FLUME NOTES:

REINFORCING BAR CLEARANCES WILL BE AS FOLLOWS:
EDGE CLEARANCES: 2" EXCEPT
TOP OF FLOOR 2¼" TO NEAR TRANSV. REINF. BAR
BOTTOM OF FLOOR 3½" TO NEAR TRANSV. REINF. BAR
END CLEARANCES:
VERTICAL TOP 2"
VERTICAL BOTTOM 3½"
TRANSVERSE 2"

FLOOR OF FLUME IS TO BE FINISHED SMOOTH. SIDES OF FOOTING ARE TO BE FORMED TO INSURE CORRECT LINE AND GRADE.

ALL FLOOR REINFORCING STEEL IS TO BE SUPPORTED AT INTERVALS OF NOT MORE THAN 3'-0 IN EITHER DIRECTION AS OUTLINED IN THE STANDARD SPECIFICATIONS.

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
MINIMUM SPLICE LENGTH	21"	26"	31"	41"	54"

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

BEVELED 2x4 KEYWAYS ARE TO BE USED FOR 9" AND 10" WALLS AND 2x6 KEYWAYS ARE USED FOR 11" AND GREATER WALL THICKNESS.

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.

GENERAL CONSIDERATIONS:

THE FLUME STANDARDS, WHEN USED IN COMBINATION WITH A PROPERLY COMPLETED SITUATION PLAN AND THE APPROPRIATE STANDARD SHEET 1070 SERIES WILL PROVIDE STRUCTURAL PLANS AND THE FLUME "ESTIMATED PROJECT QUANTITIES".

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.

TABLE OF FLUME DIMENSIONS

S x H	K	M	V (3:1)	V (4:1)	L	N	O	P	R	T	U
3'x3'	9'-6	2'-3	2'-4½	2'-3⅞	13'-0	2'-0	1'-1	3'-6	0'-9	0'-11	0'-9
4'x4'	11'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	0'-11	0'-9
5'x3'	11'-6	2'-3	2'-4½	2'-3⅞	13'-0	2'-0	1'-1	3'-6	0'-9	0'-11	0'-9
5'x4'	12'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	0'-11	0'-9
5'x5'	12'-6	3'-9	3'-11⅜	3'-10⅜	15'-0	2'-6	2'-7	3'-6	1'-0	0'-11	0'-9
5'x6'	13'-0	4'-6	4'-8⅞	4'-7⅝	16'-0	2'-9	3'-5	3'-6	1'-3	0'-11	0'-9
6'x3'	12'-6	2'-3	2'-4½	2'-3⅞	13'-0	2'-0	1'-1	3'-6	0'-9	0'-11	0'-9
6'x4'	13'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	0'-11	0'-9
6'x5'	13'-6	3'-9	3'-11⅜	3'-10⅜	15'-0	2'-6	2'-7	3'-6	1'-0	0'-11	0'-9
6'x6'	14'-0	4'-6	4'-8⅞	4'-7⅝	16'-0	2'-9	3'-5	3'-6	1'-3	0'-11	0'-9
6'x7'	14'-6	5'-3	5'-6⅜	5'-5	17'-0	3'-0	4'-2	3'-9	1'-3	0'-11	0'-9
6'x8'	15'-0	6'-0	6'-3⅞	6'-2¼	18'-0	3'-3	4'-11	4'-0	1'-3	0'-11	0'-10
8'x4'	15'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	1'-0	0'-9
8'x5'	15'-6	3'-9	3'-11⅜	3'-10⅜	15'-0	2'-6	2'-7	3'-6	1'-0	1'-0	0'-9
8'x6'	16'-0	4'-6	4'-8⅞	4'-7⅝	16'-0	2'-9	3'-5	3'-6	1'-3	1'-0	0'-9
8'x7'	16'-6	5'-3	5'-6⅜	5'-5	17'-0	3'-0	4'-2	3'-9	1'-3	1'-0	0'-9
8'x8'	17'-0	6'-0	6'-3⅞	6'-2¼	18'-0	3'-3	4'-11	4'-0	1'-3	1'-0	0'-10
8'x9'	17'-6	6'-9	7'-1⅜	6'-11½	19'-0	3'-6	5'-8	4'-3	1'-3	1'-0	0'-10
8'x10'	18'-0	7'-6	7'-10⅞	7'-8¾	20'-0	3'-9	6'-6	4'-6	1'-3	1'-0	0'-10
10'x4'	17'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	1'-1	0'-9
10'x5'	17'-6	3'-9	3'-11⅜	3'-10⅜	15'-0	2'-6	2'-7	3'-6	1'-0	1'-1	0'-9
10'x6'	18'-0	4'-6	4'-8⅞	4'-7⅝	16'-0	2'-9	3'-5	3'-6	1'-3	1'-1	0'-9
10'x7'	18'-6	5'-3	5'-6⅜	5'-5	17'-0	3'-0	4'-2	3'-9	1'-3	1'-1	0'-9
10'x8'	19'-0	6'-0	6'-3⅞	6'-2¼	18'-0	3'-3	4'-11	4'-0	1'-3	1'-1	0'-10
10'x9'	19'-6	6'-9	7'-1⅜	6'-11½	19'-0	3'-6	5'-8	4'-3	1'-3	1'-1	0'-10
10'x10'	20'-0	7'-6	7'-10⅞	7'-8¾	20'-0	3'-9	6'-6	4'-6	1'-3	1'-1	0'-10
10'x11'	20'-6	8'-3	8'-8⅜	8'-6	21'-0	4'-0	7'-3	4'-9	1'-3	1'-1	0'-11
10'x12'	21'-0	9'-0	9'-5⅞	9'-3⅜	22'-0	4'-3	8'-0	5'-0	1'-3	1'-1	1'-0
12'x4'	19'-0	3'-0	3'-2	3'-1⅛	14'-0	2'-3	1'-10	3'-6	1'-0	1'-2	0'-9
12'x5'	19'-6	3'-9	3'-11⅜	3'-10⅜	15'-0	2'-6	2'-7	3'-6	1'-0	1'-2	0'-9
12'x6'	20'-0	4'-6	4'-8⅞	4'-7⅝	16'-0	2'-9	3'-5	3'-6	1'-3	1'-2	0'-9
12'x7'	20'-6	5'-3	5'-6⅜	5'-5	17'-0	3'-0	4'-2	3'-9	1'-3	1'-2	0'-9
12'x8'	21'-0	6'-0	6'-3⅞	6'-2¼	18'-0	3'-3	4'-11	4'-0	1'-3	1'-2	0'-10
12'x9'	21'-6	6'-9	7'-1⅜	6'-11½	19'-0	3'-6	5'-8	4'-3	1'-3	1'-2	0'-10
12'x10'	22'-0	7'-6	7'-10⅞	7'-8¾	20'-0	3'-9	6'-6	4'-6	1'-3	1'-2	0'-10
12'x11'	22'-6	8'-3	8'-8⅜	8'-6	21'-0	4'-0	7'-3	4'-9	1'-3	1'-2	0'-11
12'x12'	23'-0	9'-0	9'-5⅞	9'-3⅜	22'-0	4'-3	8'-0	5'-0	1'-3	1'-2	1'-0

