



Single Reinforced Concrete Box Culvert Standards

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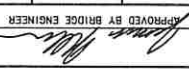
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Highway Division

Standard Design
Single Reinforced Concrete
Box Culverts
July, 2020

APPROVED BY BRIDGE ENGINEER


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Index of
Sheets

RCB G1-20



Single 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, $E_v = 0.120 \text{ Kcf}$; $E_{Hmax} = 0.060 \text{ Kcf}$ max. $E_{Hmin} = 0.030 \text{ Kcf}$.
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 situations.
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 S-1 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	2 1/2" to near transverse reinforcing bar
Bottom of floor	3 1/2" to near transverse reinforcing bar
End clearances:	2"
Vertical top	3" or 3 1/2" if overall height of the
Vertical bottom	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 (S-1 is 1/2 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.

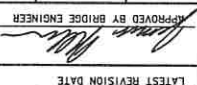
Specifications:

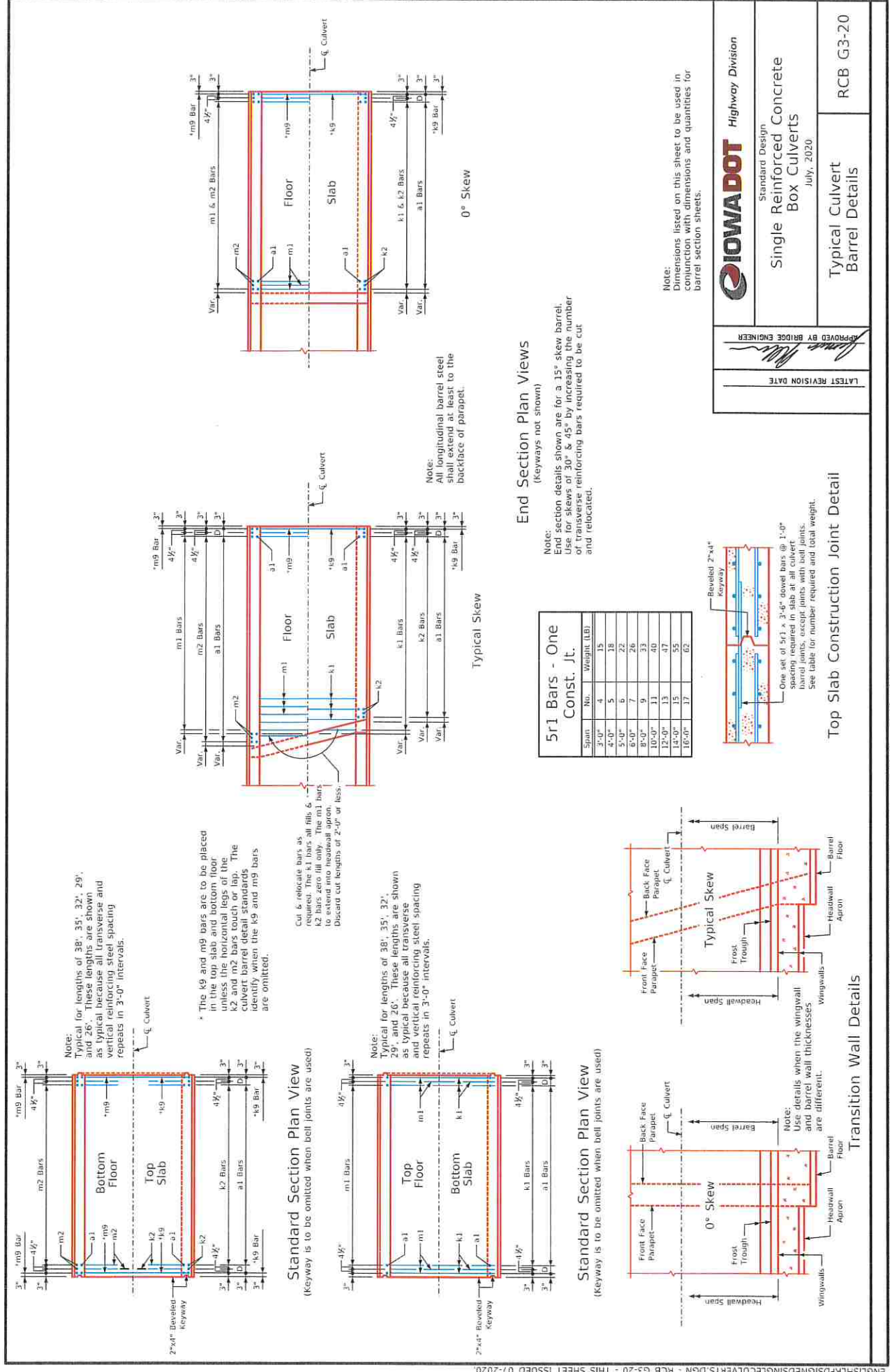
Design:
AASHTO LRFD Bridge Design Specifications, 8th Ed., Series of 2017.

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, $f'_c = 4.0 \text{ ksi}$.

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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.

* The k9 and m9 bars are to be placed in the top slab and bottom floor unless the horizontal legs of the k2 and m2 bars touch or lap. The culvert barrel detail standards identify when the k9 and m9 bars are omitted.

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.

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.

5r1 Bars - One Const. Jt.

Span	No.	Weight (Lb)
3'-0"	4	15
4'-0"	5	18
5'-0"	6	22
6'-0"	7	26
8'-0"	9	33
10'-0"	11	40
12'-0"	13	47
14'-0"	15	55
16'-0"	17	62

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

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

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

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Single Reinforced Concrete Box Culverts

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Typical Culvert Barrel Details

RCB G3-20

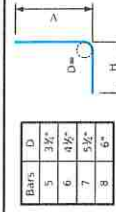
Bar List

Bars	D
5	3/8"
6	4/8"
7	5/8"
8	6"

Note:
All dimensions are in inches.
D = pin diameter.

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

Bent Bar Detail



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

Notes:

1. Dimensions listed on this sheet to be used in conjunction with Sheet RCB G3-20.
2. The k2 and m2 bars horizontal legs may lap in low fill situations.
3. Fill, dimensions "S" and "H" are in feet.
4. Dimensions "A", "B", "C", "D", and "Sp." listed in the bar list are in inches.
5. Dimensions "L", "H", "V", are in feet and inches.



Standard Design

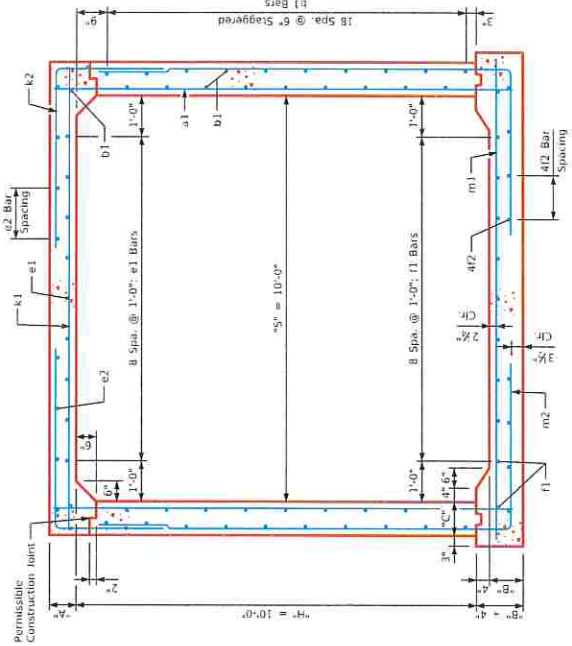
Single Reinforced Concrete Box Culverts

July, 2020

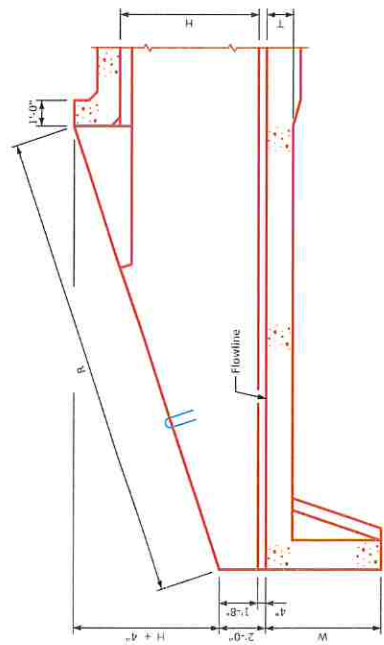
Culvert Barrel Details	RCB 10-10-20
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Culvert Barrel Details

