A d d e n d u m

Iowa Department of Transportation
Office of Contracts

Date of Letting: May 17, 2016
Date of Addendum: May 6, 2016

B.O.	Proposal ID	Proposal Work Type	County	Project Number	Addendum
306	75-C075-144	GRADING	PLYMOUTH	FM-C075(144)--55-75	17MAY306.A01

Make the following changes to the PLAN:

ADD these standards to the plan:

RCB G1-12
RCB G2-12
RCB 10-6
CBJ 3-12
CBJ 4-12
RCB G1-87
FHW 15-1-87
FHW 15-4-87
FHW 15-5-87
FHW 15-6-87

The box culvert standards being used are the latest.
The headwalls are the flared headwalls and therefore are the older standard.

Please add the attached RCBC STANDARD SHEETS TO THE PLAN.

IOWA DOT
Highway Division

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. THE RCB CULVERT SECTIONS ARE DESIGNED FOR CLASS I EXPOSURE CONDITIONS EXCEPT: CLASS 2 EXPOSURE CONDITION IS UTILIZED FOR THE SLAB DESIGN IN 0' FILL INSTANCES.
3. 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.
4. THE CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR EDGE OR END OF REINFORCING BAR TO BE 2" UNLESS OTHERWISE NOTED.
5. EXCEPT FOR DOWEL BARS 5a1 IN SLAB, LONGITUDINAL REINFORCING IS NOT TO EXTEND THRU THE CONSTRUCTION JOINTS.
6. FLOOR OF BARREL IS TO BE FINISHED SMOOTH. SIDES OF FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.
7. THE PERMISSIBLE CONSTRUCTION JOINT AT THE TOP OF THE WALLS MAY BE LOWERED AT THE CONTRACTOR'S OPTION WITH ENGINEER'S APPROVAL.
8. THE REINFORCEMENT SUPPLIED FOR THIS STRUCTURE SHALL BE GRADE 60 REINFORCEMENT IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE DESIGN STRESSES ARE BASED ON GRADE 60 REINFORCEMENT.
9. 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	17"	21"	25"	31"	41"	51"

   THIS SPLICE, IF USED, WILL BE AT THE CONTRACTOR'S EXPENSE.
10. REINFORCING BAR CLEARANCES WILL BE AS FOLLOWS:
    - EDGE CLEARANCES: 2" EXCEPT
      - TOP OF FLOOR $2\frac{1}{4}$" TO NEAR TRANSVERSE REINFORCING BAR
      - BOTTOM OF FLOOR $3\frac{1}{2}$" TO NEAR TRANSVERSE REINFORCING BAR
    - END CLEARANCES:
      - VERTICAL TOP 2"
      - VERTICAL BOTTOM 3" OR $3\frac{1}{2}$" IF OVERALL HEIGHT OF THE CULVERT IS NOT TO A FULL INCH
      - TRANSVERSE 2"
11. ALL CONSTRUCTION JOINTS SHALL BE FORMED WITH A BEVELED KEYWAY EXCEPT AT BELL JOINTS.
12. ALL BEVELED KEYWAYS SHALL BE CENTERED.
13. KEYWAY SIZE SHALL BE 2x4 EXCEPT AS FOLLOWS: KEYWAY BETWEEN THE FLOOR AND WALL SHALL BE 2x6 WHEN THE WALL IS GREATER THAN 10 INCHES WIDE.
14. 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.
15. 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.
16. ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE NOTED OR SHOWN.
17. SEE CURRENT STANDARD SPECIFICATIONS REGARDING CONCRETE FORM REMOVAL.
18. THESE CULVERT STANDARDS LABEL ALL REINFORCING STEEL WITH ENGLISH NOTATION (5a1 IS $\frac{5}{8}$ 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

19. IN THE EVENT THE SLAB THICKNESS AT THE BARREL END SECTION EXCEEDS 20 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.

INDEX FOR SINGLE CULVERT STANDARDS:

INDEX FOR SINGLE CULVERT STANDARDS (CONT'D):

SPECIFICATIONS:

DESIGN:
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 5TH ED., SERIES OF 2010.

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, 5TH ED., SERIES OF 2010:
REINFORCING STEEL IN ACCORDANCE WITH AASHTO LRFD SECTION 5, GRADE 60.
CONCRETE IN ACCORDANCE WITH AASHTO LRFD SECTION 5, f'c = 4.0 KSI.

01-2016
LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWA DOT *Highway Division*

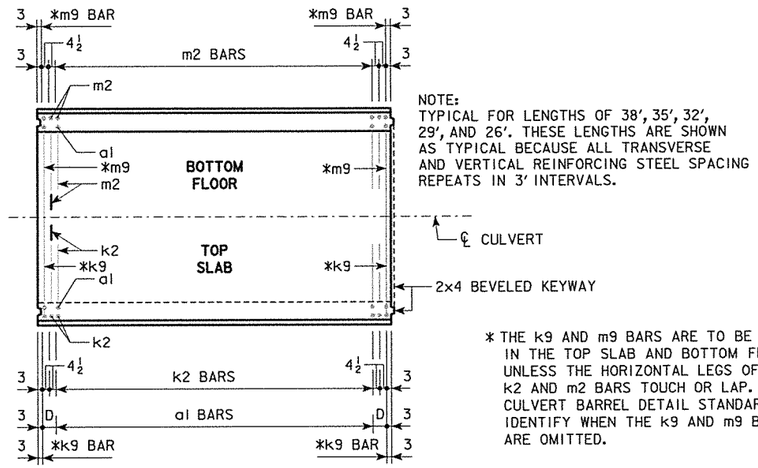
STANDARD DESIGN

SINGLE REINFORCED CONCRETE BOX CULVERTS
APRIL, 2012

INDEX & GENERAL NOTES

RCB G1-12

REVISED 10-12 - DELETED THE REFERENCE TO THE DESIGN MANUAL IN NOTE 19 PERTAINING TO DETAILS
REVISED 01-2016 - UPDATED NOTE 17 PERTAINING TO CONCRETE FORMS. (OLD NOTE: REMAINING IN PLACE 5 DAYS OR LONGER, EXCEPT MIN. CONC. FLEXURAL STRENGTH BEFORE REMOVAL SHALL BE 575 PSI).
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB G1-12 - THIS SHEET ISSUED 04-12.



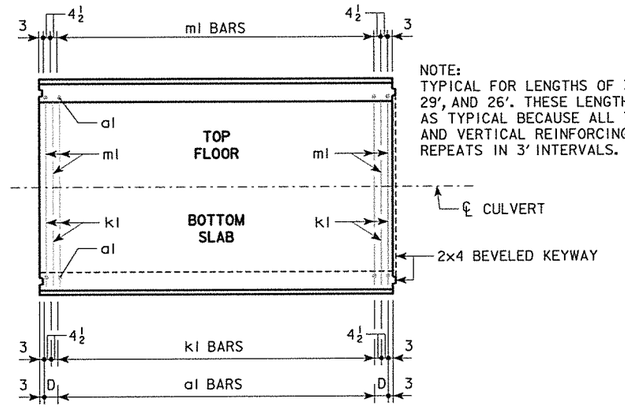
NOTE:
TYPICAL FOR LENGTHS OF 38', 35', 32', 29', AND 26'. THESE LENGTHS ARE SHOWN AS TYPICAL BECAUSE ALL TRANSVERSE AND VERTICAL REINFORCING STEEL SPACING REPEATS IN 3' INTERVALS.

℄ CULVERT

2x4 BEVELED KEYWAY

* 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.

STANDARD SECTION PLAN VIEW
(KEYWAY IS TO BE OMITTED WHEN BELL JOINTS ARE USED)



NOTE:
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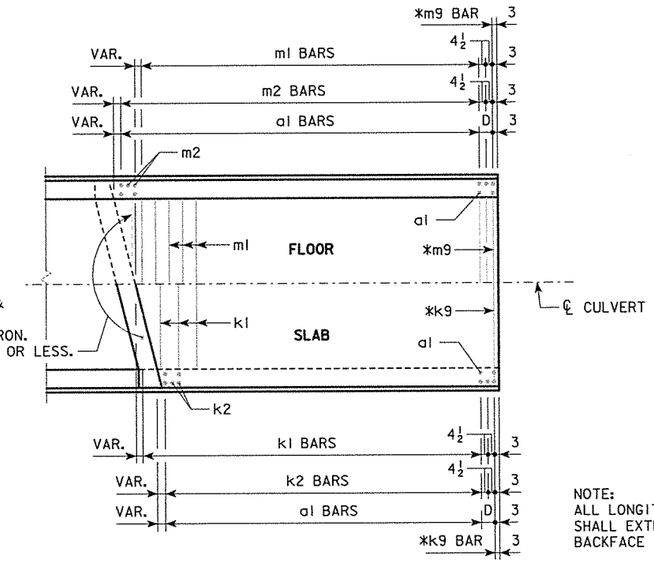
℄ CULVERT

2x4 BEVELED KEYWAY

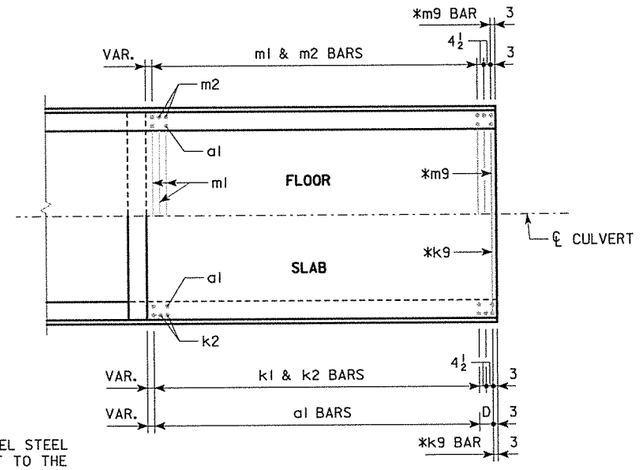
STANDARD SECTION PLAN VIEW
(KEYWAY IS TO BE OMITTED WHEN BELL JOINTS ARE USED)



CUT & RELOCATE BARS AS REQUIRED. k1 BARS ALL FILLS & k2 BARS 0' FILL ONLY. m1 BARS TO EXTEND INTO HEADWALL APRON. DISCARD CUT LENGTHS OF 2'-0 OR LESS.

℄ CULVERT

TYPICAL SKEW



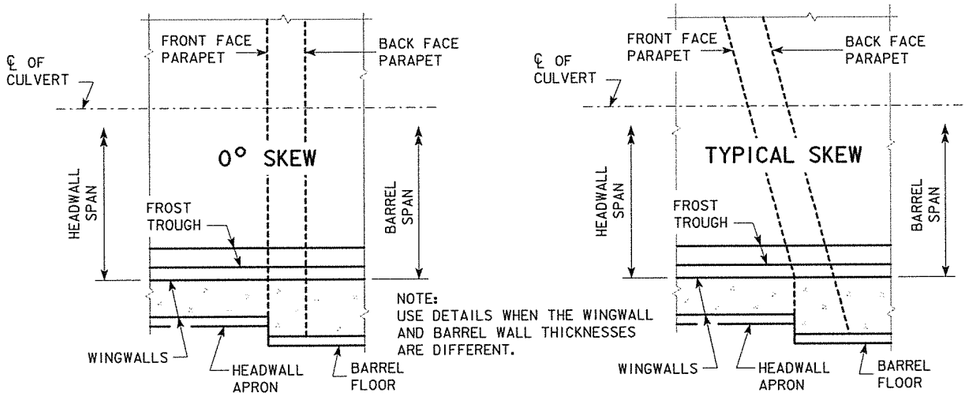
NOTE:
ALL LONGITUDINAL BARREL STEEL SHALL EXTEND AT LEAST TO THE BACKFACE OF PARAPET.