TABLE OF FLUME REINFORCING

FLUME SPAN

S \ BAR	c1, c2	f1	f2	h1	m1
3'-0	5 @ 1'-0	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
4'-0	5 @ 1'-0	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
5'-0	5 @ 0'-6	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
6'-0	5 @ 0'-6	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
8'-0	6 @ 0'-6	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
10'-0	7 @ 0'-6	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0
12'-0	7 @ 0'-6	6 @ 1'-0	5 @ 1'-0	5 @ 1'-0	6 @ 1'-0

FLUME HEIGHT

H \ BAR	a1	b1	b2	c3	s1
3'-0	4 @ 1'-0	5 @ 1'-0	4 @ 1'-0	---	#5
4'-0	4 @ 1'-0	5 @ 1'-0	4 @ 1'-0	---	#5
5'-0	4 @ 1'-0	5 @ 1'-0	4 @ 1'-0	5 @ 0'-6	#5
6'-0	4 @ 1'-0	5 @ 1'-0	4 @ 1'-0	5 @ 0'-6	#6
7'-0	5 @ 1'-0	5 @ 1'-0	4 @ 1'-0	5 @ 0'-6	#6
8'-0	5 @ 1'-0	5 @ 1'-0	4 @ 1'-0	5 @ 0'-6	#6
9'-0	4 @ 0'-6	5 @ 1'-0	4 @ 1'-0	5 @ 0'-6	#6
10'-0	5 @ 0'-6	5 @ 1'-0	4 @ 1'-0	6 @ 0'-6	#6
11'-0	5 @ 0'-6	5 @ 1'-0	4 @ 1'-0	7 @ 0'-6	#6
12'-0	5 @ 0'-6	5 @ 1'-0	4 @ 1'-0	7 @ 0'-6	#6

NOTE:
THE RESPECTIVE BAR SIZE AND SPACING SHOULD BE USED FOR APPROPRIATE FLUME SIZE WHEN THE SPAN AND HEIGHT ARE DIFFERENT.

TABLE OF FLUME CONCRETE (CY)

