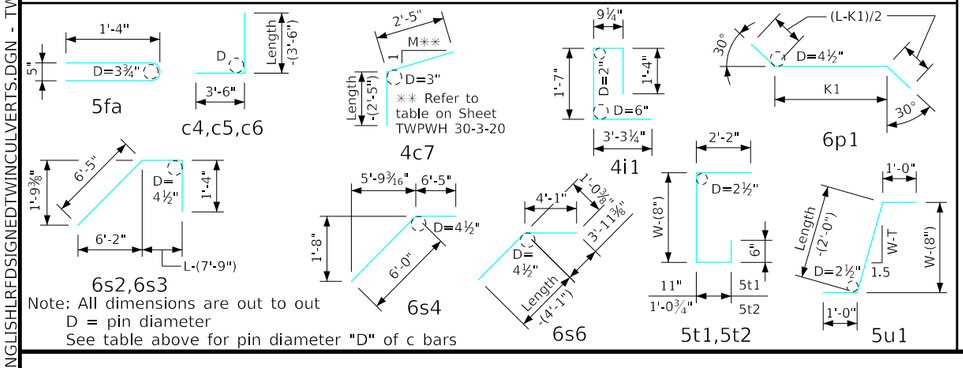
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 30-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	39'-3	82	5b1	2	35'-10	75	5b1	2	32'-4	67	5b1	2	28'-11	60	5b1	2	25'-5	53	5b1	2	22'-0	46	5b1	2	18'-6	39
Wingwall, F.F.H.		5b2	18 Var.	2 Each 10'-0 to 37'-8	447	5b2	16 Var.	2 Each 10'-0 to 34'-3	369	5b2	14 Var.	2 Each 10'-0 to 30'-9	298	5b2	12 Var.	2 Each 10'-0 to 27'-4	234	5b2	10 Var.	2 Each 10'-0 to 23'-10	176	5b2	8 Var.	2 Each 10'-0 to 20'-5	127	5b2	6 Var.	2 Each 10'-0 to 16'-11	84
Wingwall, B.F.H.		4b3	2	39'-6	53	4b3	2	36'-1	48	4b3	2	32'-7	44	4b3	2	29'-1	39	4b3	2	25'-7	34	4b3	2	22'-2	30	4b3	2	18'-8	25
Wingwall, B.F.H.		4b4	16 Var.	2 Each 13'-8 to 37'-11	276	4b4	14 Var.	2 Each 13'-8 to 34'-5	225	4b4	12 Var.	2 Each 13'-8 to 31'-0	179	4b4	10 Var.	2 Each 13'-7 to 27'-6	137	4b4	8 Var.	2 Each 13'-7 to 24'-0	100	4b4	6 Var.	2 Each 13'-7 to 20'-7	68	4b4	4 Var.	2 Each 13'-7 to 17'-1	41
Interior Wall, Both F.H.		5b5	17 Var.	7'-4 to 38'-9	409	5b5	15 Var.	7'-5 to 35'-3	334	5b5	13 Var.	7'-5 to 31'-9	266	5b5	11 Var.	7'-6 to 28'-4	206	5b5	9 Var.	7'-7 to 24'-10	152	5b5	7 Var.	7'-9 to 21'-4	106	5b5	5 Var.	8'-1 to 17'-10	68
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-5 to 12'-6	359	4c1	64 Var.	2 Each 2'-5 to 11'-4	294	4c1	76 Var.	2 Each 2'-5 to 10'-5	326	4c1	68 Var.	2 Each 2'-5 to 9'-7	273	4c1	58 Var.	2 Each 2'-5 to 8'-6	211	4c1	36 Var.	2 Each 2'-5 to 7'-4	117	4c1	30 Var.	2 Each 2'-5 to 6'-5	89
Wingwall, F.F.V.		4c2	26 Var.	2 Each 8'-11 to 12'-4	185	4c2	20 Var.	2 Each 8'-11 to 11'-6	136	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, B.F.V.		6c4	72 Var.	2 Each 6'-1 to 16'-2	1203	5c4	64 Var.	2 Each 6'-1 to 15'-1	706	5c4	58 Var.	2 Each 6'-1 to 14'-2	613	5c4	50 Var.	2 Each 6'-1 to 13'-0	498	5c4	44 Var.	2 Each 6'-1 to 12'-2	419	5c4	36 Var.	2 Each 6'-1 to 11'-0	321	5c4	30 Var.	2 Each 6'-1 to 10'-2	254
Wingwall, B.F.V. (O)		6c5	1	16'-4	25	5c5	1	15'-4	16	5c5	1	14'-4	15	5c5	1	13'-4	14	5c5	1	12'-4	13	5c5	1	11'-4	12	5c5	1	10'-4	11
Wingwall, B.F.V. (A)		6c5	3	16'-4	74	5c5	3	15'-4	48	5c5	3	14'-4	45	5c5	3	13'-4	42	5c5	3	12'-4	39	5c5	3	11'-4	35	5c5	3	10'-4	32
Wingwall, B.F.V.		6c6	42	8'-6	536	5c6	36	8'-6	319	5c6	28	8'-6	248	5c6	22	8'-6	195	5c6	14	8'-6	124	c6	--	--	--	c6	--	--	--
Interior Wall, Both F.V		4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5
Interior Wall, Both F.V		4c8	69 Var.	1'-4 to 10'-0	261	4c8	62 Var.	1'-4 to 9'-0	214	4c8	55 Var.	1'-4 to 7'-11	170	4c8	48 Var.	1'-3 to 6'-11	131	4c8	42 Var.	1'-3 to 6'-1	103	4c8	35 Var.	1'-3 to 5'-1	74	4c8	28 Var.	1'-3 to 4'-0	49
Interior Wall, Both F.V		4c9	2	10'-4	14	4c9	2	9'-4	12	4c9	2	8'-4	11	4c9	2	7'-4	10	4c9	2	6'-4	8	4c9	2	5'-4	7	4c9	2	4'-4	6
Apron, Longit., Bott.		4d1	18	39'-2	471	4d1	18	35'-8	429	4d1	18	32'-3	388	4d1	18	28'-9	346	4d1	18	25'-4	305	4d1	18	21'-10	263	4d1	18	18'-4	220
Apron, Longit., Top		6f1	18	39'-2	1059	6f1	18	35'-8	964	6f1	18	32'-3	872	6f1	18	28'-9	777	6f1	18	25'-4	685	6f1	18	21'-10	590	6f1	18	18'-4	496
Parapet, Vertical		4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154	4i1	33	7'-0	154
Parapet, Horiz.		7j1	4	20'-11	171	7j1	4	20'-11	171	7j1	4	20'-11	171	7j1	4	20'-8	169	7j1	4	20'-8	169	7j1	4	20'-8	169	7j1	4	20'-8	169
Apron, Trans., Top		5m1	32	18'-8	623	5m1	29	18'-8	565	5m1	33	18'-8	642	5m1	22	18'-5	423	5m1	18	18'-5	346	5m1	15	18'-5	288	5m1	11	18'-5	211
Apron, Trans., Top		5m2	9 Var.	3'-1 to 16'-11	94	5m2	9 Var.	2'-4 to 16'-2	87	5m2	12 Var.	3'-3 to 17'-6	130	5m2	9 Var.	2'-4 to 16'-2	87	5m2	9 Var.	3'-3 to 17'-1	95	5m2	9 Var.	2'-5 to 16'-3	88	5m2	9 Var.	3'-4 to 17'-2	96
Apron, Trans., Bott.		6m3	61	18'-9	1718	5m3	55	18'-0	1033	5m3	33	18'-0	620	5m3	22	17'-8	405	4m3	19	16'-11	215	4m3	16	16'-11	181	4m3	13	16'-11	147
Curtain, Horiz.		6p1	6	21'-3	192	6p1	6	21'-3	192	6p1	6	21'-3	192	6p1	5	21'-0	158	6p1	5	21'-0	158	6p1	5	21'-0	158	6p1	5	21'-0	158
Wing Slope, Both F.		6s1	4	33'-2	199	6s1	4	29'-6	177	6s1	4	25'-11	156	6s1	4	22'-4	134	6s1	4	18'-8	112	6s1	4	15'-1	91	6s1	4	11'-6	69
Wing Slope, Both F. (O)		6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25	6s2	2	8'-4	25
Wing Slope, Both F. (A)		6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26	6s3	2	8'-9	26
Wing Slope, F.F.		6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37	6s4	2	12'-5	37
Wing Slope, F.F.		6s5	2	30'-8	92	6s5	2	27'-1	81	6s5	2	23'-5	70	6s5	2	19'-10	60	6s5	2	16'-3	49	6s5	2	12'-8	38	6s5	2	9'-0	27
Interior Wall, Both F.		6s6	2	40'-4	128	6s6	2	36'-9	110	6s6	2	33'-1	99	6s6	2	29'-7	89	6s6	2	25'-11	78	6s6	2	22'-4	67	6s6	2	18'-9	56
Curtain, Vert.		5t1	20	7'-5	155	5t1	20	7'-2	149	5t1	20	6'-11	144	5t1	20	6'-8	139	5t1	20	6'-5	134	5t1	20	6'-5	134	5t1	20	6'-5	134
Curtain, Vert. Ends		5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30	5t2	4	6'-10	29	5t2	4	6'-7	27	5t2	4	6'-7	27	5t2	4	6'-7	27
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel			9170 LB				7095 LB				6101 LB				4957 LB				4104 LB				3332 LB				2801 LB	
	Concrete Parapet Δ			2.3				2.3				2.3				2.2				2.2				2.2				2.2	
	Concrete Wingwalls			20.7	53.1 CY			17.1	46.8 CY			13.9	40.9 CY			9.8	33.6 CY			7.5	28.6 CY			5.4	24.1 CY			3.7	19.9 CY
	Concrete Apron ✳			30.1				27.4				24.7				21.6				18.9				16.5				14.0	

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

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table above for pin diameter "D" of c bars

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 TWPWH 30-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

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IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
30° Skew

