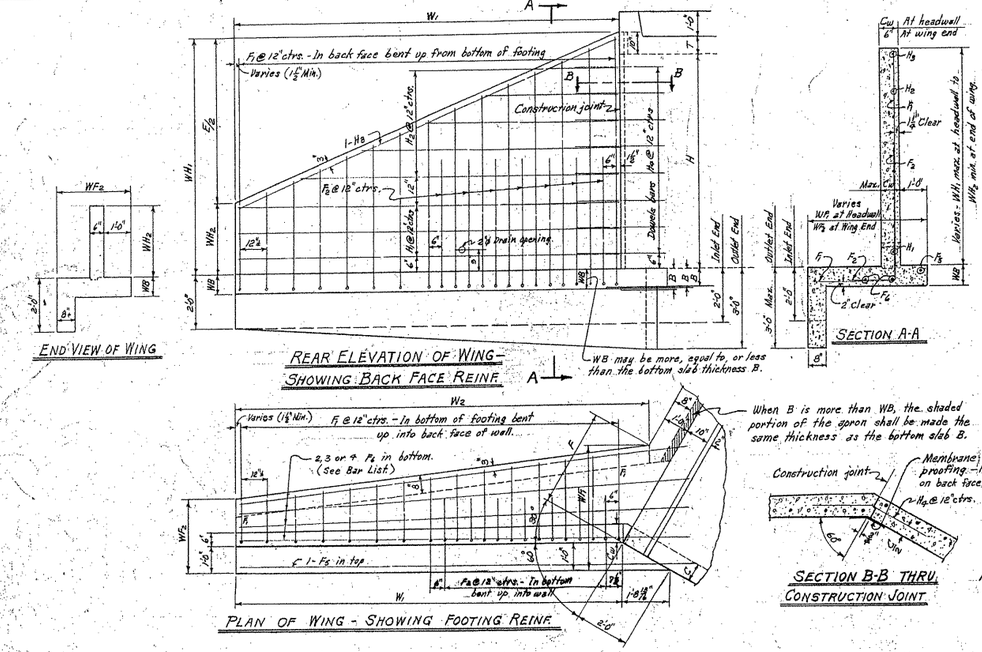
STANDARD DRAWINGS - R.C. BOX CULVERTS - "X" SERIES

PAGE	DRAWING NO.	DATE	SPANS	BARRELS	SLOPE	H-HEIGHT OR C-COVER
				STANDARD WINGS FOR STRAIGHT BARRELS		
1.	W-X002-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=8' OR LESS
2.	W-X002-2	4-19-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=9' & OVER
3.	W-X003-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=8' OR LESS
4.	W-X003-2	12-31-62	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=9' & OVER
5.	W-X004-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=8' OR LESS
6.	W-X004-2	1-3-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=9' & OVER
7.	2220	4-30-62	12'-20'	SINGLE SPAN R.C. BOX (UNDERPASS)	3:1	H=12'-14'
8.	2220A	4-8-63	14'-16'	SINGLE SPAN R.C. BOX (UNDERPASS)	3:1	H=8'-12'
				STANDARD BARREL SECTIONS FOR STRAIGHT BARRELS		
9.	R-100X-0	2-8-63	4'-12'	SINGLES	3:1 OR 4:1	C=UNDER 5'
10.	R-100X-X1	10-10-62	4'-6'	SINGLES	3:1 OR 4:1	C=OVER 5'
11.	R-1004-X	10-14-59	4'-6'	SINGLES	4:1	C=OVER 10'
11A.	R-1004-A	7- -58	3'-10'	SINGLES	4:1	C=OVER 3'
12.	R-100X-X2	1-14-63	7'-10'	SINGLES	3:1 OR 4:1	C=OVER 5'
13.	R-100X-X3	12-11-64	4', 6', 7', 8', 9' & 10'	SINGLES	2:1, 3:1 OR 4:1	C=OVER 5'
14.	R-200X-0	2-15-63	4'-12'	DOUBLES	3:1 OR 4:1	C=UNDER 5'
15.	R-200X-X1	10-15-62	4'-6'	DOUBLES	3:1 OR 4:1	C=OVER 5'
16.	R-2004-X	10-29-59	4'-6'	DOUBLES	4:1	C=OVER 10'
16A.	R-2004-A	4- -67	4'-8'	DOUBLES	4:1	C=OVER 3'
17.	R-200X-X2	1-14-63	8', 10' & 12'	DOUBLES	3:1 OR 4:1	C=OVER 5'
18.	R-200X-X3	1-13-65	7', 9' & 11'	DOUBLES	3:1 OR 4:1	C=OVER 5'
19.	R-200X-X4	1-8-65	4', 6', 7', 8', 9' & 10'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
20.	R-300X-0	2-28-63	4'-12'	TRIPLES	3:1 OR 4:1	C=UNDER 5'
21.	R-3004-X	11-24-59	4'-6'	TRIPLES	4:1	C=OVER 10'
21A.	R-3004-A	7- -58	4'-8'	TRIPLES	4:1	C=OVER 3'
22.	R-300X-X1	10-18-62	4'-6'	TRIPLES	3:1 OR 4:1	C=OVER 5'
23.	R-300X-X2	1-13-65	8', 10' & 12'	TRIPLES	3:1 OR 4:1	C=OVER 5'
24.	R-300X-X3	3-28-63	7', 9' & 11'	TRIPLES	3:1 OR 4:1	C=OVER 5'
25.	R-300X-X4	1-15-65	4', 6', 7', 8', 9' & 10'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
26.	R-400X-0	3-18-63	4'-12'	QUADRUPLES	3:1 OR 4:1	C=UNDER 5'
27.	R-400X-X1	10-22-62	4'-6'	QUADRUPLES	3:1 OR 4:1	C=OVER 5'
28.	R-400X-X2	2-28-64	7'-9'	QUADRUPLES	3:1 OR 4:1	C=OVER 5'
29.	R-500X-0	3-15-63	4'-10'	QUINTUPLES	3:1 OR 4:1	C=UNDER 5'
30.	R-500X-X1	10-26-62	4'-6'	QUINTUPLES	3:1 OR 4:1	C=OVER 5'
				STANDARD WINGS FOR 15° SKEW BARRELS		
31.	W-X15	6-13-63	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1, 3:1 OR 4:1	H=2'-12'
32.	W-X152-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=8' OR LESS
33.	W-X152-2	6-6-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=9' & OVER
34.	W-X153-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=8' OR LESS
35.	W-X153-2	6-12-63	7-'12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=9' & OVER
36.	W-X154-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=8' OR LESS
37.	W-X154-2	6-18-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=9' & OVER
				STANDARD BARREL SECTIONS FOR 15° SKEW BARRELS		
38.	R-115X-0	8-14-63	4'-12'	SINGLES	2:1, 3:1 OR 4:1	C=UNDER 5'
39.	R-115X-1	10-24-63	4'-10'	SINGLES	2:1, 3:1 OR 4:1	C=OVER 5'
40.	R-215X-0	8-23-63	4'-12'	DOUBLES	2:1, 3:1 OR 4:1	C=UNDER 5'
41.	R-215X-1	10-3-63	4'-8'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
42.	R-215X-2	10-30-63	9'-12'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
43.	R-315X-0	8-28-63	4'12'	TRIPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
44.	R-315X-1	11-4-63	4'-8'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
45.	R-315X-2	9-2-71	9'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
46.	R-415X-0	9-4-63	4'-12'	QUADRUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
47.	R-415X-1	10-14-63	4'-8'	QUADRUPLES	2:1, 3:1 OR 4:1	C=OVER 5'
48.	R-515X-0	9-9-63	4'-10'	QUINTUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
49.	R-515X-1	10-21-63	4'-7'	QUINTUPLES	2:1, 3:1 OR 4:1	C=OVER 5'

PAGE	DRAWING NO.	DATE	SPANS	BARRELS	SLOPE	H-HEIGHT OR C-COVER
				STANDARD WINGS FOR 30° SKEW BARRELS		
50.	W-X30	7-15-63	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1, 3:1 OR 4:1	H=2' - 12'
51.	W-X302-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=8' OR LESS
52.	W-X302-2	7-10-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=9' & OVER
53.	W-X303-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=8' OR LESS
54.	W-X303-2	7-22-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=9' & OVER
55.	W-X304-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=8' OR LESS
56.	W-X304-2	6-3-63	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=9' & OVER
				STANDARD BARREL SECTIONS FOR 30° SKEW BARRELS		
57.	R-130X-0	2-24-64	4'-12'	SINGLES	2:1, 3:1 OR 4:1	C=UNDER 5'
58.	R-130X-1	1-24-64	4'-10'	SINGLES	2:1, 3:1 OR 4:1	C=OVER 5'
59.	R-230X-01	2-26-64	4'-8'	DOUBLES	2:1, 3:1 OR 4:1	C=UNDER 5'
60.	R-230X-02	3-20-64	9'-12'	DOUBLES	2:1, 3:1 OR 4:1	C= UNDER 5'
61.	R-230X-1	1-28-64	4'-8'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
62.	R-230X-2	1-30-64	9'-12'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
63.	R-330X-01	2-27-64	4'-8'	TRIPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
64.	R-330X-02	3-24-64	9'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
65.	R-330X-1	2-4-64	4'-8'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
66.	R-330X-2	2-6-64	9'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
67.	R-330X-3	9-18-64	9'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=10' MAX
68.	R-3302-1	9-22-64	9'-12'	TRIPLES	2:1	C=OVER 10'
69.	R-430X-01	3-3-64	4'-8'	QUADRUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
70.	R-430X-02	6-17-66	9'-12'	QUADRUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
71.	R-430X-1	2-10-64	4'-8'	QUADRUPLES	2:1, 3:1 OR 4:1	C=OVER 5'
72.	R-530X-01	3-5-64	4'-7'	QUINTUPLES	2:1, 3:1 OR 4:1	C= UNDER 5'
73.	R-530X-02	6-17-66	8'-10'	QUINTUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
74.	R-530X-1	2-12-64	4'-7'	QUINTUPLES	2:1, 3:1 OR 4:1	C=OVER 5'
				STANDARD WINGS FOR 45° SKEW BARRELS		
75.	W-X45	6-15-64	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1, 3:1 OR 4:1	H=2'-12'
76.	W-X452-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=8' OR LESS
77.	W-X452-2	6-4-64	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	2:1	H=9' & OVER
78.	W-X453-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=8' OR LESS
79.	W-X453-2	6-8-64	7-'12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	3:1	H=9' & OVER
80.	W-X454-1	5-10-66	4'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=8' OR LESS
81.	W-X454-2	6-11-64	7'-12'	SINGLES, DOUBLES, TRIPLES, QUADS. & QUINTS.	4:1	H=9' & OVER
				STANDARD BARREL SECTIONS FOR 45° SKEW BARRELS		
82.	R-145X-0	7-10-64	4'-12'	SINGLES	2:1, 3:1 OR 4:1	C=UNDER 5'
83.	R-145X-1	8-10-64	4'-10'	SINGLES	2:1, 3:1 OR 4:1	C=OVER 5'
84.	R-245X-01	7-14-64	4'-8'	DOUBLES	2:1, 3:1 OR 4:1	C=UNDER 5'
85.	R-245X-02	7-15-64	9'-12'	DOUBLES	2:1, 3:1 OR 4:1	C=UNDER 5'
86.	R-245X-1	8-12-64	4'-8'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
87.	R-245X-2	8-25-64	9'-12'	DOUBLES	2:1, 3:1 OR 4:1	C=OVER 5'
88.	R-345X-01	7-20-64	4'-8'	TRIPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
89.	R-345X-02	7-22-64	9'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
90.	R-345X-1	8-17-64	4'-8'	TRIPLES	2:1, 3:1 OR 4:1	C=OVER 5'
91.	R-345X-2	8-28-64	9'-12'	TRIPLES	3:1 OR 4:1	C=OVER 5'
92.	R-345X-3	9-2-64	8'-12'	TRIPLES	2:1, 3:1 OR 4:1	C=10' MAX.
93.	R-3452-1	9-14-64	8'-12'	TRIPLES	2:1	C=OVER 10'
94.	R-445X-01	7-24-64	4'-8'	QUADRUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
95.	R-445X-02	6-17-66	9'-12'	QUADRUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
96.	R-445X-1	8-19-64	4'-8'	QUADRUPLES	3:1 OR 4:1	C=OVER 5'
97.	R-545X-01	8-3-64	4'-7'	QUINTUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
98.	R-545X-02	6-17-66	8'-10'	QUINTUPLES	2:1, 3:1 OR 4:1	C=UNDER 5'
99.	144-A	4-1-93		METHOD OF EXTENDING EXISTING STRUCTURES		

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



END VIEW OF WING

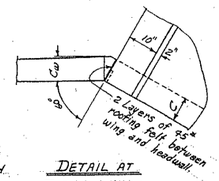
REAR ELEVATION OF WING - SHOWING BACK FACE REINF.

PLAN OF WING - SHOWING FOOTING REINF.

SECTION A-A

SECTION B-B THRU CONSTRUCTION JOINT

NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



DETAIL AT TOP OF WING

WING DIMENSIONS

CLEAR HEIGHT OF BOX	THICKNESS OF WING & FOOTING	THICKNESS OF WING AT HEADWALL & C	WINGWALL HEIGHTS: AT HEADWALL	WINGWALL HEIGHTS: AT END OF WING	WIDTHS OF WING FOOTINGS: AT HEADWALL	WIDTHS OF WING FOOTINGS: AT END OF WING	PERPENDICULAR FOOTING DIMENSION F	PERPENDICULAR DIST. FROM HDWL. TO END OF WING E	LENGTH OF WINGWALLS W1	INSIDE FOOTING DIMENSION W2	* QUANTITY PER WING CLASS S CONCRETE: INLET END	* QUANTITY PER WING CLASS S CONCRETE: OUTLET END
H	WB	Cw	WH1	WH2	W3	W4	F	E	W1	W2	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	0'-11¾"	4'-4"	5'-0"	4'-7½"	0.604	0.670
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1½"	1'-4⅜"	5'-8"	6'-6⅝"	6'-2⅝"	0.908	0.996
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9"	7'-0"	8'-1"	8'-1"	1.267	1.376
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-1⅝"	8'-4"	9'-7½"	9'-9⅜"	1.679	1.810
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-1⅝"	8'-4"	9'-7½"	9'-9⅜"	1.750	1.881
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	9'-8"	11'-2"	11'-6½"	2.330	2.483
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	9'-8"	11'-2"	11'-6½"	2.379	2.531
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	9'-8"	11'-2"	11'-6½"	2.427	2.580
7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-9"	3'-1⅝"	11'-0"	12'-8½"	13'-3½"	3.054	3.230
		8"	7'-10"	2'-4"	4'-2"	2'-9½"	3'-1⅝"	11'-0"	12'-8½"	13'-3½"	3.117	3.293
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	12'-9"	14'-3"	15'-2½"	3.905	4.104

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

APRON DIMENSION W3

W3 = (OW - 2F)

CLEAR SPAN	CLEAR HEIGHT	2 X FOOTING DIMENSION	SINGLE BARREL CULVERT: OW	SINGLE BARREL CULVERT: W3	DOUBLE BARREL CULVERT: OW	DOUBLE BARREL CULVERT: W3	TRIPLE BARREL CULVERT: OW	TRIPLE BARREL CULVERT: W3	QUADRUPLE BARREL CULVERT: OW	QUADRUPLE BARREL CULVERT: W3	QUINTUPLE BARREL CULVERT: OW	QUINTUPLE BARREL CULVERT: W3
S	H	2F	OW	W3	OW	W3	OW	W3	OW	W3	OW	W3
4'	2'	1'-11½"	5'-0"	3'-0⅝"	9'-8"	7'-8½"	14'-4"	12'-4⅝"	19'-0"	17'-0⅝"	23'-8"	21'-8⅝"
	3'	2'-8⅝"	5'-0"	2'-3⅝"	9'-8"	6'-11½"	14'-4"	11'-7⅝"	19'-0"	16'-3⅝"	23'-8"	20'-11½"
	4'	3'-6"	5'-0"	1'-8"	9'-8"	6'-2"	14'-4"	10'-10"	19'-0"	15'-6"	23'-8"	20'-2"
	5'	4'-3⅝"	5'-0"	0'-8⅝"	9'-8"	5'-4⅝"	14'-4"	10'-0⅝"	19'-0"	14'-8⅝"	23'-8"	19'-4⅝"
	6'	5'-0½"	5'-2"	0'-7½"	9'-11"	4'-10½"	14'-8"	9'-7½"	19'-5"	14'-4½"	24'-2"	19'-1½"
5'	3'	2'-8⅝"	6'-0"	3'-3⅛"	11'-8"	8'-11⅛"	17'-4"	14'-7⅛"	23'-0"	20'-3⅛"	28'-8"	25'-11⅛"
	4'	3'-6"	6'-0"	2'-6"	11'-8"	8'-2"	17'-4"	13'-10"	23'-0"	19'-4"	28'-8"	25'-2"
	5'	4'-3⅝"	6'-0"	1'-8⅝"	11'-8"	7'-4⅝"	17'-4"	13'-0⅝"	23'-0"	18'-8⅝"	28'-8"	24'-4⅝"
	6'	5'-0½"	6'-2"	1'-7½"	11'-11"	6'-10½"	17'-8"	12'-7½"	23'-5"	18'-4½"	29'-2"	24'-1½"
	7'	6'-2½"	6'-3"	0'-0½"	12'-1"	5'-10½"	17'-11"	11'-8½"	23'-9"	17'-6½"	29'-7"	23'-4½"
6'	3'	2'-8⅝"	7'-0"	4'-3⅝"	13'-8"	10'-11⅝"	20'-4"	17'-7⅝"	27'-0"	24'-3⅝"	33'-8"	30'-11⅝"
	4'	3'-6"	7'-0"	3'-6"	13'-8"	10'-2"	20'-4"	16'-10"	27'-0"	23'-6"	33'-8"	30'-2"
	5'	4'-3⅝"	7'-0"	2'-8⅝"	13'-8"	9'-4⅝"	20'-4"	16'-0⅝"	27'-0"	22'-8⅝"	33'-8"	29'-4⅝"
	6'	5'-0½"	7'-2"	2'-7½"	13'-11"	8'-10½"	20'-8"	15'-7½"	27'-5"	22'-4½"	34'-2"	29'-1½"
	7'	6'-2½"	7'-3"	1'-0½"	14'-1"	7'-10½"	20'-11"	14'-8½"	27'-9"	21'-6½"	34'-7"	28'-9½"
	8'	7'-4"	7'-4"	0'-0"	14'-2"	6'-10"	21'-0"	13'-8"	27'-10"	20'-8"	34'-8"	27'-8"
7'	4'	3'-6"	8'-6"	4'-6"	15'-8"	12'-2"	23'-4"	19'-10"	31'-0"	27'-6"	38'-8"	35'-2"
	5'	4'-3⅝"	8'-0"	3'-8⅝"	15'-8"	11'-4⅝"	23'-4"	19'-0⅝"	31'-0"	26'-8⅝"	38'-8"	34'-4⅝"
	6'	5'-0½"	8'-2"	3'-1⅝"	15'-11"	10'-10½"	23'-8"	18'-7½"	31'-5"	26'-1½"	39'-2"	34'-1½"
	7'	6'-2½"	8'-3"	2'-0½"	16'-1"	9'-10½"	23'-11"	17'-8½"	31'-9"	25'-6½"	39'-7"	33'-4½"
	8'	7'-4"	8'-4"	1'-0"	16'-2"	8'-10"	24'-0"	16'-8"	31'-10"	24'-8"	39'-8"	32'-8"
8'	4'	3'-6"	9'-0"	5'-6"	17'-8"	14'-2"	26'-4"	22'-10"	35'-0"	31'-6"	43'-8"	40'-2"
	5'	4'-3⅝"	9'-2"	4'-10⅝"	17'-11"	13'-7⅝"	26'-8"	22'-4⅝"	35'-5"	31'-1⅝"	44'-2"	39'-10⅝"
	6'	5'-0½"	9'-2"	4'-1½"	17'-11"	12'-10½"	26'-8"	21'-7½"	35'-5"	30'-4½"	44'-2"	39'-1½"
	7'	6'-2½"	9'-3"	3'-0½"	18'-1"	11'-10½"	26'-11"	20'-8½"	35'-9"	29'-6½"	44'-7"	38'-4½"
	8'	7'-4"	9'-4"	2'-0"	18'-2"	10'-10"	27'-0"	19'-8"	35'-10"	28'-8"	44'-8"	37'-8"
9'	5'	4'-3⅝"	10'-2"	5'-10⅝"	19'-11"	15'-7⅝"	29'-8"	25'-4⅝"	39'-5"	35'-1⅝"	49'-2"	44'-10⅝"
	6'	5'-0½"	10'-3"	5'-2½"	20'-1"	15'-0½"	29'-11"	24'-10½"	39'-9"	34'-6½"	49'-7"	44'-1½"
	7'	6'-2½"	10'-3"	4'-0½"	20'-1"	13'-10½"	29'-11"	23'-8½"	39'-9"	33'-4½"	49'-7"	43'-4½"
	8'	7'-4"	10'-4"	3'-0"	20'-2"	12'-10"	30'-0"	22'-8"	39'-10"	32'-8"	49'-8"	42'-8"
10'	5'	4'-3⅝"	11'-2"	6'-10⅝"	21'-11"	17'-7⅝"	32'-8"	28'-4⅝"	43'-5"	39'-1⅝"	54'-2"	49'-10⅝"
	6'	5'-0½"	11'-3"	6'-2½"	22'-1"	17'-0½"	32'-11"	27'-10½"	43'-9"	38'-6½"	54'-7"	48'-1½"
	7'	6'-2½"	11'-3"	5'-0½"	22'-1"	15'-10½"	32'-11"	26'-8½"	43'-9"	37'-4½"	54'-7"	46'-8½"
	8'	7'-4"	11'-4"	4'-0"	22'-2"	14'-10"	33'-0"	25'-8"	43'-10"	36'-8"	54'-8"	45'-8"
11'	6'	5'-0½"	12'-4"	7'-3½"	24'-2"	19'-1½"	36'-0"	30'-1½"	47'-10"	42'-3½"		
	7'	6'-2½"	12'-4"	6'-1½"	24'-2"	17'-11½"	36'-0"	28'-9½"	47'-10"	41'-1½"		
	8'	7'-4"	12'-4"	5'-0"	24'-2"	16'-10"	36'-0"	28'-8"	47'-10"	40'-6"		
12'	6'	5'-0½"	13'-4"	8'-3½"	26'-2"	21'-1½"	39'-0"	33'-1½"	51'-10"	46'-3½"		
	7'	6'-2½"	13'-4"	7'-1½"	26'-2"	19'-11½"	39'-0"	32'-3½"	51'-10"	45'-1½"		
	8'	7'-4"	13'-4"	6'-0"	26'-2"	18'-10"	39'-0"	31'-8"	51'-10"	44'-6"		

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL ® FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
					HEADWALLS, WINGWALLS, FOOTINGS, TOE WALLS AND APRONS				
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	81.0	3.30	4.25	5.21	6.17	7.13
	3'	6"	7"	119.8	4.45	5.41	6.37	7.33	8.29
	4'	6"	7"	183.3	5.83	6.78	7.74	8.70	9.66
	5'	6"	7"	253.2	7.41	8.37	9.33	10.29	11.25
	6'	7"	8"	415.4	9.97	10.95	11.94	12.93	13.92
5'	3'	6"	7"	119.8	4.67	5.83	6.99	8.16	9.33
	4'	6"	7"	183.3	6.04	7.20	8.36	9.53	10.70
	5'	6"	7"	253.2	7.63	8.78	9.95	11.12	12.28
	6'	7"	8"	415.4	10.19	11.38	12.57	13.77	14.96
	7'	7½	8½	797.6	12.98	14.19	15.41	16.63	17.85
6'	3'	6"	7"	119.8	4.88	6.26	7.62	9.00	10.38
	4'	6"	7"	183.3	6.25	7.63	8.99	10.37	11.75
	5'	6"	7"	253.2	7.83	9.22	10.57	11.96	13.33
	6'	7"	8"	415.4	10.40	11.81	13.20	14.61	16.01
	7'	7½	8½	797.6	13.19	14.63	16.04	17.47	18.90
	8'	8	9"	1004.9	16.50	17.93	19.34	20.79	22.23
7'	4'	6"	7"	183.3	6.47	8.07	9.64	11.25	12.85
	5'	6"	7"	253.2	8.05	9.66	11.23	12.84	14.44
	6'	7"	8"	415.4	10.62	12.25	13.84	15.46	17.08
	7'	7½	8½	797.6	13.42	15.06	16.68	18.32	19.96
	8'	8	9"	1004.9	16.72	18.37	20.00	21.65	23.29
8'	4'	6"	7"	183.3	6.69	8.52	10.32	12.15	13.95
	5'	7"	7"	253.2	8.59	10.44	12.26	14.11	15.92
	6'	7"	8"	415.4	10.84	12.69	14.51	16.36	18.17
	7'	7½	8½	797.6	13.63	15.50	17.34	19.21	21.03
	8'	8	9"	1004.9	16.94	18.81	20.65	22.51	24.36
9'	5'	7"	7"	253.2	8.81	10.90	12.92	15.00	17.02
	6'	7½	8"	415.4	11.27	13.38	15.42	17.52	19.56
	7'	7½	8½	797.6	13.85	15.96	18.00	20.10	22.14
	8'	8	9"	1004.9	17.16	19.26	21.31	23.41	25.45
10'	5'	7"	7"	253.2	9.04	11.35	13.60	15.81	18.08
	6'	7½	8"	415.4	11.50	13.83	16.10	18.33	20.61
	7'	7½	8½	797.6	14.08	16.41	18.68	20.91	23.20
	8'	8	9"	1004.9	17.38	19.71	21.98	24.22	26.50
11'	6'	8"	8"	415.4	11.93	14.51	17.00	19.47	
	7'	8"	8½	797.6	14.56	17.15	19.64	22.11	
	8'	8"	9"	1004.9	17.53	20.18	22.67	25.14	
12'	6'	8"	8"	415.4	12.16	14.99	17.70	20.42	
	7'	8"	8½	797.6	14.79	17.62	20.33	23.06	
	8'	8"	9"	1004.9	17.82	20.65	23.36	26.08	

® For reinforcing steel in headwalls and aprons, see Details of Standard Barrel Sections for R.C. Box Culverts for the desired span and height.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

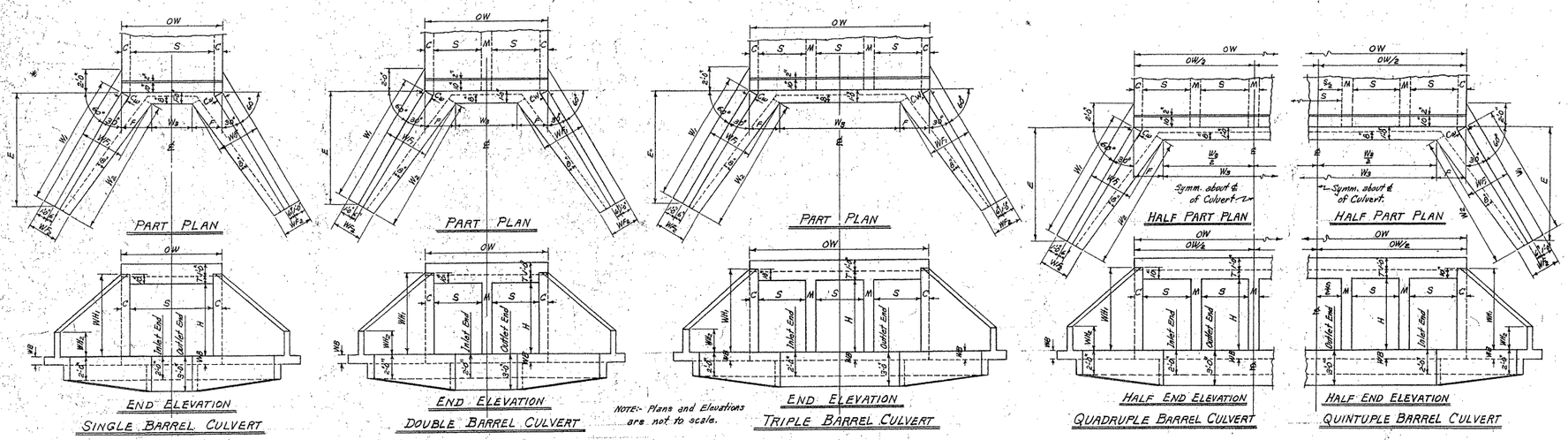
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 24,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. as listed below.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X1	R-200X-X1	R-300X-X1	R-400X-X1	R-500X-X1
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		



NOTE:- Plans and Elevations are not to scale.

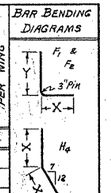
MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mopplings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT	F1 BENT (In bottom of footing, bent up into back face of wing. One bar of each length.): SIZE	SPACING	No. REQD	LENGTHS VARY MIN.	MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	F2 BENT (In bottom of footing, bent up into back face of wing. Alt. with F1 bars.): SIZE	SPACING	No. REQD	LENGTH	X	Y
H															
2'	#3	12"	6	1'-6"	3'-10"	0'-8"	1'-0"	0'-11"	2'-11"	—	—	—	—	—	—
3'	#3	12"	7	2'-2"	5'-3"	0'-10"	1'-4"	1'-5"	4'-0"	—	—	—	—	—	—
4'	#3	12"	9	2'-4"	6'-7"	0'-11"	1'-8"	1'-6"	5'-0"	—	—	—	—	—	—
5'	#3	12"	10	3'-0"	7'-10"	1'-1"	1'-11"	2'-0"	6'-0"	#3	12"	3	3'-6"	1'-1"	2'-8"
6'	#4	12"	12	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	3	4'-6"	1'-4"	3'-3"
7'	#4	12"	13	4'-1"	10'-9"	1'-4"	2'-9"	2'-10"	8'-1"	#4	12"	5	5'-6"	1'-7"	4'-0"
8'	#4	12"	15	4'-5"	12'-3"	1'-5"	3'-2"	3'-1"	9'-2"	#4	12"	7	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	F5 STRAIGHT (Longitudinal in top of wing footing heel.): SIZE	No. REQD	LENGTH	F6 STRAIGHT (Longitudinal in bottom of wing footing toe.): SIZE	No. REQD	LENGTH	H1 (Horizontal in back face of wing.): SIZE	SPACING	No. REQD	LENGTH	H2 STRAIGHT (Horizontal in back face of wing. One bar of each length.): SIZE	SPACING	No. REQD	LENGTH VARY MAX.	MIN.	H3 (In back face of wing at top-on slope.): SIZE	No. REQD	LENGTH	H4 BENT (Dowels thru construction joint at headwall.): SIZE	SPACING	No. REQD	LENGTH	X	QUANTITY REINFORCING STEEL PER WING
H																								LB.
2'	#3	1	7'-6"	#3	2	6'-3"	#3	12"	1	4'-9"	#3	12"	1	—	2'-8"	#3	1	5'-1"	#3	12"	2	2'-8"	1'-4"	20.2
3'	#3	1	9'-0"	#3	2	8'-0"	#3	12"	1	6'-3"	#3	12"	2	5'-0"	2'-8"	#3	1	6'-9"	#3	12"	3	2'-8"	1'-4"	29.9
4'	#3	1	10'-7"	#3	3	9'-9"	#3	12"	1	7'-10"	#3	12"	3	7'-4"	2'-8"	#3	1	8'-5"	#3	12"	4	2'-8"	1'-4"	45.8
5'	#3	1	12'-1"	#3	3	11'-6"	#3	12"	2	9'-4"	#3	12"	3	7'-4"	2'-8"	#3	1	10'-1"	#3	12"	5	2'-8"	1'-4"	63.3
6'	#3	1	13'-8"	#3	3	13'-3"	#3	12"	2	10'-11"	#3	12"	4	9'-8"	2'-8"	#3	1	11'-9"	#3	12"	6	2'-8"	1'-4"	103.8
7'	#4	1	15'-2"	#4	4	15'-0"	#4	12"	2	12'-5"	#4	12"	5	12'-0"	2'-8"	#4	1	13'-5"	#4	12"	7	3'-6"	1'-9"	199.4
8'	#4	1	16'-9"	#4	4	16'-9"	#4	12"	3	14'-0"	#4	12"	5	12'-0"	2'-8"	#4	1	15'-2"	#4	12"	8	3'-6"	1'-9"	251.2

BAR BENDING DIAGRAMS



NOTE:- Dimensions are to bar centers.

REVISIONS:- Membrane added. 5-10-66 W.C.H.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS

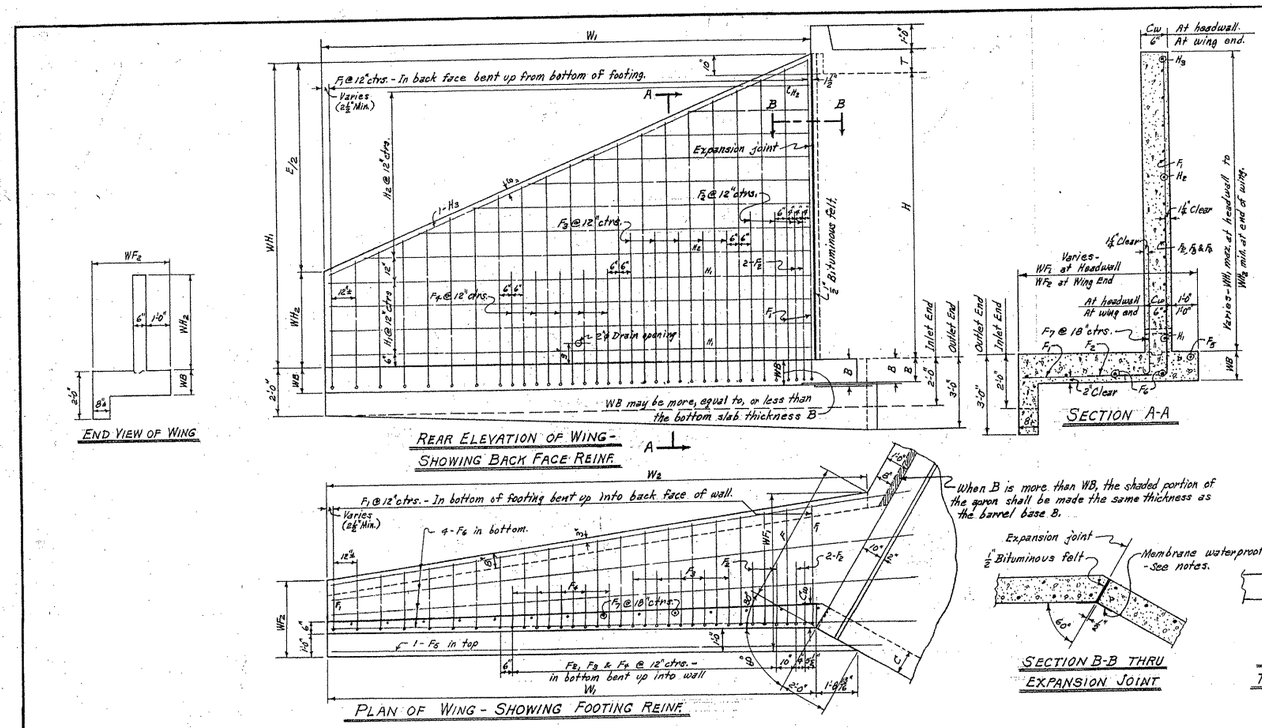
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

STANDARD DRAWING No. W-X002-1

Designed by - W.C.H. 7-25-62 Checked by - J.E.M. - 5-7-63
Drawn by - W.C.H. 4-16-63 Checked by - J.E.M. - 5-5-63
Quantities by - W.C.H. Checked by - J.E.M. - 5-5-63

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



WING DIMENSIONS

CLEAR HEIGHT - BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	PERPENDICULAR FOOTING DIMENSION	PERPENDICULAR DIST. FROM HDWL. TO END OF WING	LENGTH OF WINGWALLS	INSIDE FOOTING DIMENSION	* QUANTITY PER WING CLASS S CONCRETE INLET END	* QUANTITY PER WING CLASS S CONCRETE OUTLET END
H	WB	Cw	WH1	WH2	WF1	WF2	F	E	W1	W2	Cu.Yd.	Cu.Yd.
9'	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-3"	13'-8"	15'-2½"	17'-0⅛"	5.072	5.293
10'	11"	10"	10'-10"	3'-0"	5'-8"	3'-0"	4'-10"	15'-0"	17'-3¾"	18'-10⅛"	6.466	6.711
11'	12"	11"	11'-10"	3'-6"	6'-2"	3'-1½"	5'-5"	16'-4"	18'-10½"	20'-6⅛"	8.104	8.372
12'	15"	12"	12'-10"	4'-0"	6'-8"	3'-3"	6'-0"	17'-8"	20'-6⅜"	22'-6⅛"	10.007	10.297

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

CLEAR STEM HEIGHT - 2'-0"	FOOTING DIMENSION	SINGLE BARREL CULVERT		DOUBLE BARREL CULVERT		TRIPLE BARREL CULVERT		QUADRUPLE BARREL CULVERT		QUINTUPLE BARREL CULVERT	
		$W_3 = (OW - 2F)$									
S	H	2F	OW	W3	OW	W3	OW	W3	OW	W3	OW	W3
7'	8'	8'-6"	8'-6"	0'-0"	16'-5"	7'-11"	24'-4"	15'-10"	32'-3"	23'-9"	40'-2"	31'-8"
	9'	8'-6"	9'-6"	1'-0"	18'-5"	9'-11"	27'-4"	18'-10"	36'-3"	27'-9"	45'-2"	36'-8"
8'	9'	8'-6"	9'-8"	0'-0"	18'-8"	9'-0"	27'-8"	18'-0"	36'-8"	27'-0"	45'-8"	36'-0"
	10'	9'-8"	10'-6"	2'-0"	20'-5"	11'-11"	30'-4"	21'-10"	40'-3"	31'-9"	50'-2"	41'-8"
9'	9'	8'-6"	10'-8"	1'-0"	20'-8"	11'-0"	30'-8"	21'-0"	40'-8"	31'-0"	50'-8"	41'-0"
	10'	9'-8"	10'-10"	0'-0"	20'-10"	10'-0"	30'-10"	20'-0"	40'-10"	30'-0"	50'-10"	40'-0"
	11'	10'-10"	11'-6"	3'-0"	22'-5"	13'-11"	33'-4"	24'-10"	44'-3"	35'-9"	55'-2"	46'-8"
10'	10'	9'-8"	11'-8"	2'-0"	22'-8"	13'-0"	33'-8"	24'-0"	44'-8"	35'-0"	55'-8"	46'-0"
	11'	10'-10"	11'-10"	1'-0"	22'-10"	12'-0"	33'-10"	23'-0"	44'-10"	34'-0"	55'-10"	45'-0"
	12'	12'-0"	12'-0"	0'-0"	23'-0"	11'-0"	34'-0"	22'-0"	45'-0"	33'-0"	56'-0"	44'-0"
11'	9'	8'-6"	12'-6"	4'-0"	24'-5"	15'-11"	36'-4"	27'-10"	48'-3"	39'-9"		
	10'	9'-8"	12'-8"	3'-0"	24'-8"	15'-0"	36'-8"	27'-0"	48'-8"	39'-0"		
	11'	10'-10"	12'-10"	2'-0"	24'-10"	14'-0"	36'-10"	26'-0"	48'-10"	38'-0"		
	12'	12'-0"	13'-0"	1'-0"	25'-0"	13'-0"	37'-0"	25'-0"	49'-0"	37'-0"		
12'	9'	8'-6"	13'-6"	5'-0"	26'-5"	17'-11"	39'-4"	30'-10"	52'-3"	43'-9"		
	10'	9'-8"	13'-8"	4'-0"	26'-8"	17'-0"	39'-8"	30'-0"	52'-8"	43'-0"		
	11'	10'-10"	13'-10"	3'-0"	26'-10"	16'-0"	39'-10"	29'-0"	52'-10"	42'-0"		
	12'	12'-0"	14'-0"	2'-0"	27'-0"	15'-0"	40'-0"	28'-0"	53'-0"	41'-0"		

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊕ REINFORCING STEEL - FOR ¼ WINGS	CLASS S CONCRETE - ¼ WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS				
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	1487.2	21.29	22.97	24.64	26.32	27.99
8'	9'	9"	10"	1487.2	21.51	23.41	25.28	27.18	29.06
	10'	10"	11"	1842.6	26.99	28.92	30.83	32.76	34.68
9'	9'	9"	10"	1487.2	21.73	23.85	25.93	28.04	30.13
	10'	10"	11"	1842.6	27.22	29.36	31.49	33.63	35.76
	11'	11"	12"	2196.1	33.67	35.88	37.98	40.14	42.29
10'	9'	9"	10"	1487.2	21.95	24.30	26.61	28.92	31.24
	10'	10"	11"	1842.6	27.44	29.81	32.14	34.48	36.84
	11'	11"	12"	2196.1	33.90	36.27	38.64	41.01	43.39
	12'	12"	13"	2766.4	41.40	43.80	46.19	48.58	50.98
11'	9'	9"	10"	1487.2	22.17	24.77	27.28	29.81	
	10'	10"	11"	1842.6	27.66	30.27	32.80	35.37	
	11'	11"	12"	2196.1	34.11	36.73	39.30	41.88	
	12'	12"	13"	2766.4	41.62	44.25	46.85	49.46	
12'	9'	9"	10"	1487.2	22.39	25.24	27.97	30.76	
	10'	10"	11"	1842.6	27.88	30.74	33.49	36.30	
	11'	11"	12"	2196.1	34.34	37.20	39.95	42.78	
	12'	12"	13"	2766.4	41.85	44.71	47.52	50.35	

⊕ For reinforcing steel in Headwalls and Aprons, See Details of Standard Barrel Sections for R.C. Box Culverts for the desired Span and Height.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

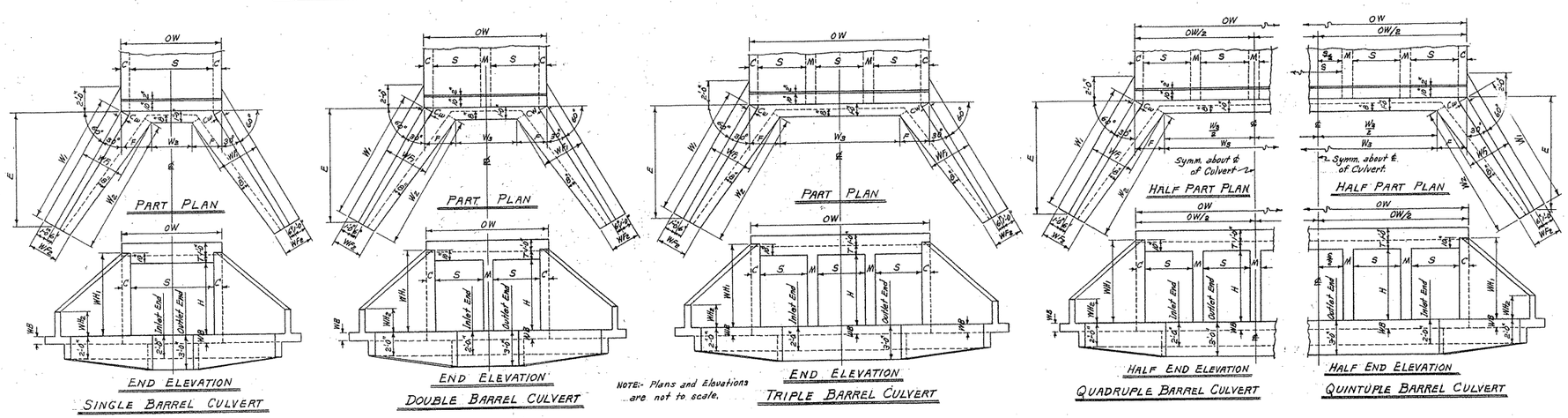
CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"



NOTE:- This drawing to be used in conjunction with Standard Barrel Sections. Drawing Nos. as listed below.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		

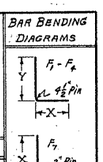
BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT	F1 BENT In bottom of footing, bent up into back face of wing. One bar of each length.								F2 In bottom of footing, bent up into back face of wing. Alt. with F1 bars						F3 BENT In bottom of footing, bent up into back face of wing. Alt. with F1 bars						F4 In bottom of footing, bent up into back face of wing. Alt. with F1 bars.					
H	SIZE	SPACING	No. READ	LENGTHS VARY MIN.	MAX.	X MIN.	MAX.	Y MIN.	MAX.	SIZE ⊕	SPACING	No. READ	LENGTH	X	Y	SIZE	SPACING	No. READ	LENGTH	X	Y	SIZE	SPACING	No. READ	LENGTH	X	Y
9'	#5	12"	16	5'-3"	13'-10"	1'-7"	3'-8"	3'-9"	10'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	5	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	#5	12"	18	5'-6"	15'-9"	1'-8"	4'-1"	3'-11"	11'-4"	#6	12"	2	8'-6"	2'-4"	6'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	5	6'-6"	1'-10"	4'-9"
11'	#5	12"	19	6'-9"	16'-10"	1'-10"	4'-6"	4'-7"	12'-5"	#6	12"	4	8'-6"	2'-4"	6'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	5	6'-6"	1'-10"	4'-9"
12'	#5	12"	21	6'-8"	18'-5"	1'-11"	5'-0"	4'-10"	13'-6"	#7	12"	4	9'-6"	2'-7"	7'-0"	#6	12"	5	8'-6"	2'-4"	6'-8"	#4	12"	5	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	F5 STRAIGHT Longitudinal in top of wing footing heel.			F6 Longitudinal in bottom of wing footing toe.			F7 BENT Footing dowels extending up into front face of wing.					H1 Horizontal in back face of wing.				H2 STRAIGHT Horizontal in back face of wing. One bar of each length.						H3 In back face of wing at top - on slope		
H	SIZE	No. READ	LENGTH	SIZE	No. READ	LENGTH	SIZE	SPACING	No. READ	LENGTH	X	SIZE	SPACING	No. READ	LENGTH	SIZE	SPACING	No. READ	LENGTHS VARY MAX.	MIN.	SIZE	No. READ	LENGTH
9'	#4	1	18'-3"	#4	4	18'-6"	#4	18"	11	4'-0"	3'-6"	#4	12"	3	15'-6"	#4	12"	6	14'-4"	2'-8"	#4	1	16'-10"
10'	#4	1	19'-10"	#4	4	20'-6"	#4	18"	12	4'-4"	3'-10"	#4	12"	3	17'-0"	#4	12"	7	16'-8"	2'-8"	#4	1	18'-6"
11'	#4	1	21'-4"	#4	4	22'-6"	#4	18"	13	4'-8"	4'-2"	#4	12"	4	18'-7"	#4	12"	7	16'-8"	2'-8"	#4	1	20'-2"
12'	#4	1	22'-11"	#4	4	24'-6"	#4	18"	14	5'-0"	4'-6"	#4	12"	4	20'-1"	#4	12"	8	19'-0"	2'-8"	#4	1	21'-10"

CLEAR HEIGHT	QUANTITY - REINFORCING STEEL PER WING LB.
9'	371.8
10'	460.7
11'	549.0
12'	691.6

BAR BENDING DIAGRAMS



NOTE:- Dimensions are to bar centers.

⊕ Except as shown at headwall.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS

7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES

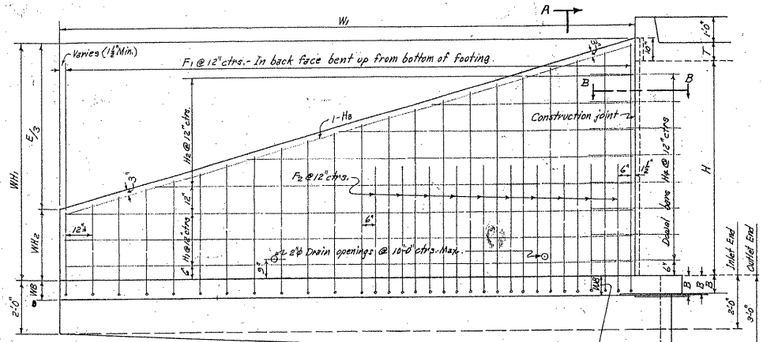
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

STANDARD DRAWING No. W-X002-2

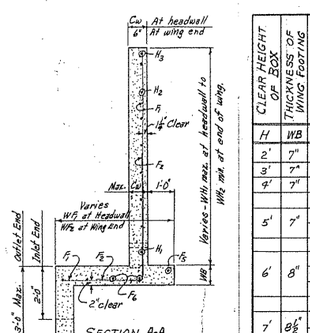
(2)

Designed By:- W.L.H. 7-25-62. Checked By:- JEM - 5-16-63
Drawn By:- W.L.H. 4-19-63. Checked By:- JEM - 5-10-63
Quantities By:- W.L.H.

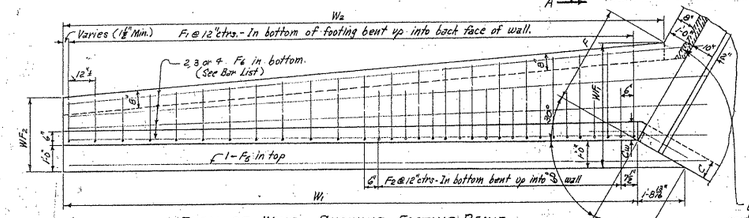
FED. ROAD Div.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



REAR ELEVATION OF WING - SHOWING BACK FACE REINF.

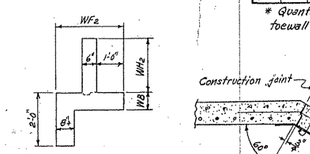


SECTION A-A

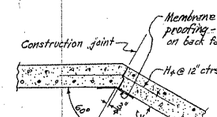


PLAN OF WING - SHOWING FOOTING REINF.

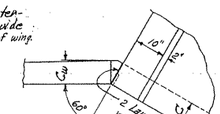
When B is more than W8, the shaded portion of the apron shall be made the same thickness as the barrel base B.



END VIEW OF WING



SECTION B-B THRU CONSTRUCTION JOINT



DETAIL AT TOP OF WING.

NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.

WING DIMENSIONS

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL = C	WINGWALL HEIGHTS: AT HEADWALL	WINGWALL HEIGHTS: AT END OF WING	WIDTHS OF WING FOOTINGS: AT HEADWALL	WIDTHS OF WING FOOTINGS: AT END OF WING	PERPENDICULAR FOOTING DIMENSION	PERPENDICULAR DIST. FROM HEAD TO END OF WING	LENGTH OF WING WALLS	INSIDE FOOTING DIMENSION	* QUANTITY PER WING CLASS S CONCRETE: INLET END	* QUANTITY PER WING CLASS S CONCRETE: OUTLET END
H	WB	C_W	WH_1	WH_2	W_{F1}	W_{F2}	F	E	W_1	W_2	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	0'-11⅜"	6'-6"	7'-6"	7'-1½"	0.889	0.986
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅛"	1'-4⅜"	8'-6"	9'-3⅜"	9'-2⅝"	1.338	1.466
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9"	10'-6"	12'-1⅛"	12'-1⅝"	1.868	2.027
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4⅝"	2'-1⅜"	12'-6"	14'-5⅝"	14'-7⅛"	2.478	2.668
		7"	5'-10"	1'-8"	3'-4"	2'-4⅝"	2'-1⅜"	12'-6"	14'-5⅝"	14'-7⅛"	2.582	2.772
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	14'-6"	16'-9"	17'-1⅛"	3.440	3.661
		7⅝"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	14'-6"	16'-9"	17'-1⅛"	3.511	3.732
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅝"	14'-6"	16'-9"	17'-1⅛"	3.582	3.803
7'	8⅝"	7⅝"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-1⅛"	16'-6"	19'-0⅝"	19'-10⅜"	4.505	4.758
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-1⅛"	16'-6"	19'-0⅝"	19'-10⅜"	4.597	4.851
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	18'-6"	21'-4⅝"	22'-9"	5.761	6.047

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_3.

APRON DIMENSION W_3

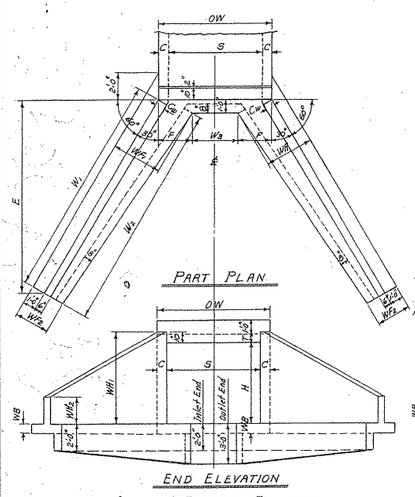
$W_3 = (OW - 2F)$

CLEAR SPAN	CLEAR HEIGHT	2 x FOOTING DIMENSION	SINGLE BARREL CULVERT: OW	SINGLE BARREL CULVERT: W_3	DOUBLE BARREL CULVERT: OW	DOUBLE BARREL CULVERT: W_3	TRIPLE BARREL CULVERT: OW	TRIPLE BARREL CULVERT: W_3	QUADRUPLE BARREL CULVERT: OW	QUADRUPLE BARREL CULVERT: W_3	QUINTUPLE BARREL CULVERT: OW	QUINTUPLE BARREL CULVERT: W_3
S	H	2F	OW	W_3	OW	W_3	OW	W_3	OW	W_3	OW	W_3
4'	2'	1'-11⅛"	5'-0"	3'-0⅞"	9'-8"	7'-8⅛"	14'-4"	12'-4⅜"	19'-0"	17'-0⅜"	23'-8"	21'-8⅜"
	3'	2'-8⅜"	5'-0"	2'-3⅜"	9'-8"	6'-11⅝"	14'-4"	11'-7⅝"	19'-0"	16'-3⅝"	23'-8"	20'-11⅝"
	4'	3'-6"	5'-0"	1'-6"	9'-8"	6'-2"	14'-4"	10'-10"	19'-0"	16'-6"	23'-8"	20'-2"
	5'	4'-3⅜"	5'-0"	0'-8⅜"	9'-8"	5'-4⅜"	14'-4"	10'-0⅜"	19'-0"	14'-8⅜"	23'-8"	19'-4⅜"
	6'	5'-0⅞"	5'-2"	0'-1⅛"	9'-11"	4'-10⅞"	14'-8"	9'-7⅞"	19'-5"	14'-4⅞"	24'-2"	19'-1⅞"
5'	3'	2'-8⅜"	6'-0"	3'-3⅜"	11'-8"	8'-11⅛"	17'-4"	14'-7⅛"	23'-0"	20'-3⅛"	28'-8"	25'-11⅛"
	4'	3'-6"	6'-0"	2'-6"	11'-8"	8'-2"	17'-4"	13'-10"	23'-0"	19'-6"	28'-8"	25'-2"
	5'	4'-3⅜"	6'-0"	1'-8⅜"	11'-8"	7'-4⅜"	17'-4"	13'-0⅜"	23'-0"	18'-8⅜"	28'-8"	24'-4⅜"
	6'	5'-0⅞"	6'-2"	1'-1⅛"	11'-11"	6'-10⅞"	17'-8"	12'-7⅞"	23'-5"	18'-4⅞"	29'-2"	24'-1⅞"
	7'	6'-2⅝"	6'-5"	0'-0⅞"	12'-1"	5'-10⅝"	17'-11"	11'-8⅝"	23'-9"	17'-6⅝"	29'-7"	23'-4⅝"
6'	3'	2'-8⅜"	7'-0"	4'-3⅜"	13'-8"	10'-11⅛"	20'-4"	17'-7⅛"	27'-0"	24'-3⅛"	33'-8"	30'-11⅛"
	4'	3'-6"	7'-0"	3'-6"	13'-8"	10'-2"	20'-4"	16'-10"	27'-0"	23'-6"	33'-8"	30'-2"
	5'	4'-3⅜"	7'-0"	2'-8⅜"	13'-8"	9'-4⅜"	20'-4"	16'-0⅜"	27'-0"	22'-8⅜"	33'-8"	29'-4⅜"
	6'	5'-0⅞"	7'-2"	2'-1⅛"	13'-11"	8'-10⅞"	20'-8"	15'-7⅞"	27'-5"	22'-4⅞"	34'-2"	29'-1⅞"
	7'	6'-2⅝"	7'-5"	1'-0⅞"	14'-1"	7'-10⅝"	20'-11"	14'-8⅝"	27'-9"	21'-6⅝"	34'-7"	28'-4⅝"
	8'	7'-4⅝"	7'-8"	0'-0"	14'-4"	6'-10"	21'-0"	13'-8"	27'-10"	20'-8"	34'-10"	27'-8"
7'	4'	3'-6"	8'-0"	4'-6"	15'-8"	12'-2"	23'-4"	19'-10"	31'-0"	27'-6"	38'-8"	35'-2"
	5'	4'-3⅜"	8'-0"	3'-8⅜"	15'-8"	11'-4⅜"	23'-4"	19'-0⅜"	31'-0"	26'-8⅜"	38'-8"	34'-4⅜"
	6'	5'-0⅞"	8'-2"	3'-1⅛"	15'-11"	10'-10⅞"	23'-8"	18'-7⅞"	31'-5"	26'-4⅞"	39'-2"	34'-1⅞"
	7'	6'-2⅝"	8'-5"	2'-0⅞"	16'-1"	9'-10⅝"	23'-11"	17'-8⅝"	31'-9"	25'-6⅝"	39'-7"	32'-4⅝"
	8'	7'-4⅝"	8'-8"	1'-0"	16'-4"	8'-10"	24'-0"	16'-8"	31'-10"	24'-8"	39'-10"	32'-8"
8'	4'	3'-6"	9'-0"	5'-6"	17'-8"	14'-2"	26'-4"	22'-10"	35'-6"	31'-6"	43'-8"	40'-2"
	5'	4'-3⅜"	9'-2"	4'-10⅜"	17'-11"	13'-7⅜"	26'-8"	22'-0⅜"	35'-5"	31'-1⅜"	44'-2"	39'-10⅜"
	6'	5'-0⅞"	9'-2"	4'-1⅛"	17'-11"	12'-10⅞"	26'-8"	21'-7⅞"	35'-5"	30'-9⅞"	44'-2"	39'-1⅞"
	7'	6'-2⅝"	9'-5"	3'-0⅞"	18'-1"	11'-10⅝"	26'-11"	20'-8⅝"	35'-9"	29'-10⅝"	44'-7"	38'-4⅝"
	8'	7'-4⅝"	9'-9"	2'-0"	18'-2"	10'-10"	27'-0"	19'-8"	35'-10"	28'-6"	44'-8"	37'-10"
9'	5'	4'-3⅜"	10'-2"	5'-10⅜"	19'-11"	15'-7⅜"	29'-8"	25'-4⅜"	39'-5"	35'-1⅜"	49'-2"	44'-10⅜"
	6'	5'-0⅞"	10'-3"	5'-2⅞"	20'-1"	15'-0⅞"	29'-11"	24'-10⅞"	39'-9"	34'-8⅞"	49'-7"	44'-1⅞"
	7'	6'-2⅝"	10'-3"	4'-0⅞"	20'-1"	13'-10⅝"	29'-11"	23'-8⅝"	39'-9"	33'-6⅝"	49'-7"	43'-4⅝"
	8'	7'-4⅝"	10'-4"	3'-0"	20'-2"	12'-10"	30'-0"	22'-8"	39'-10"	32'-6"	49'-8"	42'-8"
10'	5'	4'-3⅜"	11'-2"	6'-10⅜"	21'-11"	17'-7⅜"	32'-8"	28'-4⅜"	43'-5"	39'-1⅜"	54'-2"	49'-10⅜"
	6'	5'-0⅞"	11'-3"	6'-2⅞"	22'-1"	17'-0⅞"	32'-11"	27'-10⅞"	43'-9"	38'-8⅞"	54'-7"	49'-1⅞"
	7'	6'-2⅝"	11'-3"	5'-0⅞"	22'-1"	15'-10⅝"	32'-11"	26'-8⅝"	43'-9"	37'-6⅝"	54'-7"	48'-4⅝"
	8'	7'-4⅝"	11'-4"	4'-0"	22'-2"	14'-10"	33'-0"	25'-8"	43'-10"	36'-6"	54'-8"	47'-8"
11'	6'	5'-0⅞"	12'-9"	7'-3⅞"	24'-8"	19'-7⅞"	36'-0"	30'-11⅞"	47'-10"	42'-9⅞"		
	7'	6'-2⅝"	12'-9"	6'-1⅞"	24'-8"	17'-11⅞"	36'-0"	29'-9⅞"	47'-10"	41'-7⅞"		
	8'	7'-4"	12'-9"	5'-0"	24'-8"	16'-10"	36'-0"	28'-8"	47'-10"	40'-6"		
12'	6'	5'-0⅞"	13'-8"	8'-3⅞"	26'-2"	21'-1⅞"	39'-0"	33'-11⅞"	51'-10"	46'-9⅞"		
	7'	6'-2⅝"	13'-8"	7'-1⅞"	26'-2"	19'-11⅞"	39'-0"	32'-9⅞"	51'-10"	45'-7⅞"		
	8'	7'-4"	13'-8"	6'-0"	26'-2"	18'-10"	39'-0"	31'-8"	51'-10"	44'-6"		

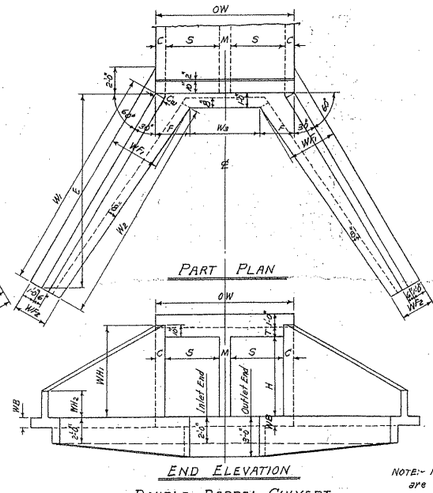
QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL - FOR 4 WINGS ⊛	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS): SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	C_W	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	108.0	4.50	5.96	6.42	7.38	8.34
	3'	6"	7"	169.4	6.26	7.21	8.17	9.13	10.09
	4'	6"	7"	259.6	8.33	9.28	10.24	11.20	12.16
	5'	6"	7"	357.8	10.72	11.68	12.64	13.60	14.56
	6'	7"	8"	583.1	14.55	15.53	16.52	17.51	18.49
5'	3'	6"	7"	164.9	6.97	7.68	8.79	9.96	11.12
	4'	6"	7"	254.6	8.54	9.70	10.87	10.03	12.20
	5'	6"	7"	357.8	10.94	12.10	13.26	14.43	15.59
	6'	7"	8"	583.1	14.77	15.96	17.15	18.34	19.54
	7'	7⅝"	8⅝"	1139.6	18.94	20.15	21.37	22.59	23.80
6'	3'	6"	7"	164.9	6.68	8.06	9.42	10.80	12.18
	4'	6"	7"	254.6	8.75	10.14	11.49	12.87	14.25
	5'	6"	7"	357.8	11.15	12.53	13.89	15.27	16.65
	6'	7"	8"	583.1	14.98	16.39	17.78	19.18	20.59
	7'	7⅝"	8⅝"	1139.6	19.15	20.58	22.00	23.43	24.86
	8'	8"	9"	1925.6	24.09	25.53	26.96	28.39	29.83
7'	4'	6"	7"	254.6	8.97	10.58	12.15	13.76	15.35
	5'	6"	7"	357.8	11.36	12.97	14.58	16.15	17.75
	6'	7"	8"	583.1	15.20	16.82	18.42	20.04	21.66
	7'	7⅝"	8⅝"	1139.6	19.38	21.02	22.68	24.28	25.92
	8'	8"	9"	1925.6	24.32	25.97	27.60	29.25	30.89
8'	4'	6"	7"	254.6	9.19	11.03	12.82	14.65	16.45
	5'	7"	7"	357.8	12.03	13.89	15.70	17.55	19.34
	6'	7"	8"	583.1	15.92	17.27	19.09	20.93	22.75
	7'	7⅝"	8⅝"	1139.6	19.59	21.46	23.30	25.16	26.99
	8'	8"	9"	1925.6	24.54	26.41	28.29	30.11	31.96
9'	5'	7"	7"	357.8	12.26	14.39	16.87	18.95	20.97
	6'	7⅝"	8"	583.1	15.94	18.04	20.09	22.19	24.23
	7'	7⅝"	8⅝"	1139.6	19.81	21.91	23.96	26.06	28.10
	8'	8"	9"	1925.6	24.76	26.86	28.91	31.00	33.05
10'	5'	7"	7"	357.8	12.49	14.80	17.05	19.24	21.52
	6'	7⅝"	8"	583.1	16.17	18.50	20.77	22.99	25.28
	7'	7⅝"	8⅝"	1139.6	20.04	22.37	24.64	26.87	29.15
	8'	8"	9"	1925.6	24.98	27.31	29.58	31.81	34.10
11'	6'	8"	8"	583.1	16.69	19.27	21.76	24.23	
	7'	8"	8⅝"	1139.6	20.64	23.22	25.71	28.18	
	8'	8"	9"	1925.6	25.19	27.77	30.27	32.74	
12'	6'	8"	8"	583.1	16.92	19.75	22.45	25.18	
	7'	8"	8⅝"	1139.6	20.87	23.69	26.40	29.13	
	8'	8"	9"	1925.6	25.42	28.25	30.96	33.69	

⊛ For reinforcing steel in Headwalls and Aprons, See Details of Standard Barrel Sections for R.C. Box Culverts for the desired Span and Height.

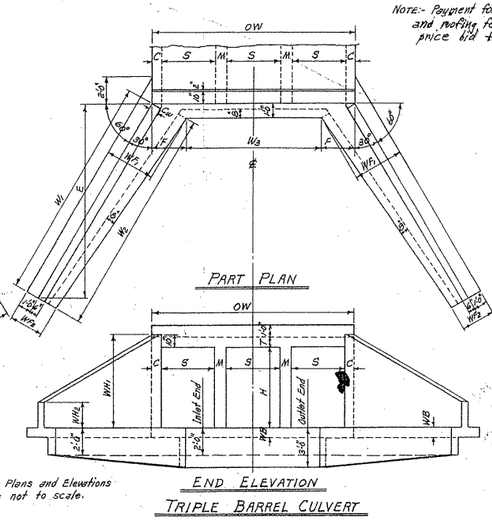


SINGLE BARREL CULVERT

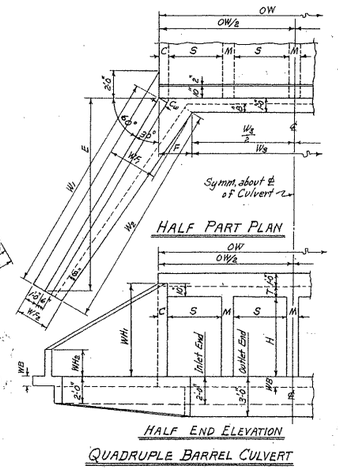


DOUBLE BARREL CULVERT

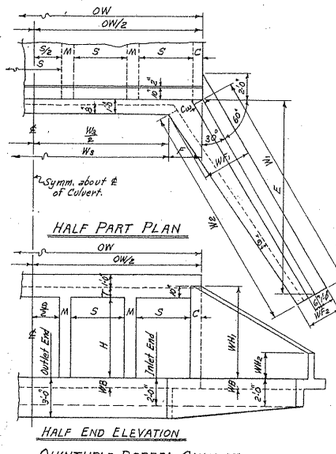
NOTE:- Plans and Elevations are not to scale.



TRIPLE BARREL CULVERT



QUADRUPLE BARREL CULVERT



QUINTUPLE BARREL CULVERT

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mopings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. as listed below.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X1	R-200X-X1	R-300X-X1	R-400X-X1	R-500X-X1
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		

CLASS S CONCRETE

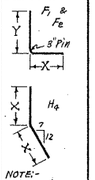
BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT	F_1 Bent (In bottom of footing, bent up into back face of wing. One bar of each length.): SIZE	SPACING	NO. REQD	LENGTHS VARY X MIN.	X MAX.	Y MIN.	Y MAX.	F_2 Bent (In bottom of footing, bent up into back face of wing. Alt. with F_1 bars.): SIZE	SPACING	NO. REQD	LENGTH	X	Y
H	SIZE	SPACING	NO. REQD	MIN.	MAX.	MIN.	MAX.	SIZE	SPACING	NO. REQD	LENGTH	X	Y
2'	#3	12"	8	1'-6"	3'-10"	0'-8"	1'-0"	0'-11"	2'-11"	—	—	—	—
3'	#3	12"	10	2'-2"	5'-2"	0'-10"	1'-3"	1'-5"	4'-0"	—	—	—	—
4'	#3	12"	13	2'-9"	6'-6"	0'-11"	1'-7"	1'-6"	5'-0"	—	—	—	—
5'	#3	12"	15	2'-11"	7'-10"	1'-1"	1'-11"	1'-11"	6'-0"	#3	12"	4	3'-6"
6'	#4	12"	17	3'-6"	9'-3"	1'-2"	2'-3"	2'-5"	7'-1"	#3	12"	4	4'-6"
7'	#4	12"	20	3'-9"	10'-9"	1'-3"	2'-9"	2'-7"	8'-1"	#4	12"	7	5'-6"
8'	#4	12"	22	4'-4"	12'-3"	1'-5"	3'-12"	3'-0"	9'-2"	#4	12"	10	6'-6"

CLEAR HEIGHT	F_3 Straight (Longitudinal in top of wing footing heel.): SIZE	NO. REQD	LENGTH	F_4 Straight (Longitudinal in bottom of wing footing toe.): SIZE	NO. REQD	LENGTH	H_1 Straight (Horizontal in back face of wing.): SIZE	SPACING	NO. REQD	LENGTH	H_2 Straight (Horizontal in back face of wing. One bar of each length.): SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	MIN.
H	SIZE	NO. REQD	LENGTH	SIZE	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	MAX.	MIN.
2'	#3	1	9'-8"	#3	2	8'-6"	#3	12"	1	7'-2"	#3	12"	1	—	9'-0"
3'	#3	1	12'-0"	#3	2	11'-0"	#3	12"	1	9'-6"	#3	12"	2	7'-6"	9'-0"
4'	#3	1	14'-4"	#3	3	13'-6"	#3	12"	1	11'-10"	#3	12"	3	10'-11"	9'-0"
5'	#3	1	16'-8"	#3	3	16'-0"	#3	12"	2	14'-2"	#3	12"	3	10'-11"	9'-0"
6'	#3	1	19'-0"	#3	3	18'-6"	#3	12"	2	16'-6"	#3	12"	4	14'-6"	9'-0"
7'	#4	1	21'-4"	#4	4	21'-0"	#4	12"	2	18'-9"	#4	12"	5	17'-9"	9'-0"
8'	#4	1	23'-8"	#4	4	23'-9"	#4	12"	3	21'-1"	#4	12"	5	17'-9"	9'-0"

CLEAR HEIGHT	H_3 Straight (In back face of wing at top - on slope.): SIZE	NO. REQD	LENGTH	H_4 Bent (Dowels thru construction joint at headwall.): SIZE	SPACING	NO. REQD	LENGTH	X	QUANTITY REINFORCING STEEL PER WING
H	SIZE	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTH	X	LB.
2'	#3	1	7'-9"	#3	12"	2	2'-8"	1'-9"	27.0
3'	#3	1	9'-9"	#3	12"	3	2'-8"	1'-9"	41.1
4'	#3	1	12'-2"	#3	12"	4	2'-8"	1'-9"	63.7
5'	#3	1	14'-7"	#3	12"	5	2'-8"	1'-9"	89.5
6'	#3	1	17'-0"	#3	12"	6	2'-8"	1'-9"	145.8
7'	#4	1	19'-5"	#4	12"	7	3'-6"	1'-9"	283.7
8'	#4	1	21'-10"	#4	12"	8	3'-6"	1'-9"	356.4

BAR BENDING DIAGRAMS



REVISIONS:- Membrane added. 5-10-66 W.C.H.

Designed By:- W.C.H. 8-20-62. Checked By:-
Drawn By:- W.C.H. 12-4-62. Checked By:-
Quantities By:- W.C.H. 12-14-62. Checked By:-
Rechecked By:-

RMS - 1-31-63
RMS - 1-31-63
RMS - 3-29-63

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS

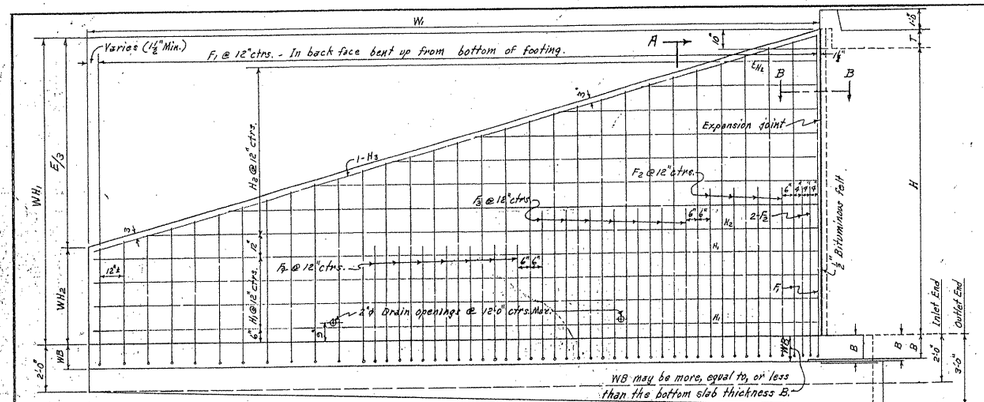
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

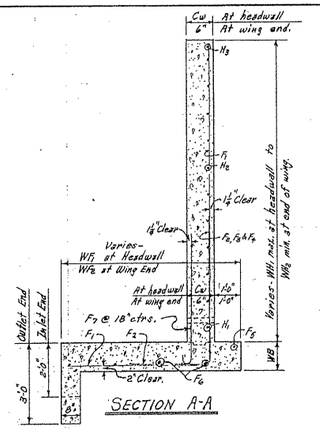
STANDARD DRAWING NO. W-X003-1

Mylar

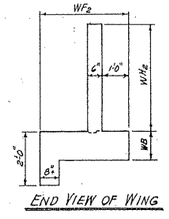
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No:					



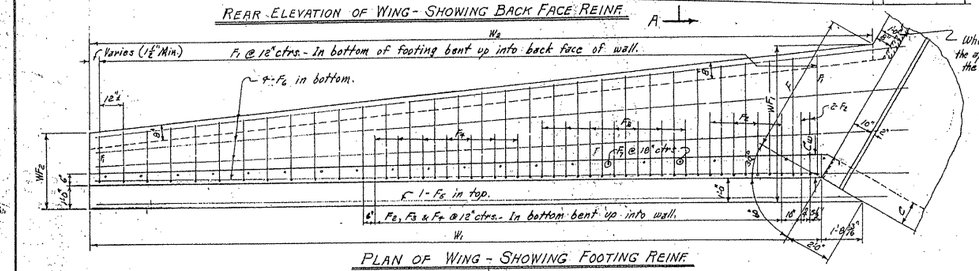
REAR ELEVATION OF WING - SHOWING BACK FACE REINF.



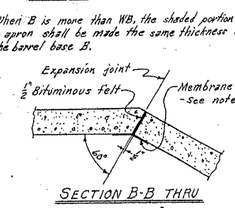
SECTION A-A



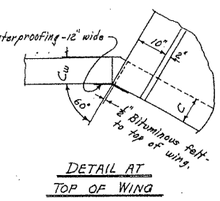
END VIEW OF WING



PLAN OF WING - SHOWING FOOTING REINF.



SECTION B-B THRU EXPANSION JOINT



DETAIL AT TOP OF WING

WING DIMENSIONS

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL = C	WINGWALL HEIGHTS		WIDTHS OF WING FOOTINGS			LENGTH OF WINGWALLS	INSIDE FOOTING DIMENSION	* QUANTITY PER WING CLASS S CONCRETE	
			AT HEADWALL	AT END OF WING	AT HEADWALL	AT END OF WING	PERPENDICULAR FOOTING DIMENSION	PERPENDICULAR DIST. FROM HDWL TO END OF WING		INLET END	OUTLET END
H	WB	Cw	WH1	WH2	WF1	WF2	F	E	W1	W2	CU.YD.	CU.YD.
9'	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-3"	20'-6"	23'-8"	24'-11"	7.492	7.810
10'	11"	10"	10'-10"	3'-9"	5'-8"	3'-0"	4'-10"	22'-6"	25'-11⅜"	27'-6⅛"	9.564	9.905
11'	12"	11"	11'-10"	3'-8"	6'-2"	3'-1⅛"	5'-5"	24'-6"	28'-3⅝"	30'-1⅛"	11.977	12.361
12'	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	6'-0"	26'-6"	30'-7⅛"	32'-8⅝"	14.791	15.206

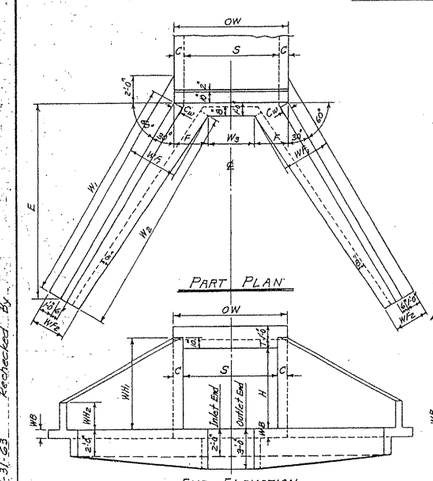
* Quantity per wing does not include headwall or that portion of apron or footwall for the length W3.

CLEAR SPAN	CLEAR HEIGHT	2 x FOOTING DIMENSION	W3 = (OW - 2F)									
			SINGLE BARREL CULVERT		DOUBLE BARREL CULVERT		TRIPLE BARREL CULVERT		QUADRUPLE BARREL CULVERT		QUINTUPLE BARREL CULVERT	
S	H	2F	OW	W3	OW	W3	OW	W3	OW	W3	OW	W3
7'	9'	8'-6"	8'-6"	0'-0"	16'-5"	7'-11"	24'-4"	15'-10"	32'-3"	23'-9"	40'-2"	31'-8"
8'	9'	8'-6"	9'-6"	1'-0"	18'-5"	9'-11"	27'-4"	18'-10"	36'-3"	27'-9"	45'-2"	36'-8"
	10'	9'-8"	9'-8"	0'-0"	18'-8"	9'-0"	27'-8"	18'-0"	36'-8"	27'-0"	45'-8"	36'-0"
9'	9'	8'-6"	10'-6"	2'-0"	20'-5"	11'-11"	30'-4"	21'-10"	40'-3"	31'-9"	50'-2"	41'-8"
	10'	9'-8"	10'-8"	1'-0"	20'-8"	11'-0"	30'-8"	21'-0"	40'-8"	31'-0"	50'-8"	41'-0"
	11'	10'-10"	10'-10"	0'-0"	20'-10"	10'-0"	30'-10"	20'-0"	40'-10"	30'-0"	50'-10"	40'-0"
10'	9'	8'-6"	11'-6"	3'-0"	22'-5"	13'-11"	33'-4"	24'-10"	44'-3"	35'-9"	55'-2"	46'-8"
	10'	9'-8"	11'-8"	2'-0"	22'-8"	13'-0"	33'-8"	24'-0"	44'-8"	35'-0"	55'-8"	46'-0"
	11'	10'-10"	11'-10"	1'-0"	22'-10"	12'-0"	33'-10"	23'-0"	44'-10"	34'-0"	55'-10"	45'-0"
	12'	12'-0"	12'-0"	0'-0"	23'-0"	11'-0"	34'-0"	22'-0"	45'-0"	33'-0"	56'-0"	44'-0"
11'	9'	8'-6"	12'-6"	4'-0"	24'-5"	15'-11"	36'-4"	27'-10"	48'-3"	39'-9"		
	10'	9'-8"	12'-8"	3'-0"	24'-8"	15'-0"	36'-8"	27'-0"	48'-8"	39'-0"		
	11'	10'-10"	12'-10"	2'-0"	24'-10"	14'-0"	36'-10"	26'-0"	48'-10"	38'-0"		
	12'	12'-0"	13'-0"	1'-0"	25'-0"	13'-0"	37'-0"	25'-0"	49'-0"	37'-0"		
12'	9'	8'-6"	13'-6"	5'-0"	26'-5"	17'-11"	39'-4"	30'-10"	52'-3"	43'-9"		
	10'	9'-8"	13'-8"	4'-0"	26'-8"	17'-0"	39'-8"	30'-0"	52'-8"	43'-0"		
	11'	10'-10"	13'-10"	3'-0"	26'-10"	16'-0"	39'-10"	29'-0"	52'-10"	42'-0"		
	12'	12'-0"	14'-0"	2'-0"	27'-0"	15'-0"	40'-0"	28'-0"	53'-0"	41'-0"		

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL - FOR 4 WINGS ⊕	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOE WALLS AND APRONS					
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	2133.2	31.16	32.84	34.51	36.19	37.87	
8'	9'	9"	10"	2133.2	31.39	33.28	35.16	37.05	38.94	
	10'	10"	11"	2651.5	39.56	41.98	43.90	45.33	47.25	
9'	9'	9"	10"	2133.2	31.61	33.73	35.81	37.91	40.01	
	10'	10"	11"	2651.6	39.78	41.93	44.05	46.20	48.33	
	11'	11"	12"	3293.1	49.39	51.55	53.70	55.87	58.02	
10'	9'	9"	10"	2133.2	31.83	34.17	36.97	38.73	41.12	
	10'	10"	11"	2651.5	40.01	42.37	44.70	47.05	49.41	
	11'	11"	12"	3293.1	49.62	52.00	54.36	56.73	59.11	
	12'	12"	13"	4049.2	60.79	63.19	65.57	67.97	70.37	
11'	9'	9"	10"	2133.2	32.04	34.64	37.15	39.68		
	10'	10"	11"	2651.5	40.22	42.83	45.37	47.99		
	11'	11"	12"	3293.1	49.84	52.45	55.02	57.61		
	12'	12"	13"	4049.2	61.01	63.64	66.24	68.85		
12'	9'	9"	10"	2133.2	32.27	35.11	37.84	40.69		
	10'	10"	11"	2651.5	40.44	43.30	46.06	48.82		
	11'	11"	12"	3293.1	50.06	52.92	55.68	58.48		
	12'	12"	13"	4049.2	61.24	64.10	66.90	69.73		

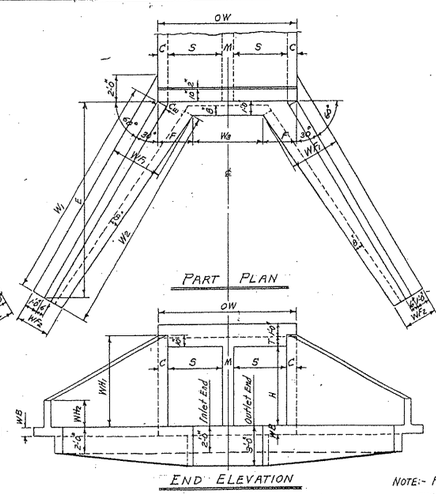
⊕ For reinforcing steel in Headwalls and Aprons, See Details of Standard Barrel Sections for R.C. Box Culverts for the desired Span and Height.



PART PLAN

END ELEVATION

SINGLE BARREL CULVERT

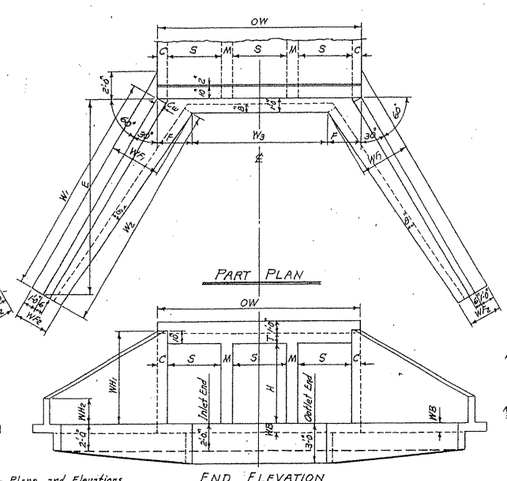


PART PLAN

END ELEVATION

DOUBLE BARREL CULVERT

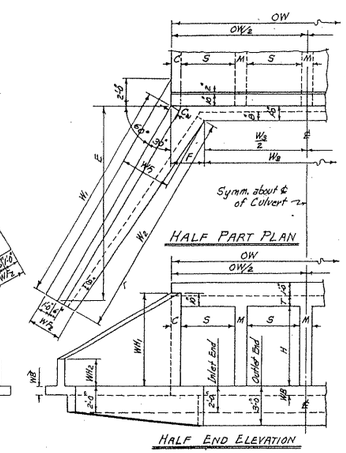
NOTE:- Plans and Elevations are not to scale.



PART PLAN

END ELEVATION

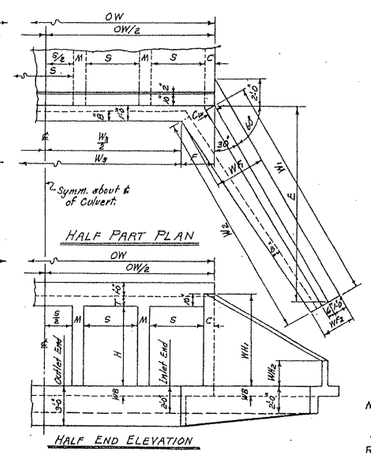
TRIPLE BARREL CULVERT



HALF PART PLAN

HALF END ELEVATION

QUADRUPLE BARREL CULVERT



HALF PART PLAN

HALF END ELEVATION

QUINTUPLE BARREL CULVERT

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. as listed below.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		

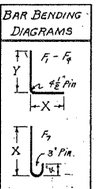
BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT	F1 BENT In bottom of footing, bent up into back face of wing. One bar of each length.								F2 BENT In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						F3 BENT In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						F4 BENT In bottom of footing, bent up into back face of wing. Alt. with F1 bars.					
H	SIZE	SPACING	No. Reqd	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SIZE ⊕	SPACING	No. Reqd	LENGTH	X	Y	SIZE	SPACING	No. Reqd	LENGTH	X	Y	SIZE	SPACING	No. Reqd	LENGTH	X	Y
9'	#5	12"	24	5'-0"	13'-10"	1'-6"	3'-8"	3'-7"	10'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	7	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	#5	12"	27	5'-4"	15'-5"	1'-7"	4'-2"	3'-10"	11'-4"	#6	12"	2	8'-6"	2'-9"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	7	6'-6"	1'-10"	4'-9"
11'	#5	12"	29	6'-0"	16'-11"	1'-9"	4'-7"	4'-4"	12'-5"	#6	12"	6	8'-6"	2'-9"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	7	6'-6"	1'-10"	4'-9"
12'	#5	12"	31	6'-8"	18'-5"	1'-11"	5'-0"	4'-10"	13'-6"	#7	12"	6	9'-6"	2'-7"	7'-0"	#6	12"	7	8'-6"	2'-4"	6'-3"	#4	12"	7	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	F5 STRAIGHT Longitudinal in top of wing footing heel.			F6 STRAIGHT Longitudinal in bottom of wing footing toe.			H1 STRAIGHT Horizontal in back face of wing.				H2 STRAIGHT Horizontal in back face of wing. One bar of each length					H3 In back face of wing at top - on slope			F7 BENT Footing dowels extending up into front face of wing.					QUANTITY REINFORCING STEEL PER WING
H	SIZE	No. Reqd	LENGTH	SIZE	No. Reqd	LENGTH	SIZE	SPACING	No. Reqd	LENGTH	SIZE	SPACING	No. Reqd	LENGTHS VARY MAX.	LENGTHS VARY MIN.	SIZE	No. Reqd	LENGTH	SIZE	SPACING	No. Reqd	LENGTH	X	LB.
9'	#4	1	26'-0"	#4	4	26'-3"	#4	12"	3	23'-5"	#4	12"	6	21'-8"	4'-0"	#4	1	24'-1"	#4	18"	16	4'-0"	3'-6"	533.3
10'	#4	1	28'-9"	#4	4	29'-0"	#4	12"	3	25'-8"	#4	12"	7	24'-7"	4'-0"	#4	1	26'-6"	#4	18"	18	4'-3"	3'-9"	662.9
11'	#4	1	30'-8"	#4	4	31'-6"	#4	12"	4	28'-0"	#4	12"	7	24'-7"	4'-0"	#4	1	28'-11"	#4	18"	19	4'-9"	4'-3"	810.8
12'	#4	1	33'-0"	#4	4	34'-0"	#4	12"	4	30'-4"	#4	12"	8	28'-0"	4'-0"	#4	1	31'-8"	#4	18"	21	5'-0"	4'-6"	1012.3

⊕ Except as shown at headwall.

BAR BENDING DIAGRAMS



Note:- Dimensions are to bar centers.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS

7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

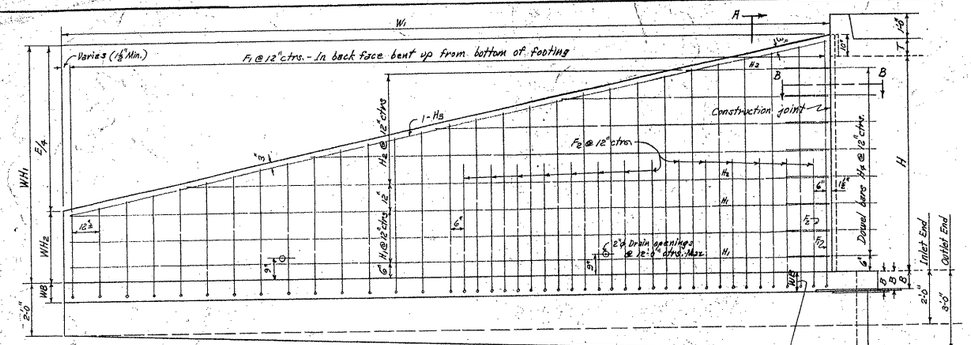
STANDARD DRAWING NO. W-X003-2

Designed By:- W.C.H. 7-25-62 Checked By:- RHS 1-3-63
Drawn By:- W.C.H. 12-31-62 Checked By:- RHS 1-3-63
Quantities By:- W.C.H. 1-11-63 Checked By:- RHS 1-31-63 Rechecked By:-

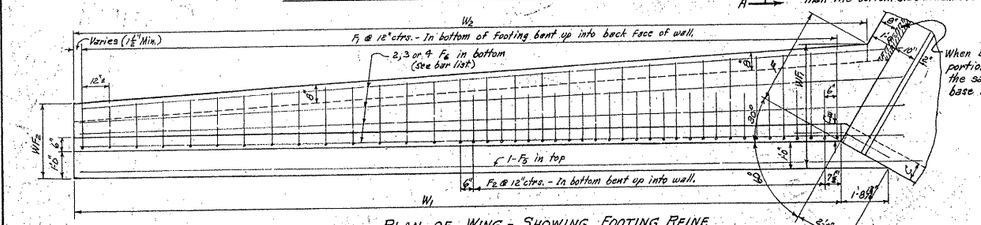
4

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				

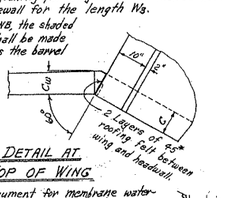
JOB No.