CULV. SIZE	3:1 SLOPE FLUME						4:1 SLOPE FLUME					
	L3 TOTAL		L2 PER FOOT		STUB	BASIN	L3 TOTAL		L2 PER FOOT		STUB	BASIN
S x H	WALLS	FOOTING	WALLS	FOOTING	CURTAIN	CURTAIN	WALLS	FOOTING	WALLS	FOOTING	CURTAIN	CURTAIN
3'x3'	3.1	4.0	0.112	0.220	0.4	0.1	4.3	5.5	0.110	0.215	0.4	0.1
4'x4'	4.3	5.0	0.156	0.256	0.6	0.2	5.9	6.8	0.153	0.250	0.6	0.2
5'x3'	3.1	5.3	0.112	0.292	0.5	0.2	4.3	7.2	0.110	0.285	0.5	0.2
5'x4'	4.3	5.6	0.156	0.292	0.7	0.3	5.9	7.8	0.153	0.285	0.7	0.3
5'x5'	5.6	6.0	0.200	0.292	0.7	0.4	7.8	8.3	0.196	0.285	0.7	0.3
5'x6'	7.1	6.4	0.244	0.292	0.9	0.5	9.8	8.9	0.239	0.285	0.9	0.5
6'x3'	3.1	5.9	0.112	0.328	0.6	0.2	4.3	8.1	0.110	0.320	0.6	0.2
6'x4'	4.3	6.3	0.156	0.328	0.8	0.3	5.9	8.7	0.153	0.320	0.8	0.3
6'x5'	5.6	6.8	0.200	0.328	0.8	0.4	7.8	9.3	0.196	0.320	0.8	0.4
6'x6'	7.1	7.2	0.244	0.328	1.0	0.6	9.8	10.0	0.239	0.320	1.0	0.6
6'x7'	8.6	7.6	0.288	0.328	1.1	0.7	11.9	10.6	0.282	0.320	1.1	0.7
6'x8'	11.4	8.9	0.369	0.362	1.2	0.8	15.9	12.4	0.360	0.354	1.2	0.8
8'x4'	4.3	8.4	0.156	0.432	1.0	0.4	5.9	11.5	0.153	0.422	1.0	0.4
8'x5'	5.6	8.9	0.200	0.432	1.0	0.5	7.8	12.3	0.196	0.422	1.0	0.5
8'x6'	7.1	9.5	0.244	0.432	1.2	0.7	9.8	13.1	0.239	0.422	1.2	0.7
8'x7'	8.6	10.0	0.288	0.432	1.3	0.8	11.9	13.9	0.282	0.422	1.3	0.8
8'x8'	11.4	10.8	0.369	0.440	1.5	1.0	15.9	15.0	0.360	0.431	1.5	1.0
8'x9'	13.5	11.3	0.417	0.440	1.6	1.1	18.7	15.9	0.408	0.431	1.6	1.1
8'x10'	15.6	11.9	0.466	0.440	1.7	1.2	21.8	16.7	0.456	0.431	1.7	1.2
10'x4'	4.3	10.6	0.156	0.549	1.1	0.4	5.9	14.6	0.153	0.537	1.1	0.4
10'x5'	5.6	11.3	0.200	0.549	1.1	0.5	7.8	15.7	0.196	0.537	1.1	0.5
10'x6'	7.1	12.0	0.244	0.549	1.4	0.8	9.8	16.7	0.239	0.537	1.4	0.8
10'x7'	8.6	12.7	0.288	0.549	1.6	1.0	11.9	17.7	0.282	0.537	1.6	0.9
10'x8'	11.4	13.7	0.369	0.558	1.7	1.1	15.9	19.1	0.360	0.546	1.7	1.1
10'x9'	13.5	14.4	0.417	0.558	1.9	1.3	18.7	20.1	0.408	0.546	1.9	1.2
10'x10'	15.6	15.1	0.466	0.558	2.0	1.4	21.8	21.1	0.456	0.546	2.0	1.4
10'x11'	19.7	16.1	0.567	0.567	2.2	1.6	27.5	22.5	0.554	0.555	2.2	1.5
10'x12'	24.4	17.1	0.677	0.576	2.4	1.7	34.2	24.0	0.662	0.564	2.3	1.7
12'x4'	4.3	13.1	0.156	0.679	1.3	0.4	5.9	18.1	0.153	0.664	1.3	0.4
12'x5'	5.6	14.0	0.200	0.679	1.3	0.6	7.8	19.4	0.196	0.664	1.3	0.6
12'x6'	7.1	14.9	0.244	0.679	1.6	0.9	9.8	20.7	0.239	0.664	1.6	0.9
12'x7'	8.6	15.8	0.288	0.679	1.8	1.1	11.9	21.9	0.282	0.664	1.8	1.1
12'x8'	11.4	16.9	0.369	0.689	2.0	1.2	15.9	23.5	0.360	0.674	1.9	1.2
12'x9'	13.5	17.7	0.417	0.689	2.1	1.4	18.7	24.8	0.408	0.674	2.1	1.4
12'x10'	15.6	18.6	0.466	0.689	2.3	1.6	21.8	26.1	0.456	0.674	2.3	1.6
12'x11'	19.7	19.8	0.567	0.699	2.5	1.8	27.5	27.8	0.554	0.683	2.5	1.7
12'x12'	24.4	21.0	0.677	0.708	2.7	1.9	34.2	29.5	0.662	0.693	2.7	1.9

NOTE: L3 CONCRETE QUANTITIES ASSUME A 1°00' ANGLE 'C'.

S = CULVERT SPAN
H = CULVERT HEIGHT

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

Iowa Department of Transportation
Highway Division

STANDARD DESIGN

REINFORCED CONCRETE BOX CULVERTS

APRIL, 2012

REINFORCED CONCRETE FLUME DETAILS

QUANTITIES AND NOTES

RCF-01-12

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