TWPWH
30-8-20

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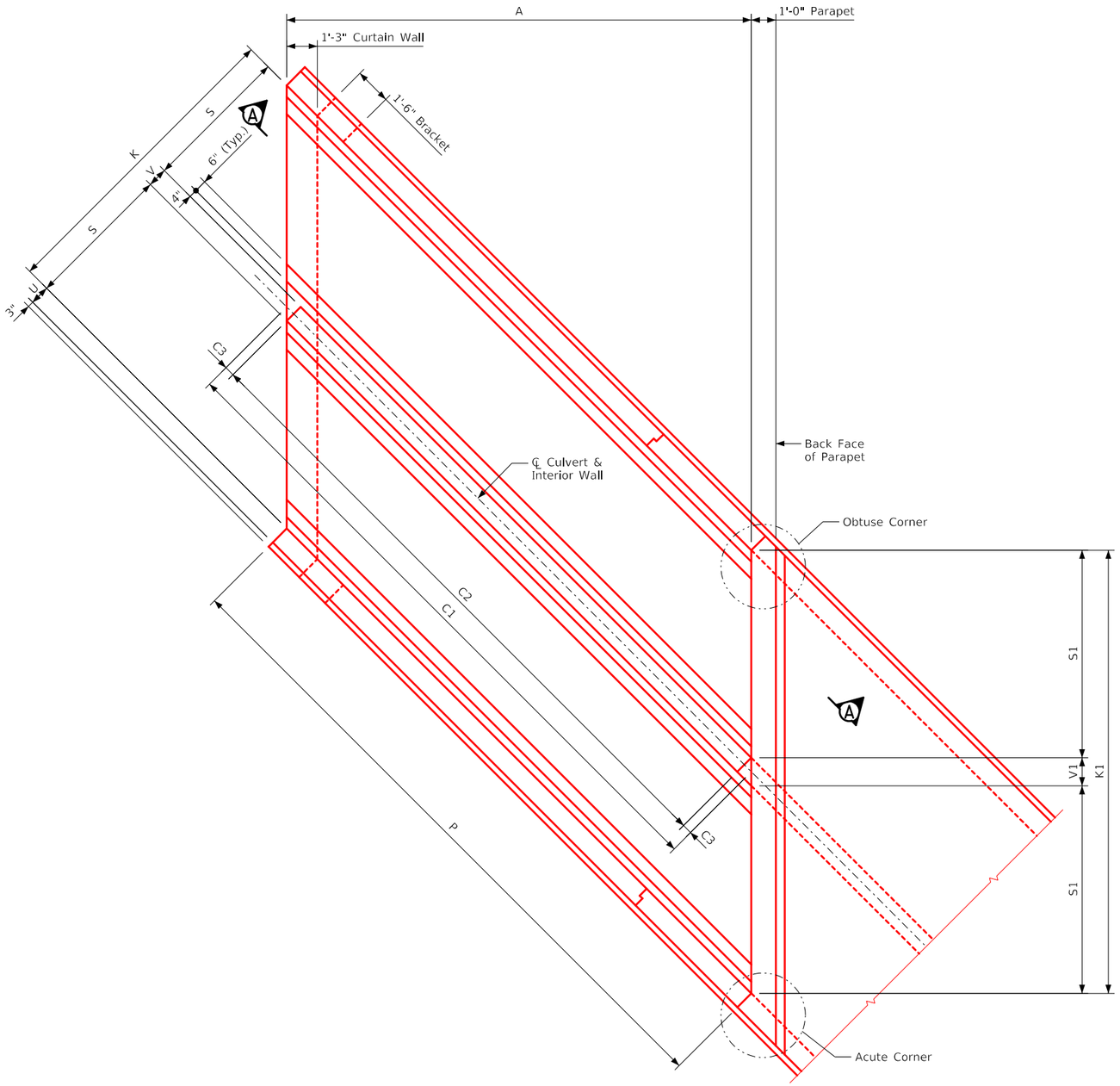
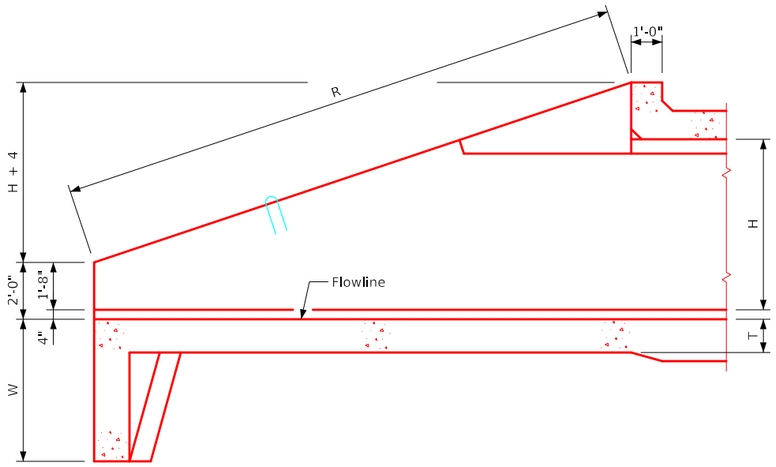


Plan View



Elevation Section A-A

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.

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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'-3⅜	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	52'-3⅜	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	C1
	C2	51'-3⅜	47'-1	43'-0⅛	38'-9⅛	34'-6¼	30'-4⅜	26'-1½	21'-10½	17'-7⅝	51'-3⅜	47'-1	43'-0⅛	38'-9⅛	34'-6¼	30'-4⅜	26'-1½	21'-10½	17'-7⅝	C2
	C3	6	6	5	5	5	4½	4½	4½	4½	6	6	5	5	5	4½	4½	4½	4½	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'-4¼	35'-4¼	35'-1⅜	35'-1⅜	35'-1⅜	35'-0	35'-0	35'-0	35'-0	29'-8½	29'-8½	29'-5⅝	29'-5⅝	29'-5⅝	29'-4¼	29'-4¼	29'-4¼	29'-4¼	K1
	P	52'-3⅜	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	52'-3⅜	48'-1	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	P
	R	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	53'-9⅛	49'-4¾	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	R
	R1	52'-5⅛	48'-1⅝	43'-11¼	39'-7	35'-2¾	30'-11⅜	26'-7⅛	22'-2⅞	17'-10⅝	52'-5⅛	48'-1⅝	43'-11¼	39'-7	35'-2¾	30'-11⅜	26'-7⅛	22'-2⅞	17'-10⅝	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'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	16'-11⅝	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	14'-1¾	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'-2⅛	1'-2⅛	1'-2⅛	1'-0¾	1'-0¾	1'-0¾	1'-0¾	1'-5	1'-5	1'-2⅛	1'-2⅛	1'-2⅛	1'-0¾	1'-0¾	1'-0¾	1'-0¾	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	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	1'-0	1'-0	9	9	9	1'-0	C
	D	6	6	1'-0	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	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'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	C1
	C2	43'-0⅛	38'-9⅛	34'-6¼	30'-4⅜	26'-1½	21'-10½	17'-7⅝	C2
	C3	5	5	5	4½	4½	4½	4½	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'-9⅝	23'-9⅝	23'-9⅝	23'-8¼	23'-8¼	23'-8¼	23'-8¼	K1
	P	43'-10⅛	39'-7⅛	35'-4¼	31'-1⅜	26'-10½	22'-7½	18'-4⅝	P
	R	45'-0½	40'-8¼	36'-3⅜	31'-11⅝	27'-7¼	23'-3	18'-10⅝	R
	R1	43'-11¼	39'-7	35'-2¾	30'-11⅜	26'-7⅛	22'-2⅞	17'-10⅝	R1
	S	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	8'-0	S
	S1	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	11'-3¾	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'-2⅛	1'-2⅛	1'-2⅛	1'-0¾	1'-0¾	1'-0¾	1'-0¾	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.

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Dimension Table
45° Skew

TWPWH
45-2-20

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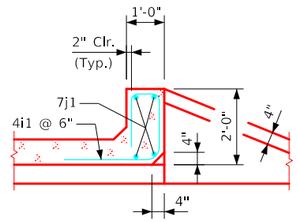
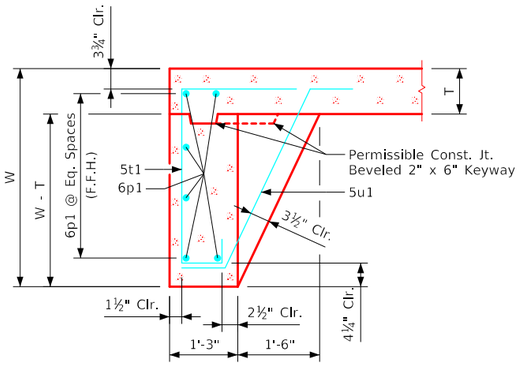
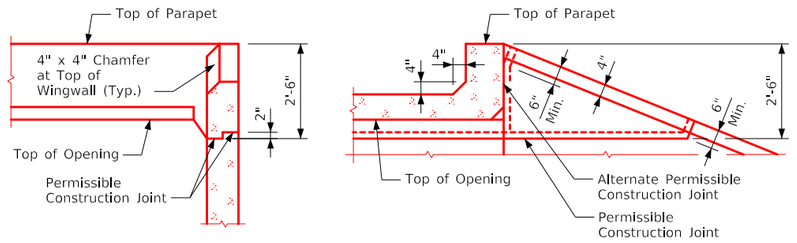


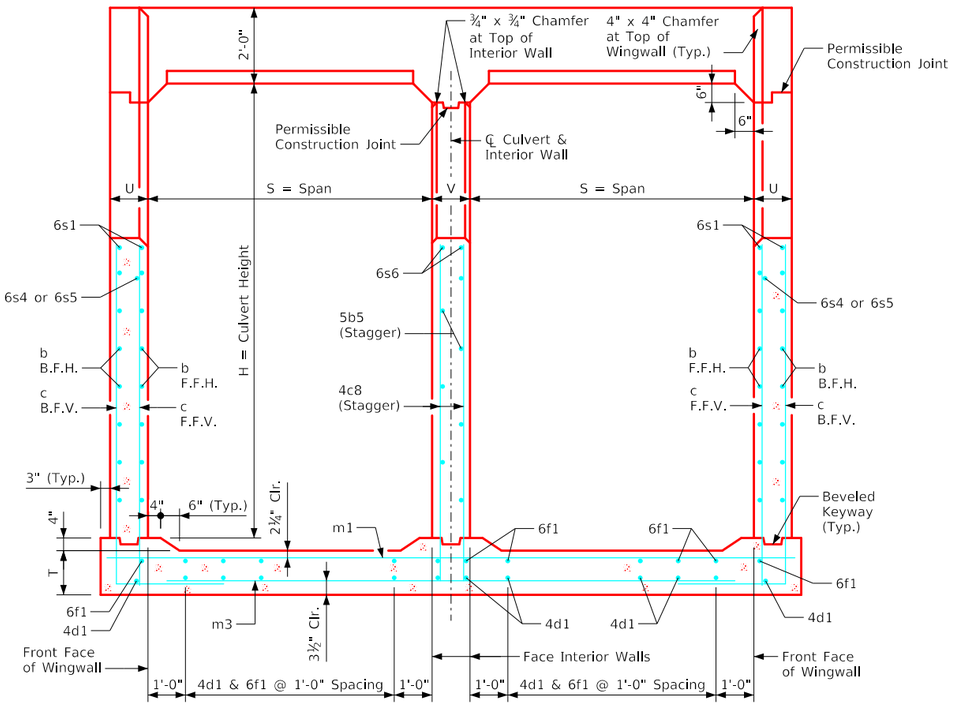
Section thru Parapet



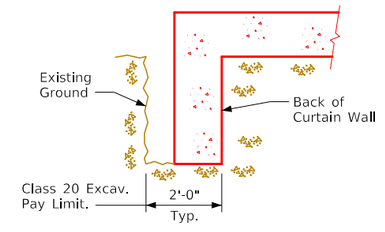
Section thru Curtain Wall



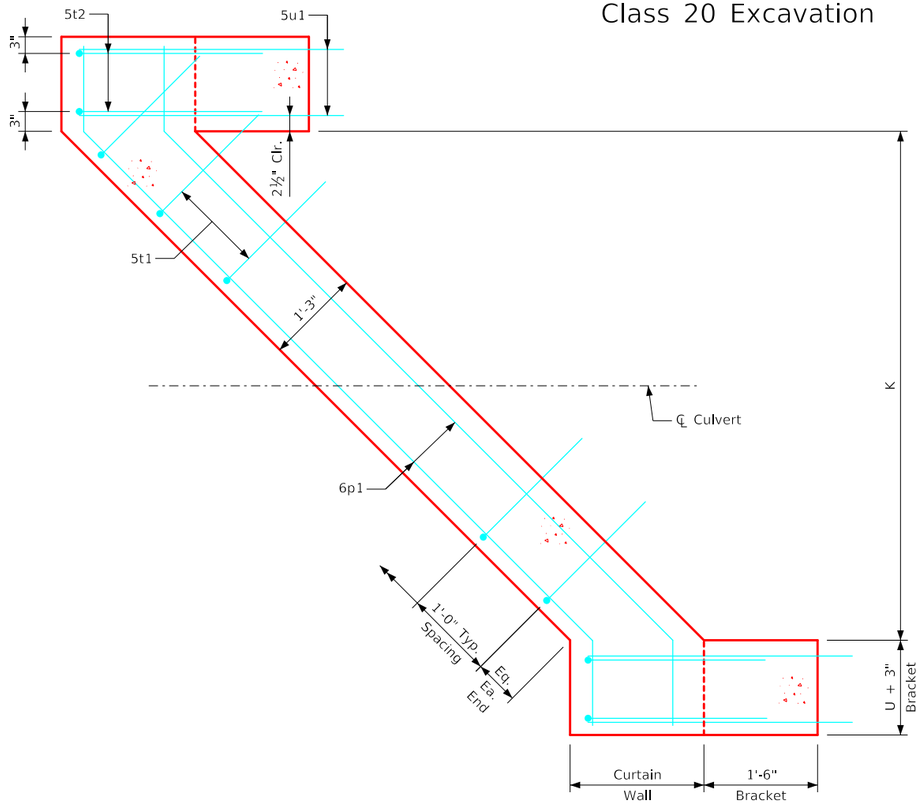
Top of Wingwall Details



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

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Cross Section Details 45° Skew	TWPWH 45-3-20