℄ CULVERT

0° SKEW

END SECTION PLAN VIEWS
(KEYWAYS NOT SHOWN)

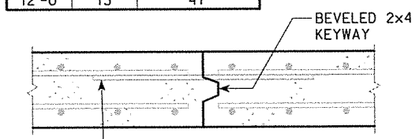
NOTE:
END SECTION DETAILS SHOWN ARE FOR A 15° SKEW BARREL. USE FOR SKEWS OF 30° & 45° BY INCREASING THE NUMBER OF TRANSVERSE REINFORCING BARS REQUIRED TO BE CUT AND RELOCATED.



NOTE:
USE DETAILS WHEN THE WINGWALL AND BARREL WALL THICKNESSES ARE DIFFERENT.

TRANSITION WALL DETAILS

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



ONE SET OF 5r1 x 3'-6 DOWEL BARS @ 1'-0 SPACING REQUIRED IN SLAB AT ALL CULVERT BARREL JOINTS, EXCEPT JOINTS WITH BELL JOINTS. SEE TABLE FOR NUMBER REQUIRED AND TOTAL WEIGHT.

TOP SLAB CONSTRUCTION JOINT DETAIL

NOTE:
DIMENSIONS LISTED ON THIS SHEET TO BE USED IN CONJUNCTION WITH DIMENSIONS AND QUANTITIES FOR BARREL SECTION SHEETS.

03-2016
LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

STANDARD DESIGN

SINGLE REINFORCED CONCRETE BOX CULVERTS

APRIL, 2012

TYPICAL CULVERT BARREL DETAILS

RCB G2-12

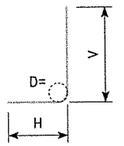
REVISED 07-14 - TRANSITION WALL DETAILS.
REVISED 03-2016 - ADDED SKEWED TRANSITION WALL DETAILS.
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB G2-12 - THIS SHEET ISSUED 04-12.

VARIABLE DIMENSIONS AND QUANTITIES FOR 10 x 6 BARREL SECTIONS

DIMENSIONS							BAR LIST																																				QUANTITIES				
							a1			b1			e1			e2			f1			f2			k1			k2						k9		m1			m2						m9		CONCRETE (CY/FT)				STEEL
FILL	S	H	A	B	C	D	SIZE	SP.	L	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	NO.	SIZE	SP.	L	SIZE	SP.	L	H	V	SIZE	L	SIZE	SP.	L	SIZE	SP.	L	H	V	SIZE	L	SLAB	FLOOR	WALLS	TOTAL	(LB/FT)
0	10	6	12	12	9	6	4	6	7'-11	4	6	24	4	12	9	4	13	8	4	12	11	4	13	8	5	6	11'-2	4	6	7'-0	3'-10	3'-2	4	11'-2	5	6	11'-8	4	6	10'-3	3'-10	6'-5	4	11'-8	0.458	0.481	0.313	1.252	156.63
1	10	6	12	12	9	6	4	6	7'-11	4	6	24	4	12	9	4	13	8	4	12	11	4	16	6	6	9	11'-2	4	6	7'-1	3'-11	3'-2	4	11'-2	5	6	11'-8	4	6	9'-9	3'-4	6'-5	4	11'-8	0.458	0.481	0.313	1.252	154.00
2	10	6	8	10	9	9	4	9	7'-5	4	6	24	5	12	9	4	16	6	4	12	11	4	16	6	6	6	11'-2	6	9	6'-6	3'-3	3'-3	6	11'-2	6	6	11'-8	6	9	9'-7	3'-4	6'-3	6	11'-8	0.316	0.407	0.313	1.036	192.42
3	10	6	8	10	9	9	4	9	7'-5	4	6	24	4	12	9	4	15	6	4	12	11	4	15	6	6	6	11'-2	6	9	6'-4	3'-2	3'-2	6	11'-2	6	6	11'-8	6	9	9'-4	3'-1	6'-3	6	11'-8	0.316	0.407	0.313	1.036	187.29
4-7	10	6	8	10	9	9	4	12	7'-5	4	6	24	4	12	9	4	14	6	4	12	11	4	14	6	6	6	11'-2	5	6	6'-0	3'-0	3'-0	5	11'-2	6	6	11'-8	5	6	9'-2	2'-11	6'-3	5	11'-8	0.316	0.407	0.313	1.036	182.05
8-10	10	6	8	10.5	9	9	4	12	7'-5	4	6	24	4	12	9	4	13	6	4	12	11	4	13	6	6	6	11'-2	5	6	5'-8	2'-10	2'-10	5	11'-2	7	6	11'-8	5	6	9'-1	2'-9	6'-4	5	11'-8	0.316	0.425	0.313	1.054	193.11
11-15	10	6	8.5	10.5	9	9	5	12	7'-6	4	6	24	4	12	9	4	13	6	4	12	11	4	12	6	7	6	11'-2	5	6	5'-8	2'-10	2'-10	5	11'-2	7	6	11'-8	5	6	8'-11	2'-7	6'-4	5	11'-8	0.334	0.425	0.313	1.072	210.55
16-20	10	6	10.5	12.5	9	6	4	6	7'-10	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	7	6	11'-2	6	9	5'-9	2'-5	3'-4	6	11'-2	8	6	11'-8	6	9	8'-11	2'-5	6'-6	6	11'-8	0.405	0.500	0.313	1.218	230.63
21-25	10	6	12	14	9	6	4	6	8'-1	4	6	24	4	12	9	4	10	6	4	12	11	4	10	6	8	6	11'-2	6	9	5'-9	2'-3	3'-6	6	11'-2	8	6	11'-8	6	9	8'-11	2'-4	6'-7	6	11'-8	0.458	0.555	0.313	1.326	245.50
26-30	10	6	14	16	9	9	4	9	8'-5	4	6	24	4	12	9	4	10	6	4	12	11	4	10	6	8	6	11'-2	6	9	6'-0	2'-4	3'-8	6	11'-2	8	6	11'-8	6	9	9'-1	2'-4	6'-9	6	11'-8	0.529	0.629	0.313	1.471	240.71
31-35	10	6	15	17.5	10	6	4	6	8'-7	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-4	6	9	6'-3	2'-6	3'-9	6	11'-4	8	6	11'-10	6	9	9'-5	2'-6	6'-11	6	11'-10	0.575	0.696	0.347	1.618	252.84
36-40	10	6	16.5	19	10.5	6	4	6	8'-10	4	6	24	4	12	9	4	11	6	4	12	11	4	11	6	8	6	11'-5	6	9	6'-6	2'-7	3'-11	6	11'-5	8	6	11'-11	6	9	9'-8	2'-8	7'-0	6	11'-11	0.635	0.757	0.366	1.758	256.50
41-45	10	6	17.5	20	11	6	4	6	9'-0	4	6	24	4	12	9	4	11	6	4	12	11	4	12	6	9	6	11'-6	6	9	6'-8	2'-8	4'-0	6	11'-6	9	6	12'-0	6	9	9'-10	2'-9	7'-1	6	12'-0	0.677	0.800	0.383	1.860	294.05
46-50	10	6	19	21	11.5	6	4	6	9'-3	4	6	24	4	12	9	4	12	6	4	12	11	4	12	6	9	6	11'-7	6	9	6'-11	2'-10	4'-1	6	11'-7	9	6	12'-1	6	9	10'-0	2'-10	7'-2	6	12'-1	0.738	0.845	0.400	1.983	297.58
51-55	10	6	20	22.5	12	6	4	6	9'-5	4	6	24	4	12	9	4	12	6	5	12	11	4	13	6	9	6	11'-8	6	9	7'-1	2'-11	4'-2	6	11'-8	9	6	12'-2	6	9	10'-4	3'-0	7'-4	6	12'-2	0.781	0.909	0.418	2.108	305.37

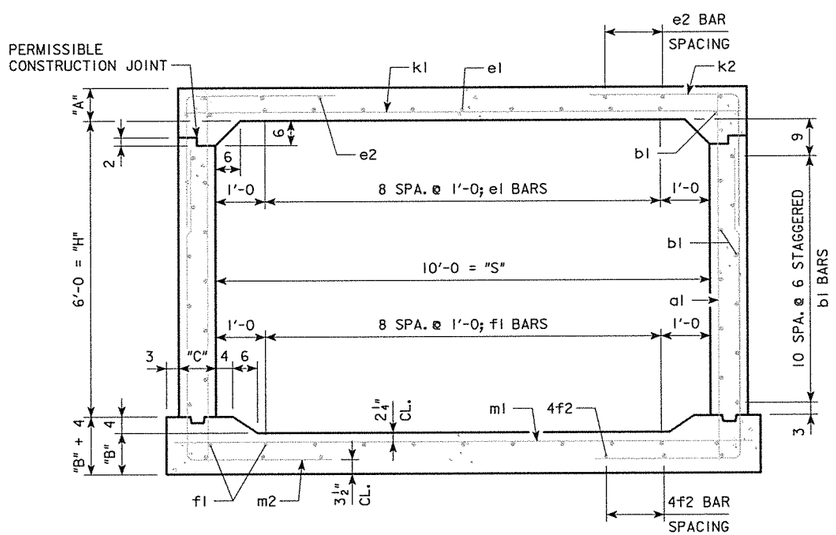
BENT BAR DETAIL

BARS	D
4	3
5	$3\frac{3}{4}$
6	$4\frac{1}{2}$



k2 & m2

NOTE:
ALL DIMENSIONS ARE OUT TO OUT.
D = PIN DIAMETER.



10 x 6 BARREL SECTION

NOTES:

1. DIMENSIONS LISTED ON THIS SHEET TO BE USED IN CONJUNCTION WITH SHEET RCB G2-12.
2. THE k2 AND m2 BARS HORIZONTAL LEGS MAY LAP IN LOW FILL SITUATIONS.
3. DIMENSIONS "A", "B", "C", "D", AND "SP." LISTED IN THE BAR LIST ARE IN INCHES.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

STANDARD DESIGN

SINGLE REINFORCED CONCRETE BOX CULVERTS

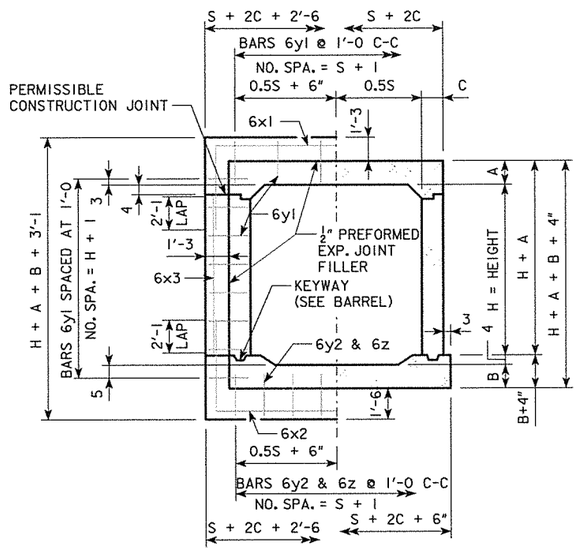
APRIL, 2012

CULVERT BARREL DETAILS

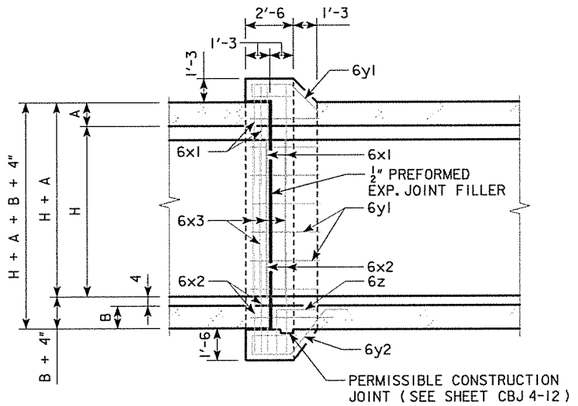
10 x 6 BARREL SECTIONS

RCB 10-6-12

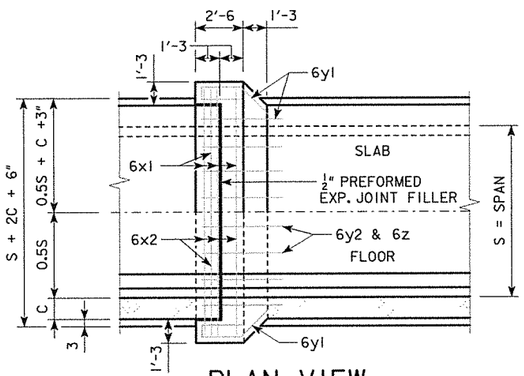
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - RCB 10-6-12 - THIS SHEET ISSUED 04-12.