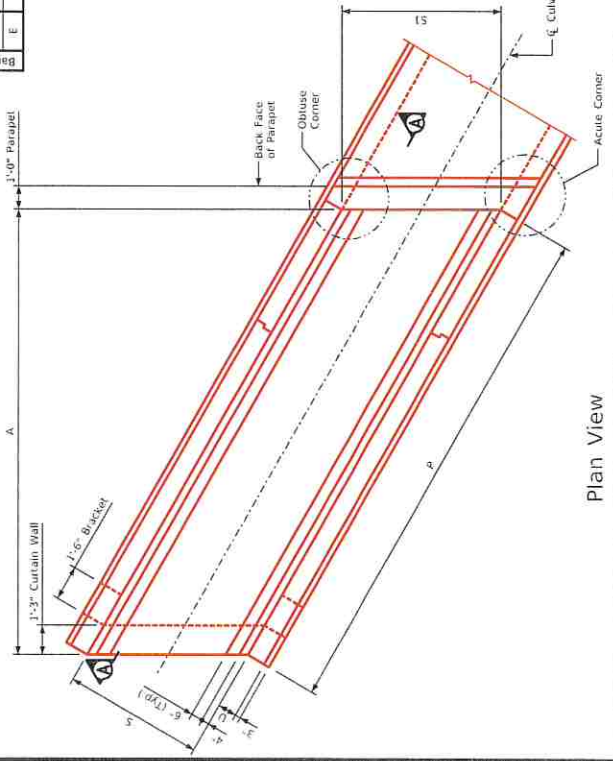
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10' x 10' Barrel Section



Elevation Section A-A



Plan View

Dimension Table

S x H	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	5' x H
A	43'-0"	37'-0"	34'-0"	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	10'-0"	43'-0"	40'-0"	37'-0"	34'-0"	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	A
H	14'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	5'-0"	4'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	H	
P	49'-7 1/2"	46'-2 1/2"	42'-8 1/2"	39'-3 3/4"	35'-9 1/2"	32'-4"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	18'-5 1/2"	15'-0 1/2"	49'-7 1/2"	46'-2 1/2"	42'-8 1/2"	39'-3 3/4"	35'-9 1/2"	32'-4"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	P
R	51'-8 1/2"	48'-0 1/2"	44'-5 1/2"	40'-10 1/2"	37'-3 3/4"	33'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	19'-2 1/2"	15'-7 1/2"	51'-8 1/2"	48'-0 1/2"	44'-5 1/2"	40'-10 1/2"	37'-3 3/4"	33'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	R
S	16'-0"	15'-0"	14'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	S
S1	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	S1
T	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	T
U	1'-1"	1'-1"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	9"	9"	9"	9"	1'-1"	1'-1"	1'-1"	1'-0"	1'-0"	1'-0"	1'-0"	9"	9"	U
W	5'-6"	5'-3"	5'-0"	4'-9"	4'-6"	4'-3"	4'-0"	3'-9"	3'-6"	3'-6"	3'-6"	5'-6"	5'-6"	5'-3"	5'-0"	4'-9"	4'-6"	4'-3"	3'-9"	3'-6"	W
B	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	B
C	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	C
D	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	D
E	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	E

Headwall Dimensions	16' x 14'	16' x 13'	16' x 12'	16' x 11'	16' x 10'	16' x 9'	16' x 8'	16' x 7'	16' x 6'	16' x 5'	16' x 4'	14' x 14'	14' x 13'	14' x 12'	14' x 11'	14' x 10'	14' x 9'	14' x 8'	14' x 7'	14' x 6'	5' x H
A	43'-0"	37'-0"	34'-0"	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	10'-0"	43'-0"	40'-0"	37'-0"	34'-0"	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	A
H	14'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	5'-0"	4'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	H	
P	49'-7 1/2"	46'-2 1/2"	42'-8 1/2"	39'-3 3/4"	35'-9 1/2"	32'-4"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	18'-5 1/2"	15'-0 1/2"	49'-7 1/2"	46'-2 1/2"	42'-8 1/2"	39'-3 3/4"	35'-9 1/2"	32'-4"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	P
R	51'-8 1/2"	48'-0 1/2"	44'-5 1/2"	40'-10 1/2"	37'-3 3/4"	33'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	19'-2 1/2"	15'-7 1/2"	51'-8 1/2"	48'-0 1/2"	44'-5 1/2"	40'-10 1/2"	37'-3 3/4"	33'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	R
S	16'-0"	15'-0"	14'-0"	13'-0"	12'-0"	11'-0"	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	14'-0"	S
S1	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	18'-5 1/2"	S1
T	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-4"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	1'-3"	T
U	1'-1"	1'-1"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	9"	9"	9"	9"	1'-1"	1'-1"	1'-1"	1'-0"	1'-0"	1'-0"	1'-0"	9"	9"	U
W	5'-6"	5'-3"	5'-0"	4'-9"	4'-6"	4'-3"	4'-0"	3'-9"	3'-6"	3'-6"	3'-6"	5'-6"	5'-6"	5'-3"	5'-0"	4'-9"	4'-6"	4'-3"	3'-9"	3'-6"	W
B	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	B
C	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	C
D	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	D
E	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	E

Dimension Table

Headrail Dimensions																						
S x H	14' x 5'	14' x 4'	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'	5' x H	
A	48'-0"	43'-0"	37'-0"	34'-0"	28'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	10'-0"	37'-0"	34'-0"	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	10'-0"	A
H	5'-0"	4'-0"	3'-0"	2'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	4'-0"	3'-0"	2'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	H
P	18'-5 1/2"	15'-0 1/2"	12'-0 1/2"	9'-3 3/4"	6'-0 1/2"	3'-0 1/2"	0'-0 1/2"	0'-0 1/2"	0'-0 1/2"	0'-0 1/2"	0'-0 1/2"	18'-5 1/2"	15'-0 1/2"	12'-0 1/2"	9'-3 3/4"	6'-0 1/2"	3'-0 1/2"	0'-0 1/2"	0'-0 1/2"	0'-0 1/2"	0'-0 1/2"	P
R	19'-2 1/2"	15'-7 1/2"	12'-2 1/2"	9'-7 1/2"	6'-2 1/2"	3'-7 1/2"	0'-7 1/2"	0'-7 1/2"	0'-7 1/2"	0'-7 1/2"	0'-7 1/2"	19'-2 1/2"	15'-7 1/2"	12'-2 1/2"	9'-7 1/2"	6'-2 1/2"	3'-7 1/2"	0'-7 1/2"	0'-7 1/2"	0'-7 1/2"	0'-7 1/2"	R
S	14'-0"	14'-0"	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"	10'-0"	S
S1	16'-2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	13'-10 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"	S1
T	1'-3"	1'-3"	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"	1'-1"	T
U	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	U
W	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	W
B	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	9"	B
C	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	C
D	1'-0"	1'-0"	6"	6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	6"	6"	6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	D
E	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	E

Dimension Table

	Headwall Dimensions																				
S x H	8' x 10'	8' x 9'	8' x 8'	8' x 7'	8' x 6'	8' x 5'	8' x 4'	6' x 8'	6' x 7'	6' x 6'	6' x 5'	6' x 4'	6' x 3'	5' x 6'	5' x 5'	5' x 4'	5' x 3'	5' x 2'	5' x 1'		
A	31'-0"	28'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	25'-0"	22'-0"	19'-0"	16'-0"	13'-0"	10'-0"	19'-0"	16'-0"	13'-0"	10'-0"	10'-0"	3'-0"		
H	10'-0"	9'-0"	8'-0"	7'-0"	6'-0"	5'-0"	4'-0"	8'-0"	7'-0"	6'-0"	5'-0"	4'-0"	3'-0"	6'-0"	5'-0"	4'-0"	3'-0"	3'-0"	3'-0"		
P	35'-9 1/2"	32'-4"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	18'-5 1/2"	15'-0 1/2"	28'-10 1/2"	25'-4 1/2"	21'-11 1/2"	18'-5 1/2"	15'-0 1/2"	11'-6 1/2"	21'-11 1/2"	18'-5 1/2"	15'-0 1/2"	11'-6 1/2"	11'-6 1/2"	11'-6 1/2"		
R	37'-3 3/4"	33'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	19'-2 1/2"	15'-7 1/2"	30'-0 1/2"	26'-5 1/2"	22'-10 1/2"	19'-2 1/2"	15'-7 1/2"	12'-0 1/2"	22'-10 1/2"	19'-2 1/2"	15'-7 1/2"	12'-0 1/2"	12'-0 1/2"	12'-0 1/2"		
S	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"	8'-0"		
S1	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"	9'-2 1/2"		
T	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"	1'-1"		
U	10'	10'	10'	9'	9'	9'	9'	10'	9'	9'	9'	9'	9'	9'	9'	9'	9'	9'	9'		
W	4'-6"	4'-3"	4'-0"	3'-9"	3'-6"	3'-6"	3'-6"	4'-0"	3'-9"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"	3'-6"		
B	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"		
C	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"		
D	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"		
E	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"		