Revised 08-2022: Changed chamfer at top of Interior Wall to 3/4" x 3/4" (was 4" x 4").
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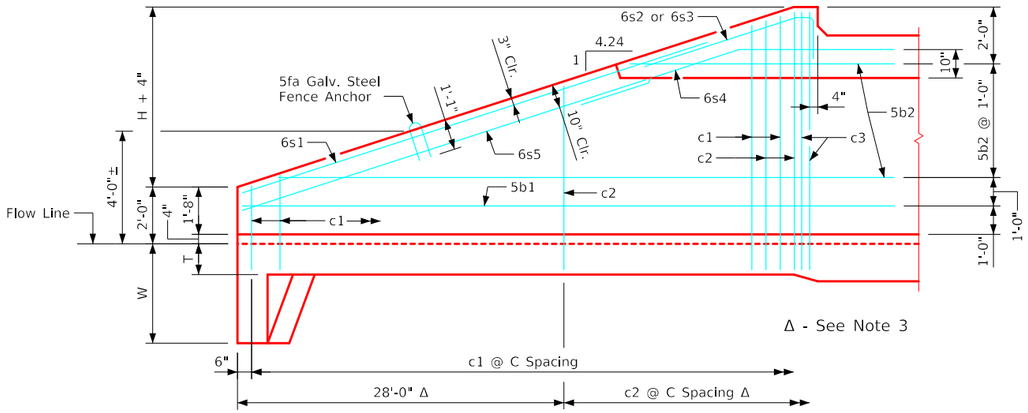
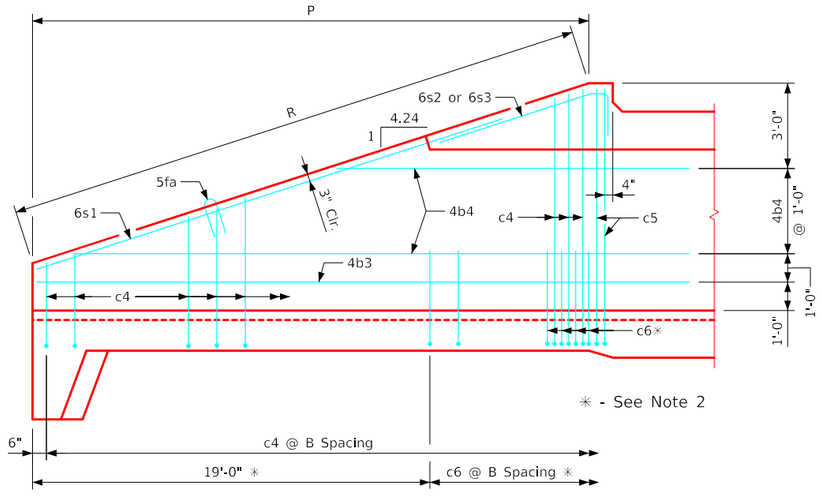
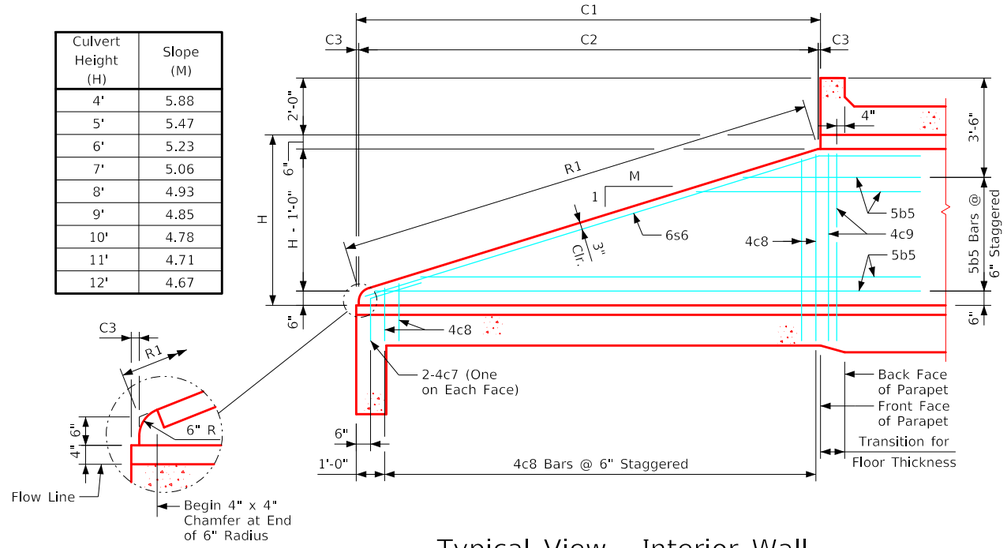


Typical View - Front Face Wingwall Reinforcing



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 ℄ 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.

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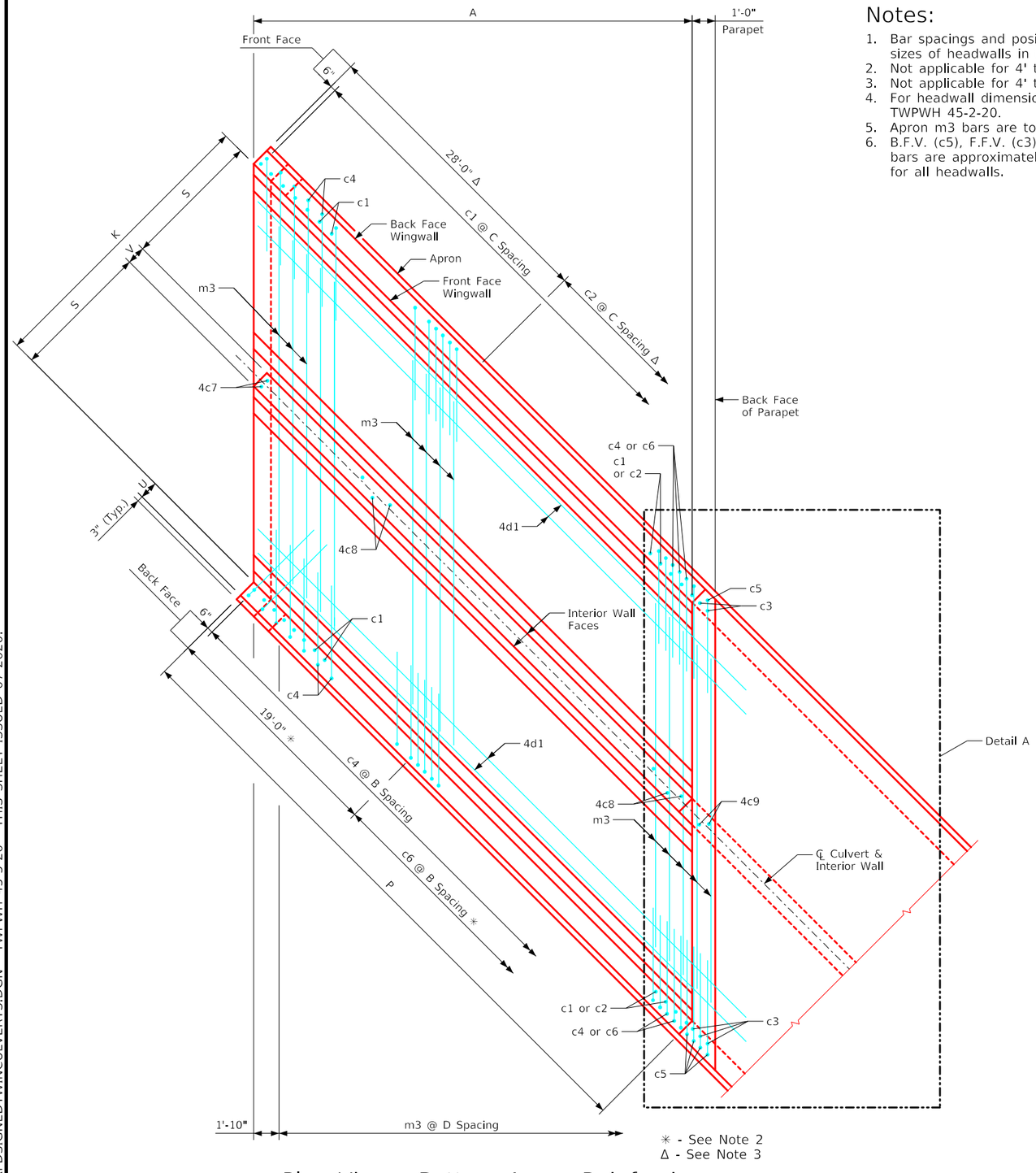
Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Wingwall Elevations 45° Skew

TWPWH 45-4-20



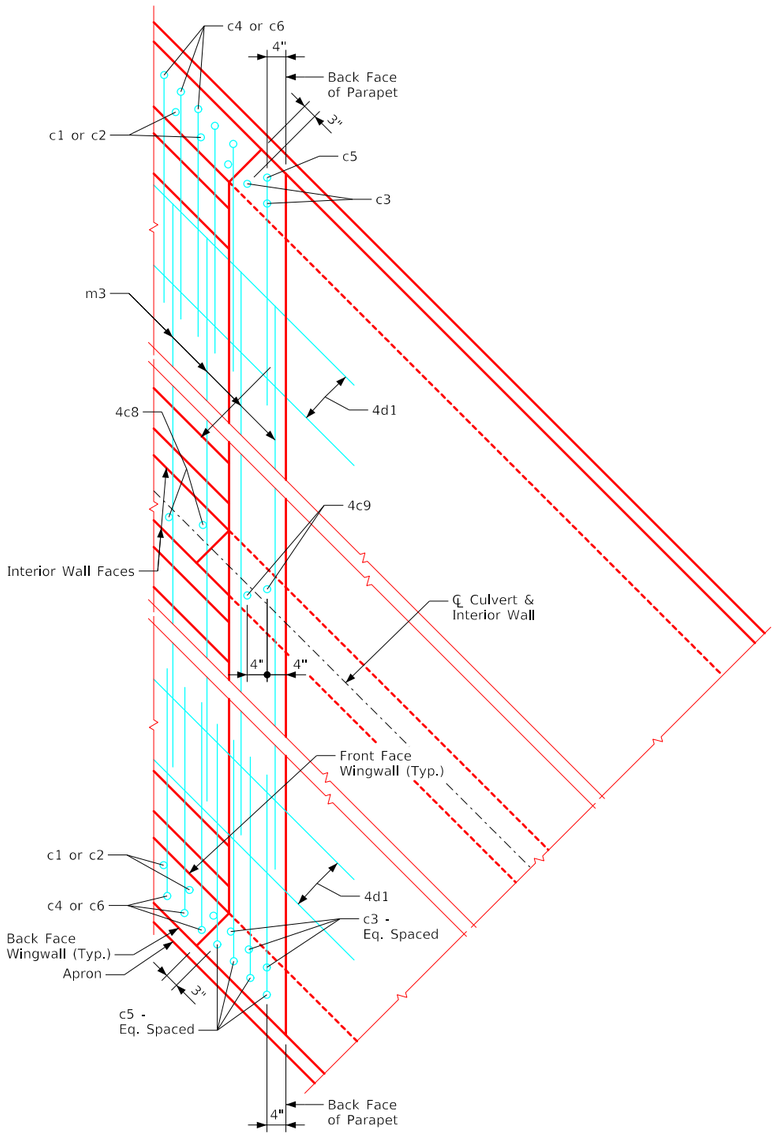
✳ - See Note 2
Δ - See Note 3

Plan View - Bottom Apron Reinforcing

(Curtain Wall Reinforcing not shown, See Sheet TWPWH 45-2-20)

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 ℄ 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