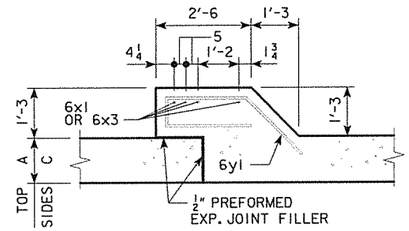
JOINT DETAIL SECTION THRU BARREL



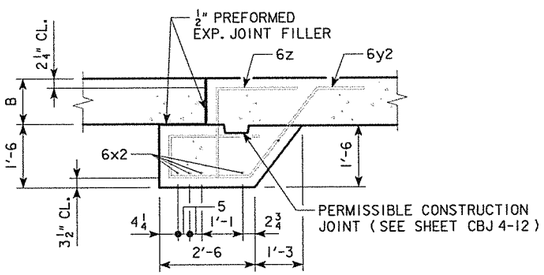
LONGITUDINAL SECTION



PLAN VIEW



TOP & SIDES - BARS 6y1



BOTTOM - BARS 6y2 & 6z

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
6x1	SLAB & WALLS		4	23'-11	144	4	23'-11	144	4	23'-11	144	4	23'-11	144	4	24'-0	144	4	24'-3	146	4	24'-5	147	4	24'-7	148	4	24'-10	149
6x2	FLOOR & WALLS		4	25'-9	155	4	27'-9	167	4	23'-9	143	4	23'-9	143	4	23'-10	143	4	24'-1	145	4	24'-3	146	4	24'-5	147	4	24'-8	148
6x3	WALLS		--	--	--	--	--	--	8	5'-2	62	8	6'-2	74	8	7'-2	86	8	8'-2	98	8	9'-2	110	8	10'-2	122	8	11'-2	134
6y1	TOP & SIDES		24	8'-0	288	26	8'-0	312	28	8'-0	336	30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481
6y2	BOTTOM		12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-6	171	12	9'-7	173	12	9'-7	173
6z	BOTTOM & FLOOR		12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71	12	3'-11	71
TOTAL WEIGHT (LB)					829			865			927			963			1000			1040			1078			1118			1156
TOTAL CONCRETE (CY)				6.2			6.5			6.8			7.1			7.4			7.8			8.1			8.5			8.8	

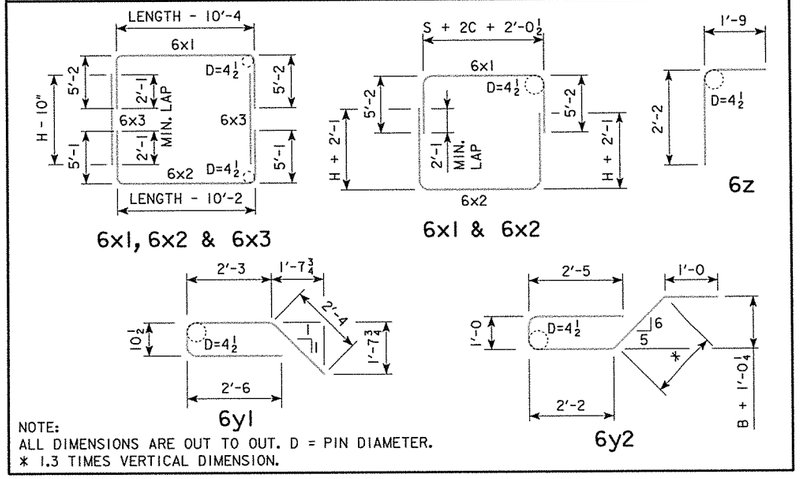
ESTIMATE OF QUANTITIES - ONE JOINT - 12' SPAN

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
6x1	SLAB & WALLS		4	26'-2	157	4	26'-2	157	4	26'-1	157	4	26'-1	157	4	26'-1	157	4	26'-3	158	4	26'-5	159	4	26'-8	160	4	26'-10	161
6x2	FLOOR & WALLS		4	28'-0	168	4	30'-0	180	4	25'-11	156	4	25'-11	156	4	25'-11	156	4	26'-1	157	4	26'-3	158	4	26'-6	159	4	26'-8	160
6x3	WALLS		--	--	--	--	--	--	8	5'-2	62	8	6'-2	74	8	7'-2	86	8	8'-2	98	8	9'-2	110	8	10'-2	122	8	11'-2	134
6y1	TOP & SIDES		26	8'-0	312	28	8'-0	336	30	8'-0	360	32	8'-0	385	34	8'-0	409	36	8'-0	433	38	8'-0	457	40	8'-0	481	42	8'-0	505
6y2	BOTTOM		14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207	14	9'-10	207
6z	BOTTOM & FLOOR		14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82	14	3'-11	82
TOTAL WEIGHT (LB)					926			962			1024			1061			1097			1135			1173			1211			1249
TOTAL CONCRETE (CY)				7.1			7.3			7.6			7.9			8.2			8.5			8.8			9.2			9.6	

CONCRETE PLACEMENT

BARREL SIZE	BARREL DIMENSION			BELL JOINT QUANTITES (CY)		
	A	B	C	FOOTING	WALLS	SLAB
10' x 4'	12.5	14	9	2.808	1.047	2.372
10' x 5'	12.5	14	9	2.808	1.332	2.372
10' x 6'	12	14	9	2.808	1.618	2.360
10' x 7'	12.5	14.5	9	2.819	1.903	2.372
10' x 8'	12	14.5	9.5	2.834	2.189	2.372
10' x 9'	12.5	14.5	11	2.877	2.474	2.419
10' x 10'	12.5	14.5	12	2.905	2.760	2.443
10' x 11'	12.5	15	13	2.946	3.045	2.467
10' x 12'	12.5	15	14.5	2.989	3.331	2.502
12' x 4'	14.5	17	10.5	3.265	1.047	2.740
12' x 5'	14.5	17	10.5	3.265	1.332	2.740
12' x 6'	14.5	17	10	3.251	1.618	2.728
12' x 7'	14.5	17	10	3.251	1.903	2.728
12' x 8'	14.5	17	10	3.251	2.189	2.728
12' x 9'	14.5	17	11	3.279	2.474	2.752
12' x 10'	14.5	17	12	3.308	2.760	2.776
12' x 12'	14.5	17.5	13.5	3.363	3.045	2.812
12' x 12'	14.5	17.5	14.5	3.392	3.331	2.835

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 RCB CULVERT BARREL DETAIL SHEETS.
2. CHANGE LENGTHS OF BARS 6x1, 6x2, 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 RCB GI-12 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.
6. BARREL FLOOR BARS m1 & m9 ARE TO BE SHORTENED 6" IN LENGTH AT BELL JOINTS.

07-13
LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT Highway Division

STANDARD DESIGN

SINGLE REINFORCED CONCRETE BOX CULVERTS

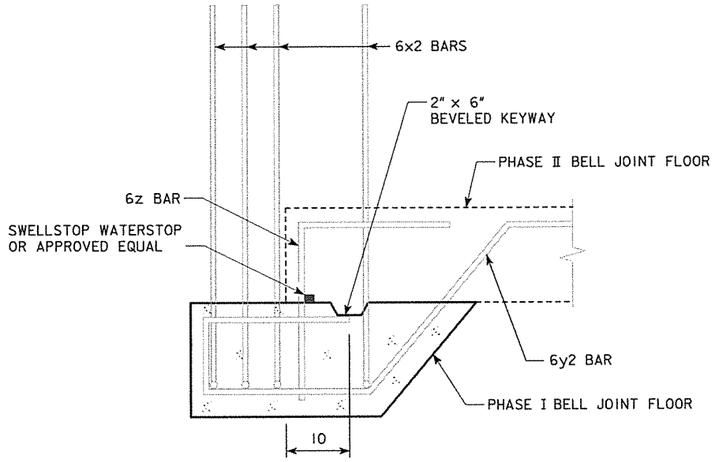
APRIL, 2012

CULVERT BELL JOINTS

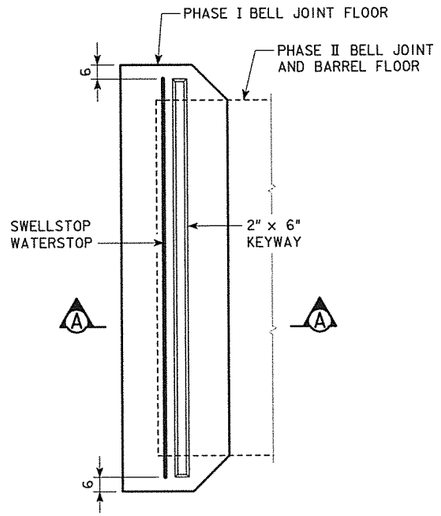
10' & 12' SPANS

CBJ 3-12

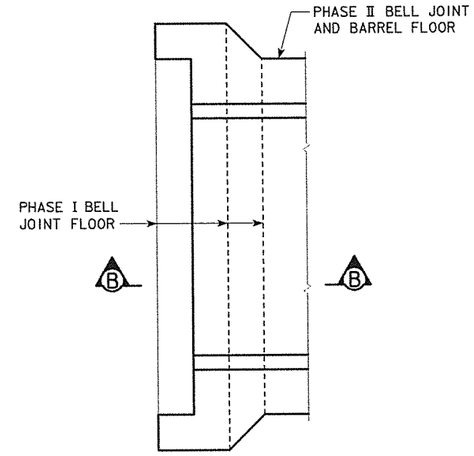
REVISED 07-13 - THE m9 BARS WERE ADDED TO NOTE NUMBER 6.
ENGLISHLRFDSIGNEDSINGLECULVERTS.DGN - CBJ 3-12 - THIS SHEET ISSUED 04-12.



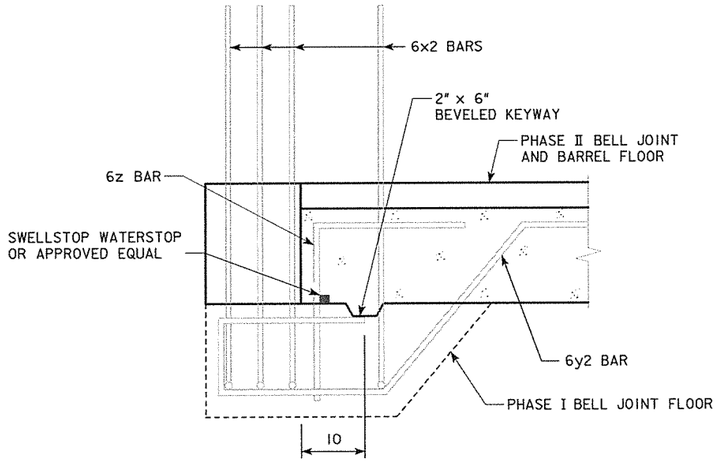
SECTION A-A
BELL JOINT AT FLOOR
COST FOR WATERSTOP CONSIDERED INCIDENTAL TO THE PROJECT.