Highway Division

Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

APPROVED BY BRIDGE ENGINEER

LATEST REVISION DATE

Dimension Table

30° Skew

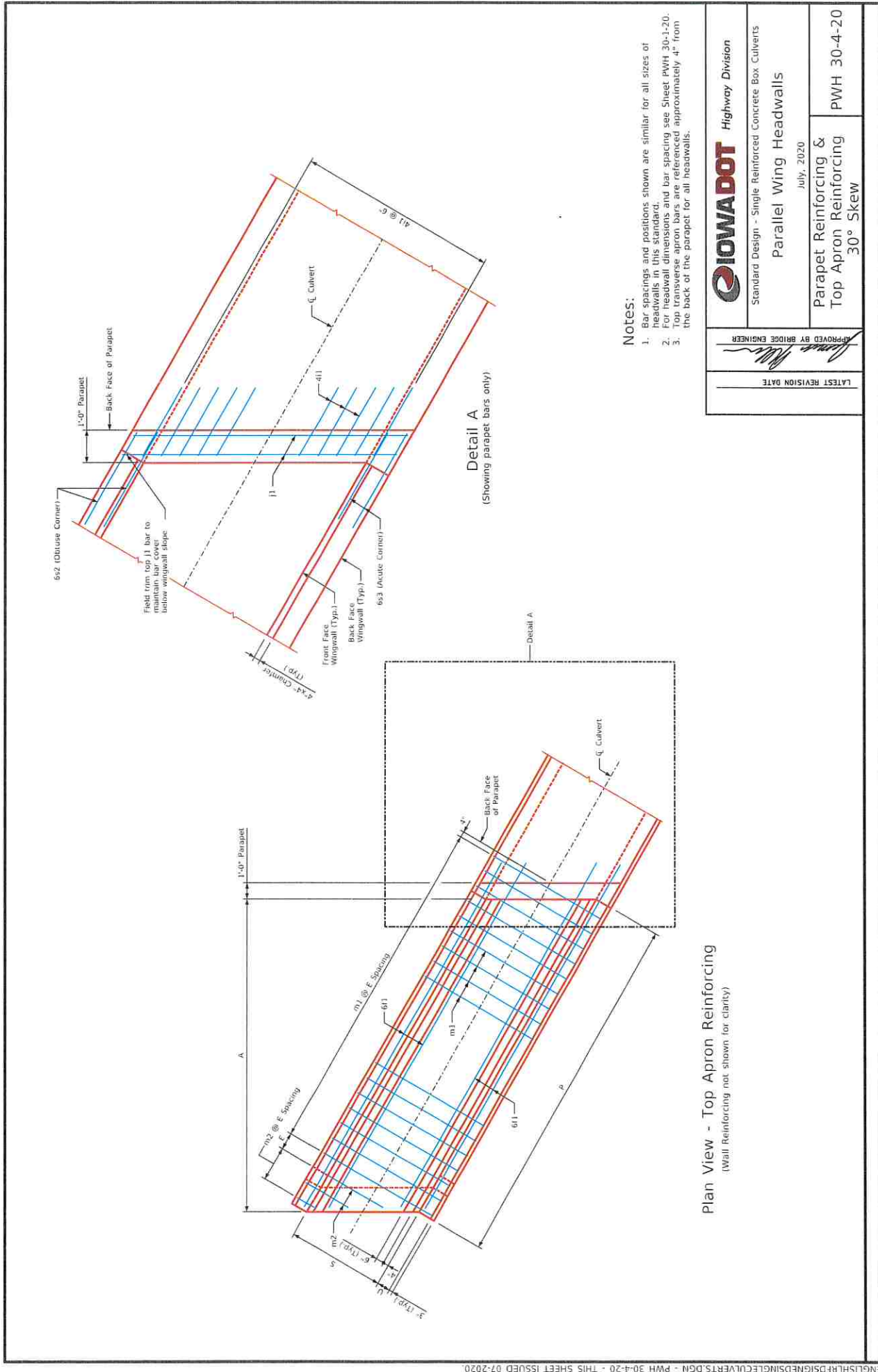
PWH 30-1-20

- Notes:
- See Sheet RCB G3-20 for General Notes, Specifications, and Design Standards.
 - See Sheets PWH 30-2-20 thru 30-4-20 for location of certain dimensions tabulated.
 - Dimensions are in feet and inches unless otherwise noted.



1. Bar spacings and positions shown are similar for all sizes of headwalls in this standard.
2. Not applicable for 3' thru 5' height headwalls.
3. Not applicable for 3' thru 5' height headwalls.
4. For headwall dimensions and bar spacing see Sheet PWH 300-1-20.
5. Aeron m3 bars are to be centered on $\bar{u}$ culvert.
6. B.F.V. (C5) and F.F.V. (C3) bars are approximately 4" from the back of parapet for all headwalls.

	Highway Division	
	Standard Design - Single Reinforced Concrete Box Culverts	
Parallel Wing Headwalls		
July, 2020		
Wingwall Elevations & Bottom Apron Reinforcing	PWH 30-3-20	
		30° Skew



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

Plan View - Top Apron Reinforcing

(Wall Reinforcing not shown for clarity)



Standard Design - Single Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Parapet Reinforcing &
Top Apron Reinforcing
30° Skew

APPROVED BY BRIDGE ENGINEER
LATEST REVISION DATE

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

Location	10' x 12'				10' x 11'				10' x 10'				10' x 9'				10' x 8'				10' x 7'				
	Shape	Bar	No.	Length	Vol.	Bar	No.	Length	Vol.	Bar	No.	Length	Vol.	Bar	No.	Length	Vol.	Bar	No.	Length	Vol.	Bar	No.	Length	Vol.
Fence Anchor (Gate)		51a	2	2'-10"	6	51a	2	2'-10"	6	51a	2	2'-10"	6	51a	2	2'-10"	6	51a	2	2'-10"	6	51a	2	2'-10"	6
		Wingwall, F.F.H.	501	2	48'-2"	101	501	2	42'-9"	94	501	2	39'-3"	82	501	2	35'-10"	75	501	2	32'-4"	67	501	2	29'-11"
Wingwall, F.F.H.		502	22	Var.	636	502	20	Var.	539	502	18	Var.	447	502	16	Var.	369	502	14	Var.	298	502	12	Var.	234
Wingwall, U.F.H.		403	2	46'-6"	65	403	2	43'-1"	61	403	2	39'-6"	53	403	2	36'-1"	48	403	2	32'-7"	44	403	2	29'-1"	39
Wingwall, S.F.H.		404	20	Var.	388	404	18	Var.	335	404	16	Var.	276	404	14	Var.	225	404	12	Var.	179	404	10	Var.	137
Wingwall, F.F.V.		5c1	86	Var.	774	5c1	78	Var.	658	4c1	72	Var.	367	4c1	64	Var.	301	4c1	76	Var.	334	4c1	68	Var.	280
Wingwall, F.F.V.		5c2	40	Var.	494	5c2	34	Var.	403	4c2	26	Var.	187	4c2	20	Var.	91	4c2	2	Var.	139	4c2	2	Var.	91
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.	1593	5c4	78	Var.	956	5c4	72	Var.	848	5c4	64	Var.	654	5c4	58	Var.	623	5c4	50	Var.	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
Apron, Longit., Bott.		4d1	11	46'-1"	356	4d1	11	42'-7"	331	4d1	11	39'-2"	288	4d1	11	35'-8"	262	4d1	11	32'-3"	237	4d1	11	28'-9"	211
Apron, Longit., Top		6f1	11	46'-1"	801	6f1	11	42'-7"	743	6f1	11	39'-2"	647	6f1	11	35'-8"	589	6f1	11	32'-3"	533	6f1	11	28'-9"	475
Parapet, Vertical		4t1	21	7'-0"	98	4d1	21	7'-0"	98	4d1	21	7'-0"	98	4d1	21	7'-0"	98	4d1	21	7'-0"	98	4d1	21	7'-0"	98
Parapet, Horiz.		7f1	4	13'-5"	110	7f1	4	13'-5"	110	7f1	4	13'-1"	107	7f1	4	13'-1"	107	7f1	4	13'-1"	107	7f1	4	12'-10"	105
Apron, Trans., Top		5m1	54	12'-2"	685	5m1	50	12'-2"	634	5m1	45	11'-10"	555	5m1	41	11'-10"	506	5m1	36	11'-10"	444	5m1	31	11'-8"	377
Apron, Trans., Bott.		5m2	7	Var.	52	5m2	7	Var.	46	5m2	7	Var.	48	5m2	6	Var.	40	5m2	7	Var.	46	5m2	7	Var.	49
Apron, Trans., Horiz.		6m3	73	11'-2"	1224	6m3	67	11'-2"	1124	6m3	61	10'-6"	993	6m3	55	10'-10"	895	6m3	53	10'-2"	861	6m3	47	9'-10"	726
Wing Slope, Both F. (O)		6p1	6	13'-8"	123	6p1	6	13'-8"	123	6p1	6	13'-4"	120	6p1	6	13'-4"	120	6p1	6	13'-4"	120	6p1	5	13'-2"	99
Wing Slope, Both F. (A)		6p2	2	8'-3"	25	6p2	2	8'-3"	25	6p2	2	8'-4"	25	6p2	2	8'-4"	25	6p2	2	8'-4"	25	6p2	2	8'-4"	25
Wing Slope, Both F. (A)		6p3	2	8'-9"	26	6p3	2	8'-9"	26	6p3	2	8'-9"	26	6p3	2	8'-9"	26	6p3	2	8'-9"	26	6p3	2	8'-9"	26
Wing Slope, F.F.		6p4	2	12'-5"	37	6p4	2	12'-5"	37	6p4	2	12'-5"	37	6p4	2	12'-5"	37	6p4	2	12'-5"	37	6p4	2	12'-5"	37
Apron, Vert. Ends		6p5	2	37'-11"	114	6p5	2	34'-3"	103	6p5	2	30'-8"	92	6p5	2	27'-1"	81	6p5	2	23'-5"	70	6p5	2	19'-10"	60
Apron, Vert.		5t1	12	7'-11"	99	5t1	12	7'-8"	96	5t1	12	7'-5"	93	5t1	12	7'-2"	90	5t1	12	6'-11"	87	5t1	12	6'-8"	83
Bracket, Vert.		5t2	4	6'-7"	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
Roof, Sloped		5t3	4	6'-7"	27	5t3	4	6'-4"	26	5t3	4	6'-2"	26	5t3	4	5'-11"	25	5t3	4	5'-8"	24	5t3	4	5'-6"	23
Roof, Flat		5t4	4	6'-7"	27	5t4	4	6'-4"	26	5t4	4	6'-2"	26	5t4	4	5'-11"	25	5t4	4	5'-8"	24	5t4	4	5'-6"	23
Estimated Quantities	1.9	24.8	53.6 CY	3.7	12.5	34.2 CY	1.7	12.5	34.2 CY	1.7	12.5	34.2 CY	1.7	12.5	34.2 CY	1.7	12.5	34.2 CY	1.7	12.5	34.2 CY	1.6	7.3	24.6 CY	
Concrete	24.8	26.9	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	15.7	15.7	24.6 CY	
Wingwalls	24.8	26.9	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	15.7	15.7	24.6 CY	
Apron =	24.8	26.9	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	18.0	20.0	15.7	15.7	24.6 CY	