REAR ELEVATION OF WING - SHOWING BACK FACE REINF.

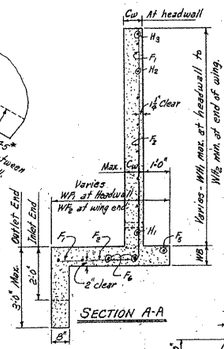


PLAN OF WING - SHOWING FOOTING REINF.

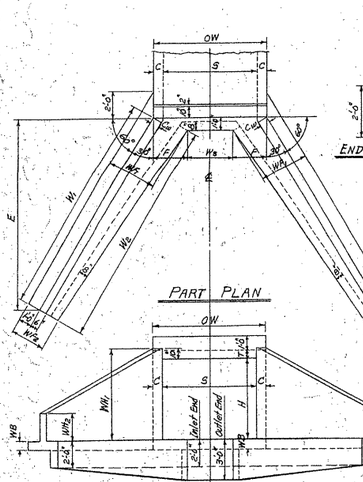


DETAIL AT TOP OF WING.

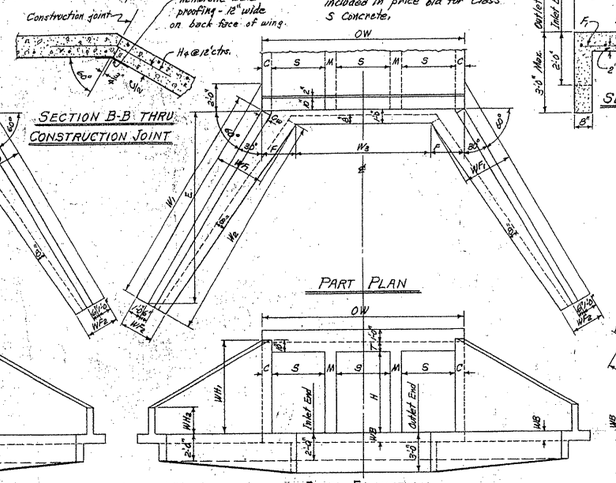
Note:- Payment for membrane waterproofing and roofing felt to be included in price bid for Class S Concrete.



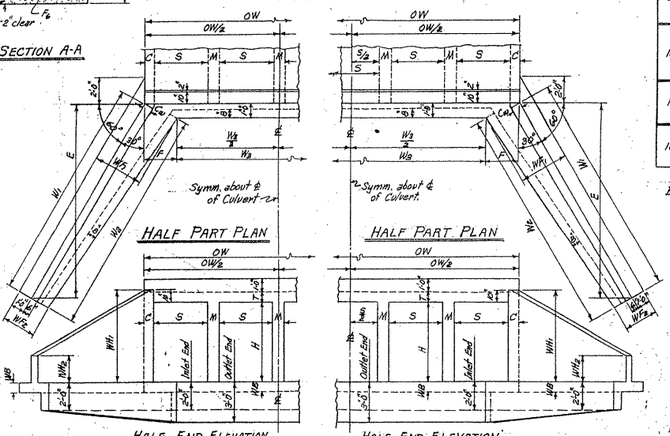
SECTION A-A



END VIEW OF WING

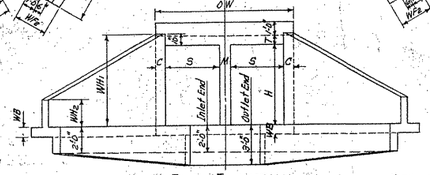


SECTION B-B THRU CONSTRUCTION JOINT



HALF PART PLAN

END ELEVATION
SINGLE BARREL CULVERT



END ELEVATION
DOUBLE BARREL CULVERT

END ELEVATION
TRIPLE BARREL CULVERT

Note:- Plans and Elevations are not to scale.

HALF END ELEVATION
QUADRUPLE BARREL CULVERT

HALF END ELEVATION
QUINTUPLE BARREL CULVERT

WING DIMENSIONS

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL "C"	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	PERPENDICULAR FOOTING DIMENSION	PERPENDICULAR DIST. FROM HDWL. TO END OF WING	LENGTH OF WINGWALLS	INSIDE FOOTING DIMENSION	* QUANTITY PER WING CLASS S CONCRETE INLET END	* QUANTITY PER WING CLASS S CONCRETE OUTLET END
H	WB	C_W	WH_1	WH_2	WF_1	WF_2	F	E	W_1	W_2	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	0'-11⅞"	8'-8"	10'-0"	9'-7⅝"	1.174	1.308
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅝"	1'-4⅜"	11'-4"	13'-1"	12'-10⅜"	1.768	1.937
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9"	14'-0"	16'-2"	16'-2"	2.969	2.678
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-1⅜"	16'-8"	19'-3"	19'-5⅛"	3.277	3.526
		7"	5'-10"	1'-8"	3'-4"	2'-4⅝"	2'-1⅜"	16'-8"	19'-3"	19'-5⅛"	3.914	3.664
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅛"	19'-4"	22'-4"	22'-8⅛"	4.550	4.840
		7⅝"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅛"	19'-4"	22'-4"	22'-8⅛"	4.644	4.934
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-6⅛"	19'-4"	22'-4"	22'-8⅛"	4.737	5.027
7'	8½"	7⅝"	7'-10"	2'-4"	4'-2"	2'-7⅞"	3'-1⅛"	22'-0"	25'-4⅝"	26'-1"	5.960	6.291
		8"	7'-10"	2'-4"	4'-2"	2'-7⅞"	3'-1⅛"	22'-0"	25'-4⅝"	26'-1"	6.081	6.413
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	24'-8"	28'-5⅝"	29'-5⅛"	7.621	7.995

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_3.

APRON DIMENSION W_3

$W_3 = (OW - 2F)$

CLEAR SPAN S	CLEAR HEIGHT H	2 x FOOTING DIMENSION 2F	SINGLE BARREL CULVERT OW	SINGLE BARREL CULVERT W_3	DOUBLE BARREL CULVERT OW	DOUBLE BARREL CULVERT W_3	TRIPLE BARREL CULVERT OW	TRIPLE BARREL CULVERT W_3	QUADRUPLE BARREL CULVERT OW	QUADRUPLE BARREL CULVERT W_3	QUINTUPLE BARREL CULVERT OW	QUINTUPLE BARREL CULVERT W_3
4'	2'	1'-11⅝"	5'-0"	3'-10⅝"	9'-8"	7'-8⅝"	14'-4"	12'-4⅝"	19'-0"	17'-0⅝"	23'-8"	21'-8⅝"
	3'	2'-8⅝"	5'-0"	2'-3⅝"	9'-8"	6'-11⅛"	14'-4"	11'-7⅛"	19'-0"	16'-3⅝"	23'-8"	20'-11⅛"
	4'	3'-6"	5'-0"	1'-6"	9'-8"	6'-2"	14'-4"	10'-10"	19'-0"	15'-6"	23'-8"	20'-2"
	5"	4'-3⅜"	5'-0"	0'-8⅝"	9'-8"	5'-4⅝"	14'-4"	10'-0⅝"	19'-0"	14'-8⅝"	23'-8"	19'-0⅝"
	6'	5'-0½"	5'-2"	0'-1⅞"	9'-11"	4'-10⅞"	14'-8"	9'-7⅞"	19'-5"	14'-4⅞"	24'-2"	19'-1⅞"
5'	3'	2'-8⅝"	6'-0"	3'-3⅝"	11'-8"	8'-11⅛"	17'-4"	14'-7⅛"	23'-0"	20'-3⅝"	28'-8"	25'-11⅛"
	4'	3'-6"	6'-0"	2'-6"	11'-8"	8'-2"	17'-4"	13'-10"	23'-0"	19'-6"	28'-8"	25'-2"
	5'	4'-3⅜"	6'-0"	1'-8⅝"	11'-8"	7'-4⅝"	17'-4"	13'-0⅝"	23'-0"	18'-8⅝"	28'-8"	24'-0⅝"
	6'	5'-0½"	6'-2"	1'-1⅞"	11'-11"	6'-10⅞"	17'-8"	12'-7⅞"	23'-5"	18'-4⅞"	29'-2"	24'-11⅞"
	7'	5'-8⅞"	6'-3"	0'-10⅞"	12'-1"	5'-10⅞"	17'-11"	11'-8⅞"	23'-7"	17'-6⅞"	29'-7"	23'-7⅞"
6'	3'	2'-8⅝"	7'-0"	4'-3⅝"	13'-8"	10'-11⅛"	20'-4"	17'-7⅛"	27'-0"	24'-3⅝"	33'-8"	30'-11⅛"
	4'	3'-6"	7'-0"	3'-6"	13'-8"	10'-2"	20'-4"	16'-10"	27'-0"	23'-6"	33'-8"	30'-2"
	5'	4'-3⅜"	7'-0"	2'-8⅝"	13'-8"	9'-4⅝"	20'-4"	16'-0⅝"	27'-0"	22'-8⅝"	33'-8"	29'-4⅝"
	6'	5'-0½"	7'-2"	2'-1⅞"	13'-11"	8'-10⅞"	20'-8"	15'-7⅞"	27'-5"	22'-4⅞"	34'-2"	29'-1⅞"
	7'	5'-8⅞"	7'-3"	1'-10⅞"	14'-1"	7'-10⅞"	20'-11"	14'-10⅞"	27'-9"	21'-6⅞"	34'-7"	28'-10⅞"
	8'	7'-4"	7'-4"	0'-8"	14'-2"	6'-10"	21'-0"	13'-8"	27'-10"	20'-6"	34'-8"	27'-8"
7'	4'	3'-6"	8'-0"	4'-6"	15'-8"	12'-2"	23'-4"	19'-10"	31'-0"	27'-6"	38'-8"	35'-2"
	5'	4'-3⅜"	8'-0"	3'-8⅝"	15'-8"	11'-4⅝"	23'-4"	19'-0⅝"	31'-0"	26'-8⅝"	38'-8"	34'-4⅝"
	6'	5'-0½"	8'-2"	3'-1⅞"	15'-11"	10'-10⅞"	23'-8"	18'-7⅞"	31'-5"	26'-4⅞"	39'-2"	34'-1⅞"
	7'	5'-8⅞"	8'-3"	2'-10⅞"	16'-1"	9'-10⅞"	23'-11"	17'-8⅞"	31'-9"	25'-6⅞"	39'-7"	33'-7⅞"
	8'	7'-4"	8'-4"	1'-0"	16'-2"	8'-10"	24'-0"	16'-8"	31'-10"	24'-6"	39'-8"	32'-8"
8'	4'	3'-6"	9'-0"	5'-6"	17'-8"	14'-2"	26'-4"	22'-10"	35'-0"	31'-6"	43'-8"	40'-2"
	5'	4'-3⅜"	9'-2"	4'-10⅝"	17'-11"	13'-7⅝"	26'-8"	22'-1⅝"	35'-5"	31'-1⅝"	44'-2"	39'-10⅝"
	6'	5'-0½"	9'-2"	4'-1⅞"	17'-11"	12'-10⅞"	26'-8"	21'-7⅞"	35'-5"	30'-4⅞"	44'-2"	39'-1⅞"
	7'	5'-8⅞"	9'-3"	3'-10⅞"	18'-1"	11'-10⅞"	26'-11"	20'-8⅞"	35'-9"	29'-6⅞"	44'-7"	38'-10⅞"
	8'	7'-4"	9'-4"	2'-0"	18'-2"	10'-10"	27'-0"	19'-8"	35'-10"	28'-6"	44'-8"	37'-8"
9'	5'	4'-3⅜"	10'-2"	5'-10⅝"	19'-11"	15'-7⅝"	29'-8"	25'-9⅝"	39'-5"	35'-1⅝"	49'-2"	44'-10⅝"
	6'	5'-0½"	10'-3"	5'-2⅞"	20'-1"	15'-0⅞"	29'-11"	24'-10⅞"	39'-9"	34'-4⅞"	49'-7"	44'-1⅞"
	7'	5'-8⅞"	10'-3"	4'-10⅞"	20'-1"	13'-10⅞"	29'-11"	23'-8⅞"	39'-9"	33'-6⅞"	49'-7"	43'-9⅞"
	8'	7'-4"	10'-4"	3'-0"	20'-2"	12'-10"	30'-0"	22'-8"	39'-10"	32'-6"	49'-8"	42'-8"
10'	5'	4'-3⅜"	11'-2"	6'-10⅝"	21'-11"	17'-7⅝"	32'-8"	28'-1⅝"	43'-5"	39'-1⅝"	54'-2"	49'-10⅝"
	6'	5'-0½"	11'-3"	6'-2⅞"	22'-1"	17'-0⅞"	32'-11"	27'-10⅞"	43'-9"	38'-4⅞"	54'-7"	49'-1⅞"
	7'	5'-8⅞"	11'-3"	5'-10⅞"	22'-1"	15'-10⅞"	32'-11"	26'-8⅞"	43'-9"	37'-6⅞"	54'-7"	48'-9⅞"
	8'	7'-4"	11'-4"	4'-0"	22'-2"	14'-10"	33'-0"	25'-8"	43'-10"	36'-6"	54'-8"	47'-8"
11'	6'	5'-0½"	12'-4"	7'-3⅝"	24'-2"	19'-1⅝"	36'-0"	30'-11⅝"	47'-10"	42'-3⅝"		
	7'	5'-8⅞"	12'-4"	6'-7⅞"	24'-2"	17'-11⅞"	36'-0"	29'-10⅞"	47'-10"	41'-7⅞"		
	8'	7'-4"	12'-4"	5'-0"	24'-2"	16'-10"	36'-0"	28'-8"	47'-10"	40'-6"		
12'	6'	5'-0½"	13'-4"	8'-3⅝"	26'-2"	21'-1⅝"	39'-0"	33'-11⅝"	51'-10"	46'-3⅝"		
	7'	6'-2⅞"	13'-4"	7'-1⅞"	26'-2"	19'-11⅞"	39'-0"	32'-9⅞"	51'-10"	45'-1⅞"		
	8'	7'-4"	13'-4"	6'-0"	26'-2"	18'-10"	39'-0"	31'-8"	51'-10"	44'-6"		

QUANTITIES

CLASS S CONCRETE - 4 WINGS

CLEAR SPAN S	CLEAR HEIGHT H	THICKNESS OF WING AT HEADWALL C_W	THICKNESS OF WING FOOTING WB	REINFORCING* STEEL - FOR 4 WINGS LB.	SINGLE BARREL CULVERT CU.YD.	DOUBLE BARREL CULVERT CU.YD.	TRIPLE BARREL CULVERT CU.YD.	QUADRUPLE BARREL CULVERT CU.YD.	QUINTUPLE BARREL CULVERT CU.YD.
				HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS					
4'	2'	6"	7"	137.1	5.71	6.66	7.62	8.58	9.59
	3'	6"	7"	214.7	8.06	9.01	9.97	10.93	11.89
	4'	6"	7"	829.0	10.83	11.79	12.75	13.71	14.67
	5'	6"	7"	964.3	14.04	14.99	15.95	16.91	17.87
	6'	7"	8"	765.8	19.18	20.11	21.10	22.08	23.07
5'	3'	6"	7"	214.7	8.27	9.43	10.59	11.76	12.93
	4'	6"	7"	329.0	11.05	12.21	13.37	14.54	15.70
	5'	6"	7"	469.3	14.25	15.41	16.58	17.74	18.91
	6'	7"	8"	765.8	19.84	20.83	21.73	22.92	24.12
	7'	7⅝"	8⅛"	1467.6	24.91	26.12	27.34	28.56	29.78
6'	3'	6"	7"	214.7	8.98	9.86	11.22	12.60	13.98
	4'	6"	7"	329.0	11.26	12.64	14.00	15.38	16.75
	5'	6"	7"	469.3	14.46	15.84	17.20	18.58	19.96
	6'	7"	8"	765.8	19.56	20.96	22.36	23.76	25.17
	7'	7⅝"	8⅛"	1467.6	25.18	26.56	27.98	29.50	30.83
	8'	8"	9"	1867.6	31.71	33.15	34.57	36.01	37.84
7'	3'	6"	7"	329.0	11.47	13.08	14.65	16.26	17.86
	5'	6"	7"	469.3	14.68	16.28	17.86	19.47	21.06
	6'	7"	8"	765.8	19.78	21.40	22.99	24.62	26.23
	7'	7⅝"	8⅛"	1467.6	25.35	26.99	28.62	30.26	31.83
	8'	8"	9"	1867.6	31.93	33.58	35.21	36.86	38.51
8'	4'	6"	7"	329.0	11.70	13.53	15.33	17.16	18.95
	5'	7"	7"	469.3	15.48	17.33	19.15	21.00	22.81
	6'	7"	8"	765.8	20.00	21.85	23.66	25.51	27.33
	7'	7⅝"	8⅛"	1467.6	25.57	27.44	29.27	31.14	32.97
	8'	8"	9"	1867.6	32.15	34.02	35.86	37.73	39.57
9'	5'	7"	7"	469.3	15.70	17.79	19.82	21.90	23.92
	6'	7⅝"	8"	765.8	20.61	22.71	24.76	26.85	29.39
	7'	7⅝"	8⅛"	1467.6	25.79	27.89	29.99	32.03	34.07
	8'	8"	9"	1867.6	32.37	34.47	36.52	38.61	40.66
10'	5'	7"	7"	469.3	15.93	18.24	20.49	22.70	24.97
	6'	7⅝"	8"	765.8	20.83	23.16	25.49	27.66	29.95
	7'	7⅝"	8⅛"	1467.6	26.01	28.34	30.61	32.84	35.13
	8'	8"	9"	1867.6	32.59	34.92	37.20	39.43	41.71
11'	6'	8"	8"	765.8	21.44	24.03	26.52	28.99	
	7'	8"	8⅛"	1467.6	26.73	29.31	31.80	34.28	
	8'	8"	9"	1867.6	32.81	35.39	37.88	40.36	
12'	6'	8"	8"	765.8	21.67	24.50	27.21	29.93	
	7'	8"	8⅛"	1467.6	26.96	29.79	32.50	35.22	
	8'	8"	9"	1867.6	33.03	35.86	38.57	41.20	

* For reinforcing steel in Headwalls and Aprons, See Details of Standard Barrel Sections for R.C. Box Culverts for the desired Span and Height.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls, shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. as listed below.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X1	R-200X-X1	R-300X-X1	R-400X-X1	R-500X-X1
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		

CLASS S CONCRETE

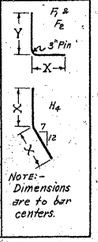
BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT H	F_1 BENT (In bottom of footing, bent up into back face of wing. One bar of each length.) SIZE	SPACING	NO. REQD	LENGTHS VARY X MIN.	X MAX.	Y MIN.	Y MAX.	F_2 BENT (In bottom of footing, bent up into back face of wing. Alt. with F_1 bars.) SIZE	SPACING	NO. REQD	LENGTH	X	Y
2'	#3	12"	10	1'-7"	3'-10"	0'-6"	1'-0"	1'-0"	2'-11"	—	—	—	—
3'	#3	12"	14	2'-0"	5'-2"	0'-10"	1'-2"	1'-3"	4'-0"	—	—	—	—
4'	#3	12"	17	2'-5"	6'-6"	0'-11"	1'-7"	1'-7"	5'-0"	—	—	—	—
5'	#3	12"	20	2'-11"	7'-10"	1'-1"	1'-11"	1'-11"	6'-0"	#3	12"	5	3'-6"
6'	#4	12"	23	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	5	4'-6"
7'	#4	12"	26	3'-10"	10'-9"	1'-3"	2'-9"	2'-8"	8'-1"	#4	12"	9	5'-6"
8'	#4	12"	29	4'-4"	12'-3"	1'-5"	3'-2"	3'-0"	9'-2"	#4	12"	14	6'-6"

CLEAR HEIGHT H	F_3 STRAIGHT (Longitudinal in top of wing footing heel.) SIZE	NO. REQD	LENGTH	F_4 STRAIGHT (Longitudinal in bottom of wing footing toe.) SIZE	NO. REQD	LENGTH	H_1 STRAIGHT (Horizontal in back face of wing.) SIZE	SPACING	NO. REQD	LENGTH	H_2 STRAIGHT (Horizontal in back face of wing. One bar of each length.) SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	MIN.
2'	#3	1	12'-6"	#3	2	10'-9"	#3	12"	1	9'-8"	#3	12"	1	—	5'-4"
3'	#3	1	16'-6"	#3	2	14'-0"	#3	12"	1	12'-9"	#3	12"	2	10'-0"	5'-4"
4'	#3	1	18'-8"	#3	3	17'-8"	#3	12"	1	15'-10"	#3	12"	3	14'-7"	5'-4"
5'	#3	1	21'-10"	#3	3	20'-6"	#3	12"	2	18'-11"	#3	12"	3	14'-7"	5'-9"
6'	#3	1	25'-0"	#3	3	23'-9"	#3	12"	2	22'-0"	#3	12"	4	19'-3"	5'-9"
7'	#4	1	28'-2"	#4	4	27'-2"	#4	12"	2	25'-1"	#4	12"	5	23'-10"	5'-9"
8'	#4	1	31'-4"	#4	4	30'-6"	#4	12"	3	28'-2"	#4	12"	5	23'-10"	5'-9"

CLEAR HEIGHT H	H_3 STRAIGHT (In back face of wing at top - on slope.) SIZE	NO. REQD	LENGTH	H_4 BENT (Dowels thru construction joint at headwall.) SIZE	SPACING	NO. REQD	LENGTH	X	QUANTITY REINFORCING STEEL PER WING LB.
2'	#3	1	3'-11"	#3	12"	2	2'-8"	1'-4"	34.3
3'	#3	1	13'-0"	#3	12"	3	2'-8"	1'-4"	58.7
4'	#3	1	16'-2"	#3	12"	4	2'-8"	1'-4"	82.2
5'	#3	1	19'-5"	#3	12"	5	2'-8"	1'-4"	116.1
6'	#3	1	22'-6"	#3	12"	6	2'-8"	1'-4"	191.5
7'	#3	1	25'-9"	#3	12"	7	3'-6"	1'-9"	366.9
8'	#4	1	28'-9"	#4	12"	8	3'-6"	1'-9"	966.9

BAR BENDING DIAGRAMS



MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

REVISIONS:- Membrane added. 5-10-66 W.C.H.

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS

[4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS
SINGLES, DOUBLES, TRIPLES,
QUADRUPLES & QUINTUPLES.]

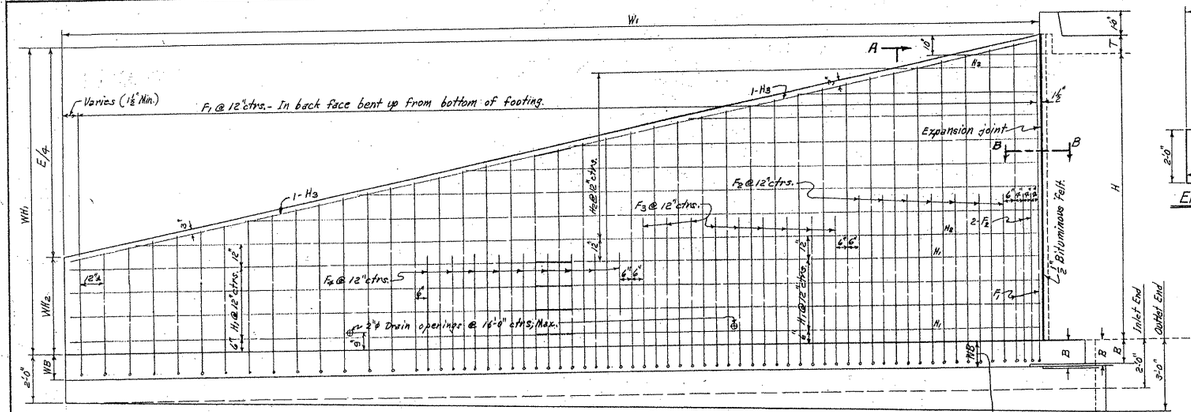
4:1 SLOPES
ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

STANDARD DRAWING NO. W-X004-1

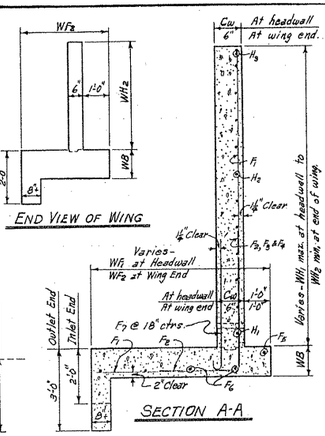
Designed By:- W.C.H. 7-22-62 Checked By:- TWS 3-29-63
Drawn By:- W.C.H. 12-20-62 Checked By:- RWS 3-29-63
Quantities By:- W.C.H. 12-17-62 Checked By:- RWS 3-29-63

(5)

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



REAR ELEVATION OF WING - SHOWING BACK FACE REINF.

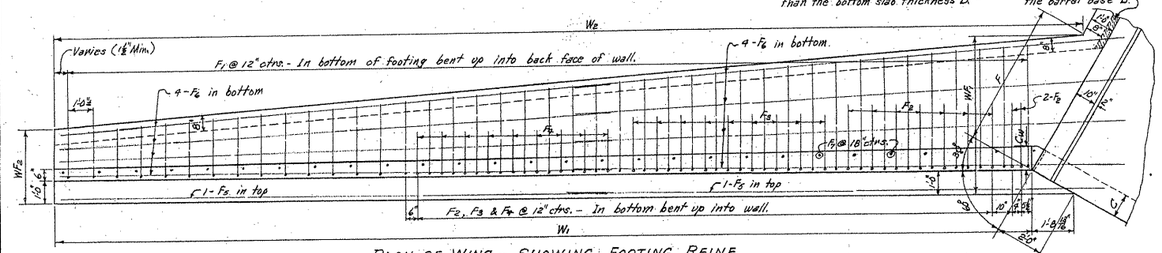


END VIEW OF WING

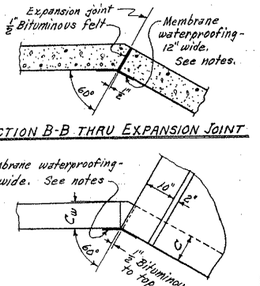
SECTION A-A

WB may be more, equal to, or less than the bottom slab thickness B.

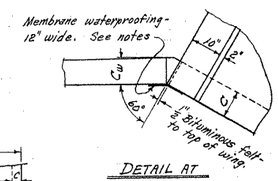
When B is more than WB, the shaded portion of the apron shall be made the same thickness as the barrel base B.



PLAN OF WING - SHOWING FOOTING REINF.



SECTION B-B THRU EXPANSION JOINT



DETAIL AT TOP OF WING

WING DIMENSIONS

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL = C	WINGWALL HEIGHTS		WIDTHS OF WING FOOTINGS		PERPENDICULAR FOOTING DIMENSION	LENGTH OF WINGWALLS	INSIDE FOOTING DIMENSION	* QUANTITY PER WING CLASS S CONCRETE	
			AT HEADWALL	AT END OF WING	AT HEADWALL	AT END OF WING				INLET END	OUTLET END
H	WB	Cw	WH1	WH2	WF1	WF2	F	E	W1	W2	CU.YD.	CU.YD.
9'	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-8"	27'-4"	31'-6⅜"	32'-9⅝"	9.913	10.328
10'	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-10"	30'-0"	34'-7⅜"	36'-2½"	12.693	13.100
11'	12"	11"	11'-10"	3'-8"	6'-2"	3'-1½"	5'-5"	32'-8"	37'-8⅝"	39'-6⅝"	15.850	16.399
12'	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	6'-0"	35'-4"	40'-5⅝"	42'-11"	19.570	20.110

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

APRON DIMENSION W3.

W3 = (OW - 2F)

CLEAR SPAN	CLEAR HEIGHT	2 x FOOTING DIMENSION	SINGLE BARREL CULVERT		DOUBLE BARREL CULVERT		TRIPLE BARREL CULVERT		QUADRUPLE BARREL CULVERT		QUINTUPLE BARREL CULVERT	
S	H	2F	OW	W3	OW	W3	OW	W3	OW	W3	OW	W3
7'	9'	8'-6"	8'-6"	0'-0"	16'-5"	7'-11"	24'-4"	15'-10"	32'-3"	23'-9"	40'-2"	31'-8"
	9'	8'-6"	9'-6"	1'-0"	18'-5"	9'-11"	27'-4"	18'-0"	36'-3"	27'-9"	45'-2"	36'-8"
8'	10'	9'-8"	9'-8"	0'-0"	18'-8"	9'-0"	27'-8"	18'-0"	36'-8"	27'-0"	45'-8"	36'-0"
9'	9'	8'-6"	10'-6"	2'-0"	20'-5"	11'-11"	30'-4"	21'-10"	40'-3"	31'-9"	50'-2"	41'-8"
	10'	9'-8"	10'-8"	1'-0"	20'-8"	11'-0"	30'-8"	21'-0"	40'-8"	31'-0"	50'-8"	41'-0"
	11'	10'-10"	10'-10"	0'-0"	20'-10"	10'-0"	30'-10"	20'-0"	40'-10"	30'-0"	50'-10"	40'-0"
10'	9'	8'-6"	11'-6"	3'-0"	22'-5"	13'-11"	33'-4"	24'-10"	44'-3"	35'-9"	55'-2"	46'-8"
	10'	9'-8"	11'-8"	2'-0"	22'-8"	13'-0"	33'-8"	24'-0"	44'-8"	35'-0"	55'-8"	46'-0"
	11'	10'-10"	11'-10"	1'-0"	22'-10"	12'-0"	33'-10"	23'-0"	44'-10"	34'-0"	55'-10"	45'-0"
	12'	12'-0"	12'-0"	0'-0"	23'-0"	11'-0"	34'-0"	22'-0"	45'-0"	33'-0"	56'-0"	44'-0"
11'	9'	8'-6"	12'-6"	4'-0"	24'-5"	15'-11"	36'-4"	27'-10"	48'-3"	39'-9"		
	10'	9'-8"	12'-8"	3'-0"	24'-8"	15'-0"	36'-8"	27'-0"	48'-8"	39'-0"		
	11'	10'-10"	12'-10"	2'-0"	24'-10"	14'-0"	36'-10"	26'-0"	48'-10"	38'-0"		
	12'	12'-0"	13'-0"	1'-0"	25'-0"	13'-0"	37'-0"	25'-0"	49'-0"	37'-0"		
12'	9'	8'-6"	13'-6"	5'-0"	26'-5"	17'-11"	39'-4"	30'-10"	52'-3"	43'-9"		
	10'	9'-8"	13'-8"	4'-0"	26'-8"	17'-0"	39'-8"	30'-0"	52'-8"	43'-0"		
	11'	10'-10"	13'-10"	3'-0"	26'-10"	16'-0"	39'-10"	29'-0"	52'-10"	42'-0"		
	12'	12'-0"	14'-0"	2'-0"	27'-0"	15'-0"	40'-0"	28'-0"	53'-0"	41'-0"		

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊛ REINFORCING STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS				
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	2910.8	41.04	42.72	44.39	46.07	47.75
8'	9'	9"	10"	2910.8	41.27	43.16	45.04	46.93	48.82
	10'	10"	11"	3588.5	52.12	54.95	55.96	57.90	59.82
9'	9'	10"	10"	2910.8	41.49	43.61	45.68	47.79	49.89
	10'	10"	11"	3588.5	52.35	54.99	56.62	58.76	60.90
	11'	11"	12"	4374.9	65.11	67.28	69.42	71.59	73.76
10'	9'	9"	10"	2910.8	41.71	44.05	46.35	48.67	50.99
	10'	10"	11"	3588.5	52.57	54.94	57.27	59.62	61.98
	11'	11"	12"	4374.9	65.34	67.72	70.08	72.45	74.83
	12'	12"	13"	5477.2	80.15	82.55	84.94	87.33	89.73
11'	9'	9"	10"	2910.8	41.92	44.52	47.03	49.53	
	10'	10"	11"	3588.5	52.79	55.40	57.94	60.50	
	11'	11"	12"	4374.9	65.56	68.17	70.74	73.33	
	12'	12"	13"	5477.2	80.37	83.00	85.60	88.22	
12'	9'	9"	10"	2910.8	42.15	44.99	47.72	50.45	
	10'	10"	11"	3588.5	52.01	55.87	58.62	61.39	
	11'	11"	12"	4374.9	65.78	68.64	71.46	74.20	
	12'	12"	13"	5477.2	80.60	83.46	86.27	89.10	

⊛ For reinforcing steel in Headwalls and Aprons, See Details of Standard Barrel Sections for R.C. Box Culverts for the desired Span and Height.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

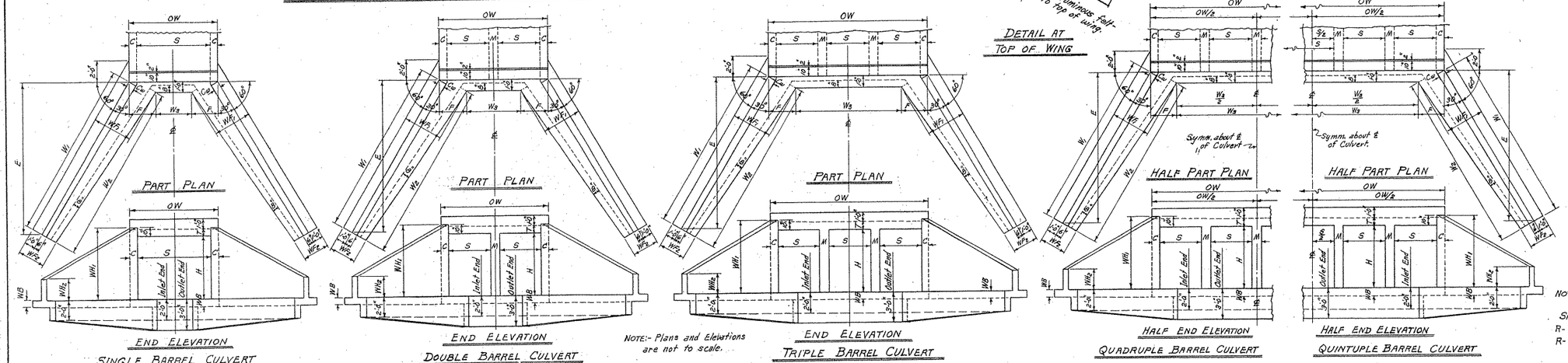
CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"



NOTE:- Plans and Elevations are not to scale.

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. as listed below.

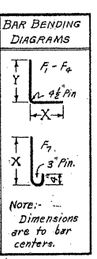
SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-100X-0	R-200X-0	R-300X-0	R-400X-0	R-500X-0
R-100X-X2	R-200X-X2	R-300X-X2	R-400X-X2	
	R-200X-X3	R-300X-X3		

BAR LIST FOR ONE WING - 4 REQUIRED

CLEAR HEIGHT	F1 BENT: In bottom of footing, bent up into back face of wing. One bar of each length.								F2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						F3 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						F4 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						F5 STRAIGHT: Longitudinal in top of wing footing heel.			F6 STRAIGHT: Longitudinal in bottom of wing footing toe.		
				LENGTHS VARY																										
H	SIZE	SPACING	No. REQ'D	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	SIZE ⊛	SPACING	No. REQ'D	LENGTH	X	Y	SIZE	SPACING	No. REQ'D	LENGTH	X	Y	SIZE	SPACING	No. REQ'D	LENGTH	X	Y	SIZE	No. REQ'D	LENGTH	SIZE	No. REQ'D	LENGTH
9'	#5	12"	32	5'-0"	13'-10"	1'-6"	3'-8"	3'-7"	10'-3"	#5	12"	5	7'-6"	2'-1"	5'-6"	#4	12"	9	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—	#4	2	18'-0"	#4	8	18'-0"
10'	#5	12"	35	5'-6"	15'-5"	1'-7"	4'-2"	4'-0"	11'-9"	#6	12"	4	8'-6"	2'-9"	6'-3"	#5	12"	5	7'-6"	2'-1"	5'-6"	#4	12"	9	6'-6"	1'-10"	4'-9"	#4	2	19'-6"	#4	8	19'-6"
11'	#5	12"	38	6'-1"	17'-0"	1'-9"	4'-8"	4'-5"	12'-5"	#6	12"	9	8'-6"	2'-9"	6'-3"	#5	12"	5	7'-6"	2'-1"	5'-6"	#4	12"	9	6'-6"	1'-10"	4'-9"	#4	2	21'-0"	#4	8	21'-9"
12'	#5	12"	41	6'-8"	18'-6"	1'-11"	5'-1"	4'-10"	13'-6"	#7	12"	9	9'-6"	2'-7"	7'-0"	#6	12"	9	8'-6"	2'-4"	6'-3"	#4	12"	9	6'-6"	1'-10"	4'-9"	#4	2	22'-6"	#4	8	23'-0"

CLEAR HEIGHT	F7 BENT: Footing dowels extending up into front face of wing.					H1 STRAIGHT: Horizontal in back face of wing.				H2 STRAIGHT: Horizontal in back face of wing. One bar of each length.						H3 STRAIGHT: In back face of wing at top - on slope.			QUANTITY REINFORCING STEEL PER WING
													LENGTHS VARY						
H	SIZE	SPACING	No. REQ'D	LENGTH	X	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	MAX.	MIN.	SIZE	No. REQ'D	LENGTH	LB.
9'	#4	18"	22	4'-0"	3'-6"	#4	12"	6	16'-6"	#4	12"	6	28'-6"	5'-6"	#4	2	16'-8"	727.7
10'	#4	18"	24	4'-4"	3'-10"	#4	12"	6	18'-0"	#4	12"	7	33'-1"	5'-6"	#4	2	18'-3"	897.1
11'	#4	18"	26	4'-8"	4'-2"	#4	12"	8	19'-6"	#4	12"	7	33'-1"	5'-6"	#4	2	19'-10"	1093.7
12'	#4	18"	28	5'-0"	4'-6"	#4	12"	8	21'-0"	#4	12"	8	37'-9"	5'-6"	#4	2	21'-5"	1369.3

BAR BENDING DIAGRAMS



NOTE:- Dimensions are to bar centers.

⊛ Except as shown at headwall.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS.

7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES

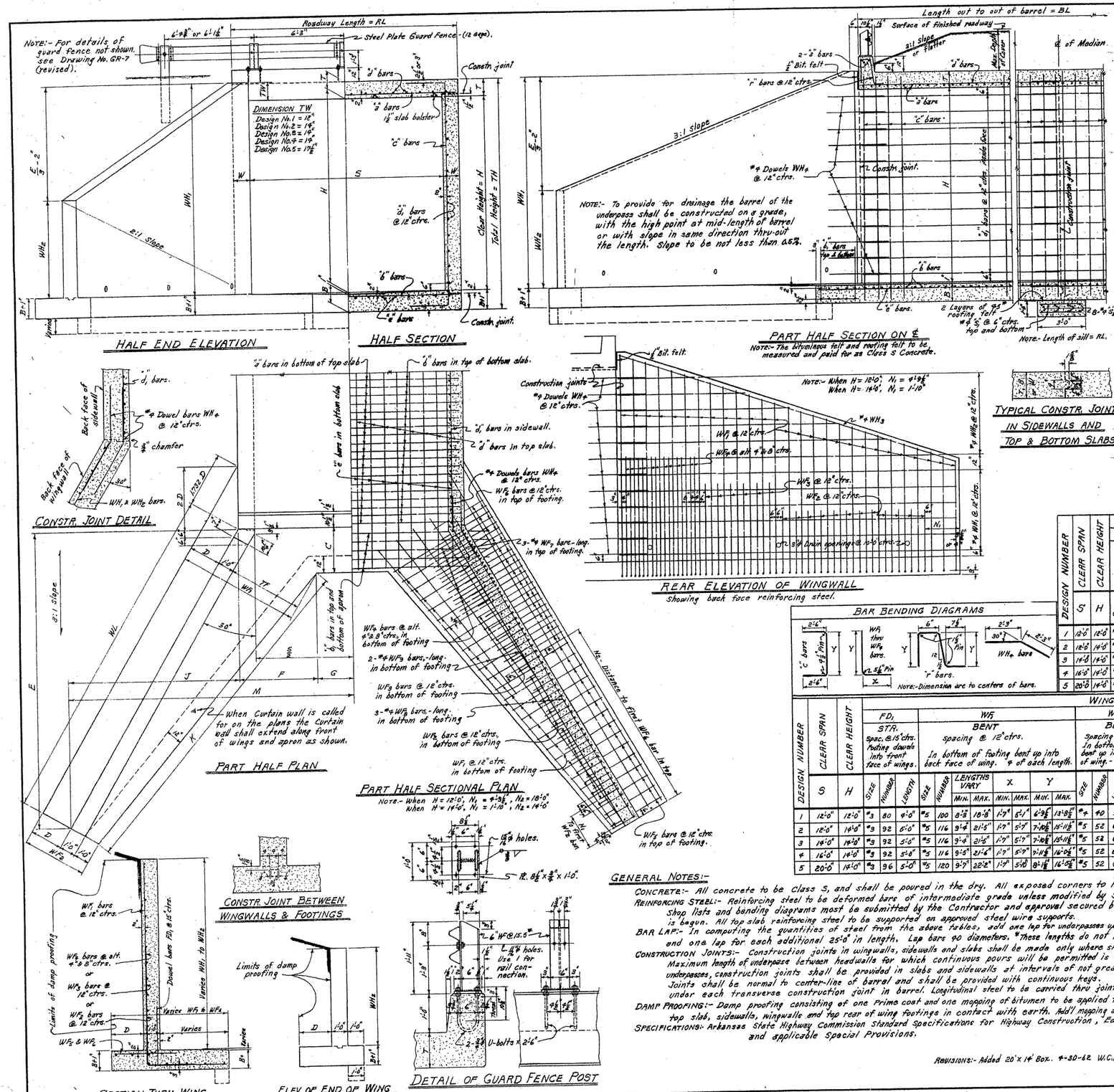
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

STANDARD DRAWING NO. W-X004-2

Designed By:- W.C.H. 7-25-62 Checked By:- RHS - 12-12-62
Drawn By:- W.C.H. 1-3-63 Checked By:- RHS - 1-4-63
Quantities By:- W.C.H. 1-11-63 Checked By:- RHS - 1-31-63

6

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



BAR BENDING DIAGRAMS

MAXIMUM DEPTH OF COVER

For 12'-0" Spans = 4'-0"
For 14'-0" Spans = 3'-6"
For 16'-0" Spans = 3'-0"
For 20'-0" Spans = 2'-6"

DIMENSIONS

DESIGN NUMBER	BARREL DIMENSIONS: CLEAR SPAN	CLEAR HEIGHT	ROADWAY LENGTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	WINGWALL & FOOTING DIMENSIONS: WINGWALL HEIGHTS: AT HEADWALL	AT END	PERPENDICULAR DIST. FROM HEADWALL TO END OF WING	LENGTH OF WINGWALLS	MAX. AT HEADWALL	WIDTH OF WING FOOTINGS: AT END	WIDTH OF HEEL OF WING FOOTING	MAX. WIDTH OF TOE OF WING FOOTING	EXTENSION OF BOTTOM SLAB	PERPENDICULAR WING DIMENSION	APRON DIMENSION	WING FOOTING DIMENSION	PERPENDICULAR DIST. FROM ℄ OF BARREL TO END OF WING	INSIDE LENGTH OF WING FOOTING	THICKNESS OF WING FOOTING
	S	H	RL	T	W	B	TH	WH1	WH2	E	WL	WF1	WF2	D	TF	C	F	G	J	M	K	B+1"
1	12'-0"	12'-0"	14'-0"	12 1/2"	12"	13"	14'-2 1/2"	13'-0"	6'-1"	21'-9"	24'-6 1/2"	7'-6"	4'-0"	2'-0"	4'-6"	2'-9"	4'-9 1/2"	2'-2 1/2"	12'-3 1/2"	19'-3 1/2"	24'-2 1/2"	14"
2	12'-0"	14'-0"	14'-0"	12 1/2"	12"	14"	16'-3 1/2"	15'-2"	7'-1"	24'-9"	28'-7"	8'-9"	4'-9"	2'-9"	5'-0"	3'-0"	5'-2 1/2"	1'-9 1/2"	14'-3 1/2"	22'-3 1/2"	28'-10 1/2"	15"
3	14'-0"	14'-0"	16'-0"	14"	12"	14"	16'-3 1/2"	15'-2"	7'-1"	24'-9"	28'-7"	8'-9"	4'-9"	2'-9"	5'-0"	3'-0"	5'-2 1/2"	2'-9 1/2"	14'-3 1/2"	22'-3 1/2"	28'-10 1/2"	15"
4	16'-0"	14'-0"	18'-0"	15"	12"	15"	16'-7"	15'-2"	7'-1"	24'-9"	28'-7"	8'-9"	4'-9"	2'-9"	5'-0"	3'-0"	5'-2 1/2"	3'-9 1/2"	14'-3 1/2"	23'-3 1/2"	28'-10 1/2"	16"
5	20'-0"	14'-0"	22'-0"	17 1/2"	12"	17"	16'-11 1/2"	15'-5 1/2"	7'-1"	25'-7 1/2"	29'-7"	9'-0"	4'-9"	2'-9"	5'-3"	3'-1 1/2"	5'-5"	5'-7"	14'-5 1/2"	25'-5 1/2"	29'-10 1/2"	18"

QUANTITIES

DESIGN NUMBER	CLEAR SPAN	CLEAR HEIGHT	CLASS S CONCRETE CU.YDS.: HEADWALLS, WINGWALLS, FOOTINGS & APRONS	PER LIN. FT. OF BARREL	SILL AT BARREL CONSTR. JOINT - EACH	CURTAIN WALL PER FOOT OF DEPTH - ONE END ONLY.	REINFORCING STEEL LBS.: HEADWALLS, WINGWALLS, FOOTINGS & APRONS	PER LIN. FT. OF BARREL	ADD'L STEEL PER LAP	SILL AT BARREL CONSTR. JOINT - EACH.	DAMP PROOFING SQ. FT.: WINGWALLS & FOOTINGS	ADD'L PER LIN. FT. OF BARREL	STEEL PLATE GUARD FENCE - TYPE A	TOTAL QUANTITIES FOR BL = 56'-0" 1 Lap No Sill: CLASS S CONCRETE	REINFORCING STEEL	DAMP PROOFING	STEEL PLATE GUARD FENCE - TYPE A	FOR BL = 144'-0" 5 Laps 1-Sill: CLASS S CONCRETE	REINFORCING STEEL	DAMP PROOFING	STEEL PLATE GUARD FENCE - TYPE A
	S	H																				
														Cu.Yd.	Lb.	Sq.Ft.	Lin.Ft.	Cu.Yd.	Lb.	Sq.Ft.	Lin.Ft.
1	12'-0"	12'-0"	63.50	2.015	1.56	2.04	5168	298.95	96.3	173	1122	42.42	57	176.34	19,205	3500	57	355.22	91,662	7230	57	
2	12'-0"	14'-0"	88.22	2.207	1.56	2.31	8142	291.80	100.7	173	1581	46.58	57	211.81	29,698	4190	57	402.59	50,844	8290	57	
3	14'-0"	14'-0"	88.91	2.448	1.78	2.39	8334	342.82	118.1	198	1579	48.89	57	226.00	27,670	4315	57	449.20	58,980	8610	57	
4	16'-0"	14'-0"	92.29	2.735	2.00	2.46	8966	410.72	149.2	223	1575	51.17	57	245.45	32,082	4440	57	488.13	69,061	8945	57	
5	20'-0"	14'-0"	104.03	3.417	2.44	2.67	10263	470.24	178.9	273	1685	55.32	57	295.38	36,775	4817	57	598.52	79,145	9737	57	

REINFORCING STEEL SCHEDULE

For Culvert 56'-0" in Length-out to out of Barrel = BL.

DESIGN NUMBER	CLEAR SPAN	CLEAR HEIGHT	"a" STRAIGHT 2 in each headwall, balance in bottom of top slab.	"b" STRAIGHT In top of bottom slab.	"b1" STRAIGHT In top and bottom of both aprons.	"c" BENT In inside face of sidewalls of barrel.	"d" STRAIGHT Longitudinal in bottom of top slab.	"d1" STRAIGHT Longitudinal in inside face of sidewalls.	"e" STRAIGHT Longitudinal in top of bottom of slab.	"r" BENT #4 @ 12" ctrs. In headwalls.	PER SILL "S1" #4 @ 6" ctrs. In top and bottom of sill.	"S2" STR. #4 @ 10" ctrs. In top and bottom of sill.
	S	H	SIZE / SPACING / NUMBER / LENGTH	SIZE / SPACING / NUMBER / LENGTH	SIZE / SPACING / NUMBER / LENGTH	SIZE / SPACING / NUMBER / LENGTH / LENGTH Y	SIZE / SPACING / NUMBER / LENGTH*	SIZE / SPACING / NUMBER* / LENGTH	SIZE / SPACING / NUMBER* / LENGTH	NUMBER / LENGTH / Y	NUMBER / LENGTH	NUMBER / LENGTH
1	12'-0"	12'-0"	#8 / 7" / 100 / 13'-8"	#8 / 7" / 96 / 13'-8"	#8 / 6 1/2" / 20 / 17'-0"	#6 / 9" / 150 / 18'-7" / 13'-9"	#5 / 10" / 16	#4 / 12" / 24	#5 / 10" / 16 / 61'-2"	28 / 4'-9" / 1'-7 1/2"	56 / 2'-8"	8 / 13'-8"
2	12'-0"	14'-0"	#8 / 7" / 100 / 13'-8"	#8 / 7" / 96 / 13'-8"	#8 / 6" / 24 / 17'-0"	#6 / 6 1/2" / 208 / 20'-8" / 15'-10"	#5 / 10" / 16	#5 / 12" / 28	#5 / 10" / 16 / 61'-10" For 56'-0" Length	28 / 4'-9" / 1'-7 1/2"	56 / 2'-8"	8 / 13'-8"
3	14'-0"	14'-0"	#8 / 6" / 116 / 15'-8"	#8 / 6" / 112 / 15'-8"	#8 / 6" / 24 / 19'-0"	#6 / 6 1/2" / 208 / 20'-9" / 15'-11"	#5 / 9" / 20	#5 / 12" / 28	#5 / 9" / 20 / 72'-2"	36 / 4'-6" / 1'-0"	72 / 2'-8"	8 / 17'-8"
4	16'-0"	14'-0"	#9 / 6 1/2" / 107 / 17'-8"	#9 / 6 1/2" / 108 / 17'-8"	#9 / 6 1/2" / 24 / 21'-0"	#6 / 6 1/2" / 208 / 20'-11" / 16'-1"	#5 / 8" / 26	#4 / 12" / 28	#5 / 8" / 26 / Length	44 / 5'-1" / 2'-0 1/2"	88 / 2'-8"	8 / 21'-8"
5	20'-0"	14'-0"	#9 / 5 1/2" / 126 / 21'-8"	#9 / 5 1/2" / 122 / 21'-8"	#9 / 6 1/2" / 28 / 25'-0"	#6 / 6 1/2" / 208 / 21'-8" / 16'-6"	#5 / 7 1/2" / 34	#4 / 12" / 28	#5 / 7 1/2" / 34 / 84'-6"	44 / 5'-1" / 2'-0 1/2"	88 / 2'-8"	8 / 21'-8"

DESIGN NUMBER	CLEAR SPAN	CLEAR HEIGHT	FD1 STR. Spac. @ 15" ctrs. Footing dowels into front face of wings.	WF1 BENT spacing @ 12" ctrs. In bottom of footing bent up into back face of wing. # of each length.	WF2 BENT Spacing @ 12" ctrs. In bottom of footing bent up into back face of wing.-Alt. with WF1.	WF3 BENT Spacing @ 12" ctrs. In bottom of footing bent up into back face of wing.-Alt. with WF1.	WF4 BENT Spacing @ alt. 4" & 8" ctrs. In bottom of footing bent up into back face of wing.-Alt. with WF1.	WF5 STRAIGHT Spac. @ 12" ctrs. In top of wing footing.	WF6 STRAIGHT Spac. @ 12" ctrs. In top of wing footing.-Alt. with WF5.	WF7 STR. #4 bars. Long. in top of wing footing.	WF8 STR. #4 bars. Long. in bottom of wing footing	WF9 STR. #4 bars. Long. in bottom of wing footing.	WH1 STR. #4 @ 12" ctrs. Horiz. in back face of wing.	WH2 STRAIGHT #4 @ 12" ctrs. Horizontal in back face of wing. # of each length.	WH3 STR. #4 bars. In back face of wing at top	WH4 BENT #4 @ 12" ctrs. Dowels in both faces of wing at constr. joint.
	S	H	SIZE / NUMBER / LENGTH	SIZE / NUMBER / LENGTHS VARY MIN. MAX. / X MIN. MAX. / Y MIN. MAX.	SIZE / NUMBER / LENGTH / X / Y	SIZE / NUMBER / LENGTH / X / Y	SIZE / NUMBER / LENGTH / X / Y	SIZE / NUMBER / LENGTH	SIZE / NUMBER / LENGTH	NUMBER / LENGTH	NUMBER / LENGTH	NUMBER / LENGTH	NUMBER / LENGTH	NUMBER / LENGTHS VARY MAX. MIN.	NUMBER / LENGTH	NUMBER / LENGTH
1	12'-0"	12'-0"	#3 / 80 / 4'-0"	#5 / 100 / 8'-8" / 18'-8" / 1'-7" / 5'-1" / 6'-9 1/2" / 13'-8 1/2"	#4 / 40 / 5'-0" / 1'-7" / 3'-4 1/2"	#5 / 20 / 7'-0" / 2'-1" / 5'-0 1/2"	#5 / 40 / 9'-8" / 2'-10" / 6'-6 1/2"	#4 / 104 / 9'-4"	#3 / 32 / 2'-10"	12 / 28'-6"	12 / 26'-6"	8 / 14'-3"	24 / 26'-2"	4 / 25'-2"	96 / 4'-6"
2	12'-0"	14'-0"	#3 / 92 / 5'-0"	#5 / 116 / 9'-4" / 21'-5" / 1'-7" / 5'-7" / 7'-10 1/2" / 15'-11 1/2"	#5 / 52 / 6'-3" / 1'-10" / 4'-6 1/2"	#7 / 28 / 9'-0" / 2'-10" / 6'-3 1/2"	#7 / 56 / 12'-3" / 3'-10" / 8'-6 1/2"	#5 / 120 / 3'-8"	#4 / 64 / 3'-2"	12 / 33'-6"	12 / 30'-6"	8 / 16'-6"	28 / 28'-4"	28 / 26'-4"	5'-6"	4 / 29'-2"	112 / 4'-6"
3	14'-0"	14'-0"	#3 / 92 / 5'-0"	#5 / 116 / 9'-4" / 21'-5" / 1'-7" / 5'-7" / 7'-10 1/2" / 15'-11 1/2"	#5 / 52 / 6'-3" / 1'-10" / 4'-6 1/2"	#7 / 28 / 9'-0" / 2'-10" / 6'-3 1/2"	#7 / 56 / 12'-3" / 3'-10" / 8'-6 1/2"	#5 / 120 / 3'-8"	#4 / 64 / 3'-2"	12 / 33'-6"	12 / 30'-6"	8 / 16'-6"	28 / 28'-4"	28 / 26'-4"	5'-6"	4 / 29'-2"	112 / 4'-6"
4	16'-0"	14'-0"	#3 / 92 / 5'-0"	#5 / 116 / 9'-5" / 21'-6" / 1'-7" / 5'-7" / 7'-11 1/2" / 16'-0 1/2"	#5 / 52 / 6'-8" / 1'-10" / 4'-9 1/2"	#7 / 28 / 9'-3" / 2'-10" / 6'-6 1/2"	#7 / 64 / 12'-6" / 3'-10" / 8'-9 1/2"	#5 / 124 / 3'-8"	#4 / 68 / 3'-2"	12 / 34'-6"	12 / 31'-6"	8 / 17'-6"	28 / 29'-4"	32 / 27'-4"	3'-1"	4 / 30'-4"	112 / 4'-6"
5	20'-0"	14'-0"	#3 / 96 / 5'-0"	#5 / 120 / 9'-7" / 22'-2" / 1'-7" / 5'-10" / 8'-1 1/2" / 16'-10 1/2"	#5 / 52 / 6'-6" / 1'-10" / 4'-9 1/2"	#7 / 28 / 9'-3" / 2'-10" / 6'-6 1/2"	#7 / 64 / 12'-6" / 3'-10" / 8'-9 1/2"	#5 / 124 / 3'-8"	#4 / 68 / 3'-2"	12 / 34'-6"	12 / 31'-6"	8 / 17'-6"	28 / 29'-4"	32 / 27'-4"	3'-1"	4 / 30'-4"	112 / 4'-6"

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have 3/4" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate grade unless modified by Special Provisions. Shop lists and bending diagrams must be submitted by the Contractor and approval secured before fabrication is begun. All top slab reinforcing steel to be supported on approved steel wire supports.

BAR LAP:- In computing the quantities of steel from the above tables, add one lap for underpasses up to 60'-0" in length and one lap for each additional 25'-0" in length. Lap bars 40 diameters. *These lengths do not include the lap.

CONSTRUCTION JOINTS:- Construction joints in wingwalls, sidewalls and slabs shall be made only where shown on the plans. Maximum length of underpass between headwalls for which continuous pours will be permitted is 80'-0". For longer underpasses, construction joints shall be provided in slabs and sidewalls at intervals of not greater than 50'-0". Joints shall be normal to center-line of barrel and shall be provided with continuous keys. Sills to be used under each transverse construction joint in barrel. Longitudinal steel to be carried thru joints.

DAMP PROOFING:- Damp proofing consisting of one Prime coat and one mopping of bitumen to be applied to all surfaces of top slab, sidewalls, wingwalls and top rear of wing footings in contact with earth. Add'l mopping at construction joints.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction, Edition of 1959, and applicable Special Provisions.

REVISIONS:- Added 20'x14' Box. 4-30-62 W.C.H.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

L. P. Carlson
BRIDGE ENGINEER

STANDARD SINGLE SPAN R.C. BOX FOR HIGHWAY UNDERPASS

12'-0", 14'-0", 16'-0" & 20'-0" SPANS 3:1 SLOPES

ROUTE SEC.

ARKANSAS STATE HIGHWAY COMMISSION

LITTLE ROCK, ARK.

DRAWN BY: W.C.H. DATE: 2-13-59

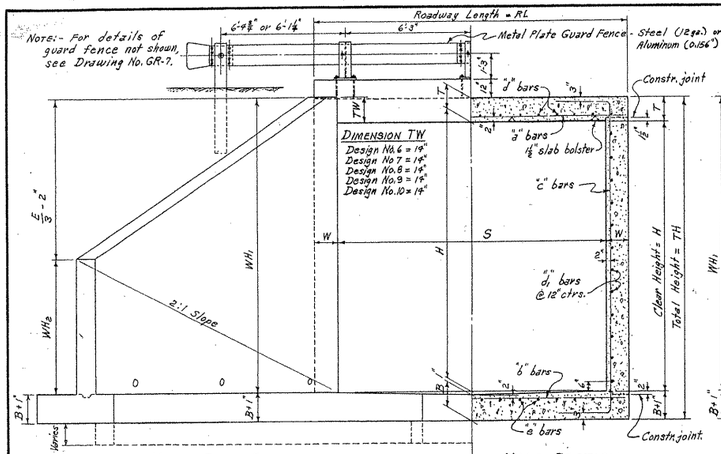
TRACED BY: DATE:

CHECKED BY: J.E.M. DATE: 2-18-59

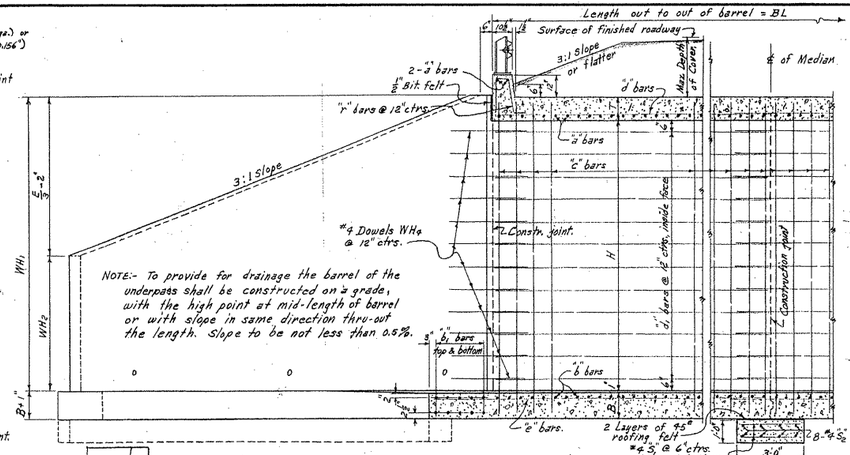
SCALE: No scale.

BRIDGE NO. DRAWING NO. 2220

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



HALF END ELEVATION



HALF SECTION

MAXIMUM DEPTH OF COVER

For 14'-0" Spans = 3'-6"
For 16'-0" Spans = 3'-0"

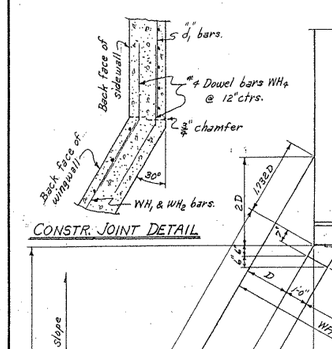
DIMENSIONS

DESIGN NUMBER	BARREL DIMENSIONS: CLEAR SPAN S	CLEAR HEIGHT H	ROADWAY LENGTH RL	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS W	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT TH	WINGWALL & FOOTING DIMENSIONS: WING-WALL HEIGHTS AT HEADWALL WH1	WING-WALL HEIGHTS AT END WH2	PERPENDICULAR DIST. FROM HEADWALL TO END OF WING E	LENGTH OF WINGWALLS WL	WIDTH OF WING FOOTINGS MAX. AT HEADWALL WF1	WIDTH OF WING FOOTINGS AT END WF2	WIDTH OF HEEL OF WING FOOTING D	MAX. WIDTH OF TOE OF WING FOOTING TF	EXTENSION OF BOTTOM SLAB C	PERPENDICULAR WING DIMENSION F	APRON DIMENSION G	WING FOOTING DIMENSION J	PERPENDICULAR DIST. FROM ℄ OF BARREL TO END OF WING M	INSIDE LENGTH OF WING FOOTING K	THICKNESS OF WING FOOTING B+1"
	S	H	RL	T	W	B	TH	WH1	WH2	E	WL	WF1	WF2	D	TF	C	F	G	J	M	K	B+1"
6	14'-0"	8'-0"	16'-0"	14"	12"	14"	10'-5"	9'-2"	4'-0"	16'-0"	18'-5 5/8"	5'-6"	3'-0"	1'-0"	3'-6"	2'-3"	3'-10 3/8"	4'-1 1/8"	9'-2 3/8"	17'-2 3/8"	18'-7 1/2"	15"
7	14'-0"	10'-0"	16'-0"	14"	12"	14"	12'-5"	11'-2"	5'-1 1/2"	18'-7 1/8"	21'-6"	6'-6"	3'-6"	1'-6"	4'-0"	2'-6"	4'-4"	3'-8"	10'-9"	19'-9"	21'-8 1/2"	15"
8	14'-0"	12'-0"	16'-0"	14"	12"	14"	14'-5"	13'-2"	6'-3"	21'-3"	24'-6 1/2"	7'-6"	4'-0"	2'-0"	4'-6"	2'-9"	4'-9 1/8"	3'-2 3/8"	12'-3 3/8"	24'-9 1/8"	25'-8"	15"
9	16'-0"	10'-0"	18'-0"	15"	12"	15"	12'-7	11'-2	5'-1 1/2"	18'-7 1/8"	21'-6"	6'-6"	3'-6"	1'-6"	4'-0"	2'-6"	4'-4"	4'-0"	10'-9"	19'-9"	21'-8 1/2"	16"
10	16'-0"	12'-0"	18'-0"	15"	12"	15"	14'-7"	13'-2"	6'-3"	21'-3"	24'-6 1/2"	7'-6"	4'-0"	2'-0"	4'-6"	2'-9"	4'-9 1/8"	4'-2 3/8"	12'-3 3/8"	21'-3 1/8"	24'-9 1/8"	16"

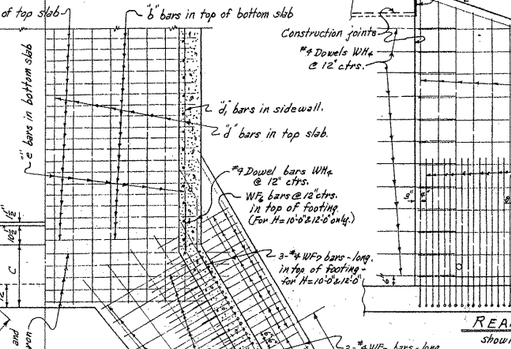
NOTE:- Design No. 8 supersedes Design No. 6 of Drawing No. 2220-1.

QUANTITIES

DESIGN NUMBER	CLEAR SPAN S	CLEAR HEIGHT H	CLASS S CONCRETE CU.YDS.: HEADWALLS, WINGWALLS, FOOTINGS & APRONS	CLASS S CONCRETE CU.YDS.: PER LIN. FT. OF BARREL	CLASS S CONCRETE CU.YDS.: SILL AT BARREL CONSTR. JOINT - EACH	CLASS S CONCRETE CU.YDS.: CURTAIN WALL PER FOOT OF DEPTH - ONE END ONLY	REINFORCING STEEL LBS.: HEADWALLS, WINGWALLS, FOOTINGS & APRONS	REINFORCING STEEL LBS.: PER LIN. FT. OF BARREL	REINFORCING STEEL LBS.: ADD'L STEEL PER LAP	REINFORCING STEEL LBS.: ADD'L AT BARREL CONSTR. JOINT - EACH	DAMP PROOFING SQ. FT.: WINGWALLS & FOOTINGS	DAMP PROOFING SQ. FT.: PER LIN. FT. OF BARREL	PLATE GUARD FENCE - TYPE A	TOTAL QUANTITIES FOR BL = 56'-0" 1 Lap No Sill: CLASS S CONCRETE	TOTAL QUANTITIES FOR BL = 56'-0" 1 Lap No Sill: REINFORCING STEEL	TOTAL QUANTITIES FOR BL = 56'-0" 1 Lap No Sill: DAMP PROOFING	TOTAL QUANTITIES FOR BL = 56'-0" 1 Lap No Sill: METAL PLATE GUARD FENCE - TYPE A	TOTAL QUANTITIES FOR BL = 194'-0" 5 Laps 1-Sill: CLASS S CONCRETE	TOTAL QUANTITIES FOR BL = 194'-0" 5 Laps 1-Sill: REINFORCING STEEL	TOTAL QUANTITIES FOR BL = 194'-0" 5 Laps 1-Sill: DAMP PROOFING	TOTAL QUANTITIES FOR BL = 194'-0" 5 Laps 1-Sill: METAL PLATE GUARD FENCE - TYPE A
	S	H											LIN. FT.	CU.YD.	LB.	SQ. FT.	LIN. FT.	CU.YD.	LB.	SQ. FT.	LIN. FT.
6	14'-0"	8'-0"	36.79	2.003	1.78	1.73	2984	250.50	104.7	198	595	36.83	57	148.94	17,100	2610	57	327.00	39,765	5850	57
7	14'-0"	10'-0"	50.59	2.151	1.78	1.92	3861	272.72	109.2	198	814	40.83	57	171.04	19,280	3105	57	362.11	43,860	6700	57
8	14'-0"	12'-0"	66.69	2.299	1.78	2.12	5478	300.17	113.4	198	1137	44.83	57	195.44	22,400	3650	57	398.53	49,450	7595	57
9	16'-0"	10'-0"	52.74	2.438	2.00	2.00	4404	340.20	135.3	223	812	43.17	57	189.27	23,525	3230	57	405.81	54,290	7030	57
10	16'-0"	12'-0"	69.34	2.586	2.00	2.19	6095	367.82	139.7	223	1133	47.17	57	219.16	26,735	3775	57	443.73	58,930	7925	57



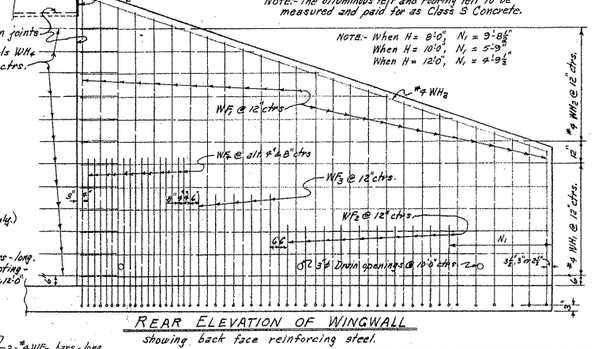
CONSTR. JOINT DETAIL



PART HALF SECTION ON ℄

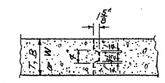
NOTE:- The bituminous felt and roofing felt to be measured and paid for as Class S Concrete.

NOTE:- When H= 8'-0", N1 = 3'-8 1/2"
When H= 10'-0", N1 = 5'-9"
When H= 12'-0", N1 = 4'-9 1/2"



REAR ELEVATION OF WINGWALL

showing back face reinforcing steel.



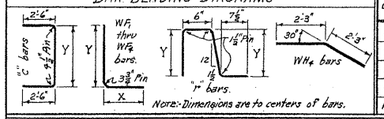
TYPICAL CONSTR. JOINTS IN SIDEWALLS AND TOP & BOTTOM SLABS.

REINFORCING STEEL SCHEDULE

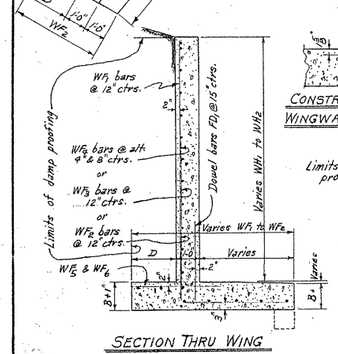
For Culvert 56'-0" in Length-out to out of Barrel = BL.

DESIGN NUMBER	CLEAR SPAN S	CLEAR HEIGHT H	BARREL, HEADWALLS AND APRONS: "a" STRAIGHT 2 in each headwall, balance in bottom of top slab. SIZE	SPACING	NUMBER	LENGTH	"b" STRAIGHT In top of bottom slab. SIZE	SPACING	NUMBER	LENGTH	"b1" STRAIGHT In top and bottom of both aprons. SIZE	SPACING	NUMBER	LENGTH	"c" BENT In inside face of sidewalls of barrel. SIZE	SPACING	NUMBER	LENGTH	Y	"d" STRAIGHT Longitudinal in bottom of top slab. SIZE	SPACING	NUMBER*	LENGTH*	"d1" STRAIGHT Longitudinal in inside face of sidewalls. SIZE	SPACING	NUMBER*	LENGTH*	"e" STRAIGHT Longitudinal in top of bottom slab. SIZE	SPACING	NUMBER*	LENGTH*	"r" BENT #4 @ 12" ctrs. In headwalls. SIZE	SPACING	NUMBER	LENGTH	Y	PER SILL: "S1" STR. #4 @ 6" ctrs. In top and bottom of sill. SIZE	SPACING	NUMBER	LENGTH	"S2" STR. #4 @ 10" ctrs. In top and bottom of sill. SIZE	SPACING	NUMBER	LENGTH
	S	H																																												
6	14'-0"	8'-0"	#8	6"	116	15'-8"	#8	6"	112	15'-8"	#8	5 5/8"	20	18'-0"	#5	12"	112	14'-9"	9'-11"	#5	9"	20		#4	12"	16		#5	9"	20	60'-2"	32	4'-6"	1'-9"	64	2'-8"	8	15'-8"								
7	14'-0"	10'-0"	#8	6"	116	15'-8"	#8	6"	112	15'-8"	#8	6"	20	19'-3"	#6	12"	112	16'-9"	11'-11"	#5	9"	20		#5	12"	20		#5	9"	20	60'-8"	32	4'-6"	1'-9"	64	2'-8"	8	15'-8"								
8	14'-0"	12'-0"	#8	6"	116	15'-8"	#8	6"	112	15'-8"	#8	6 5/8"	20	20'-6"	#6	9"	150	18'-9"	13'-11"	#5	9"	20		#4	12"	24		#5	9"	20	61'-2"	32	4'-6"	1'-9"	64	2'-8"	8	15'-8"								
9	16'-0"	10'-0"	#9	6 5/8"	107	17'-8"	#9	6 5/8"	108	17'-8"	#9	6 5/8"	20	21'-3"	#6	12"	112	16'-11"	12'-1"	#5	8"	26	55'-8" for 56'-0" Length.	#4	12"	20	55'-10" for 56'-0" Length.	#5	8"	26	60'-8"	36	4'-8"	1'-10"	72	2'-8"	8	17'-8"								
10	16'-0"	12'-0"	#9	6 5/8"	107	17'-8"	#9	6 5/8"	103	17'-8"	#9	6 5/8"	20	22'-6"	#6	9"	150	18'-11"	14'-1"	#5	8"	26		#4	12"	24		#5	8"	26	61'-2"	36	4'-8"	1'-10"	72	2'-8"	8	17'-8"								

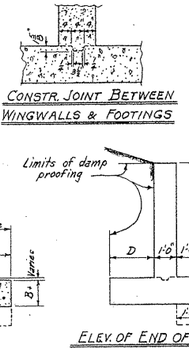
BAR BENDING DIAGRAMS



DESIGN NUMBER	CLEAR SPAN S	CLEAR HEIGHT H	WINGWALLS AND FOOTINGS - 4 WINGS. FD1 STR. Spac. @ 15" ctrs. Footing dowels into front face of wings. SIZE	NUMBER	LENGTH	WF1 BENT Spacing @ 12" ctrs. In bottom of footing bent up into back face of wing. # of each length: SIZE	NUMBER	LENGTHS VARY MIN.	MAX.	X MIN.	MAX.	Y MIN.	MAX.	WF2 BENT Spacing @ 12" ctrs. In bottom of footing bent up into back face of wing. - Alt. with WF1: SIZE	NUMBER	LENGTH	X	Y	WF3 BENT Spacing @ 12" ctrs. In bottom of footing bent up into back face of wing. - Alt. with WF1: SIZE	NUMBER	LENGTH	X	Y	WF4 BENT Spacing @ alt. 4" & 8" ctrs. In bottom of footing bent up into back face of wing. - Alt. with WF1: SIZE	NUMBER	LENGTH	X	Y	WF5 STRAIGHT Spac. @ 12" ctrs. In top of wing footing: SIZE	NUMBER	LENGTH	WF6 STRAIGHT Spac. @ 12" ctrs. In top of wing footing. - Alt. with WF5: SIZE	NUMBER	LENGTH	WF7 STR. #4 bars. Long. in top of wing footing: NUMBER	LENGTH	WF8 STR. #4 bars. Long. in bottom of wing footing: NUMBER	LENGTH	WF9 STR. #4 bars. Long. in bottom of wing footing: NUMBER	LENGTH	WH1 STR. #5 @ 12" ctrs. Horiz. in back face of wing.: NUMBER	LENGTH	WH2 STRAIGHT #4 @ 12" ctrs. Horiz. in back face of wing. # of each Length: NUMBER	LENGTHS VARY MAX.	MIN.	WH3 STR. #4 bars. In back face of wing at top: NUMBER	LENGTH	WH4 BENT #4 @ 12" ctrs. Dowels in both faces of wing at Constr. joint: NUMBER	LENGTH
	S	H																																												
6	14'-0"	8'-0"	#3	60	3'-0"	#4	76	6'-3"	14'-0"	1'-7"	4'-1"	4'-9"	10'-0"	#4	20	4'-9"	2'-1"	2'-9"	#4	16	6'-0"	2'-4"	3'-9"	—	—	—	—	—	—	—	#3	80	2'-4"	—	—	—	8	2'-10"	12	20'-2"	8	11'-3"	16	18'-2"	16	16'-0"	5'-6"	4	18'-10"	64	9'-6"
7	14'-0"	10'-0"	#3	72	3'-6"	#4	88	7'-8"	16'-6"	1'-7"	4'-7"	5-10 1/2"	12'-0"	#4	20	4'-6"	1'-10"	2'-9"	#4	20	5'-9"	2'-1"	3'-9"	#4	48	6'-9"	2'-7"	4'-3"	#3	92	2'-10"	#3	16	2'-6"	12	24'-9"	12	23'-4"	8	12'-9"	20	21'-3"	20	19'-6"	5'-6"	4	22'-0"	80	9'-6"
8	14'-0"	12'-0"	#3	80	4'-0"	#5	100	8'-6"	19'-0"	1'-7"	5'-1"	7'-0"	14'-0"	#4	40	5'-3"	1'-7"	3'-9"	#5	20	7'-6"	2'-4"	5'-3"	#5	40	9'-6"	2'-10"	6'-9"	#4	104	3'-4"	#3	32	2'-10"	12	28'-6"	12	26'-6"	8	14'-3"	24	24'-8"	24	23'-0"	5'-6"	4	25'-2"	96	9'-6"
9	16'-0"	10'-0"	#3	72	3'-6"	#4	88	7'-5"	16'-7"	1'-7"	4'-7"	5-11 1/2"	12'-1"	#4	20	4'-6"	1'-10"	2'-9"	#4	20	5'-9"	2'-1"	3'-9"	#4	48	6'-9"	2'-7"	4'-3"	#3	92	2'-10"	#3	16	2'-6"	12	24'-9"	12	23'-4"	8	12'-9"	20	21'-3"	20	19'-6"	5'-6"	4	22'-0"	80	9'-6"
10	16'-0"	12'-0"	#3	80	4'-0"	#5	100	8'-7"	19'-1"	1'-7"	5'-1"	7'-1"	14'-1"	#4	40	5'-3"	1'-7"	3'-9"	#5	20	7'-6"	2'-4"	5'-3"	#5	40	9'-6"	2'-10"	6'-9"	#4	104	3'-4"	#3	32	2'-10"	12	28'-6"	12	26'-6"	8	14'-3"	24	24'-8"	24	23'-0"	5'-6"	4	25'-2"	96	9'-6"

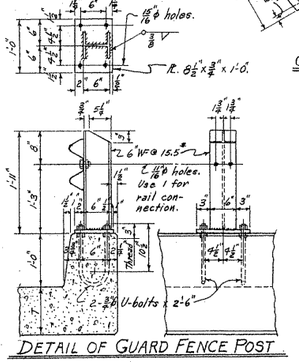


SECTION THRU WING



CONSTR. JOINT BETWEEN WINGWALLS & FOOTINGS

ELEV. OF END OF WING



DETAIL OF GUARD FENCE POST

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have 3/4" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade. Shop lists and bending diagrams must be submitted by the Contractor and approval secured before fabrication is begun. All top slab reinforcing steel to be supported on approved steel wire supports.

BAR LAP:- In computing the quantities of steel from the above tables, add one lap for underpasses up to 60'-0" in length and one lap for each additional 25'-0" in length. Lap bars 40 diameters. *These lengths do not include the lap.

CONSTRUCTION JOINTS:- Construction joints in wingwalls, sidewalls and slabs shall be made only where shown on the plans. Maximum length of underpass between headwalls for which continuous pours will be permitted is 80'-0". For longer underpasses, construction joints shall be provided in slabs and sidewalls at intervals of not greater than 50'-0". Joints shall be normal to center-line of barrel and shall be provided with continuous keys. Sills are to be used under each transverse construction joint in barrel. Longitudinal steel to be carried thru joints.

DAMP PROOFING:- Damp proofing consisting of one prime coat and one mopping of bitumen to be applied to all surfaces of top slab, sidewalls, wingwalls and top rear of wing footings in contact with earth. Add'l mopping at construction joints.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction, Edition of 1959, and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

L. P. Carlson
BRIDGE ENGINEER

STANDARD SINGLE SPAN R.C. BOX FOR HIGHWAY UNDERPASS

14'-0" AND 16'-0" SPANS 3:1 SLOPES

ROUTE SEC.

ARKANSAS STATE HIGHWAY COMMISSION
LITTLE ROCK, ARK.

DRAWN BY: W.C.H. DATE: 4-8-63
TRACED BY: DATE:
CHECKED BY: J.E.M. DATE: 4-19-1963
SCALE: No Scale

BRIDGE NO. DRAWING NO. 2220-A

GRAHAM BLUE PRINT CO.

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slabs of Barrel. 2 Add'l in Apron and Headwall- Each. SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH	"b" bars BENT - See Diagram below. In Top and Bottom Slabs of Barrel. Alternate with "a" bars. SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH	X	"d" bars STRAIGHT. Longitudinal in Top Slab of Barrel SIZE	SPACING	No. REQ'D	LENGTH	"d1" bars STRAIGHT. Longitudinal in Sidewalls SIZE	SPACING	No. REQ'D	LENGTH	"e" bars. STRAIGHT Longitudinal in Bottom Slab of Barrel SIZE	SPACING	No. REQ'D	LENGTH	"f" bars STRAIGHT Verticals in Sidewalls SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH
0'-0" TO 5'-0" MAXIMUM	1 @ 4'	2'	#5	13"	120	120	4'-9"	#6	13"	110	110	5'-10"	4'-8"	#5	10½"	6	#4	16"	4	#4	12"	5	#4	12"	120	120	2'-11"
		3'			120	120	4'-9"			110	110	5'-10"	4'-8"			6			5			5			120	120	3'-11"
		4'			120	120	4'-9"			110	110	5'-10"	4'-8"			8			5			5			120	120	4'-11"
		5'			120	120	4'-9"			110	110	5'-10"	4'-8"			10			5			5			120	120	5'-11"
		6'			120	120	4'-11"			110	110	6'-0"	4'-10"			12			5			5			120	120	6'-11"
	1 @ 5'	3'	#6	13"	120	120	5'-9"	#6	13"	110	110	6'-10"	5'-8"	#5	10½"	6	#4	12"	6	#4	12"	6	#4	12"	120	120	5'-0"
		4'			120	120	5'-9"			110	110	6'-10"	5'-8"			7			6			6			120	120	6'-0"
		5'			120	120	5'-9"			110	110	6'-10"	5'-8"			7			6			6			120	120	7'-0"
		6'			120	120	5'-11"			110	110	7'-0"	5'-10"			7			6			6			120	120	8'-0"
		7'			120	120	6'-0"			110	110	7'-1"	5'-11"			7			6			6			120	120	4'-1"
	1 @ 6'	3'	#6	12"	128	128	6'-9"	#6	12"	118	118	7'-10"	6'-8"	#5	10½"	8	#4	12"	6	#4	12"	7	#4	12"	120	120	5'-1"
		4'			128	128	6'-9"			118	118	7'-10"	6'-8"			8			8			7			120	120	6'-1"
		5'			128	128	6'-9"			118	118	7'-10"	6'-8"			8			8			7			120	120	7'-1"
		6'			128	128	6'-11"			118	118	8'-0"	6'-10"			8			8			7			120	120	8'-1"
		7'			128	128	7'-0"			118	118	8'-1"	6'-11"			8			8			7	#5	12"	120	120	9'-1"
		8'			128	128	7'-1"			118	118	8'-2"	7'-0"			8			8			7			120	120	5'-2"
	1 @ 7'	4'	#6	11"	140	140	7'-9"	#6	11"	130	130	8'-10"	7'-8"	#5	10½"	9	#4	12"	8	#4	12"	8	#4	12"	120	120	6'-2"
		5'			140	140	7'-9"			130	130	8'-10"	7'-8"			9			10			8			120	120	7'-2"
		6'			140	140	7'-11"			130	130	9'-0"	7'-10"			9			14			8			120	120	8'-2"
		7'			140	140	8'-0"			130	130	9'-1"	7'-11"			9			16			8	10"	144	144	9'-2"
		8'			140	140	8'-1"			130	130	9'-2"	8'-0"			9			18			8	#5	12"	120	120	10'-2"
		9'			140	140	8'-3"			130	130	9'-4"	8'-2"			9											
	1 @ 8'	4'	#7	12"	128	128	8'-9"	#6	12"	118	118	9'-10"	8'-8"			11			8			9			120	120	5'-9"
		5'			128	128	8'-11"			118	118	10'-0"	8'-10"			11			10			9			120	120	6'-9"
		6'			128	128	8'-11"			118	118	10'-0"	8'-10"			11			12			9			120	120	7'-9"
		7'			128	128	9'-0"			118	118	10'-1"	8'-11"			11			14			9			120	120	8'-9"
		8'			128	128	9'-1"			118	118	10'-2"	9'-0"			11			16			9	10"	144	144	9'-9"
		9'			128	128	9'-3"			118	118	10'-4"	9'-2"			11			18			9	12"	120	120	10'-9"
		10'			128	128	9'-5"			118	118	10'-5"	9'-4"			11			20			9	12"	120	120	11'-9"
	1 @ 9'	5'	#7	11"	140	140	9'-11"	#6	11"	130	130	11'-0"	9'-10"			12			10			10	#4	12"	120	120	6'-5"
		6'			140	140	10'-0"			130	130	11'-1"	9'-11"			12			12			10			120	120	7'-5"
		7'			140	140	10'-0"			130	130	11'-1"	9'-11"			12			14			10			120	120	8'-5"
		8'			140	140	10'-1"			130	130	11'-2"	10'-0"			12			16			10	10"	144	144	9'-5"
		9'			140	140	10'-3"			130	130	11'-4"	10'-2"			12			18			10	#5	12"	120	120	10'-5"
		10'			140	140	10'-5"			130	130	11'-6"	10'-4"			12			20			10	11"	132	132	11'-5"
		11'			140	140	10'-7"			130	130	11'-8"	10'-6"			12			22			10	14"	144	144	12'-5"
	1 @ 10'	5'	#7	12"	128	128	10'-11"	#7	12"	118	118	12'-2"	10'-10"			13			10			11	#4	12"	120	120	6'-6"
		6'			128	128	11'-0"			118	118	12'-3"	10'-11"			13			12			11			120	120	7'-6"
		7'			128	128	11'-0"			118	118	12'-3"	10'-11"			13			14			11			120	120	8'-6"
		8'			128	128	11'-1"			118	118	12'-4"	11'-0"			13			16			11	10"	144	144	9'-6"
		9'			128	128	11'-3"			118	118	12'-6"	11'-2"			13			18			11	#5	12"	120	120	10'-6"
		10'			128	128	11'-5"			118	118	12'-8"	11'-4"			13			20			11	10"	144	144	12'-6"
		11'			128	128	11'-7"			118	118	12'-10"	11'-6"			13			22			11	#6	12"	120	120	13'-6"
		12'			128	128	11'-9"			118	118	13'-0"	11'-8"			13			24			11					
	1 @ 11'	6'	#7	11"	140	140	12'-1"	#7	11"	130	130	13'-4"	12'-0"	#5	9½"	15	#4	12"	12	#4	12"	12	#4	12"	120	120	7'-7"
		7'			140	140	12'-1"			130	130	13'-4"	12'-0"			15			14			12			120	120	8'-7"
		8'			140	140	12'-1"			130	130	13'-4"	12'-0"			15			16			12	10"	144	144	9'-7"
		9'			140	140	12'-3"			130	130	13'-6"	12'-2"			15			18			12	12"	120	120	10'-7"
		10'			140	140	12'-5"			130	130	13'-8"	12'-4"			15			20			12	#5	11"	132	132	11'-7"
		11'			140	140	12'-7"			130	130	13'-10"	12'-6"			15			22			12	10"	144	144	12'-7"
		12'			140	140	12'-9"			130	130	14'-0"	12'-8"			15			24			12	#6	12"	120	120	13'-7"
	1 @ 12'	6'	#8	12"	128	128	13'-1"	#7	12"	118	118	14'-4"	13'-0"	#5	9½"	16	#4	12"	12	#4	12"	13	#4	12"	120	120	7'-9"
		7'			128	128	13'-1"			118	118	14'-4"	13'-0"			16			14			13			120	120	8'-9"
		8'			128	128	13'-1"			118	118	14'-4"	13'-0"			16			16			13	10"	144	144	9'-9"
		9'			128	128	13'-3"			118	118	14'-6"	13'-2"			16			18			13	12"	120	120	10'-9"
		10'			128	128	13'-5"			118	118	14'-8"	13'-4"			16			20			13	#5	11"	132	132	11'-9"
		11'			128	128	13'-7"			118	118	14'-10"	13'-6"			16			22			13	10"	144	144	12'-9"
		12'			128	128	13'-9"			118	118	15'-0"	13'-8"			16			24			13	#6	12"	120	120	13'-9"

2 @ 30'-6" For 60'-0" Length Barrel. (1'-3" Lap)

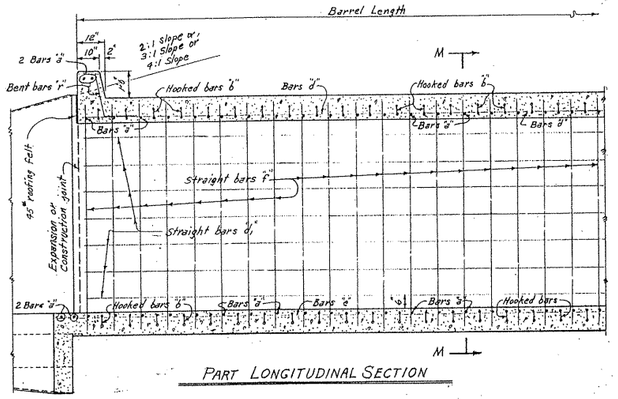
2 @ 31'-6" For 60'-0" Length Barrel. (1'-3" Lap)

2 @ 30'-6" For 60'-0" Length Barrel. (1'-3" Lap)

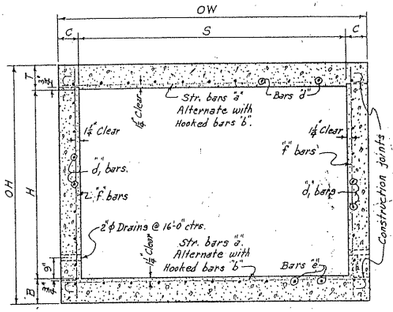
DIMENSIONS — QUANTITIES

MAX. DESIGN DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	BARREL DIMENSIONS: SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	UNIT QUANTITIES: CLASS S CONC. PER LIN. FT. OF BARREL CU.YD.	REINFORCING STEEL: PER LIN. FT. OF BARREL LB.	ADDITIONAL: PER LAP LB.	ADDITIONAL: TWO HEADWALLS & APRONS LB.
5'-0"	1 @ 4'	2'	8	5'-0"	7"	6"	6½"	3'-1½"	0.282	41.99	17.95	66.35
		3'	12	5'-0"		6"		4'-1½"	0.319	44.16	19.62	66.35
		4'	16	5'-0"		6"		5'-1½"	0.356	46.83	21.29	66.35
		5'	20	5'-0"		6"		6'-1½"	0.394	49.50	22.96	66.35
		6'	24	5'-2"		7"		7'-1½"	0.474	52.96	29.63	67.75
	1 @ 5'	3'	15	6'-0"	7½"	6"	7"	4'-2½"	0.380	55.55	22.19	101.27
		4'	20	6'-0"		6"		5'-2½"	0.417	58.23	23.86	101.27
		5'	25	6'-0"		6"		6'-2½"	0.454	60.90	25.53	101.27
		6'	30	6'-2"		7"		7'-2½"	0.535	64.49	27.20	103.27
		7'	35	6'-3"		7½"		8'-2½"	0.604	67.63	28.87	104.27
	1 @ 6'	3'	18	7'-0"	8"	6"	8"	4'-3½"	0.496	66.29	29.76	118.96
		4'	24	7'-0"		6"		5'-3½"	0.583	68.96	26.93	118.96
		5'	30	7'-0"		6"		6'-3½"	0.520	71.64	28.10	118.96
		6'	36	7'-2"		7"		7'-3½"	0.602	75.31	29.77	120.96
		7'	42	7'-3"		7½"		8'-3½"	0.671	78.98	31.44	121.97
		8'	48	7'-4"		8"		9'-3½"	0.746	88.47	33.11	122.97
	1 @ 7'	4'	28	8'-0"	8½"	6"	9½"	5'-5"	0.568	81.32	29.01	136.88
		5'	35	8'-0"		6"		6'-5"	0.605	84.00	30.68	136.88
		6'	42	8'-2"		7"		7'-5"	0.688	87.76	32.35	138.88
		7'	49	8'-3"		7½"		8'-5"	0.757	90.98	34.02	139.88
		8'	56	8'-4"		8"		9'-5"	0.832	96.65	35.69	140.88
		9'	63	8'-6"		9"		10'-5"	0.996	105.59	37.36	142.89
	1 @ 8'	4'	32	9'-0"	9½"	6"	10"	5'-7"	0.676	95.26	33.32	194.07
		5'	40	9'-2"		7"		6'-7"	0.759	99.12	34.99	196.80
		6'	48	9'-2"		7"		7'-7"	0.797	101.79	36.66	196.80
		7'	56	9'-3"		7½"		8'-7"	0.867	105.05	38.33	198.16
		8'	64	9'-4"		8"		9'-7"	0.942	110.81	40.00	199.52
		9'	72	9'-6"		9"		10'-7"	1.057	119.92	41.67	202.25
		10'	80	9'-8"		10"		11'-7"	1.184	126.67	43.34	204.97
	1 @ 9'	5'	45	10'-2"	10"	7"	11"	6'-8"	0.849	119.72	37.56	213.61
		6'	54	10'-3"		7½"		7'-8"	0.910	118.04	39.23	220.97
		7'	63	10'-3"		7½"		8'-8"	0.957	120.71	40.90	220.97
		8'	72	10'-4"		8"		9'-8"	1.033	126.54	42.57	222.33
		9'	81	10'-6"		9"		10'-8"	1.148	135.80	44.24	225.06
		10'	90	10'-8"		10"		11'-8"	1.276	142.68	45.91	227.78
		11'	99	10'-10"		11"		12'-8"	1.416	150.90	47.58	230.51
	1 @ 10'	5'	50	11'-2"	10½"	7"	11"	6'-9½"	0.957	130.64	40.13	242.64
		6'	60	11'-3"		7½"		7'-9½"	1.024	133.99	41.80	244.00
		7'	70	11'-3"		7½"		8'-9½"	1.071	136.66	43.47	244.00
		8'	80	11'-4"		8"		9'-9½"	1.147	142.55	45.14	245.36
		9'	90	11'-6"		9"		10'-9½"	1.263	151.92	46.81	248.09
		10'	100	11'-8"		10"		11'-9½"	1.391	158.89	48.48	250.81
		11'	110	11'-10"		11"		12'-9½"	1.532	166.71	50.15	253.54
		12'	120	12'-0"		12"		13'-9½"	1.685	178.67	51.82	256.26
	1 @ 11'	6'	66	12'-4"	11"	8"	11½"	7'-10½"	1.153	155.16	46.12	268.62
		7'	77	12'-4"		8"		8'-10½"	1.202	157.83	47.79	268.62
		8'	88	12'-6"		8"		9'-10½"	1.252	163.06	49.46	268.62
		9'	99	12'-6"		9"		10'-10½"	1.368	172.60	51.13	271.34
		10'	110	12'-8"		10"		11'-10½"	1.497	179.70	52.80	274.07
		11'	121	12'-10"		11"		12'-10½"	1.638	187.67	54.47	276.79
		12'	132	13'-0"		12"		13'-10½"	1.792	199.79	56.14	279.52
	1 @ 12'	6'	72	13'-4"	11¾"	8"	12¼"	8'-0"	1.284	172.20	48.69	357.62
		7'	84	13'-6"		8"		9'-0"	1.333	179.87	50.36	357.62
		8'	96	13'-8"		8"		10'-0"	1.383	180.15	52.03	357.62
		9'	108	13'-6"		9"		11'-0"	1.500	189.85	53.70	361.18
		10'	120	13'-8"		10"		12'-0"	1.630	197.07	55.37	364.74
		11'	132	13'-10"		11"		13'-0"	1.772	205.16	57.04	368.30
		12'	144	14'-0"		12"		14'-0"	1.926	217.95	58.71	371.86

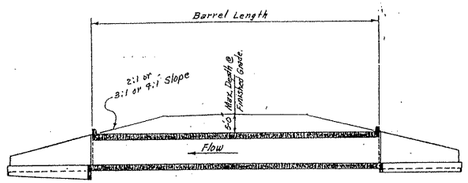
W-X002-1, W-X003-1 or W-X004-1
W-X002-2, W-X003-2 or W-X004-2.