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
COST FOR WATERSTOP CONSIDERED INCIDENTAL TO THE PROJECT.

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.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT *Highway Division*

STANDARD DESIGN

SINGLE REINFORCED CONCRETE BOX CULVERTS

APRIL, 2012

CULVERT BELL JOINTS

ALL SPANS

CBJ 4-12

Iowa Department
of Transportation
Highway Division

SINGLE SPAN
REINFORCED CONCRETE BOX CULVERT STANDARDS

GENERAL NOTES :

1. THE RCB CULVERT SECTIONS ARE DESIGNED FOR HS20-44 LIVE LOAD AND EARTH FILLS OF VARYING HEIGHTS.
2. FOR VERTICAL LOADS THE WEIGHT OF EARTH IS ASSUMED AS 140 pcf. Z = 170 FOR CRACK CONTROL.
3. LATERAL EARTH LOADS EQUIVALENT FLUID PRESSURE IS ASSUMED AS 36 psf/FT.
4. METAL BAR CHAIRS SPACED AT NOT OVER 3'-0 C-C IN EITHER DIRECTION ARE TO BE USED TO SUPPORT ALL SLAB AND FLOOR STEEL AS OUTLINED IN THE STANDARD SPECIFICATIONS (ARTICLE 2404.07).
5. THE CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR EDGE OR END OF REINFORCING BAR TO BE 2" UNLESS OTHERWISE NOTED.
6. LONGITUDINAL REINFORCING IS NOT TO EXTEND THRU THE CONSTRUCTION JOINTS, EXCEPT FOR 5ri DOWEL BARS IN SLAB.
7. ALL REINFORCING STEEL IS TO BE SECURELY WIRED IN PLACE BEFORE THE CONCRETE IS POURED (ARTICLE 2404.06).
8. FLOOR OF BARREL IS TO BE FINISHED SMOOTH. SIDES OF FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.
9. ALL EXPOSED CORNERS 90° OR SHARPER TO BE FILLETED WITH A ¾" DRESSED AND BEVELED STRIP.
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 REINFORCEMENT SUPPLIED FOR THIS STRUCTURE SHALL BE GRADE 60 REINFORCEMENT IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE DESIGN STRESSES ARE BASED ON GRADE 60 REINFORCEMENT.
12. 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	17"	21"	25"	34"	44"	56"

THIS SPLICE, IF USED WILL BE AT THE CONTRACTOR'S EXPENSE.

13. REBAR CLEARANCES WILL BE AS FOLLOWS:
    - VERTICAL, TOP 2"
    - VERTICAL, BOTTOM 3", OR 3½" IF THE OVERALL HEIGHT OF THE CULVERT IS NOT TO A FULL INCH
    - TRANSVERSE 2"
    - EDGE CLEARANCES 2" EXCEPT, TOP OF FLOOR 2¼" TO NEAR TRANSVERSE REINF BAR OR BOTTOM OF FLOOR 3½" TO NEAR TRANSVERSE REINF BAR.
14. ALL CONSTRUCTION JOINTS SHALL BE FORMED WITH A BEVELED KEYWAY EXCEPT AT BELL JOINTS.

    ALL BEVELED KEYWAYS SHALL BE CENTERED.

    KEYWAY SIZE SHALL BE 2x4 EXCEPT AS FOLLOWS : KEYWAY BETWEEN THE FLOOR AND WALL SHALL BE 2x6 WHEN THE WALL IS GREATER THAN 10 INCHES WIDE.
15. 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.

INDEX FOR CULVERT STANDARDS :

RCB 3-1-89	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 3' SPAN.
RCB 4-1-89	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 4' SPAN.
RCB 5-1-87	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 5' SPAN.
RCB 6-1-87	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 6' SPAN.
RCB 8-1-87	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 8' SPAN.
RCB 10-1-87	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 10' SPAN.
RCB 12-1-87	CULVERT BARREL DETAILS, VARIABLE DIMENSIONS AND QUANTITIES TABLE - 12' SPAN.
FWH 0-1-87	BENT BAR DETAILS, BILL OF REINFORCING FOR ONE HEADWALL, 0° SKEW - 12' & 10' SPANS.
FWH 0-2-87	BENT BAR DETAILS, BILL OF REINFORCING FOR ONE HEADWALL, 0° SKEW - 8', 6', 5', 4' & 3' SPANS.
FWH 0-3-87	DIMENSION TABLE.
FWH 0-4-87	CURTAIN WALL DETAILS AND PLAN VIEW - APRON REINFORCING, TOP & BOTTOM.
FWH 0-5-87	TYPICAL VIEW - FRONT & BACK FACE REINFORCING, SHORT & LONG WINGWALL, TYPICAL SECTION - NEAR CENTER OF APRON, TOP OF WINGWALL DETAILS AND SECTION THRU PARAPET.
FWH 15-1-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 15° SKEW - 12' & 10' SPANS.
FWH 15-2-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 15° SKEW - 8' & 6' SPANS.
FWH 15-3-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 15° SKEW - 5' SPAN.
FWH 15-4-87	DIMENSION TABLE.
FWH 15-5-87	CURTAIN WALL DETAILS AND PLAN VIEW - APRON REINFORCING, TOP & BOTTOM.
FWH 15-6-87	TYPICAL VIEW - FRONT & BACK FACE REINFORCING, SHORT & LONG WINGWALL, TYPICAL SECTION - NEAR CENTER OF APRON, TOP OF WINGWALL DETAILS AND SECTION THRU PARAPET.
FWH 30-1-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 30° SKEW - 12' & 10' SPANS.
FWH 30-2-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 30° SKEW - 8' & 6' SPANS.
FWH 30-3-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 30° SKEW - 5' SPAN.
FWH 30-4-87	DIMENSION TABLE.
FWH 30-5-87	CURTAIN WALL DETAILS AND PLAN VIEW - APRON REINFORCING, TOP & BOTTOM.
FWH 30-6-87	TYPICAL VIEW - FRONT & BACK FACE REINFORCING, SHORT & LONG WINGWALL, TYPICAL SECTION - NEAR CENTER OF APRON, TOP OF WINGWALL DETAILS AND SECTION THRU PARAPET.
FWH 45-1-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 45° SKEW - 12' & 10' SPANS.
FWH 45-2-87	BENT BAR DETAILS AND BILL OF REINFORCING FOR ONE HEADWALL, 45° SKEW - 8' & 6' SPANS.
FWH 45-3-87	BENT BAR DETAILS, BILL OF REINFORCING FOR ONE HEADWALL, 45° SKEW - 5' SPAN AND CURTAIN WALL DETAILS - ALL SPANS.
FWH 45-4-87	DIMENSION TABLE.
FWH 45-5-87	PLAN VIEW - APRON REINFORCING, TOP & BOTTOM.
FWH 45-6-87	TYPICAL VIEW - FRONT & BACK FACE REINFORCING, SHORT & LONG WINGWALL, TYPICAL SECTION - NEAR CENTER OF APRON, TOP OF WINGWALL DETAILS AND SECTION THRU PARAPET.
CBJ 1-87	CULVERT BELL JOINT DETAILS AND ESTIMATE OF QUANTITIES TABLE - 3', 4' & 5' SPANS.
CBJ 2-87	CULVERT BELL JOINT DETAILS AND ESTIMATE OF QUANTITIES TABLE - 6' & 8' SPANS.
CBJ 3-87	CULVERT BELL JOINT DETAILS AND ESTIMATE OF QUANTITIES TABLE - 10' & 12' SPANS.
CBJ 4-87	PERMISSIBLE CULVERT BELL JOINT DETAILS.

SPECIFICATIONS :

DESIGN: AASHTO SERIES OF 1983, EXCEPT AS MODIFIED IN "GENERAL NOTES 2 & 3" ABOVE.
CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION SPECIFICATION, CURRENT SERIES, PLUS CURRENT SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS.

DESIGN STRESSES :

DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SERIES OF 1983:
- REINFORCING STEEL IN ACCORDANCE WITH SECTION 8, GRADE 60.
- CONCRETE IN ACCORDANCE WITH SECTION 8, f'c = 3,500 PSI.

LATEST REVISION DATE : 04-02

APPROVED BY : Norman K. McDonald

STANDARD DESIGN

GENERAL INFORMATION

FOR
REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

MAY , 1987

RCB-G1-87

REVISED 04-02 - ADDED CBJ 4-87 STANDARD SHEET.
RCB-G1-87

6/10/2014 6:33:03 AM tsorens W:\Highway\Bridge\Cadd\VoidStandards\2009\Jan09\EnglishSignedSingleCulverts.dgn RCB-G1-87 11x17_pdf.pltcfg