Twin Reinforced Concrete Box Culvert Standards

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TWPCB 45-7-20	Parallel Wing Howls, 45° Skew, Quantity Tabulation, 12'-0" Span, Sheet 2 of 2
TWPCB 45-8-20	Parallel Wing Howls, 45° Skew, Quantity Tabulation, 10'-0" Span, Sheet 1 of 2
TWPCB 45-9-20	Parallel Wing Howls, 45° Skew, Quantity Tabulation, 10'-0" Span, Sheet 2 of 2
TWPCB 45-10-20	Parallel Wing Howls, 45° Skew, Quantity Tabulation, 8'-0" Span
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TWCB 2-20	Culvert Bell Joints, 10' & 12' Spans
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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, $E_v = 0.120$ kcf.
3. Horizontal earth pressure, $E_h = 0.060$ kcf max, $E_{hmax} = 0.030$ kcf.
4. The RCB culvert sections are designed for Class 1 exposure conditions except:
5. Class 2 exposure condition is utilized for the slab design in 0' fill instances.
6. 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.
7. The clear distance from face of concrete to near edge or end of reinforcing bar to be 2" unless otherwise noted.
8. Except for dowel bars 5/16" in slab, longitudinal reinforcing is not to extend thru the construction joints.
9. Floor of barrel is to be finished smooth. Sides of footing are to be formed to insure correct line and grade.
10. The permissible construction joint at the top of the walls may be lowered at the Contractor's option with Engineer's approval.
11. The reinforcing supplied for this structure shall be Grade 60 reinforcement in accordance with the Standard Specifications.
12. The design stresses are based on ASTM A706 Grade 60 reinforcement.
13. The critical 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"	24"	29"	34"	38"

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 2 1/2" to near transverse reinforcing bar
Bottom of floor 3 1/2" to near transverse reinforcing bar
End clearances:
Vertical top 2"
Vertical bottom 3" or 3 1/2" - If overall height of the culvert is not to a full inch
Transverse 2"
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 size shall be 2"x6" and wall height 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 (5s1 is 5/16 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:

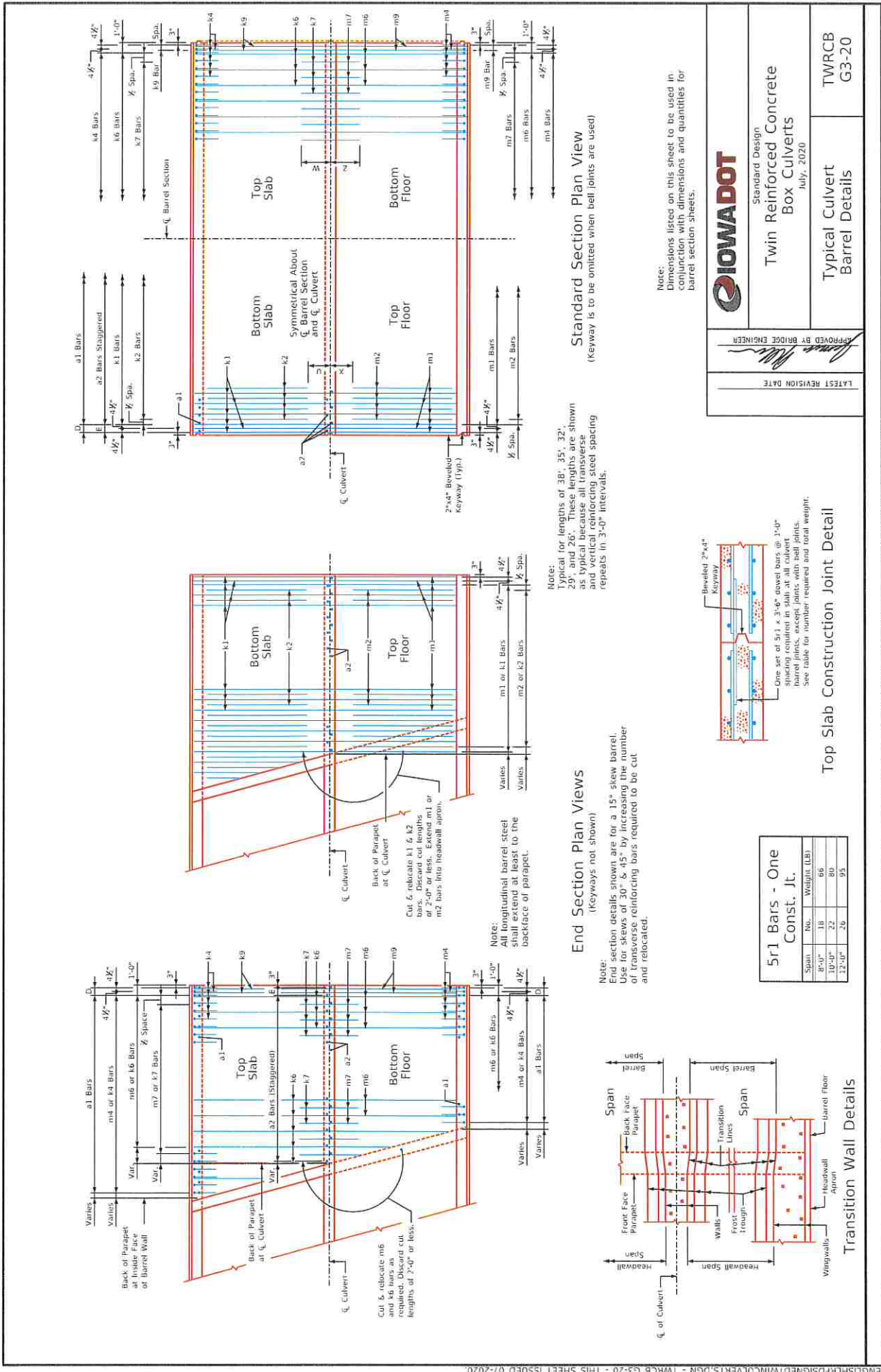
Design stresses for the following materials are in accordance with the Standard Specifications for Highway and Bridge Construction, 2017: Reinforcing steel in accordance with AASHTO LRFD Section 5, Grade 60. Concrete in accordance with AASHTO LRFD Section 5, $f'_c = 4.0$ ksi.