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M



LONGITUDINAL SECTION

Note- For details of wings and bar lists, see Drawing Nos. W-X002-1, W-X003-1, W-X004-1 and W-X002-2, W-X003-2, W-X004-2.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

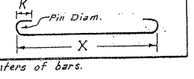
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3⅝"	5¾"	1'-9"

BENDING DIAGRAM Bars "b".

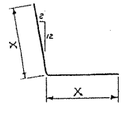


NOTE:- Dimensions are to centers of bars.

DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	11"±	12	2'-6"	1'-3"
5'	#4	11"±	14	2'-7"	1'-3⅛"
6'	#4	11"±	16	2'-8"	1'-4"
7'	#4	11"±	18	2'-9"	1'-4⅛"
8'	#4	11⅛"±	20	2'-11"	1'-5⅛"
9'	#4	11⅛"±	22	3'-0"	1'-6"
10'	#4	11⅛"±	24	3'-1"	1'-6⅛"
11'	#4	12"±	26	3'-2"	1'-7"
12'	#4	12"±	28	3'-3"	1'-7⅛"

Bars "r" Dowel bars in Headwalls.



DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 29,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 OR 4:1 SLOPES
SINGLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-100X-0

Designed By:- W.C.H. 1-23-63. Checked By:- RBG 5-8-63
Drawn By:- W.C.H. 2-8-63. Checked By:- RBG 5-8-63
Quantities By:- W.C.H. 2-12-63. Checked By:- RBG 5-24-63

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars — STRAIGHT — In Top and Bottom Slabs of Barrel, 2 Add'l in Apron and Headwall-Each.
"b" bars — BENT- See Diagram at Right — In Top and Bottom Slabs of Barrel, Alternate with "a" bars.
"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel
"d1" bars — STRAIGHT — Longitudinal in Sidewalls
"e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel
"f" bars — STRAIGHT — Verticals in Sidewalls

Section & Bar Group	Length of Sections	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" Number Req'd 3:1	"a" Number Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" Number Req'd 3:1	"b" Number Req'd 4:1	"b" Length	"b" X	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" Number Req'd 3:1	"f" Number Req'd 4:1	"f" Length
Section "A" & Bar Group "A"	3:1 = 22'-0" 4:1 = 32'-0"	0' TO 10'-0"	1 @ 4'	3'	#4	12"	48	68	4'-9"	#4	12"	44	64	5'-7"	4'-8½"	#4	12"	5	33'-3" for 32'-0" Section	#4	12"	6	33'-3" for 32'-0" Section	#4	12"	5	34'-3" for 32'-0" Section	#4	12"	44	64	3'-10"
				4'			48	68	4'-9"			44	64	5'-7"	4'-8½"			5				8				5				44	64	4'-10"
				5'			48	68	4'-9"			44	64	5'-7"	4'-8½"			5				10				5				44	64	5'-10"
				6'			48	68	4'-11"			44	64	5'-9"	4'-10½"			5				12				5				44	64	6'-10"
			1 @ 5'	3'	#5	12"	48	68	5'-9"	#5	12"	44	64	6'-8"	5'-8½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	44	64	3'-11"
				4'			48	68	5'-9"			44	64	6'-8"	5'-8½"			6				8				6				44	64	4'-11"
				5'			48	68	5'-9"			44	64	6'-8"	5'-8½"			6				10				6				44	64	5'-11"
				6'			48	68	5'-11"			44	64	6'-10"	5'-10½"			6				12				6				44	64	6'-11"
				7'			48	68	6'-0"			44	64	6'-11"	5'-11½"			6				14				6			10"	54	78	7'-11"
			1 @ 6'	4'	#5	12"	48	68	6'-9"	#6	12"	44	64	7'-10"	6'-8"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	44	64	5'-0"
				5'			48	68	6'-9"			44	64	7'-10"	6'-8"			7				10				7				44	64	6'-0"
				6'			48	68	6'-11"			44	64	8'-0"	6'-10"			7				12				7				44	64	7'-0"
				7'			48	68	7'-0"			44	64	8'-1"	6'-11"			7				14				7			10"	54	78	8'-0"
				8'			48	68	7'-1"			44	64	8'-2"	7'-0"			7				16				7		#5	11"	48	70	9'-0"
Section "B" & Bar Group "B"	3:1 = 11'-0" 4:1 = 16'-0"	10'-0" TO 15'-0"	1 @ 4'	3'	#4	12"	22	32	4'-9"	#5	12"	22	32	5'-8"	4'-8½"	#4	12"	5	34'-3" for 33'-0" Length Section	#4	12"	6	34'-3" for 33'-0" Length Section	#4	12"	5	34'-3" for 33'-0" Length Section	#4	12"	22	32	3'-10"
				4'			22	32	4'-9"			22	32	5'-8"	4'-8½"			5				8				5				22	32	4'-10"
				5'			22	32	4'-9"			22	32	5'-8"	4'-8½"			5				10				5				22	32	5'-10"
				6'			22	32	4'-11"			22	32	5'-10"	4'-10½"			5				12				5			10"	28	40	6'-10"
			1 @ 5'	3'	#5	12"	22	32	5'-9"	#6	12"	22	32	6'-10"	5'-8"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	22	32	3'-11"
				4'			22	32	5'-9"			22	32	6'-10"	5'-8"			6				8				6				22	32	4'-11"
				5'			22	32	5'-9"			22	32	6'-10"	5'-8"			6				10				6				22	32	5'-11"
				6'			22	32	5'-11"			22	32	7'-0"	5'-10"			6				12				6			11"	24	36	6'-11"
				7'			22	32	6'-0"			22	32	7'-1"	5'-11"			6				14				6		#5	12"	22	32	7'-11"
			1 @ 6'	4'	#6	12"	22	32	6'-9"	#6	12"	22	32	7'-10"	6'-8"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	22	32	5'-1"
				5'			22	32	6'-9"			22	32	7'-10"	6'-8"			7				10				7				22	32	6'-1"
				6'			22	32	6'-11"			22	32	8'-0"	6'-10"			7				12				7			10"	28	40	7'-1"
				7'			22	32	7'-0"			22	32	8'-1"	6'-11"			7				14				7		#5	11"	24	34	8'-1"
				8'			22	32	7'-1"			22	32	8'-2"	7'-0"			7				16				7		#6	12"	22	32	9'-1"
Section "C" & Bar Group "C"	3:1 = 11'-0" 4:1 = 16'-0"	15'-0" TO 20'-0"	1 @ 4'	3'	#5	12"	22	32	4'-9"	#5	12"	22	32	5'-8"	4'-8½"	#4	12"	5		#4	12"	6		#4	12"	5		#4	12"	22	32	3'-10"
				4'			22	32	4'-9"			22	32	5'-8"	4'-8½"			5				8				5				22	32	4'-10"
				5'			22	32	4'-9"			22	32	5'-8"	4'-8½"			5				10				5			10"	28	40	5'-10"
				6'			22	32	4'-11"			22	32	5'-10"	4'-10½"			5				12				5		#5	12"	22	32	6'-10"
			1 @ 5'	3'	#5	11"	24	36	5'-9"	#6	11"	24	34	6'-10"	5'-8"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	22	32	4'-0"
				4'			24	36	5'-9"			24	34	6'-10"	5'-8"			6				8				6				22	32	5'-0"
				5'			24	36	5'-9"			24	34	6'-10"	5'-8"			6				10				6			11"	24	36	6'-0"
				6'			24	36	5'-11"			24	34	7'-0"	5'-10"			6				12				6		#5	12"	22	32	7'-0"
				7'			24	36	6'-0"			24	34	7'-1"	5'-11"			6				14				6		#6	12"	22	32	8'-0"
			1 @ 6'	4'	#6	11"	24	36	6'-9"	#6	11"	24	34	7'-10"	6'-8"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	22	32	5'-2"
				5'			24	36	6'-9"			24	34	7'-10"	6'-8"			7				10				7				22	32	6'-2"
				6'			24	36	6'-11"			24	34	8'-0"	6'-10"			7				12				7		#5	12"	22	32	7'-2"
				7'			24	36	7'-0"			24	34	8'-1"	6'-11"			7				14				7		#6	12"	22	32	8'-2"
				8'			24	36	7'-1"			24	34	8'-2"	7'-0"			7				16				7			10"	26	38	9'-2"
Section "D" & Bar Group "D"	3:1 = 11'-0" 4:1 = 16'-0"	20'-0" TO 25'-0"	1 @ 4'	3'	#5	11"	24	36	4'-9"	#5	11"	24	34	5'-8"	4'-8½"	#4	12"	5		#4	12"	6		#4	12"	5		#4	12"	22	32	3'-11"
				4'			24	36	4'-9"			24	34	5'-8"	4'-8½"			5				8				5				22	32	4'-11"
				5'			24	36	4'-9"			24	34	5'-8"	4'-8½"			5				10				5		#5	12"	22	32	5'-11"
				6'			24	36	4'-11"			24	34	5'-10"	4'-10½"			5				12				5			10"	26	38	6'-11"
			1 @ 5'	3'	#6	12"	22	32	5'-9"	#6	12"	22	32	6'-10"	5'-8"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	22	32	4'-1"
				4'			22	32	5'-9"			22	32	6'-10"	5'-8"			6				8				6				22	32	5'-1"
				5'			22	32	5'-9"			22	32	6'-11"	5'-9"			6				10				6			11"	24	34	6'-1"
				6'			22	32	5'-11"			22	32	7'-1"	5'-11"			6				12				6		#5	11"	24	34	7'-1"
				7'			22	32	6'-1"			22	32	7'-2"	6'-0"			6				14				6		#6	12"	22	32	8'-1"
			1 @ 6'	4'	#7	12"	22	32	6'-9"	#6	12"	22	32	7'-10"	6'-8"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	22	32	5'-4"
				5'			22	32	6'-10"			22	32	7'-11"	6'-9"			7				10				7				22	32	6'-4"
				6'			22	32	6'-11"			22	32	8'-1"	6'-11"			7				12				7		#5	12"	22	32	7'-4"
				7'			22	32	7'-1"			22	32	8'-2"	7'-0"			7				14				7		#6	12"	22	32	8'-4"
				8'			22	32	7'-2"			22	32	8'-4"	7'-2"			7				16				7			10"	26	40	9'-4"
Section "E" & Bar Group "E"	3:1 = 11'-0" 4:1 = 16'-0"	25'-0" TO 30'-0"	1 @ 4'	3'	#6	12"	22	32	4'-9"	#5	12"	22	32	5'-8"	4'-8½"	#4	12"	5		#4	12"	6		#4	12"	5		#4	12"	22	32	4'-0"
				4'			22	32	4'-9"			22	32	5'-8"	4'-8½"			5				8				5				22	32	5'-0"
				5'			22	32	4'-10"			22	32	5'-9"	4'-9½"			5				10				5		#5	12"	22	32	6'-0"
				6'			22	32	5'-0"			22	32	5'-11"	4'-11½"			5				12				5		#6	12"	22	32	7'-0"
			1 @ 5'	3'	#6	11"	24	34	5'-9"	#6	11"	24	36	6'-10"	5'-8"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	22	32	4'-3"
				4'			24	34	5'-9"			24	36	6'-10"	5'-8"			6				8				6				22	32	5'-3"
				5'			24	34	5'-10"			24	36	7'-0"	5'-10"			6				10				6			10"	28	40	6'-3"
				6'			24	34	6'-0"			24	36	7'-2"	6'-0"			6				12				6		#5	11"	24	36	7'-3"
				7'			24	34	6'-2"			24	36	7'-3"	6'-1"			6				14				6		#6	11"	24	34	8'-3"
			1 @ 6'	4'	#7	11"	24	34	6'-9"	#6	11"	24	36	7'-10"	6'-8"	#4	11"	8		#4	12"	8		#4	11"	8		#4	12"	22	32	5'-5"
				5'			24	34	6'-11"			24	36	8'-0"	6'-10"			8				10				8			11"	24	36	6'-5"
				6'			24	34	7'-1"			24	36	8'-2"	7'-0"			8				12				8		#5	12"	22	32	7'-5"
				7'			24	34	7'-2"			24	36	8'-4"	7'-2"			8				14				8		#6	12"	22	32	8'-5"
				8'			24	34	7'-4"			24	36	8'-5"	7'-3"			8				16				8			10"	26	38	9'-5"
Section "F" & Bar Group "F"	3:1 = 11'-0" 4:1 = 16'-0"	30'-0" TO 35'-0"	1 @ 4'	3'	#6	13"	20	30	4'-9"	#6	13"	20	30	5'-10"	4'-8"	#4	12	5		#4	12"	6		#4	12"	5		#4	12"	22	32	4'-1"
				4'			20	30	4'-9"			20	30	5'-10"	4'-8"			5				8				5				22	32	5'-1"
				5'			20	30	4'-11"			20	30	6'-0"	4'-10"			5				10				5		#5	12"	22	32	6'-1"
				6'			20	30	5'-1"			20	30	6'-2"	5'-0"			5				12				5		#6	12"	22	32	7'-1"
			1 @ 5'	3'	#7	12"	22	32	5'-9"	#6	12"	22	32	6'-10"	5'-8"	#4	10½"	7		#4	12"	6		#4	10½"	7		#4	12"	22	32	4'-4"
				4'			22	32	5'-9"			22	32	6'-11"	5'-9"			7				8				7				22	32	5'-4"
				5'			22	32	5'-11"			22	32	7'-1"	5'-11"			7				10				7			10"	26	36	6'-4"
				6'			22	32	6'-1"			22	32	7'-3"	6'-1"			7				12				7		#5	11"	24	34	7'-4"
				7'			22	32	6'-3"			22	32	7'-4"	6'-2"			7				14				7		#6	11"	24	36	8'-4"
	Varies with Length of Barrel	30'-0"	1 @ 6'	4'	#7	12"	Varies with Length of Barrel	Varies with Length of Barrel	6'-10"	#7	12"	Varies with Length of Barrel	Varies with Length of Barrel	8'-1"	6'-9"	#4	9½"	9	Varies with Length of Barrel	#4	12"	8	Varies with Length of Barrel	#4	9½"	9	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	Varies with Length of Barrel	5'-7"
				5'					7'-0"					8'-3"	6'-11"			9				10				9			10"			6'-7"
				6'					7'-2"					8'-5"	7'-1"			9				12				9		#5	12"			7'-7"
				7'					7'-4"					8'-7"	7'-3"			9				14				9		#6	12"			8'-7"
				8'					7'-5"					8'-8"	7'-4"			9				16				9			10"			9'-7"
Section "G" & Bar Group "G"	Varies with Length of Barrel	35'-0" TO 40'-0"	1 @ 4'	3'	#6	12"			4'-9"	#6	12"			5'-10"	4'-8"	#4	10½"	6		#4	12"	6		#4	10½"	6		#4	12"			4'-2"
				4'					4'-10"					5'-11"	4'-9"			6				8				6						5'-2"
				5'					5'-0"					6'-1"	4'-11"			6				10				6		#5	12"			6'-2"
				6'					5'-2"					6'-3"	5'-1"			6				12				6		#6	12"			7'-2"
			1 @ 5'	3'	#7	11"			5'-9"	#6	11"			6'-10"	5'-8"	#4	10½"	7		#4	12"	6		#4	10½"	7		#4	12"			4'-5"
				4'					5'-10"					7'-0"	5'-10"			7				8				7						5'-5"
				5'					6'-0"					7'-2"	6'-0"			7				10				7			10"			6'-5"
				6'					6'-2"					7'-4"	6'-2"			7				12				7		#5	11"			7'-5"
				7'					6'-4"					7'-5"	6'-3"			7				14				7		#6	11"			8'-5"

NOTE:- Bars for each Section to be marked with the Section Letter, thus for Section B, the bars should be marked Ba, Bb, Bd, Bd1, Be and Bf.

Designed By:- W.C.H. 9-5-62 Checked By:- RHS 11-8-62
Drawn By:- W.C.H. 10-10-62 Checked By:- J.E.M. 11-12-62
Quantities By:- W.C.H. 11-7-62 Checked By:- J.E.M. 11-16-62

DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Span S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel Cu.Yd.	Reinforcing Steel per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.	Additional Two Headwalls & Aprons Lb.
Section "A" - 10'-0"	1 @ 4'	3'	12	5'-0"	6½"	6"	6½"	4'-1"	0.312	29.62	13.36	51.44
		4'	16	5'-0"		6"		5'-1"	0.349	32.29	15.03	51.44
		5'	20	5'-0"		6"		6'-1"	0.386	34.96	16.70	51.44
		6'	24	5'-2"		7"		7'-1"	0.467	38.08	18.37	52.33
	1 @ 5'	3'	15	6'-0"	7"	6"	7"	4'-2"	0.370	43.16	15.03	79.37
		4'	20	6'-0"		6"		5'-2"	0.407	45.83	16.70	79.37
		5'	25	6'-0"		6"		6'-2"	0.444	48.50	18.37	79.37
		6'	30	6'-2"		7"		7'-2"	0.526	51.87	20.04	80.77
		7'	35	6'-3"		7½"		8'-2"	0.594	57.00	21.71	81.46
	1 @ 6'	4'	24	7'-0"	7½"	6"	7½"	5'-3"	0.472	58.99	18.37	93.29
		5'	30	7'-0"		6"		6'-3"	0.509	61.66	20.04	93.29
		6'	36	7'-2"		7"		7'-3"	0.591	65.18	21.71	94.68
		7'	42	7'-3"		7½"		8'-3"	0.660	70.41	23.38	95.37
		8'	48	7'-4"		8"		9'-3"	0.735	79.83	25.05	96.07
Section "B" - 15'-0"	1 @ 4'	3'	12	5'-0"	6½"	6"	6½"	4'-1"	0.312	33.98	13.36	
		4'	16	5'-0"		6"		5'-1"	0.349	36.65	15.03	
		5'	20	5'-0"		6"		6'-1"	0.386	39.32	16.70	
		6'	24	5'-2"		7"		7'-1"	0.467	44.39	18.37	
	1 @ 5'	3'	15	6'-0"	7"	6"	7"	4'-2"	0.370	49.78	15.03	
		4'	20	6'-0"		6"		5'-2"	0.407	52.45	16.70	
		5'	25	6'-0"		6"		6'-2"	0.444	55.12	18.37	
		6'	30	6'-2"		7"		7'-2"	0.526	59.48	20.04	
		7'	35	6'-3"		7½"		8'-2"	0.594	67.68	21.71	
	1 @ 6'	4'	24	7'-0"	8"	6"	8¼"	5'-4¼"	0.499	65.30	18.37	
		5'	30	7'-0"		6"		6'-4¼"	0.536	66.63	20.04	
		6'	36	7'-2"		7"		7'-4¼"	0.619	73.58	21.71	
		7'	42	7'-3"		7½"		8'-4¼"	0.688	82.41	23.38	
		8'	48	7'-4"		8"		9'-4¼"	0.763	93.14	25.05	
Section "C" - 20'-0"	1 @ 4'	3'	12	5'-0"	6½"	6"	6¾"	4'-1¼"	0.316	37.54	13.36	
		4'	16	5'-0"		6"		5'-1¼"	0.353	40.21	15.03	
		5'	20	5'-0"		6"		6'-1¼"	0.390	44.44	16.70	
		6'	24	5'-2"		7"		7'-1¼"	0.471	51.38	18.37	
	1 @ 5'	3'	15	6'-0"	7½"	6"	7¾"	4'-3¼"	0.394	52.85	15.03	
		4'	20	6'-0"		6"		5'-3¼"	0.431	55.52	16.70	
		5'	25	6'-0"		6"		6'-3¼"	0.468	58.92	18.37	
		6'	30	6'-2"		7"		7'-3¼"	0.550	67.04	20.04	
		7'	35	6'-3"		7½"		8'-3¼"	0.618	78.27	21.71	
	1 @ 6'	4'	24	7'-0"	8½"	6"	9"	5'-5½"	0.526	69.39	18.37	
		5'	30	7'-0"		6"		6'-5½"	0.563	72.06	20.04	
		6'	36	7'-2"		7"		7'-5½"	0.646	81.20	21.71	
		7'	42	7'-3"		7½"		8'-5½"	0.716	92.67	23.38	
		8'	48	7'-4"		8"		9'-5½"	0.791	103.06	25.05	
Section "D" - 25'-0"	1 @ 4'	3'	12	5'-0"	6¾"	6"	7¼"	4'-2"	0.327	39.63	13.36	
		4'	16	5'-0"		6"		5'-2"	0.364	42.30	15.03	
		5'	20	5'-0"		6"		6'-2"	0.401	49.41	16.70	
		6'	24	5'-2"		7"		7'-2"	0.483	55.14	18.37	
	1 @ 5'	3'	15	6'-0"	8"	6"	8½"	4'-4½"	0.417	55.28	15.03	
		4'	20	6'-0"		6"		5'-4½"	0.454	57.95	16.70	
		5'	25	6'-0½"		6¼"		6'-4½"	0.501	61.61	18.37	
		6'	30	6'-2½"		7¼"		7'-4½"	0.585	71.20	20.04	
		7'	35	6'-4"		8"		8'-4½"	0.668	81.45	21.71	
	1 @ 6'	4'	24	7'-0"	9¼"	6"	9¾"	5'-7"	0.559	72.95	18.37	
		5'	30	7'-1"		6½"		6'-7"	0.616	76.21	20.04	
		6'	36	7'-2½"		7¼"		7'-7"	0.691	85.22	21.71	
		7'	42	7'-4"		8"		8'-7"	0.776	97.23	23.38	
		8'	48	7'-5½"		8¾"		9'-7"	0.869	108.02	25.05	
Section "E" - 30'-0"	1 @ 4'	3'	12	5'-0"	7¼"	6"	7¾"	4'-3"	0.343	42.12	13.36	
		4'	16	5'-0"		6"		5'-3"	0.380	44.79	15.03	
		5'	20	5'-1"		6½"		6'-3"	0.436	52.39	16.70	
		6'	24	5'-3"		7½"		7'-3"	0.521	63.09	18.37	
	1 @ 5'	3'	15	6'-0"	8¾"	6"	9¼"	4'-6"	0.444	58.94	15.03	
		4'	20	6'-0"		6"		5'-6"	0.481	61.61	16.70	
		5'	25	6'-1½"		6¾"		6'-6"	0.549	66.77	18.37	
		6'	30	6'-3½"		7¾"		7'-6"	0.637	75.68	20.04	
		7'	35	6'-5"		8½"		8'-6"	0.724	88.37	21.71	
	1 @ 6'	4'	24	7'-0"	10"	6"	10½"	5'-8½"	0.591	79.04	20.04	
		5'	30	7'-2"		7"		6'-8½"	0.669	83.78	21.71	
		6'	36	7'-4"		8"		7'-8½"	0.760	92.53	23.38	
		7'	42	7'-5½"		8¾"		8'-8½"	0.850	104.59	25.05	
		8'	48	7'-7"		9½"		9'-8½"	0.949	115.61	26.72	
Section "F" - 35'-0"	1 @ 4'	3'	12	5'-0"	7¾"	6"	8¼"	4'-4"	0.358	45.49	13.36	
		4'	16	5'-0"		6"		5'-4"	0.395	48.16	15.03	
		5'	20	5'-2"		7"		6'-4"	0.471	56.32	16.70	
		6'	24	5'-4"		8"		7'-4"	0.560	67.17	18.37	
	1 @ 5'	3'	15	6'-0"	9¼"	6"	9¾"	4'-7"	0.463	63.18	16.70	
		4'	20	6'-0½"		6¼"		5'-7"	0.509	66.11	18.37	
		5'	25	6'-2½"		7¼"		6'-7"	0.588	71.65	20.04	
		6'	30	6'-4½"		8¼"		7'-7"	0.679	80.70	21.71	
		7'	35	6'-6"		9"		8'-7"	0.770	93.59	23.38	
	1 @ 6'	4'	24	7'-1"	10¾"	6½"	11½"	5'-10"	0.641	85.81	21.71	
		5'	30	7'-3"		7½"		6'-10"	0.724	91.60	23.38	
		6'	36	7'-5"		8½"		7'-10"	0.818	99.56	25.05	
		7'	42	7'-7"		9½"		8'-10"	0.925	112.23	26.72	
		8'	48	7'-8½"		10¼"		9'-10"	1.030	123.01	28.39	
Section "G" - 40'-0"	1 @ 4'	3'	12	5'-0"	8¼"	6"	8¾"	4'-5"	0.373	49.38	15.03	
		4'	16	5'-1"		6½"		5'-5"	0.427	52.56	16.70	
		5'	20	5'-3"		7½"		6'-5"	0.507	60.85	18.37	
		6'	24	5'-5"		8½"		7'-5"	0.599	71.86	20.04	
	1 @ 5'	3'	15	6'-0"	9¾"	6"	10¼"	4'-8"	0.481	67.30	16.70	
		4'	20	6'-1½"		6¾"		5'-8"	0.545	70.89	18.37	
		5'	25	6'-3½"		7¾"		6'-8"	0.628	76.56	20.04	
		6'	30	6'-5½"		8¾"		7'-8"	0.723	85.78	21.71	
		7'	35	6'-7"		9½"		8'-8"	0.817	98.84	23.38	

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1, W-X003-1, and W-X004-1.

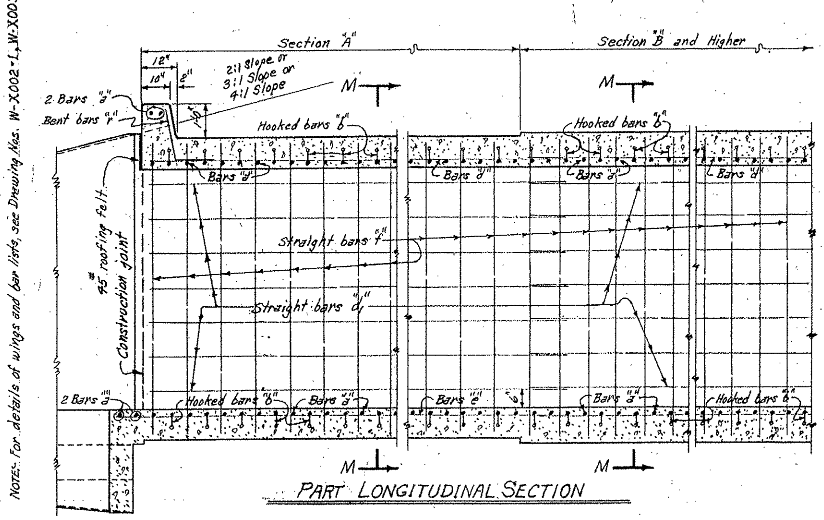
Bar Size	Pin Diam.	K	Add for 2 Hooks	Bars "b"
#4	2"	4"	0'-10½"	
#5	2½"	4¾"	0'-11½"	
#6	3"	5"	1'-2"	
#7	3½"	5¾"	1'-4"	

NOTE:- Dimensions are to centers of bars.

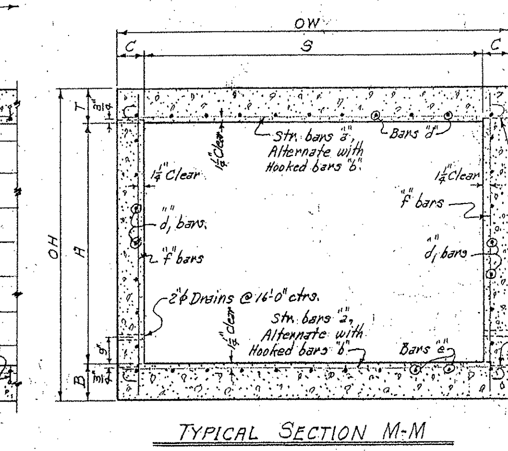
DOWEL BARS FOR TWO HEADWALLS

Span	Size	Spacing	No. Req'd	Length	X	Bars "r" Dowel bars in Headwalls
4'	#4	11"	12	2'-5"	1'-2½"	
5'	#4	11½"	14	2'-6"	1'-3"	
6'	#4	12"	16	2'-7"	1'-3½"	

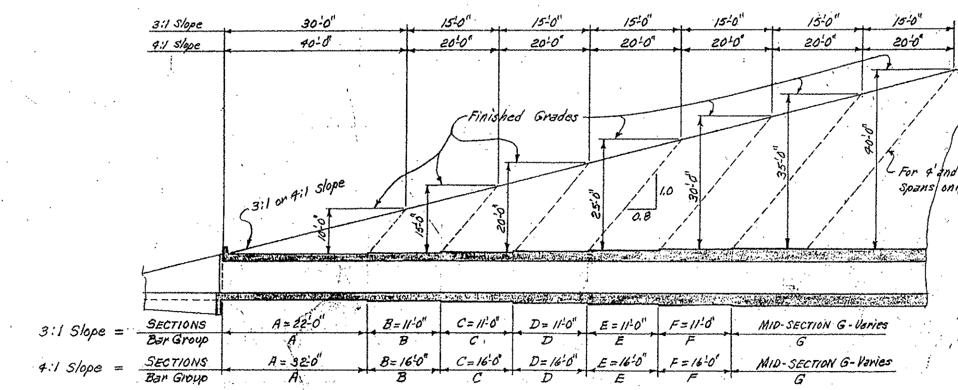
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	✓						A
10.0' to 14.5'	✓						B
15.0' to 19.5'	✓	✓					C
20.0' to 24.5'	✓	✓	✓				D
25.0' to 29.5'	✓	✓	✓	✓			E
30.0' to 34.5	✓	✓	✓	✓	✓		F
35.0' to 40.0	✓	✓	✓	✓	✓	✓	G

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B,C,D,E or F	4:1 Slopes Sections A	4:1 Slopes Sections B,C,D,E or F
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	25.403'	12.702'	36.950	18.475'
45°	1.4142	31.113'	15.556'	45.255	22.627'

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X002-1, W-X003-1 and W-X004-1.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" Ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS — 3:1 OR 4:1 SLOPES
SINGLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-100X-X1

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars: BENT (See Bending Diagram below.) In Top and Bottom Slabs of Barrel. Use 2 Add'l in Headwall and 2 in Apron. — "d" bars: STRAIGHT, Longitudinal in Bottom of Top Slab — "d_1" bars: STRAIGHT, Longitudinal in Sidewalls — "e" bars: STRAIGHT, Longitudinal in top of Bottom Slab — "f" bars: STRAIGHT, Vertical in Sidewalls

Section	Length of Section	Bar Group per Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" Number	"a" Length	"a" X	"d" Size	"d" Spacing	"d" Number	"d" Length	"d_1" Size	"d_1" Spacing	"d_1" Number	"d_1" Length	"e" Size	"e" Spacing	"e" Number	"e" Length	"f" Size	"f" Spacing	"f" Number	"f" Length
Section "A"	32'-0"	Bar Group "A"	0' to 10'	4'	3'	#4	8"	100	5'-8"	4'-9"	#4	12"	5	33'-3" Max.	#4	12	4	33'-3" Max.	#4	12"	5	34'-3" Max.	#4	12"	64	3'-11"
					4'			100	5'-8"	4'-9"			5				6				5				64	4'-11"
					5'			100	5'-8"	4'-9"			5				8				5				64	5'-11"
					6'			100	5'-10"	4'-11"			5				10				5				64	6'-11"
				5'	4'	#5	8"	100	6'-9"	5'-9"	#4	12"	6		#4	12	6		#4	12"	6		#4	12"	64	5'-0"
					5'			100	6'-9"	5'-9"			6				8				6				64	6'-0"
					6'			100	6'-11"	5'-11"			6				10				6				64	7'-0"
					7'			100	7'-0"	6'-0"			6				12				6		#5		64	8'-0"
				6'	5'	#5	6"	132	7'-9"	6'-9"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	64	6'-2"
					6'			132	7'-11"	6'-11"			7				10				7				64	7'-2"
					7'			132	8'-0"	7'-0"			7				12				7			10"	76	8'-2"
					8'			132	8'-1"	7'-1"			7				14				7		#5	11"	68	9'-2"
Section "B"	Varies - 16'-0" Min.	Bar Group "B"	10' to 15'	4'	3'	#4	6"	64	5'-8"	4'-9"	#4	12"	5	33'-3" for 2 - 16'-0" Sections	#4	12"	4	33'-3" for 2 - 16'-0" Sections	#4	12"	5	33'-3" for 2 - 16'-0" Sections	#4	12"	32	3'-11"
					4'			64	5'-8"	4'-9"			5				6				5				32	4'-11"
					5'			64	5'-8"	4'-9"			5				8				5			11"	36	5'-11"
					6'			64	5'-10"	4'-11"			5				10				5			9"	42	6'-11"
				5'	4'	#5	6½"	58	6'-9"	5'-9"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-0"
					5'			58	6'-9"	5'-9"			6				8				6				32	6'-0"
					6'			58	6'-11"	5'-11"			6				10				6			10"	38	7'-0"
					7'			58	7'-0"	6'-0"			6				12				6		#5	11"	36	8'-0"
				6'	5'	#5	5"	76	7'-9"	6'-9"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	32	6'-2"
					6'			76	7'-11"	6'-11"			7				10				7			11"	36	7'-2"
					7'			76	8'-0"	7'-0"			7				12				7		#5	12"	32	8'-2"
					8'			76	8'-1"	7'-1"			7				14				7			10"	38	9'-2"
Section "C"	Varies - 16'-0" Min.	Bar Group "C"	15' to 20'	4'	3'	#5	7"	56	5'-9"	4'-9"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"	32	3'-11"
					4'			56	5'-9"	4'-9"			5				6				5				32	4'-11"
					5'			56	5'-9"	4'-9"			5				8				5			11"	34	5'-11"
					6'			56	5'-11"	4'-11"			5				10				5			8"	48	6'-11"
				5'	4'	#5	5½"	70	6'-9"	5'-9"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-1"
					5'			70	6'-9"	5'-9"			6				8				6				32	6'-1"
					6'			70	6'-11"	5'-11"			6				10				6			9"	42	7'-1"
					7'			70	7'-0"	6'-0"			6				12				6		#5	11"	34	8'-1"
				6'	5'	#6	6½"	60	7'-10"	6'-8½"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	32	6'-3"
					6'			60	8'-0"	6'-10½"			7				10				7			10"	38	7'-3"
					7'			60	8'-1"	6'-11½"			7				12				7		#5	12"	32	8'-3"
					8'			60	8'-3"	7'-1½"			7				14				7			10"	38	9'-3"
Section "D"	Varies - 16'-0" Min.	Bar Group "D"	20' to 25'	4'	3'	#5	6"	64	5'-9"	4'-9"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"	32	4'-0"
					4'			64	5'-9"	4'-9"			5				6				5				32	5'-0"
					5'			64	5'-10"	4'-10"			5				8				5			11"	36	6'-0"
					6'			64	6'-0"	5'-0"			5				10				5			8"	48	7'-0"
				5'	4'	#6	7"	56	6'-10"	5'-8½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-2"
					5'			56	6'-11"	5'-9½"			6				8				6				32	6'-2"
					6'			56	7'-1"	5'-11½"			6				10				6			9"	42	7'-2"
					7'			56	7'-3"	6'-1½"			6				12				6		#5	11"	36	8'-2"
				6'	5'	#6	6"	64	7'-11"	6'-9½"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	32	6'-5"
					6'			64	8'-1"	6'-11½"			7				10				7			10"	38	7'-5"
					7'			64	8'-3"	7'-1½"			7				12				7		#5	12"	32	8'-5"
					8'			64	8'-5"	7'-3½"			7				14				7			10"	38	9'-5"
Section "E"	Varies - 16'-0" Min.	Bar Group "E"	25' to 30'	4'	3'	#5	5½"	70	5'-9"	4'-9"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"	32	4'-1"
					4'			70	5'-9"	4'-9"			5				6				5				32	5'-1"
					5'			70	5'-11"	4'-11"			5				8				5			11"	34	6'-1"
					6'			70	6'-1"	5'-1"			5				10				5			8"	48	7'-1"
				5'	4'	#6	6½"	58	6'-10"	5'-8½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-3"
					5'			58	7'-0"	5'-10½"			6				8				6				32	6'-3"
					6'			58	7'-2"	6'-0½"			6				10				6			9"	44	7'-3"
					7'			58	7'-4"	6'-2½"			6				12				6		#5	11"	34	8'-3"
				6'	5'	#6	5½"	70	8'-0"	6'-10½"	#4	12"	7		#4	12"	8		#4	12"	7		#4	12"	32	6'-7"
					6'			70	8'-2"	7'-0½"			7				10				7			10"	38	7'-7"
					7'			70	8'-5"	7'-3½"			7				12				7		#5	12"	32	8'-7"
					8'			70	8'-7"	7'-5½"			7				14				7			10"	38	9'-7"
Section "F"	Varies - 16'-0" Min.	Bar Group "F"	30' to 35'	4'	3'	#5	5"	76	5'-9"	4'-9"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"	32	4'-2"
					4'			76	5'-10"	4'-10"			5				6				5				32	5'-2"
					5'			76	6'-0"	5'-0"			5				8				5			11"	36	6'-2"
					6'			76	6'-2"	5'-2"			5				10				5			8"	48	7'-2"
				5'	4'	#6	6	64	7'-0"	5'-10½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-5"
					5'			64	7'-2"	6'-0½"			6				8				6				32	6'-5"
					6'			64	7'-4"	6'-2½"			6				10				6			9"	42	7'-5"
					7'			64	7'-6"	6'-4½"			6				12				6		#5	11"	36	8'-5"
				6'	5'	#6	5"	76	8'-2"	7'-0½"	#4	12"	7		#4	12	8		#4	12"	7		#4	12"	32	6'-9"
					6'			76	8'-4"	7'-2½"			7				10				7			10"	38	7'-9"
					7'			76	8'-6"	7'-4½"			7				12				7		#5	12"	32	8'-9"
					8'			76	8'-9"	7'-7½"			7				14				7			10"	38	9'-9"
Section "G"	Varies - 16'-0" Min.	Bar Group "G"	35' to 40'	4'	3'	#5	5"	76	5'-9"	4'-9"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"	32	4'-3"
					4'			76	5'-11"	4'-11"			5				6				5				32	5'-3"
					5'			76	6'-1"	5'-1"			5				8				5			11"	34	6'-3"
					6'			76	6'-3"	5'-3"			5				10				5			8"	48	7'-3"
				5'	4'	#6	5½"	70	7'-1"	5'-11½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"	32	5'-6"
					5'			70	7'-3"	6'-1½"			6				8				6				32	6'-6"
					6'			70	7'-5"	6'-3½"			6				10				6			9"	42	7'-6"
					7'			70	7'-7"	6'-5½"			6				12				6		#5	11"	34	8'-6"
	Varies.	Bar Group "H"	35' Max.	6'	5'	#6	5"	Varies with Length of Barrel	8'-4"	7'-2½"	#4	12"	7	Varies with Length of Barrel	#4	12"	8	Varies with Length of Barrel	#4	12"	7	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	6'-10"
					6'				8'-6"	7'-4½"			7				10				7			10"		7'-10"
					7'				8'-8"	7'-6½"			7				12				7		#5	12"		8'-10"
					8'				8'-11"	7'-9½"			7				14				7			10"		9'-10"
			40' Max.	4'	3'	#5	5"		5'-10"	4'-10"	#4	12"	5		#4	12"	4		#4	12"	5		#4	12"		4'-4"
					4'				6'-0"	5'-0"			5				6				5					5'-4"
					5'				6'-2"	5'-2"			5				8				5			11"		6'-4"
					6'				6'-4"	5'-4"			5				10				5			8"		7'-4"
				5'	4'	#6	5½"		7'-2"	6'-0½"	#4	12"	6		#4	12"	6		#4	12"	6		#4	12"		5'-8"
					5'				7'-4"	6'-2½"			6				8				6					6'-8"
					6'				7'-6"	6'-4½"			6				10				6			9"		7'-8"
					7'				7'-9"	6'-7½"			6				12				6		#5	11"		8'-8"

NOTE:- Bars for each Section to be marked with the Section letter, thus: for Section "B", the bars should be marked Ba, Bd, Bd_1, Be and Bf.

Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2½"	4"	0'-11"
#5	2½"	4½"	1'-0"
#6	3"	5"	1'-1⅛"

BENDING DIAGRAM FOR BARS "a": K — Pin Diam. — X

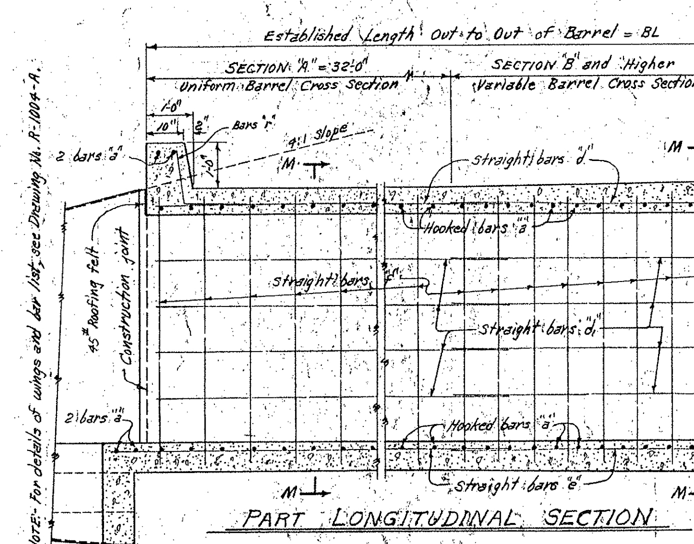
NOTE:- Dimensions are to centers of bars.

Designed by: W.C.H. 9-24-59 Checked by: L.L.K. 9-25-59
Drawn by: W.C.H. 10-14-59 Checked by: J.M.H. 10-20-59
Traced by: W.C.H. 11-3-59 Checked by: J.M.H. 11-4-59

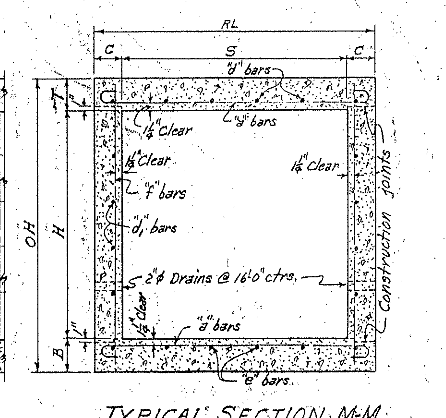
DIMENSIONS / QUANTITIES

Max. Design Depth of Culvert D	Clear Span S	Clear Height H	Sq. Ft. Opening A	Roadway Length RL	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Over-All Height OH	Unit: Class A Concrete per Lin. Ft. of Barrel CU. YD.	Unit: Reinf. Steel No Laps per Lin. Ft. of Barrel LB.	Unit: Add'l Steel per Lap LB.	Per Min. Section	Total: Class A Concrete CU. YD.	Total: Reinf. Steel No Laps LB.
Sect. "A" = Uniform X-Sect.	4'	3'	12	5'-0"	7"	6"	7½"	4'-2½"	0.335	25.94	11.7	Section "A" = 32'-0"	10.716	875
		4'	16	5'-0"		6"		5'-2½"	0.372	28.61	13.4		11.901	966
		5'	20	5'-0"		6"		6'-2½"	0.409	31.29	15.0		13.087	1057
		6'	24	5'-2"		7"		7'-2½"	0.490	34.29	16.7		15.696	1159
	5'	4'	20	6'-0"	7"	6"	8"	5'-3"	0.426	39.83	15.0		13.630	1337
		5'	25	6'-0"		6"		6'-3"	0.463	42.50	16.7		14.815	1427
		6'	30	6'-2"		7"		7'-3"	0.545	45.69	18.4		17.433	1535
		7'	35	6'-3"		7½"		8'-3"	0.613	59.62	20.0		19.630	1827
	6'	5'	30	7'-0"	8"	6"	9"	6'-5"	0.552	55.27	18.4		17.679	1844
		6'	36	7'-2"		7"		7'-5"	0.635	58.64	20.0		20.329	1957
		7'	42	7'-3"		7½"		8'-5"	0.704	63.84	21.7		22.543	2125
		8'	48	7'-4"		8"		9'-5"	0.780	73.29	23.4		24.955	2420
10'-0" @ Point "A"	4'	3'	12	5'-0"	7"	6"	7½"	4'-2½"	0.335	29.73	11.7	Section "B" = 16'-0"	5.358	476
		4'	16	5'-0"		6"		5'-2½"	0.372	32.40	13.4		5.951	518
		5'	20	5'-0"		6"		6'-2½"	0.409	35.79	15.0		6.543	577
		6'	24	5'-2"		7"		7'-2½"	0.490	41.27	16.7		7.848	657
	5'	4'	20	6'-0"	7"	6"	8"	5'-3"	0.426	44.70	15.0		6.926	708
		5'	25	6'-0"		6"		6'-3"	0.463	47.37	16.7		7.519	750
		6'	30	6'-2"		7"		7'-3"	0.545	52.56	18.4		8.830	831
		7'	35	6'-3"		7½"		8'-3"	0.613	61.20	20.0		9.931	980
	6'	5'	30	7'-0"	8"	6"	9"	6'-5"	0.552	61.74	18.4		8.969	981
		6'	36	7'-2"		7"		7'-5"	0.635	66.11	20.0		10.297	1056
		7'	42	7'-3"		7½"		8'-5"	0.704	74.96	21.7		11.406	1185
		8'	48	7'-4"		8"		9'-5"	0.780	82.12	23.4		12.847	1303
15'-0" @ Point "B"	4'	3'	12	5'-0"	7"	6"	7½"	4'-2½"	0.335	35.15	11.7	Section "C" = 16'-0"	5.420	569
		4'	16	5'-0"		6"		5'-2½"	0.372	37.82	13.4		6.012	612
		5'	20	5'-0"		6"		6'-2½"	0.409	41.21	15.0		6.759	663
		6'	24	5'-2"		7"		7'-2½"	0.490	48.38	16.7		8.090	781
	5'	4'	20	6'-0"	7¾"	6"	8"	5'-3¾"	0.440	49.54	15.0		7.222	794
		5'	25	6'-0"		6"		6'-3¾"	0.477	52.21	16.7		7.972	837
		6'	30	6'-2"		7"		7'-3¾"	0.559	58.79	18.4		9.317	939
		7'	35	6'-3"		7½"		8'-3¾"	0.628	66.29	20.0		10.653	1054
	6'	5'	30	7'-0"	8¾"	6	9"	6'-5¾"	0.569	66.49	18.4		9.607	1075
		6'	36	7'-2"		7		7'-5¾"	0.652	72.02	20.0		10.972	1162
		7'	42	7'-3"		7½		8'-5¾"	0.721	79.41	21.7		12.322	1282
		8'	48	7'-5"		8½		9'-5¾"	0.826	87.61	23.4		14.057	1409
20'-0" @ Point "C"	4'	3'	12	5'-0"	7½"	6"	7½"	4'-3"	0.343	38.69	11.7	Section "D" = 16'-0"	5.605	619
		4'	16	5'-0"		6"		5'-3"	0.380	41.36	13.4		6.198	662
		5'	20	5'-1"		6½"		6'-3"	0.436	45.11	15.0		7.257	726
		6'	24	5'-3"		7½"		7'-3"	0.521	52.92	16.7		8.643	839
	5'	4'	20	6'-0"	8½"	6"	8½"	5'-5"	0.468	54.12	15.0		7.630	878
		5'	25	6'-1"		6½"		6'-5"	0.520	57.22	16.7		8.703	927
		6'	30	6'-3"		7½"		7'-5"	0.606	63.94	18.4		10.108	1032
		7'	35	6'-5"		8½"		8'-5"	0.704	71.95	20.0		11.816	1173
	6'	5'	30	7'-1"	9¾"	6½"	10"	6'-7¾"	0.632	70.83	18.4		10.718	1133
		6'	36	7'-3"		7½"		7'-7¾"	0.720	76.49	20.0		12.161	1222
		7'	42	7'-5"		8½"		8'-7¾"	0.819	84.49	21.7		13.909	1352
		8'	48	7'-7"		9½"		9'-7¾"	0.931	92.84	23.4		15.759	1482
25'-0" @ Point "D"	4'	3'	12	5'-0"	8"	6"	8"	4'-4"	0.358	40.98	11.7	Section "E" = 16'-0"	5.852	657
		4'	16	5'-0"		6"		5'-4"	0.395	43.65	13.4		6.578	700
		5'	20	5'-2"		7"		6'-4"	0.471	47.82	15.0		7.824	763
		6'	24	5'-4"		8"		7'-4"	0.560	55.24	16.7		9.269	885
	5'	4'	20	6'-0"	9¼"	6"	9¼"	5'-6½"	0.491	56.94	15.0		8.352	900
		5'	25	6'-2"		7"		6'-6½"	0.568	60.53	16.7		9.646	957
		6'	30	6'-4"		8"		7'-6½"	0.658	67.36	18.4		11.138	1073
		7'	35	6'-6½"		9¼"		8'-6½"	0.773	75.48	20.0		12.933	1188
	6'	5'	30	7'-2½"	10¾"	7¼"	11"	6'-9¾"	0.708	75.92	18.4		11.935	1217
		6'	36	7'-4½"		8¼"		7'-9¾"	0.801	81.72	20.0		13.468	1308
		7'	42	7'-7"		9½"		8'-9¾"	0.920	90.44	21.7		15.418	1449
		8'	48	7'-9"		10½"		9'-9¾"	1.039	98.95	23.4		17.493	1582
30'-0" @ Point "E"	4'	3'	12	5'-0"	8½"	6"	8½"	4'-5"	0.373	43.71	11.7	Section "F" = 16'-0"	6.099	695
		4'	16	5'-1"		6½"		5'-5"	0.427	46.80	13.4		7.096	744
		5'	20	5'-3"		7½"		6'-5"	0.507	51.05	15.0		8.400	816
		6'	24	5'-5"		8½"		7'-5"	0.599	58.60	16.7		9.995	932
	5'	4'	20	6'-2"	10"	7"	10"	5'-8"	0.553	61.32	15.0		9.226	981
		5'	25	6'-4"		8"		6'-8"	0.638	64.99	16.7		10.607	1040
		6'	30	6'-6"		9"		7'-8"	0.735	71.97	18.4		12.185	1148
		7'	35	6'-8"		10"		8'-8"	0.844	80.25	20.0		14.069	1294
	6'	5'	30	7'-4"	11¾"	8"	12"	6'-11¾"	0.784	82.59	18.4		13.264	1312
		6'	36	7'-6"		9"		7'-11¾"	0.883	88.54	20.0		14.900	1405
		7'	42	7'-8½"		10¼"		8'-11¾"	1.008	96.90	21.7		16.957	1540
		8'	48	7'-11"		11½"		9'-11¾"	1.148	106.19	23.4		19.261	1685
35'-0" @ Point "F"	4'	3'	12	5'-0"	9"	6"	9"	4'-6"	0.389	43.82	11.7	Section "G" = 16'-0"	6.458	696
		4'	16	5'-2"		7"		5'-6"	0.460	47.32	13.4		7.623	752
		5'	20	5'-4"		8"		6'-6"	0.543	51.59	15.0		8.985	817
		6'	24	5'-6½"		9¼"		7'-6"	0.650	59.18	16.7		10.731	942
	5'	4'	20	6'-3"	10¾"	7½"	10¾"	5'-9½"	0.600	65.80	15.0		9.975	1055
		5'	25	6'-5"		8½"		6'-9½"	0.688	69.56	16.7		11.418	1115
		6'	30	6'-7"		9½"		7'-9½"	0.789	76.67	18.4		13.155	1225
		7'	35	6'-9½"		10¾"		8'-9½"	0.915	85.08	20.0		15.223	1355
	6'	5'	30	7'-6"	12¾"	9"	13"	7'-1¾"	0.874	83.91	18.4			
		6'	36	7'-8"		10"		8'-1¾"	0.980	89.87	20.0			
		7'	42	7'-10½"		11¼"		9'-1¾"	1.112	98.28	21.7			
		8'	48	8'-1"		12½"		10'-1¾"	1.260	107.61	23.7			
40'-0" @ Point "G"	4'	3'	12	5'-1"	9½"	6½"	9½"	4'-7"	0.418	44.35	11.7			
		4'	16	5'-3"		7½"		5'-7"	0.493	47.85	13.4			
		5'	20	5'-5"		8½"		6'-7"	0.580	52.13	15.0			
		6'	24	5'-7½"		9¾"		7'-7"	0.691	59.76	16.7			
	5'	4'	20	6'-4"	11½"	8"	11½"	5'-11"	0.647	66.57	15.0			
		5'	25	6'-6"		9"		6'-11"	0.739	70.33	16.7			
		6'	30	6'-8½"		10¼"		7'-11"	0.856	77.51	18.4			
		7'	35	6'-11"		11½"		8'-11"	0.988	86.55	20.0			

NOTE:- For headwall dowel bars "r", see Drawing No. R-1004-A.

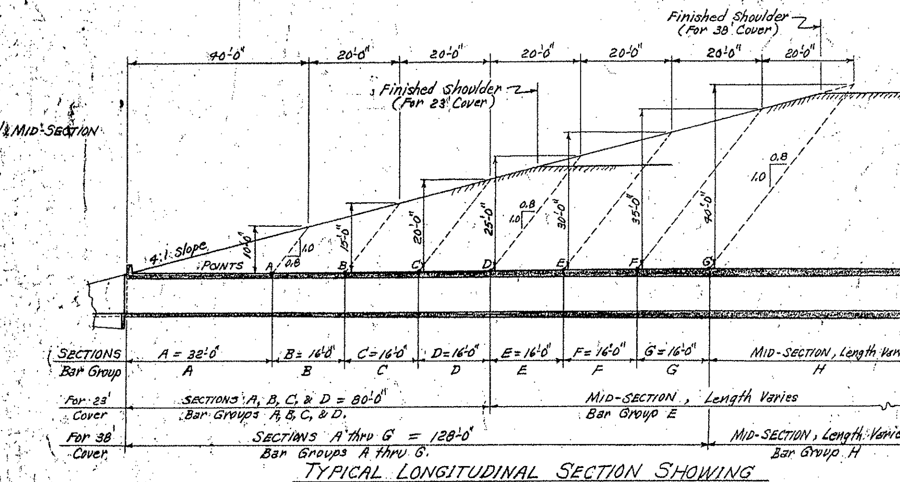


PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

NOTE:- Show END SECTION lengths with bar groups and MID-SECTION length with bar group on Cross Section Sheets.



TYPICAL LONGITUDINAL SECTION SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS HEIGHTS OF COVER
(Examples shown for 23' and 38' Depths of Cover.)

SECTIONS & BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	End Sections A	B	C	D	E	F	G	Length of End Sections	Mid-Section Dimensions	Mid-Section Bar Group
10.0' to 14.5'	✓							32'-0"	@ Point A	B
15.0' to 17.5'	✓	✓						48'-0"	@ Point B	C
18.0' to 20.0'	✓	✓	✓					64'-0"	@ Point C	D
20.5' to 25'	✓	✓	✓	✓				80'-0"	@ Point D	E
25.5' to 30'	✓	✓	✓	✓	✓			96'-0"	@ Point E	F
30.5' to 35'	✓	✓	✓	✓	✓	✓		112'-0"	@ Point F	G
35.5' to 40'	✓	✓	✓	✓	✓	✓	✓	128'-0"	@ Point G	H

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1957
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class A Concrete (n=15) 840 #/□"
Reinforcing Steel 20,000 #/□"

GENERAL NOTES:-

CONCRETE:- All concrete to be Class A, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each 32'-0" length of End Sections, and one lap for each additional 30'-0" length of the Mid-Section, less one. Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints in wingwalls, sidewalls and slabs shall be made only where shown on plans. For convenience the joints in the End Sections should be at the Dimension Points, that is, at 32'-0" or 48'-0" lengths. The Mid-Section may be in 24'-0" to 32'-0" lengths. Joints to be normal to center line of barrel.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Road and Bridge Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Drawing No. R-1004-A.

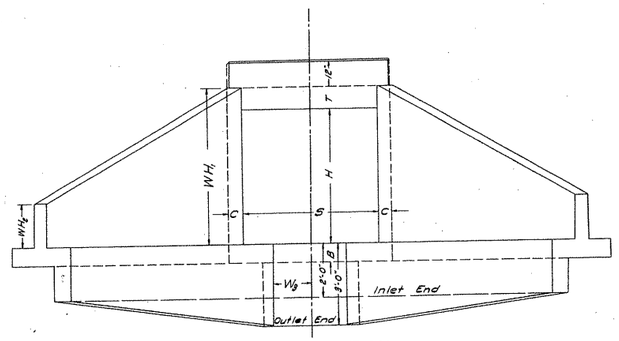
ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF SPECIAL BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

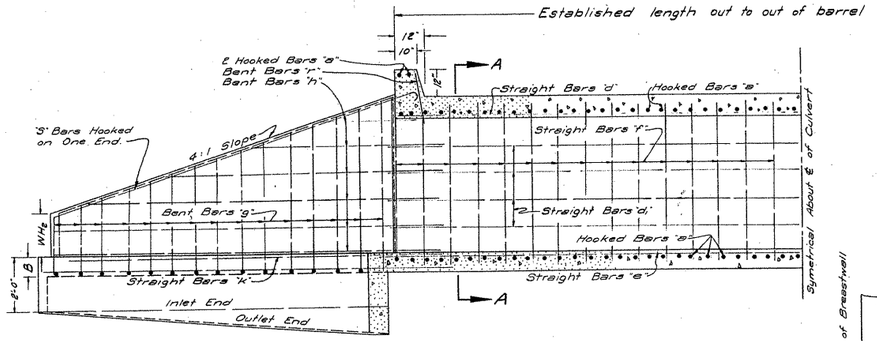
4', 5' & 6' SPANS — 4:1 SLOPES
SINGLES — OVER 10'-0" COVER

STANDARD DRAWING NO. R-1004-X

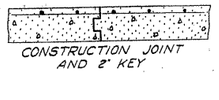
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	NO. SHEET	TOTAL SHEETS
6	ARK.				
JOB NO.					



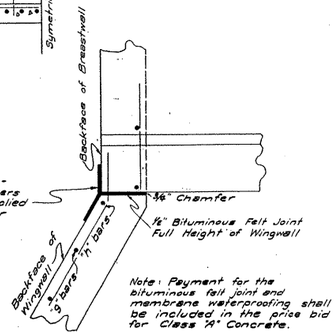
END ELEVATION



LONGITUDINAL SECTION



CONSTRUCTION JOINT AND 2" KEY

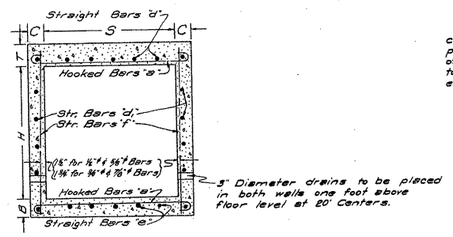


Note: Payment for the bituminous felt joint and membrane waterproofing shall be included in the price bid for Class "A" Concrete.

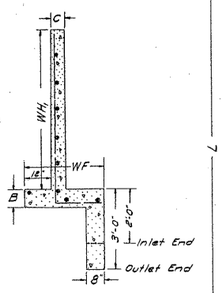
A membrane waterproofing 12" wide consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the backface of abutment to cover expansion joint.

DETAIL OF EXPANSION JOINT FOR CULVERT WHEN HEIGHT "H"=8' OR MORE

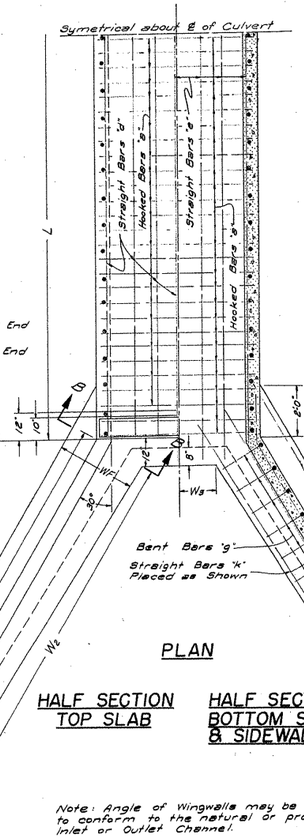
Scale 3/4" = 1'-0"



SECTION A-A



SECTION B-B

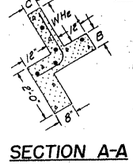


PLAN

HALF SECTION TOP SLAB

HALF SECTION BOTTOM SLAB & SIDEWALL

Note: Angle of Wingwalls may be varied to conform to the natural or proposed Inlet or Outlet Channel.



SECTION A-A

DIMENSIONS AND QUANTITIES

SPAN S	HEIGHT H	AREA OF OPENING SQ. FT. A	MAXIMUM DEPTH OF COVER D	THICKNESS OF TOP SLAB T	THICKNESS OF SIDE WALLS & THICKNESS OF BOTTOM SLAB C	B	WINGWALL HEIGHTS AT HEADWALLS WH.	WINGWALL HEIGHTS AT WINGEND WH/2	WIDTH OF WING FOOTING FROM FACE OF HDWL. TO END OF WING WF	LENGTH OF WINGWALLS E	INSIDE LENGTH OF WING FOOTINGS W.	FOOTING DIMENSION FROM ℄ OF BOX W1/2	FOOTING DIMENSION FROM ℄ OF BOX W3	CONCRETE CU. YD. HEADWALLS WINGWALLS & FOOTINGS	CONCRETE CU. YD. PER LINEAR FT. OF BARREL	STEEL LB. HEADWALLS WINGWALLS & FOOTINGS	STEEL LB. PER LINEAR FT. OF BARREL	STEEL LB. ADD'L STEEL FOR LAPS
3	2	6	16"	6 1/2"	6"	6 1/2"	2'-9"	1'-0"	2'-6"	7'-0"	8'-1"	7'-9 1/2"	0'-10 1/2"	4.76	0.235	286	22.56	11.1
	3	9			6"		3'-9"	1'-0"	2'-6"	11'-0"	12'-8 1/2"	12'-5"	0'-10 1/2"	7.59	0.272	440	25.27	13.4
	4	12			6"		4'-9"	1'-4"	2'-6"	13'-8"	15'-9 1/2"	15'-6"	0'-10 1/2"	10.06	0.309	587	27.97	15.6
4	2	8	13"	7 1/2"	6"	7 1/2"	2'-9"	1'-0"	2'-6"	7'-0"	8'-1"	7'-9 1/2"	1'-4 1/2"	5.10	0.306	298	31.05	15.6
	3	12	13"		6"		3'-9"	1'-0"	2'-6"	11'-0"	12'-8 1/2"	12'-5"	1'-4 1/2"	8.03	0.343	453	33.76	17.8
	4	16	13"		6"		4'-9"	1'-4"	2'-6"	13'-8"	15'-9 1/2"	15'-6"	1'-4 1/2"	10.64	0.380	600	36.46	20.0
	6	24	11"		7"		6'-9"	2'-0"	3'-4 1/2"	19'-0"	21'-11 1/2"	22'-2"	0'-5"	18.73	0.498	993	42.01	24.5
5	2	10	11"	8"	6"	8"	2'-10"	1'-0"	2'-6"	7'-4"	8'-5 1/2"	8'-2 1/2"	1'-10 1/2"	6.96	0.370	325	38.31	17.8
	3	15	11"		6"		3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9 1/2"	1'-10 1/2"	8.73	0.407	482	41.06	20.0
	4	20	11"		6"		4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10 1/2"	1'-10 1/2"	11.33	0.444	645	43.77	22.3
	5	25	11"		6"		5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	19'-1 1/2"	1'-4 1/2"	14.53	0.481	830	46.47	24.5
	7	35	9"		7 1/2"		7'-10"	2'-4"	3'-11"	22'-0"	25'-4 1/2"	25'-1 1/2"	0'-4"	25.20	0.633	1551	58.60	28.9
6	3	18	9"	9"	6"	9"	3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9 1/2"	2'-4 1/2"	9.26	0.500	495	50.41	22.3
	4	24	9"		6"		4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10 1/2"	2'-4 1/2"	11.93	0.537	645	53.11	24.5
	5	30	9"		6"		5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	19'-1 1/2"	1'-10 1/2"	15.30	0.574	845	55.82	26.7
	6	36	9"		7"		6'-10"	2'-0"	3'-5"	19'-4"	22'-4"	22'-7"	1'-8 1/2"	20.57	0.657	1063	58.55	28.9
	8	48	7"		8"		8'-10"	2'-8"	4'-5"	24'-8"	28'-5 1/2"	29'-4 1/2"	0'-3 1/2"	32.89	0.802	1842	72.49	33.4
8	7	56	7"	11"	7 1/2"	11"	8'-0"	2'-4"	4'-0"	22'-8"	26'-2"	26'-9 1/2"	1'-8 7/8"	29.52	0.952	1735	84.20	40.1
	8	64	7"		8"		9'-0"	2'-8"	4'-6"	25'-4"	29'-3"	30'-2 1/2"	1'-2 1/2"	36.71	1.029	2088	88.05	42.3
	10	80	7"		10"		11'-0"	3'-4"	5'-6"	30'-8"	35'-5"	36'-11 1/2"	0'-2 1/2"	57.93	1.274	3217	101.18	46.8
10	8	80	6"	13"	8"	13"	9'-0"	2'-8"	4'-6"	25'-4"	29'-3"	30'-2 1/2"	2'-2 1/2"	39.32	1.305	2159	136.74	44.5
	10	100	6"		10"		11'-0"	3'-4"	5'-6"	30'-8"	35'-5"	36'-11 1/2"	1'-2 1/2"	61.51	1.553	3299	151.04	49.0
	12	120	6"		12"		13'-0"	4'-0"	6'-6"	36'-0"	41'-6 1/2"	43'-9 1/2"	0'-2 1/2"	91.44	1.852	5333	169.90	53.4

LAP NOTE: In computing quantities of steel from the above table, add one lap for culverts up to 50'-0" in length and one lap for each additional 25'-0" in length.

SPECIFICATIONS: Arkansas Standard Road and Bridge Specifications.

*REINFORCING STEEL: To be deformed bars of Structural or Intermediate grade.

CHAMFER: All exposed corners to have 3/4" Chamfer.

CONCRETE: All Concrete to be Class "A".

*Reinforcing Steel to be deformed bars of intermediate or rail grade on all Interstate Highways.

CONSTRUCTION JOINTS: Construction joints in wing walls and apron slabs shall be made only where shown on the plans. Maximum length of culvert between headwalls for which continuous pours will be permitted is 75'. For longer culverts construction joints shall be provided in slabs and walls at intervals not greater than 50'. Joints shall be normal to ℄ of barrel and shall have 2" continuous keys.

Longitudinal reinforcing shall be continuous through joints.

REVISIONS	
March, '58	Drawn
July, 1958	Construction Joints

STEEL SCHEDULE

For Culverts 30'-0" in Length - Out to Out of Barrel

SPAN S	HEIGHT H	"a" bars (3" for 1/2" & 5/8" bars; 6" for 3/4" & 7/8" bars; 2 in each headwall balance in top and bottom slab of barrel) SIZE	SPACING	NUMBER	LENGTH	X	"d" bars (STRAIGHT, In Bottom of Top Slab) SIZE	SPACING	NUMBER	LENGTH	"d." bars (STRAIGHT, In Sidewalls) SIZE	SPACING	NUMBER	LENGTH	"e" bars (STRAIGHT, In Top of Bottom Slab) SIZE	SPACING	NUMBER	LENGTH
3	2	1/2"	6"	124	4'-6"	3'-9"	1/2"	12"	4	28'-9" for 30'-0" Length	1/2"	12"	2	31'-9" for 30'-0" Length	1/2"	12"	4	28'-9" for 30'-0" Length
	3			124	4'-6"	3'-9"			4				4				4	
	4			124	4'-6"	3'-9"			4				6				4	
4	2	1/2"	5"	108	5'-6"	4'-9"	1/2"	10"	6		1/2"	12"	2		1/2"	12"	6	
	3			108	5'-6"	4'-9"			6				4				6	
	4			108	5'-6"	4'-9"			6				6				6	
	6			108	5'-8"	4'-11"			6				10				6	
5	2	5/8"	7"	108	6'-6"	5'-9"	1/2"	10"	7		1/2"	12"	2		1/2"	12"	7	
	3			108	6'-6"	5'-9"			7				4				7	
	4			108	6'-6"	5'-9"			7				6				7	
	5			108	6'-6"	5'-9"			7				8				7	
	7			108	6'-9"	6'-0"			7				12		5/8"		7	
6	3	5/8"	6"	124	7'-6"	6'-9"	1/2"	10"	8		1/2"	12"	2		1/2"	12"	8	
	4			124	7'-6"	6'-9"			8				4				8	
	5			124	7'-6"	6'-9"			8				6				8	
	6			124	7'-8"	6'-11"			8				10				8	
	8			124	7'-10"	7'-1"			8				14				8	
8	7	3/4"	9"	84	10'-5 1/2"	8'-11 1/2"	1/2"	9"	12		1/2"	12"	9		5/8"	12"	9	
	8			84	10'-6 1/2"	9'-0 1/2"			12				12				12	
	10			84	10'-10 1/2"	9'-4 1/2"			12				18				12	
10	8	7/8"	7"	108	12'-6 1/2"	11'-0 1/2"	1/2"	10"	13		1/2"	12"	14		5/8"	12"	13	
	10			108	12'-10 1/2"	11'-4 1/2"			13				18				13	
	12			108	13'-2 1/2"	11'-8 1/2"			13				22				13	

SPAN S	HEIGHT H	"f" bars (STRAIGHT Vertical Bars In Sidewalls) SIZE	SPACING	NUMBER	LENGTH	"g" bars (Vertical Bars in back face of Wingwall bent into bottom of footing) SIZE	SPACING	NUMBER	WEDGE LENGTH	X Min.	X Max.	Y Min.	Y Max.	"h" bars (1/2" bars @ 12" Ctrs.) NUMBER	WEDGE LENGTH	Z Min.	Z Max.	"k" bars (1/2" bars STRAIGHT In Wing Footing) NUMBER	LENGTH	"r" bars (1/2" bars @ 12" Ctrs. Var. Concrete in Headwalls) NUMBER	LENGTH	"s" bars (1/2" bars In Top of Each Wingwall) NUMBER	LENGTH	Z
3	2	1/2"	12"	G2	2'-10"	1/2"	12"	3G	3'-5"	1'-3"	1'-3"	1'-3 1/2"	3'-0 1/2"	12	7'-11 1/2"	3'-2 1/2"	7'-10"	12	9'-7 1/2"	10	2'-11 1/2"	4	9'-7 1/2"	9'-1 1/2"
	3			G2	3'-10"			5G	3'-11"	1'-3"	1'-3"	1'-4 1/2"	3'-11 1/2"	16	10'-7 1/2"	3'-2 1/2"	12'-5 1/2"	12	14'-3 1/2"	10	2'-11 1/2"	4	14'-4 1/2"	13'-10"
	4			G2	4'-10"			6G	4'-7"	1'-3"	1'-3"	1'-9"	4'-11"	20	12'-6 1/2"	3'-2 1/2"	15'-6 1/2"	12	17'-4 1/2"	10	2'-11 1/2"	4	17'-5 1/2"	16'-11 1/2"
4	2	1/2"	12"	G2	3'-0"	1/2"	12"	3G	3'-6"	1'-3"	1'-3"	1'-4 1/2"	3'-1 1/2"	12	7'-11 1/2"	3'-2 1/2"	7'-10"	12	9'-7 1/2"	12	3'-0 1/2"	4	9'-7 1/2"	9'-1 1/2"
	3			G2	4'-0"			5G	4'-0"	1'-3"	1'-3"	1'-5 1/2"	4'-0 1/2"	16	10'-7 1/2"	3'-2 1/2"	12'-5 1/2"	12	14'-3 1/2"	12	3'-0 1/2"	4	14'-4"	13'-10"
	4			G2	5'-0"			6G	4'-8"	1'-3"	1'-3"	1'-10"	5'-0"	20	12'-6 1/2"	3'-2 1/2"	15'-6 1/2"	12	17'-4 1/2"	12	3'-0 1/2"	4	17'-5 1/2"	16'-11 1/2"
	6			G2	7'-0"			8G	6'-5 1/2"	1'-4"	2'-1"	2'-5 1/2"	7'-0 1/2"	28	16'-9 1/2"	3'-2 1/2"	21'-8 1/2"	12	23'-6"	12	3'-0 1/2"	4	23'-9 1/2"	23'-3 1/2"
5	2	1/2"	12"	G2	3'-1"	1/2"	12"	3G	3'-7"	1'-3"	1'-3"	1'-6"	3'-2"	12	8'-4"	3'-7 1/2"	8'-2 1/2"	12	10'-0 1/2"	14	3'-1"	4	10'-0"	9'-6"
	3			G2	4'-1"			5G	4'-1"	1'-3"	1'-3"	1'-6 1/2"	4'-1 1/2"	16	11'-0 1/2"	3'-7 1/2"	12'-10 1/2"	12	14'-7 1/2"	14	3'-1"	4	14'-8 1/2"	14'-2 1/2"
	4			G2	5'-1"			6G	4'-9"	1'-3"	1'-3"	1'-9"	5'-3"	20	12'-11 1/2"	3'-7 1/2"	15'-11"	12	17'-2 1/2"	14	3'-1"	4	17'-10 1/2"	17'-4 1/2"
	5			G2	6'-1"			8G	5'-7 1/2"	1'-3"	1'-8"	2'-2"	6'-2"	24	15'-0 1/2"	3'-7 1/2"	18'-11 1/2"	12	20'-9 1/2"	14	3'-1"	4	21'-0 1/2"	20'-6 1/2"
	7	5/8"	12"	G2	8'-1"	5/8"	12"	10G	7'-6 1/2"	1'-4 1/2"	2'-8"	3'-3"	8'-3"	32	19'-1 1/2"	3'-7 1/2"	23'-1 1/2"	12	26'-1 1/2"	14	3'-1"	4	27'-4"	26'-10"
6	3	1/2"	12"	G2	4'-3"	1/2"	12"	5G	4'-2"	1'-3"	1'-3"	1'-7 1/2"	4'-2 1/2"	16	11'-0 1/2"	3'-7 1/2"	12'-10 1/2"	12	14'-7 1/2"	16	3'-2"	4	14'-8 1/2"	14'-2 1/2"
	4			G2	5'-3"			6G	4'-10"	1'-3"	1'-3"	1'-10"	5'-0"	20	12'-11 1/2"	3'-7 1/2"	15'-11"	12	17'-2 1/2"	16	3'-2"	4	17'-10 1/2"	17'-4 1/2"
	5			G2	6'-3"	1/2"	12"	8G	5'-8 1/2"	1'-3"	1'-8"	2'-3"	6'-3"	24	15'-0 1/2"	3'-7 1/2"	18'-11 1/2"	12	20'-9 1/2"	16	3'-2"	4	21'-0 1/2"	20'-6 1/2"
	6			G2	7'-3"			9G	6'-8"	1'-4"	2'-2"	2'-7 1/2"	7'-2 1/2"	28	17'-7 1/2"	3'-7 1/2"	22'-0 1/2"	12	23'-10 1/2"	16	3'-2"	4	24'-2 1/2"	23'-8 1/2"
	8	5/8"	12"	G2	9'-3"	5/8"	12"	12G	9'-1"	1'-5"	3'-2"	3'-2 1/2"	9'-3 1/2"	36	21'-2 1/2"	3'-7 1/2"	26'-2 1/2"	12	30'-0 1/2"	16	3'-2"	4	30'-3 1/2"	29'-11 1/2"
8	7	5/8"	12"	G2	8'-7"	5/8"	12"	10G	7'-10 1/2"	1'-4 1/2"	2'-9"	3'-1"	8'-7"	32	19'-10 1/2"	4'-4 1/2"	25'-11 1/2"	12	27'-8 1/2"	20	3'-4"	4	28'-1 1/2"	27'-7 1/2"
	8			G2	9'-7"			12G	8'-10"	1'-5"	3'-3"	3'-5 1/2"	9'-6 1/2"	36	21'-11 1/2"	4'-4 1/2"	29'-0"	12	30'-9 1/2"	20	3'-4"	4	31'-3 1/2"	30'-9 1/2"
	10			7G	11'-7"			14G	10'-9"	1'-7"	4'-3"	4'-1"	11'-7"	44	26'-0 1/2"	4'-4 1/2"	35'-1 1/2"	12	36'-11 1/2"	20	3'-4"	4	37'-6 1/2"	37'-0 1/2"
10	8	5/8"	12"	G2	9'-11"	5/8"	12"	12G	9'-0"	1'-5"	3'-3"	3'-7 1/2"	9'-8 1/2"	36	21'-11 1/2"	4'-4 1/2"	29'-0"	12	30'-9 1/2"	24	3'-6"	4	31'-3 1/2"	30'-9 1/2"
	10			7G	11'-11"			14G	10'-11"	1'-7"	4'-3"	4'-3"	11'-9"	44	26'-0 1/2"	4'-4 1/2"	35'-1 1/2"	12	36'-11 1/2"	24	3'-6"	4	37'-6 1/2"	37'-0 1/2"
	12			G2	13'-11"			8	252	1'-8"	5'-3"	4'-10 1/2"	13'-9 1/2"	52	30'-2 1/2"	4'-4 1/2"	41'-3 1/2"	12	43'-1 1/2"	26	3'-6"	4	43'-10 1/2"	43'-4 1/2"

NOTE: Lengths given above do not include lap.

AASHO DESIGN LIVE LOADING H-20 S-16

UNIT STRESSES

Concrete (n-15) 840 Lbs. Per Sq. In.

Reinforcing Steel (Str. Gr.) 18000 Lbs. Per Sq. In.

SPECIAL MILITARY LOADING

Add'l Loading For Interstate Highways

2 - 24,000 Lb. Axles @ 4'-0" Ctrs.

Concrete (n-15) - 840 Lbs. Per Sq. In.

Reinf. Steel (Int. or Rail) - 20000 Lbs. Per Sq. In.

ARKANSAS STATE HIGHWAY COMMISSION

REINFORCED CONCRETE BOX CULVERTS

3' TO 10' SPAN **4:1 SLOPES**

SINGLE **OVER 3'-6" COVER**

STD. DWG. NO. R-1004-A

11-A

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars: STRAIGHT – In Top and Bottom Slabs of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars: BENT - See Diagram at Right. In Top and Bottom Slabs of Barrel. Alternate with "a" bars.
"d" bars: STRAIGHT – Longitudinal in Top Slab of Barrel
"d1" bars: STRAIGHT – Longitudinal in Sidewalls
"e" bars: STRAIGHT – Longitudinal in Bottom Slab of Barrel
"f" bars: STRAIGHT – Verticals in Sidewalls

Section & Bar Group	Length of Sections	Depth of Cover D	Clear Span S	Clear Height H	a Size	a Spacing	a No. Req'd 3:1	a No. Req'd 4:1	a Length	b Size	b Spacing	b No. Req'd 3:1	b No. Req'd 4:1	b Length	b X	d Size	d Spacing	d No. Req'd	d Length	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length	f Size	f Spacing	f No. Req'd 3:1	f No. Req'd 4:1	f Length
SECTION "A" & BAR GROUP "A"	3:1 = 22'-0"; 4:1 = 32'-0"	5'-0" TO 10'-0"	1 @ 7'	5'	#5	12"	48	68	7'-9"	#6	12"	44	64	8'-10"	7'-8"	#4	12"	8	33'-3" for 32'-0" Section	#4	12"	10	33'-3" for 32'-0" Section	#4	12"	8	34'-3" for 32'-0" Section	#4	12"	44	64	6'-1"
				6'			48	68	7'-11"			44	64	9'-0"	7'-10"			8				12				8				44	64	7'-1"
				7'			48	68	8'-0"			44	64	9'-1"	7'-11"			8				14				8			11"	48	70	8'-1"
				8'			48	68	8'-1"			44	64	9'-2"	8'-0"			8				16				8		#5	12"	44	64	9'-1"
				9'			48	68	8'-3"			44	64	9'-4"	8'-2"			8				18				8			11"	48	70	10'-1"
			1 @ 8'	6'	#6	12"	48	68	8'-11"	#6	12"	44	64	10'-0"	8'-10"	#4	12"	9		#4	12"	12		#4	12"	9		#4	12"	44	64	7'-3"
				7'			48	68	9'-0"			44	64	10'-1"	8'-11"			9				14				9				44	64	8'-3"
				8'			48	68	9'-1"			44	64	10'-2"	9'-0"			9				16				9		#5	12"	44	64	9'-3"
				9'			48	68	9'-3"			44	64	10'-4"	9'-2"			9				18				9			11"	48	70	10'-3"
				10'			48	68	9'-5"			44	64	10'-6"	9'-4"			9				20				9			10"	54	78	11'-8"
			1 @ 9'	7'	#6	11"	52	74	10'-0"	#7	11"	48	70	11'-3"	9'-11"	#4	12"	10		#4	12"	14		#4	12"	10		#4	12"	44	64	8'-5"
				8'			52	74	10'-1"			48	70	11'-4"	10'-0"			10				16				10			12"	44	64	9'-5"
				9'			52	74	10'-3"			48	70	11'-6"	10'-2"			10				18				10		#5	11"	48	70	10'-5"
				10'			52	74	10'-5"			48	70	11'-8"	10'-4"			10				20				10			10"	54	78	11'-5"
				11'			52	74	10'-7"			48	70	11'-10"	10'-6"			10				22				10		#6	12"	44	64	12'-5"
			1 @ 10'	8'	#7	12"	48	68	11'-1"	#7	12"	44	64	12'-4"	11'-0"	#4	12"	11		#4	12"	16		#4	12"	11		#5	12"	44	64	9'-7"
				9'			48	68	11'-3"			44	64	12'-6"	11'-2"			11				18				11				44	64	10'-7"
				10'			48	68	11'-5"			44	64	12'-8"	11'-4"			11				20				11			10"	54	78	11'-7"
				11'			48	68	11'-7"			44	64	12'-10"	11'-6"			11				22				11		#6	12"	44	64	12'-7"
				12'			48	68	11'-9"			44	64	13'-0"	11'-8"			11				24				11			11"	48	70	13'-7"
SECTION "B" & BAR GROUP "B"	3:1 = 11'-0"; 4:1 = 16'-0"	10'-0" TO 15'-0"	1 @ 7'	5'	#6	11"	24	36	7'-9"	#6	11"	24	34	8'-10"	7'-8"	#4	12"	8	34'-3" for 33'-0" Length Section	#4	12"	10	34'-3" for 33'-0" Length Section	#4	12"	8	34'-3" for 33'-0" Length Section	#4	12"	22	32	6'-3"
				6'			24	36	7'-11"			24	34	9'-0"	7'-10"			8				12				8				22	32	7'-3"
				7'			24	36	8'-0"			24	34	9'-1"	7'-11"			8				14				8		#5	12"	22	32	8'-3"
				8'			24	36	8'-1"			24	34	9'-2"	8'-0"			8				16				8		#6	12"	22	32	9'-3"
				9'			24	36	8'-3"			24	34	9'-4"	8'-2"			8				18				8				22	32	10'-3"
			1 @ 8'	6'	#7	12"	22	32	8'-11"	#6	12"	22	32	10'-0"	8'-10"	#4	12"	9		#4	12"	12		#4	12"	9		#4	12"	22	32	7'-5"
				7'			22	32	9'-0"			22	32	10'-1"	8'-11"			9				14				9		#5	12"	22	32	8'-5"
				8'			22	32	9'-1"			22	32	10'-2"	9'-0"			9				16				9			10"	28	40	9'-5"
				9'			22	32	9'-3"			22	32	10'-4"	9'-2"			9				18				9		#6	12"	22	32	10'-5"
				10'			22	32	9'-5"			22	32	10'-6"	9'-4"			9				20				9			10"	26	38	11'-5"
			1 @ 9'	7'	#7	12"	22	32	10'-0"	#7	12"	22	32	11'-3"	9'-11"	#4	12"	10		#4	12"	14		#4	12"	10		#5	12"	22	32	8'-7"
				8'			22	32	10'-1"			22	32	11'-4"	10'-0"			10				16				10			10"	28	40	9'-7"
				9'			22	32	10'-3"			22	32	11'-6"	10'-2"			10				18				10		#6	12"	22	32	10'-7"
				10'			22	32	10'-5"			22	32	11'-8"	10'-4"			10				20				10			10"	28	38	11'-7"
				11'			22	32	10'-7"			22	32	11'-10"	10'-6"			10				22				10		#7	12"	22	32	12'-7"
			1 @ 10'	8'	#8	12"	22	32	11'-1"	#7	12"	22	32	12'-4"	11'-0"	#4	11"	12		#4	12"	16		#4	11"	12		#5	10"	28	40	9'-9"
				9'			22	32	11'-3"			22	32	12'-6"	11'-2"			12				18				12		#6	12"	22	32	10'-9"
				10'			22	32	11'-5"			22	32	12'-8"	11'-4"			12				20				12			11"	24	34	11'-9"
				11'			22	32	11'-7"			22	32	12'-10"	11'-6"			12				22				12		#7	12"	22	32	12'-9"
				12'			22	32	11'-9"			22	32	13'-0"	11'-8"			12				24				12			11"	24	36	13'-9"
SECTION "C" & BAR GROUP "C"	3:1 = 11'-0"; 4:1 = 16'-0"	15'-0" TO 20'-0"	1 @ 7'	5'	#7	13"	20	30	7'-9"	#7	13"	20	30	9'-0"	7'-8"	#4	12"	8	34'-3" for 33'-0" Length Section	#4	12"	10	34'-3" for 33'-0" Length Section	#4	12"	8	34'-3" for 33'-0" Length Section	#4	12"	22	32	6'-5"
				6'			20	30	7'-11"			20	30	9'-2"	7'-10"			8				12				8		#5	12"	22	32	7'-5"
				7'			20	30	8'-0"			20	30	9'-3"	7'-11"			8				14				8			10"	28	38	8'-5"
				8'			20	30	8'-1"			20	30	9'-4"	8'-0"			8				16				8		#6	11"	24	36	9'-5"
				9'			20	30	8'-3"			20	30	9'-6"	8'-2"			8				18				8		#7	12"	22	32	10'-5"
			1 @ 8'	6'	#7	12"	22	32	8'-11"	#7	12"	22	32	10'-2"	8'-10"	#4	11"	10		#4	12"	12		#4	11"	10		#4	10"	28	40	7'-7"
				7'			22	32	9'-0"			22	32	10'-3"	8'-11"			10				14				10		#5	10"	28	40	8'-7"
				8'			22	32	9'-2"			22	32	10'-5"	9'-1"			10				16				10		#6	12"	22	32	9'-7"
				9'			22	32	9'-3"			22	32	10'-6"	9'-2"			10				18				10			10"	28	38	10'-7"
				10'			22	32	9'-5"			22	32	10'-8"	9'-4"			10				20				10		#7	12"	22	32	11'-7"
			1 @ 9'	7'	#8	12"	22	32	10'-1"	#7	12"	22	32	11'-4"	10'-0"	#4	11"	11		#4	12"	14		#4	11"	11		#5	12"	22	32	8'-10"
				8'			22	32	10'-2"			22	32	11'-5"	10'-1"			11				16				11		#6	12"	22	32	9'-10"
				9'			22	32	10'-3"			22	32	11'-6"	10'-2"			11				18				11			10"	28	38	10'-10"
				10'			22	32	10'-5"			22	32	11'-8"	10'-4"			11				20				11		#7	12"	22	32	11'-10"
				11'			22	32	10'-7"			22	32	11'-10"	10'-6"			11				22				11			10"	28	40	12'-10"
			1 @ 10'	8'	#8	12"	22	32	11'-2"	#8	12"	22	32	12'-7"	11'-1"	#4	10"	13		#4	12"	16		#4	10"	13		#5	10"	26	38	10'-0"
				9'			22	32	11'-4"			22	32	12'-9"	11'-3"			13				18				13		#6	11"	24	36	11'-0"
				10'			22	32	11'-5"			22	32	12'-10"	11'-4"			13				20				13		#7	12"	22	32	12'-0"
				11'			22	32	11'-7"			22	32	13'-0"	11'-6"			13				22				13			11"	24	36	13'-0"
				12'			22	32	11'-9"			22	32	13'-2"	11'-8"			13				24				13		#8	12"	22	32	14'-0"
SECTION "D" & BAR GROUP "D"	3:1 = 11'-0"; 4:1 = 16'-0"	20'-0" TO 25'-0"	1 @ 7'	5'	#7	12"	22	32	7'-10"	#7	12"	22	32	9'-1"	7'-9"	#4	11"	9		#4	12"	10		#4	11"	9		#4	12"	22	32	6'-7"
				6'			22	32	8'-0"			22	32	9'-3"	7'-11"			9				12				9		#5	12"	22	32	7'-7"
				7'			22	32	8'-1"			22	32	9'-4"	8'-0"			9				14				9			10"	26	40	8'-7"
				8'			22	32	8'-3"			22	32	9'-6"	8'-2"			9				16				9		#6	11"	24	34	9'-7"
				9'			22	32	8'-5"			22	32	9'-8"	8'-4"			9				18				9		#7	12"	22	32	10'-7"
			1 @ 8'	6'	#8	12"	22	32	9'-0"	#7	12"	22	32	10'-3"	8'-11"	#4	10"	11		#4	12"	12		#4	10"	11		#5	12"	22	32	7'-9"
				7'			22	32	9'-1"			22	32	10'-4"	9'-0"			11				14				11			10"	26	38	8'-9"
				8'			22	32	9'-3"			22	32	10'-6"	9'-2"			11				16				11		#6	12"	22	32	9'-9"
				9'			22	32	9'-5"			22	32	10'-8"	9'-4"			11				18				11			10"	26	40	10'-9"
				10'			22	32	9'-7"			22	32	10'-10"	9'-6"			11				20				11		#7	11"	24	34	11'-9"
			1 @ 9'	7'	#8	12"	22	32	10'-2"	#8	12"	22	32	11'-7"	10'-1"	#4	10"	12		#4	12"	14		#4	10"	12		#5	12"	22	32	9'-0"
				8'			22	32	10'-4"			22	32	11'-9"	10'-3"			12				16				12		#6	12"	22	32	10'-0"
				9'			22	32	10'-5"			22	32	11'-10"	10'-4"			12				18				12			10"	26	40	11'-0"
				10'			22	32	10'-7"			22	32	12'-0"	10'-6"			12				20				12		#7	12"	22	32	12'-0"
				11'			22	32	10'-9"			22	32	12'-2"	10'-8"			12				22				12			10"	26	38	13'-0"
			1 @ 10'	8'	#9	12"	Varies with Length of Barrel	Varies with Length of Barrel	11'-4"	#8	12"	Varies with Length of Barrel	Varies with Length of Barrel	12'-9"	11'-3"	#4	9½"	14	Varies with Length of Barrel	#4	12"	16	Varies with Length of Barrel	#4	9½"	14	Varies with Length of Barrel	#5	10"			10'-3"
				9'					11'-6"					12'-11"	11'-5"			14				18				14		#6	11"			11'-3"
				10'					11'-7"					13'-0"	11'-6"			14				20				14		#7	12"			12'-3"
				11'					11'-9"					13'-2"	11'-8"			14				22				14			10"			13'-3"
				12'					11'-11"					13'-4"	11'-10"			14				24				14		#8	12"			14'-3"
SECTION "E" & BAR GROUP "E"	Varies with Length of Barrel	25'-0" TO 30'-0"	1 @ 7'	5'	#7	11"	Varies with Length of Barrel	Varies with Length of Barrel	7'-11"	#7	11"	Varies with Length of Barrel	Varies with Length of Barrel	9'-2"	7'-10"	#4	11"	9	Varies with Length of Barrel	#4	12"	10	Varies with Length of Barrel	#4	11"	9	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	Varies with Length of Barrel	6'-8"
				6'					8'-1"					9'-4"	8'-0"			9				12				9		#5	12"			7'-8"
				7'					8'-3"					9'-6"	8'-2"			9				14				9			10"			8'-8"
				8'					8'-4"					9'-7"	8'-3"			9				16				9		#6	11"			9'-8"
				9'					8'-6"					9'-9"	8'-5"			9				18				9		#7	12"			10'-8"
			1 @ 8'	6'	#8	11"			9'-1"	#7	11"			10'-4"	9'-0"	#4	10"	11		#4	12"	12		#4	10"	11		#5	12"			7'-11"
				7'					9'-3"					10'-6"	9'-2"			11				14				11			10"			8'-11"
				8'					9'-5"					10'-8"	9'-4"			11				16				11		#6	12"			9'-11"
				9'					9'-7"					10'-10"	9'-6"			11				18				11			10"			10'-11"
				10'					9'-9"					11'-0"	9'-8"			11				20				11		#7	11"			11'-11"
			1 @ 9'	7'	#8	11"			10'-3"	#8	11"			11'-8"	10'-2"	#4	9"	13		#4	12"	14		#4	9"	13		#5	12"			9'-2"
				8'					10'-5"					11'-10"	10'-4"			13				16				13		#6	12"			10'-2"
				9'					10'-7"					12'-0"	10'-6"			13				18				13			10"			11'-2"
				10'					10'-9"					12'-2"	10'-8"			13				20				13		#7	11"			12'-2"
				11'					10'-11"					12'-4"	10'-10"			13				22				13			10"			13'-2"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bd, Bd1, Be and Bf.