BILL OF REINFORCING FOR ONE HEADWALL 15° SKEW CULVERT SPAN x CULVERT HEIGHT

LOCATION		SHAPE	BAR	12'X 12' NO.	12'X 12' LENGTH	12'X 12' WT.	12'X 10' NO.	12'X 10' LENGTH	12'X 10' WT.	12'X 8' NO.	12'X 8' LENGTH	12'X 8' WT.	12'X 6' NO.	12'X 6' LENGTH	12'X 6' WT.	10'X 12' NO.	10'X 12' LENGTH	10'X 12' WT.	10'X 10' NO.	10'X 10' LENGTH	10'X 10' WT.	10'X 8' NO.	10'X 8' LENGTH	10'X 8' WT.	10'X 6' NO.	10'X 6' LENGTH	10'X 6' WT.	10'X 5' NO.	10'X 5' LENGTH	10'X 5' WT.	10'X 4' NO.	10'X 4' LENGTH	10'X 4' WT.	BAR
FENCE ANCHOR			5fa	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	2	3'-1	7	5fa
WINGWALL, B.F.H.	L		4b1	1	45'-1	31	1	38'-3	26	1	31'-5	21	1	24'-6	16	1	45'-1	31	1	38'-3	26	1	31'-5	21	1	24'-6	16	1	21'-1	14	1	17'-8	12	4b1
WINGWALL, B.F.H.	S		4b2	1	39'-10	27	1	33'-10	23	1	27'-10	19	1	21'-10	15	1	39'-10	27	1	33'-10	23	1	27'-10	19	1	21'-10	15	1	18'-10	13	1	15'-10	11	4b2
WINGWALL, B.F.H.	L		4b3	10 VAR	12'-7 TO 43'-6	189	8 VAR	12'-8 TO 36'-8	132	6 VAR	12'-8 TO 29'-10	85	4 VAR	12'-7 TO 22'-11	47	10 VAR	12'-7 TO 43'-6	189	8 VAR	12'-8 TO 36'-8	132	6 VAR	12'-8 TO 29'-10	85	4 VAR	12'-7 TO 22'-11	47	3 VAR	12'-8 TO 19'-6	32	2 VAR	12'-8 TO 16'-1	19	4b3
WINGWALL, B.F.H.	S		4b4	10 VAR	11'-3 TO 38'-3	165	8 VAR	11'-3 TO 32'-3	116	6 VAR	11'-3 TO 26'-3	75	4 VAR	11'-3 TO 20'-3	42	10 VAR	11'-3 TO 38'-3	165	8 VAR	11'-3 TO 32'-3	116	6 VAR	11'-3 TO 26'-3	75	4 VAR	11'-3 TO 20'-3	42	3 VAR	11'-3 TO 17'-3	29	2 VAR	11'-3 TO 14'-3	17	4b4
WINGWALL, F.F.H.	L		5b5	1	45'-1	49	1	38'-3	40	1	31'-5	33	1	24'-6	26	1	45'-1	49	1	38'-3	40	1	31'-5	33	1	24'-6	26	1	21'-1	22	1	17'-8	18	5b5
WINGWALL, F.F.H.	S		5b6	1	39'-10	42	1	33'-10	35	1	27'-10	29	1	21'-10	23	1	39'-10	42	1	33'-10	35	1	27'-10	29	1	21'-10	23	1	18'-10	20	1	15'-10	17	5b6
WINGWALL, F.F.H.	L		5b7	11 VAR	9'-2 TO 43'-6	304	9 VAR	9'-2 TO 36'-8	215	7 VAR	9'-2 TO 29'-10	142	5 VAR	9'-2 TO 22'-11	84	11 VAR	9'-2 TO 43'-6	304	9 VAR	9'-2 TO 36'-7	215	7 VAR	9'-2 TO 29'-10	142	5 VAR	9'-2 TO 22'-11	84	4 VAR	9'-2 TO 19'-6	60	3 VAR	9'-2 TO 16'-1	40	5b7
WINGWALL, F.F.H.	S		5b8	11 VAR	8'-3 TO 38'-3	267	9 VAR	8'-3 TO 32'-3	190	7 VAR	8'-3 TO 26'-3	126	5 VAR	8'-3 TO 20'-3	74	11 VAR	8'-3 TO 38'-3	267	9 VAR	8'-3 TO 32'-3	190	7 VAR	8'-3 TO 26'-3	126	5 VAR	8'-3 TO 20'-3	74	4 VAR	8'-3 TO 17'-3	53	3 VAR	8'-3 TO 14'-3	35	5b8
WINGWALL, F.F.V.	L		4c1	42 VAR	2'-10 TO 14'-9	247	35 VAR	2'-10 TO 12'-9	182	28 VAR	2'-10 TO 10'-8	126	21 VAR	2'-10 TO 8'-8	81	42 VAR	2'-9 TO 14'-8	244	35 VAR	2'-9 TO 12'-8	180	28 VAR	2'-9 TO 10'-7	125	21 VAR	2'-9 TO 8'-7	79	18 VAR	2'-9 TO 7'-9	63	14 VAR	2'-9 TO 6'-6	43	4c1
WINGWALL, F.F.V.	S		4c2	37 VAR	2'-11 TO 14'-11	220	31 VAR	2'-11 TO 12'-11	164	25 VAR	2'-11 TO 10'-11	116	19 VAR	2'-11 TO 8'-11	75	37 VAR	2'-10 TO 14'-10	218	31 VAR	2'-10 TO 12'-10	162	25 VAR	2'-10 TO 10'-10	114	19 VAR	2'-10 TO 8'-10	74	16 VAR	2'-10 TO 7'-10	57	13 VAR	2'-10 TO 6'-10	42	4c2
WINGWALL, F.F.V.	L		4c3	2	13'-9	18	2	11'-9	16	2	9'-9	13	2	7'-9	10	2	13'-8	18	2	11'-8	16	2	9'-8	13	2	7'-8	10	2	6'-8	9	2	5'-8	8	4c3
WINGWALL, F.F.V.	S		4c3	1	13'-9	9	1	11'-9	8	1	9'-9	7	1	7'-9	5	1	13'-8	9	1	11'-8	8	1	9'-8	6	1	7'-8	5	1	6'-8	4	1	5'-8	4	4c3
WINGWALL, B.F.V.	L		5c4	9 VAR	2'-10 TO 5'-2	38	9 VAR	2'-10 TO 5'-2	38	9 VAR	2'-10 TO 5'-2	38	9 VAR	2'-10 TO 5'-2	38	9 VAR	2'-9 TO 5'-1	37	9 VAR	2'-9 TO 5'-1	37	9 VAR	2'-9 TO 5'-1	37	9 VAR	2'-9 TO 5'-1	37	9 VAR	2'-9 TO 5'-1	37	9 VAR	2'-9 TO 5'-1	37	5c4
WINGWALL, B.F.V.	S		5c5	6 VAR	2'-11 TO 4'-7	23	6 VAR	2'-11 TO 4'-7	23	6 VAR	2'-11 TO 4'-7	23	6 VAR	2'-11 TO 4'-7	23	6 VAR	2'-10 TO 4'-6	23	6 VAR	2'-10 TO 4'-6	23	6 VAR	2'-10 TO 4'-6	23	6 VAR	2'-10 TO 4'-6	23	6 VAR	2'-10 TO 4'-6	23	6 VAR	2'-10 TO 4'-6	23	5c5
WINGWALL, B.F.V.	L		5c6	33 VAR	9'-5 TO 18'-9	485	26 VAR	9'-5 TO 16'-8	354	19 VAR	9'-5 TO 14'-8	239	12 VAR	9'-5 TO 12'-7	138	33 VAR	9'-4 TO 18'-8	482	26 VAR	9'-4 TO 16'-7	351	19 VAR	9'-4 TO 14'-7	237	12 VAR	9'-4 TO 12'-6	137	9 VAR	9'-4 TO 11'-8	99	5 VAR	9'-4 TO 10'-6	52	5c6
WINGWALL, B.F.V.	S		5c7	31 VAR	8'-11 TO 18'-11	450	25 VAR	8'-11 TO 16'-11	337	19 VAR	8'-11 TO 14'-11	236	13 VAR	8'-11 TO 12'-11	148	31 VAR	8'-10 TO 18'-10	447	25 VAR	8'-10 TO 16'-10	335	19 VAR	8'-10 TO 14'-10	234	13 VAR	8'-10 TO 12'-10	147	10 VAR	8'-10 TO 11'-10	108	7 VAR	8'-10 TO 10'-10	72	5c7
WINGWALL, B.F.V.	L		5c8	25	10'-6	274	17	10'-6	186	10	10'-6	110	-	-	-	25	10'-6	274	17	10'-6	186	10	10'-6	110	-	-	-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V.	S		5c8	20	10'-6	219	13	10'-6	142	7	10'-6	77	-	-	-	20	10'-6	219	13	10'-6	142	7	10'-6	77	-	-	-	-	-	-	-	-	-	5c8
WINGWALL, B.F.V.	L		5c9	2	17'-8	37	2	15'-8	33	2	13'-8	29	2	11'-8	24	2	17'-7	37	2	15'-7	33	2	13'-7	28	2	11'-7	24	2	10'-7	22	2	9'-7	20	5c9
WINGWALL, B.F.V.	S		5c9	1	17'-8	18	1	15'-8	16	1	13'-8	14	1	11'-8	12	1	17'-7	18	1	15'-7	16	1	13'-7	14	1	11'-7	12	1	10'-7	11	1	9'-7	10	5c9
APRON, LONGIT., BOTT.			4d1	9	28'-4	170	9	24'-2	145	9	20'-0	120	9	15'-11	96	7	28'-4	132	7	24'-2	113	7	20'-0	94	7	15'-11	74	7	13'-10	65	7	11'-9	55	4d1
APRON, LONGIT., BOTT.	L		4d2	3	39'-4	79	3	32'-8	65	3	25'-11	52	3	19'-1	38	3	39'-4	79	3	32'-8	65	3	25'-11	52	3	19'-1	38	3	15'-10	32	3	12'-5	25	4d2
APRON, LONGIT., BOTT.	S		4d3	3	34'-11	70	3	29'-0	58	3	23'-1	47	3	17'-2	35	3	34'-11	70	3	29'-0	58	3	23'-1	47	3	17'-2	35	3	14'-3	29	3	11'-4	23	4d3
APRON, LONGIT., TOP			6f1	12	28'-4	511	12	24'-2	435	12	20'-0	360	12	15'-11	287	10	28'-4	426	10	24'-2	363	10	20'-0	300	10	15'-11	239	10	13'-10	208	10	11'-9	176	6f1
APRON, LONGIT., TOP	L		6f2	8 VAR	6'-10 TO 24'-7	189	6 VAR	7'-9 TO 20'-5	127	5 VAR	6'-0 TO 16'-3	84	3 VAR	6'-11 TO 12'-1	43	8 VAR	6'-10 TO 24'-7	189	6 VAR	7'-9 TO 20'-5	127	5 VAR	6'-7 TO 16'-3	84	3 VAR	6'-11 TO 12'-1	43	2 VAR	7'-1 TO 9'-8	25	1	7'-7	11	6f2
APRON, LONGIT., TOP	S		6f3	7 VAR	7'-1 TO 24'-6	166	5 VAR	8'-8 TO 20'-4	109	4 VAR	7'-5 TO 16'-2	71	3 VAR	6'-1 TO 12'-0	41	7 VAR	7'-1 TO 24'-6	166	5 VAR	8'-8 TO 20'-4	109	4 VAR	7'-5 TO 16'-2	71	3 VAR	6'-1 TO 12'-0	41	2 VAR	6'-7 TO 9'-7	24	1	7'-6	11	6f3
APRON, LONGIT., TOP	L		6f4	1	45'-1	71	1	38'-3	57	1	31'-5	47	1	24'-6	37	1	45'-1	71	1	38'-3	57	1	31'-5	47	1	24'-6	37	1	21'-1	32	1	17'-8	27	6f4
APRON, LONGIT., TOP	S		6f5	1	39'-10	60	1	33'-10	51	1	27'-10	42	1	21'-10	33	1	39'-10	60	1	33'-10	51	1	27'-10	42	1	21'-10	33	1	18'-10	28	1	15'-10	24	6f5
PARAPET, VERTICAL			4l1	25	6'-2	103	25	6'-2	103	25	6'-2	103	25	6'-2	103	21	6'-2	87	21	6'-2	87	21	6'-2	87	21	6'-2	87	21	6'-2	87	21	6'-2	87	4l1
PARAPET, HORIZONTAL			7j1	4	12'-9	104	4	12'-9	104	4	12'-9	104	4	12'-9	104	4	10'-8	87	4	10'-8	87	4	10'-8	87	4	10'-8	87	4	10'-8	87	4	10'-8	87	7j1
APRON, TRANS., TOP			6m1	3 VAR	14'-6 TO 14'-11	66	3 VAR	14'-2 TO 14'-7	65	3 VAR	14'-2 TO 14'-7	64	3 VAR	14'-0 TO 14'-5	64	3 VAR	12'-5 TO 12'-10	56	3 VAR	12'-1 TO 12'-6	55	3 VAR	12'-1 TO 12'-6	55	3 VAR	11'-11 TO 12'-4	55	3 VAR	11'-11 TO 12'-4	55	3 VAR	11'-11 TO 12'-4	55	6m1
APRON, TRANS., TOP			6m2	30 VAR	15'-0 TO 25'-10	920	25 VAR	14'-7 TO 23'-7	716	19 VAR	14'-7 TO 21'-4	512	14 VAR	14'-5 TO 19'-4	355	31 VAR	13'-0 TO 24'-3	867	25 VAR	12'-7 TO 21'-7	641	20 VAR	12'-7 TO 19'-9	486	14 VAR	12'-5 TO 17'-4	313	11 VAR	12'-5 TO 16'-2	236	9 VAR	12'-5 TO 15'-5	188	6m2
APRON, TRANS., TOP			6m3	3	18'-2	82	3	17'-2	77	3	16'-0	72	3	14'-11	67	3	16'-4	74	3	15'-3	69	3	14'-1	63	3	13'-1	59	3	12'-6	56	3	11'-11	54	6m3
APRON, TRANS., BOTT.			6m4	24 VAR	8'-0 TO 20'-5	512	20 VAR	8'-0 TO 18'-3	394	16 VAR	8'-0 TO 16'-1	289	12 VAR	7'-10 TO 13'-11	196	24 VAR	5'-11 TO 18'-4	437	20 VAR	6'-0 TO 16'-2	333	16 VAR	5'-11 TO 14'-0	239	12 VAR	5'-9 TO 11'-10	158	10 VAR	5'-11 TO 10'-9	125	8 VAR	5'-11 TO 9'-8	94	6m4
CURTAIN, HORIZONTAL			6p1	4	12'-11	78	4	12'-11	78	4	12'-11	78	4	12'-11	78	4	10'-10	65	4	10'-10	65	4	10'-10	65	4	10'-10	65	4	10'-10	65	4	10'-10	65	6p1
CURTAIN, HORIZONTAL	L		6p2	4	21'-9	131	4	18'-9	113	4	15'-9	95	4	12'-9	77	4	21'-9	131	4	18'-9	113	4	15'-9	95	4	12'-9	77	4	11'-3	68	4	9'-8	58	6p2
CURTAIN, HORIZONTAL	S		6p3	4	16'-10	101	4	14'-7	88	4	12'-5	75	4	10'-2	61	4	16'-10	101	4	14'-7	88	4	12'-5	75	4	10'-2	61	4	9'-1	55	4	8'-0	48	6p3
WING SLOPE, BOTH F.	L		6s1	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	2	6'-11	21	6s1
WING SLOPE, BOTH F.	S		6s2	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	2	6'-6	20	6s2
WING SLOPE, BOTH F.	L		6s3	2	41'-9	131	2	34'-7	104	2	27'-6	83	2	20'-4	61	2	41'-9	131	2	34'-7	104	2	27'-6	83	2	20'-4	61	2	16'-9	50	2	13'-2	40	6s3
WING SLOPE, BOTH F.	S		6s4	2	37'-4	112	2	31'-0	93	2	24'-8	74	2	18'-4	55	2	37'-4	112	2	31'-0	93	2	24'-8	74	2	18'-4	55	2	15'-3	46	2	12'-0	36	6s4
WING SLOPE, F.F	L		6s5	1	46'-1	72	1	38'-11	58	1	31'-9	48	1	24'-7	37	1	46'-1	72	1	38'-11	58	1	31'-9	48	1	24'-7	37	1	21'-1	32	1	17'-6	26	6s5
WING SLOPE, F.F	S		6s6	1	41'-3	65	1	34'-11	52	1	28'-8	43	1	22'-4	34	1	41'-3	65	1	34'-11	52	1	28'-8	43	1	22'-4	34	1	19'-2	29	1	15'-11	24	6s6
CURTAIN, VERT.			5t1	30	7'-11	248	26	7'-5	201	23	6'-11	166	18	6'-5	120	28	7'-11	231	24	7'-5	186	21	6'-11	152	16	6'-5	107	14	6'-5	94	11	5'-5	74	5t1