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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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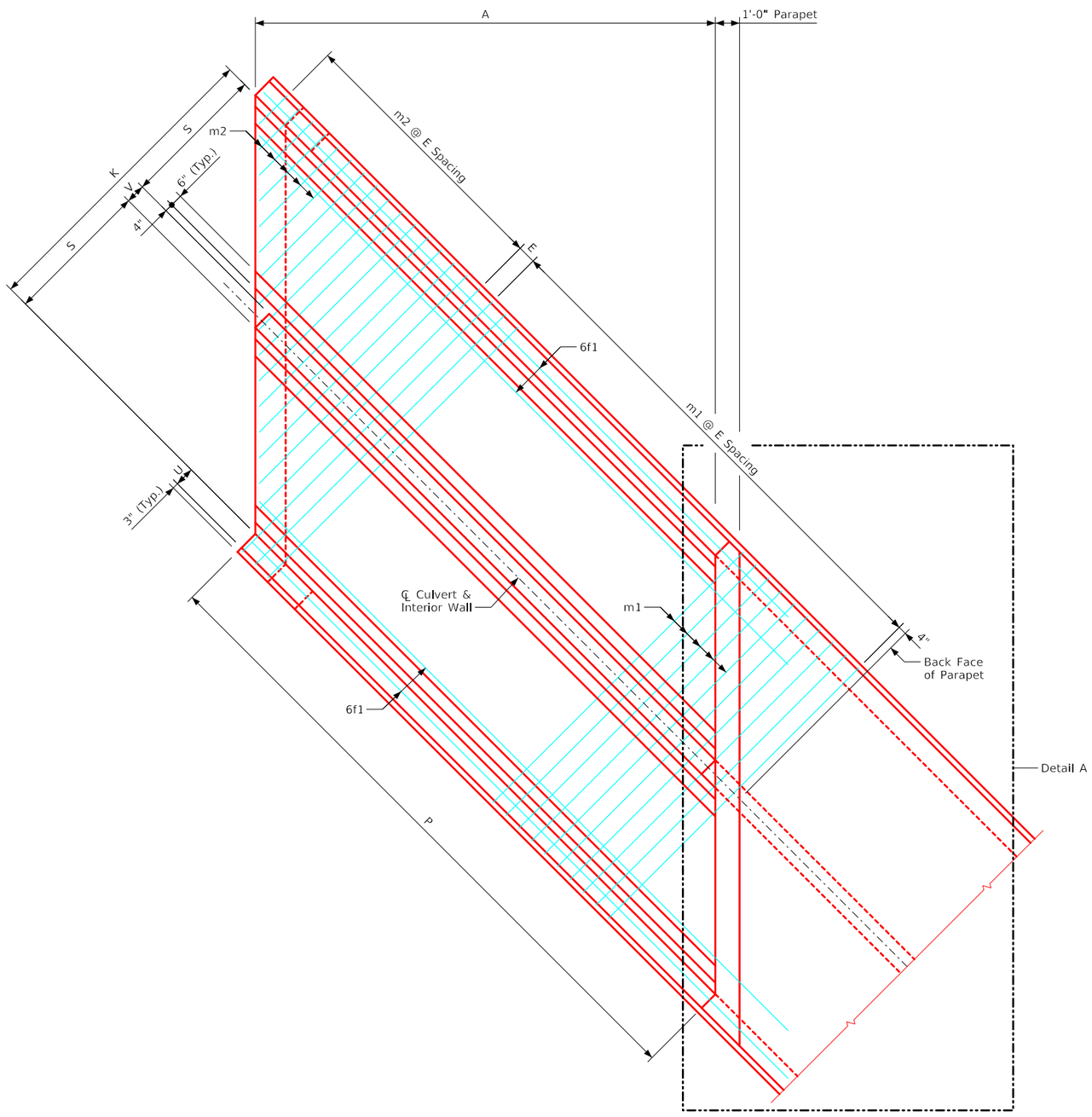
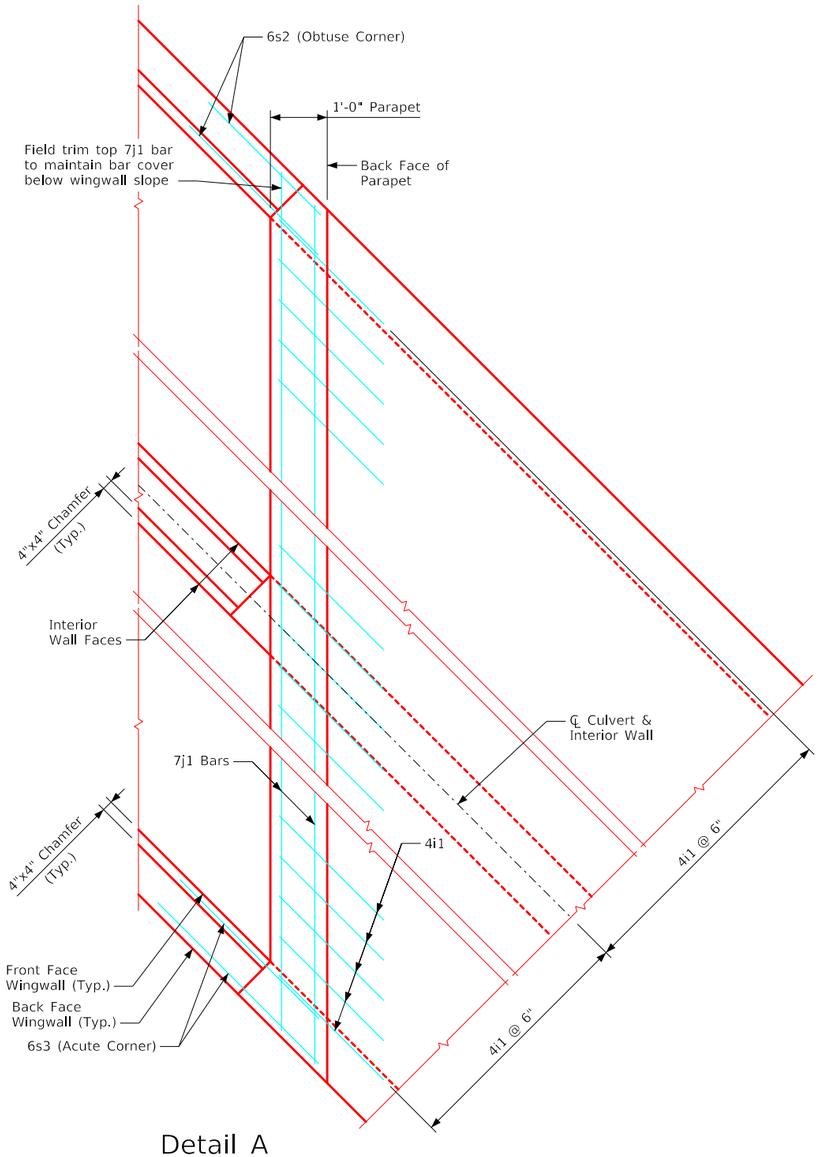


Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Detail A

(Showing parapet bars only)

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.

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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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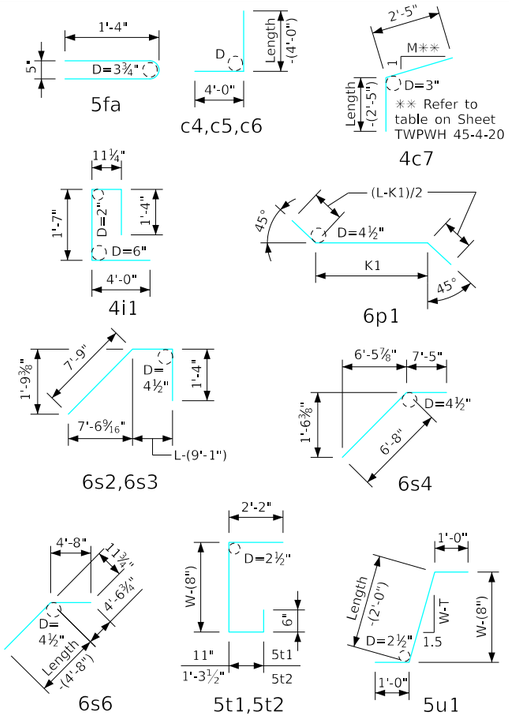
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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				17.0				12.1			
		Apron ✳	74.9			69.1				61.9				56.2				50.5				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 TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

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Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
12'-0" Span
45° Skew

TWPWH
45-7-20
Sheet 1 of 2

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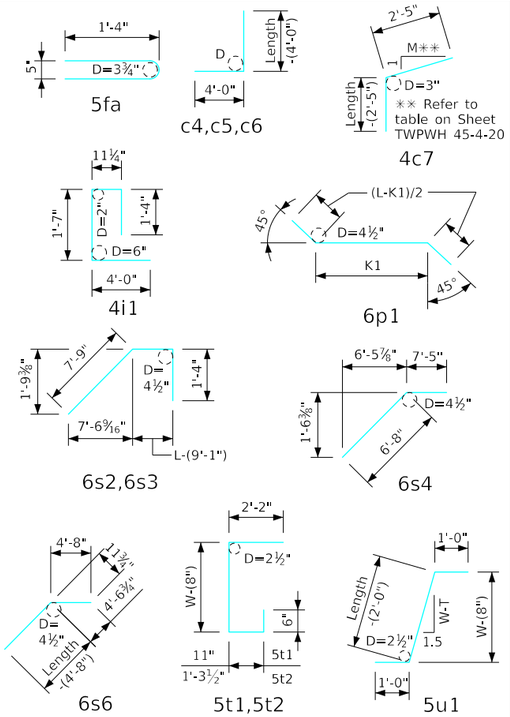
Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

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

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Location	Shape	12' x 6' Bar	12' x 6' No.	12' x 6' Length	12' x 6' Wt.	12' x 5' Bar	12' x 5' No.	12' x 5' Length	12' x 5' Wt.	12' x 4' Bar	12' x 4' No.	12' x 4' Length	12' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	39'-2	82	5b1	2	34'-11	73	5b1	2	30'-9	64
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 37'-3	358	5b2	8 Var.	2 Each 11'-9 to 33'-0	280	5b2	6 Var.	2 Each 11'-9 to 28'-9	211
Wingwall, B.F.H.		4b3	2	39'-7	53	4b3	2	35'-3	47	4b3	2	31'-0	41
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-5 to 37'-7	216	4b4	6 Var.	2 Each 16'-4 to 33'-3	166	4b4	4 Var.	2 Each 16'-4 to 29'-1	121
Interior Wall, Both F.H.		5b5	9 Var.	8'-10 to 38'-5	320	5b5	7 Var.	8'-10 to 34'-2	247	5b5	5 Var.	9'-0 to 29'-10	182
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-8 to 10'-9	421	4c1	46 Var.	2 Each 2'-8 to 9'-9	340	4c1	36 Var.	2 Each 2'-8 to 8'-10	277
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	11'-1	15	4c3	2	10'-1	13	4c3	2	9'-1	12
Wingwall, F.F.V. (A)		4c3	3	11'-1	22	4c3	3	10'-1	20	4c3	3	9'-1	18
Wingwall, B.F.V.		5c4	54 Var.	2 Each 6'-10 to 14'-10	791	6c4	60 Var.	2 Each 6'-10 to 13'-11	671	6c4	48 Var.	2 Each 6'-10 to 12'-11	556
Wingwall, B.F.V. (O)		5c5	1	15'-1	16	6c5	1	14'-1	15	6c5	1	13'-1	14
Wingwall, B.F.V. (A)		5c5	4	15'-1	63	6c5	4	14'-1	59	6c5	4	13'-1	55
Wingwall, B.F.V.		5c6	16	9'-0	319	c6	--	9'-0	244	c6	--	9'-0	150
Interior Wall, Both F.V		4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5
Interior Wall, Both F.V		4c8	51 Var.	1'-6 to 8'-4	223	4c8	42 Var.	1'-6 to 7'-3	172	4c8	34 Var.	1'-6 to 6'-3	132
Interior Wall, Both F.V		4c9	2	8'-7	11	4c9	2	7'-7	10	4c9	2	6'-7	9
Apron, Longit., Bott.		4d1	26	39'-0	677	4d1	26	34'-9	604	4d1	26	30'-6	530
Apron, Longit., Top		6f1	26	39'-0	1523	6f1	26	34'-9	1357	6f1	26	30'-6	1191
Parapet, Vertical		4i1	49	7'-10	256	4i1	49	7'-10	256	4i1	49	7'-10	256
Parapet, Horiz.		7j1	4	37'-0	303	7j1	4	36'-7	299	7j1	4	36'-7	299
Apron, Trans., Top		5m1	31	26'-8	1335	5m1	23	26'-5	1102	5m1	14	26'-5	854
Apron, Trans., Top		5m2	47 Var.	2'-0 to 25'-6	688	5m2	47 Var.	2'-2 to 25'-2	670	5m2	47 Var.	2'-5 to 25'-5	682
Apron, Trans., Bott.		5m3	19	33'-9	1267	5m3	16	32'-8	750	5m3	13	32'-8	647
Curtain, Horiz.		6p1	5	36'-11	333	6p1	5	36'-8	275	6p1	5	36'-8	275
Wing Slope, Both F.		6s1	4	30'-10	185	6s1	4	26'-6	159	6s1	4	22'-2	133
Wing Slope, Both F. (O)		6s2	2	9'-7	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	28'-5	85	6s5	2	24'-1	72	6s5	2	19'-8	59
Interior Wall, Both F.		6s6	2	39'-8	119	6s6	2	35'-5	106	6s6	2	31'-1	93
Curtain, Vert.		5t1	36	6'-11	260	5t1	36	6'-8	250	5t1	36	6'-5	241
Curtain, Vert. Ends		5t2	4	7'-4	31	5t2	4	7'-1	30	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-9	24	5u1	4	5'-6	23	5u1	4	5'-4	22
Estimated Quantities One Headwall	Reinf. Steel		7266 LB				6475 LB				5403 LB		
	Concrete Parapet Δ		3.5	51.4 CY			3.5	43.7 CY			3.5	36.3 CY	
	Concrete Wingwalls		9.2				6.7				4.5		
	Concrete Apron ✳		38.7				33.5				28.3		