Designed By: W.C.H. 7-18-62. Checked By:- RHS 7-25-62
Drawn By: W.C.H. 8-3-62. Checked By:- RHS 8-10-62
Quantities By: W.C.H. 8-1-62. Checked By:- RHS 8-10-62

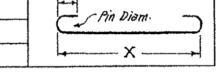
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Span S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU. YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
SECTION "A" - 10'-0"	1 @ 7'	5'	35	8'-0"	8"	6"	8½"	6'-4½"	0.593	68.20	21.71	107.42
		6'	42	8'-2"		7"		7'-4½"	0.675	71.72	23.38	108.81
		7'	49	8'-3"		7½"		8'-4½"	0.744	75.80	25.05	109.50
		8'	56	8'-4"		8"		9'-4½"	0.819	84.72	26.72	110.20
		9'	63	8'-6"		9"		10'-4½"	0.933	90.91	28.39	111.59
	1 @ 8'	6'	48	9'-2"	8½"	7"	9½"	7'-6"	0.769	86.55	25.05	157.02
		7'	56	9'-3"		7½"		8'-6"	0.838	89.72	26.72	158.02
		8'	64	9'-4"		8"		9'-6"	0.914	99.84	28.39	159.02
		9'	72	9'-6"		9"		10'-6"	1.028	106.20	30.06	161.03
		10'	80	9'-8"		10"		11'-6"	1.154	113.38	31.73	163.03
	1 @ 9'	7'	63	10'-3"	9¼"	7½"	10½"	8'-8"	0.957	116.90	28.39	177.61
		8'	72	10'-4"		8"		9'-8"	1.033	127.28	30.06	178.61
		9'	81	10'-6"		9"		10'-8"	1.148	133.97	31.73	180.61
		10'	90	10'-8"		10"		11'-8"	1.276	141.46	33.40	182.62
		11'	99	10'-10"		11"		12'-8"	1.416	152.81	35.07	184.62
	1 @ 10'	8'	80	11'-4"	10½"	8"	11½"	9'-10"	1.165	141.10	31.73	249.37
		9'	90	11'-6"		9"		10'-10"	1.281	145.89	33.40	252.10
		10'	100	11'-8"		10"		11'-10"	1.409	155.50	35.07	254.82
		11'	110	11'-10"		11"		12'-10"	1.550	167.01	36.74	257.55
		12'	120	12'-0"		12"		13'-10"	1.704	176.42	38.41	260.27
SECTION "B" - 15'-0"	1 @ 7'	5'	35	8'-0"	8¾"	6"	9¼"	6'-6"	0.630	80.06	21.71	
		6'	42	8'-2"		7"		7'-6"	0.713	83.83	23.38	
		7'	49	8'-3"		7½"		8'-6"	0.782	93.23	25.05	
		8'	56	8'-4"		8"		9'-6"	0.858	105.69	26.72	
		9'	63	8'-6"		9"		10'-6"	0.972	111.13	28.39	
	1 @ 8'	6'	48	9'-2"	9¾"	7"	10¾"	7'-8½"	0.839	96.94	25.05	
		7'	56	9'-3"		7½"		8'-8½"	0.909	106.02	26.72	
		8'	64	9'-4"		8"		9'-8½"	0.986	113.96	28.39	
		9'	72	9'-6"		9"		10'-8½"	1.101	124.20	30.06	
		10'	80	9'-8"		10"		11'-8½"	1.229	136.58	31.73	
	1 @ 9'	7'	63	10'-3"	10¾"	7½"	11¾"	8'-10½"	1.036	127.49	28.39	
		8'	72	10'-4"		8"		9'-10½"	1.113	135.59	30.06	
		9'	81	10'-6"		9"		10'-10½"	1.229	146.09	31.73	
		10'	90	10'-8"		10"		11'-10½"	1.358	158.75	33.40	
		11'	99	10'-10"		11"		12'-10½"	1.499	171.14	35.07	
	1 @ 10'	8'	80	11'-4"	11¾"	8"	12¾"	10'-0½"	1.252	160.73	33.40	
		9'	90	11'-6"		9"		11'-0½"	1.370	171.52	35.07	
		10'	100	11'-8"		10"		12'-0½"	1.499	180.64	36.74	
		11'	110	11'-10"		11"		13'-0½"	1.642	197.17	38.41	
		12'	120	12'-0"		12"		14'-0½"	1.796	209.27	40.08	
SECTION "C" - 20'-0"	1 @ 7'	5'	35	8'-0"	9¾"	6"	10¼"	6'-8"	0.679	89.15	21.71	
		6'	42	8'-2"		7"		7'-8"	0.763	98.64	23.38	
		7'	49	8'-3"		7½"		8'-8"	0.833	106.20	25.05	
		8'	56	8'-4½"		8¼"		9'-8"	0.924	117.96	26.72	
		9'	63	8'-6½"		9¼"		10'-8"	1.041	132.28	28.39	
	1 @ 8'	6'	48	9'-2"	11"	7"	11½"	7'-10½"	0.896	111.55	26.72	
		7'	56	9'-3"		7½"		8'-10½"	0.966	122.89	28.39	
		8'	64	9'-5"		8½"		9'-10½"	1.074	132.89	30.06	
		9'	72	9'-6½"		9¼"		10'-10½"	1.177	144.27	31.73	
		10'	80	9'-8½"		10¼"		11'-10½"	1.307	156.17	33.40	
	1 @ 9'	7'	63	10'-4"	12"	8"	13"	9'-1"	1.143	142.65	30.06	
		8'	72	10'-5"		8½"		10'-1"	1.224	155.88	31.73	
		9'	81	10'-6½"		9¼"		11'-1"	1.327	167.52	33.40	
		10'	90	10'-8½"		10¼"		12'-1"	1.459	179.75	35.07	
		11'	99	10'-10½"		11¼"		13'-1"	1.603	197.24	36.74	
	1 @ 10'	8'	80	11'-5½"	13¾"	8¾"	14¾"	10'-3½"	1.405	179.91	35.07	
		9'	90	11'-7"		9½"		11'-3½"	1.511	194.05	36.74	
		10'	100	11'-8½"		10¼"		12'-3½"	1.626	209.28	38.41	
		11'	110	11'-10½"		11¼"		13'-3½"	1.772	221.31	40.08	
		12'	120	12'-0½"		12¼"		14'-3½"	1.929	241.22	41.75	
SECTION "D" - 25'-0"	1 @ 7'	5'	35	8'-1"	10¾"	6½"	11¼"	6'-10"	0.749	96.65	23.38	
		6'	42	8'-3"		7½"		7'-10"	0.838	106.38	25.05	
		7'	49	8'-4½"		8¼"		8'-10"	0.925	114.06	26.72	
		8'	56	8'-6"		9"		9'-10"	1.022	126.68	28.39	
		9'	63	8'-8"		10"		10'-10"	1.144	141.24	30.06	
	1 @ 8'	6'	48	9'-3"	12"	7½"	12½"	8'-0½"	0.977	128.84	28.39	
		7'	56	9'-4½"		8¼"		9'-0½"	1.065	136.70	30.06	
		8'	64	9'-6½"		9¼"		10'-0½"	1.178	146.99	31.73	
		9'	72	9'-8½"		10¼"		11'-0½"	1.304	159.36	33.40	
		10'	80	9'-10½"		11¼"		12'-0½"	1.441	175.92	35.07	
	1 @ 9'	7'	63	10'-5"	13¾"	8½"	14¾"	9'-3½"	1.251	160.30	31.73	
		8'	72	10'-7"		9½"		10'-3½"	1.367	174.69	33.40	
		9'	81	10'-8½"		10¼"		11'-3½"	1.478	186.52	35.07	
		10'	90	10'-10½"		11¼"		12'-3½"	1.617	199.04	36.74	
		11'	99	11'-0½"		12¼"		13'-3½"	1.769	216.88	38.41	
	1 @ 10'	8'	80	11'-7"	14½"	9½"	15½"	10'-6"	1.542	200.20	36.74	
		9'	90	11'-9"		10½"		11'-6"	1.671	214.77	38.41	
		10'	100	11'-10½"		11¼"		12'-6"	1.794	230.33	40.08	
		11'	110	12'-0½"		12¼"		13'-6"	1.947	248.61	41.75	
		12'	120	12'-2½"		13¼"		14'-6"	2.112	263.06	43.42	
SECTION "E" - 30'-0"	1 @ 7'	5'	35	8'-2"	11½"	7"	12"	6'-11½"	0.808	103.80	23.38	
		6'	42	8'-4"		8"		7'-11½"	0.901	113.71	25.05	
		7'	49	8'-6"		9"		8'-11½"	1.005	122.23	26.72	
		8'	56	8'-7½"		9¾"		9'-11½"	1.107	134.29	28.39	
		9'	63	8'-9½"		10¾"		10'-11½"	1.235	149.04	30.06	
	1 @ 8'	6'	48	9'-4"	13"	8"	13½"	8'-2½"	1.060	138.22	28.39	
		7'	56	9'-6"		9"		9'-2½"	1.166	147.08	30.06	
		8'	64	9'-8"		10"		10'-2½"	1.284	157.60	31.73	
		9'	72	9'-10"		11"		11'-2½"	1.415	170.21	33.40	
		10'	80	10'-0"		12"		12'-2½"	1.559	187.05	35.07	
	1 @ 9'	7'	63	10'-6½"	14¼"	9½"	15¼"	9'-5½"	1.360	173.52	33.40	
		8'	72	10'-8½"		10¼"		10'-5½"	1.481	188.21	35.07	
		9'	81	10'-10"		11"		11'-5½"	1.597	201.20	36.74	
		10'	90	11'-0"		12"		12'-5½"	1.742	218.49	38.41	
		11'	99	11'-2"		13"		13'-5½"	1.899	232.10	40.08	

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2.

Bar Size	Pin Diam.	K	Add for 2 Hooks
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"
#8	4"	6½"	1'-6"

Bars "b"

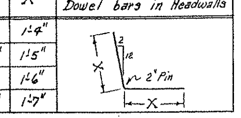


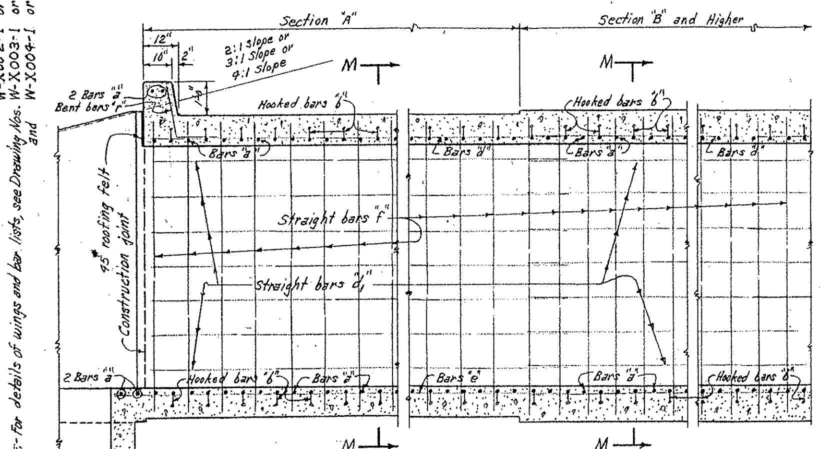
NOTE:- Dimensions are to centers of bars.

DOWEL BARS FOR TWO HEADWALLS

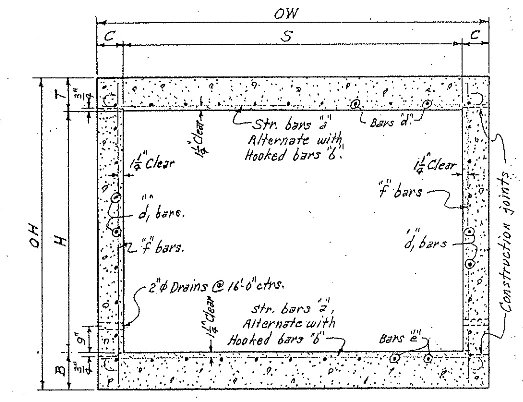
Span	Size	Spacing	No. Req'd	Length	X
7'	#4	11"	18	2'-8"	1'-4"
8'	#4	12"	20	2'-10"	1'-5"
9'	#4	12"	22	3'-0"	1'-6"
10'	#4	12"	24	3'-4"	1'-7"

Bars "r" Dowel bars in Headwalls

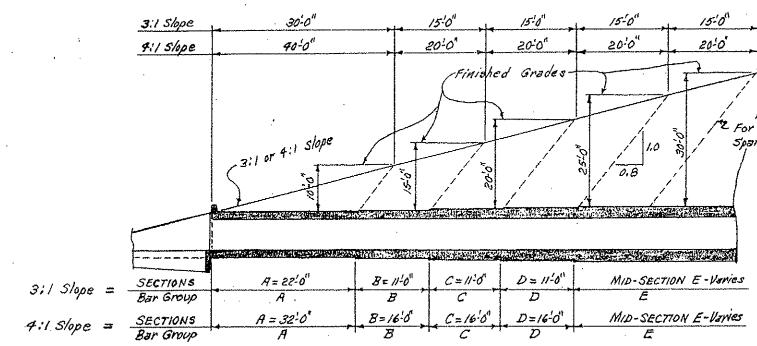




PART LONGITUDINAL SECTION



TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	Mid-Section and Bar Group
5.0' to 9.5'	✓				A
10.0' to 14.5'	✓				B
15.0' to 19.5'	✓	✓			C
20.0' to 24.5'	✓	✓	✓		D
25.0' to 30.0'	✓	✓	✓	✓	E

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C or D	4:1 Slopes Sections A	4:1 Slopes Sections B, C or D
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	25.403'	12.702'	36.950	18.475'
45°	1.4142	31.113'	15.556'	45.255'	22.627'

GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

REVISIONS:-
Wing Drwg. Nos.- W.C.H. 1-14-63.

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

7', 8', 9' & 10' SPANS — 3:1 OR 4:1 SLOPES
SINGLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-100X-X2

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars: STRAIGHT — In Top and Bottom Slabs of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars: BENT - See Diagram at Right — In top and Bottom Slabs of Barrel - Hooked. Alternate with "a" bars.
"d" bars: STRAIGHT — Longitudinal in Top Slab of Barrel.
"d1" bars: STRAIGHT — Longitudinal in Sidewalls.
"e" bars: STRAIGHT — Longitudinal in Bottom Slab of Barrel.
"f" bars: STRAIGHT — Verticals in Sidewalls.

Section & Bar Group	Length of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 2:1	"a" 3:1	"a" 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 2:1	"b" 3:1	"b" 4:1	"b" Length	"b" X	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 2:1	"f" 3:1	"f" 4:1	"f" Length
"A"	2:1=12'-0", 3:1=22'-0", 4:1=32'-0"	0' TO 10'-0"	1@ 4'	2'	#4	12"	28	48	68	4'-9"	#4	12"	24	44	64	5'-7"	4'-8½"	#4	12"	5	33'-3" for 32'-0" Section	#4	12"	4	33'-3" for 32'-0" Section	#4	12"	5	34'-3" for 32'-0" Section	#4	12"	24	44	64	2'-10"
			6'	3'	#5	12"	28	48	68	6'-9"	#6	12"	24	44	64	7'-10"	6'-8"	#4	12"	7		#4	12"	6		#4	12"	7		#4	12"	24	44	64	4'-0"
			7'	4'	#5	12"	28	48	68	7'-9"	#6	12"	24	44	64	8'-10"	7'-8"	#4	12"	8		#4	12"	8		#4	12"	8		#4	12"	24	44	64	5'-1"
			8'	4'	#6	12"	28	48	68	8'-9"	#6	12"	24	44	64	9'-10"	8'-8"	#4	12"	9		#4	12"	8		#4	12"	9		#4	12"	24	44	64	5'-3"
				5'			28	48	68	8'-11"			24	44	64	10'-0"	8'-10"			9				10				9				24	44	64	6'-3"
			9'	5'	#6	11"	30	52	74	9'-11"	#7	11"	26	48	70	11'-2"	9'-10"	#4	12"	10		#4	12"	10		#4	12"	10		#4	12"	24	44	64	6'-5"
				6'			30	52	74	10'-0"			26	48	70	11'-3"	9'-11"			10				12				10				24	44	64	7'-5"
			10'	5'	#7	12"	28	48	68	10'-11"	#7	12"	24	44	64	12'-2"	10'-10"	#4	12"	11		#4	12"	10		#4	12"	11		#4	12"	24	44	64	6'-7"
				6'			28	48	68	11'-0"			24	44	64	12'-3"	10'-11"			11				12				11				24	44	64	7'-7"
				7'			28	48	68	11'-0"			24	44	64	12'-3"	10'-11"			11				14				11				24	44	64	8'-7"
"B"	2:1=6'-0", 3:1=11'-0", 4:1=16'-0"	10'-0" TO 15'-0"	4'	2'	#4	12"	12	22	32	4'-9"	#5	12"	12	22	32	5'-8"	4'-8½"	#4	12"	5	33'-3" for 33'-0" Section	#4	12"	4	33'-3" for 33'-0" Section	#4	12"	5	34'-3" for 33'-0" Section	#4	12"	12	22	32	2'-10"
			6'	3'	#6	12"	12	22	32	6'-9"	#6	12"	12	22	32	7'-10"	6'-8"	#4	12"	7		#4	12"	6		#4	12"	7		#4	12"	12	22	32	4'-1"
			7'	4'	#6	11"	14	24	36	7'-9"	#6	11"	12	24	34	8'-10"	7'-8"	#4	12"	8		#4	12"	8		#4	12"	8		#4	12"	12	22	32	5'-3"
			8'	4'	#7	12"	12	22	32	8'-9"	#6	12"	12	22	32	9'-10"	8'-8"	#4	12"	9		#4	12"	8		#4	12"	9		#4	12"	12	22	32	5'-5"
				5'			12	22	32	8'-11"			12	22	32	10'-0"	8'-10"			9				10				9				12	22	32	6'-5"
			9'	5'	#7	12"	12	22	32	9'-11"	#7	12"	12	22	32	11'-2"	9'-10"	#4	12"	10		#4	12"	10		#4	12"	10		#4	12"	12	22	32	6'-7"
				6'			12	22	32	10'-0"			12	22	32	11'-3"	9'-11"			10				12				10				12	22	32	7'-7"
			10'	5'	#8	12"	12	22	32	10'-11"	#7	12"	12	22	32	12'-2"	10'-10"	#4	11"	12		#4	12"	10		#4	11"	12		#4	12"	12	22	32	6'-9"
				6'			12	22	32	11'-0"			12	22	32	12'-3"	10'-11"			12				12				12				12	22	32	7'-9"
				7'			12	22	32	11'-0"			12	22	32	12'-3"	10'-11"			12				14				12		#5	12"	12	22	32	8'-9"
"C"	2:1=6'-0", 3:1=11'-0", 4:1=16'-0"	15'-0" TO 20'-0"	4'	2'	#5	12"	12	22	32	4'-9"	#5	12"	12	22	32	5'-8"	4'-8½"	#4	12"	5	34'-3" for 33'-0" Section	#4	12"	4	34'-3" for 33'-0" Section	#4	12"	5	34'-3" for 33'-0" Section	#4	12"	12	22	32	2'-10"
			6'	3'	#6	11"	14	24	36	6'-9"	#6	11"	12	24	36	7'-10"	6'-8"	#4	12"	7		#4	12"	6		#4	12"	7		#4	12"	12	22	32	4'-2"
			7'	4'	#7	13"	12	20	30	7'-9"	#7	13"	10	20	30	9'-0"	7'-8"	#4	12"	8		#4	12"	8		#4	12"	8		#4	12"	12	22	32	5'-5"
			8'	4'	#7	12"	12	22	32	8'-9"	#7	12"	12	22	32	10'-0"	8'-8"	#4	11"	10		#4	12"	8		#4	11"	10		#4	12"	12	22	32	5'-7"
				5'			12	22	32	8'-11"			12	22	32	10'-2"	8'-10"			10				10				10				12	22	32	6'-7"
			9'	5'	#8	12"	12	22	32	9'-11"	#7	12"	12	22	32	11'-2"	9'-10"	#4	11"	11		#4	12"	10		#4	11"	11		#4	12"	12	22	32	6'-10"
				6'			12	22	32	10'-0"			12	22	32	11'-3"	9'-11"			11				12				11			10"	16	28	40	7'-10"
			10'	5'	#8	12"	12	22	32	10'-11"	#8	12"	12	22	32	12'-4"	10'-10"	#4	10"	13		#4	12"	10		#4	10"	13		#4	12"	12	22	32	7'-0"
				6'			12	22	32	11'-0"			12	22	32	12'-5"	10'-11"			13				12				13			10"	16	28	40	8'-0"
				7'			12	22	32	11'-0"			12	22	32	12'-5"	10'-11"			13				14				13		#5	12"	12	22	32	9'-0"
"D"	2:1=6'-0", 3:1=11'-0", 4:1=16'-0"	20'-0" TO 25'-0"	4'	2'	#5	11"	14	24	36	4'-9"	#5	11"	12	24	34	5'-8"	4'-8½"	#4	12"	5	34'-3" for 33'-0" Section	#4	12"	4	34'-3" for 33'-0" Section	#4	12"	5	34'-3" for 33'-0" Section	#4	12"	12	22	32	2'-11"
			6'	3'	#7	12"	12	22	32	6'-9"	#6	12"	12	22	32	7'-10"	6'-8"	#4	12"	7		#4	12"	6		#4	12"	7		#4	12"	12	22	32	4'-4"
			7'	4'	#7	12"	12	22	32	7'-9"	#7	12"	12	22	32	9'-0"	7'-8"	#4	11"	9		#4	12"	8		#4	11"	9		#4	12"	12	22	32	5'-7"
			8'	4'	#8	12"	12	22	32	8'-9"	#7	12"	12	22	32	10'-0"	8'-8"	#4	10"	11		#4	12"	8		#4	10"	11		#4	12"	12	22	32	5'-9"
				5'			12	22	32	8'-11"			12	22	32	10'-2"	8'-10"			11				10				11				12	22	32	6'-9"
			9'	5'	#8	12"	12	22	32	9'-11"	#8	12"	12	22	32	11'-4"	9'-10"	#4	10"	12		#4	12"	10		#4	10"	12		#4	12"	12	22	32	7'-0"
				6'			12	22	32	10'-0"			12	22	32	11'-5"	9'-11"			12				12				12		#5	12"	12	22	32	8'-0"
			10'	5'	#9	12"	12	22	32	10'-11"	#8	12"	12	22	32	12'-4"	10'-10"	#4	9½"	14		#4	12"	10		#4	9½"	14		#4	12"	12	22	32	7'-3"
				6'			12	22	32	11'-0"			12	22	32	12'-5"	10'-11"			14				12				14			10"	14	26	38	8'-3"
				7'			12	22	32	11'-2"			12	22	32	12'-7"	11'-1"			14				14				14		#5	12"	12	22	32	9'-3"
"E"	2:1=6'-0", 3:1=11'-0", 4:1=16'-0"	25'-0" TO 30'-0"	4'	2'	#6	12"	12	22	32	4'-9"	#5	12"	12	22	32	5'-8"	4'-8½"	#4	12"	5	34'-3" for 33'-0" Sect.	#4	12"	4	34'-3" for 33'-0" Sect.	#4	12"	5	34'-3" for 33'-0" Sect.	#4	12"	12	12	32	3'-0"
			6'	3'	#7	11"	14	24	36	6'-9"	#6	11"	12	24	34	7'-10"	6'-8"	#4	11"	8		#4	12"	6		#4	11"	8		#4	12"	12	22	32	4'-5"
			7'	4'	#7	11"	14	24	36	7'-9"	#7	11"	12	24	34	9'-0"	7'-8"	#4	11"	9		#4	12"	8		#4	11"	9		#4	12"	12	22	22	5'-8"
			8'	4'	#8	11"	14	24	36	8'-10"	#7	11"	12	24	34	10'-1"	8'-9"	#4	10"	11		#4	12"	8		#4	10"	11		#4	12"	12	22	32	5'-11"
				5'			14	24	36	8'-11"			12	24	34	10'-2"	8'-10"			11				10				11			11"	14	24	36	6'-11"
			9'	5'	#8	11"	14	24	36	10'-0"	#8	11"	12	24	34	11'-5"	9'-11"	#4	9"	13		#4	12"	10		#4	9"	13		#4	10"	16	28	40	7'-2"
				6'			14	24	36	10'-1"			12	24	34	11'-6"	10'-0"			13				12				13		#5	12"	12	22	32	8'-2"
	Varies		10'	5'	#9	11"	Varies with Length of Barrel			11'-0"	#8	11"	Varies with Length of Barrel			12'-5"	10'-11"	#5	12"	11	Varies	#4	12"	10	Varies	#5	12"	11	Varies	#4	10"	Varies with Length of Barrel			7'-5"
				6'						11'-2"						12'-7"	11'-1"			11				12				11			9"				8'-5"
				7'						11'-4"						12'-9"	11'-3"			11				14				11		#5	12"				9'-5"
				8'						11'-6"						12'-11"	11'-5"			11				16				11			10"				10'-5"
				9'						11'-8"						13'-1"	11'-7"			11				18				11		#6	12"				11'-5"
				10'						11'-9"						13'-2"	11'-8"			11				20				11		#7	12"				12'-5"
"F"	2:1=6'-0", 3:1=11'-0", 4:1=16'-0"	30'-0" TO 35'-0"	4'	2'	#6	13"	12	20	30	4'-9"	#6	13"	12	20	30	5'-10"	4'-8"	#4	12"	5	34'-3" for 33'-0" Section.	#4	12"	4	34'-3" for 33'-0" Section.	#4	12"	5	34'-3" for 33'-0" Section.	#4	12"	12	22	32	3'-1"
			6'	3'	#7	12"	12	22	32	6'-9"	#7	12"	12	22	32	8'-0"	6'-8"	#4	9½"	9		#4	12"	6		#4	9½"	9		#4	12"	12	22	32	4'-7"
			7'	4'	#7	10"	14	28	38	7'-11"	#7	10"	16	26	40	9'-2"	7'-10"	#4	9½"	10		#4	12"	8		#4	9½"	10		#4	12"	12	22	32	5'-10"
				5'			14	28	38	8'-0"			16	26	40	9'-3"	7'-11"			10				10				10				12	22	32	6'-10"
				6'			14	28	38	8'-2"			16	26	40	9'-5"	8'-1"			10				12				10		#5	12"	12	22	32	7'-10"
				7'			14	28	38	8'-4"			16	26	40	9'-7"	8'-3"			10				14				10			10"	16	28	40	8'-10"
				8'			14	28	38	8'-6"			16	26	40	9'-9"	8'-5"			10				16				10		#6	11"	14	24	36	9'-10"
				9'			14	28	38	8'-8"			16	26	40	9'-11"	8'-7"			10				18				10		#7	12"	12	22	32	10'-10"
			8'	4'	#8	10"	14	28	38	8'-10"	#7	10"	16	28	40	10'-1"	8'-9"	#4	9"	12		#4	12"	8		#4	9"	12		#4	12"	12	22	32	6'-1"
				5'			14	28	38	9'-0"			16	28	40	10'-3"	8'-11"			12				10				12			10"	14	28	38	7'-1"
				6'			14	28	38	9'-2"			16	28	40	10'-5"	9'-1"			12				12				12		#5	12"	12	22	32	8'-1"
				7'			14	28	38	9'-4"			16	28	40	10'-7"	9'-3"			12				14				12			11"	14	24	36	9'-1"
				8'			14	28	38	9'-6"			16	28	40	10'-9"	9'-5"			12				16				12		#6	12"	12	22	32	10'-1"
				9'			14	28	38	9'-8"			16	28	40	10'-11"	9'-7"			12				18				12			10"	16	28	38	11'-1"
				10'			14	28	38	9'-10"			16	28	40	11'-1"	9'-9"			12				20				12		#7	11"	14	24	36	12'-1"
	Varies		9'	5'	#8	10"				10'-1"	#8	10"				11'-6"	10'-0"	#5	12"	10		#4	12"	10		#5	12"	10		#4	10"				7'-4"
				6'						10'-3"						11'-8"	10'-2"			10				12				10		#5	12"				8'-4"
				7'						10'-5"						11'-10"	10'-4"			10				14				10			11"				9'-4"
				8'						10'-7"						12'-0"	10'-6"			10				16				10		#6	12"				10'-4"
				9'						10'-9"						12'-2"	10'-8"			10				18				10			10"				11'-4"
"G"	Varies with Length of Barrel	35'-0" TO 40'-0"	4'	2'	#6	12"	Varies with Length of Barrel			4'-9"	#6	12"	Varies with Length of Barrel			5'-10"	4'-8"	#4	12"	5	Varies with Length of Barrel.	#4	12"	4	Varies with Length of Barrel.	#4	12"	5	Varies with Length of Barrel.	#4	12"	Varies with Length of Barrel.			3'-2"
			6'	3'	#7	11"				6'-9"	#7	11"				8'-0"	6'-8"	#4	9½"	9		#4	12"	6		#4	9½"	9		#4	12"				4'-8"
				4'						6'-11"						8'-2"	6'-10"			9				8				9			12"				5'-8"
				5'						7'-1"						8'-4"	7'-0"			9				10				9			10"				6'-8"
				6'						7'-3"						8'-6"	7'-2"			9				12				9		#5	12"				7'-8"
				7'						7'-5"						8'-8"	7'-4"			9				14				9		#6	12"				8'-8"
				8'						7'-7"						8'-10"	7'-6"			9				16				9			10"				9'-8"
			7'	4'	#8	11"				8'-0"	#7	11"				9'-3"	7'-11"	#4	8½"	11		#4	12"	8		#4	8½"	11		#4	12"				5'-11"
				5'						8'-1"						9'-4"	8'-0"			11				10				11			10"				6'-11"
				6'						8'-3"						9'-6"	8'-2"			11				12				11		#5	12"				7'-11"
				7'						8'-5"						9'-8"	8'-4"			11				14				11			10"				8'-11"
				8'						8'-7"						9'-10"	8'-6"			11				16				11		#6	11"				9'-11"
				9'						8'-9"						10'-0"	8'-8"			11				18				11		#7	12"				10'-11"
			8'	4'	#8	11"				9'-0"	#8	11"				10'-5"	8'-11"	#4	8½"	13		#4	12"	8		#4	8½"	13		#4	12"				6'-3"
				5'						9'-2"						10'-7"	9'-1"			13				10				13			10"				7'-3"
				6'						9'-4"						10'-9"	9'-3"			13				12				13		#5	12"				8'-3"
				7'						9'-6"						10'-11"	9'-5"			13				14				13			10"				9'-3"
				8'						9'-8"						11'-1"	9'-7"			13				16				13		#6	12"				10'-3"
				9'						9'-10"						11'-3"	9'-9"			13				18				13			10"				11'-3"
				10'						10'-0"						11'-5"	9'-11"			13				20				13		#7	11"				12'-3"

NOTE:- Bars for each Section to be marked with the Section Letter, thus for Section B, the bars should be marked Ba, Bb, Bd, Bd1, Be and Bf.

Designed By:- W.C.H. 12-9-64 Checked By:-
Drawn By:- W.C.H. 12-11-64 Checked By:-
Quantities By:- W.C.H. 12-17-64 Checked By:-

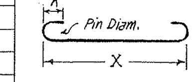
DIMENSIONS — QUANTITIES

Max. Design Depth of Cover D	Clear Span S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU.YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
SECTION "A" - 10'-0"	1@ 4'	2'	8	5'-0"	6½"	6"	6½"	3'-1"	0.275	26.94	11.69	51.93
	6'	3'	18	7'-0"	7¼"	6"	7¼"	4'-3"	0.435	56.32	16.70	93.29
	7'	4'	28	8'-0"	8"	6"	8¼"	5'-4½"	0.556	65.53	20.04	107.42
	8'	4'	32	9'-0"	8½"	6"	9½"	5'-6"	0.648	80.21	21.71	154.94
		5'	40	9'-2"		7"		6'-6"	0.725	83.88	23.38	156.95
	9'	5'	45	10'-2"	9¼"	7"	10⅛"	6'-8"	0.844	110.91	25.05	176.61
		6'	54	10'-3"		7½"		7'-8"	0.911	114.23	26.72	177.61
	10'	5'	50	11'-2"	10½"	7"	11⅛"	6'-10"	0.974	124.54	26.72	243.97
		6'	60	11'-3"		7½"		7'-10"	1.042	128.22	28.39	245.34
		7'	70	11'-3"		7½"		8'-10"	1.088	130.56	30.06	245.34
SECTION "B" - 15'-0"	4'	2'	8	5'-0"	6½"	6"	6½"	3'-1"	0.275	31.30	11.69	51.43
	6'	3'	18	7'-0"	8"	6"	8¼"	4'-4¼"	0.462	62.62	16.70	118.07
	7'	4'	28	8'-0"	8¾"	6"	9¼"	5'-6"	0.593	77.39	20.04	135.88
	8'	4'	32	9'-0"	9¾"	6"	10¾"	5'-8¼"	0.718	89.91	21.71	192.88
		5'	40	9'-2"		7"		6'-8¼"	0.796	93.77	23.38	195.61
	9'	5'	45	10'-2"	10¾"	7"	11¾"	6'-10½"	0.922	115.02	25.05	219.61
		6'	54	10'-3"		7½"		7'-10½"	0.990	118.38	26.72	220.97
	10'	5'	50	11'-2"	11¾"	7"	12¾"	7'-0½"	1.060	139.76	28.39	298.64
		6'	60	11'-3"		7½"		8'-0½"	1.128	143.22	30.06	300.42
		7'	70	11'-3"		7½"		9'-0½"	1.175	152.45	31.23	300.42
SECTION "C" - 20'-0"	4'	2'	8	5'-0"	6½"	6"	6¾"	3'-1¼"	0.279	34.87	11.69	
	6'	3'	18	7'-0"	8½"	6"	9"	4'-5½"	0.483	66.72	16.70	
	7'	4'	28	8'-0"	9¾"	6"	10¼"	5'-8"	0.642	86.48	20.04	
	8'	4'	32	9'-0"	11"	6"	11½"	5'-10½"	0.773	102.81	23.38	
		5'	40	9'-2"		7"		6'-10½"	0.853	106.85	25.05	
	9'	5'	45	10'-2"	12"	7"	13"	7'-1"	1.001	129.11	26.72	
		6'	54	10'-3"		7½"		8'-1"	1.069	134.66	28.39	
	10'	5'	50	11'-2"	13¼"	7"	14¼"	7'-3½"	1.164	157.56	30.06	
		6'	60	11'-3"		7½"		8'-3½"	1.233	163.26	31.73	
		7'	70	11'-3½"		7¾"		9'-3½"	1.293	170.54	33.40	
SECTION "D" - 25'-0"	4'	2'	8	5'-0"	6¾"	6"	7¼"	3'-2"	0.290	36.95	11.69	
	6'	3'	18	7'-0"	9¼"	6"	9¾"	4'-7"	0.522	70.27	16.70	
	7'	4'	28	8'-0"	10¾"	6"	11¼"	5'-10"	0.691	93.30	21.71	
	8'	4'	32	9'-0"	12"	6"	12½"	6'-0½"	0.829	115.33	25.05	
		5'	40	9'-2"		7"		7'-0½"	0.909	119.57	26.72	
	9'	5'	45	10'-2"	13¼"	7"	14¼"	7'-3¼"	1.079	145.54	28.39	
		6'	54	10'-3"		7½"		8'-3¼"	1.148	155.10	30.06	
	10'	5'	50	11'-2"	14½"	7"	15½"	7'-6"	1.250	175.16	31.73	
		6'	60	11'-3½"		7¾"		8'-6"	1.333	181.05	33.40	
		7'	70	11'-5½"		8¾"		9'-6"	1.489	190.48	35.07	
SECTION "E" - 30'-0"	4'	2'	8	5'-0"	7¼"	6"	7¾"	3'-3"	0.306	39.45	11.69	
	6'	3'	18	7'-0"	10"	6"	10½"	4'-8½"	0.554	76.37	18.37	
	7'	4'	28	8'-0"	11¾"	6"	12"	5'-11½"	0.728	99.64	21.71	
	8'	4'	32	9'-1"	13"	6½"	13½"	6'-2½"	0.903	124.37	25.05	
		5'	40	9'-2½"		7½"		7'-2½"	0.977	128.74	26.72	
	9'	5'	45	10'-3"	14½"	7½"	15¼"	7'-5¼"	1.165	160.30	30.06	
		6'	54	10'-4½"		8¼"		8'-5½"	1.250	168.15	31.73	
	10'	5'	50	11'-3"	15¾"	7½"	16¾"	7'-8½"	1.360	195.95	55.63	
		6'	60	11'-5"		8½"		8'-8½"	1.460	202.10	59.10	
		7'	70	11'-7"		9½"		9'-8½"	1.572	210.29	62.58	
		8'	80	11'-9"		10½"		10'-8½"	1.697	220.26	66.06	
		9'	90	11'-11"		11½"		11'-8½"	1.834	232.03	69.58	
		10'	100	12'-0½"		12¼"		12'-8½"	1.964	250.93	73.01	
SECTION "F" - 35'-0"	4'	2'	8	5'-0"	7¾"	6"	8¼"	3'-4"	0.321	42.82	11.69	
	6'	3'	18	7'-0"	10¾"	6"	11¼"	4'-10"	0.586	82.45	20.04	
	7'	4'	28	8'-2"	12¼"	7"	12¾"	6'-1"	0.803	110.30	23.38	
		5'	35	8'-3"		7½"		7'-1"	0.868	113.79	25.05	
		6'	42	8'-5"		8½"		8'-1"	0.964	123.56	26.72	
		7'	49	8'-7"		9½"		9'-1"	1.073	131.46	28.39	
		8'	56	8'-9"		10½"		10'-1"	1.194	145.80	30.06	
		9'	63	8'-11"		11½"		11'-1"	1.327	160.83	31.73	
	8'	4'	32	9'-1½"	13¾"	6¾"	14½"	6'-4½"	0.962	135.57	26.72	
		5'	40	9'-3½"		7¾"		7'-4½"	1.049	142.02	28.39	
		6'	48	9'-5½"		8¾"		8'-4½"	1.149	150.75	30.06	
		7'	56	9'-7½"		9¾"		9'-4½"	1.261	157.78	31.73	
		8'	64	9'-9½"		10¾"		10'-4½"	1.385	170.62	33.40	
		9'	72	9'-11½"		11¾"		11'-4½"	1.521	183.51	35.07	
		10'	80	10'-1½"		12¾"		12'-4½"	1.670	200.66	36.74	
	9'	5'	45	10'-4"	15¼"	8"	16"	7'-7½"	1.244	172.60	52.15	
		6'	54	10'-6"		9"		8'-7½"	1.346	186.70	55.63	
		7'	63	10'-8"		10"		9'-7½"	1.461	194.03	59.10	
		8'	72	10'-10"		11"		10'-7½"	1.588	207.30	62.58	
		9'	81	11'-0"		12"		11'-7½"	1.728	220.59	66.06	
SECTION "G" - 40'-0"	4'	2'	8	5'-0"	8¼"	6"	8¾"	3'-5"	0.336	45.38	11.69	
	6'	3'	18	7'-0"	11½"	6"	12"	4'-11½"	0.619	88.05	20.04	
		4'	24	7'-2"		7"		5'-11½"	0.693	92.21	21.71	
		5'	30	7'-4"		8"		6'-11½"	0.779	98.15	23.38	
		6'	36	7'-6"		9"		7'-11½"	0.877	106.27	25.05	
		7'	42	7'-8"		10"		8'-11½"	0.988	119.14	26.72	
		8'	48	7'-10"		11"		9'-11½"	1.111	130.77	28.39	
	7'	4'	28	8'-3"	12"	7½"	13½"	6'-2½"	0.860	115.80	25.05	
		5'	35	8'-4½"		8¼"		7'-2½"	0.940	121.18	26.72	
		6'	42	8'-6½"		9¼"		8'-2½"	1.041	129.65	28.39	
		7'	49	8'-8½"		10¼"		9'-2½"	1.155	138.51	30.06	
		8'	56	8'-10½"		11¼"		10'-2½"	1.281	151.74	31.73	
		9'	63	9'-0½"		12¼"		11'-2½"	1.420	166.92	33.40	
	8'	4'	32	9'-3"	14¾"	7½"	15½"	6'-6¼"	1.079	144.17	28.39	
		5'	40	9'-5"		8½"		7'-6¼"	1.142	152.91	30.06	
		6'	48	9'-7"		9½"		8'-6¼"	1.247	159.59	31.73	
		7'	56	9'-9"		10½"		9'-6¼"	1.364	168.81	33.40	
		8'	64	9'-11"		11½"		10'-6¼"	1.494	179.73	35.07	
		9'	72	10'-1"		12½"		11'-6¼"	1.636	192.77	36.74	
		10'	80	10'-3½"		13¾"		12'-6¼"	1.810	210.12	38.41	

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, & W-X004-1 or W-X004-2.

Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"
#8	4"	6½"	1'-6"

Bars "b"

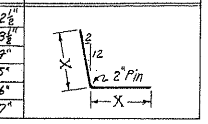


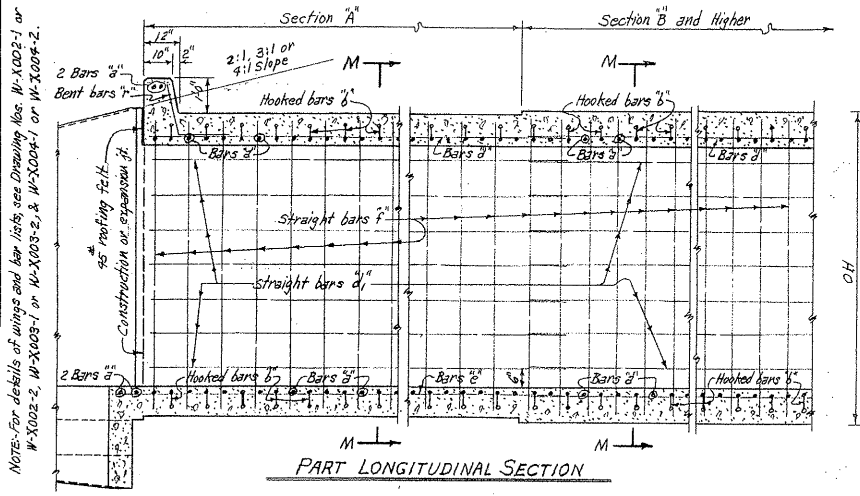
NOTE:- Dimensions are to centers of bars.

DOWEL BARS FOR TWO HEADWALLS

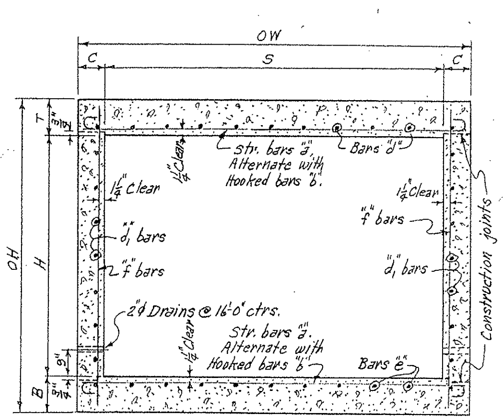
Span	Size	Spacing	No. Req'd	Length	X
4'	#4	11½"	12	2'-5"	1'-2½"
6'	#4	12¼"	16	2'-7"	1'-3½"
7'	#4	12¼"	18	2'-8"	1'-4"
8'	#4	12¼"	20	2'-10"	1'-5"
9'	#4	12¼"	22	3'-0"	1'-6"
10'	#4	12¼"	24	3'-2"	1'-7"

Bars "r" Dowel bars in Headwalls

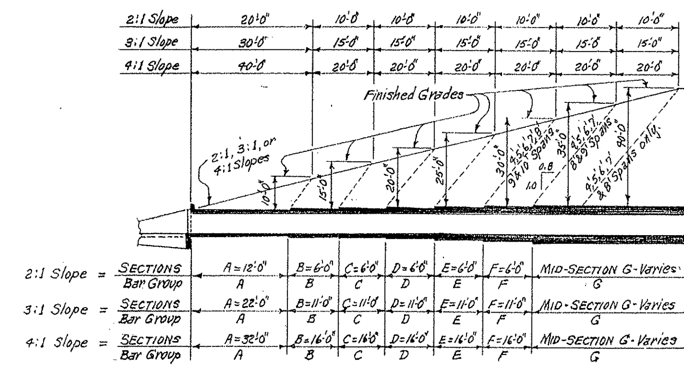




PART LONGITUDINAL SECTION



TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE: Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have 3/4 chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	2:1 Slopes Sections A	2:1 Slopes Sections B,C,D,E or F	3:1 Slopes Sections A	3:1 Slopes Sections B,C,D,E or F	4:1 Slopes Sections A	4:1 Slopes Sections B,C,D,E or F
0°	1.0	12.0'	6.0'	22.0'	11.0'	32.0'	16.0'
15°	1.0353	12.424'	6.212'	22.776'	11.388'	33.129'	16.564'
30°	1.1547	13.856'	6.928'	25.403'	12.702'	36.950'	18.475'
45°	1.4142	16.970'	8.485'	31.113'	15.556'	45.255'	22.627'

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, & W-X004-1 or W-X004-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

ADD'L 4',6',7',8',9' & 10' SPANS — 2:1, 3:1 OR 4:1 SLOPES
SINGLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-100X-X3

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

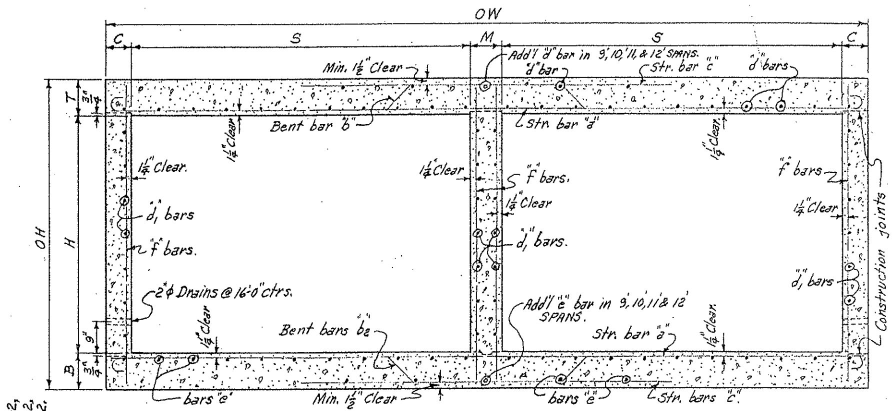
DEPTH OF COVER	CLEAR SPAN	CLEAR HEIGHT	"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.					"b" bars — BENT - See Diagram below. — In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.							
D	S	H	SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH	SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH	X	Y	Z
0'-0" TO 5'-0" MAXIMUM.	2 @ 4'	2'	#5	12"	128	128	9'-5"	#5	12"	59	59	10'-6"	0'-3"	2'-2½"	3'-4"
		3'			128	128	9'-5"			59	59	10'-6"	0'-3"	2'-2½"	3'-4"
		4'			128	128	9'-5"			59	59	10'-6"	0'-3"	2'-2½"	3'-4"
		5'			128	128	9'-5"			59	59	10'-6"	0'-3"	2'-2½"	3'-4"
		6'			128	128	9'-8"			59	59	10'-9"	0'-3"	2'-3½"	3'-5"
	2 @ 5'	3'	#6	12"	128	128	11'-5"	#5	12"	59	59	12'-7"	0'-3½"	2'-7½"	4'-1"
		4'			128	128	11'-5"			59	59	12'-7"	0'-3½"	2'-7½"	4'-1"
		5'			128	128	11'-5"			59	59	12'-7"	0'-3½"	2'-7½"	4'-1"
		6'			128	128	11'-8"			59	59	12'-10"	0'-3½"	2'-8½"	4'-2"
		7'			128	128	11'-10"			59	59	13'-0"	0'-3½"	2'-9½"	4'-2½"
	2 @ 6'	3'	#6	11"	140	140	13'-5"	#5	11"	65	65	14'-7"	0'-4"	3'-0½"	4'-10"
		4'			140	140	13'-5"			65	65	14'-7"	0'-4"	3'-0½"	4'-10"
		5'			140	140	13'-5"			65	65	14'-7"	0'-4"	3'-0½"	4'-10"
		6'			140	140	13'-8"			65	65	14'-10"	0'-4"	3'-1½"	4'-11"
		7'			140	140	13'-10"			65	65	15'-0"	0'-4"	3'-2½"	4'-11½"
		8'			140	140	13'-11"			65	65	15'-1"	0'-4"	3'-2½"	5'-0"
	2 @ 7'	4'	#6	12"	128	128	15'-5"	#6	12"	59	59	16'-9"	0'-4½"	3'-5"	5'-7"
		5'			128	128	15'-5"			59	59	16'-9"	0'-4½"	3'-5"	5'-7"
		6'			128	128	15'-8"			59	59	17'-0"	0'-4½"	3'-6"	5'-8"
		7'			128	128	15'-10"			59	59	17'-2"	0'-4½"	3'-7"	5'-8½"
		8'			128	128	15'-11"			59	59	17'-3"	0'-4½"	3'-7"	5'-9"
		9'			128	128	16'-2"			59	59	17'-6"	0'-4½"	3'-8"	5'-10"
	2 @ 8'	4'	#6	11"	140	140	17'-5"	#6	11"	65	65	18'-10"	0'-5"	3'-10"	6'-4"
		5'			140	140	17'-8"			65	65	19'-1"	0'-5"	3'-11"	6'-5"
		6'			140	140	17'-8"			65	65	19'-1"	0'-5"	3'-11"	6'-5"
		7'			140	140	17'-10"			65	65	19'-3"	0'-5"	4'-0"	6'-5½"
		8'			140	140	17'-11"			65	65	19'-4"	0'-5"	4'-0"	6'-6"
		9'			140	140	18'-2"			65	65	19'-7"	0'-5"	4'-1"	6'-7"
		10'			140	140	18'-5"			65	65	19'-10"	0'-5"	4'-2"	6'-8"
	2 @ 9'	5'	#6	11"	140	140	19'-8"	#6	11"	65	65	21'-1"	0'-5¾"	4'-4"	7'-2"
		6'			140	140	19'-10"			65	65	21'-3"	0'-5½"	4'-5"	7'-2½"
		7'			140	140	19'-10"			65	65	21'-3"	0'-5½"	4'-5"	7'-2½"
		8'			140	140	19'-11"			65	65	21'-4"	0'-5½"	4'-5"	7'-3"
		9'			140	140	20'-2"			65	65	21'-7"	0'-5½"	4'-6"	7'-4"
		10'			140	140	20'-5"			65	65	21'-10"	0'-5½"	4'-7"	7'-5"
		11'			140	140	20'-7"			65	65	22'-0"	0'-5½"	4'-7"	7'-6"
	2 @ 10'	5'	#7	12"	128	128	21'-8"	#6	12"	59	59	23'-2"	0'-6"	4'-9"	7'-11"
		6'			128	128	21'-10"			59	59	23'-4"	0'-6"	4'-10"	7'-11½"
		7'			128	128	21'-10"			59	59	23'-4"	0'-6"	4'-10"	7'-11½"
		8'			128	128	21'-11"			59	59	23'-5"	0'-6"	4'-10"	8'-0"
		9'			128	128	22'-2"			59	59	23'-8"	0'-6"	4'-11"	8'-1"
		10'			128	128	22'-5"			59	59	23'-11"	0'-6"	5'-0"	8'-2"
		11'			128	128	22'-7"			59	59	24'-1"	0'-6"	5'-0"	8'-3"
		12'			128	128	22'-9"			59	59	24'-3"	0'-6"	5'-0"	8'-4"
	2 @ 11'	6'	#7	12"	128	128	23'-11"	#6	12"	59	59	25'-5"	0'-6½"	5'-3"	8'-9"
		7'			128	128	23'-11"			59	59	25'-5"	0'-6½"	5'-3"	8'-9"
		8'			128	128	23'-11"			59	59	25'-5"	0'-6½"	5'-3"	8'-9"
		9'			128	128	24'-2"			59	59	25'-8"	0'-6½"	5'-4"	8'-10"
		10'			128	128	24'-5"			59	59	25'-11"	0'-6½"	5'-5"	8'-11"
		11'			128	128	24'-7"			59	59	26'-1"	0'-6½"	5'-5"	9'-0"
		12'			128	128	24'-9"			59	59	26'-3"	0'-6½"	5'-5"	9'-1"
	2 @ 12'	6'	#7	11"	140	140	25'-11"	#6	11"	65	65	27'-5"	0'-7"	5'-8"	9'-6"
		7'			140	140	25'-11"			65	65	27'-5"	0'-7"	5'-8"	9'-6"
		8'			140	140	25'-11"			65	65	27'-5"	0'-7"	5'-8"	9'-6"
		9'			140	140	26'-2"			65	65	27'-8"	0'-7"	5'-9"	9'-7"
		10'			140	140	26'-5"			65	65	27'-11"	0'-7"	5'-10"	9'-8"
		11'			140	140	26'-7"			65	65	28'-1"	0'-7"	5'-10"	9'-9"
		12			140	140	26'-9"			65	65	28'-3"	0'-7"	5'-10"	9'-10"

CLEAR SPAN	CLEAR HEIGHT	"b2" bars — BENT - See Diagram below. — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.								"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.				
S	H	SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH	X	Y	Z	SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH
2 @ 4'	2'	#5	12"	59	59	10'-6"	0'-2½"	2'-3½"	3'-4"	#5	12"	120	120	4'-8"
	3'			59	59	10'-6"	0'-2½"	2'-3½"	3'-4"			120	120	4'-8"
	4'			59	59	10'-6"	0'-2½"	2'-3½"	3'-4"			120	120	4'-8"
	5'			59	59	10'-6"	0'-2½"	2'-3½"	3'-4"			120	120	4'-8"
	6'			59	59	10'-9"	0'-2½"	2'-4½"	3'-5"			120	120	4'-9"
2 @ 5'	3'	#5	12"	59	59	12'-6"	0'-3"	2'-8½"	4'-1"	#6	12"	120	120	5'-8"
	4'			59	59	12'-6"	0'-3"	2'-8½"	4'-1"			120	120	5'-8"
	5'			59	59	12'-6"	0'-3"	2'-8½"	4'-1"			120	120	5'-8"
	6'			59	59	12'-9"	0'-3"	2'-9½"	4'-2"			120	120	5'-9"
	7'			59	59	12'-11"	0'-3"	2'-10½"	4'-2½"			120	120	5'-10"
2 @ 6'	3'	#5	11"	65	65	14'-7"	0'-4"	3'-0½"	4'-10"	#6	11"	132	132	6'-8"
	4'			65	65	14'-7"	0'-4"	3'-0½"	4'-10"			132	132	6'-8"
	5'			65	65	14'-7"	0'-4"	3'-0½"	4'-10"			132	132	6'-8"
	6'			65	65	14'-10"	0'-4"	3'-1½"	4'-11"			132	132	6'-9"
	7'			65	65	15'-0"	0'-4"	3'-2½"	4'-11½"			132	132	6'-10"
	8'			65	65	15'-1"	0'-4"	3'-2½"	5'-0"			132	132	6'-10"
2 @ 7'	4'	#6	12"	59	59	16'-9"	0'-4½"	3'-5"	5'-7"	#6	12"	120	120	7'-8"
	5'			59	59	16'-9"	0'-4½"	3'-5"	5'-7"			120	120	7'-8"
	6'			59	59	17'-0"	0'-4½"	3'-6"	5'-8"			120	120	7'-9"
	7'			59	59	17'-2"	0'-4½"	3'-7"	5'-8½"			120	120	7'-10"
	8'			59	59	17'-3"	0'-4½"	3'-7"	5'-9"			120	120	7'-10"
	9'			59	59	17'-6"	0'-4½"	3'-8"	5'-10"			120	120	7'-11"
2 @ 8'	4'	#6	11"	65	65	18'-10"	0'-5"	3'-10"	6'-4"	#6	11"	132	132	8'-8"
	5'			65	65	19'-1"	0'-5"	3'-11"	6'-5"			132	132	8'-9"
	6'			65	65	19'-1"	0'-5"	3'-11"	6'-5"			132	132	8'-9"
	7'			65	65	19'-3"	0'-5"	4'-0"	6'-5½"			132	132	8'-10"
	8'			65	65	19'-4"	0'-5"	4'-0"	6'-6"			132	132	8'-10"
	9'			65	65	19'-7"	0'-5"	4'-1"	6'-7"			132	132	8'-11"
	10'			65	65	19'-10"	0'-5"	4'-2"	6'-8"			132	132	9'-0"
2 @ 9'	5'	#6	11"	65	65	21'-1"	0'-5¾"	4'-3½"	7'-2"	#6	11"	132	132	9'-9"
	6'			65	65	21'-3"	0'-5¾"	4'-4½"	7'-2½"			132	132	9'-10"
	7'			65	65	21'-3"	0'-5¾"	4'-4½"	7'-2½"			132	132	9'-10"
	8'			65	65	21'-4"	0'-5¾"	4'-4½"	7'-3"			132	132	9'-10"
	9'			65	65	21'-7"	0'-5¾"	4'-5½"	7'-4"			132	132	9'-11"
	10'			65	65	21'-10"	0'-5¾"	4'-6½"	7'-5"			132	132	10'-0"
	11'			65	65	22'-0"	0'-5¾"	4'-6½"	7'-6"			132	132	10'-0"
2 @ 10'	5'	#6	12"	59	59	23'-2"	0'-6½"	4'-8"	7'-11"	#7	12"	120	120	10'-9"
	6'			59	59	23'-4"	0'-6½"	4'-9"	7'-11½"			120	120	10'-10"
	7'			59	59	23'-4"	0'-6½"	4'-9"	7'-11½"			120	120	10'-10"
	8'			59	59	23'-5"	0'-6½"	4'-9"	8'-0"			120	120	10'-10"
	9'			59	59	23'-8"	0'-6½"	4'-10"	8'-1"			120	120	10'-11"
	10'			59	59	23'-11"	0'-6½"	4'-11"	8'-2"			120	120	11'-0"
	11'			59	59	24'-1"	0'-6½"	4'-11"	8'-3"			120	120	11'-0"
	12'			59	59	24'-3"	0'-6½"	4'-11"	8'-4"			120	120	11'-0"
2 @ 11'	6'	#6	12"	59	59	25'-6"	0'-7½"	5'-1"	8'-9"	#7	12"	120	120	11'-10"
	7'			59	59	25'-6"	0'-7½"	5'-1"	8'-9"			120	120	11'-10"
	8'			59	59	25'-6"	0'-7½"	5'-1"	8'-9"			120	120	11'-10"
	9'			59	59	25'-9"	0'-7½"	5'-2"	8'-10"			120	120	11'-11"
	10'			59	59	26'-0"	0'-7½"	5'-3"	8'-11"			120	120	12'-0"
	11'			59	59	26'-2"	0'-7½"	5'-3"	9'-0"			120	120	12'-0"
	12'			59	59	26'-4"	0'-7½"	5'-3"	9'-1"			120	120	12'-0"
2 @ 12'	6'	#6	11"	65	65	27'-7"	0'-8½"	5'-5"	9'-6"	#7	11"	132	132	12'-10"
	7'			65	65	27'-7"	0'-8½"	5'-5"	9'-6"			132	132	12'-10"
	8'			65	65	27'-7"	0'-8½"	5'-5"	9'-6"			132	132	12'-10"
	9'			65	65	27'-10"	0'-8½"	5'-6"	9'-7"			132	132	12'-11"
	10'			65	65	28'-1"	0'-8½"	5'-7"	9'-8"			132	132	13'-0"
	11'			65	65	28'-3"	0'-8½"	5'-7"	9'-9"			132	132	13'-0"
	12			65	65	28'-5"	0'-8½"	5'-7"	9'-10"			132	132	13'-0"

CLEAR SPAN	CLEAR HEIGHT	"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel.				"d1" bars — STRAIGHT — Longitudinal in Sidewalls and Division Walls.				"e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel.				"f" bars — STRAIGHT — Vertical in Sidewalls and Division Walls.				
S	H	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NUMBER REQ'D 3:1	NUMBER REQ'D 4:1	LENGTH
2 @ 4'	2'	#5	12"	14	2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap)	#4	12"	8	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	14	2 @ 31'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	240	240	2'-10"
	3'			14				12				14				240	240	3'-10"
	4'			14				16				14				240	240	4'-10"
	5'			14				20				14				240	240	5'-10"
	6'			14				24				14				240	240	6'-10"
2 @ 5'	3'	#5	11½"	16		#4	12"	12		#4	12"	16		#4	12"	240	240	3'-11"
	4'			16				16				16				240	240	4'-11"
	5'			16				20				16				240	240	5'-11"
	6'			16				24				16				240	240	6'-11"
	7'			16				28				16				240	240	7'-11"
2 @ 6'	3'	#5	11½"	18		#4	12"	12		#4	12"	18		#4	12"	240	240	4'-0"
	4'			18				16				18				240	240	5'-0"
	5'			18				20				18				240	240	6'-0"
	6'			18				24				18				240	240	7'-0"
	7'			18				28				18				240	240	8'-0"
	8'			18				32				18			10"	288	288	9'-0"
2 @ 7'	4'	#5	11½"	20		#4	12"	16		#4	12"	20		#4	12"	240	240	5'-1"
	5'			20				20				20				240	240	6'-1"
	6'			20				24				20				240	240	7'-1"
	7'			20				28				20				240	240	8'-1"
	8'			20				32				20			10"	288	288	9'-1"
	9'			20				36				20		#5	12"	240	240	10'-1"
2 @ 8'	4'	#5	11½"	23		#4	12"	16		#4	12"	22		#4	12"	240	240	5'-2"
	5'			23				20				22				240	240	6'-2"
	6'			23				24				22				240	240	7'-2"
	7'			23				28				22				240	240	8'-2"
	8'			23				32				22			10"	288	288	9'-2"
	9'			23				36				22		#5	12"	240	240	10'-2"
	10'			23				40				22			11"	264	264	11'-2"
2 @ 9'	5'	#5	11½"	26		#4	12"	20		#4	12"	25		#4	12"	240	240	6'-3"
	6'			26				24				25				240	240	7'-3"
	7'			26				28				25				240	240	8'-3"
	8'			26				32				25			10"	288	288	9'-3"
	9'			26				36				25		#5	12"	240	240	10'-3"
	10'			26				40				25			11"	264	264	11'-3"
	11'			26				44				25			10"	288	288	12'-3"
2 @ 10'	5'	#5	11½"	28		#4	12"	20		#4	12"	27		#4	12"	240	240	6'-4"
	6'			28				24				27				240	240	7'-4"
	7'			28				28				27				240	240	8'-4"
	8'			28				32				27			10"	288	288	9'-4"
	9'			28				36				27		#5	12"	240	240	10'-4"
	10'			28				40				27			11"	264	264	11'-4"
	11'			28				44				27			10"	288	288	12'-4"
	12'			28				48				27		#6	12"	240	240	13'-4"
2 @ 11'	6'	#5	11½"	30		#4	12"	24		#4	12"	29		#4	12"	240	240	7'-6"
	7'			30				28				29				240	240	8'-6"
	8'			30				32				29			10"	288	288	9'-6"
	9'			30				36				29		#5	12"	240	240	10'-6"
	10'			30				40				29			11"	264	264	11'-6"
	11'			30				44				29			10"	288	288	12'-6"
	12'			30				48				29		#6	12"	240	240	13'-6"
2 @ 12'	6'	#5	11½"	32		#4	12"	24		#4	12"	31		#4	12"	240	240	7'-7"
	7'			32				28				31				240	240	8'-7"
	8'			32				32				31			10"	288	288	9'-7"
	9'			32				36				31		#5	12"	240	240	10'-7"
	10'			32				40				31			11"	264	264	11'-7"
	11'			32				44				31			10"	288	288	12'-7"
	12			32				48				31		#6	12"	240	240	13'-7"

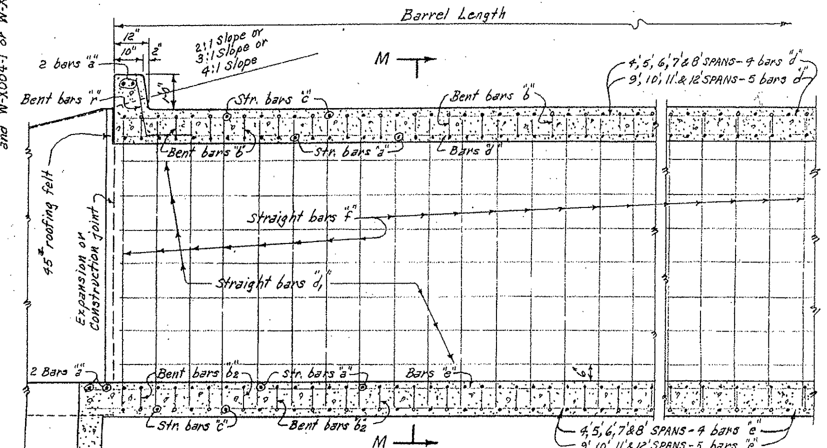
DIMENSIONS — QUANTITIES

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALL	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	CLASS S CONC. PER LIN. FT. OF BARREL	REINFORCING STEEL PER LIN. FT. OF BARREL	ADDITIONAL PER LAP	ADDITIONAL TWO HEADWALLS & APRONS
D	S	H	A	OW	T	C	M	B	OH	CU.YD.	LB.	LB.	LB.
5'-0"	2 @ 4'	2'	16	9'-8"	6½"	6"	8"	6"	3'-0½"	0.496	88.15	42.71	129.56
		3'	24	9'-8"		6"	8"		4'-0½"	0.558	93.49	46.05	129.56
		4'	32	9'-8"		6"	8"		5'-0½"	0.620	98.84	49.39	129.56
		5'	40	9'-8"		6"	8"		6'-0½"	0.682	104.18	52.73	129.56
		6'	48	9'-11"		7"	9"		7'-0½"	0.809	110.74	56.07	131.65
	2 @ 5'	3'	30	11'-8"	7"	6"	8"	6½"	4'-1½"	0.671	123.34	51.19	198.64
		4'	40	11'-8"		6"	8"		5'-1½"	0.733	128.68	54.53	198.64
		5'	50	11'-8"		6"	8"		6'-1½"	0.795	134.03	57.87	198.64
		6'	60	11'-11"		7"	9"		7'-1½"	0.922	140.89	61.21	201.64
		7'	70	12'-1"		7½"	10"		8'-1½"	1.044	147.34	64.55	203.65
	2 @ 6'	3'	36	13'-8"	7½"	6"	8"	7½"	4'-3"	0.818	148.50	56.34	233.58
		4'	48	13'-8"		6"	8"		5'-3"	0.880	153.85	59.68	233.58
		5'	60	13'-8"		6"	8"		6'-3"	0.941	159.19	63.02	233.58
		6'	72	13'-11"		7"	9"		7'-3"	1.070	166.20	66.36	236.59
		7'	84	14'-1"		7½"	10"		8'-3"	1.192	172.74	69.70	238.59
		8'	96	14'-2"		8"	10"		9'-3"	1.298	183.36	73.04	239.59
	2 @ 7'	4'	56	15'-8"	8"	6"	8"	8"	5'-4"	1.021	178.15	64.83	268.97
		5'	70	15'-8"		6"	8"		6'-4"	1.082	183.49	68.17	268.97
		6'	84	15'-11"		7"	9"		7'-4"	1.212	190.59	71.51	271.97
		7'	98	16'-1"		7½"	10"		8'-4"	1.334	197.19	74.85	273.98
		8'	112	16'-2"		8"	10"		9'-4"	1.440	207.89	78.19	274.98
		9'	126	16'-5"		9"	11"		10'-4"	1.616	225.25	81.53	277.98
	2 @ 8'	4'	64	17'-8"	8½"	6"	8"	8½"	5'-5"	1.174	210.37	71.71	304.80
		5'	80	17'-11"		7"	9"		6'-5"	1.295	217.63	75.05	307.81
		6'	96	17'-11"		7"	9"		7'-5"	1.366	222.97	78.39	307.81
		7'	112	18'-1"		7½"	10"		8'-5"	1.489	229.68	81.73	309.81
		8'	128	18'-2"		8"	10"		9'-5"	1.595	240.97	85.07	310.81
		9'	144	18'-5"		9"	11"		10'-5"	1.772	258.08	88.41	313.82
		10'	160	18'-8"		10"	12"		11'-5"	1.967	271.07	91.75	316.82
	2 @ 9'	5'	90	19'-11"	9"	7"	9"	9¼"	6'-6¼"	1.477	239.37	82.77	345.92
		6'	108	20'-1"		7½"	10"		7'-6¼"	1.594	246.08	86.11	347.93
		7'	126	20'-1"		7½"	10"		8'-6¼"	1.671	251.43	89.45	347.93
		8'	144	20'-2"		8"	10"		9'-6¼"	1.778	262.26	92.79	348.93
		9'	162	20'-5"		9"	11"		10'-6¼"	1.956	279.95	96.13	351.93
		10'	180	20'-8"		10"	12"		11'-6¼"	2.152	292.97	99.47	354.93
		11'	198	20'-10"		11"	12"		12'-6¼"	2.328	306.86	102.81	356.94
	2 @ 10'	5'	100	21'-11"	9½"	7"	9"	10"	6'-7½"	1.674	279.64	87.92	479.99
		6'	120	22'-1"		7½"	10"		7'-7½"	1.792	286.50	91.26	482.71
		7'	140	22'-1"		7½"	10"		8'-7½"	1.869	291.85	94.60	482.71
		8'	160	22'-2"		8"	10"		9'-7½"	1.976	302.77	97.94	484.08
		9'	180	22'-5"		9"	11"		10'-7½"	2.155	320.74	101.28	488.16
		10'	200	22'-8"		10"	12"		11'-7½"	2.352	333.99	104.62	492.25
		11'	220	22'-10"		11"	12"		12'-7½"	2.529	348.01	107.96	494.98
		12'	240	23'-0"		12"	12"		13'-7½"	2.718	370.23	111.30	497.70
	2 @ 11'	6'	132	24'-2"	10"	8"	10"	11"	7'-9"	2.048	309.36	96.41	530.03
		7'	154	24'-2"		8"	10"		8'-9"	2.128	314.70	99.75	530.03
		8'	176	24'-2"		8"	10"		9'-9"	2.208	325.12	103.09	530.03
		9'	198	24'-5"		9"	11"		10'-9"	2.388	343.25	106.43	534.12
		10'	220	24'-8"		10"	12"		11'-9"	2.586	356.57	109.77	538.21
		11'	242	24'-10"		11"	12"		12'-9"	2.764	370.67	113.11	540.93
		12'	264	25'-0"		12"	12"		13'-9"	2.954	393.05	116.45	543.66
	2 @ 12'	6'	144	26'-2"	10½"	8"	10"	12"	7'-10½"	2.299	353.31	101.55	576.93
		7'	168	26'-2"		8"	10"		8'-10½"	2.379	358.65	104.89	576.93
		8'	192	26'-2"		8"	10"		9'-10½"	2.459	369.12	108.23	576.93
		9'	216	26'-5"		9"	11"		10'-10½"	2.640	387.52	111.57	580.52
		10'	240	26'-8"		10"	12"		11'-10½"	2.840	401.07	114.91	584.60
		11'	264	26'-10"		11"	12"		12'-10½"	3.018	415.31	118.25	587.33
		12'	288	27'-0"		12"	12"		13'-10½"	3.208	437.88	121.59	590.05

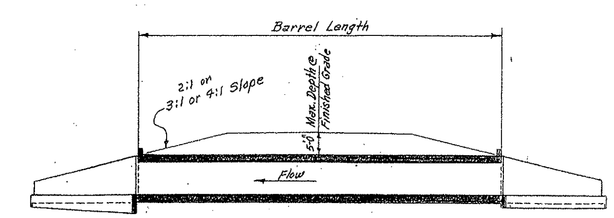


TYPICAL SECTION M-M

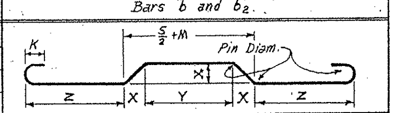
NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2.



PART LONGITUDINAL SECTION



LONGITUDINAL SECTION

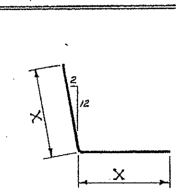
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR Bars "b" and "b2".
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	

NOTE:- Dimensions are to centers of bars. (Bars "b" and "b2")

DOWEL BARS FOR TWO HEADWALLS

2 SPANS @	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	20	2'-5"	1'-2½"
5'	#4	12"±	24	2'-6"	1'-3"
6'	#4	12"±	28	2'-7"	1'-3½"
7'	#4	12"±	32	2'-8"	1'-4"
8'	#4	12"±	36	2'-9"	1'-4½"
9'	#4	12"±	40	2'-10"	1'-5"
10'	#4	12"±	46	2'-11"	1'-5½"
11'	#4	12"±	50	3'-0"	1'-6"
12'	#4	12"±	54	3'-1"	1'-6½"

Bars "r" — Dowel bars in Headwalls.



Designed by:- W.C.H. 1-17-63. Checked by:- RHS 5-14-63
Drawn by:- W.C.H. 2-15-63. Checked by:- RHS 5-24-63
Quantities by:- W.C.H. 2-19-63. Checked by:- RHS 5-24-63

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 OR 4:1 SLOPES
DOUBLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-200X-0.

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars: STRAIGHT — In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars: BENT - see Diagram at Right. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
Section "A" & Bar Group "A"	4:1 = 32'-0"	0' TO 10'-0"	2 @ 4'	3'	#4	13"	46	64	9'-5"	#4	13"	20	29	10'-5"	0'-2¾"	2'-1"	3'-5"
				4'			46	64	9'-5"			20	29	10'-5"	0'-2¾"	2'-1"	3'-5"
				5'			46	64	9'-5"			20	29	10'-5"	0'-2¾"	2'-1"	3'-5"
				6'			46	64	9'-8"			20	29	10'-8"	0'-2¾"	2'-2"	3'-6"
			2 @ 5'	3'	#4	11"	52	74	11'-5"	#5	11"	24	35	12'-6"	0'-3"	2'-6½"	4'-2"
				4'			52	74	11'-5"			24	35	12'-6"	0'-3"	2'-6½"	4'-2"
				5'			52	74	11'-5"			24	35	12'-6"	0'-3"	2'-6½"	4'-2"
				6'			52	74	11'-8"			24	35	12'-9"	0'-3"	2'-7½"	4'-3"
				7'			52	74	11'-10"			24	35	12'-11"	0'-3"	2'-8½"	4'-3½"
	3:1 = 22'-0"		2 @ 6'	4'	#4	12"	48	68	13'-5"	#5	12"	22	32	14'-7"	0'-3¾"	2'-11"	4'-11"
				5'			48	68	13'-5"			22	32	14'-7"	0'-3¾"	2'-11"	4'-11"
				6'			48	68	13'-8"			22	32	14'-10"	0'-3¾"	3'-0"	5'-0"
				7'			48	68	13'-10"			22	32	15'-0"	0'-3¾"	3'-1"	5'-0½"
				8'			48	68	13'-11"			22	32	15'-1"	0'-3¾"	3'-1"	5'-1"
Section "B" & Bar Group "B"	4:1 = 16'-0"	10'-0" TO 15'-0"	2 @ 4'	3'	#4	11"	24	34	9'-5"	#4	11"	12	18	10'-5"	0'-2¾"	2'-1"	3'-5"
				4'			24	34	9'-5"			12	18	10'-5"	0'-2¾"	2'-1"	3'-5"
				5'			24	34	9'-5"			12	18	10'-5"	0'-2¾"	2'-1"	3'-5"
				6'			24	34	9'-8"			12	18	10'-8"	0'-2¾"	2'-2"	3'-6"
			2 @ 5'	3'	#4	11"	24	36	11'-5"	#5	11"	12	17	12'-7"	0'-3½"	2'-5½"	4'-2"
				4'			24	36	11'-5"			12	17	12'-7"	0'-3½"	2'-5½"	4'-2"
				5'			24	36	11'-5"			12	17	12'-7"	0'-3½"	2'-5½"	4'-2"
				6'			24	36	11'-8"			12	17	12'-10"	0'-3½"	2'-6½"	4'-3"
				7'			24	36	11'-10"			12	17	13'-0"	0'-3½"	2'-7½"	4'-3½"
	3:1 = 11'-0"		2 @ 6'	4'	#4	11"	24	36	13'-5"	#5	11"	12	17	14'-7"	0'-4½"	2'-9½"	4'-11"
				5'			24	36	13'-5"			12	17	14'-7"	0'-4½"	2'-9½"	4'-11"
				6'			24	36	13'-8"			12	17	14'-10"	0'-4½"	2'-10½"	5'-0"
				7'			24	36	13'-10"			12	17	15'-0"	0'-4½"	2'-11½"	5'-0½"
				8'			24	36	13'-11"			12	17	15'-1"	0'-4½"	2'-11½"	5'-1"
Section "C" & Bar Group "C"	4:1 = 16'-0"	15'-0" TO 20'-0"	2 @ 4'	3'	#4	10"	26	40	9'-5"	#4	10"	14	19	10'-5"	0'-3¼"	2'-0"	3'-5"
				4'			26	40	9'-5"			14	19	10'-5"	0'-3¼"	2'-0"	3'-5"
				5'			26	40	9'-5"			14	19	10'-5"	0'-3¼"	2'-0"	3'-5"
				6'			26	40	9'-8"			14	19	10'-8"	0'-3¼"	2'-1"	3'-6"
			2 @ 5'	3'	#4	11"	24	34	11'-5"	#5	11"	12	18	12'-7"	0'-4½"	2'-4"	4'-2"
				4'			24	34	11'-5"			12	18	12'-7"	0'-4½"	2'-4"	4'-2"
				5'			24	34	11'-5"			12	18	12'-7"	0'-4½"	2'-4"	4'-2"
				6'			24	34	11'-8"			12	18	12'-10"	0'-4½"	2'-5"	4'-3"
				7'			24	34	11'-10"			12	18	13'-0"	0'-4½"	2'-6"	4'-3½"
	3:1 = 11'-0"		2 @ 6'	4'	#5	13"	20	30	13'-5"	#6	13"	10	15	14'-10"	0'-5½"	2'-7½"	4'-11"
				5'			20	30	13'-5"			10	15	14'-10"	0'-5½"	2'-7½"	4'-11"
				6'			20	30	13'-8"			10	15	15'-1"	0'-5½"	2'-8½"	5'-0"
				7'			20	30	13'-10"			10	15	15'-3"	0'-5½"	2'-9½"	5'-0½"
				8'			20	30	13'-11"			10	15	15'-4"	0'-5½"	2'-9½"	5'-1"
Section "D" & Bar Group "D"	4:1 = 16'-0"	20'-0" TO 25'-0"	2 @ 4'	3'	#4	13"	20	28	9'-5"	#5	13"	10	15	10'-7"	0'-3½"	1'-11½"	3'-5"
				4'			20	28	9'-5"			10	15	10'-7"	0'-3½"	1'-11½"	3'-5"
				5'			20	28	9'-5"			10	15	10'-7"	0'-3½"	1'-11½"	3'-5"
				6'			20	28	9'-8"			10	15	10'-10"	0'-3½"	2'-0½"	3'-6"
			2 @ 5'	3'	#4	10"	28	38	11'-5"	#5	10"	13	19	12'-8"	0'-4¾"	2'-3"	4'-2"
				4'			28	38	11'-5"			13	19	12'-8"	0'-4¾"	2'-3"	4'-2"
				5'			28	38	11'-5"			13	19	12'-8"	0'-4¾"	2'-3"	4'-2"
				6'			28	38	11'-8"			13	19	12'-11"	0'-4¾"	2'-4"	4'-3"
				7'			28	38	11'-11"			13	19	13'-2"	0'-4¾"	2'-5"	4'-4"
	3:1 = 11'-0"		2 @ 6'	4'	#5	12"	22	32	13'-5"	#6	12"	11	16	14'-11"	0'-6"	2'-6"	4'-11"
				5'			22	32	13'-6"			11	16	15'-0"	0'-6"	2'-6"	4'-11½"
				6'			22	32	13'-8"			11	16	15'-2"	0'-6"	2'-7"	5'-0¼"
				7'			22	32	13'-11"			11	16	15'-5"	0'-6"	2'-8"	5'-1"
				8'			22	32	14'-0"			11	16	15'-6"	0'-6"	2'-8"	5'-1¾"
Section "E" & Bar Group "E"	4:1 = 16'-0"	25'-0" TO 30'-0"	2 @ 4'	3'	#4	12"	22	32	9'-5"	#5	12"	11	16	10'-7"	0'-4"	1'-10½"	3'-5"
				4'			22	32	9'-5"			11	16	10'-7"	0'-4"	1'-10½"	3'-5"
				5'			22	32	9'-6"			11	16	10'-8"	0'-4"	1'-10½"	3'-5½"
				6'			22	32	9'-9"			11	16	10'-11"	0'-4"	1'-11½"	3'-6½"
			2 @ 5'	3'	#5	13"	20	30	11'-5"	#6	13"	10	15	12'-10"	0'-5½"	2'-1"	4'-2"
				4'			20	30	11'-5"			10	15	12'-10"	0'-5½"	2'-1"	4'-2"
				5'			20	30	11'-6"			10	15	12'-11"	0'-5½"	2'-1"	4'-2½"
				6'			20	30	11'-9"			10	15	13'-2"	0'-5½"	2'-2"	4'-3½"
				7'			20	30	12'-0"			10	15	13'-5"	0'-5½"	2'-3"	4'-4½"
	3:1 = 11'-0"		2 @ 6'	4'	#5	11"	26	34	13'-5"	#6	11"	12	17	14'-11"	0'-6¾"	2'-4½"	4'-11"
				5'			26	34	13'-7"			12	17	15'-1"	0'-6¾"	2'-4½"	5'-0"
				6'			26	34	13'-10"			12	17	15'-4"	0'-6¾"	2'-5½"	5'-1"
				7'			26	34	14'-0"			12	17	15'-7"	0'-6¾"	2'-6½"	5'-1¾"
				8'			26	34	14'-2"			12	17	15'-8"	0'-6¾"	2'-6½"	5'-2½"
Section "F" & Bar Group "F"	4:1 = 16'-0"	30'-0" TO 35'-0"	2 @ 4'	3'	#4	11"	24	36	9'-5"	#5	11"	12	17	10'-7"	0'-4½"	1'-9½"	3'-5"
				4'			24	36	9'-5"			12	17	10'-7"	0'-4½"	1'-9½"	3'-5"
				5'			24	36	9'-7"			12	17	10'-9"	0'-4½"	1'-9½"	3'-6"
				6'			24	36	9'-10"			12	17	11'-0"	0'-4½"	1'-10½"	3'-7"
	3:1 = 11'-0"		2 @ 5'	3'	#5	12"	22	32	11'-5"	#6	12"	11	16	12'-11"	0'-6"	2'-0"	4'-2"
				4'			22	32	11'-6"			11	16	13'-0"	0'-6"	2'-0"	4'-2½"
				5'			22	32	11'-7"			11	16	13'-1"	0'-6"	2'-0"	4'-3"
				6'			22	32	11'-10"			11	16	13'-4"	0'-6"	2'-1"	4'-4"
				7'			22	32	12'-1"			11	16	13'-7"	0'-6"	2'-2"	4'-5"
	Varies with Length of Barrel		2 @ 6'	4'	#5	10"	Varies with Length of Barrel	Varies with Length of Barrel	13'-6"	#6	10"	Varies with Length of Barrel	Varies with Length of Barrel	15'-1"	0'-7½"	2'-4"	4'-11"
				5'					13'-8"					15'-3"	0'-7½"	2'-4"	5'-0"
				6'					13'-11"					15'-6"	0'-7½"	2'-5"	5'-1"
				7'					14'-2"					15'-9"	0'-7½"	2'-6"	5'-2"
				8'					14'-3"					15'-10"	0'-7½"	2'-6"	5'-2¾"
Section "G" & Bar Group "G"	Varies with Length of Barrel	35'-0" TO 40'-0"	2 @ 4'	3'	#4	10"	Varies with Length of Barrel	Varies with Length of Barrel	9'-5"	#5	10"	Varies with Length of Barrel	Varies with Length of Barrel	10'-8"	0'-5"	1'-8½"	3'-5"
				4'					9'-6"					10'-9"	0'-5"	1'-8½"	3'-5½"
				5'					9'-8"					10'-11"	0'-5"	1'-8½"	3'-6½"
				6'					9'-11"					11'-2"	0'-5"	1'-9½"	3'-7½"
			2 @ 5'	3'	#5	11"			11'-5"	#6	11"			12'-11"	0'-6½"	1'-11"	4'-2"
				4'					11'-6"					13'-0"	0'-6½"	1'-11"	4'-2½"
				5'					11'-8"					13'-2"	0'-6½"	1'-11"	4'-3½"
				6'					11'-11"					13'-5"	0'-6½"	2'-0"	4'-4½"
				7'					12'-2"					13'-8"	0'-6½"	2'-1"	4'-5½"

"b2" bars: BENT - See Diagram at Right. In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.
"c" bars: STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.