ESTIMATED QUANTITIES ONE HEADWALL	REINF. STEEL		7201 lbs.		5617 lbs.		4235 lbs.		2951 lbs.		6857 lbs.		5288 lbs.		3985 lbs.		2719 lbs.		2252 lbs.		1816 lbs.	
	CONCRETE	PARAPET △	1.8	67.0 cu. yd.	1.7	48.0 cu. yd.	1.7	35.5 cu. yd.	1.6	23.9 cu. yd.	1.7	62.5 cu. yd.	1.6	44.3 cu. yd.	1.6	32.5 cu. yd.	1.5	21.7 cu. yd.	1.5	17.7 cu. yd.	1.5	14.2 cu. yd.
		WINGWALLS	23.3		14.1		9.6		5.3		23.3		14.1		9.6		5.3		3.9		2.7	
		FOOTINGS	41.9		32.2		24.2		17.0		37.5		28.6		21.3		14.9		12.3		10.0	

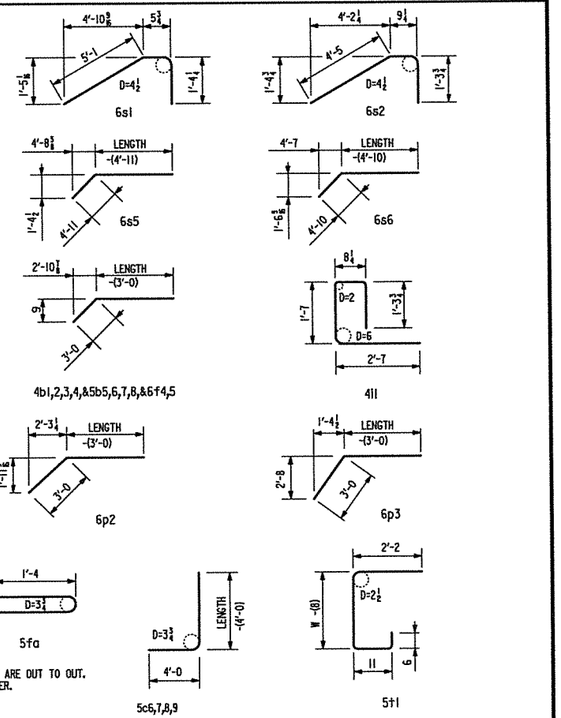
△ NOTE: INCLUDES TOP OF WINGWALL QUANTITIES. WEIGHT OF BARS OVER 40'-0 LONG INCLUDE AN ALLOWANCE OF 2'-0 FOR LAP.

SUBSCRIPT L DENOTES LONG WING.
SUBSCRIPT S DENOTES SHORT WING.

NOTES:

1. SEE DRAWING RCB-G1-87 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

BENT BAR DETAILS



NOTE:
ALL DIMENSIONS ARE OUT TO OUT.
D = PIN DIAMETER.

HEADWALL NOTES:

THIS HEADWALL IS BASED ON A 3:1 SLOPE NORMAL TO CENTERLINE OF ROADWAY.

THE SIDES OF THE FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.

ALL EXPOSED CORNERS OF 90° OR SHARPER ARE TO BE FILLETED WITH A 3/4" DRESSED AND BEVELED STRIP.

ALL REINFORCING IS TO BE SECURELY WIRED IN PLACE BEFORE THE CONCRETE IS POURED. ALL SLAB AND FLOOR REINFORCING STEEL IS TO BE SUPPORTED BY BAR CHAIRS AT INTERVALS OF NOT MORE THAN 3'-0 IN EITHER DIRECTION AS OUTLINED IN THE STANDARD SPECIFICATIONS.

CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. CLEARANCE TO THE BOTTOM ENDS OF VERTICAL BARS SHALL BE 3 INCHES.

CONCRETE QUANTITIES ARE ESTIMATED FROM BACK OF PARAPET.

HORIZONTAL TAILS OF BARS "b" & "a" ESTIMATED TO EXTEND 2'-0 BEYOND BACK OF PARAPET (INTO END OF BARREL). LONGITUDINAL BARS "c", "6f1", "6f4" AND "6f5" ESTIMATED TO PROJECT INTO END SECTION OF BARREL A MINIMUM OF 2'-0 BEYOND BACK OF PARAPET.

THE "LENGTH" COLUMN REFLECTS TOTAL NUMBER OF FEET NECESSARY TO MEET THESE REQUIREMENTS.

LATEST REVISION DATE : 1-1-98

APPROVED BY: William A. Dunlap

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

MAY , 1987

FWH 15-1-87

REVISED 1/98; BEND DIMENSIONS OF 4l1 BAR CHANGED.
FWH 15-1-87

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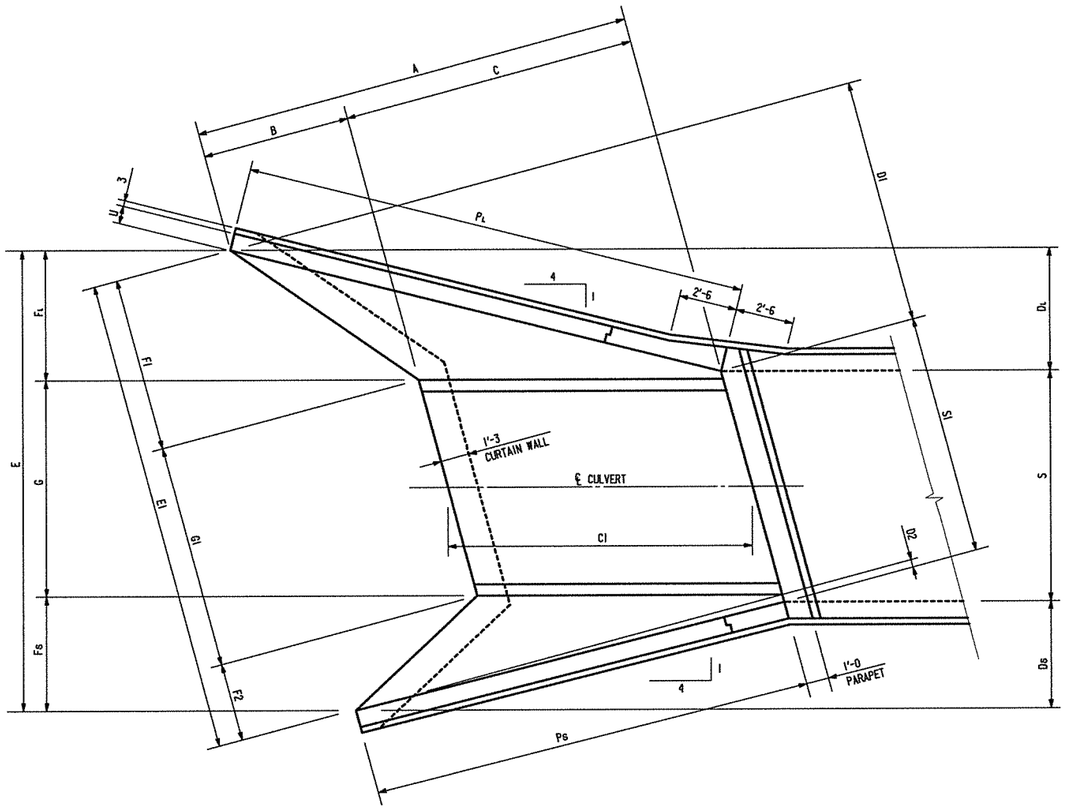