Standard Design
Twin Reinforced Concrete
Box Culverts
July, 2020

General Notes
& Specifications
TWRCB
G2-20

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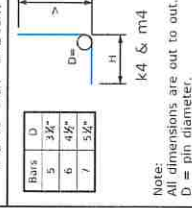


Variable Dimensions and Quantities for Twin 10' x 10' Barrel Sections

[illegible]

Fill	m1			m2			m3			m4			m5			m6			m7			m8			m9			m10			m11			m12			m13			m14			m15			m16			m17			m18			m19			m20			m21			m22			m23			m24			m25			m26			m27			m28			m29			m30			m31			m32			m33			m34			m35			m36			m37			m38			m39			m40			m41			m42			m43			m44			m45			m46			m47			m48			m49			m50			m51			m52			m53			m54			m55			m56			m57			m58			m59			m60			m61			m62			m63			m64			m65			m66			m67			m68			m69			m70			m71			m72			m73			m74			m75			m76			m77			m78			m79			m80			m81			m82			m83			m84			m85			m86			m87			m88			m89			m90			m91			m92			m93			m94			m95			m96			m97			m98			m99			m100			m101			m102			m103			m104			m105			m106			m107			m108			m109			m110			m111			m112			m113			m114			m115			m116			m117			m118			m119			m120			m121			m122			m123			m124			m125			m126			m127			m128			m129			m130			m131			m132			m133			m134			m135			m136			m137			m138			m139			m140			m141			m142			m143			m144			m145			m146			m147			m148			m149			m150			m151			m152			m153			m154			m155			m156			m157			m158			m159			m160			m161			m162			m163			m164			m165			m166			m167			m168			m169			m170			m171			m172			m173			m174			m175			m176			m177			m178			m179			m180			m181			m182			m183			m184			m185			m186			m187			m188			m189			m190			m191			m192			m193			m194			m195			m196			m197			m198			m199			m200			m201			m202			m203			m204			m205			m206			m207			m208			m209			m210			m211			m212			m213			m214			m215			m216			m217			m218			m219			m220			m221			m222			m223			m224			m225			m226			m227			m228			m229			m230			m231			m232			m233			m234			m235			m236			m237			m238			m239			m240			m241			m242			m243			m244			m245			m246			m247			m248			m249			m250			m251			m252			m253			m254			m255			m256			m257			m258			m259			m260			m261			m262			m263			m264			m265			m266			m267			m268			m269			m270			m271			m272			m273			m274			m275			m276			m277			m278			m279			m280			m281			m282			m283			m284			m285			m286			m287			m288			m289			m290			m291			m292			m293			m294			m295			m296			m297			m298			m299			m300			m301			m302			m303			m304			m305			m306			m307			m308			m309			m310			m311			m312			m313			m314			m315			m316			m317			m318			m319			m320			m321			m322			m323			m324			m325			m326			m327			m328			m329			m330			m331			m332			m333			m334			m335			m336			m337			m338			m339			m340			m341			m342			m343			m344			m345			m346			m347			m348			m349			m350			m351			m352			m353			m354			m355			m356			m357			m358			m359			m360			m361			m362			m363			m364			m365			m366			m367			m368			m369			m370			m371			m372			m373			m374			m375			m376			m377			m378			m379			m380			m381			m382			m383			m384			m385			m386			m387			m388			m389			m390			m391			m392			m393			m394			m395			m396			m397			m398			m399			m400			m401			m402			m403			m404			m405			m406			m407			m408			m409			m410			m411			m412			m413			m414			m415			m416			m417			m418			m419			m420			m421			m422			m423			m424			m425			m426			m427			m428			m429			m430			m431			m432			m433			m434			m435			m436			m437			m438			m439			m440			m441			m442			m443			m444			m445			m446			m447			m448			m449			m450			m451			m452			m453			m454			m455			m456			m457			m458			m459			m460			m461			m462			m463			m464			m465			m466			m467			m468			m469			m470			m471			m472			m473			m474			m475			m476			m477			m478			m479			m480			m481			m482			m483			m484			m485			m486			m487			m488			m489			m490			m491			m492			m493			m494			m495			m496			m497			m498			m499			m500			m501			m502			m503			m504			m505			m506			m507			m508			m509			m510			m511			m512			m513			m514			m515			m516			m517			m518			m519			m520			m521			m522			m523			m524			m525			m526			m527			m528			m529			m530			m531			m532			m533			m534			m535			m536			m537			m538			m539			m540			m541			m542			m543			m544			m545			m546			m547			m548			m549			m550			m551			m552			m553			m554			m555			m556			m557			m558			m559			m560			m561			m562			m563			m564			m565			m566			m567			m568			m569			m570			m571			m572			m573			m574			m575			m576			m577			m578			m579			m580			m581			m582			m583			m584			m585			m586			m587			m588			m589			m590			m591			m592			m593			m594			m595			m596			m597			m598			m599			m600			m601			m602			m603			m604			m605			m606			m607			m608			m609			m610			m611			m612			m613			m614			m615			m616			m617			m618			m619			m620			m621			m622			m623			m624			m625			m626			m627			m628			m629			m630			m631			m632			m633			m634			m635			m636			m637			m638			m639			m640			m641			m642			m643			m644			m645			m646			m647			m648			m649			m650			m651			m652			m653			m654			m655			m656			m657			m658			m659			m660			m661			m662			m663			m664			m665			m666			m667			m668			m669			m670			m671			m672			m673			m674			m675			m676			m677			m678			m679			m680			m681			m682			m683			m684			m685			m686			m687			m688			m689			m690			m691			m692			m693			m694			m695			m696			m697			m698			m699			m700			m701			m702			m703			m704			m705			m706			m707			m708			m709			m710			m711			m712			m713			m714			m715			m716			m717			m718			m719			m720			m721			m722			m723			m724			m725			m726			m727			m728			m729			m730			m731			m732			m733			m734			m735			m736			m737			m738			m739			m740			m741			m742			m743			m744			m745			m746			m747			m748			m749			m750			m751			m752			m753			m754			m755			m756			m757			m758			m759			m760			m761			m762			m763			m764			m765			m766			m767			m768			m769			m770			m771			m772			m773			m774			m775			m776			m777			m778			m779			m780			m781			m782			m783			m784			m785			m786			m787			m788			m789			m790			m791			m792			m793			m794			m795			m796			m797			m798			m799			m800			m801			m802			m803			m804			m805			m806			m807			m808			m809			m810			m811			m812			m813			m814			m815			m816			m817			m818			m819			m820			m821			m822			m823			m824			m825			m826			m827			m828			m829			m830			m831			m832			m833			m834			m835			m836			m837			m838			m839			m840			m841			m842			m843			m844			m845			m846			m847			m848			m849			m850			m851			m852			m853			m854			m855			m856			m857			m858			m859			m860			m861			m862			m863			m864			m865			m866			m867			m868			m869			m870			m871			m872			m873			m874			m875			m876			m877			m878			m879			m880			m881			m882			m883			m884			m885			m886			m887			m888			m889			m890			m891			m892			m893			m894			m895			m896			m897			m898			m899			m900			m901			m902			m903			m904			m905			m906			m907			m908			m909			m910			m911			m912			m913			m914			m915			m916			m917			m918			m919			m920			m921			m922			m923			m924			m925			m926			m927			m928			m929			m930			m931			m932			m933			m934			m935			m936			m937			m938			m939			m940			m941			m942			m943			m944			m945			m946			m947			m948			m949			m950			m951			m952			m953			m954			m955			m956			m957			m958			m959			m960			m961			m962			m963			m964			m965			m966			m967			m968			m969			m970			m971			m972			m973			m974			m975			m976			m977			m978			m979			m980			m981			m982			m983			m984			m985			m986			m987			m988			m989			m990			m991			m992			m993			m994			m995			m996			m997			m998			m999			m1000		
	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L	Size	Sp.	Sp.	L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

Bent Bar Detail



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", "H₁" are in feet and inches.