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 TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

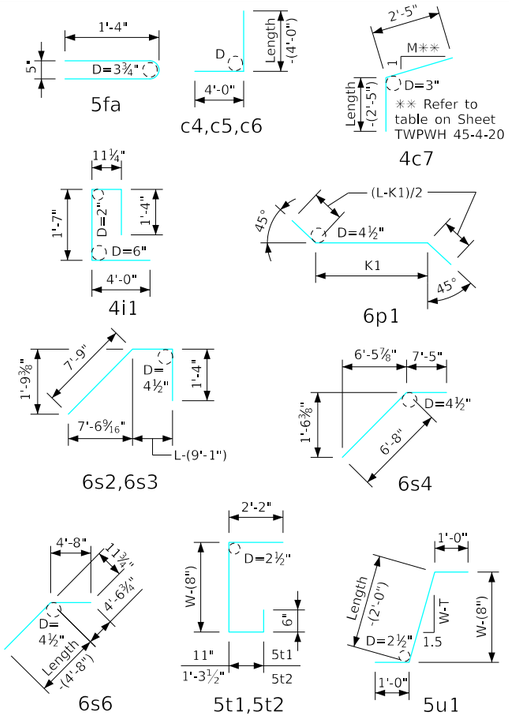
July, 2020

Quantity Tabulation
12'-0" Span
45° Skew

TWPWH
45-7-20
Sheet 2 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 45-7-20 S2 - THIS SHEET ISSUED 07-2020.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' 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'-7 to 14'-7	931	5c1	96 Var.	2 Each 2'-7 to 13'-8	814	4c1	88 Var.	2 Each 2'-7 to 12'-8	448	4c1	80 Var.	2 Each 2'-7 to 11'-9	383	4c1	94 Var.	2 Each 2'-7 to 10'-8	416	4c1	82 Var.	2 Each 2'-7 to 9'-8	336
Wingwall, F.F.V.		5c2	50 Var.	2 Each 9'-0 to 14'-8	617	5c2	42 Var.	2 Each 9'-0 to 13'-9	498	4c2	32 Var.	2 Each 9'-0 to 12'-7	231	4c2	24 Var.	2 Each 9'-0 to 11'-8	166	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		5c3	2	15'-0	31	5c3	2	14'-0	29	4c3	2	13'-0	17	4c3	2	12'-0	16	4c3	2	11'-0	15	4c3	2	10'-0	13
Wingwall, F.F.V. (A)		5c3	3	15'-0	47	5c3	3	14'-0	44	4c3	3	13'-0	26	4c3	3	12'-0	24	4c3	3	11'-0	22	4c3	3	10'-0	20
Wingwall, B.F.V.		6c4	104 Var.	2 Each 6'-9 to 18'-9	1992	5c4	96 Var.	2 Each 6'-9 to 17'-10	1231	5c4	88 Var.	2 Each 6'-9 to 16'-10	1082	5c4	80 Var.	2 Each 6'-9 to 15'-11	946	5c4	70 Var.	2 Each 6'-9 to 14'-9	785	5c4	62 Var.	2 Each 6'-9 to 13'-10	666
Wingwall, B.F.V. (O)		6c5	1	19'-0	29	5c5	1	18'-0	19	5c5	1	17'-0	18	5c5	1	16'-0	17	5c5	1	15'-0	16	5c5	1	14'-0	15
Wingwall, B.F.V. (A)		6c5	4	19'-0	114	5c5	4	18'-0	75	5c5	4	17'-0	71	5c5	4	16'-0	67	5c5	4	15'-0	63	5c5	4	14'-0	58
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'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	101 Var.	1'-5 to 12'-2	458	4c8	93 Var.	1'-5 to 11'-2	391	4c8	85 Var.	1'-5 to 10'-3	331	4c8	76 Var.	1'-5 to 9'-2	269	4c8	68 Var.	1'-5 to 8'-3	220	4c8	59 Var.	1'-5 to 7'-2	169
Interior Wall, Both F.V		4c9	2	12'-6	17	4c9	2	11'-6	15	4c9	2	10'-6	14	4c9	2	9'-6	13	4c9	2	8'-6	11	4c9	2	7'-6	10
Apron, Longit., Bott.		4d1	22	55'-11	857	4d1	22	51'-8	795	4d1	22	47'-6	734	4d1	22	43'-3	671	4d1	22	39'-0	573	4d1	22	34'-9	511
Apron, Longit., Top		6f1	22	55'-11	1928	6f1	22	51'-8	1787	6f1	22	47'-6	1649	6f1	22	43'-3	1509	6f1	22	39'-0	1289	6f1	22	34'-9	1148
Parapet, Vertical		4i1	43	7'-10	225	4i1	43	7'-10	225	4i1	41	7'-10	215	4i1	41	7'-10	215	4i1	41	7'-10	215	4i1	41	7'-10	215
Parapet, Horiz.		7j1	4	32'-0	262	7j1	4	32'-0	262	7j1	4	31'-4	256	7j1	4	31'-4	256	7j1	4	31'-4	256	7j1	4	31'-0	253
Apron, Trans., Top		6m1	86	23'-2	2992	6m1	77	23'-2	2679	6m1	69	22'-8	2349	5m1	61	22'-8	1442	5m1	52	22'-8	1229	5m1	44	22'-5	1029
Apron, Trans., Top		6m2	40 Var.	2'-3 to 21'-9	721	6m2	40 Var.	2'-6 to 22'-0	736	6m2	40 Var.	2'-0 to 21'-6	706	5m2	39 Var.	2'-3 to 21'-3	478	5m2	40 Var.	2'-0 to 21'-6	490	5m2	39 Var.	2'-2 to 21'-2	475
Apron, Trans., Bott.		6m3	73	28'-10	3161	5m3	67	28'-0	1957	5m3	61	27'-4	1739	6m3	28	28'-1	1181	6m3	25	28'-1	1055	5m3	22	27'-0	620
Curtain, Horiz.		6p1	6	31'-10	287	6p1	6	31'-10	287	6p1	6	31'-3	282	6p1	6	31'-3	282	6p1	6	31'-3	282	6p1	5	31'-0	233
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	30	7'-11	248	5t1	30	7'-8	240	5t1	30	7'-5	232	5t1	30	7'-2	224	5t1	30	6'-11	216	5t1	30	6'-8	209
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'-4	26	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-6	23
Estimated Quantities One Headwall	Reinf. Steel			18,824 LB				15,505 LB				13,312 LB				10,636 LB				9058 LB				7540 LB	
	Concrete	Parapet Δ	3.5	106.7 CY		3.5	95.8 CY			3.2	78.7 CY			3.2	69.7 CY			3.2	61.1 CY			3.1	51.1 CY		
		Wingwalls	42.4			36.2				25.4				21.0				17.0				12.1			
		Apron ✳	60.8			56.1				50.1				45.5				40.9				35.9			

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 TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

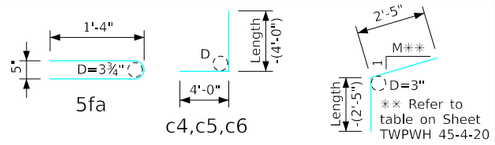
July, 2020

Quantity Tabulation
10'-0" Span
45° Skew

TWPWH
45-8-20
Sheet 1 of 2

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 45-8-20 S1 - THIS SHEET ISSUED 07-2020.

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table below for pin diameter "D" of c bars

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

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

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Location	Shape	10' x 6' Bar	10' x 6' No.	10' x 6' Length	10' x 6' Wt.	10' x 5' Bar	10' x 5' No.	10' x 5' Length	10' x 5' Wt.	10' x 4' Bar	10' x 4' No.	10' x 4' Length	10' x 4' Wt.
Fence Anchor (Galv.)		5fa	2	2'-10	6	5fa	2	2'-10	6	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Interior Wall, Both F.H.		5b5	9 Var.	9'-0 to 29'-10	182	5b5	7 Var.	9'-2 to 25'-7	127	5b5	5 Var.	9'-6 to 21'-3	80
Wingwall, F.F.V.		4c1	72 Var.	2 Each 2'-7 to 8'-9	273	4c1	46 Var.	2 Each 2'-7 to 7'-9	159	4c1	36 Var.	2 Each 2'-7 to 6'-7	110
Wingwall, F.F.V.		c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	9'-0	12	4c3	2	8'-0	11	4c3	2	7'-0	9
Wingwall, F.F.V. (A)		4c3	3	9'-0	18	4c3	3	8'-0	16	4c3	3	7'-0	14
Wingwall, B.F.V.		5c4	54 Var.	2 Each 6'-9 to 12'-10	551	6c4	60 Var.	2 Each 6'-9 to 11'-10	837	6c4	48 Var.	2 Each 6'-9 to 10'-10	634
Wingwall, B.F.V. (O)		5c5	1	13'-0	14	6c5	1	12'-0	18	6c5	1	11'-0	17
Wingwall, B.F.V. (A)		5c5	4	13'-0	54	6c5	4	12'-0	72	6c5	4	11'-0	66
Wingwall, B.F.V.		5c6	16	9'-0	150	c6	--	9'-0	--	c6	--	9'-0	--
Interior Wall, Both F.V		4c7	2	3'-9	5	4c7	2	3'-9	5	4c7	2	3'-9	5
Interior Wall, Both F.V		4c8	51 Var.	1'-5 to 6'-2	129	4c8	42 Var.	1'-5 to 5'-2	92	4c8	34 Var.	1'-5 to 4'-2	63
Interior Wall, Both F.V		4c9	2	6'-6	9	4c9	2	5'-6	7	4c9	2	4'-6	6
Apron, Longit., Bott.		4d1	22	30'-6	448	4d1	22	26'-3	386	4d1	22	22'-0	323
Apron, Longit., Top		6f1	22	30'-6	1008	6f1	22	26'-3	867	6f1	22	22'-0	727
Parapet, Vertical		4i1	41	7'-10	215	4i1	41	7'-10	215	4i1	41	7'-10	215
Parapet, Horiz.		7j1	4	31'-0	253	7j1	4	31'-0	253	7j1	4	31'-0	253
Apron, Trans., Top		5m1	35	22'-5	818	5m1	27	22'-5	631	5m1	18	22'-5	421
Apron, Trans., Top		5m2	39 Var.	2'-5 to 21'-5	485	5m2	39 Var.	2'-2 to 21'-2	475	5m2	39 Var.	2'-5 to 21'-5	485
Apron, Trans., Bott.		5m3	19	27'-0	535	5m3	16	27'-0	451	5m3	13	27'-0	366
Curtain, Horiz.		6p1	5	31'-0	233	6p1	5	31'-0	233	6p1	5	31'-0	233
Wing Slope, Both F.		6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-8	29	6s2	2	9'-8	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
Wing Slope, F.F.		6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Interior Wall, Both F.		6s6	2	31'-1	93	6s6	2	26'-8	80	6s6	2	22'-4	67
Curtain, Vert.		5t1	30	6'-5	201	5t1	30	6'-5	201	5t1	30	6'-5	201
Curtain, Vert. Ends		5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	5'-4	22	5u1	4	5'-4	22	5u1	4	5'-4	22
Estimated Quantities One Headwall	Reinf. Steel			6474 LB				5772 LB				4793 LB	
	Concrete, Parapet Δ		3.1	43.6 CY			3.1	37.0 CY			3.1	30.6 CY	
	Concrete, Wingwalls		9.2				6.7				4.5		
	Concrete, Apron ✳		31.3				27.2				23.0		