PLAN VIEW

DIMENSION TABLE

S X H	12' X 12'	12' X 10'	12' X 8'	12' X 6'	10' X 12'	10' X 10'	10' X 8'	10' X 6'	10' X 5'	10' X 4'	8' X 10'	8' X 8'	S X H
A	37'-0	31'-0	25'-0	19'-0	37'-0	31'-0	25'-0	19'-0	16'-0	13'-0	31'-0	25'-0	A
B	12'-4	10'-4	8'-4	6'-4	12'-4	10'-4	8'-4	6'-4	5'-4	4'-4	10'-4	8'-4	B
C	24'-8	20'-8	16'-8	12'-8	24'-8	20'-8	16'-8	12'-8	10'-8	8'-8	20'-8	16'-8	C
C1	25'-6 1/2	21'-4 3/4	17'-3	13'-1 3/8	25'-6 1/2	21'-4 3/4	17'-3	13'-1 3/8	11'-0 1/2	8'-11 5/8	21'-4 3/4	17'-3	C1
DL	10-3	8'-7 1/4	6'-11 1/4	5'-3	10'-3	8'-7 1/4	6'-11 1/4	5'-3	4'-5	3'-7	8'-7 1/4	6'-11 1/4	DL
Ds	8'-11 3/4	7'-6	6'-0 3/4	4'-7 1/2	8'-11 3/4	7'-6	6'-0 3/4	4'-7 1/2	3'-10 5/8	3'-1	7'-6	6'-0 3/4	Ds
D1	20'-6 1/2	17'-2	13'-10 1/2	10'-6 5/8	20'-6	17'-2	13'-10 1/2	10'-6 5/8	8'-10 5/8	7'-2 5/8	17'-2	13'-10 1/2	D1
D2	0'-7	0'-6	0'-5	0'-3	0'-7	0'-6	0'-5	0'-3	0'-3	0'-2 5/8	0'-6	0'-5	D2
E	31'-2	28'-1	25'-0	21'-10	29'-2	26'-1	23'-0	19'-10	18'-3	16'-9	24'-1	21'-0	E
E1	32'-4	29'-1	25'-10 5/8	22'-7 3/8	30'-3	27'-0	23'-9 3/8	20'-7	18'-11	17'-4	24'-11	21'-8	E1
FL	10'-7	8'-11	7'-3	5'-7	10'-7	8'-11	7'-3	5'-7	4'-9	3'-11	8'-11	7'-3	FL
Fs	9'-3	7'-10	6'-4	4'-11	9'-3	7'-10	6'-4	4'-11	4'-2	3'-5	7'-10	6'-4	Fs
F1	14'-3	12'-0	9'-9	7'-6	14'-3	12'-0	9'-9	7'-6	6'-4	5'-2	12'-0	9'-9	F1
F2	6'-4	5'-4	4'-4	3'-5	6'-4	5'-4	4'-4	3'-5	2'-11	2'-5	5'-4	4'-4	F2
G	11'-4	11'-4	11'-4	11'-4	9'-4	9'-4	9'-4	9'-4	9'-4	9'-4	7'-4	7'-4	G
G1	11'-8	11'-8	11'-8	11'-8	9'-8	9'-8	9'-8	9'-8	9'-8	9'-8	7'-7	7'-7	G1
G2	12'-11	12'-11	12'-11	12'-11	10'-10	10'-10	10'-10	10'-10	10'-10	10'-10	8'-9	8'-9	G2
G3	18'-10	15'-10	12'-10	9'-9	18'-10	15'-10	12'-10	9'-9	8'-3	6'-9	15'-10	12'-10	G3
G4	19'-6	16'-0	13'-0	9'-9	19'-6	16'-0	13'-0	9'-9	8'-3	6'-9	16'-0	13'-0	G4
G5	13'-10	11'-7	9'-5	7'-2	13'-10	11'-7	9'-5	7'-2	6'-1	4'-11	11'-7	9'-5	G5
G6	14'-11	12'-4	10'-1	7'-9	14'-11	12'-4	10'-1	7'-9	6'-7	5'-6	12'-4	10'-1	G6
G7	0'-2	0'-8	0'-8	0'-10	0'-2	0'-8	0'-8	0'-10	0'-10	0'-10	0'-8	0'-8	G7
G8	0'-3	0'-7	0'-7	0'-9	0'-3	0'-7	0'-7	0'-9	0'-9	0'-9	0'-7	0'-7	G8
S1	12'-5	12'-5	12'-5	12'-5	10'-4	10'-4	10'-4	10'-4	10'-4	10'-4	8'-3	8'-3	S1
PL	42'-3	35'-5	28'-7	21'-8	42'-3	35'-5	28'-7	21'-8	18'-3	14'-10	35'-5	28'-7	PL
Ps	37'-0	31'-0	25'-0	19'-0	37'-0	31'-0	25'-0	19'-0	16'-0	13'-0	31'-0	25'-0	Ps
RL	44'-1	36'-11	29'-9	22'-7	44'-1	36'-11	29'-9	22'-7	19'-0	15'-5	36'-11	29'-9	RL
Rs	39'-0	32'-8	26'-4	20'-0	39'-0	32'-8	26'-4	20'-0	16'-10	13'-8	32'-8	26'-4	Rs
T	1'-2	1'-2	1'-2	1'-2	1'-1	1'-1	1'-1	1'-1	1'-1	1'-1	11"	11"	T
U	12"	10"	10"	9"	12"	10"	10"	9"	9"	9"	10"	10"	U
W	5'-0	4'-6	4'-0	3'-6	5'-0	4'-6	4'-0	3'-6	3'-6	3'-6	4'-6	4'-0	W

S X H	8' X 6'	8' X 5'	8' X 4'	6' X 8'	6' X 6'	6' X 5'	6' X 4'	6' X 3'	5' X 5'	5' X 5'	5' X 4'	5' X 3'	S X H
A	19'-0	16'-0	13'-0	25'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	A
B	6'-4	5'-4	4'-4	8'-4	6'-4	5'-4	4'-4	3'-4	6'-4	5'-4	4'-4	3'-4	B
C	12'-8	10'-8	8'-8	16'-8	12'-8	10'-8	8'-8	6'-8	12'-8	10'-8	8'-8	6'-8	C
C1	13'-1 3/8	11'-0 1/2	8'-11 5/8	17'-3	13'-1 3/8	11'-0 1/2	8'-11 5/8	6'-10 1/2	13'-1 3/8	11'-0 1/2	8'-11 5/8	6'-10 7/8	C1
DL	5'-3	4'-5	3'-7	6'-11 1/4	5'-3	4'-5 1/4	3'-7 1/4	2'-9	5'-3	4'-5 1/4	3'-7 1/4	2'-9	DL
Ds	4'-7 1/2	3'-10 5/8	3'-1	6'-0 3/4	4'-7 1/2	3'-10 5/8	3'-1	2'-5 5/8	4'-7 1/2	3'-10 5/8	3'-1	2'-5 5/8	Ds
D1	10'-6 5/8	8'-10 5/8	7'-2 5/8	13'-10 1/2	10'-6 5/8	8'-10 5/8	7'-2 5/8	5'-6 5/8	10'-6 5/8	8'-10 5/8	7'-2 5/8	5'-6 5/8	D1
D2	0'-3	0'-3	0'-2 5/8	0'-5	0'-3	0'-3	0'-2 5/8	0'-2	0'-3	0'-3	0'-2 5/8	0'-2	D2
E	17'-10 1/2	16'-3 3/4	14'-9	19'-0	15'-10 1/2	14'-3	12'-9	11'-2 1/4	14'-10 1/2	13'-3 3/4	11'-9	10-2 1/8	E
E1	18'-6 1/8	16'-10 3/4	15'-3 3/8	19'-8	16'-5 1/8	14'-9 1/4	13'-2 1/2	11'-7 1/8	15'-4 1/8	13'-9 1/2	12'-2 1/8	10'-6 5/8	E1
FL	5'-7 1/4	4'-9 1/4	3'-11 1/4	7'-3 1/4	5'-7 1/4	4'-9 1/4	3'-11 1/4	3'-1 1/4	5'-7 1/4	4'-9 1/4	3'-11 1/4	3'-1 1/4	FL
Fs	4'-11 1/4	4'-2 3/8	3'-5 5/8	6'-4 3/4	4'-11 1/4	4'-2 5/8	3'-5 5/8	2'-9 3/8	4'-11 1/4	4'-2 3/8	3'-5 5/8	2'-9 3/8	Fs
F1	7'-6	6'-4 3/4	5'-2 1/8	9'-9 3/8	7'-6	6'-4 3/4	5'-2 1/8	4'-1 7/8	7'-6	6'-4 3/4	5'-2 1/8	4'-1 3/8	F1
F2	3'-5	2'-11 1/4	2'-5 5/8	4'-4 3/8	3'-5	2'-11 1/4	2'-5 5/8	1'-11 1/2	3'-5	2'-11 1/4	2'-5 5/8	1'-11 1/2	F2
G	7'-4	7'-4	7'-4	5'-4	5'-4	5'-4	5'-4	4'-4	4'-4	4'-4	4'-4	4'-4	G
G1	7'-7 1/8	7'-7 1/8	7'-7 1/8	5'-6 1/4	5'-6 1/4	5'-6 1/4	5'-6 1/4	5'-6 1/4	4'-5 3/8	4'-5 3/8	4'-5 3/8	4'-5 3/8	G1
G2	8'-9 3/8	8'-9 3/8	8'-9 1/4	6'-8 1/8	6'-8 1/8	6'-8 1/8	6'-8 1/8	6'-8 1/8	5'-8 1/8	5'-8 1/8	5'-8	5'-7 1/8	G2
G3	9'-9 3/8	8'-3 1/8	6'-9 3/8	12'-10	9'-9 3/8	8'-3 1/8	6'-9 3/8	5'-3 1/2	9'-9 3/8	8'-3 1/8	6'-9 3/8	5'-3 1/2	G3
G4	9'-9 3/8	8'-3 1/8	6'-9 3/8	13'-0 1/8	9'-9 3/8	8'-3 1/8	6'-9 3/8	5'-3 1/2	9'-9 3/8	8'-3 1/8	6'-9 3/8	5'-3 1/2	G4
G5	7'-2 1/8	6'-1	4'-11 1/8	9'-5	7'-2 1/8	6'-1	4'-11 1/8	3'-10 3/8	7'-2 1/8	6'-1	4'-11 1/8	3'-10 3/8	G5
G6	7'-9 1/8	6'-7 1/8	5'-6 1/8	10'-1 3/4	7'-9 1/8	6'-7 1/8	5'-6 1/8	4'-5 1/4	7'-9 1/8	6'-7 1/8	5'-6 1/8	4'-5 1/4	G6
G7	0'-10 3/8	0'-10 3/8	0'-10 1/2	0'-8 1/8	0'-10 3/8	0'-10 3/8	0'-10 3/8	0'-10 3/8	0'-10 3/8	0'-10 3/8	0'-10 1/2	0'-10 3/8	G7
G8	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-7 1/2	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-9 1/4	0'-9 1/4	G8
S1	8'-3 1/8	8'-3 1/8	8'-3 1/8	6'-2 1/2	6'-2 1/2	6'-2 1/2	6'-2 1/2	6'-2 1/2	5'-2 1/2	5'-2 1/2	5'-2 1/2	5'-2 1/2	S1
PL	21'-8 3/8	18'-3 3/8	14'-10 3/8	28'-7 1/8	21'-8 3/8	18'-3 3/8	14'-10 3/8	11'-5 1/4	21'-8 3/8	18'-3 3/8	14'-10 3/8	11'-5 1/4	PL
Ps	19'-0	16'-0	13'-0	25'-0	19'-0	16'-0	13'-0	10'-0	19'-0	16'-0	13'-0	10'-0	Ps
RL	22'-7 3/8	19'-0 3/4	15'-5 1/8	29'-9 3/8	22'-7 3/8	19'-0 3/4	15'-5 1/8	11'-11	22'-7 3/8	19'-0 3/4	15'-5 1/8	11'-11	RL
Rs	20'-0 3/8	16'-10 3/8	13'-8 1/2	26'-4 1/8	20'-0 3/8	16'-10 3/8	13'-8 1/2	10'-6 1/2	20'-0 3/8	16'-10 3/8	13'-8 1/2	10'-6 1/2	Rs
T	11"	11"	11"	11"	11"	11"	11"	11"	11"	11"	11"	11"	T
U	9"	9"	9"	10"	9"	9"	9"	9"	9"	9"	9"	9"	U
W	3'-6	3'-6	3'-6	4'-0	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	3'-6	W

NOTES:

1. SEE DRAWING RCB-G1-87 FOR GENERAL INFORMATION, SPECIFICATIONS, AND DESIGN STRESSES.

LATEST REVISION DATE :

William A. Lundquist
APPROVED BY :