Standard Design

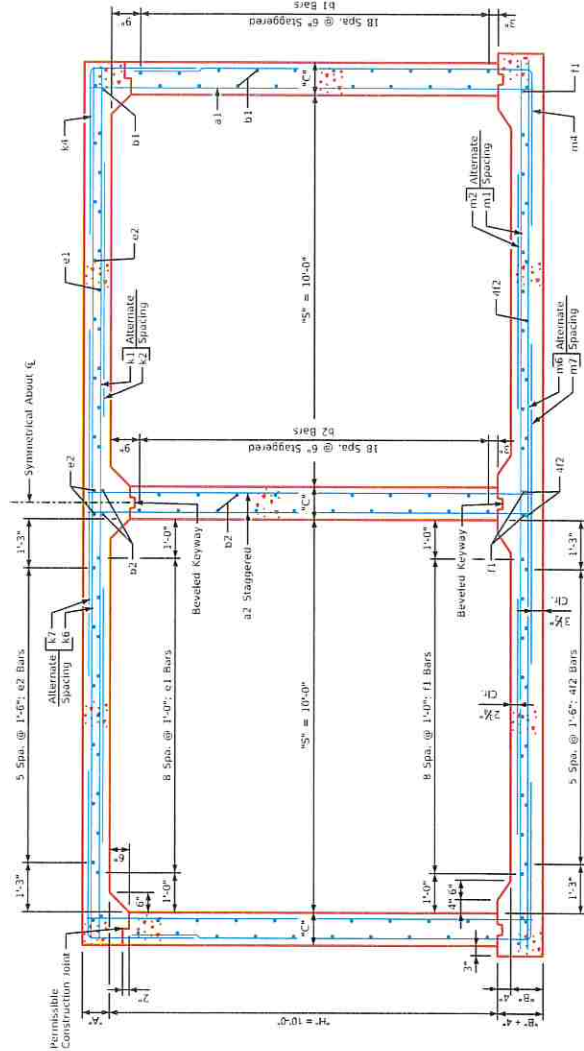
Twin Reinforced Concrete Box Culverts

July, 2020

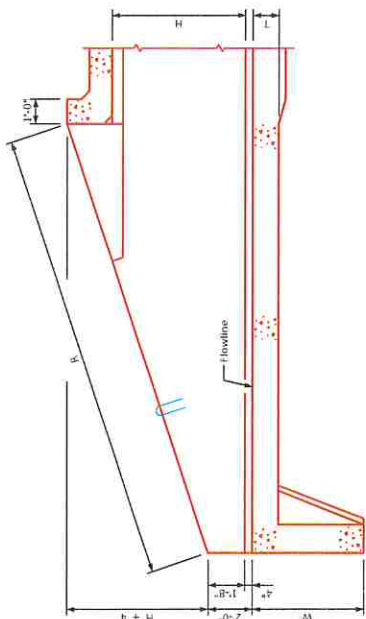
Cultist David

10-10-20

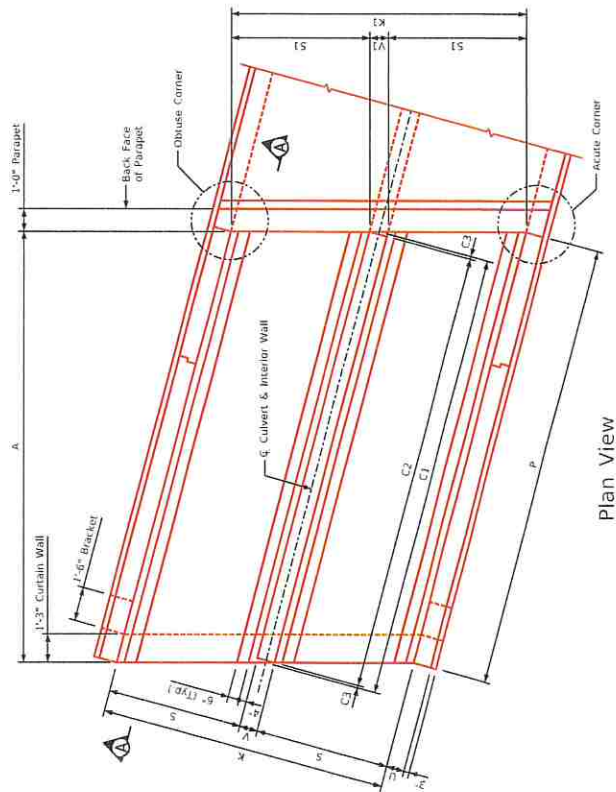
Details



Twin 10' x 10' Barrel Section



Elevation Section A-A



Dimension Table

Sealing	Residual Dimensions	5 × H	12 × 12	12 × 11	12 × 10	12 × 9	12 × 8	12 × 7	12 × 6	12 × 5	12 × 4	10 ³ × 12	10 ³ × 11	10 ³ × 10	10 ³ × 9	10 ³ × 8	10 ³ × 7	10 ³ × 6	10 ³ × 5	10 ³ × 4	5 × H
A	37 × 30	34 × 30	31 × 30	28 × 30	25 × 30	22 × 30	20 × 30	18 × 30	16 × 30	15 × 30	13 × 30	34 × 30	31 × 30	28 × 30	25 × 30	22 × 30	20 × 30	18 × 30	16 × 30	15 × 30	A
C1	38 × 30	35 × 30	32 × 30	29 × 30	27 × 30	25 × 30	23 × 30	21 × 30	19 × 30	18 × 30	16 × 30	35 × 30	32 × 30	29 × 30	27 × 30	25 × 30	23 × 30	21 × 30	19 × 30	18 × 30	C1
C2	38 × 30	34 × 11 1/2	31 × 10 3/4	28 × 9 1/2	25 × 7 1/2	22 × 6 1/2	20 × 5 1/2	18 × 5 1/2	16 × 4 1/2	15 × 4 1/2	13 × 3 1/2	34 × 11 1/2	31 × 10 3/4	28 × 9 1/2	25 × 7 1/2	22 × 6 1/2	20 × 5 1/2	18 × 5 1/2	16 × 4 1/2	15 × 4 1/2	C2
C3	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	C3
H	25 × 30	24 × 30	23 × 30	22 × 30	21 × 30	20 × 30	19 × 30	18 × 30	17 × 30	16 × 30	15 × 30	24 × 30	23 × 30	22 × 30	21 × 30	20 × 30	19 × 30	18 × 30	17 × 30	16 × 30	H
K	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	25 × 30	K
K1	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	25 × 10 3/4	K1
P	38 × 30	35 × 30	32 × 30	29 × 30	27 × 30	25 × 30	23 × 30	21 × 30	19 × 30	18 × 30	16 × 30	35 × 30	32 × 30	29 × 30	27 × 30	25 × 30	23 × 30	21 × 30	19 × 30	18 × 30	P
R	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	38 × 30	R
R1	39 × 7 1/2	36 × 4	33 × 1 1/2	30 × 1 1/2	27 × 1 1/2	24 × 1 1/2	21 × 1 1/2	18 × 1 1/2	15 × 1 1/2	12 × 1 1/2	9 × 1 1/2	36 × 4	33 × 1 1/2	30 × 1 1/2	27 × 1 1/2	24 × 1 1/2	21 × 1 1/2	18 × 1 1/2	15 × 1 1/2	12 × 1 1/2	R1
S	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	12 × 30	S
S1	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	12 × 5 3/8	S1
U	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	U
V	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	V
V1	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	V1
W	5 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	4 × 30	W
B	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	B
C	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	C
D	6	6	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	6	6	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	1 × 30	D
E	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	E