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 TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
10'-0" Span
45° Skew

TWPWH
45-8-20
Sheet 2 of 2

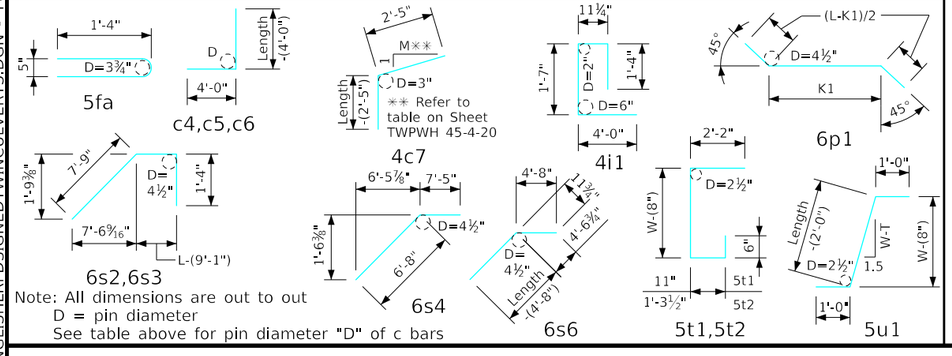
ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 45-8-20 S2 - THIS SHEET ISSUED 07-2020.

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Location	Shape	8' x 10'				8' x 9'				8' x 8'				8' x 7'				8' x 6'				8' x 5'				8' x 4'			
		Bar	No.	Length	Wt.	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	5fa	2	2'-10	6
Wingwall, F.F.H.		5b1	2	47'-8	104	5b1	2	43'-5	96	5b1	2	39'-2	82	5b1	2	34'-11	73	5b1	2	30'-9	64	5b1	2	26'-6	55	5b1	2	22'-3	46
Wingwall, F.F.H.		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	5b2	10 Var.	2 Each 11'-9 to 28'-9	211	5b2	8 Var.	2 Each 11'-9 to 24'-6	151	5b2	6 Var.	2 Each 11'-9 to 20'-3	100
Wingwall, B.F.H.		4b3	2	48'-1	67	4b3	2	43'-10	62	4b3	2	39'-7	53	4b3	2	35'-3	47	4b3	2	31'-0	41	4b3	2	26'-9	36	4b3	2	22'-6	30
Wingwall, B.F.H.		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	4b4	8 Var.	2 Each 16'-4 to 29'-1	121	4b4	6 Var.	2 Each 16'-4 to 24'-10	82	4b4	4 Var.	2 Each 16'-4 to 20'-7	49
Interior Wall, Both F.H.		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	5b5	9 Var.	9'-0 to 29'-10	182	5b5	7 Var.	9'-2 to 25'-7	127	5b5	5 Var.	9'-6 to 21'-3	80
Wingwall, F.F.V.		4c1	88 Var.	2 Each 2'-5 to 12'-6	438	4c1	80 Var.	2 Each 2'-5 to 11'-7	374	4c1	94 Var.	2 Each 2'-5 to 10'-6	406	4c1	82 Var.	2 Each 2'-5 to 9'-6	326	4c1	72 Var.	2 Each 2'-5 to 8'-7	265	4c1	46 Var.	2 Each 2'-5 to 7'-7	154	4c1	36 Var.	2 Each 2'-5 to 6'-5	106
Wingwall, F.F.V.		4c2	32 Var.	2 Each 8'-10 to 12'-5	227	4c2	24 Var.	2 Each 8'-10 to 11'-6	163	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--	c2	--	--	--
Wingwall, F.F.V. (O)		4c3	2	12'-10	17	4c3	2	11'-10	16	4c3	2	10'-10	14	4c3	2	9'-10	13	4c3	2	8'-10	12	4c3	2	7'-10	10	4c3	2	6'-10	9
Wingwall, F.F.V. (A)		4c3	3	12'-10	26	4c3	3	11'-10	24	4c3	3	10'-10	22	4c3	3	9'-10	20	4c3	3	8'-10	18	4c3	3	7'-10	16	4c3	3	6'-10	14
Wingwall, B.F.V.		5c4	88 Var.	2 Each 6'-7 to 16'-8	1067	5c4	80 Var.	2 Each 6'-7 to 15'-9	932	5c4	70 Var.	2 Each 6'-7 to 14'-7	773	5c4	62 Var.	2 Each 6'-7 to 13'-8	655	5c4	54 Var.	2 Each 6'-7 to 12'-8	542	5c4	60 Var.	2 Each 6'-7 to 11'-8	571	5c4	48 Var.	2 Each 6'-7 to 10'-8	432
Wingwall, B.F.V. (O)		5c5	1	16'-10	18	5c5	1	15'-10	17	5c5	1	14'-10	15	5c5	1	13'-10	14	5c5	1	12'-10	13	5c5	1	11'-10	12	5c5	1	10'-10	11
Wingwall, B.F.V. (A)		5c5	4	16'-10	70	5c5	4	15'-10	66	5c5	4	14'-10	62	5c5	4	13'-10	58	5c5	4	12'-10	54	5c5	4	11'-10	49	5c5	4	10'-10	45
Wingwall, B.F.V.		6c6	50	9'-0	676	6c6	42	9'-0	568	5c6	34	9'-0	319	5c6	26	9'-0	244	5c6	16	9'-0	150	c6	--	9'-0	--	c6	--	9'-0	--
Interior Wall, Both F.V		4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5	4c7	2	3'-7	5
Interior Wall, Both F.V		4c8	85 Var.	1'-3 to 10'-1	322	4c8	76 Var.	1'-3 to 9'-0	260	4c8	68 Var.	1'-3 to 8'-1	212	4c8	59 Var.	1'-3 to 7'-0	163	4c8	51 Var.	1'-3 to 6'-0	123	4c8	42 Var.	1'-3 to 5'-0	88	4c8	34 Var.	1'-3 to 4'-0	60
Interior Wall, Both F.V		4c9	2	10'-4	14	4c9	2	9'-4	12	4c9	2	8'-4	11	4c9	2	7'-4	10	4c9	2	6'-4	8	4c9	2	5'-4	7	4c9	2	4'-4	6
Apron, Longit., Bott.		4d1	18	47'-6	600	4d1	18	43'-3	549	4d1	18	39'-0	469	4d1	18	34'-9	418	4d1	18	30'-6	367	4d1	18	26'-3	316	4d1	18	22'-0	265
Apron, Longit., Top		6f1	18	47'-6	1350	6f1	18	43'-3	1235	6f1	18	39'-0	1054	6f1	18	34'-9	940	6f1	18	30'-6	825	6f1	18	26'-3	710	6f1	18	22'-0	595
Parapet, Vertical		4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173	4i1	33	7'-10	173
Parapet, Horiz.		7j1	4	25'-8	210	7j1	4	25'-8	210	7j1	4	25'-8	210	7j1	4	25'-4	207	7j1	4	25'-4	207	7j1	4	25'-4	207	7j1	4	25'-4	207
Apron, Trans., Top		5m1	73	18'-8	1421	5m1	65	18'-8	1266	5m1	56	18'-8	1090	5m1	48	18'-5	922	5m1	39	18'-5	749	5m1	21	18'-5	403	5m1	15	18'-5	288
Apron, Trans., Top		5m2	32 Var.	2'-0 to 17'-6	325	5m2	31 Var.	2'-3 to 17'-3	315	5m2	32 Var.	2'-0 to 17'-6	325	5m2	31 Var.	2'-2 to 17'-2	313	5m2	31 Var.	2'-5 to 17'-5	321	5m2	20 Var.	2'-8 to 16'-11	204	5m2	21 Var.	2'-2 to 17'-2	212
Apron, Trans., Bott.		5m3	61	21'-8	1378	5m3	55	21'-8	1243	6m3	25	22'-5	842	5m3	22	21'-4	490	5m3	19	21'-4	423	5m3	16	21'-4	356	5m3	13	21'-4	289
Curtain, Horiz.		6p1	6	25'-7	231	6p1	6	25'-7	231	6p1	6	25'-7	231	6p1	5	25'-4	190	6p1	5	25'-4	190	6p1	5	25'-4	190	6p1	5	25'-4	190
Wing Slope, Both F.		6s1	4	39'-7	238	6s1	4	35'-3	212	6s1	4	30'-10	185	6s1	4	26'-6	159	6s1	4	22'-2	133	6s1	4	17'-9	107	6s1	4	13'-5	81
Wing Slope, Both F. (O)		6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-8	29	6s2	2	9'-8	29	6s2	2	9'-8	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	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	6s4	2	14'-1	42
Wing Slope, F.F.		6s5	2	37'-2	112	6s5	2	32'-9	98	6s5	2	28'-5	85	6s5	2	24'-1	72	6s5	2	19'-8	59	6s5	2	15'-4	46	6s5	2	11'-0	33
Interior Wall, Both F.		6s6	2	48'-5	153	6s6	2	44'-0	139	6s6	2	39'-8	119	6s6	2	35'-5	106	6s6	2	31'-1	93	6s6	2	26'-8	80	6s6	2	22'-4	67
Curtain, Vert.		5t1	24	7'-5	186	5t1	24	7'-2	179	5t1	24	6'-11	173	5t1	24	6'-8	167	5t1	24	6'-5	161	5t1	24	6'-5	161	5t1	24	6'-5	161
Curtain, Vert. Ends		5t2	4	7'-10	33	5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30	5t2	4	6'-10	29	5t2	4	6'-10	29	5t2	4	6'-10	29
Bracket, Vert.		5u1	4	6'-1	25	5u1	4	5'-11	25	5u1	4	5'-8	24	5u1	4	5'-5	23	5u1	4	5'-3	22	5u1	4	5'-3	22	5u1	4	5'-3	22
Estimated Quantities One Headwall	Reinf. Steel			10,984 LB				9742 LB				7987 LB				6639 LB				5669 LB				4475 LB				3713 LB	
	Concrete Parapet Δ		2.8	65.0 CY			2.8	57.3 CY			2.8	50.0 CY			2.7	41.2 CY			2.7	35.0 CY			2.7	29.5 CY			2.7	24.4 CY	
	Concrete Wingwalls		25.4				21.0				17.0				12.1				9.2				6.7				4.5		
	Concrete Apron ✳		36.8				33.5				30.2				26.4				23.1				20.1				17.2		