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

MAY , 1987

FWH 15-4-87

FWH 15-4-87

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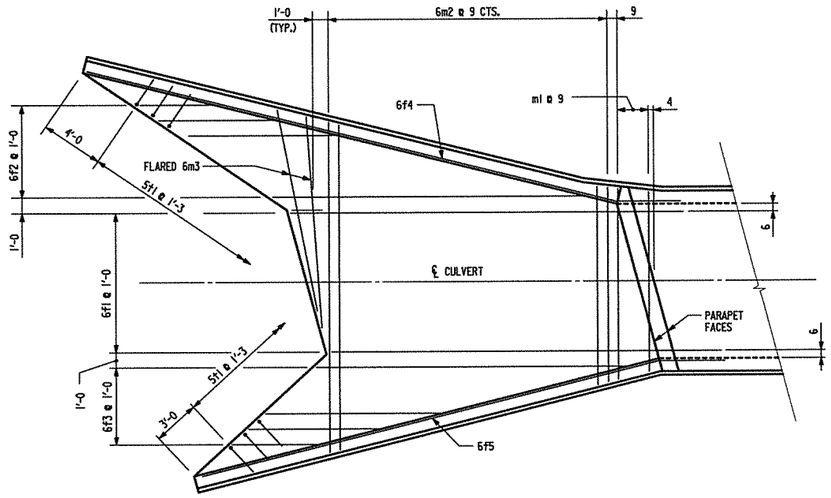
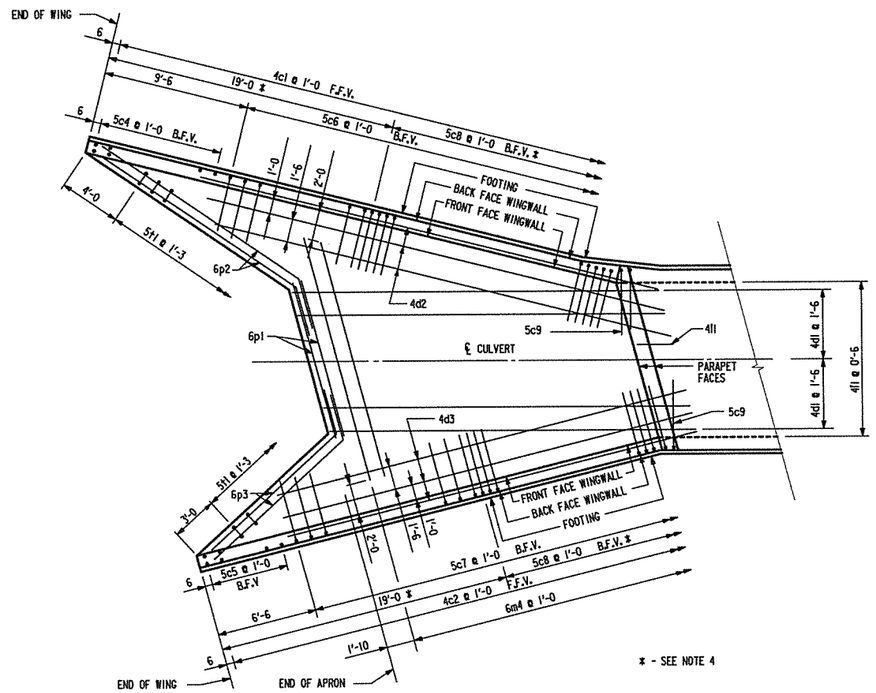
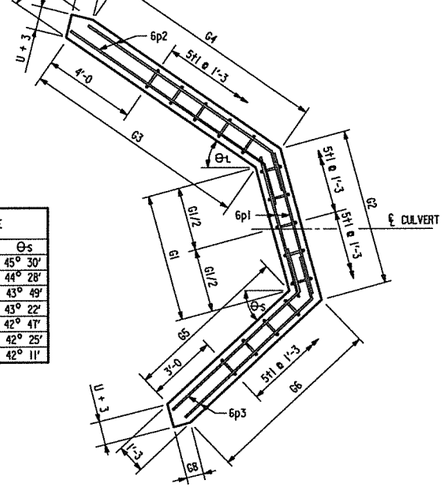


PLAN VIEW - TOP OF APRON REINFORCING BARS

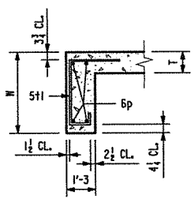


PLAN VIEW - BOTTOM OF APRON REINFORCING BARS



CULVERT HEIGHT (H)	ANGLE	
	θL	θS
3'	35° 57'	45° 30'
4'	35° 25'	44° 28'
5'	35° 03'	43° 49'
6'	34° 49'	43° 22'
8'	34° 30'	42° 47'
10'	34° 18'	42° 25'
12'	34° 11'	42° 11'

PLAN



SECTION

CURTAIN WALL DETAILS

NOTES :

1. BAR SPACINGS AND POSITIONS SHOWN ARE SIMILAR FOR ALL SIZES OF HEADWALLS IN THIS STANDARD.
2. WINGWALL BARS CONSISTENTLY REFERENCED FROM END OF WING FOR ALL HEADWALLS.
3. TOP TRANSVERSE FLOOR BARS ARE REFERENCED APPROXIMATELY 4" FROM THE BACK OF THE PARAPET FOR ALL HEADWALLS.
4. THERE ARE NO 5c8 BARS IN THE 3', 4', 5', AND 6' HEIGHT HEADWALL.
5. FOR REINFORCING IN CURTAIN WALL SEE CURTAIN WALL DETAILS ON THIS DWG.
6. FOR DIMENSION TABLE SEE DWG. FWH 15-4-87.

LATEST REVISION DATE :

APPROVED BY : William A. Lundquist

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

MAY , 1987

FWH 15-5-87

FWH 15-5-87

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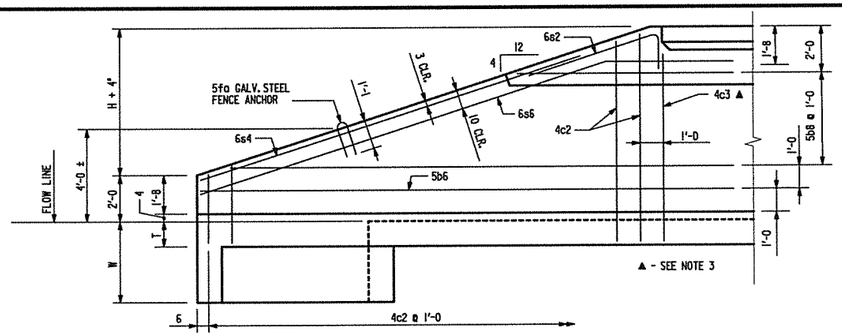
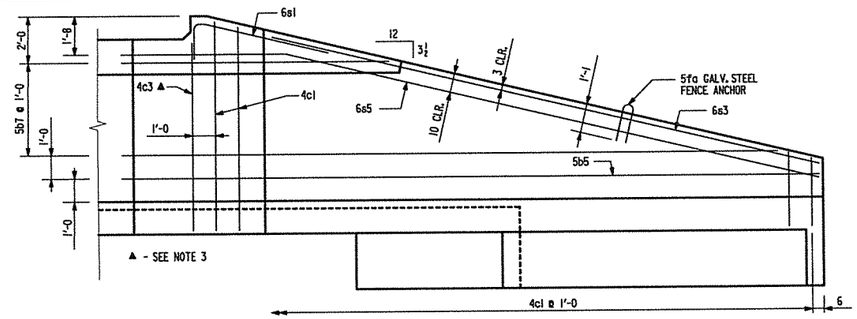
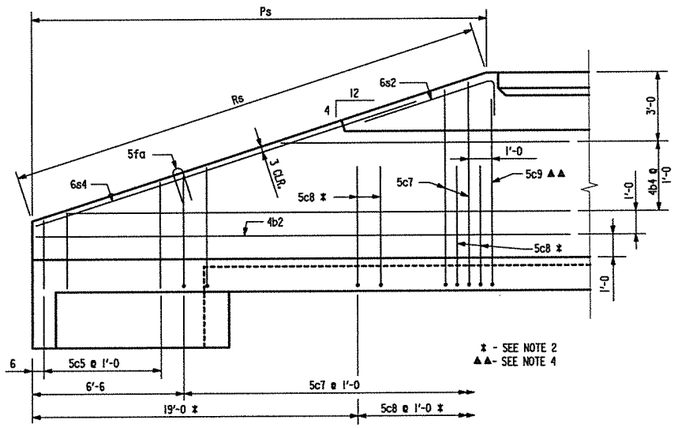


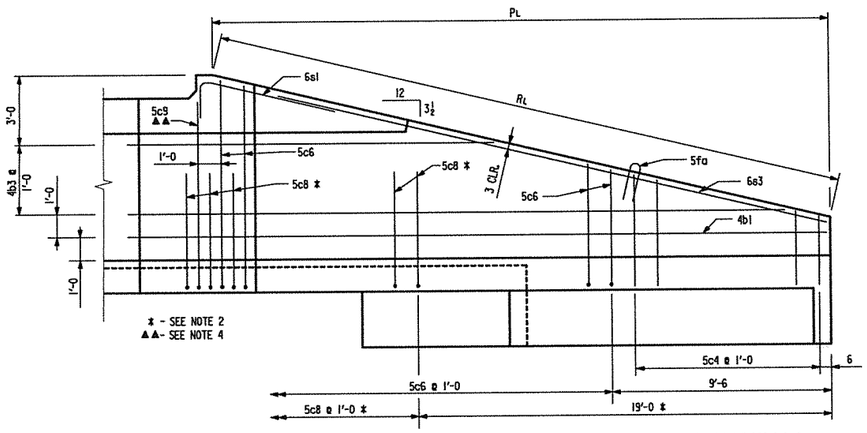
TYPICAL VIEW - FRONT FACE REINFORCING SHORT WINGWALL



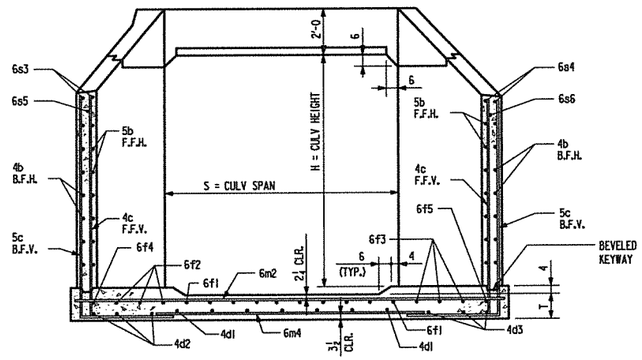
TYPICAL VIEW - FRONT FACE REINFORCING LONG WINGWALL



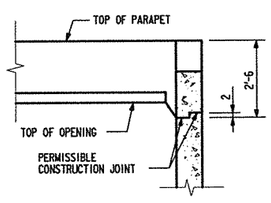
TYPICAL VIEW - BACK FACE REINFORCING SHORT WINGWALL

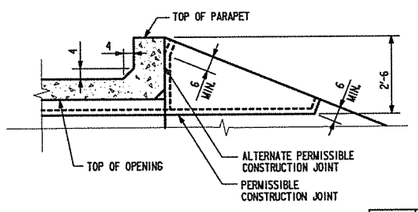


TYPICAL VIEW - BACK FACE REINFORCING LONG WINGWALL

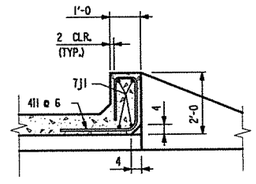


TYPICAL SECTION - NEAR CENTER OF APRON





TOP OF WINGWALL DETAILS



SECTION THRU PARAPET

NOTES :

1. BAR SPACINGS AND POSITIONS SHOWN ARE SIMILAR FOR ALL SIZES OF HEADWALLS IN THIS STANDARD.
2. NOT APPLICABLE TO HEADWALL HEIGHTS OF H=3', H=4', H=5' AND H=6'.
3. TWO 4c3 BARS - LONG WINGWALL, ONE 4c3 BAR - SHORT WINGWALL.
4. TWO 5c9 BARS - LONG WINGWALL, ONE 5c9 BAR - SHORT WINGWALL.
5. FOR DIMENSION TABLE SEE DWG. FWH 15-4-87.

LATEST REVISION DATE : 1-1-98

APPROVED BY : Vivian A. Lindquist

STANDARD DESIGN

FLARED WING HEADWALLS

FOR
REINFORCED CONCRETE BOX CULVERTS

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

MAY , 1987

FWH 15-6-87

REVISED 1/98; CLEAR DISTANCE TO 4I1 BAR CHANGED.
FWH 15-6-87

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