Section	S	H	"b2" Size	"b2" Spacing	"b2" No. 3:1	"b2" No. 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. 3:1	"c" No. 4:1	"c" Length
A	2 @ 4'	3'	#4	13"	20	29	10'-5"	0'-2¾"	2'-1"	3'-5"	#5	13"	42	60	4'-8"
		4'			20	29	10'-5"	0'-2¾"	2'-1"	3'-5"			42	60	4'-8"
		5'			20	29	10'-5"	0'-2¾"	2'-1"	3'-5"			42	60	4'-8"
		6'			20	29	10'-8"	0'-2¾"	2'-2"	3'-6"			42	60	4'-9"
	2 @ 5'	3'	#5	11"	24	35	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	48	70	5'-8"
		4'			24	35	12'-6"	0'-3"	2'-6½"	4'-2"			48	70	5'-8"
		5'			24	35	12'-6"	0'-3"	2'-6½"	4'-2"			48	70	5'-8"
		6'			24	35	12'-9"	0'-3"	2'-7½"	4'-3"			48	70	5'-9"
		7'			24	35	12'-11"	0'-3"	2'-8½"	4'-3½"			48	70	5'-10"
	2 @ 6'	4'	#5	12"	22	32	14'-7"	0'-4¼"	2'-10"	4'-11"	#6	12"	44	64	6'-8"
		5'			22	32	14'-7"	0'-4¼"	2'-10"	4'-11"			44	64	6'-8"
		6'			22	32	14'-10"	0'-4¼"	2'-11"	5'-0"			44	64	6'-9"
		7'			22	32	15'-0"	0'-4¼"	3'-0"	5'-0½"			44	64	6'-10"
		8'			22	32	15'-1"	0'-4¼"	3'-0"	5'-1"			44	64	6'-10"
B	2 @ 4'	3'	#4	11"	12	18	10'-5"	0'-3¼"	2'-0"	3'-5"	#5	11"	24	34	4'-8"
		4'			12	18	10'-5"	0'-3¼"	2'-0"	3'-5"			24	34	4'-8"
		5'			12	18	10'-5"	0'-3¼"	2'-0"	3'-5"			24	34	4'-8"
		6'			12	18	10'-8"	0'-3¼"	2'-1"	3'-6"			24	34	4'-9"
	2 @ 5'	3'	#5	11"	12	17	12'-7"	0'-4"	2'-4½"	4'-2"	#5	11"	24	36	5'-8"
		4'			12	17	12'-7"	0'-4"	2'-4½"	4'-2"			24	36	5'-8"
		5'			12	17	12'-7"	0'-4"	2'-4½"	4'-2"			24	36	5'-8"
		6'			12	17	12'-10"	0'-4"	2'-5½"	4'-3"			24	36	5'-9"
		7'			12	17	13'-0"	0'-4"	2'-6½"	4'-3½"			24	36	5'-10"
	2 @ 6'	4'	#5	11"	12	17	14'-8"	0'-5"	2'-8½"	4'-11"	#6	11"	24	36	6'-8"
		5'			12	17	14'-8"	0'-5"	2'-8½"	4'-11"			24	36	6'-8"
		6'			12	17	14'-11"	0'-5"	2'-9½"	5'-0"			24	36	6'-9"
		7'			12	17	15'-1"	0'-5"	2'-10½"	5'-0½"			24	36	6'-10"
		8'			12	17	15'-2"	0'-5"	2'-10½"	5'-1"			24	36	6'-10"
C	2 @ 4'	3'	#4	10"	14	19	10'-6"	0'-3¾"	1'-11"	3'-5"	#5	10"	26	40	4'-8"
		4'			14	19	10'-6"	0'-3¾"	1'-11"	3'-5"			26	40	4'-8"
		5'			14	19	10'-6"	0'-3¾"	1'-11"	3'-5"			26	40	4'-8"
		6'			14	19	10'-9"	0'-3¾"	2'-0"	3'-6"			26	40	4'-9"
	2 @ 5'	3'	#5	11"	12	18	12'-8"	0'-4¾"	2'-3"	4'-2"	#6	11"	24	34	5'-8"
		4'			12	18	12'-8"	0'-4¾"	2'-3"	4'-2"			24	34	5'-8"
		5'			12	18	12'-8"	0'-4¾"	2'-3"	4'-2"			24	34	5'-8"
		6'			12	18	12'-11"	0'-4¾"	2'-4"	4'-3"			24	34	5'-9"
		7'			12	18	13'-1"	0'-4¾"	2'-5"	4'-3½"			24	34	5'-10"
	2 @ 6'	4'	#6	13"	10	15	14'-10"	0'-5¾"	2'-6½"	4'-11"	#7	13"	20	30	6'-8"
		5'			10	15	14'-10"	0'-5¾"	2'-6½"	4'-11"			20	30	6'-8"
		6'			10	15	15'-1"	0'-5¾"	2'-7½"	5'-0"			20	30	6'-9"
		7'			10	15	15'-3"	0'-5¾"	2'-8½"	5'-0½"			20	30	6'-10"
		8'			10	15	15'-4"	0'-5¾"	2'-8½"	5'-1"			20	30	6'-10"
D	2 @ 4'	3'	#5	13"	10	15	10'-7"	0'-4"	1'-10½"	3'-5"	#6	13"	20	28	4'-8"
		4'			10	15	10'-7"	0'-4"	1'-10½"	3'-5"			20	28	4'-8"
		5'			10	15	10'-7"	0'-4"	1'-10½"	3'-5"			20	28	4'-8"
		6'			10	15	10'-10"	0'-4"	1'-11½"	3'-6"			20	28	4'-9"
	2 @ 5'	3'	#5	10"	13	19	12'-8"	0'-5¼"	2'-2"	4'-2"	#6	10"	28	38	5'-8"
		4'			13	19	12'-8"	0'-5¼"	2'-2"	4'-2"			28	38	5'-8"
		5'			13	19	12'-8"	0'-5¼"	2'-2"	4'-2"			28	38	5'-8"
		6'			13	19	12'-11"	0'-5¼"	2'-3"	4'-3"			28	38	5'-9"
		7'			13	19	13'-2"	0'-5¼"	2'-4"	4'-4"			28	38	5'-10"
	2 @ 6'	4'	#6	12"	11	16	14'-11"	0'-6½"	2'-5"	4'-11"	#7	12"	22	32	6'-8"
		5'			11	16	15'-0"	0'-6½"	2'-5"	4'-11½"			22	32	6'-8"
		6'			11	16	15'-2"	0'-6½"	2'-6"	5'-0¼"			22	32	6'-9"
		7'			11	16	15'-5"	0'-6½"	2'-7"	5'-1"			22	32	6'-10"
		8'			11	16	15'-6"	0'-6½"	2'-7"	5'-1¾"			22	32	6'-10"
E	2 @ 4'	3'	#5	12"	11	16	10'-7"	0'-4½"	1'-9½"	3'-5"	#6	12"	22	32	4'-8"
		4'			11	16	10'-7"	0'-4½"	1'-9½"	3'-5"			22	32	4'-8"
		5'			11	16	10'-8"	0'-4½"	1'-9½"	3'-5½"			22	32	4'-8"
		6'			11	16	10'-11"	0'-4½"	1'-10½"	3'-6½"			22	32	4'-9"
	2 @ 5'	3'	#6	13"	10	15	12'-11"	0'-6"	2'-0"	4'-2"	#7	13"	20	30	5'-8"
		4'			10	15	12'-11"	0'-6"	2'-0"	4'-2"			20	30	5'-8"
		5'			10	15	13'-0"	0'-6"	2'-0"	4'-2½"			20	30	5'-8"
		6'			10	15	13'-3"	0'-6"	2'-1"	4'-3½"			20	30	5'-9"
		7'			10	15	13'-6"	0'-6"	2'-2"	4'-4½"			20	30	5'-10"
	2 @ 6'	4'	#6	11"	12	17	15'-0"	0'-7¼"	2'-3½"	4'-11"	#7	11"	26	34	6'-8"
		5'			12	17	15'-2"	0'-7¼"	2'-3½"	5'-0"			26	34	6'-8"
		6'			12	17	15'-5"	0'-7¼"	2'-4½"	5'-1"			26	34	6'-9"
		7'			12	17	15'-7"	0'-7¼"	2'-5½"	5'-1¾"			26	34	6'-10"
		8'			12	17	15'-9"	0'-7¼"	2'-5½"	5'-2½"			26	34	6'-10"
F	2 @ 4'	3'	#5	11"	12	17	10'-8"	0'-5"	1'-8½"	3'-5"	#6	11"	24	36	4'-8"
		4'			12	17	10'-8"	0'-5"	1'-8½"	3'-5"			24	36	4'-8"
		5'			12	17	10'-10"	0'-5"	1'-8½"	3'-6"			24	36	4'-8"
		6'			12	17	11'-1"	0'-5"	1'-9½"	3'-7"			24	36	4'-9"
	2 @ 5'	3'	#6	12"	11	16	12'-11"	0'-6½"	1'-11"	4'-2"	#7	12"	22	32	5'-8"
		4'			11	16	13'-0"	0'-6½"	1'-11"	4'-2½"			22	32	5'-8"
		5'			11	16	13'-1"	0'-6½"	1'-11"	4'-3"			22	32	5'-8"
		6'			11	16	13'-4"	0'-6½"	2'-0"	4'-4"			22	32	5'-9"
		7'			11	16	13'-7"	0'-6½"	2'-1"	4'-5"			22	32	5'-10"
	2 @ 6'	4'	#6	10"	Varies with Length of Barrel	Varies with Length of Barrel	15'-1"	0'-8"	2'-3"	4'-11"	#7	10"	Varies with Length of Barrel	Varies with Length of Barrel	6'-8"
		5'					15'-3"	0'-8"	2'-3"	5'-0"					6'-8"
		6'					15'-6"	0'-8"	2'-4"	5'-1"					6'-9"
		7'					15'-9"	0'-8"	2'-5"	5'-2"					6'-10"
		8'					15'-10"	0'-8"	2'-5"	5'-2¾"					6'-10"
G	2 @ 4'	3'	#5	10"	Varies with Length of Barrel	Varies with Length of Barrel	10'-8"	0'-5½"	1'-7½"	3'-5"	#6	10"	Varies with Length of Barrel	Varies with Length of Barrel	4'-8"
		4'					10'-9"	0'-5½"	1'-7½"	3'-5½"					4'-8"
		5'					10'-11"	0'-5½"	1'-7½"	3'-6½"					4'-8"
		6'					11'-2"	0'-5½"	1'-8½"	3'-7½"					4'-9"
	2 @ 5'	3'	#6	11"			12'-11"	0'-7"	1'-10"	4'-2"	#7	11"			5'-8"
		4'					13'-0"	0'-7"	1'-10"	4'-2½"					5'-8"
		5'					13'-2"	0'-7"	1'-10"	4'-3½"					5'-8"
		6'					13'-5"	0'-7"	1'-11"	4'-4½"					5'-9"
		7'					13'-8"	0'-7"	2'-0"	4'-5½"					5'-10"

"d" bars: STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars: Longitudinal in Sidewalls and Division Walls. "e" bars: Longitudinal in Bottom Slab of Barrel. "f" bars: STRAIGHT — Vertical in Sidewalls and Division Walls.

Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. 3:1	"f" No. 4:1	"f" Length
A	2 @ 4'	3'	#4	12"	14	33'-3" for 32'-0" Section	#4	12"	12	33'-3" for 32'-0" Section	#4	12"	14	34'-3" for 32'-0" Section	#4	12"	88	128	3'-9"
		4'			14				16				14				88	128	4'-9"
		5'			14				20				14				88	128	5'-9"
		6'			14				24				14				88	128	6'-9"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	88	128	3'-10"
		4'			16				16				16				88	128	4'-10"
		5'			16				20				16				88	128	5'-10"
		6'			16				24				16				88	128	6'-10"
		7'			16				28				16		#5	12"	88	128	7'-10"
	2 @ 6'	4'	#4	12"	18		#4	12"	16		#4	12"	18		#4	12"	88	128	5'-0"
		5'			18				20				18				88	128	6'-0"
		6'			18				24				18				88	128	7'-0"
		7'			18				28				18		#5	12"	88	128	8'-0"
		8'			18				32				18			11"	96	140	9'-0"
B	2 @ 4'	3'	#4	12"	14	34'-3" for 33'-0" Length Section	#4	12"	12	34'-3" for 33'-0" Length Section	#4	12"	14	34'-3" for 33'-0" Length Section	#4	12"	44	64	3'-9"
		4'			14				16				14				44	64	4'-9"
		5'			14				20				14				44	64	5'-9"
		6'			14				24				14		#5	12"	44	64	6'-9"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	44	64	3'-11"
		4'			16				16				16				44	64	4'-11"
		5'			16				20				16				44	64	5'-11"
		6'			16				24				16			10"	56	80	6'-11"
		7'			16				28				16		#5	11"	48	72	7'-11"
	2 @ 6'	4'	#4	12"	18		#4	12"	16		#4	12"	18		#4	12"	44	64	5'-1"
		5'			18				20				18				44	64	6'-1"
		6'			18				24				18			10"	56	80	7'-1"
		7'			18				28				18		#5	11"	48	72	8'-1"
		8'			18				32				18		#6	12"	44	64	9'-1"
C	2 @ 4'	3'	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	44	64	3'-10"
		4'			14				16				14				44	64	4'-10"
		5'			14				20				14		#5	12"	44	64	5'-10"
		6'			14				24				14			11"	48	72	6'-10"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	44	64	4'-1"
		4'			16				16				16				44	64	5'-1"
		5'			16				20				16			10"	56	80	6'-1"
		6'			16				24				16		#5	12"	44	64	7'-1"
		7'			16				28				16		#6	12"	44	64	8'-1"
	2 @ 6'	4'	#4	12"	18		#4	12"	16		#4	12"	18		#4	12"	44	64	5'-3"
		5'			18				20				18			10"	56	80	6'-3"
		6'			18				24				18		#5	12"	44	64	7'-3"
		7'			18				28				18		#6	12"	44	64	8'-3"
		8'			18				32				18			10"	56	76	9'-3"
D	2 @ 4'	3'	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	44	64	3'-11"
		4'			14				16				14				44	64	4'-11"
		5'			14				20				14		#5	11"	48	72	5'-11"
		6'			14				24				14		#6	12"	44	64	6'-11"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	44	64	4'-2"
		4'			16				16				16				44	64	5'-2"
		5'			16				20				16		#5	12"	44	64	6'-2"
		6'			16				24				16		#6	12"	44	64	7'-2"
		7'			16				28				16			11"	48	68	8'-2"
	2 @ 6'	4'	#4	12"	18		#4	12"	16		#4	12"	18		#4	12"	44	64	5'-4"
		5'			18				20				18			10"	52	76	6'-4"
		6'			18				24				18		#5	11"	48	68	7'-4"
		7'			18				28				18		#6	12"	44	64	8'-4"
		8'			18				32				18			9"	56	88	9'-4"
E	2 @ 4'	3'	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	44	64	4'-0"
		4'			14				16				14				44	64	5'-0"
		5'			14				20				14		#5	11"	48	68	6'-0"
		6'			14				24				14		#6	12"	44	64	7'-0"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	44	64	4'-3"
		4'			16				16				16				44	64	5'-3"
		5'			16				20				16		#5	12"	44	64	6'-3"
		6'			16				24				16		#6	12"	44	64	7'-3"
		7'			16				28				16			10"	56	80	8'-3"
	2 @ 6'	4'	#4	12"	18		#4	12"	16		#4	12"	18		#4	12"	44	64	5'-6"
		5'			18				20				18			10"	52	76	6'-6"
		6'			18				24				18		#5	11"	48	72	7'-6"
		7'			18				28				18		#6	12"	44	64	8'-6"
		8'			18				32				18			9"	60	84	9'-6"
F	2 @ 4'	3'	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	44	64	4'-1"
		4'			14				16				14				44	64	5'-1"
		5'			14				20				14		#5	11"	48	72	6'-1"
		6'			14				24				14		#6	12"	44	64	7'-1"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"	44	64	4'-4"
		4'			16				16				16				44	64	5'-4"
		5'			16				20				16		#5	12"	44	64	6'-4"
		6'			16				24				16		#6	12"	44	64	7'-4"
		7'			16				28				16			10"	52	76	8'-4"
	2 @ 6'	4'	#4	12"	18	Varies with Length of Barrel	#4	12"	16	Varies with Length of Barrel	#4	12"	18	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	Varies with Length of Barrel	5'-7"
		5'			18				20				18			10"			6'-7"
		6'			18				24				18		#5	11"			7'-7"
		7'			18				28				18			12"			8'-7"
		8'			18				32				18		#6	9"			9'-7"
G	2 @ 4'	3'	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"			4'-2"
		4'			14				16				14						5'-2"
		5'			14				20				14		#5	11"			6'-2"
		6'			14				24				14		#6	12"			7'-2"
	2 @ 5'	3'	#4	12"	16		#4	12"	12		#4	12"	16		#4	12"			4'-5"
		4'			16				16				16			11"			5'-5"
		5'			16				20				16		#5	12"			6'-5"
		6'			16				24				16			12"			7'-5"
		7'			16				28				16		#6	10"			8'-5"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

Designed by:- W.C.H. 9-17-62 Checked by:- RHS 11-12-62
Drawn by:- W.C.H. 10-15-62 Checked by:- RHS 11-19-62
Quantities by:- W.C.H. 11-9-62 Checked by:- RHS 11-20-62

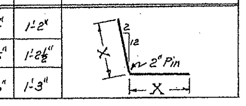
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU.YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
Section "A" = 10'-0"	2 @ 4'	3'	24	9'-8"	6"	6"	8"	6"	4'-0"	0.543	70.19	33.40	100.20
		4'	32	9'-8"		6"	8"		5'-0"	0.606	75.53	36.74	100.20
		5'	40	9'-8"		6"	8"		6'-0"	0.667	80.87	40.08	100.20
		6'	48	9'-11"		7"	9"		7'-0"	0.793	86.99	43.42	101.54
	2 @ 5'	3'	30	11'-8"	6½"	6"	8"	6½"	4'-1"	0.653	97.61	36.74	121.13
		4'	40	11'-8"		6"	8"		5'-1"	0.715	102.96	40.08	121.13
		5'	50	11'-8"		6"	8"		6'-1"	0.777	108.30	43.42	121.13
		6'	60	11'-11"		7"	9"		7'-1"	0.904	114.77	46.76	122.47
		7'	70	12'-1"		7½"	10"		8'-1"	1.025	132.68	50.10	123.36
	2 @ 6'	4'	48	13'-8"	7¼"	6"	8"	7¾"	5'-3"	0.880	116.47	43.42	142.51
		5'	60	13'-8"		6"	8"		6'-3"	0.941	121.81	46.76	142.51
		6'	72	13'-11"		7"	9"		7'-3"	1.070	128.26	50.10	143.84
		7'	84	14'-1"		7½"	10"		8'-3"	1.192	146.43	53.44	144.73
		8'	96	14'-2"		8"	10"		9'-3"	1.298	156.97	56.78	145.18
Section "B" = 15'-0"	2 @ 4'	3'	24	9'-8"	6"	6"	8"	6½"	4'-0½"	0.558	76.27	33.40	
		4'	32	9'-8"		6"	8"		5'-0½"	0.620	81.61	36.74	
		5'	40	9'-8"		6"	8"		6'-0½"	0.682	86.95	40.08	
		6'	48	9'-11"		7"	9"		7'-0½"	0.809	103.34	43.42	
	2 @ 5'	3'	30	11'-8"	7"	6"	8"	7½"	4'-2½"	0.707	98.03	36.74	
		4'	40	11'-8"		6"	8"		5'-2½"	0.769	103.37	40.08	
		5'	50	11'-8"		6"	8"		6'-2½"	0.831	108.71	43.42	
		6'	60	11'-11"		7"	9"		7'-2½"	0.959	118.88	46.76	
		7'	70	12'-1"		7½"	10"		8'-2½"	1.081	136.22	50.10	
	2 @ 6'	4'	48	13'-8"	8"	6"	8"	8½"	5'-4½"	0.943	123.00	43.42	
		5'	60	13'-8"		6"	8"		6'-4½"	1.005	128.35	46.76	
		6'	72	13'-11"		7"	9"		7'-4½"	1.135	138.68	50.10	
		7'	84	14'-1"		7½"	10"		8'-4½"	1.257	156.32	53.44	
		8'	96	14'-2"		8"	10"		9'-4½"	1.363	177.09	56.78	
Section "C" = 20'-0"	2 @ 4'	3'	24	9'-8"	6½"	6"	8"	7"	4'-1½"	0.588	80.51	33.40	
		4'	32	9'-8"		6"	8"		5'-1½"	0.650	85.85	36.74	
		5'	40	9'-8"		6"	8"		6'-1½"	0.711	99.95	40.08	
		6'	48	9'-11"		7"	9"		7'-1½"	0.839	110.39	43.42	
	2 @ 5'	3'	30	11'-8"	7¾"	6"	8"	8¼"	4'-4"	0.761	104.24	36.74	
		4'	40	11'-8"		6"	8"		5'-4"	0.823	109.59	40.08	
		5'	50	11'-8"		6"	8"		6'-4"	0.885	118.18	43.42	
		6'	60	11'-11"		7"	9"		7'-4"	1.014	132.11	46.76	
		7'	70	12'-1"		7½"	10"		8'-4"	1.137	154.69	50.10	
	2 @ 6'	4'	48	13'-8"	8¾"	6"	8"	9¼"	5'-6"	1.006	140.89	43.42	
		5'	60	13'-8"		6"	8"		6'-6"	1.068	149.57	46.76	
		6'	72	13'-11"		7"	9"		7'-6"	1.199	163.94	50.10	
		7'	84	14'-1"		7½"	10"		8'-6"	1.323	187.03	53.44	
		8'	96	14'-2"		8"	10"		9'-6"	1.429	207.21	56.78	
Section "D" = 25'-0"	2 @ 4'	3'	24	9'-8"	7"	6"	8"	7½"	4'-2½"	0.618	82.12	33.40	
		4'	32	9'-8"		6"	8"		5'-2½"	0.680	87.46	36.74	
		5'	40	9'-8"		6"	8"		6'-2½"	0.741	103.92	40.08	
		6'	48	9'-11"		7"	9"		7'-2½"	0.870	122.24	43.42	
	2 @ 5'	3'	30	11'-8"	8¼"	6"	8"	8¾"	4'-5"	0.797	110.96	36.74	
		4'	40	11'-8"		6"	8"		5'-5"	0.859	116.31	40.08	
		5'	50	11'-8½"		6¼"	8"		6'-5"	0.931	130.90	43.42	
		6'	60	11'-11"		7"	9"		7'-5"	1.051	152.23	46.76	
		7'	70	12'-2"		8"	10"		8'-5"	1.200	166.70	50.10	
	2 @ 6'	4'	48	13'-8"	9½"	6"	8"	10"	5'-7½"	1.069	149.04	43.42	
		5'	60	13'-9"		6½"	8"		6'-7½"	1.152	158.19	46.76	
		6'	72	13'-11½"		7½"	9"		7'-7½"	1.275	175.12	50.10	
		7'	84	14'-2"		8"	10"		8'-7½"	1.414	196.10	53.44	
		8'	96	14'-3½"		8¾"	10"		9'-7½"	1.539	223.89	56.78	
Section "E" = 30'-0"	2 @ 4'	3'	24	9'-8"	7½"	6"	8"	8"	4'-3½"	0.648	86.09	33.40	
		4'	32	9'-8"		6"	8"		5'-3½"	0.709	91.43	36.74	
		5'	40	9'-9"		6½"	8"		6'-3½"	0.791	108.33	40.08	
		6'	48	10'-0"		7½"	9"		7'-3½"	0.923	126.86	43.42	
	2 @ 5'	3'	30	11'-8"	9"	6"	8"	9½"	4'-6½"	0.851	119.82	36.74	
		4'	40	11'-8"		6"	8"		5'-6½"	0.913	125.16	40.08	
		5'	50	11'-9½"		6¾"	8"		6'-6½"	1.005	140.27	43.42	
		6'	60	12'-0"		7½"	9"		7'-6½"	1.130	161.92	46.76	
		7'	70	12'-3"		8½"	10"		8'-6½"	1.283	182.00	50.10	
	2 @ 6'	4'	48	13'-8"	10¼"	6"	8"	10¾"	5'-9"	1.133	158.71	43.42	
		5'	60	13'-10"		7"	8"		6'-9"	1.236	168.46	46.76	
		6'	72	14'-1"		8"	9"		7'-9"	1.376	186.18	50.10	
		7'	84	14'-3½"		8¾"	10"		8'-9"	1.520	207.22	53.44	
		8'	96	14'-5"		9½"	10"		9'-9"	1.650	235.72	56.78	
Section "F" = 35'-0"	2 @ 4'	3'	24	9'-8"	8"	6"	8"	8½"	4'-4½"	0.677	90.83	33.40	
		4'	32	9'-8"		6"	8"		5'-4½"	0.739	96.17	36.74	
		5'	40	9'-10"		7"	8"		6'-4½"	0.840	113.57	40.08	
		6'	48	10'-1"		8"	9"		7'-4½"	0.976	132.32	43.42	
	2 @ 5'	3'	30	11'-8"	9½"	6"	8"	10"	4'-7½"	0.887	126.75	36.74	
		4'	40	11'-9"		6½"	8"		5'-7½"	0.966	132.52	40.08	
		5'	50	11'-10"		7"	8"		6'-7½"	1.052	147.79	43.42	
		6'	60	12'-1"		8"	9"		7'-7½"	1.190	169.71	46.76	
		7'	70	12'-4"		9"	10"		8'-7½"	1.347	190.02	50.10	
	2 @ 6'	4'	48	13'-9"	11"	6½"	8"	11½"	5'-10½"	1.214	170.52	43.42	
		5'	60	13'-11"		7½"	8"		6'-10½"	1.321	180.40	46.76	
		6'	72	14'-2"		8½"	9"		7'-10½"	1.465	198.92	50.10	
		7'	84	14'-5"		9½"	10"		8'-10½"	1.628	220.08	53.44	
		8'	96	14'-6½"		10¼"	10"		9'-10½"	1.763	248.96	56.78	
Section "G" = 40'-0"	2 @ 4'	3'	24	9'-8"	8½"	6"	8"	9"	4'-5½"	0.707	96.47	33.40	
		4'	32	9'-9"		6½"	8"		5'-5½"	0.786	102.16	36.74	
		5'	40	9'-11"		7½"	8"		6'-5½"	0.891	119.78	40.08	
		6'	48	10'-2"		8½"	9"		7'-5½"	1.031	138.77	43.42	
	2 @ 5'	3'	30	11'-8"	10"	6"	8"	10½"	4'-8½"	0.923	134.77	36.74	
		4'	40	11'-9"		6½"	8"		5'-8½"	1.003	141.90	40.08	
		5'	50	11'-11"		7½"	8"		6'-8½"	1.109	156.47	43.42	
		6'	60	12'-2"		8½"	9"		7'-8½"	1.251	178.70	46.76	
		7'	70	12'-5"		9½"	10"		8'-8½"	1.412	199.25	50.10	

DOWEL BARS FOR TWO HEADWALLS

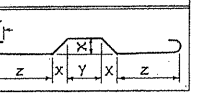
Span	Size	Spacing	No. Req'd	Length	X
4'	#4	12"	20	2'-4"	1'-2"
5'	#4	12"	24	2'-5"	1'-2½"
6'	#4	12"	28	2'-6"	1'-3"

Bars "r" Dowel bars in Headwalls



Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4¾"	0'-11½"
#6	3"	5"	1'-1½"

BENDING DIAGRAM FOR BARS "b" and "b2"



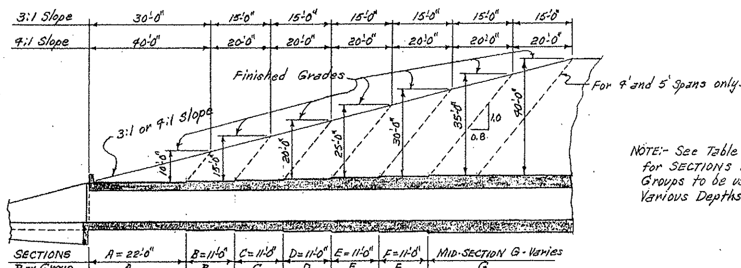
NOTE:- Dimensions are to centers of bars. (b & b2)

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	✓						A
10.0' to 14.5'	✓						B
15.0' to 19.5'	✓	✓					C
20.0' to 24.5'	✓	✓	✓				D
25.0' to 29.5'	✓	✓	✓	✓			E
30.0' to 34.5'	✓	✓	✓	✓	✓		F
35.0' to 40.0'	✓	✓	✓	✓	✓	✓	G

(Columns A–F: Sections & Bar Groups for End Sections.)

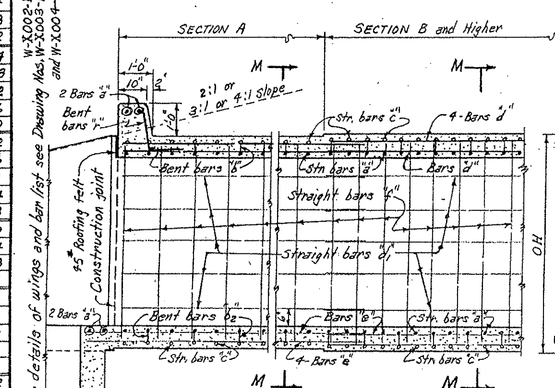


NOTE:- See Table above for SECTIONS and Bar Groups to be used for Various Depths of Cover.

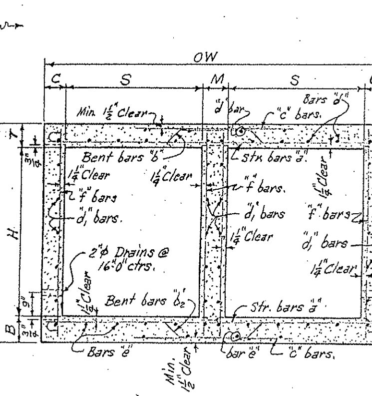
3:1 Slope =	Sections / Bar Group	A = 22'-0" / A	B = 11'-0" / B	C = 11'-0" / C	D = 11'-0" / D	E = 11'-0" / E	F = 11'-0" / F	Mid-Section G - Varies / G
4:1 Slope =	Sections / Bar Group	A = 32'-0" / A	B = 16'-0" / B	C = 16'-0" / C	D = 16'-0" / D	E = 16'-0" / E	F = 16'-0" / F	Mid-Section G - Varies / G

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B,C,D,E or F	4:1 Slopes Sections A	4:1 Slopes Sections B,C,D,E or F
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	25.403'	12.702'	36.950'	18.475'
45°	1.4142	31.113'	15.556'	45.255'	22.627'

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X002-1, W-X003-1 and W-X004-1.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS DOUBLES — 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

STANDARD DRAWING NO. R-200X-X1

Fed. Road No.	State	Fed. Aid Project	Fiscal Year	Sheet No.	Total Sheets
6	ARK.				
Job No.					

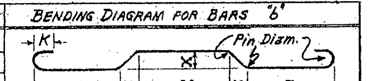
BAR LIST FOR VARIOUS SECTIONS OF BARREL

Section	Length of Section	Bar Group per Section	Depth of Cover D	Clear Span S	Clear Height H	"a" bars Straight – In Top & Bottom Slab of Barrel, 2 Add'l in Apron and Headwall: Size	Spacing	Number	Length	"b" bars Bent (see Bending Diagram below) – In bottom of Top Slab bent up over Division Wall and in top of Bottom Slab bent down under Division Wall. Alternate with "a" and "c" bars: Size	Spacing	Number	Length	X	Y	Z	"c" bars Straight – In Top & Bottom Slab of Barrel Alt. with "b" bars: Size	Spacing	Number	Length	"d" bars Straight – Longitudinal in Top Slab of Barrel: Size	Spacing	Number	Length	"d1" bars Straight – Longitudinal in Sidewalls and Division Wall: Size	Spacing	Number	Length	"e" bars Straight – Longitudinal in Bottom Slab of Barrel: Size	Spacing	Number	Length	"f" bars Straight – Vertical in Sidewalls and Division Wall: Size	Spacing	Number	Length
Section "A"	32'-0"	Bar Group "A"	0' to 10'	4'	3'	#4	16"	52	9'-5"	#4	16"	48	10'-7"	0'-4½"	2'-0"	3'-4½"	#4	16"	48	4'-8"	#4	12"	12	33'-3" Max.	#4	12"	8	33'-3" Max.	#4	12"	12	34'-3" Max.	#4	12"	128	4'-0"
					4'			52	9'-5"			48	10'-7"	0'-4½"	2'-0"	3'-4½"			48	4'-8"			12				12				12				128	5'-0"
					5'			52	9'-5"			48	10'-7"	0'-4½"	2'-0"	3'-4½"			48	4'-8"			12				16				12				128	6'-0"
					6'			52	9'-8"			48	10'-10"	0'-4½"	2'-1"	3'-5½"			48	4'-9"			12				20				12				128	7'-0"
				5'	4'	#5	16"	52	11'-5"	#5	16"	48	12'-8"	0'-4½"	2'-6"	4'-1"	#5	16"	48	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	128	5'-1"
					5'			52	11'-5"			48	12'-8"	0'-4½"	2'-6"	4'-1"			48	5'-8"			14				16				14				128	6'-1"
					6'			52	11'-8"			48	12'-11"	0'-4½"	2'-7"	4'-2"			48	5'-9"			14				20				14				128	7'-1"
					7'			52	11'-10"			48	13'-1"	0'-4½"	2'-8"	4'-2½"			48	5'-10"			14				24				14		#5		128	8'-1"
				6'	5'	#5	15"	56	13'-5"	#5	15"	50	14'-9"	0'-5"	2'-11"	4'-10"	#6	15"	52	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	128	6'-2"
					6'			56	13'-8"			50	15'-0"	0'-5"	3'-0"	4'-11"			52	6'-9"			16				20				16			12"	128	7'-2"
					7'			56	13'-10"			50	15'-2"	0'-5"	3'-1"	4'-11½"			52	6'-10"			16				24				16			10"	156	8'-2"
					8'			56	13'-11"			50	15'-3"	0'-5"	3'-1"	5'-0"			52	6'-10"			16				28				16		#5	12"	128	9'-2"
Section "B"	Varies - 16'-0" Min.	Bar Group "B"	10' to 15'	4'	3'	#4	12"	32	9'-5"	#4	12"	32	10'-7"	0'-4½"	2'-0"	3'-4½"	#4	12"	32	4'-8"	#4	12"	12	33'-3" for 2-16'-0" Sections	#4	12"	8	33'-3" for 2-16'-0" Sections	#4	12"	12	33'-3" for 2-16'-0" Sections	#4	12"	64	4'-0"
					4'			32	9'-5"			32	10'-7"	0'-4½"	2'-0"	3'-4½"			32	4'-8"			12				12				12				64	5'-0"
					5'			32	9'-5"			32	10'-7"	0'-4½"	2'-0"	3'-4½"			32	4'-8"			12				16				12				64	6'-0"
					6'			32	9'-8"			32	10'-10"	0'-4½"	2'-1"	3'-5½"			32	4'-9"			12				20				12			9"	84	7'-0"
				5'	4'	#5	13"	30	11'-5"	#5	13"	30	12'-8"	0'-4½"	2'-6"	4'-1"	#5	13"	30	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-1"
					5'			30	11'-5"			30	12'-8"	0'-4½"	2'-6"	4'-1"			30	5'-8"			14				16				14				64	6'-1"
					6'			30	11'-8"			30	12'-11"	0'-4½"	2'-7"	4'-2"			30	5'-9"			14				20				14			10"	76	7'-1"
					7'			30	11'-10"			30	13'-1"	0'-4½"	2'-8"	4'-2½"			30	5'-10"			14				24				14		#5	11"	72	8'-1"
				6'	5'	#5	13"	30	13'-5"	#5	13"	30	14'-9"	0'-5"	2'-11"	4'-10"	#6	13"	30	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	64	6'-2"
					6'			30	13'-8"			30	15'-0"	0'-5"	3'-0"	4'-11"			30	6'-9"			16				20				16			10"	76	7'-2"
					7'			30	13'-10"			30	15'-2"	0'-5"	3'-1"	4'-11½"			30	6'-10"			16				24				16		#5	11"	72	8'-2"
					8'			30	13'-11"			30	15'-3"	0'-5"	3'-1"	5'-0"			30	6'-10"			16				28				16			9"	84	9'-2"
Section "C"	Varies - 16'-0" Min.	Bar Group "C"	15' to 20'	4'	3'	#4	12"	32	9'-5"	#4	12"	32	10'-7"	0'-4½"	2'-0"	3'-4½"	#5	12"	32	4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"	64	4'-0"
					4'			32	9'-5"			32	10'-7"	0'-4½"	2'-0"	3'-4½"			32	4'-8"			12				12				12				64	5'-0"
					5'			32	9'-5"			32	10'-7"	0'-4½"	2'-0"	3'-4½"			32	4'-8"			12				16				12			11"	72	6'-0"
					6'			32	9'-8"			32	10'-10"	0'-4½"	2'-1"	3'-5½"			32	4'-9"			12				20				12			8"	96	7'-0"
				5'	4'	#5	13"	30	11'-5"	#5	13"	28	12'-8"	0'-4½"	2'-6"	4'-1"	#6	13"	30	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-1"
					5'			30	11'-5"			28	12'-8"	0'-4½"	2'-6"	4'-1"			30	5'-8"			14				16				14				64	6'-1"
					6'			30	11'-8"			28	12'-11"	0'-4½"	2'-7"	4'-2"			30	5'-9"			14				20				14			9"	88	7'-1"
					7'			30	11'-10"			28	13'-1"	0'-4½"	2'-8"	4'-2½"			30	5'-10"			14				24				14		#5	10"	76	8'-1"
				6'	5'	#5	11"	34	13'-5"	#5	11"	36	14'-9"	0'-5½"	2'-10"	4'-10"	#6	11"	34	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	64	6'-3"
					6'			34	13'-8"			36	15'-0"	0'-5½"	2'-11"	4'-11"			34	6'-9"			16				20				16			9"	88	7'-3"
					7'			34	13'-10"			36	15'-2"	0'-5½"	3'-0"	4'-11½"			34	6'-10"			16				24				16		#5	11"	68	8'-3"
					8'			34	14'-0"			36	15'-4"	0'-5½"	3'-0"	5'-0½"			34	6'-10"			16				28				16			9"	88	9'-3"
Section "D"	Varies - 16'-0" Min.	Bar Group "D"	20' to 25'	4'	3'	#4	12"	32	9'-5"	#4	12"	32	10'-7"	0'-4½"	2'-0"	3'-4½"	#6	12"	32	4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"	64	4'-0"
					4'			32	9'-5"			32	10'-7"	0'-4½"	2'-0"	3'-4½"			32	4'-8"			12				12				12				64	5'-0"
					5'			32	9'-6"			32	10'-8"	0'-4½"	2'-0"	3'-4¾"			32	4'-8"			12				16				12			10"	76	6'-0"
					6'			32	9'-9"			32	10'-11"	0'-4½"	2'-1"	3'-5¾"			32	4'-9"			12				20				12		#5	12"	64	7'-0"
				5'	4'	#5	13"	30	11'-5"	#5	13"	30	12'-9"	0'-5¼"	2'-5"	4'-0¾"	#7	13"	30	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-2"
					5'			30	11'-6"			30	12'-10"	0'-5¼"	2'-5"	4'-1¼"			30	5'-8"			14				16				14				64	6'-2"
					6'			30	11'-9"			30	13'-1"	0'-5¼"	2'-6"	4'-2¼"			30	5'-9"			14				20				14			8"	96	7'-2"
					7'			30	12'-0"			30	13'-4"	0'-5¼"	2'-7"	4'-3¼"			30	5'-10"			14				24				14		#5	10"	76	8'-2"
				6'	5'	#5	10"	38	13'-6"	#5	10"	38	14'-11"	0'-6¼"	2'-8"	4'-10½"	#6	10"	38	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	64	6'-5"
					6'			38	13'-9"			38	15'-2"	0'-6¼"	2'-9"	4'-11½"			38	6'-9"			16				20				16			9"	84	7'-5"
					7'			38	14'-0"			38	15'-5"	0'-6¼"	2'-10"	5'-0½"			38	6'-10"			16				24				16		#5	11"	72	8'-5"
					8'			38	14'-2"			38	15'-7"	0'-6¼"	2'-10"	5'-1½"			38	6'-10"			16				28				16			8"	96	9'-5"
Section "E"	Varies - 16'-0" Min.	Bar Group "E"	25' to 30'	4'	3'	#4	12"	32	9'-5"	#4	12"	32	10'-7½"	0'-4¾"	1'-11"	3'-4¾"	#6	12"	32	4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"	64	4'-1"
					4'			32	9'-5"			32	10'-7½"	0'-4¾"	1'-11"	3'-4¾"			32	4'-8"			12				12				12				64	5'-1"
					5'			32	9'-7"			32	10'-9½"	0'-4¾"	1'-11"	3'-5¾"			32	4'-8"			12				16				12			10"	76	6'-1"
					6'			32	9'-10"			32	11'-0½"	0'-4¾"	2'-0"	3'-6¾"			32	4'-9"			12				20				12		#5	11"	72	7'-1"
				5'	4'	#5	13"	28	11'-5"	#5	13"	30	12'-9½"	0'-6"	2'-3"	4'-1"	#7	13"	28	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-4"
					5'			28	11'-7"			30	12'-11½"	0'-6"	2'-3"	4'-2"			28	5'-8"			14				16				14				64	6'-4"
					6'			28	11'-10"			30	13'-2½"	0'-6"	2'-4"	4'-3"			28	5'-9"			14				20				14			8"	96	7'-4"
					7'			28	12'-1"			30	13'-5½"	0'-6"	2'-5"	4'-4"			28	5'-10"			14				24				14		#5	9"	84	8'-4"
				6'	5'	#5	10"	40	13'-7"	#5	10"	38	15'-1"	0'-7½"	2'-6"	4'-11"	#7	10"	40	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	64	6'-7"
					6'			40	13'-10"			38	15'-4"	0'-7½"	2'-7"	5'-0"			40	6'-9"			16				20				16			9"	84	7'-7"
					7'			40	14'-1"			38	15'-7"	0'-7½"	2'-8"	5'-1"			40	6'-10"			16				24				16		#5	10"	76	8'-7"
					8'			40	14'-3"			38	15'-9"	0'-7½"	2'-8"	5'-2"			40	6'-10"			16				28				16			8"	96	9'-7"
Section "F"	Varies - 16'-0" Min.	Bar Group "F"	30' to 35'	4'	3'	#4	11"	36	9'-5"	#4	11"	34	10'-8"	0'-5¼"	1'-10"	3'-4¾"	#6	11"	36	4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"	64	4'-2"
					4'			36	9'-6"			34	10'-9"	0'-5¼"	1'-10"	3'-4¾"			36	4'-8"			12				12				12				64	5'-2"
					5'			36	9'-8"			34	10'-11"	0'-5¼"	1'-10"	3'-5¾"			36	4'-8"			12				16				12			9"	84	6'-2"
					6'			36	9'-11"			34	11'-2"	0'-5¼"	1'-11"	3'-6¾"			36	4'-9"			12				20				12		#5	10"	76	7'-2"
				5'	4'	#5	12"	32	11'-7"	#5	12"	32	13'-0"	0'-6¾"	2'-2"	4'-1¾"	#7	12"	32	5'-8"	#4	12	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-5"
					5'			32	11'-9"			32	13'-2"	0'-6¾"	2'-2"	4'-2¾"			32	5'-8"			14				16				14				64	6'-5"
					6'			32	12'-0"			32	13'-5"	0'-6¾"	2'-3"	4'-3¾"			32	5'-9"			14				20				14			8"	96	7'-5"
					7'			32	12'-3"			32	13'-8"	0'-6¾"	2'-4"	4'-4¾"			32	5'-10"			14				24				14		#5	9"	84	8'-5"
				6'	5'	#5	10"	38	13'-9"	#5	10"	38	15'-3"	0'-8¼"	2'-4"	5'-0"	#7	10"	38	6'-8"	#4	12"	16		#4	12"	16		#4	12"	16		#4	12"	64	6'-9"
					6'			38	14'-0"			38	15'-6"	0'-8¼"	2'-5½"	5'-1"			38	6'-9"			16				20				16			9"	88	7'-9"
					7'			38	14'-3"			38	15'-9"	0'-8¼"	2'-6"	5'-2"			38	6'-10"			16				24				16		#5	10"	76	8'-9"
					8'			38	14'-5"			38	15'-11"	0'-8¼"	2'-6"	5'-3"			38	6'-10"			16				28				16			8"	96	9'-9"
Section "G"	Varies - 16'-0" Min.	Bar Group "G"	35' to 40'	4'	3'	#4	10"	38	9'-5"	#4	10"	40	10'-8½"	0'-5¾"	1'-9"	3'-4¾"	#6	10"	38	4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"	64	4'-3"
					4'			38	9'-7"			40	10'-10½"	0'-5¾"	1'-9"	3'-5¾"			38	4'-8"			12				12				12				64	5'-3"
					5'			38	9'-9"			40	11'-0½"	0'-5¾"	1'-9"	3'-6¾"			38	4'-8"			12				16				12			9"	88	6'-3"
					6'			38	10'-0"			40	11'-3½"	0'-5¾"	1'-10"	3'-7¾"			38	4'-9"			12				20				12		#5	10"	76	7'-3"
				5'	4'	#5	12"	32	11'-8"	#5	12"	32	13'-2"	0'-7½"	2'-0"	4'-2½"	#7	12"	32	5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"	64	5'-7"
					5'			32	11'-10"			32	13'-4"	0'-7½"	2'-0"	4'-3½"			32	5'-8"			14				16				14				64	6'-7"
					6'			32	12'-1"			32	13'-7"	0'-7½"	2'-1"	4'-4½"			32	5'-9"			14				20				14			8"	96	7'-7"
					7'			32	12'-4"			32	13'-10"	0'-7½"	2'-2"	4'-5½"			32	5'-10"			14				24				14		#5	8"	100	8'-7"
Varies		Bar Group "H"	35' Max.	6'	5'	#5	10"	Varies with Length of Barrel	13'-10"	#5	10"	Varies with Length of Barrel	15'-5"	0'-9½"	2'-2"	5'-0½"	#7	10"	Varies with Length of Barrel	6'-8"	#4	12"	16	Varies with Length of Barrel	#4	12"	16	Varies with Length of Barrel	#4	12"	16	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	6'-11"
					6'				14'-1"				15'-8"	0'-9½"	2'-3"	5'-1½"				6'-9"			16				20				16			9"		7'-11"
					7'				14'-4"				15'-11"	0'-9½"	2'-4"	5'-2½"				6'-10"			16				24				16		#5	10"		8'-11"
					8'				14'-6"				16'-1"	0'-9½"	2'-4"	5'-3½"				6'-10"			16				28				16			8"		9'-11"
			40' Max.	4'	3'	#4	10"		9'-6"	#4	10"		10'-10"	0'-6¼"	1'-8"	3'-4¾"	#6	10"		4'-8"	#4	12"	12		#4	12"	8		#4	12"	12		#4	12"		4'-4"
					4'				9'-8"				11'-0"	0'-6¼"	1'-8"	3'-5¾"				4'-8"			12				12				12					5'-4"
					5'				9'-10"				11'-2"	0'-6¼"	1'-8"	3'-6¾"				4'-8"			12				16				12			9"		6'-4"
					6'				10'-1"				11'-5"	0'-6¼"	1'-9"	3'-7¾"				4'-9"			12				20				12		#5	10"		7'-4"
				5'	4'	#5	12"		11'-9"	#5	12"		13'-3½"	0'-8¼"	1'-11"	4'-2¾"	#7	12"		5'-8"	#4	12"	14		#4	12"	12		#4	12"	14		#4	12"		5'-8"
					5'				11'-11"				13'-5½"	0'-8¼"	1'-11"	4'-3¾"				5'-8"			14				16				14					6'-8"
					6'				12'-2"				13'-8½"	0'-8¼"	2'-0"	4'-4¾"				5'-9"			14				20				14			8"		7'-8"
					7'				12'-5"				13'-11½"	0'-8¼"	2'-1"	4'-5¾"				5'-10"			14				24				14		#5	8"		8'-8"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section "B", the bars should be marked Ba, Bd, Bd1, Be and Bf.

Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2½"	4"	0'-11"
#5	2½"	4½"	1'-0"

BENDING DIAGRAM FOR BARS "b"



NOTE:- For headwall dowel bars "r", see Drawing No. R-2004-A.

NOTE:- Dimensions are to centers of bars.

DIMENSIONS — QUANTITIES

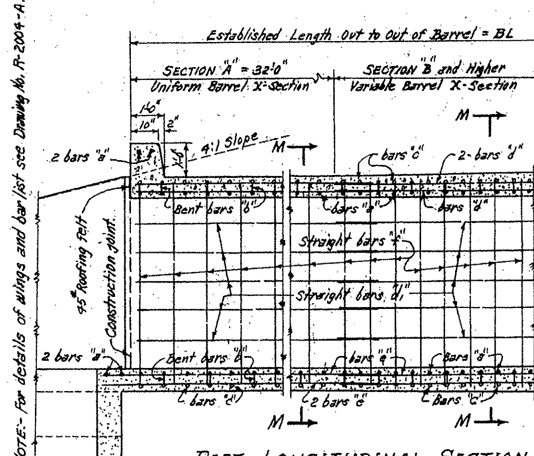
Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Roadway Length RL	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Over-All Height OH	Unit Quantities: Class A Concrete per Lin. Ft. of Barrel (Cu. Yd.)	Unit Quantities: Reinf. Steel No Laps per Lin. Ft. of Barrel (Lb.)	Unit Quantities: Add'l Steel per Lap (Lb.)	Per Min. Section	Total Quantities: Class A Concrete (Cu. Yd.)	Total Quantities: Reinf. Steel No Laps (Lb.)
Sect. "A" = Uniform X-Sect.	2 @ 4'	3'	24	9'-8"	7¼"	6"	8"	7½"	4'-2¾"	0.625	56.78	26.7	Section A = 32'-0"	20.008	1830
		4'	32	9'-8"		6"	8"		5'-2¾"	0.687	62.12	30.1		21.984	2001
		5'	40	9'-8"		6"	8"		6'-2¾"	0.749	67.47	33.4		23.959	2172
		6'	48	9'-11"		7"	9"		7'-2¾"	0.877	73.90	36.7		28.076	2362
	2 @ 5'	4'	40	11'-8"	7¾"	6"	8"	8"	5'-3¾"	0.814	86.85	33.4		26.049	2375
		5'	50	11'-8"		6"	8"		6'-3¾"	0.876	92.19	36.7		28.025	2504
		6'	60	11'-11"		7"	9"		7'-3¾"	1.005	98.45	40.1		32.167	2662
		7'	70	12'-1"		7½"	10"		8'-3¾"	1.128	116.57	43.4		36.080	3199
	2 @ 6'	5'	60	13'-8"	8¼"	6"	8"	8½"	6'-4¾"	1.015	111.57	40.1		32.486	3599
		6'	72	13'-11"		7"	9"		7'-4¾"	1.145	117.95	43.4		36.652	3804
		7'	84	14'-1"		7½"	10"		8'-4¾"	1.268	128.41	46.8		40.582	4152
		8'	96	14'-2"		8"	10"		9'-4¾"	1.374	143.92	50.1		43.979	4619
10'-0" @ Point "A"	2 @ 4'	3'	24	9'-8"	7¼"	6"	8"	7½"	4'-2¾"	0.625	65.02	26.7	Section B = 16'-0"	10.004	1040
		4'	32	9'-8"		6"	8"		5'-2¾"	0.687	70.36	30.1		10.992	1126
		5'	40	9'-8"		6"	8"		6'-2¾"	0.749	75.71	33.4		11.979	1211
		6'	48	9'-11"		7"	9"		7'-2¾"	0.877	88.07	36.7		14.038	1403
	2 @ 5'	4'	40	11'-8"	7¾"	6"	8"	8"	5'-3¾"	0.814	97.59	33.4		13.025	1576
		5'	50	11'-8"		6"	8"		6'-3¾"	0.876	102.93	36.7		14.012	1661
		6'	60	11'-11"		7"	9"		7'-3¾"	1.005	113.18	40.1		16.083	1822
		7'	70	12'-1"		7½"	10"		8'-3¾"	1.128	130.74	43.4		18.040	2125
	2 @ 6'	5'	60	13'-8"	8¼"	6"	8"	8½"	6'-4¾"	1.015	121.26	40.1		13.617	1958
		6'	72	13'-11"		7"	9"		7'-4¾"	1.145	131.63	43.4		18.670	2121
		7'	84	14'-1"		7½"	10"		8'-4¾"	1.268	149.37	46.8		20.639	2427
		8'	96	14'-2"		8"	10"		9'-4¾"	1.374	166.18	50.1		22.573	2665
15'-0" @ Point "B"	2 @ 4'	3'	24	9'-8"	7¼"	6"	8"	7½"	4'-2¾"	0.625	68.52	26.7	Section C = 16'-0"	10.004	1096
		4'	32	9'-8"		6"	8"		5'-2¾"	0.687	73.86	30.1		10.992	1182
		5'	40	9'-8"		6"	8"		6'-2¾"	0.749	80.66	33.4		12.136	1299
		6'	48	9'-11"		7"	9"		7'-2¾"	0.877	94.75	36.7		14.217	1516
	2 @ 5'	4'	40	11'-8"	7¾"	6"	8"	8"	5'-3¾"	0.814	102.39	33.4		13.457	1627
		5'	50	11'-8"		6"	8"		6'-3¾"	0.876	107.73	36.7		14.602	1713
		6'	60	11'-11"		7"	9"		7'-3¾"	1.005	120.58	40.1		16.707	1931
		7'	70	12'-1"		7½"	10"		8'-3¾"	1.128	139.36	43.4		18.902	2212
	2 @ 6'	5'	60	13'-8"	8¾"	6"	8"	9"	6'-5¾"	1.057	134.71	40.1		17.755	2150
		6'	72	13'-11"		7"	9"		7'-5¾"	1.188	147.92	43.4		19.888	2375
		7'	84	14'-1"		7½"	10"		8'-5¾"	1.312	163.34	46.8		22.106	2593
		8'	96	14'-3"		8½"	10"		9'-5¾"	1.447	180.68	50.1		24.335	2911
20'-0" @ Point "C"	2 @ 4'	3'	24	9'-8"	7¼"	6"	8"	7½"	4'-2¾"	0.625	72.80	26.7	Section D = 16'-0"	10.243	1165
		4'	32	9'-8"		6"	8"		5'-2¾"	0.687	78.15	30.1		11.230	1250
		5'	40	9'-9"		6½"	8"		6'-2¾"	0.768	86.92	33.4		12.683	1388
		6'	48	10'-0"		7½"	9"		7'-2¾"	0.900	100.48	36.7		14.822	1604
	2 @ 5'	4'	40	11'-8"	8¼"	6"	8"	8¾"	5'-5¼"	0.868	108.44	33.4		14.321	1752
		5'	50	11'-9"		6½"	8"		6'-5¼"	0.950	114.11	36.7		15.791	1843
		6'	60	12'-0"		7½"	9"		7'-5¼"	1.093	130.30	40.1		17.963	2102
		7'	70	12'-3"		8½"	10"		8'-5¼"	1.236	146.41	43.4		20.538	2354
	2 @ 6'	5'	60	13'-9"	9¾"	6½"	8"	10"	6'-7¾"	[illegible]	149.37	40.1		19.525	2294
		6'	72	14'-0"		7½"	9"		7'-7¾"	[illegible]	157.88	43.4		21.744	2503
		7'	84	14'-3"		8½"	10"		8'-7¾"	1.452	173.98	46.8		24.260	2787
		8'	96	14'-5"		9½"	10"		9'-7¾"	1.595	198.11	50.1		26.591	3153
25'-0" @ Point "D"	2 @ 4'	3'	24	9'-8"	7¾"	6"	8"	8"	4'-3¾"	0.655	73.08	26.7	Section E = 16'-0"	10.720	1169
		4'	32	9'-8"		6"	8"		5'-3¾"	0.717	78.43	30.1		11.840	1255
		5'	40	9'-10"		7"	8"		6'-3¾"	0.818	87.47	33.4		13.480	1396
		6'	48	10'-1"		8"	9"		7'-3¾"	0.953	103.79	36.7		15.681	1677
	2 @ 5'	4'	40	11'-8"	9¼"	6"	8"	9½"	5'-6¾"	0.922	108.97	33.4		15.469	1714
		5'	50	11'-10"		7"	8"		6'-6¾"	1.024	114.95	36.7		17.155	1809
		6'	60	12'-1"		8"	9"		7'-6¾"	1.162	131.37	40.1		19.421	2071
		7'	70	12'-4½"		9½"	10"		8'-6¾"	1.332	152.29	43.4		22.089	2394
	2 @ 6'	5'	60	13'-10½"	10¾"	7½"	8"	11"	6'-9¾"	1.279	154.12	40.1		21.400	2504
		6'	72	14'-1½"		8½"	9"		7'-9¾"	1.420	167.88	43.4		23.718	2718
		7'	84	14'-4½"		9½"	10"		8'-9¾"	1.581	188.16	46.8		26.332	3073
		8'	96	14'-6½"		10½"	10"		9'-9¾"	1.729	208.67	50.1		28.754	3378
30'-0" @ Point "E"	2 @ 4'	3'	24	9'-8"	8¼"	6"	8"	8½"	4'-4¾"	0.685	77.07	26.7	Section F = 16'-0"	11.197	1241
		4'	32	9'-9"		6½"	8"		5'-4¾"	0.763	82.66	30.1		12.588	1331
		5'	40	9'-11"		7½"	8"		6'-4¾"	0.868	93.98	33.4		14.286	1506
		6'	48	10'-2"		8½"	9"		7'-4¾"	1.007	111.57	36.7		16.548	1787
	2 @ 5'	4'	40	11'-10"	10"	7"	8"	10¼"	5'-8¼"	1.011	115.69	33.4		16.760	1850
		5'	50	12'-0"		8"	8"		6'-8¼"	1.120	121.68	36.7		18.538	1947
		6'	60	12'-3"		9"	9"		7'-8¼"	1.266	138.92	40.1		20.896	2213
		7'	70	12'-6"		10"	10"		8'-8¼"	1.429	159.96	43.4		23.550	2540
	2 @ 6'	5'	60	14'-0"	11¾"	8"	8"	12"	6'-11¾"	1.397	155.90	40.1		23.300	2469
		6'	72	14'-3"		9"	9"		7'-11¾"	1.545	169.30	43.4		25.716	2705
		7'	84	14'-6"		10"	10"		8'-11¾"	1.711	189.83	46.8		28.429	3012
		8'	96	14'-8"		11"	10"		9'-11¾"	1.865	210.55	50.1		30.942	3351
35'-0" @ Point "F"	2 @ 4'	3'	24	9'-8"	8¾"	6"	8"	9"	4'-5¾"	0.715	81.82	26.7	Sect. G = 16'-0"	11.787	1315
		4'	32	9'-10"		7"	8"		5'-5¾"	0.810	87.70	30.1		13.344	1409
		5'	40	10'-0"		8"	8"		6'-5¾"	0.918	99.14	33.4		15.100	1604
		6'	48	10'-3"		9"	9"		7'-5¾"	1.062	116.95	36.7		17.424	1872
	2 @ 5'	4'	40	11'-11"	10¾"	7½"	8"	11"	5'-9¾"	1.084	116.61	33.4		17.930	1866
		5'	50	12'-1"		8½"	8"		6'-9¾"	1.197	122.65	36.7		19.769	1962
		6'	60	12'-4"		9½"	9"		7'-9¾"	1.346	139.51	40.1		22.195	2232
		7'	70	12'-7"		10½"	10"		8'-9¾"	1.514	166.88	43.4		24.917	2706
	2 @ 6'	5'	60	14'-1½"	12¾"	8¾"	8"	13"	7'-1¾"	1.516	156.97	40.1			
		6'	72	14'-4½"		9¾"	9"		8'-1¾"	1.670	170.52	43.4			
		7'	84	14'-7½"		10¾"	10"		9'-1¾"	1.843	191.29	46.8			
		8'	96	14'-9½"		11¾"	10"		10'-1¾"	2.003	212.22	50.1			
40'-0" @ Point "G"	2 @ 4'	3'	24	9'-9"	9¼"	6½"	8"	9½"	4'-6¾"	0.759	82.38	26.7			
		4'	32	9'-11"		7½"	8"		5'-6¾"	0.858	88.25	30.1			
		5'	40	10'-1"		8½"	8"		6'-6¾"	0.969	99.77	33.4			
		6'	48	10'-4"		9½"	9"		7'-6¾"	1.117	117.70	36.7			
	2 @ 5'	4'	40	12'-0"	11½"	8"	8"	11¾"	5'-11¼"	1.157	117.26	33.4			
		5'	50	12'-2"		9"	8"		6'-11¼"	1.274	123.30	36.7			
		6'	60	12'-5"		10"	9"		7'-11¼"	1.428	140.27	40.1			
		7'	70	12'-8"		11"	10"		8'-11¼"	1.600	167.84	43.4			

DESIGN LIVE LOAD

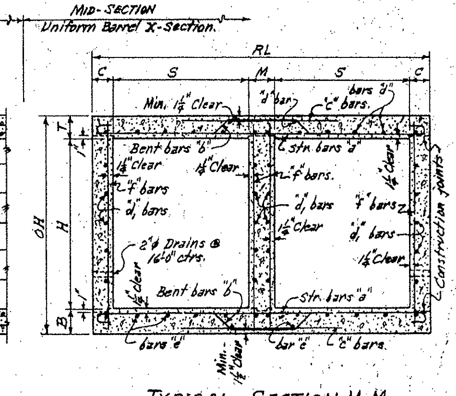
H20-S16 LOADING A.A.S.H.O. 1957
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class A Concrete (n=15) 840#/□"
Reinforcing Steel 20,000#/□"

NOTE:- For details of wings and bar list see Drawing No. R-2004-A.

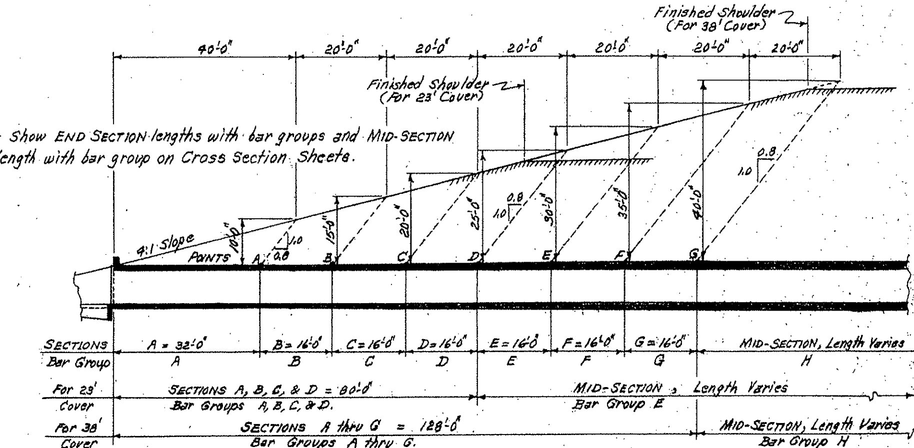


PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

NOTE:- Show END SECTION lengths with bar groups and MID-SECTION length with bar group on Cross Section Sheets.



TYPICAL LONGITUDINAL SECTION SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS HEIGHTS OF COVER
(Examples shown for 23' and 38' Depths of Cover.)

SECTIONS & BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	A	B	C	D	E	F	G	Length of End Sections	Mid-Section Dimensions	Mid-Section Bar Group
10.0' to 14.5'	✓							32'-0"	@ Point A	B
15.0' to 17.5'	✓	✓						48'-0"	@ Point B	C
18.0' to 20.0'	✓	✓	✓					64'-0"	@ Point C	D
20.5' to 25.0'	✓	✓	✓	✓				80'-0"	@ Point D	E
25.5' to 30.0'	✓	✓	✓	✓	✓			96'-0"	@ Point E	F
30.5' to 35.0'	✓	✓	✓	✓	✓	✓		112'-0"	@ Point F	G
35.5' to 40.0'	✓	✓	✓	✓	✓	✓	✓	128'-0"	@ Point G	H

(Columns A–G: Sections & Bar Groups for End Sections.)

GENERAL NOTES:-

CONCRETE:- All concrete to be Class A, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each 32'-0" length of End Sections, and one lap for each additional 30'-0" length of the Mid-Section, less one. Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints in wingwalls, sidewalls and slabs shall be made only where shown on plans. For convenience the joints in the End Sections should be at the Dimension Points; that is, at 32'-0" or 48'-0" lengths. The Mid-Section may be in 24'-0" to 32'-0" lengths. Joints to be normal to center-line of barrel.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Road and Bridge Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Drawing No. R-2004-A.

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF SPECIAL BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

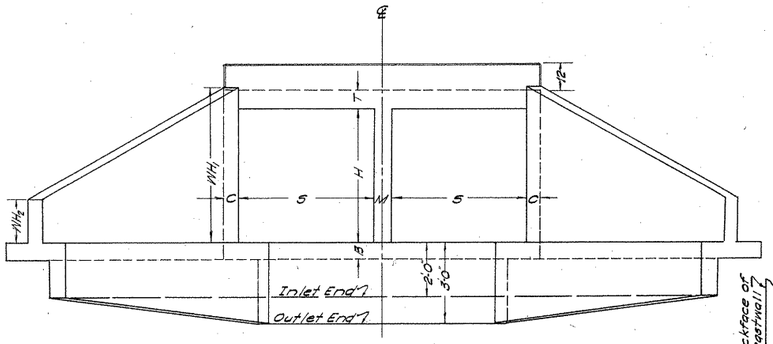
4', 5' & 6' SPANS — 4:1 SLOPES
DOUBLES — OVER 10'-0" COVER

STANDARD DRAWING NO. R-2004-X

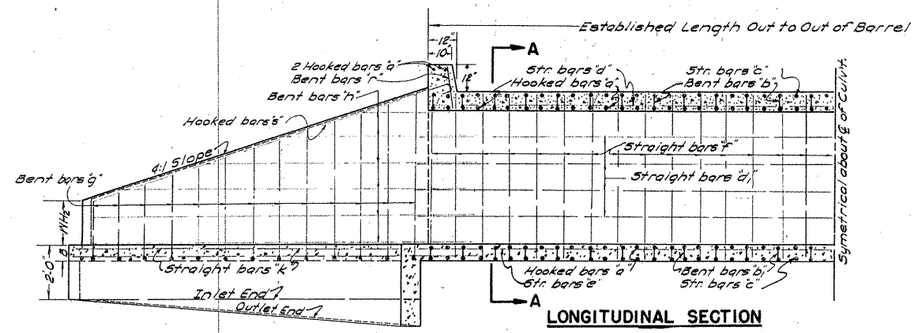
Designed by:- W.C.H. 9-30-59 Checked by:- L.L.K. 10-6-59
Drawn by:- W.C.H. 10-29-59 Checked by:- J.M.H. 10-29-59
Traced by:- W.C.H. 11-6-59 Checked by:- J.M.H. 11-9-59

336 ~~92~~

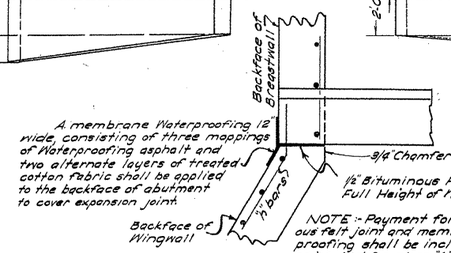
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	NO. SHEET	TOTAL SHEETS
6	ARK.				
JOB NO.					



END ELEVATION

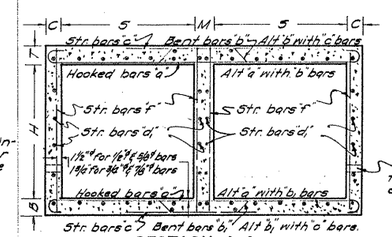


LONGITUDINAL SECTION



NOTE:- Payment for the bituminous felt joint and membrane Waterproofing shall be included in the price bid for class A Concrete

DETAILS OF EXPANSION JOINT FOR CULVERTS WHEN "H"= 8' OR MORE



3" diameter drains @ 20'-0" Centers to be placed in both outside walls one foot above floor level.

SECTION A-A

DIMENSIONS AND QUANTITIES

NUMBER OF SPANS S	SPAN H	HEIGHT A	AREA OF OPENING SQ. FT.	MAXIMUM DEPTH OF FOOTINGS D	THICKNESS OF TOP SLAB T	THICKNESS OF SIDE WALLS & WINGWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	WINGWALL HEIGHTS AT HEADWALL WH	WINGWALL HEIGHTS AT WING END WH½	MAXIMUM WIDTH OF WINGWALL PARALLEL TO DIST. FROM FACE OF HDWL. TO END OF WING WF	LENGTH OF WINGWALLS E	INSIDE LENGTH OF WING FOOTING W1	FOOTING DIMENSION FROM ℄ OF BOX W2	W3	CONCRETE CU YDS HEADWALLS WINGWALLS & FOOTINGS	CONCRETE CU YDS PER LINEAR FOOT OF BARREL	STEEL LBS. HEADWALLS WINGWALLS & FOOTINGS	STEEL LBS. PER LINEAR FOOT OF BARREL	STEEL LBS. ADD'L STEEL FOR LAPS
2	4	2	16	13'	7½	6"	8"	7½	2'-0"	1'-0"	2'-6"	7'-0"	4'-1"	7'-9½"	3'-8⅛"	6.17	0.671	937	70.00	35.6
		3	24						3'-9"	1'-0"	2'-6"	11'-0"	12'-8⅛"	12'-8"	3'-8⅛"	8.60	0.693	492	75.47	40.1
		4	32						4'-9"	1'-4"	2'-6"	13'-8"	15'-0⅛"	15'-6"	3'-8½"	11.61	0.694	640	80.88	44.5
		6	48	11'		7"	9"		6'-9"	2'-0"	3'-4½"	19'-0"	21'-11⅛"	22'-2"	2'-9½"	19.71	0.835	1032	92.64	53.4
2	5	2	20	11'	8"	6"	8"	8"	2'-10"	1'-0"	2'-6"	7'-4"	8'-5½"	8'-2⅛"	4'-8⅛"	6.00	0.700	382	91.44	40.1
		3	30						3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9½"	4'-8⅛"	8.91	0.761	540	96.86	44.5
		4	40						4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10½"	4'-8⅛"	12.51	0.823	700	102.26	49.0
		5	50						5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	18'-2¼"	4'-2⅜"	15.75	0.885	886	107.67	53.4
		7	70	9'		7½"	10"		7'-10"	2'-4"	3'-11"	22'-0"	25'-4⅜"	26'-11½"	3'-3"	26.41	1.137	1641	132.97	62.3
2	6	3	36	9'	8½"	6"	8"	8½"	3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9½"	5'-8⅛"	10.49	0.902	571	122.48	49.0
		4	48						4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10½"	5'-8⅛"	13.13	0.964	722	127.80	53.4
		5	60						5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	18'-2¼"	5'-2⅜"	16.43	1.026	908	133.30	57.0
		6	72			7"	9"		6'-10"	2'-0"	3'-5"	19'-4"	22'-4"	22'-7"	4'-0"	21.65	1.156	1127	140.00	62.3
		8	96	7'		8"	10"		8'-10"	2'-8"	4'-5"	24'-8"	28'-5⅜"	29'-4⅛"	3'-9⅜"	33.70	1.395	2008	156.42	71.3
2	8	3	48	7'	10½"	7"	9"	10½"	4'-0"	1'-0"	2'-7"	12'-0"	14'-10⅛"	15'-7½"	7'-1⅞"	13.22	1.374	666	147.00	62.3
		4	64						5'-0"	1'-4"	2'-7"	16'-8"	19'-1⅛"	19'-8¼"	7'-1⅞"	16.32	1.446	802	153.40	66.8
		5	80						6'-0"	1'-8"	3'-0"	17'-4"	20'-0⅛"	20'-0⅛"	7'-2⅜"	20.27	1.518	1000	166.81	71.3
		6	96						7'-0"	2'-0"	3'-6"	20'-0"	23'-1"	23'-4⅜"	6'-7½"	24.06	1.587	1228	181.22	75.7
		7	112			7½"	10"		8'-0"	2'-4"	4'-0"	22'-8"	26'-2"	26'-10½"	6'-7⅛"	30.95	1.712	1801	210.93	80.2
		8	128			8"	10"		9'-0"	2'-8"	4'-8"	25'-8"	29'-3"	30'-2"	5'-7½"	38.04	1.810	2182	218.36	84.6
		10	160			10"	12"		11'-0"	3'-4"	5'-6"	30'-0"	35'-5"	36'-11½"	4'-8½"	50.06	2.107	3278	243.44	93.5

LAP NOTE:- In computing quantities of Steel from the above table, add one lap for culverts up to 50'-0 in length and one Lap for each additional 25'-0 in length.

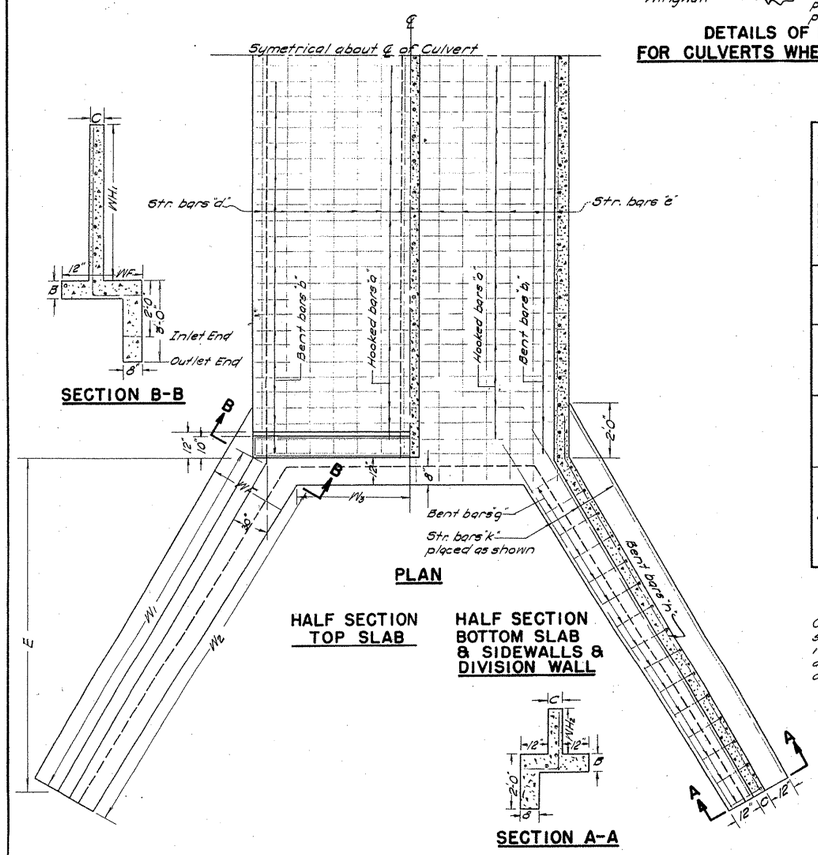
*SPECIFICATIONS:- Arkansas Standard Road and Bridge Specifications

*REINFORCING STEEL:- To be deformed bars of Structural or intermediate grade.

CHAMFER:- All exposed Corners to have 3/4" Chamfer.

CONCRETE:- All concrete to be Class A.

*REINFORCING STEEL to be deformed bars of intermediate or rail grade on all Interstate Highways.



STEEL SCHEDULE

For Culverts 30'-0 in Length: Out to Out of Barrel

NUMBER OF SPANS S	SPAN H	HEIGHT H	"a" bars (3" for 1/16" ϕ 5/8" bars; 4" for 3/4" & 7/8" bars; Z in each headwall balance in top & bottom slab of barrel) SIZE	SPACING	NUMBER	LENGTH	X
2	4	2			76	10'-2"	9'-5"
		3			76	10'-2"	9'-5"
		4	1/16" ϕ	10"	76	10'-2"	9'-5"
		6			76	10'-5"	9'-9"
2	5	2			60	12'-2"	11'-5"
		3			60	12'-2"	11'-5"
		4	5/8" ϕ	13"	60	12'-2"	11'-5"
		5			60	12'-2"	11'-5"
		7			60	12'-7"	11'-10"
2	6	3			60	14'-2"	13'-5"
		4			60	14'-2"	13'-5"
		5	5/8" ϕ	13"	60	14'-2"	13'-5"
		6			60	14'-5"	13'-8"
		8			60	14'-8"	13'-11"
2	8	3			70	16'-5"	17'-8"
		4			70	16'-5"	17'-8"
		5	5/8" ϕ	11"	70	16'-5"	17'-8"
		6			70	16'-5"	17'-8"
		7			70	16'-7"	17'-10"
		8			70	16'-8"	17'-11"
		10			70	16'-2"	18'-5"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"b" bars (3" for 1/16" ϕ 5/8" bars; 4" for 3/4" & 7/8" bars; In Top Slab of barrel Alt with "a" bars) SIZE	SPACING	NUMBER	LENGTH	X	Y	Z
2	4	2			36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		3			36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		4	1/16" ϕ	10"	36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		6			36	10'-8⅛"	0'-6½"	2'-0"	3'-5½"
2	5	2			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		3			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		4	5/8" ϕ	13"	28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		5			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		7			28	12'-11⅛"	0'-5"	2'-6"	4'-3"
2	6	3			28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		4			28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		5	5/8" ϕ	13"	28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		6			28	14'-11⅜"	0'-5"	2'-11"	4'-11⅛"
		8			28	15'-2⅜"	0'-5"	3'-0"	5'-0⅛"
2	8	3			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		4			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		5	5/8" ϕ	11"	33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		6			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		7			33	10'-3⅛"	0'-7"	3'-8"	6'-6⅛"
		8			33	10'-4⅛"	0'-7"	3'-8"	6'-6⅛"
		10			33	10'-10⅛"	0'-7"	3'-10"	6'-8⅛"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"bi" bars (3" for 1/16" ϕ 5/8" bars; 4" for 3/4" & 7/8" bars; In Bottom Slab of Barrel Alt. with "a" bars) SIZE	SPACING	NUMBER	LENGTH	X	Y	Z
2	4	2			36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		3			36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		4	1/16" ϕ	10"	36	10'-5⅛"	0'-4½"	1'-11"	3'-4½"
		6			36	10'-8⅛"	0'-6½"	2'-0"	3'-5½"
2	5	2			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		3			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		4	5/8" ϕ	13"	28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		5			28	12'-6⅛"	0'-5"	2'-4"	4'-1½"
		7			28	12'-11⅛"	0'-5"	2'-6"	4'-3"
2	6	3			28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		4			28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		5	5/8" ϕ	13"	28	14'-8⅜"	0'-5"	2'-10"	4'-10⅛"
		6			28	14'-11⅜"	0'-5"	2'-11"	4'-11⅛"
		8			28	15'-2⅜"	0'-5"	3'-0"	5'-0⅛"
2	8	3			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		4			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		5	5/8" ϕ	11"	33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		6			33	10'-1⅛"	0'-7"	3'-7"	6'-5⅛"
		7			33	10'-3⅛"	0'-7"	3'-8"	6'-6⅛"
		8			33	10'-4⅛"	0'-7"	3'-8"	6'-6⅛"
		10			33	10'-10⅛"	0'-7"	3'-10"	6'-8⅛"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"c" bars STRAIGHT (In Top & Bottom Slab of Barrel Alternate with "b" & "bi" bars) SIZE	SPACING	NUMBER	LENGTH
2	4	2			72	4'-8"
		3			72	4'-8"
		4	1/16" ϕ	10"	72	4'-8"
		6			72	4'-9"
2	5	2			56	5'-8"
		3			56	5'-8"
		4	5/8" ϕ	13"	56	5'-8"
		5			56	5'-8"
		7			56	5'-10"
2	6	3			56	6'-8"
		4			56	6'-8"
		5	5/8" ϕ	13"	56	6'-8"
		6			56	6'-9"
		8			56	6'-10"
2	8	3			66	8'-0"
		4			66	8'-0"
		5	5/8" ϕ	11"	66	8'-0"
		6			66	8'-0"
		7			66	8'-10"
		8			66	8'-10"
		10			66	9'-0"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"d" bars STRAIGHT 1/2" ϕ bars (In Top Slab of Barrel) SPACING	NUMBER	LENGTH	"di" bars STRAIGHT 1/2" ϕ bars (In Sidewalls & Division Walls) SPACING	NUMBER	LENGTH	"e" bars STRAIGHT 1/2" ϕ bars (In Bottom Slab of Barrel) SPACING	NUMBER	LENGTH
2	4	2		14			9			14	
		3		14			9			14	
		4	10½"	14		12"	12		10½"	14	
		6		14			20			14	
2	5	2		16			9			16	
		3		16			9			16	
		4	10½"	16		12"	12		10½"	16	
		5		16			10			16	
		7		16			24			16	
2	6	3		18			9			18	
		4		18			12			18	
		5	10⅜"	18		12"	16		10⅜"	18	
		6		18			20			18	
		8		18			28			18	
2	8	3		20			9			20	
		4		20			12			20	
		5	10"	20		12"	16		10"	20	
		6		20			20			20	
		7		20			24			20	
		8		20			28			20	
		10		20			36			20	

NUMBER OF SPANS S	SPAN H	HEIGHT H	"f" bars STRAIGHT Vertical bars in Sidewalls & Division Walls SIZE	SPACING	NUMBER	LENGTH
2	4	2			124	3'-0"
		3			124	4'-0"
		4	1/16" ϕ	12"	124	5'-0"
		6			124	7'-0"
2	5	2			124	3'-1"
		3			124	4'-1"
		4	1/16" ϕ	12"	124	5'-1"
		5			124	6'-1"
		7	5/8" ϕ		124	8'-1"
2	6	3			124	4'-2"
		4			124	5'-2"
		5	1/16" ϕ	12"	124	6'-8"
		6			124	7'-2"
		8	5/8" ϕ	12"	124	9'-2"
2	8	3			124	4'-6"
		4			124	5'-6"
		5	1/16" ϕ	12"	124	6'-6"
		6			124	7'-6"
		7	5/8" ϕ	12"	124	8'-6"
		8	5/8" ϕ	12"	124	9'-6"
		10	5/8" ϕ	10"	124	11'-6"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"g" bars (Vertical bars in backface of Wingwall, bent into bottom of footings) SIZE	SPACING	NUMBER	LENGTH	X Min	X Max	Y Min	Y Max	Z Min	Z Max
2	4	2			36	5'-6"	1'-3"	1'-3"	1'-4⅛"	3'-1½"	12	7'-11½"
		3			52	4'-0"	1'-3"	1'-3"	1'-5⅛"	4'-0½"	16	10'-7⅜"
		4	1/16" ϕ	12"	64	4'-8"	1'-3"	1'-3"	1'-10"	5'-0"	20	12'-6⅛"
		6			88	6'-8½"	1'-4"	2'-1"	2'-5⅜"	7'-0½"	28	16'-9⅜"
2	5	2			36	5'-7"	1'-3"	1'-3"	1'-6"	3'-2"	12	8'-9⅛"
		3			56	4'-1"	1'-3"	1'-3"	1'-6½"	4'-1½"	16	11'-0½"
		4	1/16" ϕ	12"	68	4'-9"	1'-3"	1'-3"	1'-0"	5'-3"	20	12'-1½"
		5			80	5'-7½"	1'-3"	1'-3"	2'-2"	6'-2"	24	15'-0⅛"
		7		12"	104	7'-6¼"	1'-4½"	2'-8"	2'-0"	8'-3"	32	19'-1½"
2	6	3			56	4'-1½"	1'-3"	1'-3"	1'-6⅛"	4'-2⅛"	16	11'-0½"
		4			68	4'-9½"	1'-3"	1'-3"	1'-0½"	5'-3½"	20	12'-1½"
		5	1/16" ϕ	12"	80	5'-8"	1'-3"	1'-3"	2'-2½"	6'-2½"	24	15'-0⅛"
		6			92	6'-7½"	1'-4"	2'-2"	2'-6⅜"	7'-2⅛"	28	17'-1⅜"
		8	5/8" ϕ	12"	116	8'-6"	1'-5"	2'-2"	3'-2⅛"	9'-2⅜"	36	21'-2⅛"
2	8	3			56	4'-5⅛"	1'-4"	1'-4"	1'-8¼"	4'-8⅜"	16	11'-9⅜"
		4			68	5'-1½"	1'-4"	1'-4"	2'-0⅜"	5'-6⅛"	20	13'-8⅜"
		5	1/16" ϕ	12"	84	6'-0"	1'-4"	1'-4"	2'-3⅛"	6'-7½"	24	15'-9⅜"
		6			96	6'-11"	1'-4"	2'-3"	2'-5"	7'-7"	28	17'-8⅜"
		7	5/8" ϕ	12"	108	7'-10⅛"	1'-4½"	2'-9"	3'-0½"	8'-8⅛"	32	19'-10⅜"
		8	5/8" ϕ	12"	120	8'-9½"	1'-5"	3'-3"	3'-5⅛"	9'-5⅜"	36	21'-11⅜"
		10	5/8" ϕ	10"	172	10'-8½"	1'-7"	4'-3"	4'-0½"	11'-6½"	44	26'-0⅜"

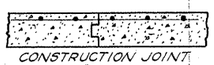
NUMBER OF SPANS S	SPAN H	HEIGHT H	"h" bars 1/2" ϕ bars @ 12 Centers (Horizontal bars in Wingwalls) SIZE	SPACING	NUMBER	LENGTH	Z Min	Z Max
2	4	2			20	3'-0½"	3'-0"	3'-0½"
		3			20	3'-0½"	3'-0"	3'-0½"
		4	1/2" ϕ	12"	20	3'-0½"	3'-0"	3'-0½"
		6			20	3'-0½"	3'-0"	3'-0½"
2	5	2			24	3'-1"	3'-0"	3'-1"
		3			24	3'-1"	3'-0"	3'-1"
		4	1/2" ϕ	12"	24	3'-1"	3'-0"	3'-1"
		5			24	3'-1"	3'-0"	3'-1"
		7			24	3'-1"	3'-0"	3'-1"
2	6	3			28	3'-1½"	3'-0"	3'-1½"
		4			28	3'-1½"	3'-0"	3'-1½"
		5	1/2" ϕ	12"	28	3'-1½"	3'-0"	3'-1½"
		6			28	3'-1½"	3'-0"	3'-1½"
		8			28	3'-1½"	3'-0"	3'-1½"
2	8	3			36	3'-3½"	3'-0"	3'-3½"
		4			36	3'-3½"	3'-0"	3'-3½"
		5	1/2" ϕ	12"	36	3'-3½"	3'-0"	3'-3½"
		6			36	3'-3½"	3'-0"	3'-3½"
		7			36	3'-3½"	3'-0"	3'-3½"
		8			36	3'-3½"	3'-0"	3'-3½"
		10			36	3'-3½"	3'-0"	3'-3½"

NUMBER OF SPANS S	SPAN H	HEIGHT H	"k" bars 1/2" ϕ bars STRAIGHT (In Wing Footings) SIZE	SPACING	NUMBER	LENGTH	"r" bars 1/2" ϕ bars @ 12 Ctrs (Dowels in H'dwalls) SIZE	SPACING	NUMBER	LENGTH	"s" bars 1/2" ϕ bars (In Top of each Wingwall) SIZE	SPACING	NUMBER	LENGTH	Z
2	4	2			12	5'-7½"			20	3'-0½"			12	9'-7½"	9'-1¼"
		3			12	7'-3½"			20	3'-0½"			12	14'-4"	13'-10"
		4	1/2" ϕ	12"	12	9'-1"	1/2" ϕ	12"	20	3'-0½"	1/2" ϕ	12"	12	17'-6⅛"	16'-11⅜"
		6			12	13'-6"			20	3'-0½"			12	23'-9⅜"	23'-3⅜"
2	5	2			12	5'-9"			24	3'-1"			12	10'-0½"	9'-6"
		3			12	7'-3"			24	3'-1"			12	14'-7⅜"	14'-2⅜"
		4	1/2" ϕ	12"	12	9'-1"	1/2" ϕ	12"	24	3'-1"	1/2" ϕ	12"	12	19'-10⅜"	19'-4⅜"
		5			12	11'-0"			24	3'-1"			12	21'-0⅜"	20'-6⅜"
		7			12	14'-7½"			24	3'-1"			12	27'-4"	26'-10"
2	6	3			12	5'-9½"			28	3'-1½"			12	10'-0½"	9'-6½"
		4			12	7'-3½"			28	3'-1½"			12	14'-7⅜"	14'-2⅜"
		5	1/2" ϕ	12"	12	9'-1½"	1/2" ϕ	12"	28	3'-1½"	1/2" ϕ	12"	12	19'-10⅜"	19'-4⅜"
		6			12	11'-0½"			28	3'-1½"			12	21'-0⅜"	20'-6⅜"
		8			12	14'-7½"			28	3'-1½"			12	27'-4"	26'-10"
2	8	3			12	5'-9⅜"			36	3'-3½"			12	10'-0½"	9'-6½"
		4			12	7'-3⅜"			36	3'-3½"			12	14'-7⅜"	14'-2⅜"
		5	1/2" ϕ	12"	12	9'-1⅜"	1/2" ϕ	12"	36	3'-3½"	1/2" ϕ	12"	12	19'-10⅜"	19'-4⅜"
		6			12	11'-0⅜"			36	3'-3½"			12	21'-0⅜"	20'-6⅜"
		7			12	14'-7⅜"			36	3'-3½"			12	27'-4⅜"	26'-10⅜"
		8			12	17'-6⅜"			36	3'-3½"			12	33'-8⅜"	33'-2⅜"
		10			12	23'-9⅜"			36	3'-3½"			12	46'-1⅜"	45'-7⅜"

NOTE:- Lengths given above do not include lap.

CONSTRUCTION JOINTS:- Construction joints in wing walls and apron slabs shall be made only where shown on the plans. Maximum length of culvert between headwalls for which continuous pours will be permitted is 75'. For longer culverts construction joints shall be provided in slabs and walls at intervals not greater than 50'. Joints shall be normal to ℄ of barrel and shall have 2" continuous keys.

Longitudinal reinforcing shall be continuous through joints.