Dimension Table

5 x H	H x 10 ³	H ² x 10 ³	H ³ x 10 ³	H ⁴ x 10 ³	H ⁵ x 10 ³	H ⁶ x 10 ³	H ⁷ x 10 ³	H ⁸ x 10 ³	H ⁹ x 10 ³	H ¹⁰ x 10 ³	H ¹¹ x 10 ³	H ¹² x 10 ³	H ¹³ x 10 ³	H ¹⁴ x 10 ³	H ¹⁵ x 10 ³	H ¹⁶ x 10 ³	H ¹⁷ x 10 ³	H ¹⁸ x 10 ³	H ¹⁹ x 10 ³	H ²⁰ x 10 ³	H ²¹ x 10 ³	H ²² x 10 ³	H ²³ x 10 ³	H ²⁴ x 10 ³	H ²⁵ x 10 ³	H ²⁶ x 10 ³	H ²⁷ x 10 ³	H ²⁸ x 10 ³	H ²⁹ x 10 ³	H ³⁰ x 10 ³	H ³¹ x 10 ³	H ³² x 10 ³	H ³³ x 10 ³	H ³⁴ x 10 ³	H ³⁵ x 10 ³	H ³⁶ x 10 ³	H ³⁷ x 10 ³	H ³⁸ x 10 ³	H ³⁹ x 10 ³	H ⁴⁰ x 10 ³	H ⁴¹ x 10 ³	H ⁴² x 10 ³	H ⁴³ x 10 ³	H ⁴⁴ x 10 ³	H ⁴⁵ x 10 ³	H ⁴⁶ x 10 ³	H ⁴⁷ x 10 ³	H ⁴⁸ x 10 ³	H ⁴⁹ x 10 ³	H ⁵⁰ x 10 ³	H ⁵¹ x 10 ³	H ⁵² x 10 ³	H ⁵³ x 10 ³	H ⁵⁴ x 10 ³	H ⁵⁵ x 10 ³	H ⁵⁶ x 10 ³	H ⁵⁷ x 10 ³	H ⁵⁸ x 10 ³	H ⁵⁹ x 10 ³	H ⁶⁰ x 10 ³	H ⁶¹ x 10 ³	H ⁶² x 10 ³	H ⁶³ x 10 ³	H ⁶⁴ x 10 ³	H ⁶⁵ x 10 ³	H ⁶⁶ x 10 ³	H ⁶⁷ x 10 ³	H ⁶⁸ x 10 ³	H ⁶⁹ x 10 ³	H ⁷⁰ x 10 ³	H ⁷¹ x 10 ³	H ⁷² x 10 ³	H ⁷³ x 10 ³	H ⁷⁴ x 10 ³	H ⁷⁵ x 10 ³	H ⁷⁶ x 10 ³	H ⁷⁷ x 10 ³	H ⁷⁸ x 10 ³	H ⁷⁹ x 10 ³	H ⁸⁰ x 10 ³	H ⁸¹ x 10 ³	H ⁸² x 10 ³	H ⁸³ x 10 ³	H ⁸⁴ x 10 ³	H ⁸⁵ x 10 ³	H ⁸⁶ x 10 ³	H ⁸⁷ x 10 ³	H ⁸⁸ x 10 ³	H ⁸⁹ x 10 ³	H ⁹⁰ x 10 ³	H ⁹¹ x 10 ³	H ⁹² x 10 ³	H ⁹³ x 10 ³	H ⁹⁴ x 10 ³	H ⁹⁵ x 10 ³	H ⁹⁶ x 10 ³	H ⁹⁷ x 10 ³	H ⁹⁸ x 10 ³	H ⁹⁹ x 10 ³	H ¹⁰⁰ x 10 ³	H ¹⁰¹ x 10 ³	H ¹⁰² x 10 ³	H ¹⁰³ x 10 ³	H ¹⁰⁴ x 10 ³	H ¹⁰⁵ x 10 ³	H ¹⁰⁶ x 10 ³	H ¹⁰⁷ x 10 ³	H ¹⁰⁸ x 10 ³	H ¹⁰⁹ x 10 ³	H ¹¹⁰ x 10 ³	H ¹¹¹ x 10 ³	H ¹¹² x 10 ³	H ¹¹³ x 10 ³	H ¹¹⁴ x 10 ³	H ¹¹⁵ x 10 ³	H ¹¹⁶ x 10 ³	H ¹¹⁷ x 10 ³	H ¹¹⁸ x 10 ³	H ¹¹⁹ x 10 ³	H ¹²⁰ x 10 ³	H ¹²¹ x 10 ³	H ¹²² x 10 ³	H ¹²³ x 10 ³	H ¹²⁴ x 10 ³	H ¹²⁵ x 10 ³	H ¹²⁶ x 10 ³	H ¹²⁷ x 10 ³	H ¹²⁸ x 10 ³	H ¹²⁹ x 10 ³	H ¹³⁰ x 10 ³	H ¹³¹ x 10 ³	H ¹³² x 10 ³	H ¹³³ x 10 ³	H ¹³⁴ x 10 ³	H ¹³⁵ x 10 ³	H ¹³⁶ x 10 ³	H ¹³⁷ x 10 ³	H ¹³⁸ x 10 ³	H ¹³⁹ x 10 ³	H ¹⁴⁰ x 10 ³	H ¹⁴¹ x 10 ³	H ¹⁴² x 10 ³	H ¹⁴³ x 10 ³	H ¹⁴⁴ x 10 ³	H ¹⁴⁵ x 10 ³	H ¹⁴⁶ x 10 ³	H ¹⁴⁷ x 10 ³	H ¹⁴⁸ x 10 ³	H ¹⁴⁹ x 10 ³	H ¹⁵⁰ x 10 ³	H ¹⁵¹ x 10 ³	H ¹⁵² x 10 ³	H ¹⁵³ x 10 ³	H ¹⁵⁴ x 10 ³	H ¹⁵⁵ x 10 ³	H ¹⁵⁶ x 10 ³	H ¹⁵⁷ x 10 ³	H ¹⁵⁸ x 10 ³	H ¹⁵⁹ x 10 ³	H ¹⁶⁰ x 10 ³	H ¹⁶¹ x 10 ³	H ¹⁶² x 10 ³	H ¹⁶³ x 10 ³	H ¹⁶⁴ x 10 ³	H ¹⁶⁵ x 10 ³	H ¹⁶⁶ x 10 ³	H ¹⁶⁷ x 10 ³	H ¹⁶⁸ x 10 ³	H ¹⁶⁹ x 10 ³	H ¹⁷⁰ x 10 ³	H ¹⁷¹ x 10 ³	H ¹⁷² x 10 ³	H ¹⁷³ x 10 ³	H ¹⁷⁴ x 10 ³	H ¹⁷⁵ x 10
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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.