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

Bent Bar Details



Note: All dimensions are out to out
D = pin diameter
See table above for pin diameter "D" of c bars

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 TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
45° Skew

TWPWH
45-9-20

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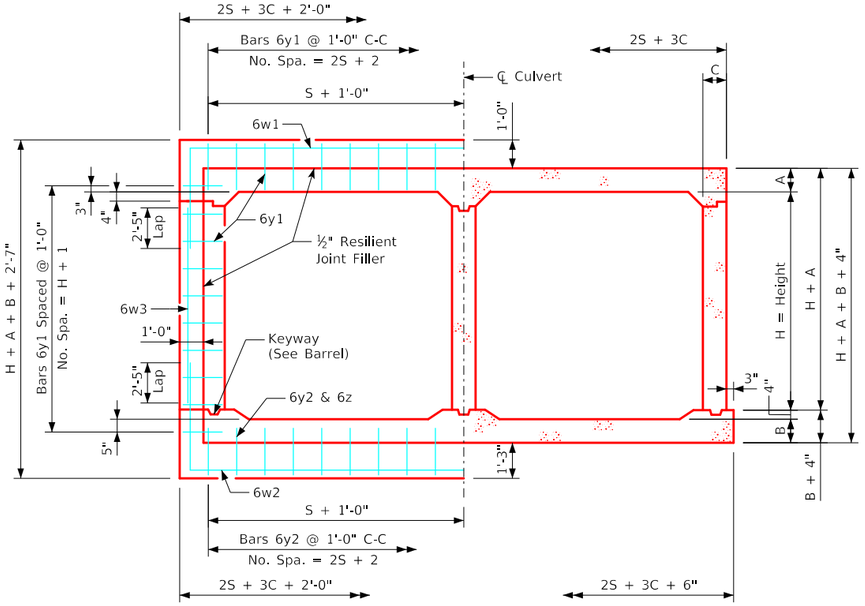


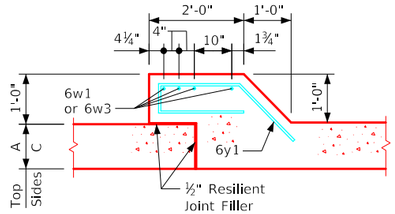
Joint Detail
Section thru Barrel

Estimate of Quantities - One Joint - 8' Span

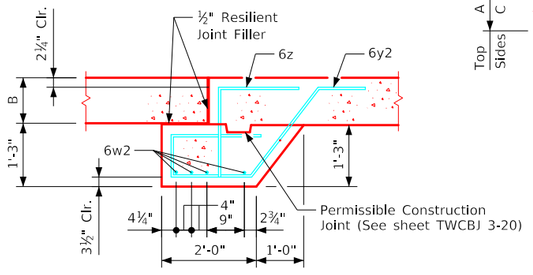
Bill of Reinforcing Steel			8' x 4'			8' x 5'			8' x 6'			8' x 7'			8' x 8'			8' x 9'			8' x 10'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	28'-9	173	4	28'-9	173	4	28'-9	173	4	28'-9	173	4	28'-9	173	4	28'-9	173	4	29'-2	175
6w2	Floor & Walls		4	31'-3	188	4	33'-3	200	4	29'-1	175	4	29'-1	175	4	29'-1	175	4	29'-1	175	4	29'-6	177
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114
6y1	Top & Sides		31	6'-2	287	33	6'-2	306	35	6'-2	324	37	6'-2	343	39	6'-2	361	41	6'-2	380	43	6'-2	398
6y2	Bottom		19	7'-5	212	19	7'-5	212	19	7'-5	212	19	7'-5	212	19	7'-5	212	19	7'-5	212	19	7'-5	212
6z	Bottom & Floor		19	3'-4	95	19	3'-4	95	19	3'-4	95	19	3'-4	95	19	3'-4	95	19	3'-4	95	19	3'-4	95
Total Weight (LB)					955			986			1045			1076			1106			1137			1171
Total Concrete (CY)				5.2			5.4			5.6			5.8			6.0			6.2			6.4	

Concrete Placement

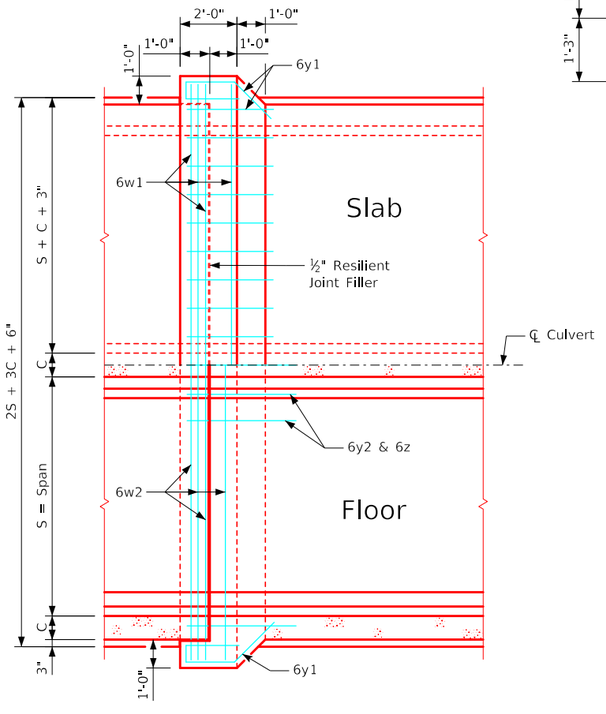
Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
8' x 4'	9.5	12	9	2.543	0.668	2.039
8' x 5'	9.5	12	9	2.543	0.850	2.039
8' x 6'	9.5	11.5	9	2.535	1.032	2.039
8' x 7'	9.5	12	9	2.543	1.214	2.039
8' x 8'	9.5	12	9	2.543	1.396	2.039
8' x 9'	9.5	12.5	9	2.550	1.578	2.039
8' x 10'	9.5	12	10.5	2.586	1.760	2.073



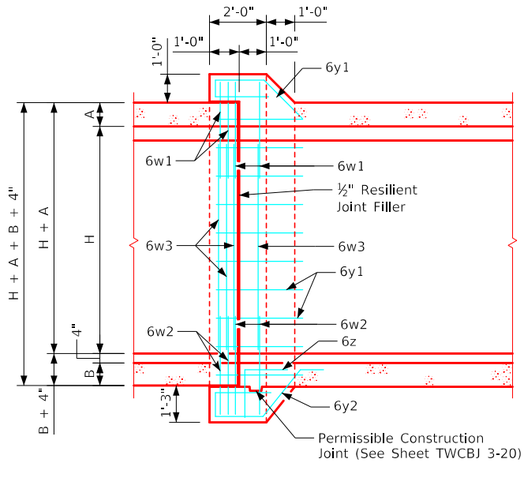
Top & Sides - Bars 6y1



Bottom - Bars 6y2 & 6z

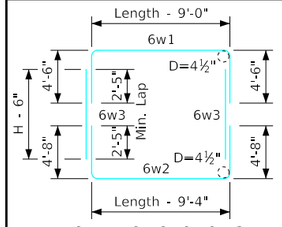


Plan View

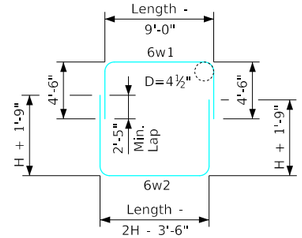


Longitudinal Section

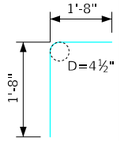
Bent Bar Details



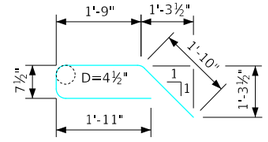
6w1, 6w2 & 6w3



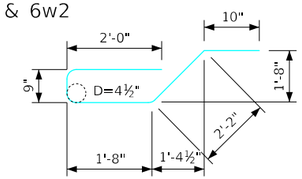
6w1 & 6w2



6z



6y1



6y2

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

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the TWRCB culvert barrel detail sheets.
2. Change lengths of bars 6w1, 6w2, 6z, and adjust reinforcing steel and concrete quantities accordingly for slab, wall, and floor thicknesses other than shown.
3. All bar lengths are estimated with a 2" clearance from concrete edge to outside of bar, except as noted.
4. Material and construction to be in accordance with the current Standard Specifications of I.D.O.T.
5. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
6. Bars 6w1 & 6w2 may be furnished in two equal lengths adding 2'-5" to the overall length to obtain a 2'-5" min. lap. The above is to be performed at no additional cost to the contracting authority.
7. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
8. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.

LATEST REVISION DATE

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IOWADOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

8' Span

TWCBJ 1-20

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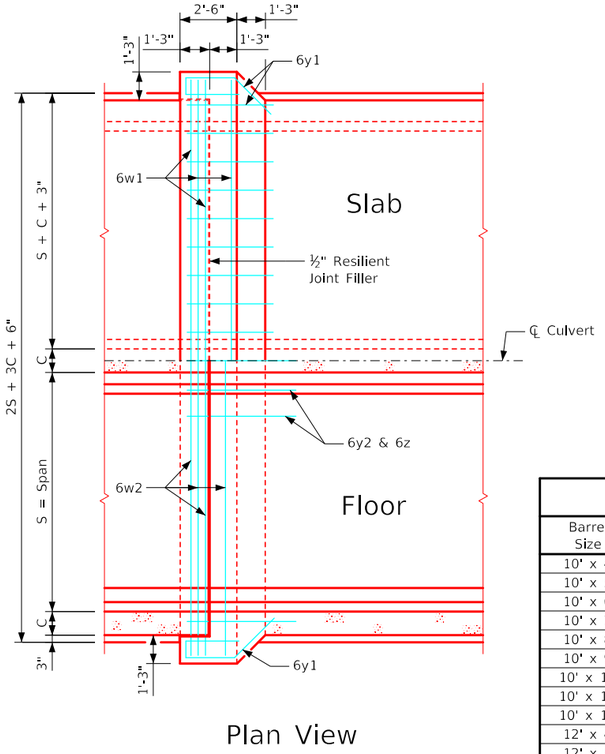


Plan View

Estimate of Quantities - One Joint - 10' Span

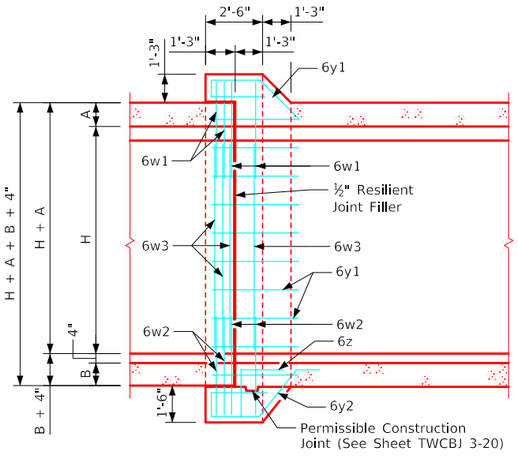
Bill of Reinforcing Steel			10' x 4'			10' x 5'			10' x 6'			10' x 7'			10' x 8'			10' x 9'			10' x 10'			10' x 11'			10' x 12'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	34'-7	208	4	34'-7	208	4	34'-7	208	4	34'-7	208	4	34'-7	208	4	34'-7	208	4	35'-0	210	4	35'-3	212	4	35'-6	213
6w2	Floor & Walls		4	37'-1	223	4	39'-1	235	4	34'-11	210	4	34'-11	210	4	34'-11	210	4	34'-11	210	4	35'-4	212	4	35'-7	214	4	35'-10	215
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138
6y1	Top & Sides		35	8'-0	421	37	8'-0	445	39	8'-0	469	41	8'-0	493	43	8'-0	517	45	8'-0	541	47	8'-0	565	49	8'-0	589	51	8'-0	613
6y2	Bottom		23	9'-6	328	23	9'-6	328	23	9'-6	328	23	9'-6	328	23	9'-6	328	23	9'-7	331	23	9'-7	331	23	9'-6	328	23	9'-6	328
6z	Bottom & Floor		23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135	23	3'-11	135
Total Weight (LB)					1315			1351			1416			1452			1488			1527			1567			1604			1642
Total Concrete (CY)				9.6			9.9			10.2			10.5			10.8			11.1			11.5			11.8			12.2	