CONSTRUCTION JOINT AND 2" KEY

A.A.S.H.O. DESIGN LIVE LOADING H20-S16 UNIT STRESSES

Concrete (n-18) - 840 Lbs. per Sq. In.
Reinf. Steel (Str. Gr.) 18000 Lbs. per Sq. In.

SPECIAL MILITARY LOADING

Add'l Loading For Interstate Highways
2-24,000 Lb. Axles @ 4'-0" Ctrs.
Concrete (n-16) - 840 Lbs. per Sq. In.
Reinf. Steel (Int. or Rail) - 20,000 Lbs. Per Sq. In.

REVISIONS	
March '58	Drawn
July '58	Construction Joints
April '67	Corrected "e" bar Length

ARKANSAS STATE HIGHWAY COMMISSION

REINFORCED CONCRETE BOX CULVERTS

4' TO 8' SPAN — 4:1 SLOPES
DOUBLE — OVER 3'-6" COVER

DRAWING NO. R-2004-A

16A

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel, 2 Add'l in Apron and Headwall - Each.
"b" bars — BENT - See Diagram below. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.
"b2" bars — BENT - See Diagram below. In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.
"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel.
"d1" bars — STRAIGHT — Longitudinal in Sidewalls and Division Walls.
"e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel.
"f" bars — STRAIGHT — Vertical in Sidewalls and Division Walls.

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
SECTION "A" & BAR GROUP "A"	3:1 = 22'-0"; 4:1 = 32'-0"	0' TO 10'-0"	2 @ 8'	5'	#5	13"	46	64	17'-8"	#6	13"	20	29	19'-1"	0'-5¾"	3'-8"	6'-6"
				6'			46	64	17'-8"			20	29	19'-1"	0'-5¾"	3'-8"	6'-6"
				7'			46	64	17'-10"			20	29	19'-3"	0'-5¾"	3'-9"	6'-6½"
				8'			46	64	17'-11"			20	29	19'-4"	0'-5¾"	3'-9"	6'-7"
				9'			46	64	18'-2"			20	29	19'-7"	0'-5¾"	3'-10"	6'-8"
				10'			46	64	18'-5"			20	29	19'-10"	0'-5¾"	3'-11"	6'-9"
			2 @ 10'	6'	#5	12"	48	68	21'-10"	#6	12"	22	32	23'-4"	0'-7¼"	4'-7½"	7'-11½"
				7'			48	68	21'-10"			22	32	23'-4"	0'-7¼"	4'-7½"	7'-11½"
				8'			48	68	21'-11"			22	32	23'-5"	0'-7¼"	4'-7½"	8'-0"
				9'			48	68	22'-2"			22	32	23'-8"	0'-7¼"	4'-8½"	8'-1"
				10'			48	68	22'-5"			22	32	23'-11"	0'-7¼"	4'-9½"	8'-2"
				11'			48	68	22'-7"			22	32	24'-1"	0'-7¼"	4'-9½"	8'-3"
				12'			48	68	22'-9"			22	32	24'-3"	0'-7¼"	4'-9½"	8'-4"
			2 @ 12'	6'	#5	11"	52	74	25'-11"	#7	11"	24	35	27'-8"	0'-8¾"	5'-4½"	9'-6"
				7'			52	74	25'-11"			24	35	27'-8"	0'-8¾"	5'-4½"	9'-6"
				8'			52	74	25'-11"			24	35	27'-8"	0'-8¾"	5'-4½"	9'-6"
				9'			52	74	26'-2"			24	35	27'-11"	0'-8¾"	5'-5½"	9'-7"
				10'			52	74	26'-5"			24	35	28'-2"	0'-8¾"	5'-6½"	9'-8"
				11'			52	74	26'-7"			24	35	28'-4"	0'-8¾"	5'-6½"	9'-9"
				12'			52	74	26'-9"			24	35	28'-6"	0'-8¾"	5'-6½"	9'-10"
SECTION "B" & BAR GROUP "B"	3:1 = 11'-0"; 4:1 = 16'-0"	10'-0" TO 15'-0"	2 @ 8'	5'	#5	12"	22	32	17'-8"	#6	12"	11	16	19'-2"	0'-6¾"	3'-6"	6'-6"
				6'			22	32	17'-8"			11	16	19'-2"	0'-6¾"	3'-6"	6'-6"
				7'			22	32	17'-10"			11	16	19'-4"	0'-6¾"	3'-7"	6'-6½"
				8'			22	32	17'-11"			11	16	19'-5"	0'-6¾"	3'-7"	6'-7"
				9'			22	32	18'-2"			11	16	19'-8"	0'-6¾"	3'-8"	6'-8"
				10'			22	32	18'-5"			11	16	19'-11"	0'-6¾"	3'-9"	6'-9"
			2 @ 10'	6'	#5	12"	22	32	21'-10"	#7	12"	11	16	23'-7"	0'-8½"	4'-5½"	7'-11½"
				7'			22	32	21'-10"			11	16	23'-7"	0'-8½"	4'-5½"	7'-11½"
				8'			22	32	21'-11"			11	16	23'-8"	0'-8½"	4'-5½"	8'-0"
				9'			22	32	22'-2"			11	16	23'-11"	0'-8½"	4'-6½"	8'-1"
				10'			22	32	22'-5"			11	16	24'-2"	0'-8½"	4'-7½"	8'-2"
				11'			22	32	22'-7"			11	16	24'-4"	0'-8½"	4'-7½"	8'-3"
				12'			22	32	22'-9"			11	16	24'-6"	0'-8½"	4'-7½"	8'-4"
			2 @ 12'	6'	#6	13"	20	30	25'-11"	#8	13"	10	15	28'-0"	0'-10½"	5'-1"	9'-6"
				7'			20	30	25'-11"			10	15	28'-0"	0'-10½"	5'-1"	9'-6"
				8'			20	30	25'-11"			10	15	28'-0"	0'-10½"	5'-1"	9'-6"
				9'			20	30	26'-2"			10	15	28'-3"	0'-10½"	5'-2"	9'-7"
				10'			20	30	26'-5"			10	15	28'-6"	0'-10½"	5'-3"	9'-8"
				11'			20	30	26'-7"			10	15	28'-8"	0'-10½"	5'-3"	9'-9"
				12'			20	30	26'-9"			10	15	28'-10"	0'-10½"	5'-3"	9'-10"
SECTION "C" & BAR GROUP "C"	3:1 = 11'-0"; 4:1 = 16'-0"	15'-0" TO 20'-0"	2 @ 8'	5'	#5	12"	22	32	17'-8"	#6	12"	11	16	19'-3"	0'-7¾"	3'-4"	6'-6"
				6'			22	32	17'-8"			11	16	19'-3"	0'-7¾"	3'-4"	6'-6"
				7'			22	32	17'-10"			11	16	19'-5"	0'-7¾"	3'-5"	6'-6½"
				8'			22	32	17'-11"			11	16	19'-6"	0'-7¾"	3'-5"	6'-7"
				9'			22	32	18'-2"			11	16	19'-9"	0'-7¾"	3'-6"	6'-8"
				10'			22	32	18'-5"			11	16	20'-0"	0'-7¾"	3'-7"	6'-9"
			2 @ 10'	6'	#6	13"	20	30	21'-11"	#8	13"	10	15	23'-11"	0'-9¾"	4'-2½"	8'-0"
				7'			20	30	21'-11"			10	15	23'-11"	0'-9¾"	4'-2½"	8'-0"
				8'			20	30	22'-0"			10	15	24'-0"	0'-9¾"	4'-2½"	8'-0½"
				9'			20	30	22'-3"			10	15	24'-3"	0'-9¾"	4'-3½"	8'-1½"
				10'			20	30	22'-5"			10	15	24'-6"	0'-9¾"	4'-4½"	8'-2½"
				11'			20	30	22'-7"			10	15	24'-7"	0'-9¾"	4'-4½"	8'-3"
				12'			20	30	22'-9"			10	15	24'-9"	0'-9¾"	4'-4½"	8'-4"
			2 @ 12'	6'	#6	11"	24	34	25'-11"	#8	11"	12	17	28'-2"	1'-0¼"	4'-9½"	9'-6"
				7'			24	34	25'-11"			12	17	28'-2"	1'-0¼"	4'-9½"	9'-6"
				8'			24	34	26'-0"			12	17	28'-3"	1'-0¼"	4'-9½"	9'-6¾"
				9'			24	34	26'-3"			12	17	28'-6"	1'-0¼"	4'-10½"	9'-7¾"
				10'			24	34	26'-5"			12	17	28'-8"	1'-0¼"	4'-11½"	9'-8¾"
				11'			24	34	26'-7"			12	17	28'-10"	1'-0¼"	4'-11½"	9'-9¾"
				12'			24	34	26'-9"			12	17	29'-0"	1'-0¼"	4'-11½"	9'-10¾"
SECTION "D" & BAR GROUP "D"	Varies with Length of Barrel	20'-0" TO 25'-0"	2 @ 8'	5'	#5	11"	Varies with length of Barrel.	Varies with length of Barrel.	17'-8"	#6	11"	Varies with length of Barrel.	Varies with length of Barrel.	19'-4"	0'-8¾"	3'-2"	6'-6"
				6'					17'-9"					19'-5"	0'-8¾"	3'-2"	6'-6½"
				7'					18'-0"					19'-8"	0'-8¾"	3'-3"	6'-7½"
				8'					18'-1"					19'-9"	0'-8¾"	3'-3"	6'-8"
				9'					18'-4"					20'-0"	0'-8¾"	3'-4"	6'-9"
				10'					18'-7"					20'-3"	0'-8¾"	3'-5"	6'-10"
			2 @ 10'	6'	#6	12"			21'-11"	#8	12"			24'-0"	0'-10¾"	4'-0½"	8'-0"
				7'					22'-0"					24'-1"	0'-10¾"	4'-0½"	8'-0½"
				8'					22'-1"					24'-3"	0'-10¾"	4'-0½"	8'-1½"
				9'					22'-4"					24'-6"	0'-10¾"	4'-1½"	8'-2½"
				10'					22'-7"					24'-9"	0'-10¾"	4'-2½"	8'-3½"
				11'					22'-9"					24'-10"	0'-10¾"	4'-2½"	8'-4"
				12'					22'-10"					25'-0"	0'-10¾"	4'-2½"	8'-4½"
			2 @ 12'	6'	#6	10"			25'-11"	#8	10"			28'-3"	1'-1¾"	4'-6½"	9'-6"
				7'					26'-0"					28'-4"	1'-1¾"	4'-6½"	9'-6¾"
				8'					26'-2"					28'-6"	1'-1¾"	4'-6½"	9'-7½"
				9'					26'-5"					28'-9"	1'-1¾"	4'-7½"	9'-8½"
				10'					26'-7"					28'-11"	1'-1¾"	4'-8½"	9'-9½"
				11'					26'-9"					29'-1"	1'-1¾"	4'-8½"	9'-10½"
				12'					26'-11"					29'-3"	1'-1¾"	4'-8½"	9'-11½"

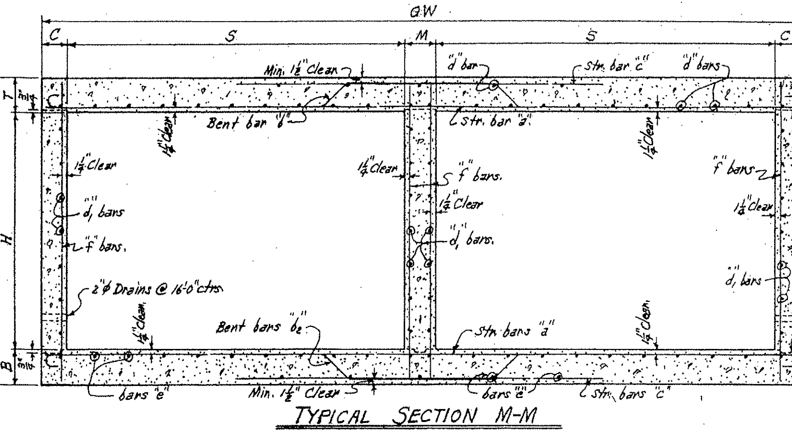
Section	S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
A	2 @ 8'	5'	#6	13"	20	29	19'-2"	0'-6¼"	3'-7"	6'-6"	#7	13"	42	60	8'-9"
A		6'			20	29	19'-2"	0'-6¼"	3'-7"	6'-6"			42	60	8'-9"
A		7'			20	29	19'-4"	0'-6¼"	3'-8"	6'-6½"			42	60	8'-10"
A		8'			20	29	19'-5"	0'-6¼"	3'-8"	6'-7"			42	60	8'-10"
A		9'			20	29	19'-8"	0'-6¼"	3'-9"	6'-8"			42	60	8'-11"
A		10'			20	29	19'-11"	0'-6¼"	3'-10"	6'-9"			42	60	9'-0"
A	2 @ 10'	6'	#6	12"	22	32	23'-5"	0'-8"	4'-6"	7'-11½"	#8	12"	44	64	10'-10"
A		7'			22	32	23'-5"	0'-8"	4'-6"	7'-11½"			44	64	10'-10"
A		8'			22	32	23'-6"	0'-8"	4'-6"	8'-0"			44	64	10'-10"
A		9'			22	32	23'-9"	0'-8"	4'-7"	8'-1"			44	64	10'-11"
A		10'			22	32	24'-0"	0'-8"	4'-8"	8'-2"			44	64	11'-0"
A		11'			22	32	24'-2"	0'-8"	4'-8"	8'-3"			44	64	11'-0"
A		12'			22	32	24'-4"	0'-8"	4'-8"	8'-4"			44	64	11'-0"
A	2 @ 12'	6'	#7	11"	24	35	27'-9"	0'-9¾"	5'-2½"	9'-6"	#8	11"	48	70	12'-10"
A		7'			24	35	27'-9"	0'-9¾"	5'-2½"	9'-6"			48	70	12'-10"
A		8'			24	35	27'-9"	0'-9¾"	5'-2½"	9'-6"			48	70	12'-10"
A		9'			24	35	28'-0"	0'-9¾"	5'-3½"	9'-7"			48	70	12'-11"
A		10'			24	35	28'-3"	0'-9¾"	5'-4½"	9'-8"			48	70	13'-0"
A		11'			24	35	28'-5"	0'-9¾"	5'-4½"	9'-9"			48	70	13'-0"
A		12'			24	35	28'-7"	0'-9¾"	5'-4½"	9'-10"			48	70	13'-0"
B	2 @ 8'	5'	#6	12"	11	16	19'-3"	0'-7¼"	3'-5"	6'-6"	#7	12"	22	32	8'-9"
B		6'			11	16	19'-3"	0'-7¼"	3'-5"	6'-6"			22	32	8'-9"
B		7'			11	16	19'-5"	0'-7¼"	3'-6"	6'-6½"			22	32	8'-10"
B		8'			11	16	19'-6"	0'-7¼"	3'-6"	6'-7"			22	32	8'-10"
B		9'			11	16	19'-9"	0'-7¼"	3'-7"	6'-8"			22	32	8'-11"
B		10'			11	16	20'-0"	0'-7¼"	3'-8"	6'-9"			22	32	9'-0"
B	2 @ 10'	6'	#7	12"	11	16	23'-8"	0'-9½"	4'-3½"	7'-11½"	#8	12"	22	32	10'-10"
B		7'			11	16	23'-8"	0'-9½"	4'-3½"	7'-11½"			22	32	10'-10"
B		8'			11	16	23'-9"	0'-9½"	4'-3½"	8'-0"			22	32	10'-10"
B		9'			11	16	24'-0"	0'-9½"	4'-4½"	8'-1"			22	32	10'-11"
B		10'			11	16	24'-3"	0'-9½"	4'-5½"	8'-2"			22	32	11'-0"
B		11'			11	16	24'-5"	0'-9½"	4'-5½"	8'-3"			22	32	11'-0"
B		12'			11	16	24'-7"	0'-9½"	4'-5½"	8'-4"			22	32	11'-0"
B	2 @ 12'	6'	#8	13"	10	15	28'-1"	0'-11½"	4'-11½"	9'-6"	#9	13"	20	30	12'-10"
B		7'			10	15	28'-1"	0'-11½"	4'-11½"	9'-6"			20	30	12'-10"
B		8'			10	15	28'-1"	0'-11½"	4'-11½"	9'-6"			20	30	12'-10"
B		9'			10	15	28'-4"	0'-11½"	5'-0½"	9'-7"			20	30	12'-11"
B		10'			10	15	28'-7"	0'-11½"	5'-1½"	9'-8"			20	30	13'-0"
B		11'			10	15	28'-9"	0'-11½"	5'-1½"	9'-9"			20	30	13'-0"
B		12'			10	15	28'-11"	0'-11½"	5'-1½"	9'-10"			20	30	13'-0"
C	2 @ 8'	5'	#6	12"	11	16	19'-3"	0'-8¼"	3'-3"	6'-6"	#8	12"	22	32	8'-9"
C		6'			11	16	19'-3"	0'-8¼"	3'-3"	6'-6"			22	32	8'-9"
C		7'			11	16	19'-5"	0'-8¼"	3'-4"	6'-6½"			22	32	8'-10"
C		8'			11	16	19'-6"	0'-8¼"	3'-4"	6'-7"			22	32	8'-10"
C		9'			11	16	19'-9"	0'-8¼"	3'-5"	6'-8"			22	32	8'-11"
C		10'			11	16	20'-0"	0'-8¼"	3'-6"	6'-9"			22	32	9'-0"
C	2 @ 10'	6'	#8	13"	10	15	24'-0"	0'-10½"	4'-1"	8'-0"	#9	13"	20	30	10'-10"
C		7'			10	15	24'-0"	0'-10½"	4'-1"	8'-0"			20	30	10'-10"
C		8'			10	15	24'-1"	0'-10½"	4'-1"	8'-0½"			20	30	10'-10"
C		9'			10	15	24'-4"	0'-10½"	4'-2"	8'-1½"			20	30	10'-11"
C		10'			10	15	24'-7"	0'-10½"	4'-3"	8'-2½"			20	30	11'-0"
C		11'			10	15	24'-8"	0'-10½"	4'-3"	8'-3"			20	30	11'-0"
C		12'			10	15	24'-10"	0'-10½"	4'-3"	8'-4"			20	30	11'-0"
C	2 @ 12'	6'	#8	11"	12	17	28'-2"	1'-0¾"	4'-8½"	9'-6"	#9	11"	24	34	12'-10"
C		7'			12	17	28'-2"	1'-0¾"	4'-8½"	9'-6"			24	34	12'-10"
C		8'			12	17	28'-3"	1'-0¾"	4'-8½"	9'-6¾"			24	34	12'-10"
C		9'			12	17	28'-6"	1'-0¾"	4'-9½"	9'-7¾"			24	34	12'-11"
C		10'			12	17	28'-8"	1'-0¾"	4'-10½"	9'-8¾"			24	34	13'-0"
C		11'			12	17	28'-10"	1'-0¾"	4'-10½"	9'-9¾"			24	34	13'-0"
C		12'			12	17	29'-0"	1'-0¾"	4'-10½"	9'-10¾"			24	34	13'-0"
D	2 @ 8'	5'	#6	11"	Varies with length of Barrel.	Varies with length of Barrel.	19'-4"	0'-9¼"	3'-1"	6'-6"	#8	11"	Varies with length of Barrel.	Varies with length of Barrel.	8'-9"
D		6'					19'-5"	0'-9¼"	3'-1"	6'-6½"					8'-9"
D		7'					19'-8"	0'-9¼"	3'-2"	6'-7½"					8'-10"
D		8'					19'-9"	0'-9¼"	3'-2"	6'-8"					8'-10"
D		9'					20'-0"	0'-9¼"	3'-3"	6'-9"					8'-11"
D		10'					20'-3"	0'-9¼"	3'-4"	6'-10"					9'-0"
D	2 @ 10'	6'	#8	12"			24'-1"	0'-11½"	3'-11"	8'-0"	#9	12"			10'-10"
D		7'					24'-2"	0'-11½"	3'-11"	8'-0½"					10'-10"
D		8'					24'-3"	0'-11½"	3'-11"	8'-1½"					10'-10"
D		9'					24'-6"	0'-11½"	4'-0"	8'-2½"					10'-11"
D		10'					24'-9"	0'-11½"	4'-1"	8'-3½"					11'-0"
D		11'					24'-11"	0'-11½"	4'-1"	8'-4"					11'-0"
D		12'					25'-0"	0'-11½"	4'-1"	8'-4½"					11'-0"
D	2 @ 12'	6'	#8	10"			28'-3"	1'-2¼"	4'-5½"	9'-6"	#9	10"			12'-10"
D		7'					28'-5"	1'-2¼"	4'-5½"	9'-6¾"					12'-10"
D		8'					28'-6"	1'-2¼"	4'-5½"	9'-7½"					12'-10"
D		9'					28'-9"	1'-2¼"	4'-6½"	9'-8½"					12'-11"
D		10'					29'-0"	1'-2¼"	4'-7½"	9'-9½"					13'-0"
D		11'					29'-2"	1'-2¼"	4'-7½"	9'-10½"					13'-0"
D		12'					29'-4"	1'-2¼"	4'-7½"	9'-11½"					13'-0"

Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
A	2 @ 8'	5'	#4	12"	23	33'-3" for 32'-0" Section	#4	12"	20	33'-3" for 32'-0" Section	#4	12"	23	34'-3" for 32'-0" Section	#4	12"	88	128	6'-4"
A		6'			23				24				23				88	128	7'-4"
A		7'			23				28				23			10"	108	156	8'-4"
A		8'			23				32				23		#5	11"	96	140	9'-4"
A		9'			23				36				23			10"	108	156	10'-4"
A		10'			23				40				23		#6	12"	88	128	11'-4"
A	2 @ 10'	6'	#4	12"	27		#4	12"	24		#4	12"	27		#4	12"	88	128	7'-7"
A		7'			27				28				27			10"	108	156	8'-7"
A		8'			27				32				27		#5	12"	88	128	9'-7"
A		9'			27				36				27			10"	108	156	10'-7"
A		10'			27				40				27			12"	88	128	11'-7"
A		11'			27				44				27		#6	11"	96	140	12'-7"
A		12'			27				48				27			10"	108	156	13'-7"
A	2 @ 12'	6'	#4	12"	31		#4	12"	24		#4	12"	31		#4	12"	88	128	7'-11"
A		7'			31				28				31				88	128	8'-11"
A		8'			31				32				31		#5	12"	88	128	9'-11"
A		9'			31				36				31			10"	108	156	10'-11"
A		10'			31				40				31			12"	88	128	11'-11"
A		11'			31				44				31		#6	11"	96	140	12'-11"
A		12'			31				48				31			9"	120	172	13'-11"
B	2 @ 8'	5'	#4	12"	23	34'-3" for 33'-0" Length Section	#4	12"	20	34'-3" for 33'-0" Length Section	#4	12"	23	34'-3" for 33'-0" Length Section	#4	12"	44	64	6'-6"
B		6'			23				24				23				44	64	7'-6"
B		7'			23				28				23		#5	12"	44	64	8'-6"
B		8'			23				32				23			9"	60	89	9'-6"
B		9'			23				36				23		#6	11"	48	68	10'-6"
B		10'			23				40				23			10"	56	80	11'-6"
B	2 @ 10'	6'	#4	12"	27		#4	12"	24		#4	12"	27		#4	12"	44	64	7'-10"
B		7'			27				28				27		#5	12"	44	64	8'-10"
B		8'			27				32				27			9"	60	88	9'-10"
B		9'			27				36				27		#6	12"	44	64	10'-10"
B		10'			27				40				27			10"	56	80	11'-10"
B		11'			27				44				27			9"	60	88	12'-10"
B		12'			27				48				27			8"	64	96	13'-10"
B	2 @ 12'	6'	#4	12"	31		#4	12"	24		#4	12"	31		#4	12"	44	64	8'-2"
B		7'			31				28				31			9"	60	88	9'-2"
B		8'			31				32				31		#6	12"	44	64	10'-2"
B		9'			31				36				31			11"	48	68	11'-2"
B		10'			31				40				31			9"	60	88	12'-2"
B		11'			31				44				31		#7	11"	48	72	13'-2"
B		12'			31				48				31			10"	52	76	14'-2"
C	2 @ 8'	5'	#4	12"	23		#4	12"	20		#4	12"	23		#4	12"	44	64	6'-8"
C		6'			23				24				23				44	64	7'-8"
C		7'			23				28				23		#5	11"	48	68	8'-8"
C		8'			23				32				23		#6	11"	48	68	9'-8"
C		9'			23				36				23			10"	52	76	10'-8"
C		10'			23				40				23		#7	10"	52	76	11'-8"
C	2 @ 10'	6'	#4	12"	27		#4	12"	24		#4	12"	27		#4	12"	44	64	8'-0"
C		7'			27				28				27		#5	12"	44	64	9'-0"
C		8'			27				32				27		#6	12"	44	64	10'-0"
C		9'			27				36				27			10"	52	76	11'-0"
C		10'			27				40				27			12"	44	64	12'-0"
C		11'			27				44				27		#7	10"	52	76	13'-0"
C		12'			27				48				27			9"	60	84	14'-0"
C	2 @ 12'	6'	#4	11"	33		#4	12"	24		#4	11"	33		#4	12"	44	64	8'-5"
C		7'			33				28				33		#5	11"	48	68	9'-5"
C		8'			33				32				33		#6	12"	44	64	10'-5"
C		9'			33				36				33			10"	52	76	11'-5"
C		10'			33				40				33			11"	48	68	12'-5"
C		11'			33				44				33		#7	10"	56	76	13'-5"
C		12'			33				48				33			8"	64	96	14'-5"
D	2 @ 8'	5'	#4	12"	23	Varies with length of Barrel.	#4	12"	20	Varies with length of Barrel.	#4	12"	23	Varies with length of Barrel.	#4	12"	Varies with length of Barrel.	Varies with length of Barrel.	6'-10"
D		6'			23				24				23			10"			7'-10"
D		7'			23				28				23		#5	10"			8'-10"
D		8'			23				32				23			11"			9'-10"
D		9'			23				36				23		#6	9"			10'-10"
D		10'			23				40				23			8"			11'-10"
D	2 @ 10'	6'	#4	12"	27		#4	12"	24		#4	12"	27		#4	12"			8'-2"
D		7'			27				28				27		#5	11"			9'-2"
D		8'			27				32				27		#6	12"			10'-2"
D		9'			27				36				27			10"			11'-2"
D		10'			27				40				27		#7	11"			12'-2"
D		11'			27				44				27			9"			13'-2"
D		12'			27				48				27			8"			14'-2"
D	2 @ 12'	6'	#4	10½"	35		#4	12"	24		#4	10½"	35		#4	12"			8'-8"
D		7'			35				28				35		#5	11"			9'-8"
D		8'			35				32				35		#6	12"			10'-8"
D		9'			35				36				35			10"			11'-8"
D		10'			35				40				35			11"			12'-8"
D		11'			35				44				35		#7	9"			13'-8"
D		12'			35				48				35			8"			14'-8"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

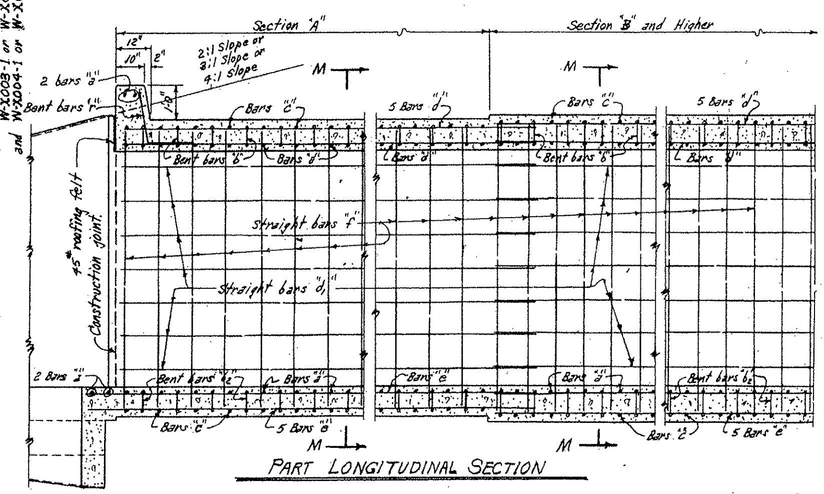
DIMENSIONS — QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU.YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
SECTION "A" - 10'-0"	2 @ 8'	5'	80	17'-11"	9¼"	7"	9"	9¾"	6'-7"	1.406	181.08	55.11	250.28
		6'	96	17'-11"		7"	9"		7'-7"	1.477	186.42	58.45	250.28
		7'	112	18'-1"		7½"	10"		8'-7"	1.601	197.32	61.79	251.67
		8'	128	18'-2"		8"	10"		9'-7"	1.707	216.14	65.13	252.37
		9'	144	18'-5"		9"	11"		10'-7"	1.886	229.56	68.47	254.46
		10'	160	18'-8"		10"	12"		11'-7"	2.082	250.08	71.81	256.54
	2 @ 10'	6'	120	22'-1"	10¾"	7½"	10"	11½"	7'-10½"	1.979	245.98	65.13	315.55
		7'	140	22'-1"		7½"	10"		8'-10½"	2.057	265.91	68.47	315.55
		8'	160	22'-2"		8"	10"		9'-10½"	2.164	271.47	71.81	316.25
		9'	180	22'-5"		9"	11"		10'-10½"	2.345	288.86	75.15	318.34
		10'	200	22'-8"		10"	12"		11'-10½"	2.544	309.86	78.49	320.42
		11'	220	22'-10"		11"	12"		12'-10½"	2.722	326.26	81.83	321.81
		12'	240	23'-0"		12"	12"		13'-10½"	2.913	345.84	85.17	323.20
	2 @ 12'	6'	144	26'-2"	12½"	8"	10"	13½"	8'-2"	2.581	335.91	71.81	383.92
		7'	168	26'-2"		8"	10"		9'-2"	2.662	341.25	75.15	383.92
		8'	192	26'-2"		8"	10"		10'-2"	2.742	361.47	78.49	383.92
		9'	216	26'-5"		9"	11"		11'-2"	2.925	379.59	81.83	386.00
		10'	240	26'-8"		10"	12"		12'-2"	3.128	401.88	85.17	388.09
		11'	264	26'-10"		11"	12"		13'-2"	3.308	418.23	88.51	389.48
		12'	288	27'-0"		12"	12"		14'-2"	3.500	448.85	91.85	390.87
SECTION "B" - 15'-0"	2 @ 8'	5'	80	17'-11"	10¼"	7"	9"	10¾"	6'-9"	1.516	191.78	55.11	
		6'	96	17'-11"		7"	9"		7'-9"	1.587	197.13	58.45	
		7'	112	18'-1"		7½"	10"		8'-9"	1.712	216.41	61.79	
		8'	128	18'-2"		8"	10"		9'-9"	1.819	236.89	65.13	
		9'	144	18'-5"		9"	11"		10'-9"	1.999	257.15	68.47	
		10'	160	18'-8"		10"	12"		11'-9"	2.198	275.52	71.81	
	2 @ 10'	6'	120	22'-1"	12"	7½"	10"	13"	8'-1"	2.167	273.01	65.13	
		7'	140	22'-1"		7½"	10"		9'-1"	2.244	291.60	68.47	
		8'	160	22'-2"		8"	10"		10'-1"	2.352	312.64	71.81	
		9'	180	22'-5"		9"	11"		11'-1"	2.535	327.68	75.15	
		10'	200	22'-8"		10"	12"		12'-1"	2.737	352.57	78.49	
		11'	220	22'-10"		11"	12"		13'-1"	2.916	373.76	81.83	
		12'	240	23'-0"		12"	12"		14'-1"	3.108	399.33	85.17	
	2 @ 12'	6'	144	26'-2"	14¼"	8"	10"	15"	8'-5¼"	2.849	369.91	71.81	
		7'	168	26'-2"		8"	10"		9'-5¼"	2.929	383.42	75.15	
		8'	192	26'-2"		8"	10"		10'-5¼"	3.004	414.52	78.49	
		9'	216	26'-5"		9"	11"		11'-5¼"	3.190	431.74	81.83	
		10'	240	26'-8"		10"	12"		12'-5¼"	3.395	461.14	85.17	
		11'	264	26'-10"		11"	12"		13'-5¼"	3.577	485.07	88.51	
		12'	288	27'-0"		12"	12"		14'-5¼"	3.771	510.58	91.85	
SECTION "C" - 20'-0"	2 @ 8'	5'	80	17'-11"	11¼"	7"	9"	11¾"	6'-11"	1.627	203.81	55.11	
		6'	96	17'-11½"		7½"	9"		7'-11"	1.710	208.65	58.45	
		7'	112	18'-1½"		7¾"	10"		8'-11"	1.838	231.57	61.79	
		8'	128	18'-2½"		8½"	10"		9'-11"	1.947	258.58	65.13	
		9'	144	18'-5½"		9½"	11"		10'-11"	2.130	276.32	68.47	
		10'	160	18'-8½"		10½"	12"		11'-11"	2.331	318.47	71.81	
	2 @ 10'	6'	120	22'-2"	13½"	8"	10"	14½"	8'-3¾"	2.380	320.35	65.13	
		7'	140	22'-2"		8"	10"		9'-3¾"	2.460	339.19	68.47	
		8'	160	22'-3"		8½"	10"		10'-3¾"	2.572	365.09	71.81	
		9'	180	22'-6"		9½"	11"		11'-3¾"	2.760	389.39	75.15	
		10'	200	22'-8½"		10½"	12"		12'-3¾"	2.948	413.08	78.49	
		11'	220	22'-10"		11"	12"		13'-3¾"	3.110	446.06	81.83	
		12'	240	23'-0"		12"	12"		14'-3¾"	3.303	475.09	85.17	
	2 @ 12'	6'	144	26'-2"	16"	8"	10"	16½"	8'-8½"	3.106	426.82	75.15	
		7'	168	26'-2"		8"	10"		9'-8½"	3.186	449.87	78.49	
		8'	192	26'-3½"		8½"	10"		10'-8½"	3.316	473.02	81.83	
		9'	216	26'-6"		9½"	11"		11'-8½"	3.492	498.31	85.17	
		10'	240	26'-8½"		10½"	12"		12'-8½"	3.682	531.56	88.51	
		11'	264	26'-10½"		11½"	12"		13'-8½"	3.867	556.63	91.85	
		12'	288	27'-0½"		12½"	12"		14'-8½"	4.064	605.99	95.19	
SECTION "D" - 25'-0"	2 @ 8'	5'	80	17'-11"	12¼"	7"	9"	12¾"	7'-1"	1.737	216.88	55.11	
		6'	96	18'-0½"		7½"	9"		8'-1"	1.846	226.87	58.45	
		7'	112	18'-3"		8¼"	10"		9'-1"	1.992	250.52	61.79	
		8'	128	18'-4½"		9¼"	10"		10'-1"	2.122	278.89	65.13	
		9'	144	18'-7"		10"	11"		11'-1"	2.295	300.76	68.47	
		10'	160	18'-10"		11"	12"		12'-1"	2.503	325.17	71.81	
	2 @ 10'	6'	120	22'-2"	14½"	8"	10"	15¼"	8'-5¾"	2.517	341.89	65.13	
		7'	140	22'-3"		8½"	10"		9'-5¾"	2.626	365.08	68.47	
		8'	160	22'-4½"		9½"	10"		10'-5¾"	2.758	388.03	71.81	
		9'	180	22'-7½"		10½"	11"		11'-5¾"	2.952	412.78	75.15	
		10'	200	22'-10½"		11½"	12"		12'-5¾"	3.165	446.12	78.49	
		11'	220	23'-0"		12"	12"		13'-5¾"	3.334	489.97	81.83	
		12'	240	23'-1½"		12½"	12"		14'-5¾"	3.512	518.79	85.17	
	2 @ 12'	6'	144	26'-2"	17½"	8"	10"	18"	8'-11½"	3.349	465.12	78.49	
		7'	168	26'-3½"		8½"	10"		9'-11½"	3.475	489.73	81.83	
		8'	192	26'-5"		9½"	10"		10'-11½"	3.610	513.90	85.17	
		9'	216	26'-8"		10½"	11"		11'-11½"	3.811	539.78	88.51	
		10'	240	26'-10½"		11½"	12"		12'-11½"	4.009	578.93	91.85	
		11'	264	27'-0½"		12½"	12"		13'-11½"	4.202	619.28	95.19	
		12'	288	27'-2½"		13½"	12"		14'-11½"	4.407	649.51	98.53	

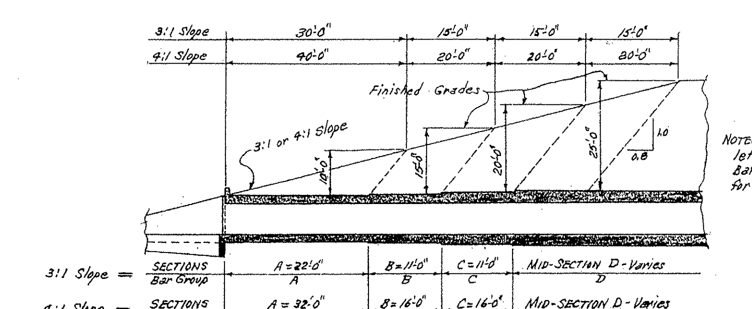


TYPICAL SECTION M-M

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2.



PART LONGITUDINAL SECTION



NOTE:- See Table at lower left for SECTIONS and Bar Groups to be used for Various Depths of Cover.

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

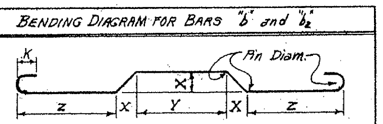
NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.
To use this Drawing for skewed culverts, multiply the length of each section by the secant of the skew angle. For 15° by 1.0353, for 30° by 1.1547, and for 45° by 1.4142.

REVISIONS:-
Wing Drwg. Nos.- W.C.H. 1-14-63.

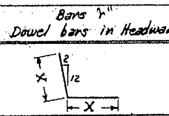
Bar Size	Pin Diam.	K	Add for 2 Hooks
#6	3"	5"	1'-1½"
#7	3½"	5¾"	1'-3¾"
#8	4"	6½"	1'-6"

BENDING DIAGRAM FOR BARS "b" and "b2"



Dowel Bars for Two Headwalls: S	Size	Spacing	No. Req'd	Length	X
8'	#4	12½"	36	3'-0"	1'-6"
10'	#4	12½"	46	3'-2"	1'-7"
12'	#4	12"	54	3'-6"	1'-9"

Bars "r" Dowel bars in Headwalls



NOTE:- Dimension are to centers of bars. ("b" and "b2").

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	Mid-Section and Bar Group
5.0' to 9.5'	✓			A
10.0' to 14.5'	✓			B
15.0' to 19.5'	✓	✓		C
20.0' to 25.0'	✓	✓	✓	D

GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

8', 10' & 12' SPANS — 3:1 OR 4:1 SLOPES
DOUBLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-200X-X2

Designed by:- W.C. Haigh 6-26-62 Checked by:- R.H.S. 7-16-62
Drawn by:- W.C. Haigh 7-6-62 Checked by:- R.H.S. 7-20-62
Quantities by:- W.C. Haigh 7-5-62 Checked by:- R.H.S. 7-19-62

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars – BENT - See Diagram below. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Spans S	Clear Height H	"a" Size	"a" Spacing	"a" No. 3:1	"a" No. 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. 3:1	"b" No. 4:1	"b" Length	X	Y	Z
SECTION "A" & BAR GROUP "A"	3:1 = 22'-0"; 4:1 = 32'-0"	0' TO 10'-0"	2 @ 7'	5'	#4	12"	48	68	15'-5"	#6	12"	22	32	16'-10"	0'-4¾"	3'-4½"	5'-7"
				6'			48	68	15'-8"			22	32	17'-1"	0'-4¾"	3'-5½"	5'-8"
				7'			48	68	15'-10"			22	32	17'-3"	0'-4¾"	3'-6½"	5'-8½"
				8'			48	68	15'-11"			22	32	17'-4"	0'-4¾"	3'-6½"	5'-9"
				9'			48	68	16'-2"			22	32	17'-7"	0'-4¾"	3'-7½"	5'-10"
			2 @ 9'	6'	#5	11"	52	74	19'-10"	#6	11"	24	35	21'-4"	0'-6½"	4'-3"	7'-2½"
				7'			52	74	19'-10"			24	35	21'-4"	0'-6½"	4'-3"	7'-2½"
				8'			52	74	19'-11"			24	35	21'-5"	0'-6½"	4'-3"	7'-3"
				9'			52	74	20'-2"			24	35	21'-8"	0'-6½"	4'-4"	7'-4"
				10'			52	74	20'-5"			24	35	21'-11"	0'-6½"	4'-5"	7'-5"
				11'			52	74	20'-7"			24	35	22'-1"	0'-6½"	4'-5"	7'-6"
			2 @ 11'	6'	#5	12"	48	68	23'-11"	#7	12"	22	32	25'-8"	0'-8"	5'-0"	8'-9"
				7'			48	68	23'-11"			22	32	25'-8"	0'-8"	5'-0"	8'-9"
				8'			48	68	23'-11"			22	32	25'-8"	0'-8"	5'-0"	8'-9"
				9'			48	68	24'-2"			22	32	25'-11"	0'-8"	5'-1"	8'-10"
				10'			48	68	24'-5"			22	32	26'-2"	0'-8"	5'-2"	8'-11"
				11'			48	68	24'-7"			22	32	26'-4"	0'-8"	5'-2"	9'-0"
				12'			48	68	24'-9"			22	32	26'-6"	0'-8"	5'-2"	9'-1"
SECTION "B" & BAR GROUP "B"	3:1 = 11'-0"; 4:1 = 16'-0"	10'-0" TO 15'-0"	2 @ 7'	5'	#5	13"	20	30	15'-5"	#6	13"	10	15	16'-10"	0'-5¾"	3'-2½"	5'-7"
				6'			20	30	15'-8"			10	15	17'-1"	0'-5¾"	3'-3½"	5'-8"
				7'			20	30	15'-10"			10	15	17'-3"	0'-5¾"	3'-4½"	5'-8½"
				8'			20	30	15'-11"			10	15	17'-4"	0'-5¾"	3'-4½"	5'-9"
				9'			20	30	16'-2"			10	15	17'-7"	0'-5¾"	3'-5½"	5'-10"
			2 @ 9'	6'	#5	13"	20	30	19'-10"	#7	13"	10	14	21'-7"	0'-7½"	4'-1"	7'-2½"
				7'			20	30	19'-10"			10	14	21'-7"	0'-7½"	4'-1"	7'-2½"
				8'			20	30	19'-11"			10	14	21'-8"	0'-7½"	4'-1"	7'-3"
				9'			20	30	20'-2"			10	14	21'-11"	0'-7½"	4'-2"	7'-4"
				10'			20	30	20'-5"			10	14	22'-2"	0'-7½"	4'-3"	7'-5"
				11'			20	30	20'-7"			10	14	22'-4"	0'-7½"	4'-3"	7'-6"
			2 @ 11'	6'	#6	11"	24	36	23'-11"	#7	11"	12	17	25'-9"	0'-9½"	4'-9"	8'-9"
				7'			24	36	23'-11"			12	17	25'-9"	0'-9½"	4'-9"	8'-9"
				8'			24	36	23'-11"			12	17	25'-9"	0'-9½"	4'-9"	8'-9"
				9'			24	36	24'-2"			12	17	26'-0"	0'-9½"	4'-10"	8'-10"
				10'			24	36	24'-5"			12	17	26'-3"	0'-9½"	4'-11"	8'-11"
				11'			24	36	24'-7"			12	17	26'-5"	0'-9½"	4'-11"	9'-0"
				12'			24	36	24'-9"			12	17	26'-7"	0'-9½"	4'-11"	9'-1"
SECTION "C" & BAR GROUP "C"	3:1 = 11'-0"; 4:1 = 16'-0"	15'-0" TO 20'-0"	2 @ 7'	5'	#5	12"	22	32	15'-6"	#6	12"	11	16	17'-0"	0'-6½"	3'-1"	5'-7½"
				6'			22	32	15'-8"			11	16	17'-2"	0'-6½"	3'-2"	5'-8"
				7'			22	32	15'-10"			11	16	17'-4"	0'-6½"	3'-3"	5'-8½"
				8'			22	32	15'-11"			11	16	17'-5"	0'-6½"	3'-3"	5'-9¼"
				9'			22	32	16'-2"			11	16	17'-8"	0'-6½"	3'-4"	5'-10"
			2 @ 9'	6'	#6	12"	22	32	19'-10"	#7	12"	11	17	21'-8"	0'-8¾"	3'-10½"	7'-2½"
				7'			22	32	19'-11"			11	17	21'-9"	0'-8¾"	3'-10½"	7'-3"
				8'			22	32	20'-0"			11	17	21'-10"	0'-8¾"	3'-10½"	7'-3½"
				9'			22	32	20'-2"			11	17	22'-0"	0'-8¾"	3'-11½"	7'-4¼"
				10'			22	32	20'-5"			11	17	22'-3"	0'-8¾"	4'-0½"	7'-5¼"
				11'			22	32	20'-7"			11	17	22'-5"	0'-8¾"	4'-0½"	7'-6"
			2 @ 11'	6'	#6	12"	22	32	23'-11"	#8	12"	11	16	26'-0"	0'-11"	4'-6"	8'-9"
				7'			22	32	23'-11"			11	16	26'-0"	0'-11"	4'-6"	8'-9"
				8'			22	32	24'-0"			11	16	26'-2"	0'-11"	4'-6"	8'-9¾"
				9'			22	32	24'-3"			11	16	26'-4"	0'-11"	4'-7"	8'-10½"
				10'			22	32	24'-5"			11	16	26'-7"	0'-11"	4'-8"	8'-11¼"
				11'			22	32	24'-7"			11	16	26'-9"	0'-11"	4'-8"	9'-0¼"
				12'			22	32	24'-9"			11	16	26'-10"	0'-11"	4'-8"	9'-1"
SECTION "D" & BAR GROUP "D"	3:1 = 11'-0"; 4:1 = 16'-0"	20'-0" TO 25'-0"	2 @ 7'	5'	#5	11"	26	36	15'-6"	#6	11"	12	17	17'-1"	0'-7½"	2'-11"	5'-7¾"
				6'			26	36	15'-9"			12	17	17'-4"	0'-7½"	3'-0"	5'-8½"
				7'			26	36	15'-11"			12	17	17'-6"	0'-7½"	3'-1"	5'-9¼"
				8'			26	36	16'-1"			12	17	17'-8"	0'-7½"	3'-1"	5'-10"
				9'			26	36	16'-3"			12	17	17'-10"	0'-7½"	3'-2"	5'-10¾"
	Varies with Length of Barrel.		2 @ 9'	6'	#6	11"	Varies with length of Barrel.	Varies with length of Barrel.	19'-11"	#7	11"	Varies with length of Barrel.	Varies with length of Barrel.	21'-10"	0'-9¾"	3'-8½"	7'-3"
				7'					20'-0"					21'-11"	0'-9¾"	3'-8½"	7'-3½"
				8'					20'-1"					22'-0"	0'-9¾"	3'-8½"	7'-4½"
				9'					20'-4"					22'-3"	0'-9¾"	3'-9½"	7'-5"
				10'					20'-7"					22'-6"	0'-9¾"	3'-10½"	7'-6"
				11'					20'-9"					22'-8"	0'-9¾"	3'-10½"	7'-7"
			2 @ 11'	6'	#6	11"			23'-11"	#8	11"			26'-1"	1'-0¼"	4'-3½"	8'-9"
				7'					24'-0"					26'-3"	1'-0¼"	4'-3½"	8'-9¾"
				8'					24'-2"					26'-4"	1'-0¼"	4'-3½"	8'-10½"
				9'					24'-5"					26'-7"	1'-0¼"	4'-4½"	8'-11½"
				10'					24'-7"					26'-10"	1'-0¼"	4'-5½"	9'-0¼"
				11'					24'-9"					27'-0"	1'-0¼"	4'-5½"	9'-1¼"
				12'					24'-11"					27'-1"	1'-0¼"	4'-5½"	9'-2"
SECTION "E", BAR GRP "E"	Varies with Length of Barrel.	25'-0" TO 30'-0"	2 @ 7'	5'	#5	10"			15'-7"	#6	10"			17'-2"	0'-8½"	2'-9½"	5'-8"
				6'					15'-10"					17'-5"	0'-8½"	2'-10½"	5'-9"
				7'					16'-1"					17'-8"	0'-8½"	2'-11½"	5'-10"
				8'					16'-2"					17'-10"	0'-8½"	2'-11½"	5'-10¾"
				9'					16'-5"					18'-0"	0'-8½"	3'-0½"	5'-11½"

"b2" bars – BENT - See Diagram below. In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.
"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.

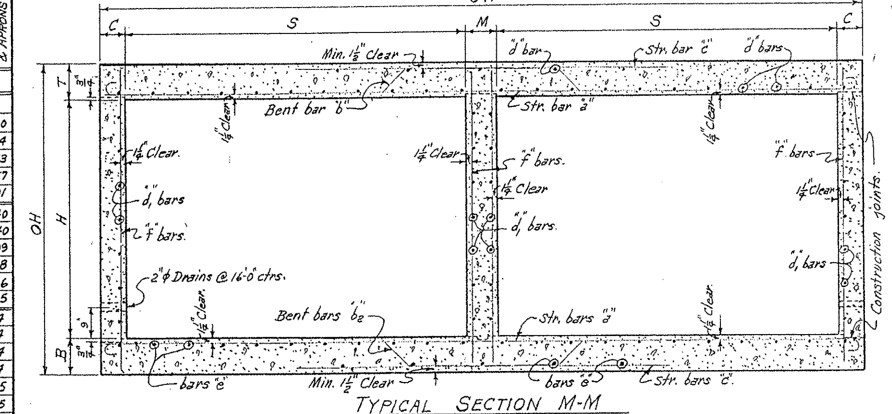
Section	S	H	"b2" Size	"b2" Spacing	"b2" No. 3:1	"b2" No. 4:1	"b2" Length	X	Y	Z	"c" Size	"c" Spacing	"c" No. 3:1	"c" No. 4:1	"c" Length
A	2 @ 7'	5'	#6	12"	22	32	16'-10"	0'-5¼"	3'-3½"	5'-7"	#6	12"	44	64	7'-8"
		6'			22	32	17'-1"	0'-5¼"	3'-4½"	5'-8"			44	64	7'-9"
		7'			22	32	17'-3"	0'-5¼"	3'-5½"	5'-8½"			44	64	7'-10"
		8'			22	32	17'-4"	0'-5¼"	3'-5½"	5'-9"			44	64	7'-10"
		9'			22	32	17'-7"	0'-5¼"	3'-6½"	5'-10"			44	64	7'-11"
	2 @ 9'	6'	#6	11"	24	35	21'-5"	0'-7¾"	4'-1½"	7'-2½"	#7	11"	48	70	9'-10"
		7'			24	35	21'-5"	0'-7¾"	4'-1½"	7'-2½"			48	70	9'-10"
		8'			24	35	21'-6"	0'-7¾"	4'-1½"	7'-3"			48	70	9'-10"
		9'			24	35	21'-9"	0'-7¾"	4'-2½"	7'-4"			48	70	9'-11"
		10'			24	35	22'-0"	0'-7¾"	4'-3½"	7'-5"			48	70	10'-0"
		11'			24	35	22'-2"	0'-7¾"	4'-3½"	7'-6"			48	70	10'-0"
	2 @ 11'	6'	#7	12"	22	32	25'-9"	0'-8¾"	4'-10½"	8'-9"	#8	12"	44	64	11'-10"
		7'			22	32	25'-9"	0'-8¾"	4'-10½"	8'-9"			44	64	11'-10"
		8'			22	32	25'-9"	0'-8¾"	4'-10½"	8'-9"			44	64	11'-10"
		9'			22	32	26'-0"	0'-8¾"	4'-11½"	8'-10"			44	64	11'-11"
		10'			22	32	26'-3"	0'-8¾"	5'-0½"	8'-11"			44	64	12'-0"
		11'			22	32	26'-5"	0'-8¾"	5'-0½"	9'-0"			44	64	12'-0"
		12'			22	32	26'-7"	0'-8¾"	5'-0½"	9'-1"			44	64	12'-0"
B	2 @ 7'	5'	#6	13"	10	15	16'-11"	0'-6¼"	3'-1½"	5'-7"	#7	13"	20	30	7'-8"
		6'			10	15	17'-2"	0'-6¼"	3'-2½"	5'-8"			20	30	7'-9"
		7'			10	15	17'-4"	0'-6¼"	3'-3½"	5'-8½"			20	30	7'-10"
		8'			10	15	17'-5"	0'-6¼"	3'-3½"	5'-9"			20	30	7'-10"
		9'			10	15	17'-8"	0'-6¼"	3'-4½"	5'-10"			20	30	7'-11"
	2 @ 9'	6'	#7	13"	10	14	21'-7"	0'-8¼"	3'-11½"	7'-2½"	#8	13"	20	30	9'-10"
		7'			10	14	21'-7"	0'-8¼"	3'-11½"	7'-2½"			20	30	9'-10"
		8'			10	14	21'-8"	0'-8¼"	3'-11½"	7'-3"			20	30	9'-10"
		9'			10	14	21'-11"	0'-8¼"	4'-0½"	7'-4"			20	30	9'-11"
		10'			10	14	22'-2"	0'-8¼"	4'-1½"	7'-5"			20	30	10'-0"
		11'			10	14	22'-4"	0'-8¼"	4'-1½"	7'-6"			20	30	10'-0"
	2 @ 11'	6'	#7	11"	12	17	25'-10"	0'-10¼"	4'-7½"	8'-9"	#8	11"	24	36	11'-10"
		7'			12	17	25'-10"	0'-10¼"	4'-7½"	8'-9"			24	36	11'-10"
		8'			12	17	25'-10"	0'-10¼"	4'-7½"	8'-9"			24	36	11'-10"
		9'			12	17	26'-1"	0'-10¼"	4'-8½"	8'-10"			24	36	11'-11"
		10'			12	17	26'-4"	0'-10¼"	4'-9½"	8'-11"			24	36	12'-0"
		11'			12	17	26'-6"	0'-10¼"	4'-9½"	9'-0"			24	36	12'-0"
		12'			12	17	26'-8"	0'-10¼"	4'-9½"	9'-1"			24	36	12'-0"
C	2 @ 7'	5'	#6	12"	11	16	17'-1"	0'-7½"	2'-11"	5'-7½"	#7	12"	22	32	7'-8"
		6'			11	16	17'-3"	0'-7½"	3'-0"	5'-8"			22	32	7'-9"
		7'			11	16	17'-5"	0'-7½"	3'-1"	5'-8½"			22	32	7'-10"
		8'			11	16	17'-6"	0'-7½"	3'-1"	5'-9¼"			22	32	7'-10"
		9'			11	16	17'-9"	0'-7½"	3'-2"	5'-10"			22	32	7'-11"
	2 @ 9'	6'	#7	12"	11	17	21'-8"	0'-9½"	3'-9½"	7'-2½"	#8	12"	22	32	9'-10"
		7'			11	17	21'-9"	0'-9½"	3'-9½"	7'-3"			22	32	9'-10"
		8'			11	17	21'-10"	0'-9½"	3'-9½"	7'-3½"			22	32	9'-10"
		9'			11	17	22'-1"	0'-9½"	3'-10½"	7'-4¼"			22	32	9'-11"
		10'			11	17	22'-4"	0'-9½"	3'-11½"	7'-5¼"			22	32	10'-0"
		11'			11	17	22'-5"	0'-9½"	3'-11½"	7'-6"			22	32	10'-0"
	2 @ 11'	6'	#8	12"	11	16	26'-1"	0'-11¾"	4'-4½"	8'-9"	#9	12"	22	32	11'-10"
		7'			11	16	26'-1"	0'-11¾"	4'-4½"	8'-9"			22	32	11'-10"
		8'			11	16	26'-3"	0'-11¾"	4'-4½"	8'-9¾"			22	32	11'-10"
		9'			11	16	26'-5"	0'-11¾"	4'-5½"	8'-10½"			22	32	11'-11"
		10'			11	16	26'-8"	0'-11¾"	4'-6½"	8'-11¼"			22	32	12'-0"
		11'			11	16	26'-10"	0'-11¾"	4'-6½"	9'-0¼"			22	32	12'-0"
		12'			11	16	26'-11"	0'-11¾"	4'-6½"	9'-1"			22	32	12'-0"
D	2 @ 7'	5'	#6	11"	12	17	17'-2"	0'-8½"	2'-9"	5'-7¾"	#7	11"	26	36	7'-8"
		6'			12	17	17'-5"	0'-8½"	2'-10"	5'-8½"			26	36	7'-9"
		7'			12	17	17'-7"	0'-8½"	2'-11"	5'-9¼"			26	36	7'-10"
		8'			12	17	17'-9"	0'-8½"	2'-11"	5'-10"			26	36	7'-10"
		9'			12	17	17'-11"	0'-8½"	3'-0"	5'-10¾"			26	36	7'-11"
	2 @ 9'	6'	#7	11"	Varies with length of Barrel.	Varies with length of Barrel.	21'-10"	0'-10½"	3'-7½"	7'-3"	#8	11"	Varies with length of Barrel.	Varies with length of Barrel.	9'-10"
		7'					21'-11"	0'-10½"	3'-7½"	7'-3½"					9'-10"
		8'					22'-0"	0'-10½"	3'-7½"	7'-4½"					9'-10"
		9'					22'-3"	0'-10½"	3'-8½"	7'-5"					9'-11"
		10'					22'-6"	0'-10½"	3'-9½"	7'-6"					10'-0"
		11'					22'-8"	0'-10½"	3'-9½"	7'-7"					10'-0"
	2 @ 11'	6'	#8	11"			26'-2"	1'-1¼"	4'-1½"	8'-9"	#9	11"			11'-10"
		7'					26'-4"	1'-1¼"	4'-1½"	8'-9¾"					11'-10"
		8'					26'-5"	1'-1¼"	4'-1½"	8'-10½"					11'-10"
		9'					26'-8"	1'-1¼"	4'-2½"	8'-11½"					11'-11"
		10'					26'-11"	1'-1¼"	4'-3½"	9'-0¼"					12'-0"
		11'					27'-1"	1'-1¼"	4'-3½"	9'-1¼"					12'-0"
		12'					27'-2"	1'-1¼"	4'-3½"	9'-2"					12'-0"
E	2 @ 7'	5'	#6	10"			17'-3"	0'-9½"	2'-7½"	5'-8"	#7	10"			7'-8"
		6'					17'-6"	0'-9½"	2'-8½"	5'-9"					7'-9"
		7'					17'-9"	0'-9½"	2'-9½"	5'-10"					7'-10"
		8'					17'-11"	0'-9½"	2'-9½"	5'-10¾"					7'-10"
		9'					18'-1"	0'-9½"	2'-10½"	5'-11½"					7'-11"

"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Wall.
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
"f" bars – STRAIGHT – Vertical in Sidewalls and Division Wall.

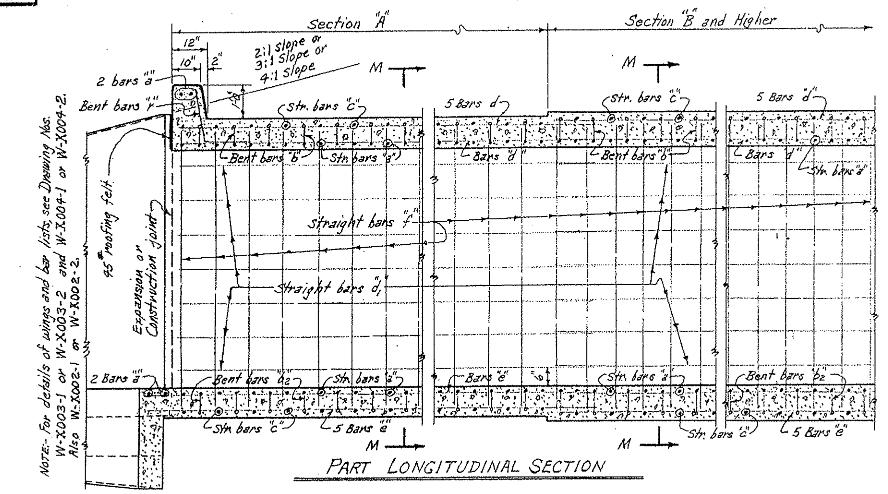
Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. 3:1	"f" No. 4:1	"f" Length
A	2 @ 7'	5'	#4	12"	21	33'-3" for 32'-0" Section	#4	12"	20	33'-3" for 32'-0" Section	#4	12"	21	34'-3" for 32'-0" Section	#4	12"	88	129	6'-2"
		6'			21				24				21			12"	88	128	7'-2"
		7'			21				28				21			12"	88	128	8'-2"
		8'			21				32				21		#5	11"	96	140	9'-2"
		9'			21				36				21			10"	108	156	10'-2"
	2 @ 9'	6'	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	88	128	7'-5"
		7'			25				28				25			10"	108	156	8'-5"
		8'			25				32				25		#5	12"	88	128	9'-5"
		9'			25				36				25			10"	108	156	10'-5"
		10'			25				40				25		#6	12"	88	128	11'-5"
		11'			25				44				25			11"	96	140	12'-5"
	2 @ 11'	6'	#4	12"	29		#4	12"	24		#4	12"	29		#4	12"	88	128	7'-9"
		7'			29				28				29			11"	96	140	8'-9"
		8'			29				32				29		#5	12"	88	128	9'-9"
		9'			29				36				29			10"	108	156	10'-9"
		10'			29				40				29			12"	88	128	11'-9"
		11'			29				44				29		#6	11"	96	140	12'-9"
		12'			29				48				29			9"	120	172	13'-9"
B	2 @ 7'	5'	#4	12"	21	34'-3" for 33'-0" Length Section	#4	12"	20	34'-3" for 33'-0" Length Section	#4	12"	21	34'-3" for 33'-0" Length Section	#4	12"	44	64	6'-4"
		6'			21				24				21			11"	48	72	7'-4"
		7'			21				28				21		#5	12"	44	64	8'-4"
		8'			21				32				21		#6	12"	44	64	9'-4"
		9'			21				36				21			11"	48	68	10'-4"
	2 @ 9'	6'	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	44	64	7'-8"
		7'			25				28				25		#5	12"	44	64	8'-8"
		8'			25				32				25			12"	44	64	9'-8"
		9'			25				36				25		#6	11"	48	68	10'-8"
		10'			25				40				25			10"	56	80	11'-8"
		11'			25				44				25		#7	12"	44	64	12'-8"
	2 @ 11'	6'	#4	12"	29		#4	12"	24		#4	12"	29		#4	12"	44	64	8'-0"
		7'			29				28				29		#5	12"	44	64	9'-0"
		8'			29				32				29			12"	44	64	10'-0"
		9'			29				36				29		#6	11"	48	68	11'-0"
		10'			29				40				29			9"	60	88	12'-0"
		11'			29				44				29		#7	11"	48	72	13'-0"
		12'			29				48				29			10"	52	76	14'-0"
C	2 @ 7'	5'	#4	12"	21		#4	12"	20		#4	12"	21		#4	12"	44	64	6'-6"
		6'			21				24				21			10"	56	76	7'-6"
		7'			21				28				21		#5	10"	56	80	8'-6"
		8'			21				32				21		#6	10"	56	76	9'-6"
		9'			21				36				21		#7	12"	44	64	10'-6"
	2 @ 9'	6'	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	44	64	7'-10"
		7'			25				28				25		#5	11"	48	68	8'-10"
		8'			25				32				25		#6	12"	44	64	9'-10"
		9'			25				36				25			10"	52	76	10'-10"
		10'			25				40				25		#7	11"	48	68	11'-10"
		11'			25				44				25			10"	56	76	12'-10"
	2 @ 11'	6'	#4	12"	29		#4	12"	24		#4	12"	29		#4	12"	44	64	8'-3"
		7'			29				28				29		#5	12"	44	64	9'-3"
		8'			29				32				29		#6	12"	44	64	10'-3"
		9'			29				36				29			11"	48	72	11'-3"
		10'			29				40				29		#7	12"	44	64	12'-3"
		11'			29				44				29			10"	56	76	13'-3"
		12'			29				48				29			9"	56	84	14'-3"
D	2 @ 7'	5'	#4	12"	21	Varies with length of Barrel.	#4	12"	20	Varies with length of Barrel.	#4	12"	21	Varies with length of Barrel.	#4	12"	44	64	6'-8"
		6'			21				24				21		#5	12"	44	64	7'-8"
		7'			21				28				21			12"	44	64	8'-8"
		8'			21				32				21		#6	10"	52	80	9'-8"
		9'			21				36				21		#7	12"	44	64	10'-8"
	2 @ 9'	6'	#4	12"	25		#4	12"	24		#4	12"	25		#4	11"	Varies with length of Barrel.	Varies with length of Barrel.	8'-0"
		7'			25				28				25		#5	11"			9'-0"
		8'			25				32				25		#6	11"			10'-0"
		9'			25				36				25			12"			11'-0"
		10'			25				40				25		#7	10"			12'-0"
		11'			25				44				25			9"			13'-0"
	2 @ 11'	6'	#4	12"	29		#4	12"	24		#4	12"	29		#4	11"			8'-6"
		7'			29				28				29		#5	12"			9'-6"
		8'			29				32				29			12"			10'-6"
		9'			29				36				29		#6	11"			11'-6"
		10'			29				40				29			12"			12'-6"
		11'			29				44				29		#7	10"			13'-6"
		12'			29				48				29			8"			14'-6"
E	2 @ 7'	5'	#4	12"	21		#4	12"	20		#4	12"	21		#4	12"			6'-9"
		6'			21				24				21		#5	12"			7'-9"
		7'			21				28				21			12"			8'-9"
		8'			21				32				21		#6	10"			9'-9"
		9'			21				36				21		#7	11"			10'-9"

DIMENSIONS / QUANTITIES

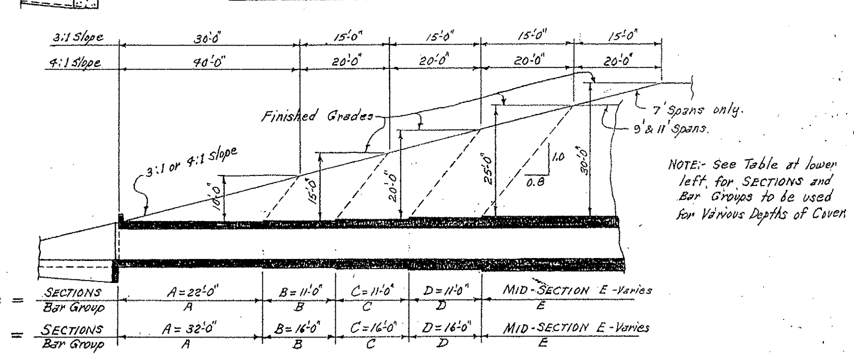
Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU.YD.	Reinf. Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
SECTION "A" ~ 10'-0"	2 @ 7'	5'	70	15'-8"	8¼"	6"	8"	8¾"	6'-5"	1.131	152.09	51.77	172.90
		6'	84	15'-11"		7"	9"		7'-5"	1.261	158.77	55.11	174.24
		7'	98	16'-1"		7½"	10"		8'-5"	1.384	177.33	58.45	175.13
		8'	112	16'-2"		8"	10"		9'-5"	1.490	188.02	61.79	175.57
		9'	126	16'-5"		9"	11"		10'-5"	1.667	201.20	65.13	176.91
	2 @ 9'	6'	108	20'-1"	10"	7½"	10"	10¾"	7'-8¾"	1.749	228.28	61.79	285.40
		7'	126	20'-1"		7½"	10"		8'-8¾"	1.826	238.13	65.13	285.40
		8'	144	20'-2"		8"	10"		9'-8¾"	1.934	253.56	68.47	286.09
		9'	162	20'-5"		9"	11"		10'-8¾"	2.113	270.86	71.81	288.18
		10'	180	20'-8"		10"	12"		11'-8¾"	2.311	291.73	75.15	290.26
		11'	198	20'-10"		11"	12"		12'-8¾"	2.489	301.12	78.49	291.65
	2 @ 11'	6'	132	24'-2"	11¾"	8"	10"	12½"	8'-0¼"	2.290	293.66	68.47	349.64
		7'	154	24'-2"		8"	10"		9'-0¼"	2.370	301.13	71.81	349.64
		8'	176	24'-2"		8"	10"		10'-0¼"	2.451	318.97	75.15	349.64
		9'	198	24'-5"		9"	11"		11'-0¼"	2.633	336.78	78.49	352.64
		10'	220	24'-8"		10"	12"		12'-0¼"	2.834	358.21	81.83	355.65
		11'	242	24'-10"		11"	12"		13'-0¼"	3.013	374.88	85.17	357.65
		12'	264	25'-0"		12"	12"		14'-0¼"	3.204	405.17	88.51	359.65
SECTION "B" ~ 15'-0"	2 @ 7'	5'	70	15'-8"	9¼"	6"	8"	9¾"	6'-7"	1.227	163.75	51.77	
		6'	84	15'-11"		7"	9"		7'-7"	1.359	172.36	55.11	
		7'	98	16'-1"		7½"	10"		8'-7"	1.483	189.52	58.45	
		8'	112	16'-2"		8"	10"		9'-7"	1.590	213.89	61.79	
		9'	126	16'-5"		9"	11"		10'-7"	1.768	229.71	65.13	
	2 @ 9'	6'	108	20'-1"	11¼"	7½"	10"	12"	7'-11¼"	1.904	238.02	61.79	
		7'	126	20'-1"		7½"	10"		8'-11¼"	1.981	256.37	65.13	
		8'	144	20'-2"		8"	10"		9'-11¼"	2.089	281.43	68.47	
		9'	162	20'-5"		9"	11"		10'-11¼"	2.271	297.78	71.81	
		10'	180	20'-8"		10"	12"		11'-11¼"	2.471	316.48	75.15	
		11'	198	20'-10"		11"	12"		12'-11¼"	2.649	339.56	78.49	
	2 @ 11'	6'	132	24'-2"	13¼"	8"	10"	14"	8'-3¼"	2.514	338.49	68.47	
		7'	154	24'-2"		8"	10"		9'-3¼"	2.594	357.33	71.81	
		8'	176	24'-2"		8"	10"		10'-3¼"	2.675	382.53	75.15	
		9'	198	24'-5"		9"	11"		11'-3¼"	2.859	399.64	78.49	
		10'	220	24'-8"		10"	12"		12'-3¼"	3.062	428.76	81.83	
		11'	242	24'-10"		11"	12"		13'-3¼"	3.293	452.55	85.17	
		12'	264	25'-0"		12"	12"		14'-3¼"	3.436	477.92	88.51	
SECTION "C" ~ 20'-0"	2 @ 7'	5'	70	15'-9"	10"	6½"	8"	11"	6'-9"	1.345	173.65	51.77	
		6'	84	15'-11"		7"	9"		7'-9"	1.458	184.19	55.11	
		7'	98	16'-1"		7½"	10"		8'-9"	1.583	206.55	58.45	
		8'	112	16'-2½"		8¼"	10"		9'-9"	1.705	235.59	61.79	
		9'	126	16'-5"		9"	11"		10'-9"	1.870	257.24	65.13	
	2 @ 9'	6'	108	20'-1"	12½"	7½"	10"	13"	8'-1½"	2.044	271.03	61.79	
		7'	126	20'-2"		8"	10"		9'-1½"	2.149	293.56	65.13	
		8'	144	20'-3"		8½"	10"		10'-1½"	2.260	315.70	68.47	
		9'	162	20'-5½"		9½"	11"		11'-1½"	2.430	339.19	71.81	
		10'	180	20'-8½"		10½"	12"		12'-1½"	2.633	371.53	75.15	
		11'	198	20'-10"		11"	12"		13'-1½"	2.794	395.57	78.49	
	2 @ 11'	6'	132	24'-2"	14¾"	8"	10"	15½"	8'-6¼"	2.738	368.20	68.47	
		7'	154	24'-2"		8"	10"		9'-6¼"	2.818	387.42	71.81	
		8'	176	24'-3½"		8¾"	10"		10'-6¼"	2.947	414.22	75.15	
		9'	198	24'-6"		9½"	11"		11'-6¼"	3.121	431.25	78.49	
		10'	220	24'-8½"		10½"	12"		12'-6¼"	3.310	462.75	81.83	
		11'	242	24'-10½"		11¼"	12"		13'-6¼"	3.494	496.65	85.17	
		12'	264	25'-0"		12"	12"		14'-6¼"	3.667	525.61	88.51	
SECTION "D" ~ 25'-0"	2 @ 7'	5'	70	15'-9½"	11"	6¾"	8"	12"	6'-11"	1.453	184.81	51.77	
		6'	84	16'-0"		7½"	9"		7'-11"	1.580	203.42	55.11	
		7'	98	16'-2½"		8¼"	10"		8'-11"	1.723	227.47	58.45	
		8'	112	16'-4"		9"	10"		9'-11"	1.851	248.69	61.79	
		9'	126	16'-6½"		9¾"	11"		10'-11"	2.021	270.18	65.13	
	2 @ 9'	6'	108	20'-2"	13½"	8"	10"	14"	8'-3½"	2.193	292.67	61.79	
		7'	126	20'-3"		8½"	10"		9'-3½"	2.302	313.63	65.13	
		8'	144	20'-4½"		9½"	10"		10'-3½"	2.433	341.53	68.47	
		9'	162	20'-7"		10"	11"		11'-3½"	2.608	371.01	71.81	
		10'	180	20'-10"		11"	12"		12'-3½"	2.818	403.90	75.15	
		11'	198	21'-0"		12"	12"		13'-3½"	3.005	431.85	78.49	
	2 @ 11'	6'	132	24'-2"	16"	8"	10"	17"	8'-9"	2.943	397.90	68.47	
		7'	154	24'-3½"		8¾"	10"		9'-9"	3.068	416.68	71.81	
		8'	176	24'-5"		9½"	10"		10'-9"	3.203	443.83	75.15	
		9'	198	24'-8"		10½"	11"		11'-9"	3.401	461.68	78.49	
		10'	220	24'-10½"		11¼"	12"		12'-9"	3.598	493.80	81.83	
		11'	242	25'-0½"		12¼"	12"		13'-9"	3.790	528.24	85.17	
		12'	264	25'-2"		13"	12"		14'-9"	3.971	577.32	88.51	
SECTION "E" ~ 30'-0"	2 @ 7'	5'	70	15'-10"	11¾"	7"	8"	12¾"	7'-0½"	1.537	198.10	51.77	
		6'	84	16'-1"		8"	9"		8'-0½"	1.679	217.01	55.11	
		7'	98	16'-4"		9"	10"		9'-0½"	1.840	241.85	58.45	
		8'	112	16'-5½"		9¾"	10"		10'-0½"	1.973	263.06	61.79	
		9'	126	16'-8"		10½"	11"		11'-0½"	2.149	292.95	65.13	



TYPICAL SECTION M-M



PART LONGITUDINAL SECTION



NOTE:- See Table at lower left for SECTIONS and Bar Groups to be used for Various Depths of Cover.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

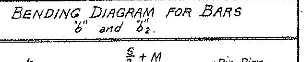
REVISIONS:- Size bar "a" & quant. Sect. "A" - 2@11', W.C.H. 2-28-64.
Size bar "a" & quant. Sect. "B" - 2@9', W.C.H. 1-13-65

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

Bar Size	Pin Diam.	K	Add for 2 Hooks
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"
#8	4"	6½"	1'-6"

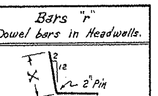
BENDING DIAGRAM FOR BARS "b" and "b2".



NOTE:- Dimensions are to centers of bars. ("b" and "b2").

Dowel Bars for Two Headwalls: S	Size	Spacing	No. Req'd	Length	X
7'	#4	12"±	34	2'-9"	1'-4½"
9'	#4	12"±	42	3'-1"	1'-6½"
11'	#4	12"±	50	3'-4"	1'-8"

Bars "r" – Dowel bars in Headwalls.



GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n = 10) 1200#/□"
Reinforcing Steel 20,000#/□"

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C or D	4:1 Slopes Sections A	4:1 Slopes Sections B, C or D
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	25.403'	12.702'	36.950'	18.475'
45°	1.4142	31.113'	15.556'	45.255'	22.627'

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	Mid-Section and Bar Group
5.0' to 9.5'	✓				A
10.0' to 14.5'	✓				B
15.0' to 19.5'	✓	✓			C
20.0' to 25.0'	✓	✓	✓		D
25.0' to 30.0'	✓	✓	✓	✓	E

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

7', 9' & 11' SPANS — 3:1 OR 4:1 SLOPES
DOUBLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-200X-X3

Designed by:- W.C.H. 1-29-63. Checked by:- RHS 5-29-63
Drawn by:- W.C.H. 3-25-63. Checked by:- RHS 6-17-63
Quantities by:- W.C.H. 5-2-63. Checked by:- RHS 6-17-63

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

"a" bars: STRAIGHT — In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars: BENT - See Diagram below. — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
"b2" bars: BENT - See Diagram below. — In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars: STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"d" bars: STRAIGHT — Longitudinal in Top Slab of Barrel.
"d1" bars: STRAIGHT — Longitudinal in Sidewalls and Division Walls.
"e" bars: STRAIGHT — Longitudinal in Bottom Slab of Barrel.
"f" bars: STRAIGHT — Vertical in Sidewalls and Division Walls.

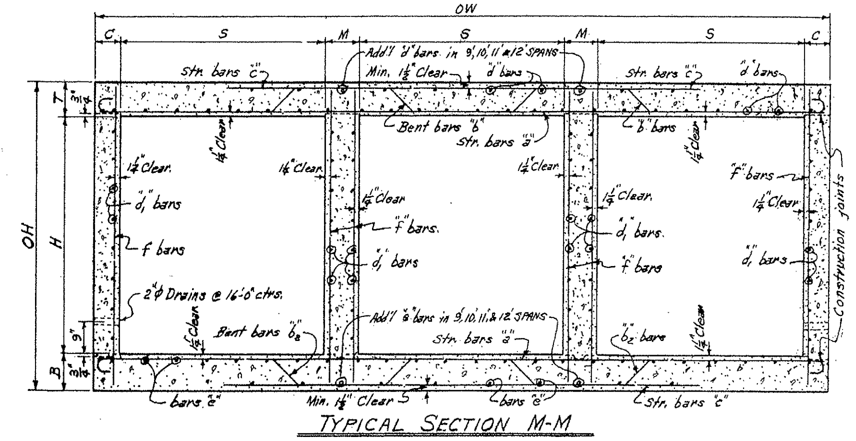
D (Depth of Cover)	S (Clear Span)	H (Clear Height)	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
0'-0" TO 5'-0" MAXIMUM	3 @ 4'	2'	#5	12"	128	128	14'-1"	#5	12"	59	59	15'-4"	0'-3"	2'-2"	3'-4¼"
		3'			128	128	14'-1"			59	59	15'-4"	0'-3"	2'-2"	3'-4¼"
		4'			128	128	14'-1"			59	59	15'-4"	0'-3"	2'-2"	3'-4¼"
		5'			128	128	14'-1"			59	59	15'-4"	0'-3"	2'-2"	3'-4¼"
		6'			128	128	14'-5"			59	59	15'-8"	0'-3"	2'-3"	3'-5¼"
	3 @ 5'	3'	#6	12"	128	128	17'-1"	#5	12"	59	59	18'-5"	0'-3½"	2'-7"	4'-1⅛"
		4'			128	128	17'-1"			59	59	18'-5"	0'-3½"	2'-7"	4'-1⅛"
		5'			128	128	17'-1"			59	59	18'-5"	0'-3½"	2'-7"	4'-1⅛"
		6'			128	128	17'-5"			59	59	18'-9"	0'-3½"	2'-8"	4'-2⅛"
		7'			128	128	17'-8"			59	59	19'-0"	0'-3½"	2'-9"	4'-2¾"
	3 @ 6'	3'	#6	11"	140	140	20'-1"	#5	11"	65	65	21'-6"	0'-4"	3'-0"	4'-10½"
		4'			140	140	20'-1"			65	65	21'-6"	0'-4"	3'-0"	4'-10½"
		5'			140	140	20'-1"			65	65	21'-6"	0'-4"	3'-0"	4'-10½"
		6'			140	140	20'-5"			65	65	21'-10"	0'-4"	3'-1"	4'-11½"
		7'			140	140	20'-8"			65	65	22'-1"	0'-4"	3'-2"	4'-11¾"
		8'			140	140	20'-9"			65	65	22'-2"	0'-4"	3'-2"	5'-0¼"
	3 @ 7'	4'	#6	12"	128	128	23'-1"	#6	12"	59	59	24'-8"	0'-4½"	3'-5"	5'-7"
		5'			128	128	23'-1"			59	59	24'-8"	0'-4½"	3'-5"	5'-7"
		6'			128	128	23'-5"			59	59	25'-0"	0'-4½"	3'-6"	5'-8"
		7'			128	128	23'-8"			59	59	25'-3"	0'-4½"	3'-7"	5'-8½"
		8'			128	128	23'-9"			59	59	25'-4"	0'-4½"	3'-7"	5'-9"
		9'			128	128	24'-1"			59	59	25'-8"	0'-4½"	3'-8"	5'-10"
	3 @ 8'	4'	#6	11"	140	140	26'-1"	#6	11"	65	65	27'-9"	0'-5"	3'-10"	6'-4"
		5'			140	140	26'-5"			65	65	28'-1"	0'-5"	3'-11"	6'-5"
		6'			140	140	26'-5"			65	65	28'-1"	0'-5"	3'-11"	6'-5"
		7'			140	140	26'-8"			65	65	28'-4"	0'-5"	4'-0"	6'-5½"
		8'			140	140	26'-9"			65	65	28'-5"	0'-5"	4'-0"	6'-6"
		9'			140	140	27'-1"			65	65	28'-9"	0'-5"	4'-1"	6'-7"
		10'			140	140	27'-5"			65	65	29'-1"	0'-5"	4'-2"	6'-8"
	3 @ 9'	5'	#6	11"	140	140	29'-5"	#6	11"	65	65	31'-2"	0'-5½"	4'-4"	7'-2"
		6'			140	140	29'-8"			65	65	31'-5"	0'-5½"	4'-5"	7'-2½"
		7'			140	140	29'-8"			65	65	31'-5"	0'-5½"	4'-5"	7'-2½"
		8'			140	140	29'-9"			65	65	31'-6"	0'-5½"	4'-5"	7'-3"
		9'			140	140	30'-1"			65	65	31'-10"	0'-5½"	4'-6"	7'-4"
		10'			140	140	30'-5"			65	65	32'-2"	0'-5½"	4'-7"	7'-5"
		11'			140	140	30'-7"			65	65	32'-4"	0'-5½"	4'-7"	7'-6"
	3 @ 10'	5'	#7	12"	128	128	32'-5"	#6	12"	59	59	34'-3"	0'-6"	4'-9"	7'-11"
		6'			128	128	32'-8"			59	59	34'-6"	0'-6"	4'-10"	7'-11½"
		7'			128	128	32'-8"			59	59	34'-6"	0'-6"	4'-10"	7'-11½"
		8'			128	128	32'-9"			59	59	34'-7"	0'-6"	4'-10"	8'-0"
		9'			128	128	33'-1"			59	59	34'-11"	0'-6"	4'-11"	8'-1"
		10'			128	128	33'-5"			59	59	35'-3"	0'-6"	5'-0"	8'-2"
		11'			128	128	33'-7"			59	59	35'-5"	0'-6"	5'-0"	8'-3"
		12'			128	128	33'-9"			59	59	35'-7"	0'-6"	5'-0"	8'-4"
	3 @ 11'	6'	#7	11"	140	140	35'-9"	#6	11"	65	65	37'-8"	0'-6½"	5'-3"	8'-9"
		7'			140	140	35'-9"			65	65	37'-8"	0'-6½"	5'-3"	8'-9"
		8'			140	140	35'-9"			65	65	37'-8"	0'-6½"	5'-3"	8'-9"
		9'			140	140	36'-1"			65	65	38'-0"	0'-6½"	5'-4"	8'-10"
		10'			140	140	36'-5"			65	65	38'-4"	0'-6½"	5'-5"	8'-11"
		11'			140	140	36'-7"			65	65	38'-6"	0'-6½"	5'-5"	9'-0"
		12'			140	140	36'-9"			65	65	38'-8"	0'-6½"	5'-5"	9'-1"
	3 @ 12'	6'	#7	11"	140	140	38'-9"	#6	11"	65	65	40'-9"	0'-7"	5'-8"	9'-6"
		7'			140	140	38'-9"			65	65	40'-9"	0'-7"	5'-8"	9'-6"
		8'			140	140	38'-9"			65	65	40'-9"	0'-7"	5'-8"	9'-6"
		9'			140	140	39'-1"			65	65	41'-1"	0'-7"	5'-9"	9'-7"
		10'			140	140	39'-5"			65	65	41'-5"	0'-7"	5'-10"	9'-8"
		11'			140	140	39'-7"			65	65	41'-7"	0'-7"	5'-10"	9'-9"
		12'			140	140	39'-9"			65	65	41'-9"	0'-7"	5'-10"	9'-10"

S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
3 @ 4'	2'	#5	12"	59	59	15'-3"	0'-2½"	2'-3"	3'-4¼"	#5	12"	120	120	9'-4"
	3'			59	59	15'-3"	0'-2½"	2'-3"	3'-4¼"			120	120	9'-4"
	4'			59	59	15'-3"	0'-2½"	2'-3"	3'-4¼"			120	120	9'-4"
	5'			59	59	15'-3"	0'-2½"	2'-3"	3'-4¼"			120	120	9'-4"
	6'			59	59	15'-7"	0'-2½"	2'-4"	3'-5¼"			120	120	9'-6"
3 @ 5'	3'	#5	12"	59	59	18'-4"	0'-3"	2'-8"	4'-1⅛"	#6	12"	120	120	11'-4"
	4'			59	59	18'-4"	0'-3"	2'-8"	4'-1⅛"			120	120	11'-4"
	5'			59	59	18'-4"	0'-3"	2'-8"	4'-1⅛"			120	120	11'-4"
	6'			59	59	18'-8"	0'-3"	2'-9"	4'-2⅛"			120	120	11'-6"
	7'			59	59	18'-11"	0'-3"	2'-10"	4'-2¾"			120	120	11'-8"
3 @ 6'	3'	#5	11"	65	65	21'-5"	0'-3½"	3'-1"	4'-10½"	#6	11"	132	132	13'-4"
	4'			65	65	21'-5"	0'-3½"	3'-1"	4'-10½"			132	132	13'-4"
	5'			65	65	21'-5"	0'-3½"	3'-1"	4'-10½"			132	132	13'-4"
	6'			65	65	21'-9"	0'-3½"	3'-2"	4'-11½"			132	132	13'-6"
	7'			65	65	22'-0"	0'-3½"	3'-3"	4'-11¾"			132	132	13'-8"
	8'			65	65	22'-1"	0'-3½"	3'-3"	5'-0¼"			132	132	13'-8"
3 @ 7'	4'	#6	12"	59	59	24'-8"	0'-4½"	3'-5½"	5'-7"	#6	12"	120	120	15'-4"
	5'			59	59	24'-8"	0'-4½"	3'-5½"	5'-7"			120	120	15'-4"
	6'			59	59	25'-0"	0'-4½"	3'-6½"	5'-8"			120	120	15'-6"
	7'			59	59	25'-3"	0'-4½"	3'-7½"	5'-8½"			120	120	15'-8"
	8'			59	59	25'-4"	0'-4½"	3'-7½"	5'-9"			120	120	15'-8"
	9'			59	59	25'-8"	0'-4½"	3'-8½"	5'-10"			120	120	15'-10"
3 @ 8'	4'	#6	11"	65	65	27'-9"	0'-5"	3'-10"	6'-4"	#6	11"	132	132	17'-4"
	5'			65	65	28'-1"	0'-5"	3'-11"	6'-5"			132	132	17'-6"
	6'			65	65	28'-1"	0'-5"	3'-11"	6'-5"			132	132	17'-6"
	7'			65	65	28'-4"	0'-5"	4'-0"	6'-5½"			132	132	17'-8"
	8'			65	65	28'-5"	0'-5"	4'-0"	6'-6"			132	132	17'-8"
	9'			65	65	28'-9"	0'-5"	4'-1"	6'-7"			132	132	17'-10"
	10'			65	65	29'-1"	0'-5"	4'-2"	6'-8"			132	132	18'-0"
3 @ 9'	5'	#6	11"	65	65	31'-2"	0'-5½"	4'-4"	7'-2"	#6	11"	132	132	19'-6"
	6'			65	65	31'-5"	0'-5½"	4'-5"	7'-2½"			132	132	19'-8"
	7'			65	65	31'-5"	0'-5½"	4'-5"	7'-2½"			132	132	19'-8"
	8'			65	65	31'-6"	0'-5½"	4'-5"	7'-3"			132	132	19'-8"
	9'			65	65	31'-10"	0'-5½"	4'-6"	7'-4"			132	132	19'-10"
	10'			65	65	32'-2"	0'-5½"	4'-7"	7'-5"			132	132	20'-0"
	11'			65	65	32'-4"	0'-5½"	4'-7"	7'-6"			132	132	20'-0"
3 @ 10'	5'	#6	12"	59	59	34'-3"	0'-6"	4'-9"	7'-11"	#7	12"	120	120	21'-6"
	6'			59	59	34'-6"	0'-6"	4'-10"	7'-11½"			120	120	21'-8"
	7'			59	59	34'-6"	0'-6"	4'-10"	7'-11½"			120	120	21'-8"
	8'			59	59	34'-7"	0'-6"	4'-10"	8'-0"			120	120	21'-8"
	9'			59	59	34'-11"	0'-6"	4'-11"	8'-1"			120	120	21'-10"
	10'			59	59	35'-3"	0'-6"	5'-0"	8'-2"			120	120	22'-0"
	11'			59	59	35'-5"	0'-6"	5'-0"	8'-3"			120	120	22'-0"
	12'			59	59	35'-7"	0'-6"	5'-0"	8'-4"			120	120	22'-0"
3 @ 11'	6'	#6	11"	65	65	37'-8"	0'-6½"	5'-3"	8'-9"	#7	11"	132	132	23'-8"
	7'			65	65	37'-8"	0'-6½"	5'-3"	8'-9"			132	132	23'-8"
	8'			65	65	37'-8"	0'-6½"	5'-3"	8'-9"			132	132	23'-8"
	9'			65	65	38'-0"	0'-6½"	5'-4"	8'-10"			132	132	23'-10"
	10'			65	65	38'-4"	0'-6½"	5'-5"	8'-11"			132	132	24'-0"
	11'			65	65	38'-6"	0'-6½"	5'-5"	9'-0"			132	132	24'-0"
	12'			65	65	38'-8"	0'-6½"	5'-5"	9'-1"			132	132	24'-0"
3 @ 12'	6'	#6	11"	65	65	40'-9"	0'-7"	5'-8"	9'-6"	#7	11"	132	132	25'-8"
	7'			65	65	40'-9"	0'-7"	5'-8"	9'-6"			132	132	25'-8"
	8'			65	65	40'-9"	0'-7"	5'-8"	9'-6"			132	132	25'-8"
	9'			65	65	41'-1"	0'-7"	5'-9"	9'-7"			132	132	25'-10"
	10'			65	65	41'-5"	0'-7"	5'-10"	9'-8"			132	132	26'-0"
	11'			65	65	41'-7"	0'-7"	5'-10"	9'-9"			132	132	26'-0"
	12'			65	65	41'-9"	0'-7"	5'-10"	9'-10"			132	132	26'-0"

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
3 @ 4'	2'	#5	12"	22	2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap.)	#4	12"	12	2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap.)	#4	12"	22	2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap.)	#4	12"	360	360	2'-10"
	3'			22				18				22				360	360	3'-10"
	4'			22				24				22				360	360	4'-10"
	5'			22				30				22				360	360	5'-10"
	6'			22				36				22				360	360	6'-10"
3 @ 5'	3'	#5	11½"	26		#4	12"	18		#4	12"	25		#4	12"	360	360	3'-11"
	4'			26				24				25				360	360	4'-11"
	5'			26				30				25				360	360	5'-11"
	6'			26				36				25				360	360	6'-11"
	7'			26				42				25				360	360	7'-11"
3 @ 6'	3'	#5	11½"	30		#4	12"	18		#4	12"	28		#4	12"	360	360	4'-0"
	4'			30				24				28				360	360	5'-0"
	5'			30				30				28				360	360	6'-0"
	6'			30				36				28				360	360	7'-0"
	7'			30				42				28				360	360	8'-0"
	8'			30				48				28			10"	432	432	9'-0"
3 @ 7'	4'	#5	11½"	32		#4	12"	24		#4	12"	31		#4	12"	360	360	5'-1"
	5'			32				30				31				360	360	6'-1"
	6'			32				36				31				360	360	7'-1"
	7'			32				42				31				360	360	8'-1"
	8'			32				48				31			10"	432	432	9'-1"
	9'			32				54				31		#5	12"	360	360	10'-1"
3 @ 8'	4'	#5	11½"	36		#4	12"	24		#4	12"	35		#4	12"	360	360	5'-2"
	5'			36				30				35				360	360	6'-2"
	6'			36				36				35				360	360	7'-2"
	7'			36				42				35				360	360	8'-2"
	8'			36				48				35			10"	432	432	9'-2"
	9'			36				54				35		#5	12"	360	360	10'-2"
	10'			36				60				35			11"	396	396	11'-2"
3 @ 9'	5'	#5	11½"	41		#4	12"	30		#4	12"	40		#4	12"	360	360	6'-3"
	6'			41				36				40				360	360	7'-3"
	7'			41				42				40				360	360	8'-3"
	8'			41				48				40			10"	432	432	9'-3"
	9'			41				54				40		#5	12"	360	360	10'-3"
	10'			41				60				40			11"	396	396	11'-3"
	11'			41				66				40			10"	432	432	12'-3"
3 @ 10'	5'	#5	11½"	44		#4	12"	30		#4	12"	43		#4	12"	360	360	6'-4"
	6'			44				36				43				360	360	7'-4"
	7'			44				42				43				360	360	8'-4"
	8'			44				48				43			10"	432	432	9'-4"
	9'			44				54				43		#5	12"	360	360	10'-4"
	10'			44				60				43			11"	396	396	11'-4"
	11'			44				66				43			10"	432	432	12'-4"
	12'			44				72				43		#6	12"	360	360	13'-4"
3 @ 11'	6'	#5	11½"	48		#4	12"	36		#4	12"	46		#4	12"	360	360	7'-5"
	7'			48				42				46				360	360	8'-5"
	8'			48				48				46			10"	432	432	9'-5"
	9'			48				54				46		#5	12"	360	360	10'-5"
	10'			48				60				46			11"	396	396	11'-5"
	11'			48				66				46			10"	432	432	12'-5"
	12'			48				72				46		#6	12"	360	360	13'-5"
3 @ 12'	6'	#5	11½"	51		#4	12"	36		#4	12"	49		#4	12"	360	360	7'-6"
	7'			51				42				49				360	360	8'-6"
	8'			51				48				49			10"	432	432	9'-6"
	9'			51				54				49		#5	12"	360	360	10'-6"
	10'			51				60				49			11"	396	396	11'-6"
	11'			51				66				49			10"	432	432	12'-6"
	12'			51				72				49		#6	12"	360	360	13'-6"

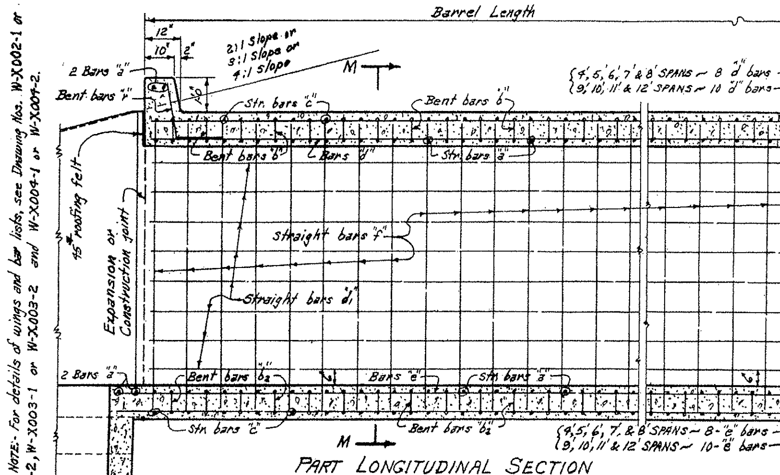
DIMENSIONS / QUANTITIES

D (Max. Design Depth of Cover)	S (Clear Spans)	H (Clear Height)	A (Sq. Ft. Opening)	OW (Overall Width)	T (Thickness of Top Slab)	C (Thickness of Sidewalls)	M (Thickness of Division Walls)	B (Thickness of Bottom Slab)	OH (Overall Height)	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
5'-0"	3 @ 4'	2'	24	14'-4"	6½"	6"	8"	6"	3'-0½"	0.726	137.76	66.63	195.33
		3'	36	14'-4"		6"	8"		4'-0½"	0.812	145.78	71.64	195.33
		4'	48	14'-4"		6"	8"		5'-0½"	0.899	153.79	76.65	195.33
		5'	60	14'-4"		6"	8"		6'-0½"	0.985	161.81	81.66	195.33
		6'	72	14'-8"		7"	9"		7'-0½"	1.158	171.56	86.67	198.11
	3 @ 5'	3'	45	17'-4"	7"	6"	8"	6½"	4'-1½"	0.981	195.23	81.10	298.79
		4'	60	17'-4"		6"	8"		5'-1½"	1.068	203.25	86.11	298.79
		5'	75	17'-4"		6"	8"		6'-1½"	1.154	211.27	91.12	298.79
		6'	90	17'-8"		7"	9"		7'-1½"	1.329	221.98	96.13	302.80
		7'	105	17'-11"		7½"	10"		8'-1½"	1.503	231.27	101.14	305.80
	3 @ 6'	3'	54	20'-4"	7½"	6"	8"	7"	4'-2½"	1.169	236.39	90.56	351.21
		4'	72	20'-4"		6"	8"		5'-2½"	1.266	244.41	95.57	351.21
		5'	90	20'-4"		6"	8"		6'-2½"	1.342	252.42	100.58	351.21
		6'	108	20'-8"		7"	9"		7'-2½"	1.517	262.84	105.59	355.21
		7'	126	20'-11"		7½"	10"		8'-2½"	1.692	272.79	110.60	358.22
		8'	144	21'-0"		8"	10"		9'-2½"	1.829	288.48	115.61	359.22
	3 @ 7'	4'	84	23'-4"	8"	6"	8"	7¾"	5'-3¾"	1.480	279.99	101.55	404.29
		5'	105	23'-4"		6"	8"		6'-3¾"	1.566	288.01	106.56	409.29
		6'	126	23'-8"		7"	9"		7'-3¾"	1.743	298.53	111.57	408.29
		7'	147	23'-11"		7½"	10"		8'-3¾"	1.919	308.55	116.58	411.30
		8'	168	24'-0"		8"	10"		9'-3¾"	2.056	324.34	121.59	412.30
		9'	189	24'-4"		9"	11"		10'-3¾"	2.294	350.27	126.60	416.30
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	8½"	5'-5"	1.727	330.89	111.85	459.38
		5'	120	26'-8"		7"	9"		6'-5"	1.893	341.69	116.86	463.38
		6'	144	26'-8"		7"	9"		7'-5"	1.992	349.65	121.87	463.38
		7'	168	26'-11"		7½"	10"		8'-5"	2.168	359.85	126.88	466.38
		8'	192	27'-0"		8"	10"		9'-5"	2.306	375.76	131.89	467.39
		9'	216	27'-4"		9"	11"		10'-5"	2.595	402.04	136.90	471.39
		10'	240	27'-8"		10"	12"		11'-5"	2.810	421.39	141.91	475.40
	3 @ 9'	5'	135	29'-8"	9"	7"	9"	9"	6'-6"	2.142	377.01	129.72	520.47
		6'	162	29'-11"		7½"	10"		7'-6"	2.310	387.21	134.73	523.48
		7'	189	29'-11"		7½"	10"		8'-6"	2.418	396.23	139.74	523.48
		8'	216	30'-0"		8"	10"		9'-6"	2.556	411.21	144.75	524.48
		9'	243	30'-4"		9"	11"		10'-6"	2.796	437.60	149.76	528.48
		10'	270	30'-8"		10"	12"		11'-6"	3.062	457.00	154.77	532.49
		11'	297	30'-10"		11"	12"		12'-6"	3.275	477.29	159.78	534.49
	3 @ 10'	5'	150	32'-8"	9½"	7"	9"	9½"	6'-7"	2.409	443.34	137.44	716.12
		6'	180	32'-11"		7½"	10"		7'-7"	2.578	453.81	142.45	720.20
		7'	210	32'-11"		7½"	10"		8'-7"	2.686	461.83	147.46	720.20
		8'	240	33'-0"		8"	10"		9'-7"	2.824	477.91	152.47	721.57
		9'	270	33'-4"		9"	11"		10'-7"	3.066	509.74	157.48	727.02
		10'	300	33'-8"		10"	12"		11'-7"	3.332	524.50	162.49	732.47
		11'	330	33'-10"		11"	12"		12'-7"	3.546	544.94	167.50	735.19
		12'	360	34'-0"		12"	12"		13'-7"	3.772	577.67	172.51	737.92
	3 @ 11'	6'	198	36'-0"	10"	8"	10"	10"	7'-8"	2.889	522.98	151.91	790.33
		7'	231	36'-0"		8"	10"		8'-8"	3.000	531.00	156.92	790.33
		8'	264	36'-0"		8"	10"		9'-8"	3.111	546.56	161.93	790.33
		9'	297	36'-4"		9"	11"		10'-8"	3.354	573.79	166.94	795.78
		10'	330	36'-8"		10"	12"		11'-8"	3.621	593.87	171.95	801.23
		11'	363	36'-10"		11"	12"		12'-8"	3.835	614.97	176.96	803.96
		12'	396	37'-0"		12"	12"		13'-8"	4.062	647.44	181.97	806.68
	3 @ 12'	6'	216	39'-0"	10½"	8"	10"	10½"	7'-9"	3.194	560.85	159.63	859.76
		7'	252	39'-0"		8"	10"		8'-9"	3.306	568.87	164.64	859.76
		8'	288	39'-0"		8"	10"		9'-9"	3.417	584.50	169.65	859.76
		9'	324	39'-4"		9"	11"		10'-9"	3.660	611.85	174.66	865.21
		10'	360	39'-8"		10"	12"		11'-9"	3.929	631.98	179.67	870.66
		11'	396	39'-10"		11"	12"		12'-9"	4.144	652.63	184.68	873.39
		12'	432	40'-0"		12"	12"		13'-9"	4.870	685.72	189.69	876.110

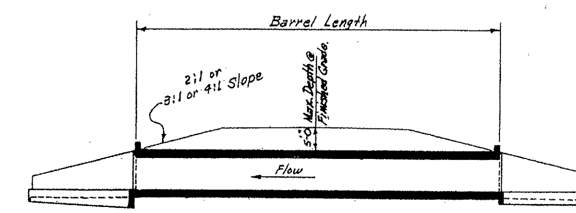


TYPICAL SECTION M-M

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2.