Standard Design - Twin Reinforced Concrete Box Culverts

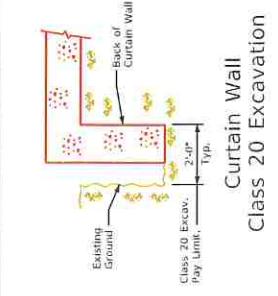
Parallel Wing Headwalls

July, 2020

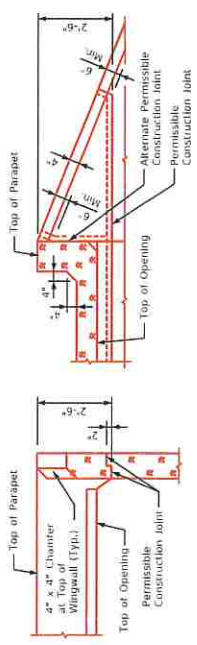
Dimension Table
15° Skew

3

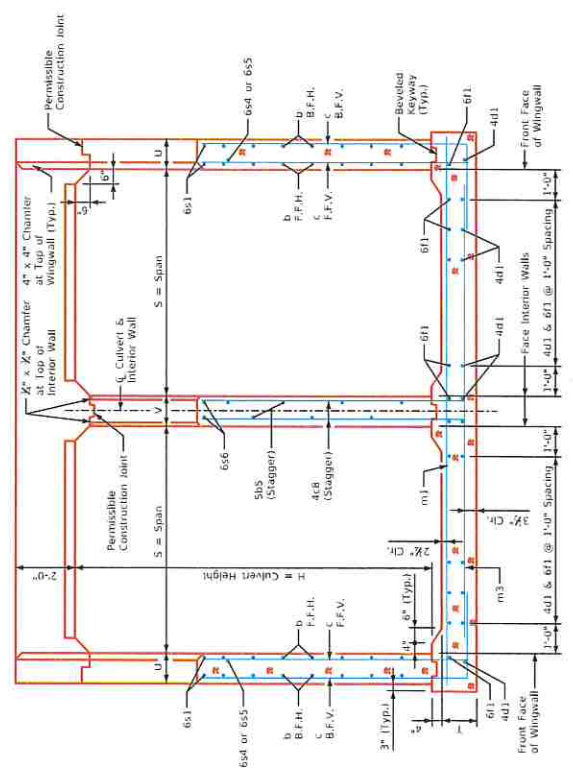
APPROVED BY BRIDGE ENGINEER



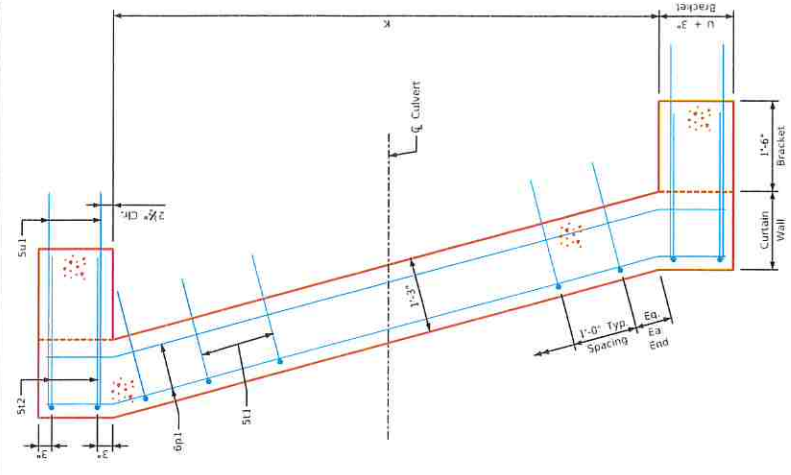
Section thru Curtain Wall



Top of Wingwall Details



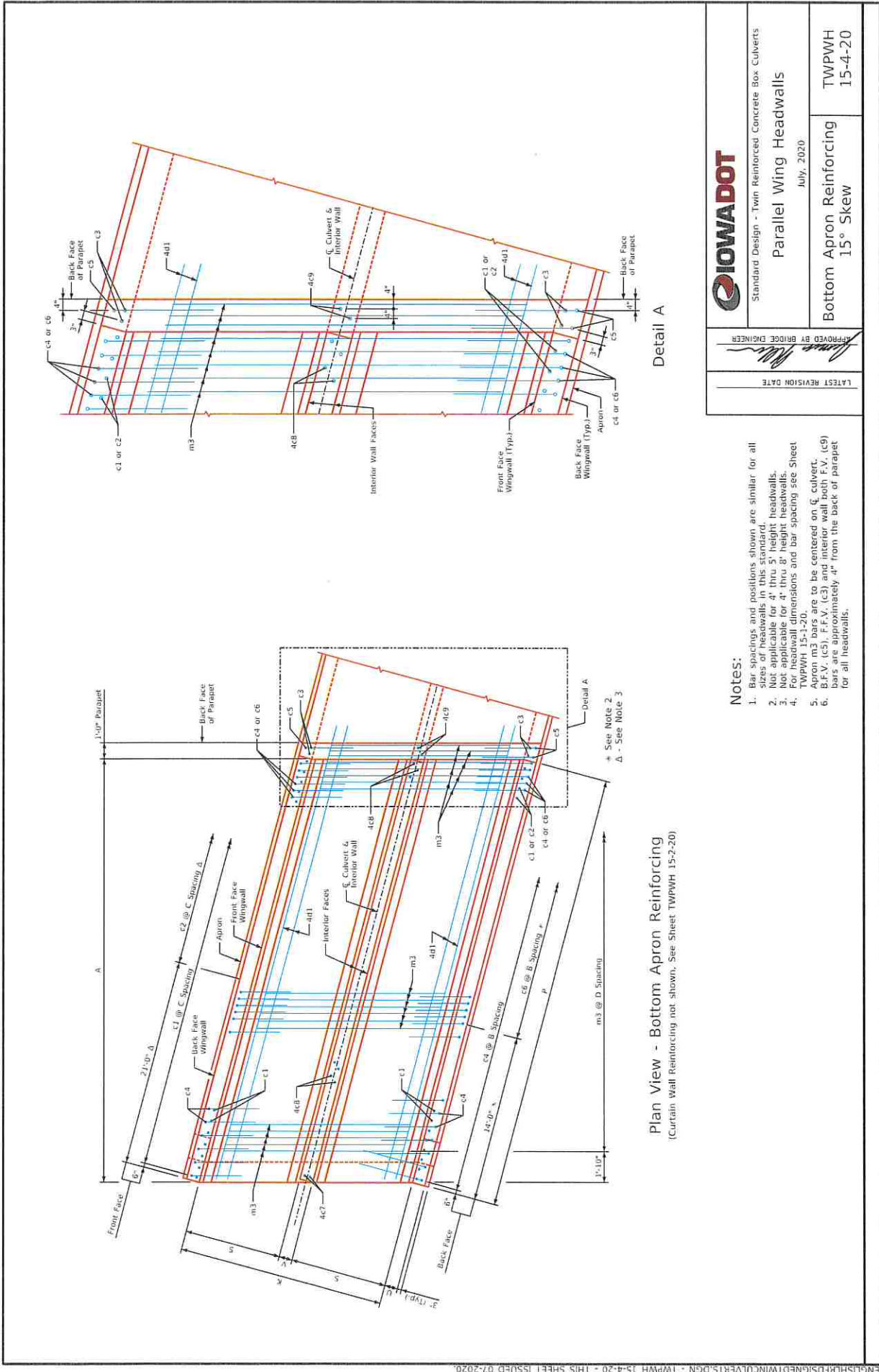
Typical Cross Section - thru Headwall



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

- Notes:**
1. See Sheet TWP/RCB G3-20 for General Notes, Specifications, and Design Stresses.
 2. For dimension table see Sheet TWP/WH 15.-20.

	Standard Design - Twin Reinforced Concrete Box Culverts	
	Parallel Wing Headwalls	
July, 2020		TWPWH 15-2-20
Cross Section Details 15° Skew		Approved by BRIDGE ENGINEER 
August 2022		LATEST REVISION DATE



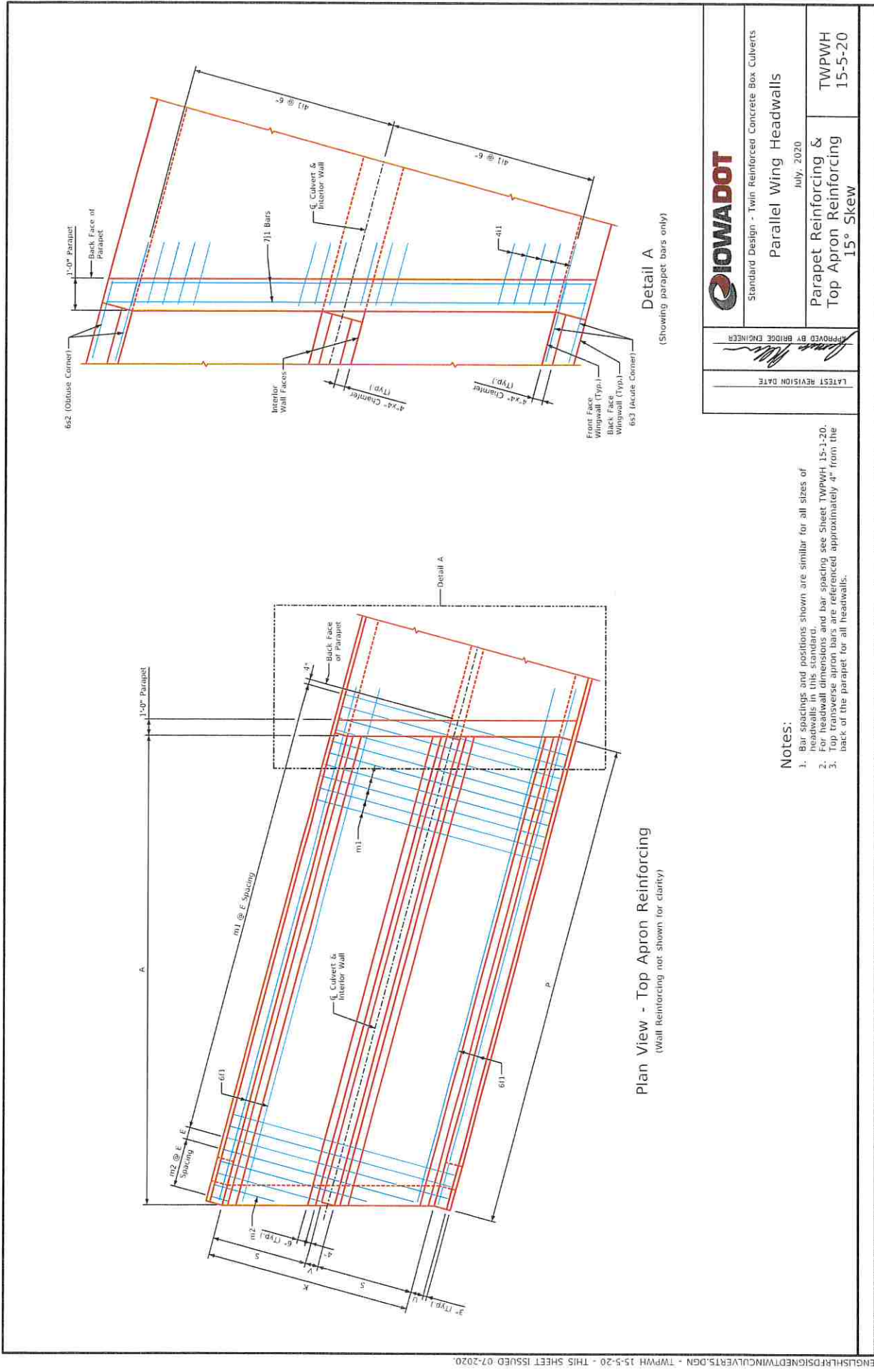
Standard Design - Twin Reinforced Concrete Box Culverts
 Parallel Wing Headwalls

July, 2020

Bottom Apron Reinforcing
 15° Skew

TWPWH
 15-4-20

APPROVED BY BRIDGE ENGINEER
 LATEST REVISION DATE



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 15-5-20.
3. Top transverse apron bars are referenced approximately 4" from the back of the parapet for all headwalls.

Standard Design - Twin Reinforced Concrete Box Culverts	
Parallel Wing Headwalls	
July, 2020	
Parapet Reinforcing & Top Apron Reinforcing	TWPWH 15-5-20
15° Skew	
APPROVED BY BRIDGE ENGINEER 	
LATEST REVISION DATE _____	