Estimate of Quantities - One Joint - 12' Span

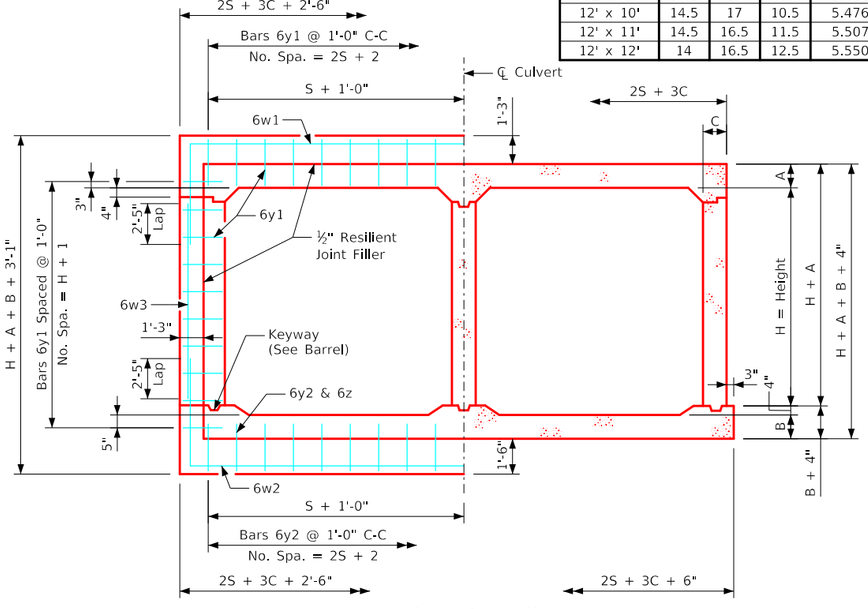
Bill of Reinforcing Steel			12' x 4'			12' x 5'			12' x 6'			12' x 7'			12' x 8'			12' x 9'			12' x 10'			12' x 11'			12' x 12'		
Bar	Location	Shape	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight	No.	Length	Weight
6w1	Slab & Walls		4	38'-7	232	4	38'-7	232	4	38'-7	232	4	38'-7	232	4	38'-7	232	4	38'-7	232	4	39'-0	234	4	39'-3	236	4	39'-6	237
6w2	Floor & Walls		4	41'-1	247	4	43'-1	259	4	38'-11	234	4	38'-11	234	4	38'-11	234	4	38'-11	234	4	39'-4	236	4	39'-7	238	4	39'-10	239
6w3	Walls		--	--	--	--	--	--	8	5'-6	66	8	6'-6	78	8	7'-6	90	8	8'-6	102	8	9'-6	114	8	10'-6	126	8	11'-6	138
6y1	Top & Sides		39	8'-0	469	41	8'-0	493	43	8'-0	517	45	8'-0	541	47	8'-0	565	49	8'-0	589	51	8'-0	613	53	8'-0	637	55	8'-0	661
6y2	Bottom		27	9'-9	395	27	9'-9	395	27	9'-9	395	27	9'-9	395	27	9'-10	399	27	9'-10	399	27	9'-10	399	27	9'-9	395	27	9'-9	395
6z	Bottom & Floor		27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159	27	3'-11	159
Total Weight (LB)					1502			1538			1603			1639			1679			1715			1755			1791			1829
Total Concrete (CY)				11.0			11.3			11.5			11.8			12.1			12.4			12.8			13.2			13.5	

Concrete Placement

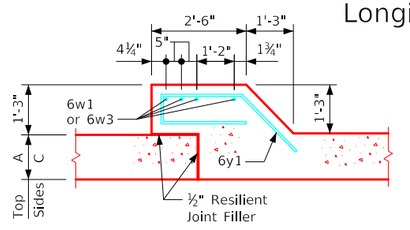
Barrel Size	Barrel Dimension			Bell Joint Quantities (CY)		
	A	B	C	Footing	Walls	Slab
10' x 4'	12.5	14.5	9	4.665	1.047	3.906
10' x 5'	12.5	14.5	9	4.665	1.332	3.906
10' x 6'	12.5	14.5	9	4.665	1.618	3.906
10' x 7'	12.5	14.5	9	4.665	1.903	3.906
10' x 8'	12.5	14.5	9	4.665	2.189	3.906
10' x 9'	12.5	15	9	4.677	2.474	3.906
10' x 10'	12.5	15	10.5	4.741	2.760	3.960
10' x 11'	12.5	14.5	11.5	4.772	3.045	3.995
10' x 12'	12	14.5	12.5	4.815	3.331	4.019
12' x 4'	14.5	16.5	9	5.399	1.047	4.525
12' x 5'	14.5	16.5	9	5.399	1.332	4.525
12' x 6'	14.5	16.5	9	5.399	1.618	4.525
12' x 7'	14.5	16.5	9	5.399	1.903	4.525
12' x 8'	14.5	17	9	5.411	2.189	4.525
12' x 9'	14.5	17	9	5.411	2.474	4.525
12' x 10'	14.5	17	10.5	5.476	2.760	4.578
12' x 11'	14.5	16.5	11.5	5.507	3.045	4.614
12' x 12'	14	16.5	12.5	5.550	3.331	4.638



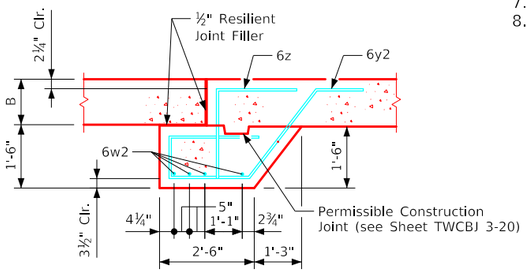
Longitudinal Section



Joint Detail
Section thru Barrel

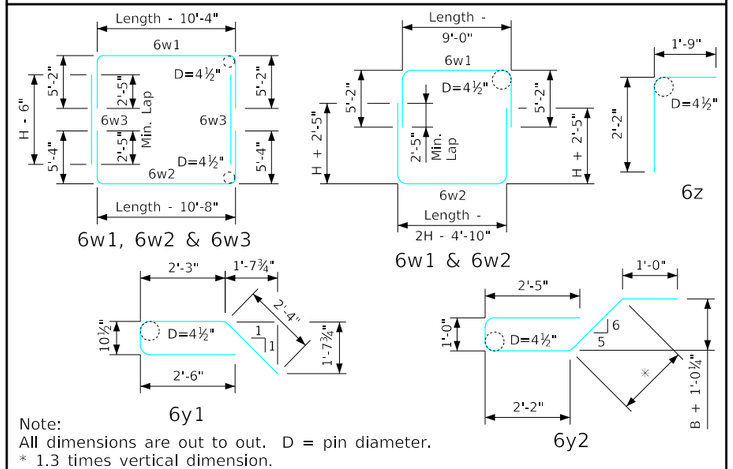


Top & Sides - Bars 6y1



Bottom - Bars 6y2 & 6z

Bent Bar Details



Note:
All dimensions are out to out. D = pin diameter.
* 1.3 times vertical dimension.

Notes:

1. Dimensions and quantities shown are based on slab, floor, and wall thicknesses (A, B, and C, respectively). Values for these dimensions, under varying fill conditions, can be found on the TWRCB culvert barrel detail sheets.
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5. See Sheet TWRCB G2-20 for General Notes, Specifications, and Design Stresses.
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7. Barrel floor bars m1 & m9 are to be shortened 6" in length at bell joints.
8. Dimensions "A", "B" and "C" are in inches. "Length" dimensions in bar lists are in feet and inches.

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IOWADOT

Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

10' & 12' Spans

TWCBJ 2-20

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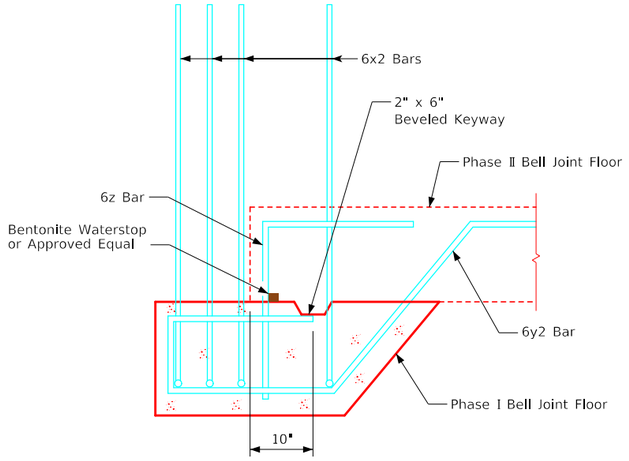
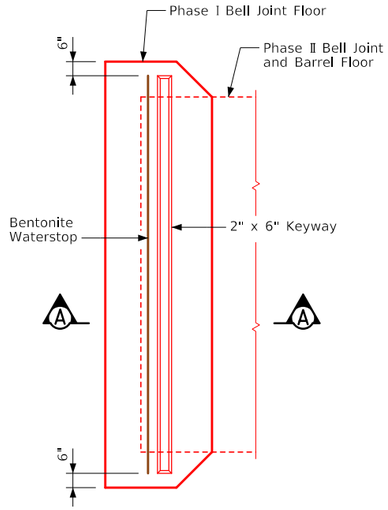


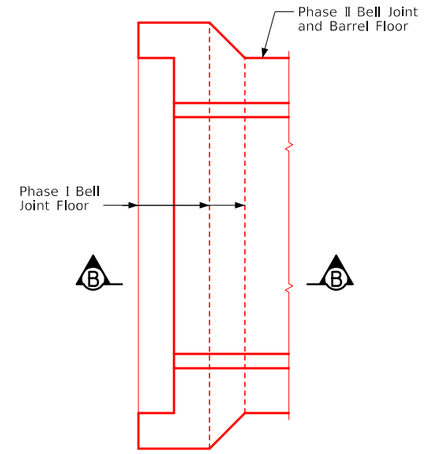
Section A-A

Bell Joint at Floor



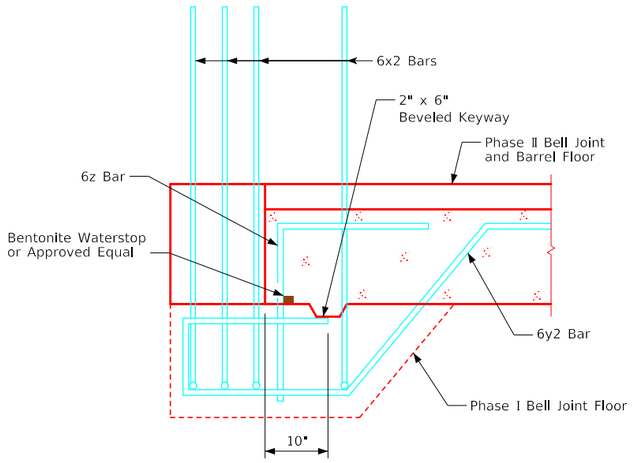
Plan View - Phase I

(Showing Phase I of floor bell joint construction)



Plan View - Phase II

(Showing Phase II of floor bell joint
and barrel floor construction)



Section B-B

Bell Joint at Floor

Notes:

1. The details shown on this sheet are an option for the contractor to construct the floor of the bell joint with a permissible construction joint as shown.
2. Reinforcing steel will be placed prior to placing the phase I concrete.
3. The cost of the waterstop is considered incidental to the project.
4. A 2" x 6" beveled keyway will be formed to the distance shown and location noted before placing the concrete.
5. For details and dimensions of the bell joint refer to the bell joint standard sheets.
6. Cost of waterstop considered incidental to the project.

LATEST REVISION DATE

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Standard Design

Twin Reinforced Concrete Box Culverts

July, 2020

Culvert Bell Joints

All Spans

TWCBJ 3-20

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