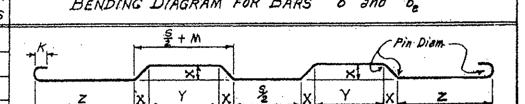
PART LONGITUDINAL SECTION



LONGITUDINAL SECTION

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#5	2¼"	4¾"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" and "b2"

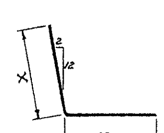


NOTE:- Dimensions are to centers of bars ("b" and "b2")

DOWEL BARS FOR TWO HEADWALLS

3 SPANS @	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	30	2'-5"	1'-2½"
5'	#4	12"±	36	2'-6"	1'-3"
6'	#4	12"±	42	2'-7"	1'-3½"
7'	#4	12"±	48	2'-8"	1'-4"
8'	#4	12"±	54	2'-9"	1'-4½"
9	#4	12"±	60	2'-10"	1'-5"
10'	#4	12"±	66	2'-11"	1'-5½"
11'	#4	12"±	72	3'-0"	1'-6"
12'	#4	12"±	78	3'-1"	1'-6½"

Bars "r" — Dowel bars in Headwalls.



GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING.
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 OR 4:1 SLOPES
TRIPLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-300X-0

Designed By:- W.C.H. 1-22-63. Checked By:- BHS 5-17-63
Drawn By:- W.C.H. 2-28-63. Checked By:- BHS 5-24-63
Quantities By:- W.C.H. 3-4-63. Checked By:- BHS 5-24-63

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars – STRAIGHT – In Top & Bottom Slab of Barrel. 2 Add'l in Apron and Headwall.
"b" bars – BENT (See Bending Diagram below) – In bottom of Top Slab bent up over Division Walls and in top of Bottom Slab bent down under Division Walls. Alternate with "a" and "c" bars.

SECTION	LENGTH OF SECTION	BAR GROUP PER SECTION	DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" Size	"a" Spacing	"a" Number	"a" Length	"b" Size	"b" Spacing	"b" Number	"b" Length	X	Y	Z
SECTION "A"	32'-0"	Bar Group "A"	0' to 10'	4'	3'	#4	16"	52	14'-1"	#4	16"	48	15'-6"	0'-4"	2'-0"	3'-4½"
					4'			52	14'-1"			48	15'-6"	0'-4"	2'-0"	3'-4½"
					5'			52	14'-1"			48	15'-6"	0'-4"	2'-0"	3'-4½"
					6'			52	14'-5"			48	15'-10"	0'-4"	2'-1"	3'-5½"
				5'	4'	#4	14"	60	17'-1"	#4	14"	54	18'-7"	0'-4½"	2'-5"	4'-1½"
					5'			60	17'-1"			54	18'-7"	0'-4½"	2'-5"	4'-1½"
					6'			60	17'-5"			54	18'-11"	0'-4½"	2'-6"	4'-2½"
					7'			60	17'-8"			54	19'-2"	0'-4½"	2'-7"	4'-3"
				6'	5'	#4	14"	60	20'-1"	#5	14"	54	21'-8"	0'-4¾"	2'-11"	4'-10"
					6'			60	20'-5"			54	22'-0"	0'-4¾"	3'-0"	4'-11"
					7'			60	20'-7"			54	22'-2"	0'-4¾"	3'-0"	5'-0"
					8'			60	20'-9"			54	22'-4"	0'-4¾"	3'-1"	5'-0"
SECTION "B"	Varies - 16'-0" Min.	Bar Group "B"	10' to 15'	4'	3'	#4	12"	32	14'-1"	#4	12"	32	15'-6"	0'-4"	2'-0"	3'-4½"
					4'			32	14'-1"			32	15'-6"	0'-4"	2'-0"	3'-4½"
					5'			32	14'-1"			32	15'-6"	0'-4"	2'-0"	3'-4½"
					6'			32	14'-5"			32	15'-10"	0'-4"	2'-1"	3'-5½"
				5'	4'	#4	14"	26	17'-1"	#5	14"	28	18'-7"	0'-4½"	2'-6"	4'-1"
					5'			26	17'-1"			28	18'-7"	0'-4½"	2'-6"	4'-1"
					6'			26	17'-5"			28	18'-11"	0'-4½"	2'-7"	4'-2"
					7'			26	17'-8"			28	19'-2"	0'-4½"	2'-8"	4'-2½"
				6'	5'	#5	14"	26	20'-1"	#5	14"	28	21'-8"	0'-4¾"	2'-11"	4'-10"
					6'			26	20'-5"			28	22'-0"	0'-4¾"	3'-0"	4'-11"
					7'			26	20'-7"			28	22'-2"	0'-4¾"	3'-0"	5'-0"
					8'			26	20'-9"			28	22'-4"	0'-4¾"	3'-1"	5'-0"
SECTION "C"	Varies - 16'-0" Min.	Bar Group "C"	15' to 20'	4'	3'	#4	12"	32	14'-1"	#4	12"	32	15'-6"	0'-4"	2'-0"	3'-4½"
					4'			32	14'-1"			32	15'-6"	0'-4"	2'-0"	3'-4½"
					5'			32	14'-1"			32	15'-6"	0'-4"	2'-0"	3'-4½"
					6'			32	14'-5"			32	15'-10"	0'-4"	2'-1"	3'-5½"
				5'	4'	#4	13"	30	17'-1"	#5	13"	30	18'-7"	0'-4½"	2'-6"	4'-1"
					5'			30	17'-1"			30	18'-7"	0'-4½"	2'-6"	4'-1"
					6'			30	17'-5"			30	18'-11"	0'-4½"	2'-7"	4'-2"
					7'			30	17'-8"			30	19'-2"	0'-4½"	2'-8"	4'-2½"
				6'	5'	#5	12"	32	20'-1"	#5	12"	32	21'-8"	0'-5"	2'-10"	4'-10½"
					6'			32	20'-5"			32	22'-0"	0'-5"	2'-11"	4'-11½"
					7'			32	20'-7"			32	22'-2"	0'-5"	2'-11"	5'-0½"
					8'			32	20'-10"			32	22'-5"	0'-5"	3'-0"	5'-1"
SECTION "D"	Varies - 16'-0" Min.	Bar Group "D"	20' to 25'	4'	3'	#4	11"	36	14'-1"	#4	11"	34	15'-6"	0'-4"	2'-0"	3'-4½"
					4'			36	14'-1"			34	15'-6"	0'-4"	2'-0"	3'-4½"
					5'			36	14'-2"			34	15'-7"	0'-4"	2'-0"	3'-5"
					6'			36	14'-6"			34	15'-11"	0'-4"	2'-1"	3'-6"
				5'	4'	#5	13"	30	17'-1"	#5	13"	30	18'-8"	0'-4¾"	2'-5"	4'-1"
					5'			30	17'-2"			30	18'-9"	0'-4¾"	2'-5"	4'-1½"
					6'			30	17'-6"			30	19'-1"	0'-4¾"	2'-6"	4'-2½"
					7'			30	17'-10"			30	19'-5"	0'-4¾"	2'-7"	4'-3½"
				6'	5'	#5	11"	36	20'-2"	#5	11"	34	21'-10"	0'-5¾"	2'-9"	4'-10½"
					6'			36	20'-6"			34	22'-2"	0'-5¾"	2'-10"	4'-11½"
					7'			36	20'-9"			34	22'-5"	0'-5¾"	2'-10"	5'-1"
					8'			36	21'-0"			34	22'-8"	0'-5¾"	2'-11"	5'-1½"
SECTION "E"	Varies - 16'-0" Min.	Bar Group "E"	25' to 30'	4'	3'	#4	10"	38	14'-1"	#4	10"	38	15'-6"	0'-4"	2'-0"	3'-4½"
					4'			38	14'-1"			38	15'-6"	0'-4"	2'-0"	3'-4½"
					5'			38	14'-3"			38	15'-8"	0'-4"	2'-0"	3'-5½"
					6'			38	14'-7"			38	16'-0"	0'-4"	2'-1"	3'-6½"
				5'	4'	#5	12"	32	17'-1"	#5	12"	32	18'-9"	0'-5¼"	2'-4"	4'-1"
					5'			32	17'-3"			32	18'-11"	0'-5¼"	2'-4"	4'-2"
					6'			32	17'-7"			32	19'-3"	0'-5¼"	2'-5"	4'-3"
					7'			32	17'-11"			32	19'-7"	0'-5¼"	2'-6"	4'-4"
				6'	5'	#5	10"	38	20'-3"	#5	10"	40	22'-1"	0'-6½"	2'-7"	4'-11½"
					6'			38	20'-7"			40	22'-5"	0'-6½"	2'-8"	5'-0½"
					7'			38	20'-10"			40	22'-8"	0'-6½"	2'-8"	5'-2"
					8'			38	21'-1"			40	22'-11"	0'-6½"	2'-9"	5'-2½"
SECTION "F"	Varies - 16'-0" Min.	Bar Group "F"	30' to 35'	4'	3'	#4	11"	34	14'-1"	#5	11"	36	15'-7"	0'-4¼"	1'-11"	3'-5"
					4'			34	14'-2"			36	15'-8"	0'-4¼"	1'-11"	3'-5½"
					5'			34	14'-4"			36	15'-10"	0'-4¼"	1'-11"	3'-6½"
					6'			34	14'-8"			36	16'-2"	0'-4¼"	2'-0"	3'-7½"
				5'	4'	#5	11"	34	17'-3"	#5	11"	34	18'-11"	0'-5¾"	2'-3"	4'-2"
					5'			34	17'-5"			34	19'-1"	0'-5¾"	2'-3"	4'-3"
					6'			34	17'-9"			34	19'-5"	0'-5¾"	2'-4"	4'-4"
					7'			34	18'-1"			34	19'-9"	0'-5¾"	2'-5"	4'-5"
				6'	5'	#5	10"	38	20'-5"	#5	10"	38	22'-4"	0'-7¼"	2'-6"	5'-0"
					6'			38	20'-9"			38	22'-8"	0'-7¼"	2'-7"	5'-1"
					7'			38	21'-0"			38	22'-11"	0'-7¼"	2'-7"	5'-2½"
					8'			38	21'-3"			38	23'-2"	0'-7¼"	2'-8"	5'-3"
SECTION "G"	Varies-16'-0" Min.	Bar Group "G"	35' to 40'	4'	3'	#4	11"	36	14'-1"	#5	11"	34	15'-8"	0'-4¾"	1'-10"	3'-5"
					4'			36	14'-3"			34	15'-10"	0'-4¾"	1'-10"	3'-6"
					5'			36	14'-5"			34	16'-0"	0'-4¾"	1'-10"	3'-7"
					6'			36	14'-9"			34	16'-4"	0'-4¾"	1'-11"	3'-8"
				5'	4'	#5	11"	36	17'-4"	#5	11"	34	19'-2"	0'-6½"	2'-1"	4'-3"
					5'			36	17'-6"			34	19'-4"	0'-6½"	2'-1"	4'-4"
					6'			36	17'-10"			34	19'-8"	0'-6½"	2'-2"	4'-5"
					7'			36	18'-2"			34	20'-0"	0'-6½"	2'-3"	4'-6"
	Varies	Bar Group "H"	35' Max.	6'	5'	#5	10"	Varies with Length of Barrel	20'-6"	#5	10"	Varies with Length of Barrel	22'-6"	0'-8"	2'-4"	5'-1"
					6'				20'-10"				22'-10"	0'-8"	2'-5"	5'-2"
					7'				21'-1"				23'-1"	0'-8"	2'-5"	5'-3½"
					8'				21'-4"				23'-4"	0'-8"	2'-6"	5'-4"
			40' Max.	4'	3'	#4	11"		14'-2"	#5	11"		15'-10"	0'-5¼"	1'-9"	3'-5½"
					4'				14'-4"				16'-0"	0'-5¼"	1'-9"	3'-6½"
					5'				14'-6"				16'-2"	0'-5¼"	1'-9"	3'-7½"
					6'				14'-10"				16'-6"	0'-5¼"	1'-10"	3'-8½"
				5'	4'	#5	11"		17'-5"	#5	11"		19'-3"	0'-7"	2'-0"	4'-3½"
					5'				17'-7"				19'-5"	0'-7"	2'-0"	4'-4½"
					6'				17'-11"				19'-9"	0'-7"	2'-1"	4'-5½"
					7'				18'-3"				20'-1"	0'-7"	2'-2"	4'-6½"

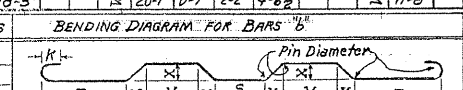
"c" bars – STRAIGHT – In Top & Bottom Slab of Barrel. Alt. with "b" bars.
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls.
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
"f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls.

SECTION	S	H	"c" Size	"c" Spacing	"c" Number	"c" Length	"d" Size	"d" Spacing	"d" Number	"d" Length	"d1" Size	"d1" Spacing	"d1" Number	"d1" Length	"e" Size	"e" Spacing	"e" Number	"e" Length	"f" Size	"f" Spacing	"f" Number	"f" Length
A	4'	3'	#4	16"	48	9'-4"	#4	12"	19	33'-3" Max.	#4	12"	12	33'-3" Max.	#4	12"	19	39'-3" Max.	#4	12"	192	3'-11"
		4'			48	9'-4"			19				18				19				192	4'-11"
		5'			48	9'-4"			19				24				19				192	5'-11"
		6'			48	9'-6"			19				30				19				192	6'-11"
	5'	4'	#5	14"	56	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	192	5'-0"
		5'			56	11'-4"			22				24				22				192	6'-0"
		6'			56	11'-6"			22				30				22				192	7'-0"
		7'			56	11'-8"			22				36				22		#5		192	8'-0"
	6'	5'	#5	14"	56	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	192	6'-1"
		6'			56	13'-6"			25				30				25				192	7'-1"
		7'			56	13'-7"			25				36				25			10"	234	8'-1"
		8'			56	13'-8"			25				42				25		#5	12"	192	9'-1"
B	4'	3'	#4	12"	32	9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"	96	3'-11"
		4'			32	9'-4"			19				18				19				96	4'-11"
		5'			32	9'-4"			19				24				19				96	5'-11"
		6'			32	9'-6"			19				30				19			9"	126	6'-11"
	5'	4'	#5	14"	26	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-0"
		5'			26	11'-4"			22				24				22				96	6'-0"
		6'			26	11'-6"			22				30				22			10"	114	7'-0"
		7'			26	11'-8"			22				36				22		#5	11"	108	8'-0"
	6'	5'	#6	14"	26	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	96	6'-1"
		6'			26	13'-6"			25				30				25			10"	114	7'-1"
		7'			26	13'-7"			25				36				25		#5	11"	108	8'-1"
		8'			26	13'-8"			25				42				25			9"	126	9'-1"
C	4'	3'	#5	12"	32	9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"	96	3'-11"
		4'			32	9'-4"			19				18				19				96	4'-11"
		5'			32	9'-4"			19				24				19			11"	108	5'-11"
		6'			32	9'-6"			19				30				19			8"	144	6'-11"
	5'	4'	#5	13"	30	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-0"
		5'			30	11'-4"			22				24				22				96	6'-0"
		6'			30	11'-6"			22				30				22			9"	132	7'-0"
		7'			30	11'-8"			22				36				22		#5	10"	114	8'-0"
	6'	5'	#6	12"	32	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	96	6'-2"
		6'			32	13'-6"			25				30				25			9"	132	7'-2"
		7'			32	13'-7"			25				36				25		#5	11"	102	8'-2"
		8'			32	13'-8"			25				42				25			9"	132	9'-2"
D	4'	3'	#5	11"	36	9'-4"	#4	12"	19	2 - 16'-0" Sections for 33'-3"	#4	12"	12	2 - 16'-0" Sections for 33'-3"	#4	12"	19	2 - 16'-0" Sections for 33'-3"	#4	12"	96	3'-11"
		4'			36	9'-4"			19				18				19				96	4'-11"
		5'			36	9'-4"			19				24				19			10"	114	5'-11"
		6'			36	9'-6"			19				30				19		#5	12"	96	6'-11"
	5'	4'	#6	13"	30	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-1"
		5'			30	11'-4"			22				24				22				96	6'-1"
		6'			30	11'-6"			22				30				22			8"	144	7'-1"
		7'			30	11'-8"			22				36				22		#5	10"	114	8'-1"
	6'	5'	#6	11"	36	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	96	6'-3"
		6'			36	13'-6"			25				30				25			9"	126	7'-3"
		7'			36	13'-7"			25				36				25		#5	11"	108	8'-3"
		8'			36	13'-8"			25				42				25			8"	144	9'-3"
E	4'	3'	#5	10"	38	9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"	96	3'-11"
		4'			38	9'-4"			19				18				19				96	4'-11"
		5'			38	9'-4"			19				24				19			10"	114	5'-11"
		6'			38	9'-6"			19				30				19		#5	11"	108	6'-11"
	5'	4'	#6	12"	32	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-2"
		5'			32	11'-4"			22				24				22				96	6'-2"
		6'			32	11'-6"			22				30				22			8"	144	7'-2"
		7'			32	11'-8"			22				36				22		#5	9"	126	8'-2"
	6'	5'	#6	10"	38	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	96	6'-5"
		6'			38	13'-6"			25				30				25			9"	126	7'-5"
		7'			38	13'-7"			25				36				25		#5	10"	114	8'-5"
		8'			38	13'-8"			25				42				25			8"	144	9'-5"
F	4'	3'	#5	11"	34	9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"	96	4'-0"
		4'			34	9'-4"			19				18				19				96	5'-0"
		5'			34	9'-4"			19				24				19			9"	126	6'-0"
		6'			34	9'-6"			19				30				19		#5	10"	114	7'-0"
	5'	4'	#6	11"	34	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-3"
		5'			34	11'-4"			22				24				22				96	6'-3"
		6'			34	11'-6"			22				30				22			8"	144	7'-3"
		7'			34	11'-8"			22				36				22		#5	9"	126	8'-3"
	6'	5'	#6	10"	38	13'-4"	#4	12"	25		#4	12"	24		#4	12"	25		#4	12"	96	6'-6"
		6'			38	13'-6"			25				30				25			9"	132	7'-6"
		7'			38	13'-7"			25				36				25		#5	10"	114	8'-6"
		8'			38	13'-8"			25				42				25			8"	144	9'-6"
G	4'	3'	#5	11"	36	9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"	96	4'-1"
		4'			36	9'-4"			19				18				19				96	5'-1"
		5'			36	9'-4"			19				24				19			9"	132	6'-1"
		6'			36	9'-6"			19				30				19		#5	10"	114	7'-1"
	5'	4'	#6	11"	36	11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	96	5'-5"
		5'			36	11'-4"			22				24				22				96	6'-5"
		6'			36	11'-6"			22				30				22			8"	144	7'-5"
		7'			36	11'-8"			22				36				22		#5	8"	150	8'-5"
H	6'	5'	#6	10"	Varies with Length of Barrel	13'-4"	#4	12"	25	Varies with Length of Barrel	#4	12"	24	Varies with Length of Barrel	#4	12"	25	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	6'-8"
		6'				13'-6"			25				30				25			9"		7'-8"
		7'				13'-7"			25				36				25		#5	10"		8'-8"
		8'				13'-8"			25				42				25			8"		9'-8"
	4'	3'	#5	11"		9'-4"	#4	12"	19		#4	12"	12		#4	12"	19		#4	12"		4'-2"
		4'				9'-4"			19				18				19					5'-2"
		5'				9'-4"			19				24				19			9"		6'-2"
		6'				9'-6"			19				30				19		#5	10"		7'-2"
	5'	4'	#6	11"		11'-4"	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"		5'-6"
		5'				11'-4"			22				24				22					6'-6"
		6'				11'-6"			22				30				22			8"		7'-6"
		7'				11'-8"			22				36				22		#5	8"		8'-6"

NOTE:- Bars for each section to be marked with the section letter, thus for Section "B", the bars should be marked Ba, Bb, Bd, Bd1, Be and Bf.

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2½"	4"	0'-11"
#5	2½"	4½"	1'-0"

BENDING DIAGRAM FOR BARS "b"



NOTE:- For headwall dowel bars "r", see Drawing No. R-3004-A.

NOTE:- Dimensions are to centers of bars.

DIMENSIONS QUANTITIES

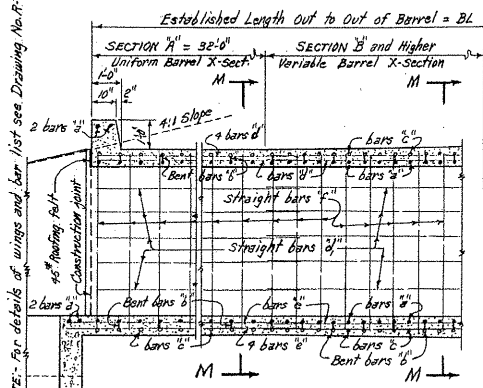
MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	ROADWAY LENGTH RL	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVER-ALL HEIGHT OH	UNIT: CLASS A CONCRETE PER LIN. FT. OF BARREL CU.YD.	UNIT: REINF. STEEL NO LAPS PER LIN. FT. OF BARREL LB.	UNIT: ADD'L STEEL PER LAP LB.	PER MIN. SECTION	TOTAL: CLASS A CONCRETE CU.YD.	TOTAL: REINF. STEEL (NO LAPS) LB.
Sect. "A" = Uniform X-Sect.	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	88.09	41.8	SECTION A = 32'-0"	28.823	2838
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	96.11	46.8		31.588	3094
		5'	60	14'-4"		6"	8"		6'-2½"	1.074	104.13	51.8		34.354	3351
		6'	72	14'-8"		7"	9"		7'-2½"	1.249	112.98	56.8		39.967	3635
	3 @ 5'	4'	60	17'-4"	7½"	6"	8"	8"	5'-3½"	1.175	122.56	51.8		37.597	3961
		5'	75	17'-4"		6"	8"		6'-3½"	1.261	130.58	56.8		40.362	4217
		6'	90	17'-8"		7"	9"		7'-3½"	1.438	139.66	61.8		46.008	4509
		7'	105	17'-11"		7½"	10"		8'-3½"	1.613	166.54	66.8		51.625	5369
	3 @ 6'	5'	90	20'-4"	8"	6"	8"	8½"	6'-4½"	1.468	159.39	61.8		46.963	5139
		6'	108	20'-8"		7"	9"		7'-4½"	1.645	168.68	66.8		52.642	5437
		7'	126	20'-10"		7½"	9½"		8'-4½"	1.796	183.82	71.8		57.457	5941
		8'	144	21'-0"		8"	10"		9'-4½"	1.958	206.43	76.8		62.667	6696
10'-0" @ Point "A"	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	101.09	41.8	SECTION B = 16'-0"	14.411	1618
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	109.11	46.8		15.794	1746
		5'	60	14'-4"		6"	8"		6'-2½"	1.074	117.12	51.8		17.177	1874
		6'	72	14'-8"		7"	9"		7'-2½"	1.249	135.49	56.8		19.984	2159
	3 @ 5'	4'	60	17'-4"	7½"	6"	8"	8"	5'-3½"	1.175	139.51	51.8		18.798	2130
		5'	75	17'-4"		6"	8"		6'-3½"	1.261	142.53	56.8		20.181	2258
		6'	90	17'-8"		7"	9"		7'-3½"	1.438	157.93	61.8		23.004	2491
		7'	105	17'-11"		7½"	10"		8'-3½"	1.613	183.92	66.8		25.813	2939
	3 @ 6'	5'	90	20'-4"	8"	6"	8"	8½"	6'-4½"	1.468	182.80	61.8		23.732	2879
		6'	108	20'-8"		7"	9"		7'-4½"	1.645	198.11	66.8		26.576	3118
		7'	126	20'-10"		7½"	9½"		8'-4½"	1.796	224.04	71.8		28.986	3566
		8'	144	21'-0"		8"	10"		9'-4½"	1.958	249.47	76.8		31.825	3926
15'-0" @ Point "B"	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	108.09	41.8	SECTION C = 16'-0"	14.411	1729
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	116.11	46.8		15.794	1858
		5'	60	14'-4"		6"	8"		6'-2½"	1.074	126.28	51.8		17.330	2033
		6'	72	14'-8"		7"	9"		7'-2½"	1.249	147.24	56.8		20.161	2356
	3 @ 5'	4'	60	17'-4"	7½"	6"	8"	8"	5'-3½"	1.175	140.13	51.8		19.226	2262
		5'	75	17'-4"		6"	8"		6'-3½"	1.261	148.15	56.8		20.766	2390
		6'	90	17'-8"		7"	9"		7'-3½"	1.438	166.89	61.8		23.622	2709
		7'	105	17'-11"		7½"	10"		8'-3½"	1.613	197.67	66.8		26.667	3125
	3 @ 6'	5'	90	20'-4"	8¾"	6"	8"	8¾"	6'-5"	1.499	201.29	61.8		24.897	3221
		6'	108	20'-8"		7"	9"		7'-5"	1.677	220.77	66.8		27.782	3552
		7'	126	20'-10"		7½"	9½"		8'-5"	1.828	243.18	71.8		30.434	3868
		8'	144	21'-1"		8½"	10"		9'-5"	2.020	269.22	76.8		33.567	4346
20'-0" @ Point "C"	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	113.95	41.8	SECTION D = 16'-0"	14.411	1827
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	121.47	46.8		15.794	1955
		5'	60	14'-5"		6½"	8"		6'-2½"	1.093	134.47	51.8		17.637	2158
		6'	72	14'-9"		7½"	9"		7'-2½"	1.271	157.66	56.8		20.517	2486
	3 @ 5'	4'	60	17'-4"	8"	6"	8"	8½"	5'-4½"	1.228	162.05	51.8		20.082	2618
		5'	75	17'-5"		6½"	8"		6'-4½"	1.354	170.39	56.8		21.991	2751
		6'	90	17'-9"		7½"	9"		7'-4½"	1.515	194.35	61.8		24.862	3135
		7'	105	18'-1"		8½"	10"		8'-4½"	1.720	218.22	66.8		28.283	3507
	3 @ 6'	5'	90	20'-5"	9"	6½"	8"	9½"	6'-6½"	1.613	213.75	61.8		26.814	3444
		6'	108	20'-9"		7½"	9"		7'-6½"	1.796	233.52	66.8		29.786	3751
		7'	126	21'-0"		8½"	9½"		8'-6½"	1.977	256.52	71.8		32.727	4157
		8'	144	21'-3"		9½"	10"		9'-6½"	2.176	292.44	76.8		35.965	4704
25'-0" @ Point "D"	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	119.89	41.8	SECTION E = 16'-0"	14.765	1906
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	127.91	46.8		16.278	2035
		5'	60	14'-6"		7"	8"		6'-2½"	1.112	141.20	51.8		18.303	2243
		6'	72	14'-10"		8"	9"		7'-2½"	1.293	165.46	56.8		21.241	2659
	3 @ 5'	4'	60	17'-4"	8½"	6"	8"	9"	5'-5½"	1.282	170.92	51.8		21.211	2735
		5'	75	17'-6"		7"	8"		6'-5½"	1.408	179.63	56.8		23.285	2874
		6'	90	17'-10"		8"	9"		7'-5½"	1.593	203.90	61.8		26.297	3262
		7'	105	18'-2½"		9¼"	10"		8'-5½"	1.815	234.86	66.8		29.809	3741
	3 @ 6'	5'	90	20'-6½"	9¾"	7¼"	8"	10¼"	6'-8"	1.739	229.18	61.8		28.830	3687
		6'	108	20'-10½"		8¼"	9"		7'-8"	1.927	249.38	66.8		31.900	4001
		7'	126	21'-1½"		9¼"	9½"		8'-8"	2.114	278.41	71.8		34.934	4467
		8'	144	21'-4½"		10¼"	10"		9'-8"	2.319	309.26	76.8		38.264	4969
30'-0" @ Point "E"	3 @ 4'	3'	36	14'-4"	7½"	6"	8"	8"	4'-3½"	0.945	126.66	41.8	SECTION F = 16'-0"	15.473	2027
		4'	48	14'-5"		6½"	8"		5'-3½"	1.048	134.99	46.8		17.251	2160
		5'	60	14'-7"		7½"	8"		6'-3½"	1.176	151.64	51.8		19.334	2419
		6'	72	14'-11"		8½"	9"		7'-3½"	1.362	177.78	56.8		22.338	2836
	3 @ 5'	4'	60	17'-6"	9"	7"	8"	9½"	5'-6½"	1.370	181.90	51.8		22.701	2861
		5'	75	17'-8"		8"	8"		6'-6½"	1.503	190.68	56.8		24.859	3001
		6'	90	18'-0"		9"	9"		7'-6½"	1.694	215.28	61.8		27.966	3394
		7'	105	18'-4"		10"	10"		8'-6½"	1.911	246.61	66.8		31.468	3877
	3 @ 6'	5'	90	20'-8"	10½"	8"	8"	11"	6'-9½"	1.865	230.56	61.8		30.864	3663
		6'	108	21'-0"		9"	9"		7'-9½"	2.060	250.87	66.8		34.032	4008
		7'	126	21'-3"		10"	9½"		8'-9½"	2.253	280.18	71.8		37.159	4446
		8'	144	21'-6"		11"	10"		9'-9½"	2.464	311.08	76.8		40.582	4951
35'-0" @ Point "F"	3 @ 4'	3'	36	14'-4"	8"	6"	8"	8½"	4'-4½"	0.989	127.18	41.8	SECT. G = 16'-0"	16.290	2041
		4'	48	14'-6"		7"	8"		5'-4½"	1.109	135.82	46.8		18.233	2179
		5'	60	14'-8"		8"	8"		6'-4½"	1.241	152.59	51.8		20.373	2464
		6'	72	15'-0"		9"	9"		7'-4½"	1.431	178.90	56.8		23.443	2860
	3 @ 5'	4'	60	17'-7"	9¾"	7½"	8"	10¼"	5'-8"	1.468	183.33	51.8		24.065	2953
		5'	75	17'-9"		8½"	8"		6'-8"	1.605	192.10	56.8		26.283	3094
		6'	90	18'-1"		9½"	9"		7'-8"	1.801	217.04	61.8		29.460	3493
		7'	105	18'-5"		10½"	10"		8'-8"	2.023	257.53	66.8		33.032	4194
	3 @ 6'	5'	90	20'-9¾"	11¼"	8¾"	8"	11¾"	6'-11"	1.993	231.85	61.8			
		6'	108	21'-1¾"		9¾"	9"		7'-11"	2.194	252.38	66.8			
		7'	126	21'-4¾"		10¾"	9½"		8'-11"	2.392	282.05	71.8			
		8'	144	21'-7¾"		11¾"	10"		9'-11"	2.609	313.27	76.8			
40'-0" @ Point "G"	3 @ 4'	3'	36	14'-5"	8½"	6½"	8"	9"	4'-5½"	1.047	128.02	41.8			
		4'	48	14'-7"		7½"	8"		5'-5½"	1.170	136.66	46.8			
		5'	60	14'-9"		8½"	8"		6'-5½"	1.306	153.53	51.8			
		6'	72	15'-1"		9½"	9"		7'-5½"	1.500	180.03	56.8			
	3 @ 5'	4'	60	17'-8"	10¼"	8"	8"	10¾"	5'-9"	1.590	184.04	51.8			
		5'	75	17'-10"		9"	8"		6'-9"	1.681	192.82	56.8			
		6'	90	18'-2"		10"	9"		7'-9"	1.881	217.93	61.8			
		7'	105	18'-6"		11"	10"		8'-9"	2.106	258.70	66.8			

DESIGN LIVE LOAD

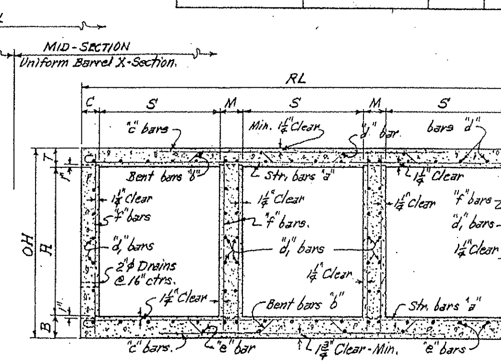
H20-S16 LOADING A.A.S.H.O. 1957
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class A Concrete (n=15) 840 #/□"
Reinforcing Steel 20,000 #/□"

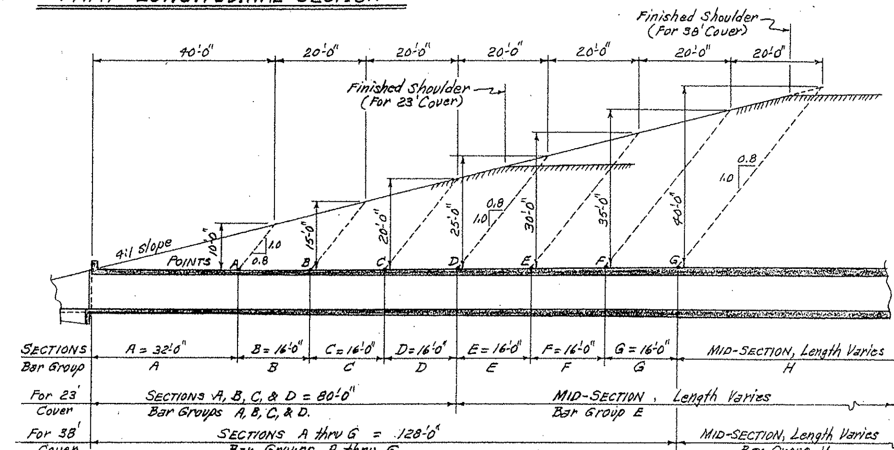
NOTE:- For details of wings and bar list see Drawing No. R-3004-A.



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS HEIGHTS OF COVER
(Examples shown for 23' and 38' Depths of Cover)

NOTE:- Show END SECTION lengths with bar groups and MID-SECTION length with bar group on Cross Section Sheets.

SECTIONS & BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	A	B	C	D	E	F	G	LENGTH OF END SECTIONS	MID-SECTION DIMENSIONS	MID-SECTION BAR GROUP
10.0' to 14.5'	✓							32'-0"	@ POINT A	B
15.0' to 17.5'	✓	✓						48'-0"	@ POINT B	C
18.0' to 20.0'	✓	✓	✓					64'-0"	@ POINT C	D
20.5' to 25.0'	✓	✓	✓	✓				80'-0"	@ POINT D	E
25.5' to 30.0'	✓	✓	✓	✓	✓			96'-0"	@ POINT E	F
30.5' to 35.0'	✓	✓	✓	✓	✓	✓		112'-0"	@ POINT F	G
35.5' to 40.0'	✓	✓	✓	✓	✓	✓	✓	128'-0"	@ POINT G	H

(Columns A–G: SECTIONS & BAR GROUPS FOR END SECTIONS)

GENERAL NOTES:-

CONCRETE:- All concrete to be Class A, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each 32'-0" length of End Sections and one lap for each additional 30'-0" length of the Mid-Section, less one. Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints in wingwalls, sidewalls and slabs shall be made only where shown on plans. For convenience the joints in the End Sections should be at the Dimension Points; that is, at 32'-0" or 48'-0" lengths. The Mid-Section may be in 24'-0" to 32'-0" lengths. Joints to be normal to center-line of barrel.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Road and Bridge Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Drawing No. R-3004-A.

ARKANSAS STATE HIGHWAY COMMISSION

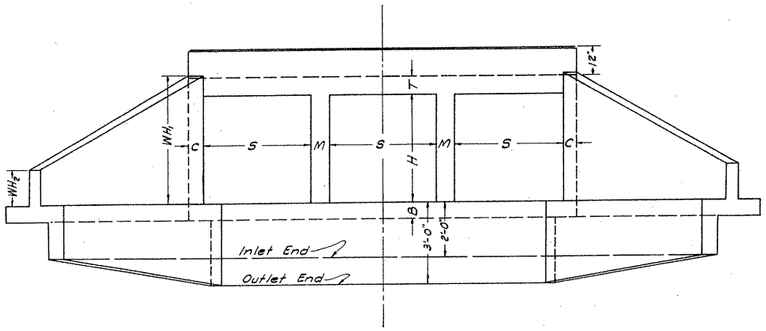
DETAILS OF SPECIAL BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS
TRIPLES
4:1 SLOPES
OVER 10'-0" COVER

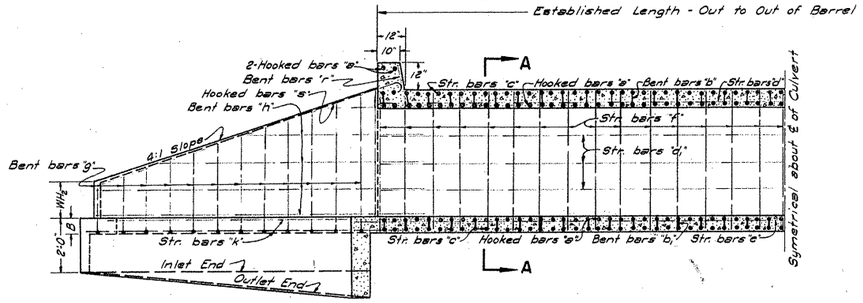
STANDARD DRAWING NO. R-3004-X

Designed by:- W.C.H. 11-11-59. Checked by:- J.M.H. 12-1-59.
Drawn by:- W.C.H. 11-24-59. Checked by:- J.M.H. 12-8-59.
Traced by:- W.C.H. 12-10-59. Checked by:- J.M.H. 12-29-59.

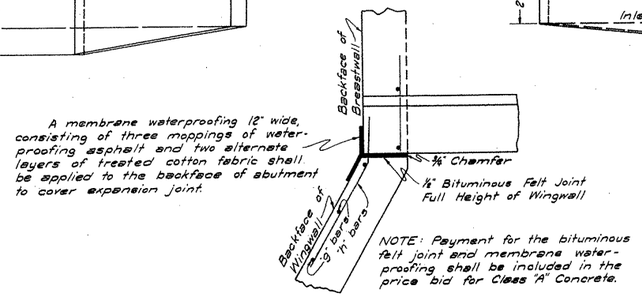
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	NO. SHEET	TOTAL SHEETS
6	ARK.				
JOB NO.					



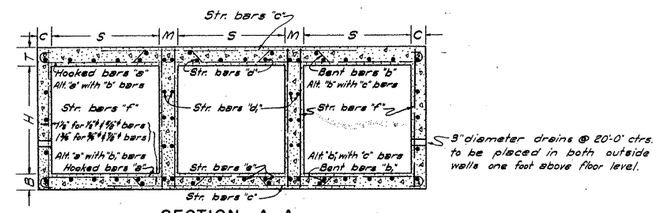
END ELEVATION



LONGITUDINAL SECTION



DETAILS OF EXPANSION JOINT
FOR CULVERTS WHEN HEIGHT "H"=8' OR MORE



SECTION A-A

DIMENSIONS AND QUANTITIES

NUMBER OF SPANS S	SPAN S	HEIGHT H	AREA OF OPENING SQ. FT. A	MAXIMUM DEPTH OF COVER D	THICKNESS OF TOP SLAB T	THICKNESS OF SIDE WALLS & WINGWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	WING-WALL HEIGHTS AT HEADWALL WH1	WING-WALL HEIGHTS AT WINGEND WH2	MAXIMUM WIDTH OF WING FOOTING WF	PERPENDICULAR DIST. FROM FOOTING TO END OF WING E	LENGTH OF WINGWALLS W1	INSIDE LENGTH OF WING FOOTING W2	FOOTING DIMENSION FROM ℄ OF BOX W3	CONCRETE CU. YDS. HEADWALLS, WINGWALLS, & FOOTINGS	CONCRETE CU. YDS. PER LINEAR FOOT OF BARREL	STEEL LBS. HEADWALLS, WINGWALLS, & FOOTINGS	STEEL LBS. PER LINEAR FOOT OF BARREL	STEEL LBS. ADDL. STEEL FOR LAPS
3	4'	2	24	13'	7 7/8"	6"	8"	7 7/8"	2'-9"	1'-0"	2'-6"	7'-0"	8'-1"	7'-9 1/8"	6'-0 1/8"	7.10	0.836	377	109.07	55.7
		3	36						3'-9"	1'-0"	2'-6"	11'-0"	12'-8 1/8"	12'-5"	6'-0 1/8"	10.03	0.923	531	117.19	62.4
		4	48						4'-9"	1'-0"	2'-6"	13'-8"	15'-9 1/8"	15'-6"	6'-0 1/8"	12.57	1.009	679	125.31	69.0
		6	72	11'		7"	9"		6'-9"	2'-0"	3'-4 1/2"	18'-0"	21'-11 1/8"	22'-2"	5'-2"	20.63	1.272	1076	142.87	82.4
3	5'	2	30	11'	8"	6"	8"	8"	2'-10"	1'-0"	2'-6"	7'-4"	8'-5 1/8"	8'-2 1/8"	7'-6 1/8"	8.07	1.029	662	142.87	62.4
		3	45						3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9 1/8"	7'-6 1/8"	11.08	1.115	910	150.79	69.0
		4	60						4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10 1/8"	7'-6 1/8"	13.69	1.202	761	158.90	75.7
		5	75						5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	19'-2 1/8"	7'-0 1/8"	16.93	1.288	946	167.02	82.4
		7	105	9"		7 1/8"	10"		7'-10"	2'-4"	3'-11"	22'-0"	25'-4 1/8"	25'-11 1/8"	6'-2"	27.63	1.641	1702	204.87	95.8
3	6'	3	54	9"	8 1/8"	6"	8"	8 1/8"	3'-10"	1'-0"	2'-6"	11'-4"	13'-1"	12'-9 1/8"	9'-0 1/8"	11.88	1.326	941	189.80	75.7
		4	72						4'-10"	1'-4"	2'-6"	14'-0"	16'-2"	15'-10 1/8"	9'-0 1/8"	14.56	1.412	794	197.92	82.4
		5	90						5'-10"	1'-8"	2'-11"	16'-8"	19'-3"	19'-2 1/8"	8'-6 1/8"	17.82	1.499	979	206.04	88.1
		6	108			7"	9"		6'-10"	2'-0"	3'-5"	19'-0"	22'-4"	22'-7"	8'-1 1/8"	23.02	1.677	1197	212.06	95.8
		8	144	7"		8"	10"		8'-10"	2'-8"	4'-5"	24'-8"	28'-5 1/8"	29'-1 1/8"	7'-1 1/8"	35.22	1.981	2079	255.51	109.1
3	8'	3	72	10 1/2"	10"	7"	9"	10 1/2"	4'-0"	1'-0"	2'-7"	12'-0"	13'-10 1/8"	13'-7 1/8"	12'-1"	15.18	2.025	736	267.80	88.1
		4	96						5'-0"	1'-4"	2'-7"	14'-8"	16'-11 1/8"	16'-8 1/8"	12'-1"	18.19	2.123	892	276.00	95.8
		5	120						6'-0"	1'-8"	3'-0"	17'-4"	20'-0 1/8"	20'-0 1/8"	11'-7 1/8"	22.13	2.222	1098	284.12	102.4
		6	144	7'					7'-0"	2'-0"	3'-6"	20'-0"	23'-1"	23'-0 1/8"	11'-0 1/8"	26.76	2.321	1317	292.24	109.1
		7	168			7 1/8"	10"		8'-0"	2'-4"	4'-0"	22'-8"	26'-2"	26'-0 1/8"	10'-6 1/8"	32.83	2.501	1886	321.90	115.8
		8	192			8"	10"		9'-0"	2'-8"	4'-6"	25'-4"	29'-3"	30'-2"	10'-0 1/2"	39.92	2.612	2242	332.80	122.5
		10	240			10"	12"		11'-0"	3'-4"	5'-6"	30'-8"	35'-5"	36'-11 1/8"	9'-2 1/2"	60.08	3.151	3368	370.18	135.8

LAP NOTE: In computing quantities of Steel from the above table, add one lap for culvert up to 50'-0" in length and add one lap for each additional 25'-0" in length.
SPECIFICATIONS: Arkansas Standard Road and Bridge Specifications
* REINFORCING STEEL: To be deformed bars of Structural or Intermediate grade.
CHAMFER: All exposed corners to have 3/4" Chamfer.
CONCRETE: All concrete to be Class "A".
* Reinforcing Steel to be deformed bars of intermediate or rail grade on all Interstate Highways.

STEEL SCHEDULE

For Culvert 90'-0" in Length - Out to Out of Barrel

NUMBER OF SPANS S	SPAN	HEIGHT H	"a" bars (3" for 1/2"ϕ & 5/8"ϕ bars; 4" for 3/4"ϕ & 7/8"ϕ bars; 2 in each Headwall Balance in Top and bottom slab of barrel) SIZE	SPACING	NUMBER	LENGTH	X
3	4'	2	1/2"ϕ	10"	7G	14'-10"	14'-1"
		3			7G	14'-10"	14'-1"
		4			7G	14'-10"	14'-1"
		6			7G	15'-2"	14'-5"
3	5'	2	5/8"ϕ	13"	6O	17'-10"	17'-1"
		3			6O	17'-10"	17'-1"
		4			7O	17'-10"	17'-1"
		5			6O	17'-10"	17'-1"
		7			6O	18'-5"	17'-8"
3	6'	3	5/8"ϕ	13"	6O	20'-10"	20'-1"
		4			6O	20'-10"	20'-1"
		5			6O	20'-10"	20'-1"
		6			6O	21'-2"	20'-5"
		8			6O	21'-6"	20'-9"
3	8'	3	5/8"ϕ	11"	7O	27'-2"	26'-5"
		4			7O	27'-2"	26'-5"
		5			7O	27'-2"	26'-5"
		6			7O	27'-2"	26'-5"
		7			7O	27'-5"	26'-8"
		8			7O	27'-6"	26'-9"
		10			7O	28'-2"	27'-5"

NUMBER OF SPANS S	SPAN	HEIGHT H	"b" bars (3" for 1/2"ϕ & 5/8"ϕ bars; 4" for 3/4"ϕ & 7/8"ϕ bars; In Top Slab of Barrel Alternate with "a" bars) SIZE	SPACING	NUMBER	LENGTH	Q	X	Y	Z
3	4'	2	1/2"ϕ	10"	3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		3			3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		4			3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		6			3G	15'-9 1/8"	2'-0"	0'-4 1/8"	2'-0"	3'-5 1/8"
3	5'	2	5/8"ϕ	13"	2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		3			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		4			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		5			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		7			2B	19'-1"	2'-6"	0'-5"	2'-6"	4'-3"
3	6'	3	5/8"ϕ	13"	2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		4			2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		5			2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		6			2B	22'-1"	3'-0"	0'-5"	2'-11"	4'-11 1/8"
		8			2B	22'-5"	3'-0"	0'-5"	3'-0"	5'-0 1/8"
3	8'	3	3/4"ϕ	11"	3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		4			3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		5			3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		6			3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		7			3B	28'-7 1/8"	4'-0"	0'-7"	3'-8"	6'-5 3/8"
		8			3B	28'-8 1/8"	4'-0"	0'-7"	3'-8"	6'-6 1/8"
		10			3B	29'-4 1/8"	4'-0"	0'-7"	3'-10"	6'-8 1/8"

NUMBER OF SPANS S	SPAN	HEIGHT H	"b" bars (3" for 1/2"ϕ & 5/8"ϕ bars; 4" for 3/4"ϕ & 7/8"ϕ bars; In Bottom Slab of Barrel Alternate with "a" bars) SIZE	SPACING	NUMBER	LENGTH	Q	X	Y	Z
3	4'	2	1/2"ϕ	10"	3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		3			3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		4			3G	15'-5 1/8"	2'-0"	0'-4 1/8"	1'-11"	3'-4 1/8"
		6			3G	15'-9 1/8"	2'-0"	0'-4 1/8"	2'-0"	3'-5 1/8"
3	5'	2	5/8"ϕ	13"	2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		3			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		4			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		5			2B	18'-6"	2'-6"	0'-5"	2'-4"	4'-1 1/8"
		7			2B	19'-1"	2'-6"	0'-5"	2'-6"	4'-3"
3	6'	3	5/8"ϕ	13"	2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		4			2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		5			2B	21'-9"	3'-0"	0'-5"	2'-10"	4'-10 1/8"
		6			2B	22'-1"	3'-0"	0'-5"	2'-11"	4'-11 1/8"
		8			2B	22'-5"	3'-0"	0'-5"	3'-0"	5'-0 1/8"
3	8'	3	3/4"ϕ	11"	3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		4			3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		5			3B	28'-4 1/8"	4'-0"	0'-7"	3'-7"	6'-5 1/8"
		6			3B	28'-4 1/8"	4'-0"	0'-7 1/8"	3'-7"	6'-5 1/8"
		7			3B	28'-7 1/8"	4'-0"	0'-7"	3'-8"	6'-5 3/8"
		8			3B	28'-8 1/8"	4'-0"	0'-7"	3'-8"	6'-6 1/8"
		10			3B	29'-4 1/8"	4'-0"	0'-7"	3'-10"	6'-8 1/8"

NUMBER OF SPANS S	SPAN	HEIGHT H	"c" bars (STRAIGHT, In Top & Bottom slab of barrel Alternate with "b" & "b" bars) SIZE	SPACING	NUMBER	LENGTH
3	4'	2	1/2"ϕ	10"	7E	9'-4"
		3			7E	9'-4"
		4			7E	9'-4"
		6			7E	9'-6"
3	5'	2	5/8"ϕ	13"	5G	11'-4"
		3			5G	11'-4"
		4			5G	11'-4"
		5			5G	11'-4"
		7			5G	11'-8"
3	6'	3	5/8"ϕ	13"	5G	13'-4"
		4			5G	13'-4"
		5			5G	13'-4"
		6			5G	13'-6"
		8			5G	13'-8"
3	8'	3	5/8"ϕ	11"	6G	17'-6"
		4			6G	17'-6"
		5			6G	17'-6"
		6			6G	17'-6"
		7			6G	17'-8"
		8			6G	17'-8"
		10			6G	18'-0"

NUMBER OF SPANS S	SPAN	HEIGHT H	"d" bars (STRAIGHT 1/2"ϕ bars, In Top Slab) SPACING	NUMBER	LENGTH
3	4'	2	10 1/2"	22	30'-0" Length
		3		22	
		4		22	
		6		22	
3	5'	2	10 1/2"	25	
		3		25	
		4		25	
		5		25	
		7		25	
3	6'	3	10 1/2"	28	29'-9" for 30'-0" Length
		4		28	
		5		28	
		6		28	
		8		28	
3	8'	3	10 1/2"	34	
		4		34	
		5		34	
		6		34	
		7		34	
		8		34	
		10		34	

NUMBER OF SPANS S	SPAN	HEIGHT H	"e" bars (STRAIGHT 1/2"ϕ bars, In Sidewalls & Division Walls) SPACING	NUMBER	LENGTH
3	4'	2	12"	6	30'-0" Length
		3		12	
		4		18	
		6		30	
3	5'	2	12"	6	
		3		12	
		4		18	
		5		24	
		7		36	
3	6'	3	12"	12	29'-9" for 30'-0" Length
		4		18	
		5		24	
		6		30	
		8		42	
3	8'	3	12"	34	
		4		18	
		5		24	
		6		30	
		7		36	
		8		42	
		10		54	

NUMBER OF SPANS S	SPAN	HEIGHT H	"f" bars (STRAIGHT Vertical bars in sidewalls & Division Walls) SPACING	NUMBER	LENGTH
3	4'	2	10 1/2"	22	31'-9" for 30'-0" Length
		3		22	
		4		22	
		6		22	
3	5'	2	10 1/2"	25	
		3		25	
		4		25	
		5		25	
		7		25	
3	6'	3	10 3/4"	28	
		4		28	
		5		28	
		6		28	
		8		28	
3	8'	3	11"	34	
		4		34	
		5		34	
		6		34	
		7		34	
		8		34	
		10		34	

NUMBER OF SPANS S	SPAN	HEIGHT H	"g" bars (Vertical bars in backface of Wingwall bent into bottom of footing) SIZE	SPACING	NUMBER	LENGTH	X Min.	X Max.	Y Min.	Y Max.
3	4'	2	1/2"	12"	3G	3'-6"	1'-3"	1'-3"	1'-4 1/2"	3'-1 1/2"
		3			5G	4'-0"	1'-3"	1'-3"	1'-5 1/2"	4'-0 1/2"
		4			6G	4'-8"	1'-3"	1'-3"	1'-10"	5'-0"
		6			8G	6'-5 1/2"	1'-6"	2'-1"	2'-5 1/2"	7'-0 1/2"
3	5'	2	1/2"	12"	3G	3'-7"	1'-3"	1'-3"	1'-6"	3'-2"
		3			5G	4'-1"	1'-3"	1'-3"	1'-6 1/2"	4'-1 1/2"
		4			6G	4'-8"	1'-3"	1'-3"	1'-9"	5'-3"
		5			8O	5'-7 1/2"	1'-3"	1'-5"	2'-2"	6'-2"
		7			10O	7'-6 1/2"	1'-4 1/2"	2'-8"	2'-9"	8'-3"
3	6'	3	1/2"	12"	5G	4'-1 1/2"	1'-3"	1'-3"	1'-6 1/2"	4'-2 1/2"
		4			6G	4'-9 1/2"	1'-3"	1'-3"	1'-8 1/2"	5'-3 1/2"
		5			8O	5'-8"	1'-3"	1'-5"	2'-2 1/2"	6'-2 1/2"
		6			9O	6'-7 1/2"	1'-4"	2'-2"	2'-6 3/4"	7'-2 1/2"
		8			11G	8'-6"	1'-5"	3'-2"	3'-2 1/2"	9'-2 1/2"
3	8'	3	1/2"	12"	5G	4'-5 1/2"	1'-4"	1'-4"	1'-8 1/2"	4'-6 1/2"
		4			6G	5'-1 1/2"	1'-4"	1'-4"	2'-0 1/2"	5'-6 1/2"
		5			8O	6'-0"	1'-4"	1'-9"	2'-3 1/2"	6'-7 1/2"
		6			9G	6'-11"	1'-4"	2'-3"	2'-8"	7'-7"
		7			10G	7'-10 1/2"	1'-4 1/2"	2'-9"	3'-0 1/2"	8'-6 1/2"
		8			12O	8'-9 1/2"	1'-5"	3'-3"	3'-5 1/2"	9'-5 1/2"
		10			17Z	10'-8 1/2"	1'-7"	4'-3"	4'-0 1/2"	11'-6 1/2"

NUMBER OF SPANS S	SPAN	HEIGHT H	"g" bars Z Min.	Z Max.	"h" bars (1/2"ϕ bars @ 12" Ctrs. Horizontal bars in Wingwalls) SIZE	SPACING	NUMBER	AVERAGE LENGTH
3	4'	2	3'-2 1/2"	7'-1 1/2"	12"	18G	3'-0"	7'-10"
		3	3'-2 1/2"	12'-5 1/2"	12	18G	4'-0"	12'-10"
		4	3'-2 1/2"	15'-6 1/2"	12	18G	5'-0"	15'-6"
		6	3'-2 1/2"	21'-8 1/2"	12	18G	7'-0"	21'-8"
3	5'	2	3'-7 1/2"	8'-8 1/2"	12	18G	3'-1"	8'-10"
		3	3'-7 1/2"	12'-10"	12	18G	4'-1"	12'-10"
		4	3'-7 1/2"	15'-11"	12	18G	5'-1"	15'-11"
		5	3'-7 1/2"	19'-0"	12	18G	6'-1"	19'-0"
		7	3'-7 1/2"	25'-1 1/2"	32	18G	8'-1"	25'-1 1/2"
3	6'	3	3'-7 1/2"	12'-10"	12	18G	4'-2"	12'-10"
		4	3'-7 1/2"	15'-11"	12	18G	5'-2"	15'-11"
		5	3'-7 1/2"	19'-0"	12	18G	6'-2"	19'-0"
		6	3'-7 1/2"	22'-1"	12	18G	7'-2"	22'-1"
		8	3'-7 1/2"	28'-2 1/2"	12	18G	9'-2"	28'-2 1/2"
3	8'	3	3'-7 1/2"	12'-10"	12	18G	4'-6"	12'-10"
		4	3'-7 1/2"	15'-11"	12	18G	5'-6"	15'-11"
		5	3'-7 1/2"	19'-0"	12	18G	6'-6"	19'-0"
		6	3'-7 1/2"	22'-1"	12	18G	7'-6"	22'-1"
		7	3'-7 1/2"	25'-2"	12	18G	8'-6"	25'-2"
		8	3'-7 1/2"	28'-3"	12	18G	9'-6"	28'-3"
		10	3'-7 1/2"	35'-2"	12	21G	11'-6"	35'-2"

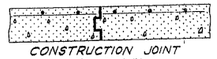
NUMBER OF SPANS S	SPAN	HEIGHT H	"r" bars (1/2"ϕ bars @ 12" Ctrs. Dowels in Headwalls) SPACING	NUMBER	LENGTH	"s" bars (1/2"ϕ bars, In Top of each Wingwall) NUMBER	LENGTH	Z
3	4'	2	12"	28	3'-0 1/2"	4	2'-7 1/2"	2'-1 1/2"
		3		28	3'-0 1/2"	4	1'-4"	1'-11 1/2"
		4		28	3'-0 1/2"	4	1'-7 1/2"	1'-11 1/2"
		6		30	3'-0 1/2"	4	2'-3 1/2"	2'-3 1/2"
3	5'	2	12"	36	3'-1"	4	2'-0"	2'-6"
		3		36	3'-1"	4	1'-7 1/2"	2'-2 1/2"
		4		36	3'-1"	4	1'-7 1/2"	1'-7 1/2"
		5		36	3'-1"	4	2'-3 1/2"	2'-3 1/2"
		7		38	3'-1"	4	2'-7"	2'-6 1/2"
3	6'	3	12"	42	3'-1 1/2"	4	1'-6 1/2"	1'-2 1/2"
		4		42	3'-1 1/2"	4	1'-7 1/2"	1'-2 1/2"
		5		42	3'-1 1/2"	4	2'-3 1/2"	1'-8 1/2"
		6		42	3'-1 1/2"	4	2'-7 1/2"	2'-2 1/2"
		8		44	3'-1 1/2"	4	3'-3 1/2"	2'-8 1/2"
3	8'	3	12"	56	3'-3 1/2"	4	1'-6"	1'-2"
		4		56	3'-3 1/2"	4	1'-7"	1'-2"
		5		56	3'-3 1/2"	4	2'-3"	1'-8"
		6		56	3'-3 1/2"	4	2'-7"	2'-2"
		7		56	3'-3 1/2"	4	3'-3"	2'-8"
		8		56	3'-3 1/2"	4	3'-7"	3'-2"
		10	12"	56	3'-3 1/2"	4	4'-7"	3'-11 1/2"

NOTE: Lengths given above do not include lap.

SPECIAL MILITARY LOADING

Add'l Loading for Interstate Highways -
2-24,000 Lb. Axles @ 2'-0" Ctrs.
Concrete (n-15) - 840 Lbs. Per Sq. In.
Reinf. Steel (Int. or Rail) - 20000 Lbs. Per Sq. In.

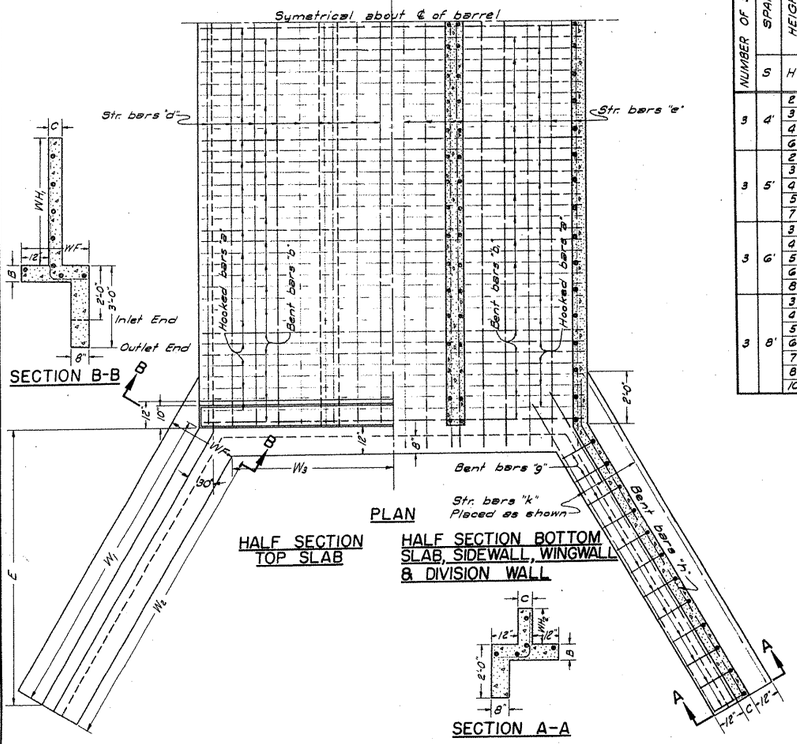
CONSTRUCTION JOINTS: Construction joints in wing walls and apron slabs shall be made only where shown in the plans. Maximum length of culvert between headwalls for which continuous pours will be permitted is 75'. For longer culverts construction joints shall be provided in slabs and walls at intervals not greater than 50'. Joints shall be normal to centerline of barrel and shall have 2" continuous keys.
Longitudinal reinforcing shall be continuous through joints.



CONSTRUCTION JOINT AND 2" KEY

A.A.S.H.O. DESIGN LIVE LOADING H20-S16 UNIT STRESSES

Concrete (n-15) - 840 Lbs. Per Sq. In.
Reinf. Steel (Str. Gr) - 18000 Lbs. Per Sq. In.



REVISIONS	
March 58	Drawn
July, 1958	Construction Joint

ARKANSAS STATE HIGHWAY COMMISSION
REINFORCED CONCRETE BOX CULVERTS
4' TO 8' SPAN 4:1 SLOPES
TRIPLE OVER 3'-6" COVER
DRAWING NO. R-3004-A

21-A

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars — BENT - See Diagram at Right. — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
"b2" bars — BENT - See Diagram at Right. — In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel
"d1" bars — STRAIGHT — Longitudinal in Sidewalls and Division Walls.
"e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel
"f" bars — STRAIGHT — Vertical in Sidewalls and Division Walls

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
SECTION "A" & BAR GROUP "A"	3:1 = 22'-0" 4:1 = 32'-0"	0' TO 10'-0"	3 @ 4'	3'	#4	12"	48	68	14'-1"	#4	12"	22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				4'			48	68	14'-1"			22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				5'			48	68	14'-1"			22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				6'			48	68	14'-5"			22	32	15'-7"	0'-2¾"	2'-3½"	3'-5¼"
			3 @ 5'	3'	#4	11"	52	74	17'-1"	#4	11"	24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				4'			52	74	17'-1"			24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				5'			52	74	17'-1"			24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				6'			52	74	17'-5"			24	35	18'-8"	0'-3½"	2'-8½"	4'-2¼"
				7'			52	74	17'-8"			24	35	18'-11"	0'-3½"	2'-9½"	4'-2¾"
			3 @ 6'	4'	#4	11"	52	74	20'-1"	#5	11"	24	35	21'-5"	0'-3½"	3'-1"	4'-10½"
				5'			52	74	20'-1"			24	35	21'-5"	0'-3½"	3'-1"	4'-10½"
				6'			52	74	20'-5"			24	35	21'-9"	0'-3½"	3'-2"	4'-11½"
				7'			52	74	20'-8"			24	35	22'-0"	0'-3½"	3'-3"	4'-11¾"
				8'			52	74	20'-9"			24	35	22'-1"	0'-3½"	3'-3"	5'-0½"
SECTION "B" & BAR GROUP "B"	3:1 = 11'-0" 4:1 = 16'-0"	10'-0" TO 15'-0"	3 @ 4'	3'	#4	12"	22	32	14'-1"	#4	12"	11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				4'			22	32	14'-1"			11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				5'			22	32	14'-1"			11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
				6'			22	32	14'-5"			11	16	15'-7"	0'-2¾"	2'-3½"	3'-5¼"
			3 @ 5'	3'	#5	12"	22	32	17'-1"	#4	12"	11	16	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				4'			22	32	17'-1"			11	16	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				5'			22	32	17'-1"			11	16	18'-4"	0'-3½"	2'-7½"	4'-1¼"
				6'			22	32	17'-5"			11	16	18'-8"	0'-3½"	2'-8½"	4'-2¼"
				7'			22	32	17'-8"			11	16	18'-11"	0'-3½"	2'-9½"	4'-2¾"
			3 @ 6'	4'	#5	12"	22	32	20'-1"	#5	12"	11	16	21'-6"	0'-4"	3'-0"	4'-10½"
				5'			22	32	20'-1"			11	16	21'-6"	0'-4"	3'-0"	4'-10½"
				6'			22	32	20'-5"			11	16	21'-10"	0'-4"	3'-1"	4'-11½"
				7'			22	32	20'-8"			11	16	22'-1"	0'-4"	3'-2"	4'-11¾"
				8'			22	32	20'-9"			11	16	22'-2"	0'-4"	3'-2"	5'-0½"
SECTION "C" & BAR GROUP "C"	3:1 = 11'-0" 4:1 = 16'-0"	15'-0" TO 20'-0"	3 @ 4'	3'	#4	11"	24	36	14'-1"	#4	11"	12	17	15'-3"	0'-2¾"	2'-2½"	3'-4½"
				4'			24	36	14'-1"			12	17	15'-3"	0'-2¾"	2'-2½"	3'-4½"
				5'			24	36	14'-1"			12	17	15'-3"	0'-2¾"	2'-2½"	3'-4½"
				6'			24	36	14'-5"			12	17	15'-7"	0'-2¾"	2'-3½"	3'-5½"
			3 @ 5'	3'	#5	13"	20	30	17'-1"	#5	13"	10	14	18'-5"	0'-3¾"	2'-6½"	4'-1¼"
				4'			20	30	17'-1"			10	14	18'-5"	0'-3¾"	2'-6½"	4'-1¼"
				5'			20	30	17'-1"			10	14	18'-5"	0'-3¾"	2'-6½"	4'-1¼"
				6'			20	30	17'-5"			10	14	18'-9"	0'-3¾"	2'-7½"	4'-2¼"
				7'			20	30	17'-8"			10	14	19'-0"	0'-3¾"	2'-8½"	4'-2¾"
			3 @ 6'	4'	#5	12"	22	32	20'-1"	#6	12"	11	16	21'-8"	0'-4½"	2'-11"	4'-10"
				5'			22	32	20'-1"			11	16	21'-8"	0'-4½"	2'-11"	4'-10"
				6'			22	32	20'-5"			11	16	22'-0"	0'-4½"	3'-0"	4'-11"
				7'			22	32	20'-8"			11	16	22'-3"	0'-4½"	3'-1"	4'-11½"
				8'			22	32	20'-9"			11	16	22'-4"	0'-4½"	3'-1"	5'-0"
SECTION "D" & BAR GROUP "D"	3:1 = 11'-0" 4:1 = 16'-0"	20'-0" TO 25'-0"	3 @ 4'	3'	#4	12"	22	32	14'-1"	#5	12"	11	16	15'-5"	0'-3¼"	2'-1½"	3'-4½"
				4'			22	32	14'-1"			11	16	15'-5"	0'-3¼"	2'-1½"	3'-4½"
				5'			22	32	14'-1"			11	16	15'-5"	0'-3¼"	2'-1½"	3'-4½"
				6'			22	32	14'-5"			11	16	15'-9"	0'-3¼"	2'-2½"	3'-5½"
			3 @ 5'	3'	#5	12"	22	32	17'-1"	#5	12"	11	16	18'-6"	0'-4¼"	2'-5½"	4'-1½"
				4'			22	32	17'-1"			11	16	18'-6"	0'-4¼"	2'-5½"	4'-1½"
				5'			22	32	17'-1"			11	16	18'-6"	0'-4¼"	2'-5½"	4'-1½"
				6'			22	32	17'-5"			11	16	18'-10"	0'-4¼"	2'-6½"	4'-2½"
				7'			22	32	17'-9"			11	16	19'-1"	0'-4¼"	2'-7½"	4'-3½"
			3 @ 6'	4'	#5	11"	24	36	20'-1"	#6	11"	12	17	21'-10"	0'-5¼"	2'-9½"	4'-10"
				5'			24	36	20'-2"			12	17	21'-11"	0'-5¼"	2'-9½"	4'-10½"
				6'			24	36	20'-5"			12	17	22'-2"	0'-5¼"	2'-10½"	4'-11¼"
				7'			24	36	20'-9"			12	17	22'-6"	0'-5¼"	2'-11½"	5'-0"
				8'			24	36	20'-10"			12	17	22'-7"	0'-5¼"	2'-11½"	5'-0¾"
SECTION "E" & BAR GROUP "E"	3:1 = 11'-0" 4:1 = 16'-0"	25'-0" TO 30'-0"	3 @ 4'	3'	#4	11"	24	34	14'-1"	#5	11"	12	18	15'-5"	0'-3½"	2'-1"	3'-4½"
				4'			24	34	14'-1"			12	18	15'-5"	0'-3½"	2'-1"	3'-4½"
				5'			24	34	14'-2"			12	18	15'-6"	0'-3½"	2'-1"	3'-4¾"
				6'			24	34	14'-6"			12	18	15'-10"	0'-3½"	2'-2"	3'-5¾"
			3 @ 5'	3'	#5	11"	24	34	17'-1"	#5	11"	12	18	18'-7"	0'-4¾"	2'-4½"	4'-1¼"
				4'			24	34	17'-1"			12	18	18'-7"	0'-4¾"	2'-4½"	4'-1¼"
				5'			24	34	17'-2"			12	18	18'-9"	0'-4¾"	2'-4½"	4'-2"
				6'			24	34	17'-6"			12	18	19'-0"	0'-4¾"	2'-5½"	4'-2¾"
				7'			24	34	17'-10"			12	18	19'-4"	0'-4¾"	2'-6½"	4'-3¾"
			3 @ 6'	4'	#5	10"	28	38	20'-1"	#6	10"	13	19	21'-10"	0'-5¾"	2'-8½"	4'-10"
				5'			28	38	20'-3"			13	19	22'-0"	0'-5¾"	2'-8½"	4'-11"
				6'			28	38	20'-7"			13	19	22'-4"	0'-5¾"	2'-9½"	5'-0"
				7'			28	38	20'-10"			13	19	22'-8"	0'-5¾"	2'-10½"	5'-0¾"
				8'			28	38	21'-0"			13	19	22'-9"	0'-5¾"	2'-10½"	5'-1½"
SECTION "F" & BAR GROUP "F"	3:1 = 11'-0" 4:1 = 16'-0"	30'-0" TO 35'-0"	3 @ 4'	3'	#5	12"	22	32	14'-1"	#5	12"	11	16	15'-6"	0'-4"	2'-0"	3'-4½"
				4'			22	32	14'-1"			11	16	15'-6"	0'-4"	2'-0"	3'-4½"
				5'			22	32	14'-3"			11	16	15'-8"	0'-4"	2'-0"	3'-5½"
				6'			22	32	14'-7"			11	16	16'-0"	0'-4"	2'-1"	3'-6½"
			3 @ 5'	3'	#5	12"	22	32	17'-1"	#6	12"	11	16	18'-10"	0'-5¼"	2'-3½"	4'-1"
				4'			22	32	17'-2"			11	16	18'-11"	0'-5¼"	2'-3½"	4'-1½"
				5'			22	32	17'-3"			11	16	19'-0"	0'-5¼"	2'-3½"	4'-2"
				6'			22	32	17'-7"			11	16	19'-4"	0'-5¼"	2'-4½"	4'-3"
				7'			22	32	17'-11"			11	16	19'-8"	0'-5¼"	2'-5½"	4'-4"
	Varies with Length of Barrel.	30'-0"	3 @ 6'	4'	#5	10"	Varies with Length of Barrel.	Varies with Length of Barrel.	20'-2"	#6	10"	Varies with Length of Barrel.	Varies with Length of Barrel.	22'-1"	0'-6½"	2'-7"	4'-10½"
				5'					20'-4"					22'-3"	0'-6½"	2'-7"	4'-11½"
				6'					20'-8"					22'-7"	0'-6½"	2'-8"	5'-0½"
				7'					21'-0"					22'-11"	0'-6½"	2'-9"	5'-1½"
				8'					21'-1"					23'-0"	0'-6½"	2'-9"	5'-2¼"
SECTION "G" & BAR GROUP "G"	Varies with Length of Barrel.	35'-0" TO 40'-0"	3 @ 4'	3'	#5	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	14'-1"	#5	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	15'-7"	0'-4½"	1'-11"	3'-4½"
				4'					14'-2"					15'-8"	0'-4½"	1'-11"	3'-4¾"
				5'					14'-4"					15'-10"	0'-4½"	1'-11"	3'-5¾"
				6'					14'-8"					16'-2"	0'-4½"	2'-0"	3'-6¾"
			3 @ 5'	3'	#5	11"			17'-1"	#6	11"			18'-11"	0'-5¾"	2'-2½"	4'-1"
				4'					17'-2"					19'-0"	0'-5¾"	2'-2½"	4'-1½"
				5'					17'-4"					19'-2"	0'-5¾"	2'-2½"	4'-2½"
				6'					17'-8"					19'-6"	0'-5¾"	2'-3½"	4'-3½"
				7'					18'-0"					19'-10"	0'-5¾"	2'-4½"	4'-4½"

Section	S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
A	3 @ 4'	3'	#4	12"	22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	44	64	9'-4"
		4'			22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"			44	64	9'-4"
		5'			22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"			44	64	9'-4"
		6'			22	32	15'-7"	0'-2¾"	2'-3½"	3'-5¼"			44	64	9'-6"
	3 @ 5'	3'	#4	11"	24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"	#5	11"	48	70	11'-4"
		4'			24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"			48	70	11'-4"
		5'			24	35	18'-4"	0'-3½"	2'-7½"	4'-1¼"			48	70	11'-4"
		6'			24	35	18'-8"	0'-3½"	2'-8½"	4'-2¼"			48	70	11'-6"
		7'			24	35	18'-11"	0'-3½"	2'-9½"	4'-2¾"			48	70	11'-8"
	3 @ 6'	4'	#5	11"	24	35	21'-5"	0'-3½"	3'-1"	4'-10½"	#5	11"	48	70	13'-4"
		5'			24	35	21'-5"	0'-3½"	3'-1"	4'-10½"			48	70	13'-4"
		6'			24	35	21'-9"	0'-3½"	3'-2"	4'-11½"			48	70	13'-6"
		7'			24	35	22'-0"	0'-3½"	3'-3"	4'-11¾"			48	70	13'-8"
		8'			24	35	22'-1"	0'-3½"	3'-3"	5'-0½"			48	70	13'-8"
B	3 @ 4'	3'	#4	12"	11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#5	12"	22	32	9'-4"
		4'			11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"			22	32	9'-4"
		5'			11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"			22	32	9'-4"
		6'			11	16	15'-7"	0'-2¾"	2'-3½"	3'-5¼"			22	32	9'-6"
	3 @ 5'	3'	#4	12"	11	16	18'-5"	0'-3¾"	2'-6½"	4'-1¼"	#6	12"	22	32	11'-4"
		4'			11	16	18'-5"	0'-3¾"	2'-6½"	4'-1¼"			22	32	11'-4"
		5'			11	16	18'-5"	0'-3¾"	2'-6½"	4'-1¼"			22	32	11'-4"
		6'			11	16	18'-9"	0'-3¾"	2'-7½"	4'-2¼"			22	32	11'-6"
		7'			11	16	19'-0"	0'-3¾"	2'-8½"	4'-2¾"			22	32	11'-8"
	3 @ 6'	4'	#5	12"	11	16	21'-7"	0'-4½"	2'-11"	4'-10½"	#6	12"	22	32	13'-4"
		5'			11	16	21'-7"	0'-4½"	2'-11"	4'-10½"			22	32	13'-4"
		6'			11	16	21'-11"	0'-4½"	3'-0"	4'-11½"			22	32	13'-6"
		7'			11	16	22'-2"	0'-4½"	3'-1"	4'-11¾"			22	32	13'-8"
		8'			11	16	22'-3"	0'-4½"	3'-1"	5'-0½"			22	32	13'-8"
C	3 @ 4'	3'	#4	11"	12	17	15'-4"	0'-3¼"	2'-1½"	3'-4½"	#5	11"	24	36	9'-4"
		4'			12	17	15'-4"	0'-3¼"	2'-1½"	3'-4½"			24	36	9'-4"
		5'			12	17	15'-4"	0'-3¼"	2'-1½"	3'-4½"			24	36	9'-4"
		6'			12	17	15'-8"	0'-3¼"	2'-2½"	3'-5½"			24	36	9'-6"
	3 @ 5'	3'	#5	13"	10	14	18'-6"	0'-4¼"	2'-5½"	4'-1¼"	#6	13"	20	30	11'-4"
		4'			10	14	18'-6"	0'-4¼"	2'-5½"	4'-1¼"			20	30	11'-4"
		5'			10	14	18'-6"	0'-4¼"	2'-5½"	4'-1¼"			20	30	11'-4"
		6'			10	14	18'-10"	0'-4¼"	2'-6½"	4'-2¼"			20	30	11'-6"
		7'			10	14	19'-1"	0'-4¼"	2'-7½"	4'-2¾"			20	30	11'-8"
	3 @ 6'	4'	#6	12"	11	16	21'-9"	0'-5"	2'-10"	4'-10"	#6	12"	22	32	13'-4"
		5'			11	16	21'-9"	0'-5"	2'-10"	4'-10"			22	32	13'-4"
		6'			11	16	22'-1"	0'-5"	2'-11"	4'-11"			22	32	13'-6"
		7'			11	16	22'-4"	0'-5"	3'-0"	4'-11½"			22	32	13'-8"
		8'			11	16	22'-5"	0'-5"	3'-0"	5'-0"			22	32	13'-8"
D	3 @ 4'	3'	#5	12"	11	16	15'-5"	0'-3½"	2'-1"	3'-4½"	#5	12"	22	32	9'-4"
		4'			11	16	15'-5"	0'-3½"	2'-1"	3'-4½"			22	32	9'-4"
		5'			11	16	15'-5"	0'-3½"	2'-1"	3'-4½"			22	32	9'-4"
		6'			11	16	15'-9"	0'-3½"	2'-2"	3'-5½"			22	32	9'-6"
	3 @ 5'	3'	#5	12"	11	16	18'-7"	0'-4¾"	2'-4½"	4'-1½"	#6	12"	22	32	11'-4"
		4'			11	16	18'-7"	0'-4¾"	2'-4½"	4'-1½"			22	32	11'-4"
		5'			11	16	18'-8"	0'-4¾"	2'-4½"	4'-1½"			22	32	11'-4"
		6'			11	16	18'-11"	0'-4¾"	2'-5½"	4'-2½"			22	32	11'-6"
		7'			11	16	19'-3"	0'-4¾"	2'-6½"	4'-3½"			22	32	11'-8"
	3 @ 6'	4'	#6	11"	12	17	21'-10"	0'-5¾"	2'-8½"	4'-10"	#6	11"	24	36	13'-4"
		5'			12	17	21'-11"	0'-5¾"	2'-8½"	4'-10½"			24	36	13'-4"
		6'			12	17	22'-3"	0'-5¾"	2'-9½"	4'-11¼"			24	36	13'-6"
		7'			12	17	22'-6"	0'-5¾"	2'-10½"	5'-0"			24	36	13'-8"
		8'			12	17	22'-8"	0'-5¾"	2'-10½"	5'-0¾"			24	36	13'-8"
E	3 @ 4'	3'	#5	11"	12	18	15'-6"	0'-4"	2'-0"	3'-4½"	#5	11"	24	34	9'-4"
		4'			12	18	15'-6"	0'-4"	2'-0"	3'-4½"			24	34	9'-4"
		5'			12	18	15'-7"	0'-4"	2'-0"	3'-4¾"			24	34	9'-4"
		6'			12	18	15'-11"	0'-4"	2'-1"	3'-5¾"			24	34	9'-6"
	3 @ 5'	3'	#5	11"	12	18	18'-8"	0'-5¼"	2'-3½"	4'-1¼"	#6	11"	24	34	11'-4"
		4'			12	18	18'-8"	0'-5¼"	2'-3½"	4'-1¼"			24	34	11'-4"
		5'			12	18	18'-9"	0'-5¼"	2'-3½"	4'-2"			24	34	11'-4"
		6'			12	18	19'-1"	0'-5¼"	2'-4½"	4'-2¾"			24	34	11'-6"
		7'			12	18	19'-5"	0'-5¼"	2'-5½"	4'-3¾"			24	34	11'-8"
	3 @ 6'	4'	#6	10"	13	19	21'-11"	0'-6¼"	2'-7½"	4'-10"	#6	10"	28	38	13'-4"
		5'			13	19	22'-1"	0'-6¼"	2'-7½"	4'-11"			28	38	13'-4"
		6'			13	19	22'-5"	0'-6¼"	2'-8½"	5'-0"			28	38	13'-6"
		7'			13	19	22'-9"	0'-6¼"	2'-9½"	5'-0¾"			28	38	13'-8"
		8'			13	19	22'-10"	0'-6¼"	2'-9½"	5'-1½"			28	38	13'-8"
F	3 @ 4'	3'	#5	12"	11	16	15'-7"	0'-4½"	1'-11"	3'-4½"	#6	12"	22	32	9'-4"
		4'			11	16	15'-7"	0'-4½"	1'-11"	3'-4½"			22	32	9'-4"
		5'			11	16	15'-9"	0'-4½"	1'-11"	3'-5½"			22	32	9'-4"
		6'			11	16	16'-1"	0'-4½"	2'-0"	3'-6½"			22	32	9'-6"
	3 @ 5'	3'	#6	12"	11	16	18'-11"	0'-5¾"	2'-2½"	4'-1"	#6	12"	22	32	11'-4"
		4'			11	16	19'-0"	0'-5¾"	2'-2½"	4'-1½"			22	32	11'-4"
		5'			11	16	19'-1"	0'-5¾"	2'-2½"	4'-2"			22	32	11'-4"
		6'			11	16	19'-5"	0'-5¾"	2'-3½"	4'-3"			22	32	11'-6"
		7'			11	16	19'-9"	0'-5¾"	2'-4½"	4'-4"			22	32	11'-8"
	3 @ 6'	4'	#6	10"	Varies with Length of Barrel.	Varies with Length of Barrel.	22'-2"	0'-7"	2'-6"	4'-10½"	#6	10"	Varies with Length of Barrel.	Varies with Length of Barrel.	13'-4"
		5'					22'-4"	0'-7"	2'-6"	4'-11½"					13'-4"
		6'					22'-8"	0'-7"	2'-7"	5'-0½"					13'-6"
		7'					23'-0"	0'-7"	2'-8"	5'-1½"					13'-8"
		8'					23'-1"	0'-7"	2'-8"	5'-2¼"					13'-8"
G	3 @ 4'	3'	#5	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	15'-7"	0'-5"	1'-10"	3'-4½"	#6	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	9'-4"
		4'					15'-8"	0'-5"	1'-10"	3'-4¾"					9'-4"
		5'					15'-10"	0'-5"	1'-10"	3'-5¾"					9'-4"
		6'					16'-2"	0'-5"	1'-11"	3'-6¾"					9'-6"
	3 @ 5'	3'	#6	11"			18'-11"	0'-6¼"	2'-1½"	4'-1"	#6	11"			11'-4"
		4'					19'-0"	0'-6¼"	2'-1½"	4'-1½"					11'-4"
		5'					19'-2"	0'-6¼"	2'-1½"	4'-2½"					11'-4"
		6'					19'-6"	0'-6¼"	2'-2½"	4'-3½"					11'-6"
		7'					19'-10"	0'-6¼"	2'-3½"	4'-4½"					11'-8"

Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
A	3 @ 4'	3'	#4	12"	22	33'-3" for 32'-0" Section.	#4	12"	18	33'-3" for 32'-0" Section	#4	12"	22	34'-3" for 32'-0" Section.	#4	12"	132	192	3'-9"
		4'			22				24				22				132	192	4'-9"
		5'			22				30				22				132	192	5'-9"
		6'			22				36				22				132	192	6'-9"
	3 @ 5'	3'	#4	12	25		#4	12"	18		#4	12"	25		#4	12"	132	192	3'-10"
		4'			25				24				25				132	192	4'-10"
		5'			25				30				25				132	192	5'-10"
		6'			25				36				25				132	192	6'-10"
		7'			25				42				25		#5	12"	132	192	7'-10"
	3 @ 6'	4'	#4	12"	28		#4	12"	24		#4	12"	28		#4	12"	132	192	4'-11"
		5'			28				30				28				132	192	5'-11"
		6'			28				36				28				132	192	6'-11"
		7'			28				42				28		#5	12"	132	192	7'-11"
		8'			28				48				28			11"	144	210	8'-11"
B	3 @ 4'	3'	#4	12"	22	34'-3" for 33'-0" Length Section	#4	12"	18	34'-3" for 33'-0" Length Section	#4	12"	22	34'-3" for 33'-0" Length Section.	#4	12"	66	96	3'-9"
		4'			22				24				22				66	96	4'-9"
		5'			22				30				22				66	96	5'-9"
		6'			22				36				22		#5	12"	66	96	6'-9"
	3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25		#4	12"	66	96	3'-10"
		4'			25				24				25				66	96	4'-10"
		5'			25				30				25				66	96	5'-10"
		6'			25				36				25			10"	84	120	6'-10"
		7'			25				42				25		#5	11"	72	108	7'-10"
	3 @ 6'	4'	#4	12"	28		#4	12"	24		#4	12"	28		#4	12"	66	96	5'-0"
		5'			28				30				28				66	96	6'-0"
		6'			28				36				28			10"	84	120	7'-0"
		7'			28				42				28		#5	11"	72	108	8'-0"
		8'			28				48				28		#6	12"	66	96	9'-0"
C	3 @ 4'	3'	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	66	96	3'-9"
		4'			22				24				22				66	96	4'-9"
		5'			22				30				22		#5	12"	66	96	5'-9"
		6'			22				36				22			11"	72	108	6'-9"
	3 @ 5'	3'	#4	12	25		#4	12"	18		#4	12"	25		#4	12"	66	96	4'-0"
		4'			25				24				25				66	96	5'-0"
		5'			25				30				25			10"	84	120	6'-0"
		6'			25				36				25		#5	12"	66	96	7'-0"
		7'			25				42				25		#6	12"	66	96	8'-0"
	3 @ 6'	4'	#4	12"	28		#4	12"	24		#4	12"	28		#4	12"	66	96	5'-1"
		5'			28				30				28			10"	84	120	6'-1"
		6'			28				36				28		#5	12"	66	96	7'-1"
		7'			28				42				28		#6	12"	66	96	8'-1"
		8'			28				48				28			10"	84	114	9'-1"
D	3 @ 4'	3'	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	66	96	3'-10"
		4'			22				24				22				66	96	4'-10"
		5'			22				30				22		#5	11"	72	108	5'-10"
		6'			22				36				22		#6	12"	66	96	6'-10"
	3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25		#4	12"	66	96	4'-1"
		4'			25				24				25				66	96	5'-1"
		5'			25				30				25		#5	12"	66	96	6'-1"
		6'			25				36				25		#6	12"	66	96	7'-1"
		7'			25				42				25			11"	72	102	8'-1"
	3 @ 6'	4'	#4	12"	28		#4	12"	24		#4	12"	28		#4	12"	66	96	5'-3"
		5'			28				30				28			10"	78	114	6'-3"
		6'			28				36				28		#5	11"	72	102	7'-3"
		7'			28				42				28		#6	12"	66	96	8'-3"
		8'			28				48				28			9"	84	132	9'-3"
E	3 @ 4'	3'	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	66	96	3'-11"
		4'			22				24				22				66	96	4'-11"
		5'			22				30				22		#5	11"	72	102	5'-11"
		6'			22				36				22		#6	12"	66	96	6'-11"
	3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25		#4	12"	66	96	4'-2"
		4'			25				24				25				66	96	5'-2"
		5'			25				30				25		#5	12"	66	96	6'-2"
		6'			25				36				25		#6	12"	66	96	7'-2"
		7'			25				42				25			10"	84	120	8'-2"
	3 @ 6'	4'	#4	12"	28		#4	12"	24		#4	12"	28		#4	12"	66	96	5'-4"
		5'			28				30				28			10"	78	114	6'-4"
		6'			28				36				28		#5	11"	72	108	7'-4"
		7'			28				42				28		#6	12"	66	96	8'-4"
		8'			28				48				28			9"	90	126	9'-4"
F	3 @ 4'	3'	#4	12"	22		#4	12"	18		#4	12"	22		#4	12"	66	96	4'-0"
		4'			22				24				22				66	96	5'-0"
		5'			22				30				22		#5	11"	72	108	6'-0"
		6'			22				36				22		#6	12"	66	96	7'-0"
	3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25		#4	12"	66	96	4'-3"
		4'			25				24				25				66	96	5'-3"
		5'			25				30				25		#5	12"	66	96	6'-3"
		6'			25				36				25		#6	12"	66	96	7'-3"
		7'			25				42				25			10"	78	114	8'-3"
	3 @ 6'	4'	#4	12"	28	Varies with Length of Barrel.	#4	12"	24	Varies with Length of Barrel.	#4	12"	28	Varies with Length of Barrel.	#4	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	5'-5"
		5'			28				30				28			10"			6'-5"
		6'			28				36				28		#5	11"			7'-5"
		7'			28				42				28		#6	12"			8'-5"
		8'			28				48				28			9"			9'-5"
G	3 @ 4'	3'	#4	12"	22	Varies with Length of Barrel.	#4	12"	18	Varies with Length of Barrel.	#4	12"	22	Varies with Length of Barrel.	#4	12"	Varies with Length of Barrel.	Varies with Length of Barrel.	4'-1"
		4'			22				24				22						5'-1"
		5'			22				30				22		#5	11"			6'-1"
		6'			22				36				22		#6	12"			7'-1"
	3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25		#4	12"			4'-4"
		4'			25				24				25			11"			5'-4"
		5'			25				30				25		#5	12"			6'-4"
		6'			25				36				25			12"			7'-4"
		7'			25				42				25		#6	10"			8'-4"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

Designed by:- W.C.H. 9-24-62 Checked by:- R.H.S. - 11-12-62
Drawn by:- W.C.H. 10-18-62 Checked by:- J.E.M. - 11-21-62
Quantities by:- W.C.H. 11-12-62 Checked by:- J.E.M. - 11-27-62

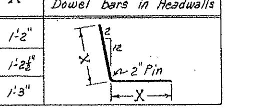
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel (Cu.Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
SECTION "A" = 10'-0"	3 @ 4'	3'	36	14'-4"	6"	6"	8"	6"	4'-0"	0.790	108.11	51.77	151.41
		4'	48	14'-4"		6"	8"		5'-0"	0.877	116.12	56.78	151.41
		5'	60	14'-4"		6"	8"		6'-0"	0.963	124.14	61.79	151.41
		6'	72	14'-8"		7"	9"		7'-0"	1.136	133.27	66.80	153.19
	3 @ 5'	3'	45	17'-4"	6½"	6"	8"	6½"	4'-1"	0.955	138.20	56.78	182.81
		4'	60	17'-4"		6"	8"		5'-1"	1.041	146.21	61.79	182.81
		5'	75	17'-4"		6"	8"		6'-1"	1.128	154.23	66.80	182.81
		6'	90	17'-8"		7"	9"		7'-1"	1.301	163.60	71.81	184.59
		7'	105	17'-11"		7½"	10"		8'-1"	1.475	190.35	76.82	185.93
	3 @ 6'	4'	72	20'-4"	7"	6"	8"	7"	5'-2"	1.224	181.50	66.80	214.87
		5'	90	20'-4"		6"	8"		6'-2"	1.311	189.51	71.81	214.87
		6'	108	20'-8"		7"	9"		7'-2"	1.486	199.15	76.82	216.65
		7'	126	20'-11"		7½"	10"		8'-2"	1.660	226.29	81.83	217.99
		8'	144	21'-0"		8"	10"		9'-2"	1.796	241.94	86.84	218.44
SECTION "B" = 15'-0"	3 @ 4'	3'	36	14'-4"	6"	6"	8"	6"	4'-0"	0.790	115.10	51.77	
		4'	48	14'-4"		6"	8"		5'-0"	0.877	123.12	56.78	
		5'	60	14'-4"		6"	8"		6'-0"	0.963	131.14	61.79	
		6'	72	14'-8"		7"	9"		7'-0"	1.136	155.58	66.80	
	3 @ 5'	3'	45	17'-4"	6½"	6"	8"	7"	4'-1½"	0.981	155.02	56.78	
		4'	60	17'-4"		6"	8"		5'-1½"	1.068	163.03	61.79	
		5'	75	17'-4"		6"	8"		6'-1½"	1.154	171.05	66.80	
		6'	90	17'-8"		7"	9"		7'-1½"	1.329	186.19	71.81	
		7'	105	17'-11"		7½"	10"		8'-1½"	1.503	212.16	76.82	
	3 @ 6'	4'	72	20'-4"	7½"	6"	8"	8"	5'-3½"	1.318	200.36	66.80	
		5'	90	20'-4"		6"	8"		6'-3½"	1.405	208.38	71.81	
		6'	108	20'-8"		7"	9"		7'-3½"	1.581	223.90	76.82	
		7'	126	20'-11"		7½"	10"		8'-3½"	1.757	250.40	81.83	
		8'	144	21'-0"		8"	10"		9'-3½"	1.894	281.25	86.84	
SECTION "C" = 20'-0"	3 @ 4'	3'	36	14'-4"	6"	6"	8"	6½"	4'-0½"	0.812	120.50	51.77	
		4'	48	14'-4"		6"	8"		5'-0½"	0.899	128.51	56.78	
		5'	60	14'-4"		6"	8"		6'-0½"	0.985	149.47	61.79	
		6'	72	14'-8"		7"	9"		7'-0½"	1.158	164.93	66.80	
	3 @ 5'	3'	45	17'-4"	7¼"	6"	8"	7¾"	4'-3"	1.062	161.32	56.78	
		4'	60	17'-4"		6"	8"		5'-3"	1.148	169.34	61.79	
		5'	75	17'-4"		6"	8"		6'-3"	1.235	182.16	66.80	
		6'	90	17'-8"		7"	9"		7'-3"	1.410	202.86	71.81	
		7'	105	17'-11"		7½"	10"		8'-3"	1.586	236.59	76.82	
	3 @ 6'	4'	72	20'-4"	8"	6"	8"	8½"	5'-4½"	1.381	220.97	66.80	
		5'	90	20'-4"		6"	8"		6'-4½"	1.468	233.87	71.81	
		6'	108	20'-8"		7"	9"		7'-4½"	1.645	255.14	76.82	
		7'	126	20'-11"		7½"	10"		8'-4½"	1.821	289.44	81.83	
		8'	144	21'-0"		8"	10"		9'-4½"	1.958	319.26	86.84	
SECTION "D" = 25'-0"	3 @ 4'	3'	36	14'-4"	6½"	6"	8"	7"	4'-1½"	0.856	127.22	51.77	
		4'	48	14'-4"		6"	8"		5'-1½"	0.943	135.24	56.78	
		5'	60	14'-4"		6"	8"		6'-1½"	1.029	159.70	61.79	
		6'	72	14'-8"		7"	9"		7'-1½"	1.204	186.96	66.80	
	3 @ 5'	3'	45	17'-4"	7¾"	6"	8"	8¼"	4'-4"	1.115	170.15	56.78	
		4'	60	17'-4"		6"	8"		5'-4"	1.202	178.17	61.79	
		5'	75	17'-4½"		6½"	8"		6'-4"	1.298	199.96	66.80	
		6'	90	17'-8"		7"	9"		7'-4"	1.465	231.53	71.81	
		7'	105	18'-0"		8"	10"		8'-4"	1.667	252.98	76.82	
	3 @ 6'	4'	72	20'-4"	8¾"	6"	8"	9¼"	5'-6"	1.475	235.43	66.80	
		5'	90	20'-5"		6½"	8"		6'-6"	1.582	248.92	71.81	
		6'	108	20'-8½"		7¼"	9"		7'-6"	1.752	274.43	76.82	
		7'	126	21'-0"		8"	10"		8'-6"	1.949	305.55	81.83	
		8'	144	21'-1½"		8¾"	10"		9'-6"	2.100	346.96	86.84	
SECTION "E" = 30'-0"	3 @ 4'	3'	36	14'-4"	7"	6"	8"	7½"	4'-2½"	0.901	134.06	51.77	
		4'	48	14'-4"		6"	8"		5'-2½"	0.987	142.07	56.78	
		5'	60	14'-5"		6½"	8"		6'-2½"	1.093	167.08	61.79	
		6'	72	14'-9"		7½"	9"		7'-2½"	1.271	197.65	66.80	
	3 @ 5'	3'	45	17'-4"	8¼"	6"	8"	8¾"	4'-5"	1.169	180.52	56.78	
		4'	60	17'-4"		6"	8"		5'-5"	1.255	188.54	61.79	
		5'	75	17'-5½"		6¾"	8"		6'-5"	1.371	210.90	66.80	
		6'	90	17'-9"		7½"	9"		7'-5"	1.572	242.88	71.81	
		7'	105	18'-1"		8½"	10"		8'-5"	1.748	272.68	76.82	
	3 @ 6'	4'	72	20'-4"	9¼"	6"	8"	9¾"	5'-7"	1.538	252.01	66.80	
		5'	90	20'-6"		7"	8"		6'-7"	1.665	266.12	71.81	
		6'	108	20'-10"		8"	9"		7'-7"	1.851	292.37	76.82	
		7'	126	21'-1½"		8¾"	10"		8'-7"	2.049	323.84	81.83	
		8'	144	21'-3"		9½"	10"		9'-7"	2.209	365.61	86.84	
SECTION "F" = 35'-0"	3 @ 4'	3'	36	14'-4"	7½"	6"	8"	8"	4'-3½"	0.945	147.28	51.77	
		4'	48	14'-4"		6"	8"		5'-3½"	1.031	155.30	56.78	
		5'	60	14'-6"		7"	8"		6'-3½"	1.157	180.92	61.79	
		6'	72	14'-10"		8"	9"		7'-3½"	1.339	208.95	66.80	
	3 @ 5'	3'	45	17'-4"	8¾"	6"	8"	9½"	4'-6"	1.222	188.84	56.78	
		4'	60	17'-5"		6½"	8"		5'-6"	1.326	197.28	61.79	
		5'	75	17'-6"		7"	8"		6'-6"	1.435	219.78	66.80	
		6'	90	17'-10"		8"	9"		7'-6"	1.620	252.21	71.81	
		7'	105	18'-2"		9"	10"		8'-6"	1.830	282.30	76.82	
	3 @ 6'	4'	72	20'-5"	10"	6½"	8"	10½"	5'-8½"	1.650	253.45	66.80	
		5'	90	20'-7"		7½"	8"		6'-8½"	1.781	267.63	71.81	
		6'	108	20'-11"		8½"	9"		7'-8½"	1.972	294.05	76.82	
		7'	126	21'-3"		9½"	10"		8'-8½"	2.187	325.91	81.83	
		8'	144	21'-4½"		10¼"	10"		9'-8½"	2.352	367.73	86.84	
SECTION "G" = 40'-0"	3 @ 4'	3'	36	14'-4"	8"	6"	8"	8½"	4'-4½"	0.989	147.70	51.77	
		4'	48	14'-5"		6½"	8"		5'-4½"	1.092	156.07	56.78	
		5'	60	14'-7"		7½"	8"		6'-4½"	1.221	181.93	61.79	
		6'	72	14'-11"		8½"	9"		7'-4½"	1.408	210.13	66.80	
	3 @ 5'	3'	45	17'-4"	9¼"	6"	8"	9¾"	4'-7"	1.276	200.80	56.78	
		4'	60	17'-5"		6½"	8"		5'-7"	1.379	211.22	61.79	
		5'	75	17'-7"		7½"	8"		6'-7"	1.510	232.47	66.80	
		6'	90	17'-11"		8½"	9"		7'-7"	1.699	265.33	71.81	
		7'	105	18'-3"		9½"	10"		8'-7"	1.913	295.77	76.82	

DOWEL BARS FOR TWO HEADWALLS

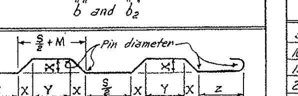
Span	Size	Spacing	No. Req'd	Length	X
4'	#4	12"±	30	2'-4"	1'-2"
5'	#4	12"±	36	2'-5"	1'-2¼"
6'	#4	12"±	42	2'-6"	1'-3"

Bars "r" Dowel bars in Headwalls



Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4¾"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" and "b2"



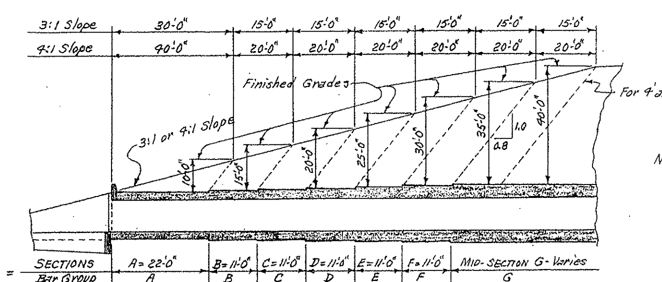
NOTE:- Dimensions are to centers of bars (b & b2).

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	A	B	C	D	E	F	Mid-Sect. and Bar Group
5.0' to 9.5'	✓						A
10.0' to 14.5'	✓						B
15.0' to 19.5'	✓	✓					C
20.0' to 24.5'	✓	✓	✓				D
25.0' to 29.5'	✓	✓	✓	✓			E
30.0' to 34.5'	✓	✓	✓	✓	✓		F
35.0' to 40.0'	✓	✓	✓	✓	✓	✓	G

(Columns A–F: Sections & Bar Groups for End Sections.)



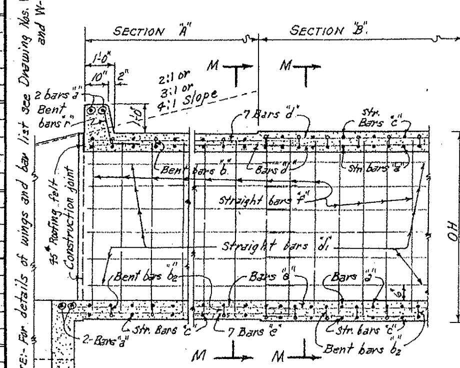
NOTE:- See Table above for SECTIONS and Bar Groups to be used for Various Depths of Cover.

	Sections							
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G

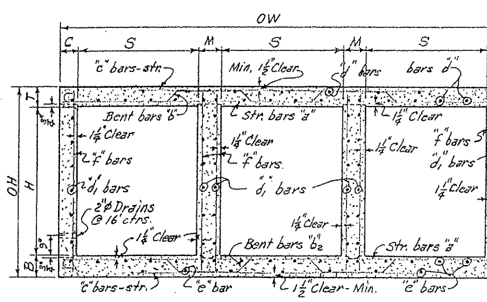
TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

NOTE:- For details of wings and bar list see Drawing Nos. W-X002-1, W-X003-1, and W-X004-1.



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B,C,D,E or F	4:1 Slopes Sections A	4:1 Slopes Sections B,C,D,E or F
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

* See Drawings For Skewed Culverts.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X002-1, W-X003-1 and W-X004-1.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS — 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-300X-X1

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars – BENT - See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

Section & Bar Group	Lengths of Section	D (Depth of Cover)	S (Clear Span)	H (Clear Height)	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
Section "A" & Bar Group "A"	4:1 = 32'-0"; 3:1 = 22'-0"	0 to 10'-0"	3 @ 8'	5'	#5	12"	48	68	26'-5"	#6	12"	22	32	28'-1"	0'-5"	3'-11"	6'-5"
				6'			48	68	26'-5"			22	32	28'-1"	0'-5"	3'-11"	6'-5"
				7'			48	68	26'-8"			22	32	28'-4"	0'-5"	4'-0"	6'-5½"
				8'			48	68	26'-9"			22	32	28'-5"	0'-5"	4'-0"	6'-6"
				9'			48	68	27'-1"			22	32	28'-9"	0'-5"	4'-1"	6'-7"
				10'			48	68	27'-5"			22	32	29'-1"	0'-5"	4'-2"	6'-8"
			3 @ 10'	6'	#6	11"	52	74	32'-8"	#6	11"	24	35	34'-6"	0'-6½"	4'-9"	7'-11½"
				7'			52	74	32'-8"			24	35	34'-6"	0'-6½"	4'-9"	7'-11½"
				8'			52	74	32'-9"			24	35	34'-7"	0'-6½"	4'-9"	8'-0"
				9'			52	74	33'-1"			24	35	34'-11"	0'-6½"	4'-10"	8'-1"
				10'			52	74	33'-5"			24	35	35'-3"	0'-6½"	4'-11"	8'-2"
				11'			52	74	33'-7"			24	35	35'-5"	0'-6½"	4'-11"	8'-3"
				12'			52	74	33'-9"			24	35	35'-7"	0'-6½"	4'-11"	8'-4"
			3 @ 12'	6'	#6	11"	52	74	38'-9"	#7	11"	24	35	40'-11"	0'-7¾"	5'-6½"	9'-6"
				7'			52	74	38'-9"			24	35	40'-11"	0'-7¾"	5'-6½"	9'-6"
				8'			52	74	38'-9"			24	35	40'-11"	0'-7¾"	5'-6½"	9'-6"
				9'			52	74	39'-1"			24	35	41'-3"	0'-7¾"	5'-7½"	9'-7"
				10'			52	74	39'-5"			24	35	41'-7"	0'-7¾"	5'-8½"	9'-8"
				11'			52	74	39'-7"			24	35	41'-9"	0'-7¾"	5'-8½"	9'-9"
				12'			52	74	39'-9"			24	35	41'-11"	0'-7¾"	5'-8½"	9'-10"
Section "B" & Bar Group "B"	4:1 = 16'-0"; 3:1 = 11'-0"	10'-0" to 15'-0"	3 @ 8'	5'	#5	11"	24	36	26'-5"	#6	11"	12	17	28'-3"	0'-6"	3'-9"	6'-5"
				6'			24	36	26'-5"			12	17	28'-3"	0'-6"	3'-9"	6'-5"
				7'			24	36	26'-8"			12	17	28'-6"	0'-6"	3'-10"	6'-5½"
				8'			24	36	26'-9"			12	17	28'-7"	0'-6"	3'-10"	6'-6"
				9'			24	36	27'-1"			12	17	28'-11"	0'-6"	3'-11"	6'-7"
				10'			24	36	27'-5"			12	17	29'-3"	0'-6"	4'-0"	6'-8"
			3 @ 10'	6'	#6	13"	20	30	32'-8"	#7	13"	10	14	34'-10"	0'-7½"	4'-7"	7'-11½"
				7'			20	30	32'-8"			10	14	34'-10"	0'-7½"	4'-7"	7'-11½"
				8'			20	30	32'-9"			10	14	34'-11"	0'-7½"	4'-7"	8'-0"
				9'			20	30	33'-1"			10	14	35'-3"	0'-7½"	4'-8"	8'-1"
				10'			20	30	33'-5"			10	14	35'-7"	0'-7½"	4'-9"	8'-2"
				11'			20	30	33'-7"			10	14	35'-9"	0'-7½"	4'-9"	8'-3"
				12'			20	30	33'-9"			10	14	35'-11"	0'-7½"	4'-9"	8'-4"
			3 @ 12'	6'	#7	12"	22	32	38'-9"	#7	12"	11	16	41'-2"	0'-9¼"	5'-3½"	9'-6"
				7'			22	32	38'-9"			11	16	41'-2"	0'-9¼"	5'-3½"	9'-6"
				8'			22	32	38'-9"			11	16	41'-2"	0'-9¼"	5'-3½"	9'-6"
				9'			22	32	39'-1"			11	16	41'-6"	0'-9¼"	5'-4½"	9'-7"
				10'			22	32	39'-5"			11	16	41'-10"	0'-9¼"	5'-5½"	9'-8"
				11'			22	32	39'-7"			11	16	42'-0"	0'-9¼"	5'-5½"	9'-9"
				12'			22	32	39'-9"			11	16	42'-2"	0'-9¼"	5'-5½"	9'-10"
Section "C" & Bar Group "C"	4:1 = 16'-0"; 3:1 = 11'-0"	15'-0" to 20'-0"	3 @ 8'	5'	#6	11"	24	34	26'-5"	#6	11"	12	18	28'-4"	0'-7"	3'-7"	6'-5"
				6'			24	34	26'-5"			12	18	28'-4"	0'-7"	3'-7"	6'-5"
				7'			24	34	26'-8"			12	18	28'-7"	0'-7"	3'-8"	6'-5½"
				8'			24	34	26'-9"			12	18	28'-8"	0'-7"	3'-8"	6'-6"
				9'			24	34	27'-1"			12	18	29'-0"	0'-7"	3'-9"	6'-7"
				10'			24	34	27'-5"			12	18	29'-4"	0'-7"	3'-10"	6'-8"
			3 @ 10'	6'	#7	12"	22	32	32'-9"	#7	12"	11	16	35'-1"	0'-8¾"	4'-4½"	8'-0"
				7'			22	32	32'-9"			11	16	35'-1"	0'-8¾"	4'-4½"	8'-0"
				8'			22	32	32'-10"			11	16	35'-2"	0'-8¾"	4'-4½"	8'-0½"
				9'			22	32	33'-2"			11	16	35'-6"	0'-8¾"	4'-5½"	8'-1½"
				10'			22	32	33'-5"			11	16	35'-10"	0'-8¾"	4'-6½"	8'-2¼"
				11'			22	32	33'-7"			11	16	35'-11"	0'-8¾"	4'-6½"	8'-3"
				12'			22	32	33'-9"			11	16	36'-1"	0'-8¾"	4'-6½"	8'-4"
			3 @ 12'	6'	#7	12"	22	32	38'-9"	#8	12"	11	16	41'-6"	0'-10¾"	5'-0½"	9'-6"
				7'			22	32	38'-9"			11	16	41'-6"	0'-10¾"	5'-0½"	9'-6"
				8'			22	32	38'-10"			11	16	41'-8"	0'-10¾"	5'-0½"	9'-6¾"
				9'			22	32	39'-2"			11	16	41'-11"	0'-10¾"	5'-1½"	9'-7½"
				10'			22	32	39'-5"			11	16	42'-3"	0'-10¾"	5'-2½"	9'-8¼"
				11'			22	32	39'-7"			11	16	42'-5"	0'-10¾"	5'-2½"	9'-9¼"
				12'			22	32	39'-9"			11	16	42'-7"	0'-10¾"	5'-2½"	9'-10¼"
Section "D" & Bar Group "D"	Varies with Length of Barrel	20'-0" to 25'-0"	3 @ 8'	5'	#6	12"	Varies with length of Barrel.	Varies with length of Barrel.	26'-5"	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	28'-7"	0'-7¾"	3'-5½"	6'-5"
				6'					26'-6"					28'-9"	0'-7¾"	3'-5½"	6'-5¾"
				7'					26'-10"					29'-0"	0'-7¾"	3'-6½"	6'-6½"
				8'					26'-11"					29'-2"	0'-7¾"	3'-6½"	6'-7¼"
				9'					27'-3"					29'-5"	0'-7¾"	3'-7½"	6'-8"
				10'					27'-7"					29'-9"	0'-7¾"	3'-8½"	6'-9"
			3 @ 10'	6'	#7	11"			32'-9"	#7	11"			35'-3"	0'-10"	4'-2"	8'-0"
				7'					32'-10"					35'-4"	0'-10"	4'-2"	8'-0½"
				8'					32'-11"					35'-6"	0'-10"	4'-2"	8'-1½"
				9'					33'-3"					35'-10"	0'-10"	4'-3"	8'-2½"
				10'					33'-7"					36'-2"	0'-10"	4'-4"	8'-3½"
				11'					33'-9"					36'-3"	0'-10"	4'-4"	8'-4"
				12'					33'-10"					36'-5"	0'-10"	4'-4"	8'-4½"
			3 @ 12'	6'	#7	11"			38'-9"	#8	11"			41'-9"	1'-0¼"	4'-9½"	9'-6"
				7'					38'-10"					41'-10"	1'-0¼"	4'-9½"	9'-6¾"
				8'					39'-0"					42'-0"	1'-0¼"	4'-9½"	9'-7½"
				9'					39'-4"					42'-4"	1'-0¼"	4'-10½"	9'-8¼"
				10'					39'-7"					42'-7"	1'-0¼"	4'-11½"	9'-9¼"
				11'					39'-9"					42'-9"	1'-0¼"	4'-11½"	9'-10¼"
				12'					39'-11"					42'-11"	1'-0¼"	4'-11½"	9'-11¼"

"b2" bars – BENT - See Diagram below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.

Section	S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
A	3 @ 8'	5'	#6	12"	22	32	28'-2"	0'-5½"	3'-10"	6'-5"	#6	12"	44	64	17'-6"
		6'			22	32	28'-2"	0'-5½"	3'-10"	6'-5"			44	64	17'-6"
		7'			22	32	28'-5"	0'-5½"	3'-11"	6'-5½"			44	64	17'-8"
		8'			22	32	28'-6"	0'-5½"	3'-11"	6'-6"			44	64	17'-8"
		9'			22	32	28'-10"	0'-5½"	4'-0"	6'-7"			44	64	17'-10"
		10'			22	32	29'-2"	0'-5½"	4'-1"	6'-8"			44	64	18'-0"
	3 @ 10'	6'	#6	11"	24	35	34'-7"	0'-7"	4'-8"	7'-11½"	#7	11"	48	70	21'-8"
		7'			24	35	34'-7"	0'-7"	4'-8"	7'-11½"			48	70	21'-8"
		8'			24	35	34'-8"	0'-7"	4'-8"	8'-0"			48	70	21'-8"
		9'			24	35	35'-0"	0'-7"	4'-9"	8'-1"			48	70	21'-10"
		10'			24	35	35'-4"	0'-7"	4'-10"	8'-2"			48	70	22'-0"
		11'			24	35	35'-6"	0'-7"	4'-10"	8'-3"			48	70	22'-0"
		12'			24	35	35'-8"	0'-7"	4'-10"	8'-4"			48	70	22'-0"
	3 @ 12'	6'	#7	11"	24	35	41'-0"	0'-8¼"	5'-5½"	9'-6"	#7	11"	48	70	25'-8"
		7'			24	35	41'-0"	0'-8¼"	5'-5½"	9'-6"			48	70	25'-8"
		8'			24	35	41'-0"	0'-8¼"	5'-5½"	9'-6"			48	70	25'-8"
		9'			24	35	41'-4"	0'-8¼"	5'-6½"	9'-7"			48	70	25'-10"
		10'			24	35	41'-8"	0'-8¼"	5'-7½"	9'-8"			48	70	26'-0"
		11'			24	35	41'-10"	0'-8¼"	5'-7½"	9'-9"			48	70	26'-0"
		12'			24	35	42'-0"	0'-8¼"	5'-7½"	9'-10"			48	70	26'-0"
B	3 @ 8'	5'	#6	11"	12	17	28'-4"	0'-6½"	3'-8"	6'-5"	#6	11"	24	36	17'-6"
		6'			12	17	28'-4"	0'-6½"	3'-8"	6'-5"			24	36	17'-6"
		7'			12	17	28'-7"	0'-6½"	3'-9"	6'-5½"			24	36	17'-8"
		8'			12	17	28'-8"	0'-6½"	3'-9"	6'-6"			24	36	17'-8"
		9'			12	17	29'-0"	0'-6½"	3'-10"	6'-7"			24	36	17'-10"
		10'			12	17	29'-4"	0'-6½"	3'-11"	6'-8"			24	36	18'-0"
	3 @ 10'	6'	#7	13"	10	14	34'-11"	0'-8"	4'-6"	7'-11½"	#8	13"	20	30	21'-8"
		7'			10	14	34'-11"	0'-8"	4'-6"	7'-11½"			20	30	21'-8"
		8'			10	14	35'-0"	0'-8"	4'-6"	8'-0"			20	30	21'-8"
		9'			10	14	35'-4"	0'-8"	4'-7"	8'-1"			20	30	21'-10"
		10'			10	14	35'-8"	0'-8"	4'-8"	8'-2"			20	30	22'-0"
		11'			10	14	35'-10"	0'-8"	4'-8"	8'-3"			20	30	22'-0"
		12'			10	14	36'-0"	0'-8"	4'-8"	8'-4"			20	30	22'-0"
	3 @ 12'	6'	#7	12"	11	16	41'-3"	0'-9¾"	5'-2½"	9'-6"	#9	12"	22	32	25'-8"
		7'			11	16	41'-3"	0'-9¾"	5'-2½"	9'-6"			22	32	25'-8"
		8'			11	16	41'-3"	0'-9¾"	5'-2½"	9'-6"			22	32	25'-8"
		9'			11	16	41'-7"	0'-9¾"	5'-3½"	9'-7"			22	32	25'-10"
		10'			11	16	41'-11"	0'-9¾"	5'-4½"	9'-8"			22	32	26'-0"
		11'			11	16	42'-1"	0'-9¾"	5'-4½"	9'-9"			22	32	26'-0"
		12'			11	16	42'-3"	0'-9¾"	5'-4½"	9'-10"			22	32	26'-0"
C	3 @ 8'	5'	#6	11"	12	18	28'-5"	0'-7½"	3'-6"	6'-5"	#7	11"	24	34	17'-6"
		6'			12	18	28'-5"	0'-7½"	3'-6"	6'-5"			24	34	17'-6"
		7'			12	18	28'-8"	0'-7½"	3'-7"	6'-5½"			24	34	17'-8"
		8'			12	18	28'-9"	0'-7½"	3'-7"	6'-6"			24	34	17'-8"
		9'			12	18	29'-1"	0'-7½"	3'-8"	6'-7"			24	34	17'-10"
		10'			12	18	29'-5"	0'-7½"	3'-9"	6'-8"			24	34	18'-0"
	3 @ 10'	6'	#7	12"	11	16	35'-2"	0'-9¼"	4'-3½"	8'-0"	#8	12"	22	32	21'-8"
		7'			11	16	35'-2"	0'-9¼"	4'-3½"	8'-0"			22	32	21'-8"
		8'			11	16	35'-3"	0'-9¼"	4'-3½"	8'-0½"			22	32	21'-8"
		9'			11	16	35'-7"	0'-9¼"	4'-4½"	8'-1½"			22	32	21'-10"
		10'			11	16	35'-11"	0'-9¼"	4'-5½"	8'-2¼"			22	32	22'-0"
		11'			11	16	36'-0"	0'-9¼"	4'-5½"	8'-3"			22	32	22'-0"
		12'			11	16	36'-2"	0'-9¼"	4'-5½"	8'-4"			22	32	22'-0"
	3 @ 12'	6'	#8	12"	11	16	41'-7"	0'-11¼"	4'-11½"	9'-6"	#9	12"	22	32	25'-8"
		7'			11	16	41'-7"	0'-11¼"	4'-11½"	9'-6"			22	32	25'-8"
		8'			11	16	41'-9"	0'-11¼"	4'-11½"	9'-6¾"			22	32	25'-8"
		9'			11	16	42'-0"	0'-11¼"	5'-0½"	9'-7½"			22	32	25'-10"
		10'			11	16	42'-4"	0'-11¼"	5'-1½"	9'-8¼"			22	32	26'-0"
		11'			11	16	42'-6"	0'-11¼"	5'-1½"	9'-9¼"			22	32	26'-0"
		12'			11	16	42'-8"	0'-11¼"	5'-1½"	9'-10¼"			22	32	26'-0"
D	3 @ 8'	5'	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	28'-8"	0'-8¼"	3'-4½"	6'-5"	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	17'-6"
		6'					28'-10"	0'-8¼"	3'-4½"	6'-5¾"					17'-6"
		7'					29'-1"	0'-8¼"	3'-5½"	6'-6½"					17'-8"
		8'					29'-3"	0'-8¼"	3'-5½"	6'-7¼"					17'-8"
		9'					29'-6"	0'-8¼"	3'-6½"	6'-8"					17'-10"
		10'					29'-10"	0'-8¼"	3'-7½"	6'-9"					18'-0"
	3 @ 10'	6'	#8	11"			35'-4"	0'-10½"	4'-1"	8'-0"	#8	11"			21'-8"
		7'					35'-5"	0'-10½"	4'-1"	8'-0½"					21'-8"
		8'					35'-7"	0'-10½"	4'-1"	8'-1½"					21'-8"
		9'					35'-11"	0'-10½"	4'-2"	8'-2½"					21'-10"
		10'					36'-3"	0'-10½"	4'-3"	8'-3½"					22'-0"
		11'					36'-4"	0'-10½"	4'-3"	8'-4"					22'-0"
		12'					36'-6"	0'-10½"	4'-3"	8'-4½"					22'-0"
	3 @ 12'	6'	#9	11"			41'-10"	1'-0¾"	4'-8½"	9'-6"	#9	11"			25'-8"
		7'					41'-11"	1'-0¾"	4'-8½"	9'-6¾"					25'-8"
		8'					42'-1"	1'-0¾"	4'-8½"	9'-7½"					25'-8"
		9'					42'-5"	1'-0¾"	4'-9½"	9'-8¼"					25'-10"
		10'					42'-8"	1'-0¾"	4'-10½"	9'-9¼"					26'-0"
		11'					42'-10"	1'-0¾"	4'-10½"	9'-10¼"					26'-0"
		12'					43'-0"	1'-0¾"	4'-10½"	9'-11¼"					26'-0"

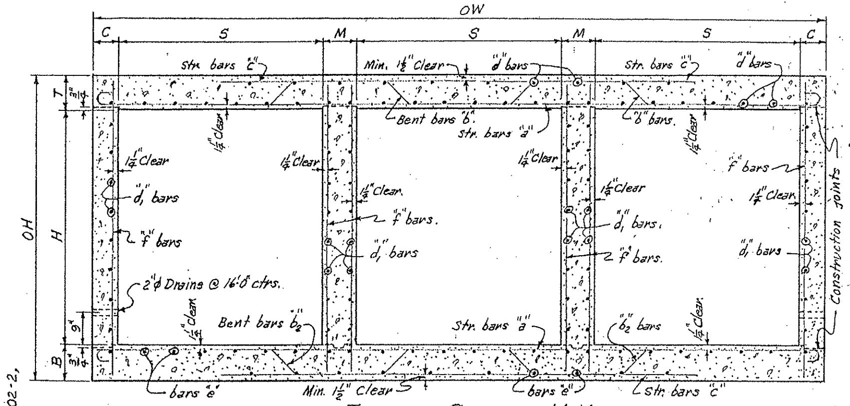
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls.
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
"f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls.

Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
A	3 @ 8'	5'	#4	12"	37	33'-3" for 32'-0" Section	#4	12"	30	33'-3" for 32'-0" Section	#4	12"	37	34'-3" for 32'-0" Section	#4	12"	132	192	6'-2"
		6'			37				36				37				132	192	7'-2"
		7'			37				42				37			10"	162	234	8'-2"
		8'			37				48				37		#5	11"	144	210	9'-2"
		9'			37				54				37			10"	162	234	10'-2"
		10'			37				60				37		#6	12"	132	192	11'-2"
	3 @ 10'	6'	#4	12"	43		#4	12"	36		#4	12"	43		#4	12"	132	192	7'-5"
		7'			43				42				43			10"	162	234	8'-5"
		8'			43				48				43		#5	12"	132	192	9'-5"
		9'			43				54				43			10"	162	234	10'-5"
		10'			43				60				43			12"	132	192	11'-5"
		11'			43				66				43		#6	11"	144	210	12'-5"
		12'			43				72				43			10"	162	234	13'-5"
	3 @ 12'	6'	#4	12"	49		#4	12"	36		#4	12"	49		#4	12"	132	192	7'-8"
		7'			49				42				49				132	192	8'-8"
		8'			49				48				49		#5	12"	132	192	9'-8"
		9'			49				54				49			10"	162	234	10'-8"
		10'			49				60				49			12"	132	192	11'-8"
		11'			49				66				49		#6	11"	144	210	12'-8"
		12'			49				72				49			9"	180	258	13'-8"
B	3 @ 8'	5'	#4	12"	37	34'-3" for 33'-0" Length Section	#4	12"	30	34'-3" for 33'-0" Length Section	#4	12"	37	34'-3" for 33'-0" Length Section	#4	12"	66	96	6'-4"
		6'			37				36				37				66	96	7'-4"
		7'			37				42				37		#5	12"	66	96	8'-4"
		8'			37				48				37			9"	90	126	9'-4"
		9'			37				54				37		#6	11"	72	102	10'-4"
		10'			37				60				37			10"	84	120	11'-4"
	3 @ 10'	6'	#4	12"	43		#4	12"	36		#4	12"	43		#4	12"	66	96	7'-8"
		7'			43				42				43		#5	12"	66	96	8'-8"
		8'			43				48				43			9"	90	132	9'-8"
		9'			43				54				43			12"	66	96	10'-8"
		10'			43				60				43		#6	10"	84	120	11'-8"
		11'			43				66				43			9"	90	132	12'-8"
		12'			43				72				43			8"	96	144	13'-8"
	3 @ 12'	6'	#4	12"	49		#4	12"	36		#4	12"	49		#4	12"	66	96	7'-11"
		7'			49				42				49			9"	90	132	8'-11"
		8'			49				48				49			12"	66	96	9'-11"
		9'			49				54				49		#6	11"	72	102	10'-11"
		10'			49				60				49			9"	90	132	11'-11"
		11'			49				66				49		#7	11"	72	108	12'-11"
		12'			49				72				49			10"	78	114	13'-11"
C	3 @ 8'	5'	#4	12"	37		#4	12"	30		#4	12"	37		#4	12"	66	96	6'-6"
		6'			37				36				37				66	96	7'-6"
		7'			37				42				37		#5	11"	72	102	8'-6"
		8'			37				48				37		#6	11"	72	102	9'-6"
		9'			37				54				37			10"	78	114	10'-6"
		10'			37				60				37		#7	10"	78	114	11'-6"
	3 @ 10'	6'	#4	12"	43		#4	12"	36		#4	12"	43		#4	12"	66	96	7'-10"
		7'			43				42				43		#5	12"	66	96	8'-10"
		8'			43				48				43		#6	12"	66	96	9'-10"
		9'			43				54				43			10"	78	114	10'-10"
		10'			43				60				43			12"	66	96	11'-10"
		11'			43				66				43		#7	10"	78	114	12'-10"
		12'			43				72				43			9"	90	126	13'-10"
	3 @ 12'	6'	#4	12"	49		#4	12"	36		#4	12"	49		#4	12"	66	96	8'-2"
		7'			49				42				49		#5	11"	72	102	9'-2"
		8'			49				48				49		#6	12"	66	96	10'-2"
		9'			49				54				49			10"	78	114	11'-2"
		10'			49				60				49			11"	72	102	12'-2"
		11'			49				66				49		#7	10"	84	114	13'-2"
		12'			49				72				49			8"	96	144	14'-2"
D	3 @ 8'	5'	#4	12"	37	Varies with length of Barrel.	#4	12"	30	Varies with length of Barrel.	#4	12"	37	Varies with length of Barrel.	#4	12"	Varies with length of Barrel.	Varies with length of Barrel.	6'-8"
		6'			37				36				37			10"			7'-8"
		7'			37				42				37		#5	10"			8'-8"
		8'			37				48				37			11"			9'-8"
		9'			37				54				37		#6	9"			10'-8"
		10'			37				60				37			8"			11'-8"
	3 @ 10'	6'	#4	12"	43		#4	12"	36		#4	12"	43		#4	12"			8'-1"
		7'			43				42				43		#5	11"			9'-1"
		8'			43				48				43		#6	12"			10'-1"
		9'			43				54				43			10"			11'-1"
		10'			43				60				43			11"			12'-1"
		11'			43				66				43		#7	9"			13'-1"
		12'			43				72				43			8"			14'-1"
	3 @ 12'	6'	#4	11"	52		#4	12"	36		#4	11"	52		#4	12"			8'-5"
		7'			52				42				52		#5	11"			9'-5"
		8'			52				48				52		#6	12"			10'-5"
		9'			52				54				52			10"			11'-5"
		10'			52				60				52			11"			12'-5"
		11'			52				66				52		#7	9"			13'-5"
		12'			52				72				52			8"			14'-5"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

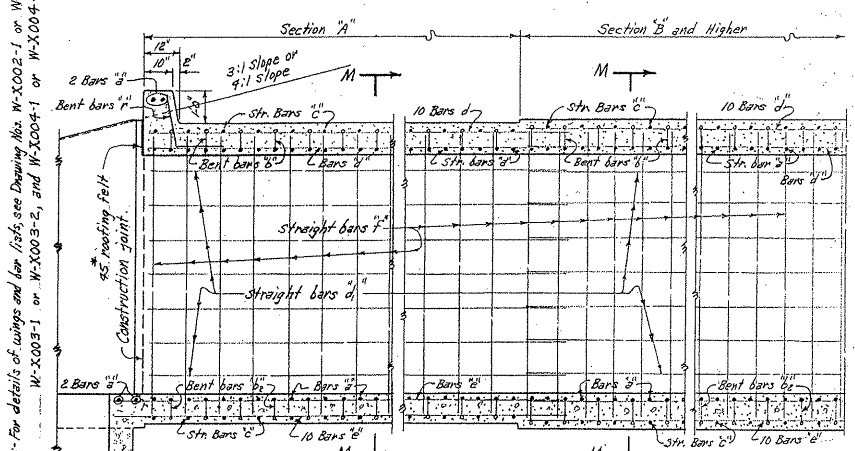
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU.YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
Section "A" - 10'-0"	3 @ 8'	5'	120	26'-8"	8½"	7"	9"	9"	6'-5½"	1.934	286.35	86.84	372.06
		6'	144	26'-8"		7"	9"		7'-5½"	2.033	294.37	91.85	372.06
		7'	168	26'-11"		7½"	10"		8'-5½"	2.210	310.70	96.86	374.14
		8'	192	27'-0"		8"	10"		9'-5½"	2.347	338.44	101.87	379.84
		9'	216	27'-4"		9"	11"		10'-5½"	2.587	358.41	106.88	377.62
		10'	240	27'-8"		10"	12"		11'-5½"	2.852	388.90	111.89	380.40
	3 @ 10'	6'	180	32'-11"	10"	7½"	10"	10½"	7'-8½"	2.731	428.10	101.87	582.24
		7'	210	32'-11"		7½"	10"		8'-8½"	2.839	442.86	106.88	582.24
		8'	240	33'-0"		8"	10"		9'-8½"	2.977	465.86	111.89	583.24
		9'	270	33'-4"		9"	11"		10'-8½"	3.220	492.09	116.90	587.24
		10'	300	33'-8"		10"	12"		11'-8½"	3.488	522.69	121.91	591.25
		11'	330	33'-10"		11"	12"		12'-8½"	3.702	547.98	126.92	593.25
		12'	360	34'-0"		12"	12"		13'-8½"	3.929	576.10	131.93	595.25
	3 @ 12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	3.495	544.35	111.89	704.76
		7'	252	39'-0"		8"	10"		8'-11½"	3.606	552.37	116.90	704.76
		8'	288	39'-0"		8"	10"		9'-11½"	3.718	582.13	121.91	704.76
		9'	324	39'-4"		9"	11"		10'-11½"	3.964	609.07	126.92	708.77
		10'	360	39'-8"		10"	12"		11'-11½"	4.235	641.44	131.93	712.77
		11'	396	39'-10"		11"	12"		12'-11½"	4.451	666.13	136.94	714.78
		12'	432	40'-0"		12"	12"		13'-11½"	4.679	711.11	141.95	716.78
Section "B" - 15'-0"	3 @ 8'	5'	120	26'-8"	9½"	7"	9"	10"	6'-7½"	2.099	305.08	86.84	
		6'	144	26'-8"		7"	9"		7'-7½"	2.198	313.05	91.85	
		7'	168	26'-11"		7½"	10"		8'-7½"	2.376	341.75	96.86	
		8'	192	27'-0"		8"	10"		9'-7½"	2.514	371.95	101.87	
		9'	216	27'-4"		9"	11"		10'-7½"	2.756	402.07	106.88	
		10'	240	27'-8"		10"	12"		11'-7½"	3.023	429.44	111.89	
	3 @ 10'	6'	180	32'-11"	11¼"	7½"	10"	11¾"	7'-11"	2.985	441.21	101.87	
		7'	210	32'-11"		7½"	10"		8'-11"	3.093	468.72	106.88	
		8'	240	33'-0"		8"	10"		9'-11"	3.231	499.70	111.89	
		9'	270	33'-4"		9"	11"		10'-11"	3.477	522.18	116.90	
		10'	300	33'-8"		10"	12"		11'-11"	3.748	559.23	121.91	
		11'	330	33'-10"		11"	12"		12'-11"	3.963	590.37	126.92	
		12'	360	34'-0"		12"	12"		13'-11"	4.191	628.01	131.93	
	3 @ 12'	6'	216	39'-0"	13"	8"	10"	13½"	8'-2½"	3.856	622.65	111.89	
		7'	252	39'-0"		8"	10"		9'-2½"	3.968	642.57	116.90	
		8'	288	39'-0"		8"	10"		10'-2½"	4.079	688.30	121.91	
		9'	324	39'-4"		9"	11"		11'-2½"	4.328	714.12	126.92	
		10'	360	39'-8"		10"	12"		12'-2½"	4.602	757.69	131.93	
		11'	396	39'-10"		11"	12"		13'-2½"	4.820	792.68	136.94	
		12'	432	40'-0"		12"	12"		14'-2½"	5.049	830.04	141.95	
Section "C" - 20'-0"	3 @ 8'	5'	120	26'-8"	10½"	7"	9"	11"	6'-9½"	2.263	353.13	86.84	
		6'	144	26'-8½"		7¼"	9"		7'-9½"	2.374	361.14	91.85	
		7'	168	26'-11½"		7¾"	10"		8'-9½"	2.556	395.50	96.86	
		8'	192	27'-0½"		8¼"	10"		9'-9½"	2.696	435.42	101.87	
		9'	216	27'-4½"		9¼"	11"		10'-9½"	2.942	462.51	106.88	
		10'	240	27'-8½"		10¼"	12"		11'-9½"	3.212	525.14	111.89	
	3 @ 10'	6'	180	33'-0"	12½"	8"	10"	13"	8'-1½"	3.264	506.07	101.87	
		7'	210	33'-0"		8"	10"		9'-1½"	3.375	533.96	106.88	
		8'	240	33'-1"		8½"	10"		10'-1½"	3.517	571.98	111.89	
		9'	270	33'-5"		9½"	11"		11'-1½"	3.769	608.15	116.90	
		10'	300	33'-8½"		10¼"	12"		12'-1½"	4.026	643.40	121.91	
		11'	330	33'-10"		11"	12"		13'-1½"	4.225	692.17	126.92	
		12'	360	34'-0"		12"	12"		14'-1½"	4.457	734.88	131.93	
	3 @ 12'	6'	216	39'-0"	14½"	8"	10"	15"	8'-5½"	4.218	677.02	111.89	
		7'	252	39'-0"		8"	10"		9'-5½"	4.329	710.88	116.90	
		8'	288	39'-1½"		8¾"	10"		10'-5½"	4.488	745.16	121.91	
		9'	324	39'-5"		9½"	11"		11'-5½"	4.728	782.14	126.92	
		10'	360	39'-8½"		10¼"	12"		12'-5½"	4.989	832.09	131.93	
		11'	396	39'-10½"		11¼"	12"		13'-5½"	5.209	868.67	136.94	
		12'	432	40'-0½"		12¼"	12"		14'-5½"	5.442	941.08	141.95	
Section "D" - 25'-0"	3 @ 8'	5'	120	26'-8"	11½"	7"	9"	12"	6'-11½"	2.428	364.11	86.84	
		6'	144	26'-9½"		7¾"	9"		7'-11½"	2.564	379.20	91.85	
		7'	168	27'-1"		8½"	10"		8'-11½"	2.764	414.12	96.86	
		8'	192	27'-2½"		9¼"	10"		9'-11½"	2.924	449.02	101.87	
		9'	216	27'-6"		10"	11"		10'-11½"	3.161	488.86	106.88	
		10'	240	27'-10"		11"	12"		11'-11½"	3.439	525.45	111.89	
	3 @ 10'	6'	180	33'-0"	13¾"	8"	10"	14¼"	8'-4"	3.519	543.55	101.87	
		7'	210	33'-1"		8½"	10"		9'-4"	3.658	577.92	106.88	
		8'	240	33'-2¾"		9¾"	10"		10'-4"	3.820	611.90	111.89	
		9'	270	33'-6½"		10½"	11"		11'-4"	4.079	647.87	116.90	
		10'	300	33'-10"		11½"	12"		12'-4"	4.363	698.60	121.91	
		11'	330	34'-0"		12"	12"		13'-4"	4.568	756.00	126.92	
		12'	360	34'-1½"		12¾"	12"		14'-4"	4.782	806.26	131.93	
	3 @ 12'	6'	216	39'-0"	16"	8"	10"	16½"	8'-8½"	4.579	733.92	116.90	
		7'	252	39'-1½"		8¾"	10"		9'-8½"	4.735	769.34	121.91	
		8'	288	39'-3"		9½"	10"		10'-8½"	4.900	804.65	126.92	
		9'	324	39'-7"		10½"	11"		11'-8½"	5.165	842.91	131.93	
		10'	360	39'-10½"		11½"	12"		12'-8½"	5.435	893.38	136.94	
		11'	396	40'-0½"		12¼"	12"		13'-8½"	5.663	952.37	141.95	
		12'	432	40'-2½"		13¼"	12"		14'-8½"	5.904	1003.92	146.96	

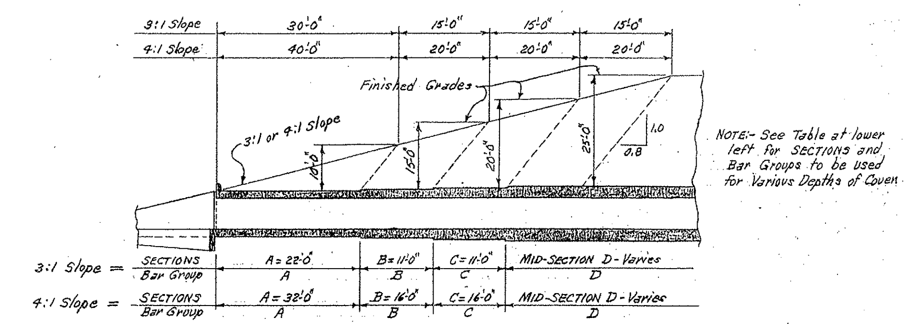


TYPICAL SECTION M-M

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2.



PART LONGITUDINAL SECTION



NOTE:- See Table at lower left for SECTIONS and Bar Groups to be used for Various Depths of Cover.

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

SECTIONS & BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER.

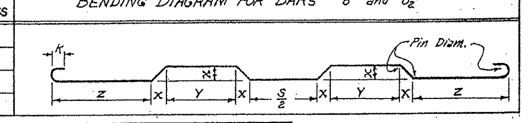
Depths of Cover	Sections & Bar Groups for End Sections A	B	C		Mid-Section and Bar Group
5.0' to 9.5'	⌞				A
10.0' to 14.5'	⌞				B
15.0' to 19.5'	⌞	⌞			C
20.0' to 25.0'	⌞	⌞	⌞		D

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

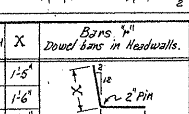
Bar Size	Pin Diam.	K	Add for 2 Hooks
#6	3"	5"	1'-1½"
#7	3½"	5¾"	1'-3¾"
#8	4"	6½"	1'-6"

BENDING DIAGRAM FOR BARS "b" and "b2"



NOTE:- Dimension are to centers of bars. ("b" and "b2")

Dowel Bars for Two Headwalls: S	Size	Spacing	No. Req'd	Length	X	Bars "r" Dowel bars in Headwalls.
8'	#4	12"±	54	2'-10"	1'-5"	
10'	#4	12"±	66	3'-0"	1'-6"	
12'	#4	12"±	78	3'-4"	1'-8"	



GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, or C	4:1 Slopes Sections A	4:1 Slopes Sections B, or C
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

* Variable, see Drawings for Skewed Culverts.

REVISIONS:-
Wing Drwg. Nos.- W.C.H. 1-14-63.
Bar size, spacing, no., & quant. for 10' Spans, Sect. "C" & "D", W.C.H. 1-13-65.

Designed by:- W.C.H. 8-7-62 Checked by:- RHS 8-10-62
Drawn by:- W.C.H. 8-15-62 Checked by:- RHS 8-20-62
Quantities by:- W.C.H. 8-17-62 Checked by:- RHS 8-20-62

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

8', 10' & 12' SPANS — 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-300X-X2

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

BAR LIST FOR VARIOUS SECTIONS OF BARREL

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars – BENT - See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
"b2" bars – BENT - See Diagram below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

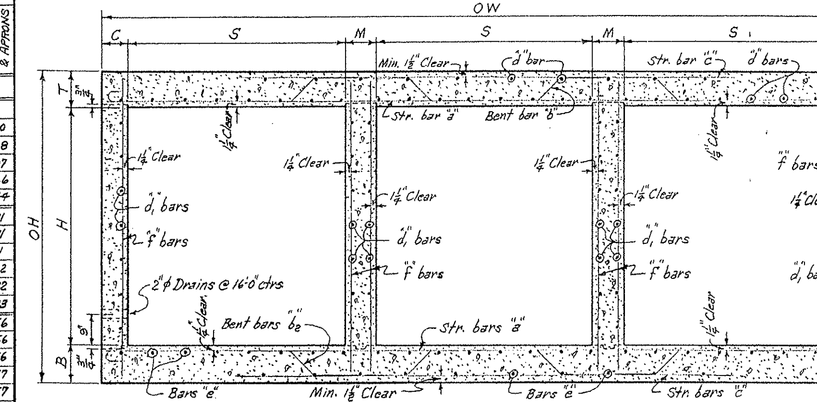
Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Spans S	Clear Height H	a Size	a Spacing	a No. Req'd 3:1	a No. Req'd 4:1	a Length	b Size	b Spacing	b No. Req'd 3:1	b No. Req'd 4:1	b Length	b X	b Y	b Z	b2 Size	b2 Spacing	b2 No. Req'd 3:1	b2 No. Req'd 4:1	b2 Length	b2 X	b2 Y	b2 Z
Section "A" & Bar Group "A"	3:1 = 22'-0"; 4:1 = 32'-0"	0' to 10'-0"	3 @ 7'	5'	#5	12"	48	68	23'-1"	#5	12"	22	32	24'-6"	0'-4½"	3'-5½"	5'-7"	#5	12"	22	32	24'-6"	0'-4½"	3'-5"	5'-7"
				6'			48	68	23'-5"			22	32	24'-10"	0'-4½"	3'-6½"	5'-8"			22	32	24'-10"	0'-4½"	3'-6"	5'-8"
				7'			48	68	23'-8"			22	32	25'-1"	0'-4½"	3'-7½"	5'-8½"			22	32	25'-1"	0'-4½"	3'-7"	5'-8½"
				8'			48	68	23'-9"			22	32	25'-2"	0'-4½"	3'-7½"	5'-9"			22	32	25'-2"	0'-4½"	3'-7"	5'-9"
				9'			48	68	24'-1"			22	32	25'-6"	0'-4½"	3'-8½"	5'-10"			22	32	25'-6"	0'-4½"	3'-8"	5'-10"
			3 @ 9'	6'	#6	12"	48	68	29'-8"	#6	12"	22	32	31'-5"	0'-5¾"	4'-4½"	7'-2½"	#6	12"	22	32	31'-6"	0'-6¼"	4'-3½"	7'-2½"
				7'			48	68	29'-8"			22	32	31'-5"	0'-5¾"	4'-4½"	7'-2½"			22	32	31'-6"	0'-6¼"	4'-3½"	7'-2½"
				8'			48	68	29'-9"			22	32	31'-6"	0'-5¾"	4'-4½"	7'-3"			22	32	31'-7"	0'-6¼"	4'-3½"	7'-3"
				9'			48	68	30'-1"			22	32	31'-10"	0'-5¾"	4'-5½"	7'-4"			22	32	31'-11"	0'-6¼"	4'-4½"	7'-4"
				10'			48	68	30'-5"			22	32	32'-2"	0'-5¾"	4'-6½"	7'-5"			22	32	32'-3"	0'-6¼"	4'-5½"	7'-5"
				11'			48	68	30'-7"			22	32	32'-4"	0'-5¾"	4'-6½"	7'-6"			22	32	32'-5"	0'-6¼"	4'-5½"	7'-6"
			3 @ 11'	6'	#6	12"	48	68	35'-9"	#7	12"	22	32	37'-10"	0'-7"	5'-2"	8'-9"	#7	12"	22	32	37'-11"	0'-7½"	5'-1"	8'-9"
				7'			48	68	35'-9"			22	32	37'-10"	0'-7"	5'-2"	8'-9"			22	32	37'-11"	0'-7½"	5'-1"	8'-9"
				8'			48	68	35'-9"			22	32	37'-10"	0'-7"	5'-2"	8'-9"			22	32	37'-11"	0'-7½"	5'-1"	8'-9"
				9'			48	68	36'-1"			22	32	38'-2"	0'-7"	5'-3"	8'-10"			22	32	38'-3"	0'-7½"	5'-2"	8'-10"
				10'			48	68	36'-5"			22	32	38'-6"	0'-7"	5'-4"	8'-11"			22	32	38'-7"	0'-7½"	5'-3"	8'-11"
				11'			48	68	36'-7"			22	32	38'-8"	0'-7"	5'-4"	9'-0"			22	32	38'-9"	0'-7½"	5'-3"	9'-0"
				12'			48	68	36'-9"			22	32	38'-10"	0'-7"	5'-4"	9'-1"			22	32	38'-11"	0'-7½"	5'-3"	9'-1"
Section "B" & Bar Group "B"	3:1 = 11'-0"; 4:1 = 16'-0"	10'-0" to 15'-0"	3 @ 7'	5'	#5	12"	22	32	23'-1"	#6	12"	11	16	24'-9"	0'-5"	3'-4"	5'-7"	#6	12"	11	16	24'-10"	0'-5⅝"	3'-3"	5'-7"
				6'			22	32	23'-5"			11	16	25'-1"	0'-5"	3'-5"	5'-8"			11	16	25'-2"	0'-5⅝"	3'-4"	5'-8"
				7'			22	32	23'-8"			11	16	25'-4"	0'-5"	3'-6"	5'-8½"			11	16	25'-5"	0'-5⅝"	3'-5"	5'-8½"
				8'			22	32	23'-9"			11	16	25'-5"	0'-5"	3'-6"	5'-9"			11	16	25'-6"	0'-5⅝"	3'-5"	5'-9"
				9'			22	32	24'-1"			11	16	25'-9"	0'-5"	3'-7"	5'-10"			11	16	25'-10"	0'-5⅝"	3'-6"	5'-10"
			3 @ 9'	6'	#6	11"	24	36	29'-8"	#6	11"	12	17	31'-7"	0'-6¾"	4'-2½"	7'-2½"	#6	11"	12	17	31'-8"	0'-7¼"	4'-1½"	7'-2½"
				7'			24	36	29'-8"			12	17	31'-7"	0'-6¾"	4'-2½"	7'-2½"			12	17	31'-8"	0'-7¼"	4'-1½"	7'-2½"
				8'			24	36	29'-9"			12	17	31'-8"	0'-6¾"	4'-2½"	7'-3"			12	17	31'-9"	0'-7¼"	4'-1½"	7'-3"
				9'			24	36	30'-1"			12	17	32'-0"	0'-6¾"	4'-3½"	7'-4"			12	17	32'-1"	0'-7¼"	4'-2½"	7'-4"
				10'			24	36	30'-5"			12	17	32'-4"	0'-6¾"	4'-4½"	7'-5"			12	17	32'-5"	0'-7¼"	4'-3½"	7'-5"
				11'			24	36	30'-7"			12	17	32'-6"	0'-6¾"	4'-4½"	7'-6"			12	17	32'-7"	0'-7¼"	4'-3½"	7'-6"
			3 @ 11'	6'	#7	12"	22	32	35'-9"	#7	12"	11	16	38'-1"	0'-8½"	4'-11½"	8'-9"	#7	12"	11	16	38'-2"	0'-9"	4'-10"	8'-9"
				7'			22	32	35'-9"			11	16	38'-1"	0'-8½"	4'-11½"	8'-9"			11	16	38'-2"	0'-9"	4'-10"	8'-9"
				8'			22	32	35'-9"			11	16	38'-1"	0'-8½"	4'-11½"	8'-9"			11	16	38'-2"	0'-9"	4'-10"	8'-9"
				9'			22	32	36'-1"			11	16	38'-5"	0'-8½"	5'-0½"	8'-10"			11	16	38'-6"	0'-9"	4'-11"	8'-10"
				10'			22	32	36'-5"			11	16	38'-9"	0'-8½"	5'-1½"	8'-11"			11	16	38'-10"	0'-9"	5'-0"	8'-11"
				11'			22	32	36'-7"			11	16	38'-11"	0'-8½"	5'-1½"	9'-0"			11	16	39'-0"	0'-9"	5'-0"	9'-0"
				12'			22	32	36'-9"			11	16	39'-1"	0'-8½"	5'-1½"	9'-1"			11	16	39'-2"	0'-9"	5'-0"	9'-1"
Section "C" & Bar Group "C"	3:1 = 11'-0"; 4:1 = 16'-0"	15'-0" to 20'-0"	3 @ 7'	5'	#5	11"	24	36	23'-2"	#6	11"	12	17	24'-11"	0'-5¾"	3'-2½"	5'-7½"	#6	11"	12	17	25'-0"	0'-6¼"	3'-1½"	5'-7½"
				6'			24	36	23'-5"			12	17	25'-2"	0'-5¾"	3'-3½"	5'-8"			12	17	25'-3"	0'-6¼"	3'-2½"	5'-8"
				7'			24	36	23'-8"			12	17	25'-5"	0'-5¾"	3'-4½"	5'-8½"			12	17	25'-6"	0'-6¼"	3'-3½"	5'-8½"
				8'			24	36	23'-9"			12	17	25'-7"	0'-5¾"	3'-4½"	5'-9½"			12	17	25'-8"	0'-6¼"	3'-3½"	5'-9½"
				9'			24	36	24'-1"			12	17	25'-10"	0'-5¾"	3'-5½"	5'-10"			12	17	25'-11"	0'-6¼"	3'-4½"	5'-10"
			3 @ 9'	6'	#7	13"	20	30	29'-8"	#7	13"	10	15	31'-11"	0'-7¾"	4'-0½"	7'-2½"	#7	13"	10	15	32'-0"	0'-8¼"	3'-11½"	7'-2½"
				7'			20	30	29'-9"			10	15	32'-0"	0'-7¾"	4'-0½"	7'-3"			10	15	32'-1"	0'-8¼"	3'-11½"	7'-3"
				8'			20	30	29'-10"			10	15	32'-1"	0'-7¾"	4'-0½"	7'-3½"			10	15	32'-2"	0'-8¼"	3'-11½"	7'-3½"
				9'			20	30	30'-1"			10	15	32'-4"	0'-7¾"	4'-1½"	7'-4¼"			10	15	32'-5"	0'-8¼"	4'-0½"	7'-4¼"
				10'			20	30	30'-5"			10	15	32'-8"	0'-7¾"	4'-2½"	7'-5¼"			10	15	32'-9"	0'-8¼"	4'-1½"	7'-5¼"
				11'			20	30	30'-7"			10	15	32'-10"	0'-7¾"	4'-2½"	7'-6"			10	15	32'-11"	0'-8¼"	4'-1½"	7'-6"
			3 @ 11'	6'	#7	11"	24	36	35'-9"	#7	11"	12	17	38'-3"	0'-9¾"	4'-8½"	8'-9"	#7	11"	12	17	38'-4"	0'-10¼"	4'-7½"	8'-9"
				7'			24	36	35'-9"			12	17	38'-3"	0'-9¾"	4'-8½"	8'-9"			12	17	38'-4"	0'-10¼"	4'-7½"	8'-9"
				8'			24	36	35'-10"			12	17	38'-5"	0'-9¾"	4'-8½"	8'-9¾"			12	17	38'-5"	0'-10¼"	4'-7½"	8'-9¾"
				9'			24	36	36'-2"			12	17	38'-8"	0'-9¾"	4'-9½"	8'-10½"			12	17	38'-9"	0'-10¼"	4'-8½"	8'-10½"
				10'			24	36	36'-5"			12	17	39'-0"	0'-9¾"	4'-10½"	8'-11¼"			12	17	39'-0"	0'-10¼"	4'-9½"	8'-11¼"
				11'			24	36	36'-7"			12	17	39'-2"	0'-9¾"	4'-10½"	9'-0¼"			12	17	39'-2"	0'-10¼"	4'-9½"	9'-0¼"
				12'			24	36	36'-9"			12	17	39'-3"	0'-9¾"	4'-10½"	9'-1"			12	17	39'-4"	0'-10¼"	4'-9½"	9'-1"
Section "D" & Bar Group "D"	3:1 = 11'-0"; 4:1 = 16'-0"	20'-0" to 25'-0"	3 @ 7'	5'	#6	13"	20	30	23'-2"	#7	13"	10	15	25'-3"	0'-6½"	3'-1½"	5'-7¾"	#7	13"	10	15	25'-4"	0'-6¾"	3'-0½"	5'-7¾"
				6'			20	30	23'-6"			10	15	25'-6"	0'-6½"	3'-2½"	5'-8½"			10	15	25'-7"	0'-6¾"	3'-1½"	5'-8½"
				7'			20	30	23'-9"			10	15	25'-10"	0'-6½"	3'-3½"	5'-9¼"			10	15	25'-11"	0'-6¾"	3'-2½"	5'-9¼"
				8'			20	30	23'-11"			10	15	25'-11"	0'-6½"	3'-3½"	5'-10"			10	15	26'-0"	0'-6¾"	3'-2½"	5'-10"
				9'			20	30	24'-2"			10	15	26'-3"	0'-6½"	3'-4½"	5'-10¾"			10	15	26'-4"	0'-6¾"	3'-3½"	5'-10¾"
	Varies with Length of Barrel.		3 @ 9'	6'	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	29'-9"	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	32'-1"	0'-8¾"	3'-10½"	7'-3"	#7	12"	Varies with length of Barrel.	Varies with length of Barrel.	32'-2"	0'-9¼"	3'-9½"	7'-3"
				7'					29'-10"					32'-2"	0'-8¾"	3'-10½"	7'-3½"					32'-3"	0'-9¼"	3'-9½"	7'-3½"
				8'					29'-11"					32'-4"	0'-8¾"	3'-10½"	7'-4¼"					32'-5"	0'-9¼"	3'-9½"	7'-4¼"
				9'					30'-3"					32'-7"	0'-8¾"	3'-11½"	7'-5"					32'-8"	0'-9¼"	3'-10½"	7'-5"
				10'					30'-7"					32'-11"	0'-8¾"	4'-0½"	7'-6"					33'-0"	0'-9¼"	3'-11½"	7'-6"
				11'					30'-9"					33'-1"	0'-8¾"	4'-0½"	7'-7"					33'-2"	0'-9¼"	3'-11½"	7'-7"
			3 @ 11'	6'	#7	10"			35'-9"	#7	10"			38'-5"	0'-11"	4'-6"	8'-9"	#7	10"			38'-6"	0'-11½"	4'-5"	8'-9"
				7'					35'-10"					38'-7"	0'-11"	4'-6"	8'-9¾"					38'-7"	0'-11½"	4'-5"	8'-9¾"
				8'					36'-0"					38'-8"	0'-11"	4'-6"	8'-10½"					38'-9"	0'-11½"	4'-5"	8'-10½"
				9'					36'-4"					39'-0"	0'-11"	4'-7"	8'-11½"					39'-1"	0'-11½"	4'-6"	8'-11½"
				10'					36'-7"					39'-4"	0'-11"	4'-8"	9'-0½"					39'-4"	0'-11½"	4'-7"	9'-0½"
				11'					36'-9"					39'-6"	0'-11"	4'-8"	9'-1½"					39'-6"	0'-11½"	4'-7"	9'-1½"
				12'					36'-11"					39'-7"	0'-11"	4'-8"	9'-2"					39'-8"	0'-11½"	4'-7"	9'-2"
Section "E", Bar Grp "E"	Varies with length of Barrel.	25'-0" to 30'-0"	3 @ 7'	5'	#6	12"			23'-3"	#7	12"			25'-4"	0'-7"	3'-0"	5'-8"	#7	12"			25'-5"	0'-7½"	2'-11"	5'-8"
				6'					23'-7"					25'-8"	0'-7"	3'-1"	5'-9"					25'-9"	0'-7½"	3'-0"	5'-9"
				7'					23'-11"					26'-0"	0'-7"	3'-2"	5'-10"					26'-1"	0'-7½"	3'-1"	5'-10"
				8'					24'-0"					26'-2"	0'-7"	3'-2"	5'-10¾"					26'-3"	0'-7½"	3'-1"	5'-10¾"
				9'					24'-4"					26'-5"	0'-7"	3'-3"	5'-11½"					26'-6"	0'-7½"	3'-2"	5'-11½"

"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls.
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
"f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls.

Section	S	H	c Size	c Spacing	c No. Req'd 3:1	c No. Req'd 4:1	c Length	d Size	d Spacing	d No. Req'd	d Length	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length	f Size	f Spacing	f No. Req'd 3:1	f No. Req'd 4:1	f Length
A	3 @ 7'	5'	#6	12"	44	64	15'-4"	#4	12"	34	33'-3" for 32'-0" Section.	#4	12"	30	33'-3" for 32'-0" Section.	#4	12"	34	34'-3" for 32'-0" Section.	#4	12"	132	192	6'-1"
		6'			44	64	15'-6"			34				36				34				132	192	7'-1"
		7'			44	64	15'-8"			34				42				34		#5	12"	132	192	8'-1"
		8'			44	64	15'-8"			34				48				34			11"	144	210	9'-1"
		9'			44	64	15'-10"			34				54				34			10"	162	234	10'-1"
	3 @ 9'	6'	#7	12"	44	64	19'-8"	#4	12"	40		#4	12"	36		#4	12"	40		#4	12"	132	192	7'-4"
		7'			44	64	19'-8"			40				42				40			10"	162	234	8'-4"
		8'			44	64	19'-8"			40				48				40		#5	12"	132	192	9'-4"
		9'			44	64	19'-10"			40				54				40			10"	162	234	10'-4"
		10'			44	64	20'-0"			40				60				40		#6	12"	132	192	11'-4"
		11'			44	64	20'-0"			40				66				40			11"	144	210	12'-4"
	3 @ 11'	6'	#7	12"	44	64	23'-8"	#4	12"	46		#4	12"	36		#4	12"	46		#4	12"	132	192	7'-7"
		7'			44	64	23'-8"			46				42				46			11"	144	210	8'-7"
		8'			44	64	23'-8"			46				48				46		#5	12"	132	192	9'-7"
		9'			44	64	23'-10"			46				54				46			10"	162	234	10'-7"
		10'			44	64	24'-0"			46				60				46		#6	12"	132	192	11'-7"
		11'			44	64	24'-0"			46				66				46			11"	144	210	12'-7"
		12'			44	64	24'-0"			46				72				46			9"	180	258	13'-7"
B	3 @ 7'	5'	#6	12"	22	32	15'-4"	#4	12"	34		#4	12"	30		#4	12"	34		#4	12"	66	96	6'-2"
		6'			22	32	15'-6"			34				36				34			11"	72	108	7'-2"
		7'			22	32	15'-8"			34				42				34		#5	12"	66	96	8'-2"
		8'			22	32	15'-8"			34				48				34		#6	12"	66	96	9'-2"
		9'			22	32	15'-10"			34				54				34			11"	72	102	10'-2"
	3 @ 9'	6'	#7	11"	24	36	19'-8"	#4	12"	40		#4	12"	36		#4	12"	40		#4	12"	66	96	7'-6"
		7'			24	36	19'-8"			40				42				40		#5	12"	66	96	8'-6"
		8'			24	36	19'-8"			40				48				40		#6	12"	66	96	9'-6"
		9'			24	36	19'-10"			40				54				40			11"	72	102	10'-6"
		10'			24	36	20'-0"			40				60				40			10"	84	120	11'-6"
		11'			24	36	20'-0"			40				66				40		#7	12"	66	96	12'-6"
	3 @ 11'	6'	#8	12"	22	32	23'-8"	#4	12"	46	34'-3" for 33'-0" Length Section.	#4	12"	36	34'-3" for 33'-0" Length Section.	#4	12"	46	34'-3" for 33'-0" Length Section.	#4	12"	66	96	7'-10"
		7'			22	32	23'-8"			46				42				46		#5	12"	66	96	8'-10"
		8'			22	32	23'-8"			46				48				46		#6	12"	66	96	9'-10"
		9'			22	32	23'-10"			46				54				46			11"	72	102	10'-10"
		10'			22	32	24'-0"			46				60				46			9"	90	132	11'-10"
		11'			22	32	24'-0"			46				66				46		#7	11"	72	108	12'-10"
		12'			22	32	24'-0"			46				72				46			10"	78	114	13'-10"
C	3 @ 7'	5'	#6	11"	24	36	15'-4"	#4	12"	34		#4	12"	30		#4	12"	34		#4	12"	66	96	6'-4"
		6'			24	36	15'-6"			34				36				34			10"	84	114	7'-4"
		7'			24	36	15'-8"			34				42				34		#5	10"	84	120	8'-4"
		8'			24	36	15'-8"			34				48				34		#6	10"	84	114	9'-4"
		9'			24	36	15'-10"			34				54				34		#7	12"	66	96	10'-4"
	3 @ 9'	6'	#8	13"	20	30	19'-8"	#4	12"	40		#4	12"	36		#4	12"	40		#4	12"	66	96	7'-8"
		7'			20	30	19'-8"			40				42				40		#5	11"	72	102	8'-8"
		8'			20	30	19'-8"			40				48				40		#6	12"	66	96	9'-8"
		9'			20	30	19'-10"			40				54				40			10"	78	114	10'-8"
		10'			20	30	20'-0"			40				60				40		#7	11"	72	102	11'-8"
		11'			20	30	20'-0"			40				66				40			10"	84	114	12'-8"
	3 @ 11'	6'	#8	11"	24	36	23'-8"	#4	12"	46		#4	12"	36		#4	12"	46		#4	12"	66	96	8'-0"
		7'			24	36	23'-8"			46				42				46		#5	12"	66	96	9'-0"
		8'			24	36	23'-8"			46				48				46		#6	12"	66	96	10'-0"
		9'			24	36	23'-10"			46				54				46			11"	72	108	11'-0"
		10'			24	36	24'-0"			46				60				46			12"	66	96	12'-0"
		11'			24	36	24'-0"			46				66				46		#7	10"	84	114	13'-0"
		12'			24	36	24'-0"			46				72				46			9"	84	126	14'-0"
D	3 @ 7'	5'	#7	13"	20	30	15'-4"	#4	12"	34		#4	12"	30		#4	12"	34		#4	12"	66	96	6'-5"
		6'			20	30	15'-6"			34				36				34		#5	12"	66	96	7'-5"
		7'			20	30	15'-8"			34				42				34		#6	12"	66	96	8'-5"
		8'			20	30	15'-8"			34				48				34			10"	78	120	9'-5"
		9'			20	30	15'-10"			34				54				34		#7	12"	66	96	10'-5"
	3 @ 9'	6'	#8	12"	Varies with length of Barrel.	Varies with length of Barrel.	19'-8"	#4	12"	40	Varies with length of Barrel.	#4	12"	36	Varies with length of Barrel.	#4	12"	40	Varies with length of Barrel.	#4	11"	Varies with length of Barrel.	Varies with length of Barrel.	7'-10"
		7'					19'-8"			40				42				40		#5	11"			8'-10"
		8'					19'-8"			40				48				40		#6	11"			9'-10"
		9'					19'-10"			40				54				40			12"			10'-10"
		10'					20'-0"			40				60				40		#7	10"			11'-10"
		11'					20'-0"			40				66				40			9"			12'-10"
	3 @ 11'	6'	#8	10"			23'-8"	#4	11"	50		#4	12"	36		#4	11"	50		#4	11"			8'-3"
		7'					23'-8"			50				42				50		#5	12"			9'-3"
		8'					23'-8"			50				48				50		#6	12"			10'-3"
		9'					23'-10"			50				54				50			11"			11'-3"
		10'					24'-0"			50				60				50			12"			12'-3"
		11'					24'-0"			50				66				50		#7	10"			13'-3"
		12'					24'-0"			50				72				50			8"			14'-3"
E	3 @ 7'	5'	#7	12"			15'-4"	#4	12"	34		#4	12"	30		#4	12"	34		#4	12"			6'-7"
		6'					15'-6"			34				36				34		#5	12"			7'-7"
		7'					15'-8"			34				42				34		#6	12"			8'-7"
		8'					15'-8"			34				48				34			10"			9'-7"
		9'					15'-10"			34				54				34		#7	11"			10'-7"

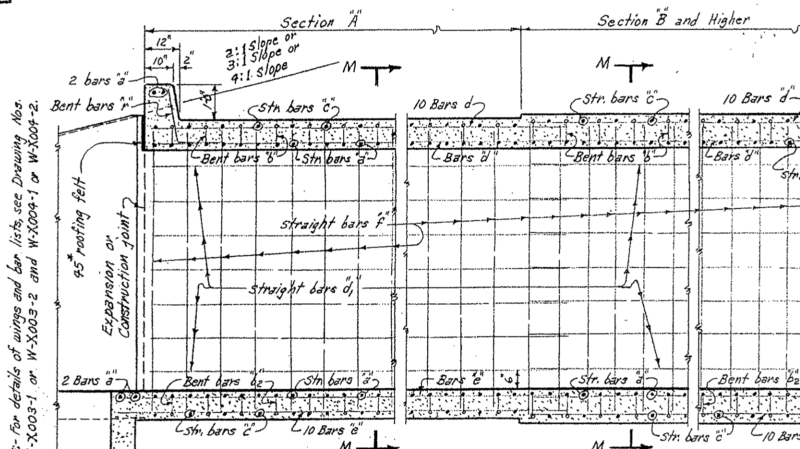
DIMENSIONS — QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel Cu. Yd.	Reinforcing Steel per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.	Additional Two Headwalls & Aprons Lb.
Section "A" – 10'-0"	3 @ 7'	5'	105	23'-4"	7¾"	6"	8"	8"	6'-3¾"	1.566	235.17	81.83	327.10
		6'	126	23'-8"		7"	9"		7'-3¾"	1.743	245.07	86.84	329.88
		7'	147	23'-11"		7½"	10"		8'-3¾"	1.919	272.82	91.85	331.97
		8'	168	24'-0"		8"	10"		9'-3¾"	2.056	288.60	96.86	332.66
		9'	189	24'-4"		9"	11"		10'-3¾"	2.294	308.21	101.87	335.44
	3 @ 9'	6'	162	29'-11"	9¼"	7½"	10"	9¾"	7'-7"	2.403	370.90	96.86	530.71
		7'	189	29'-11"		7½"	10"		8'-7"	2.511	385.59	101.87	530.71
		8'	216	30'-0"		8"	10"		9'-7"	2.648	408.43	106.88	531.71
		9'	243	30'-4"		9"	11"		10'-7"	2.890	434.31	111.89	535.72
		10'	270	30'-8"		10"	12"		11'-7"	3.156	465.54	116.90	539.72
		11'	297	30'-10"		11"	12"		12'-7"	3.370	489.67	121.91	541.73
	3 @ 11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	3.111	474.87	106.88	647.56
		7'	231	36'-0"		8"	10"		8'-10"	3.222	486.02	111.89	647.56
		8'	264	36'-0"		8"	10"		9'-10"	3.333	512.47	116.90	647.56
		9'	297	36'-4"		9"	11"		10'-10"	3.578	539.03	121.91	651.57
		10'	330	36'-8"		10"	12"		11'-10"	3.848	570.99	126.92	655.57
		11'	363	36'-10"		11"	12"		12'-10"	4.063	595.50	131.93	657.58
		12'	396	37'-0"		12"	12"		13'-10"	4.290	640.20	136.94	659.58
Section "B" – 15'-0"	3 @ 7'	5'	105	23'-4"	8½"	6"	8"	9"	6'-5½"	1.692	258.87	81.83	
		6'	126	23'-8"		7"	9"		7'-5½"	1.871	271.69	86.84	
		7'	147	23'-11"		7½"	10"		8'-5½"	2.098	297.25	91.85	
		8'	168	24'-0"		8"	10"		9'-5½"	2.185	333.18	96.86	
		9'	189	24'-4"		9"	11"		10'-5½"	2.425	356.73	101.87	
	3 @ 9'	6'	162	29'-11"	10¼"	7½"	10"	10¾"	7'-9"	2.587	396.11	96.86	
		7'	189	29'-11"		7½"	10"		8'-9"	2.695	423.25	101.87	
		8'	216	30'-0"		8"	10"		9'-9"	2.833	460.23	106.88	
		9'	243	30'-4"		9"	11"		10'-9"	3.077	484.78	111.89	
		10'	270	30'-8"		10"	12"		11'-9"	3.346	512.85	116.90	
		11'	297	30'-10"		11"	12"		12'-9"	3.560	546.89	121.91	
	3 @ 11'	6'	198	36'-0"	12"	8"	10"	12¾"	8'-0¾"	3.417	545.28	106.88	
		7'	231	36'-0"		8"	10"		9'-0¾"	3.528	573.17	111.89	
		8'	264	36'-0"		8"	10"		10'-0¾"	3.629	610.52	116.90	
		9'	297	36'-4"		9"	11"		11'-0¾"	3.887	636.03	121.91	
		10'	330	36'-8"		10"	12"		12'-0¾"	4.159	679.34	126.92	
		11'	363	36'-10"		11"	12"		13'-0¾"	4.375	714.21	131.93	
		12'	396	37'-0"		12"	12"		14'-0¾"	4.604	751.47	136.94	
Section "C" – 20'-0"	3 @ 7'	5'	105	23'-5"	9¼"	6½"	8"	9¾"	6'-7"	1.821	275.61	81.83	
		6'	126	23'-8"		7"	9"		7'-7"	1.980	291.44	86.84	
		7'	147	23'-11"		7½"	10"		8'-7"	2.159	324.69	91.85	
		8'	168	24'-0½"		8¼"	10"		9'-7"	2.311	367.79	96.86	
		9'	189	24'-4"		9"	11"		10'-7"	2.538	399.71	101.87	
	3 @ 9'	6'	162	29'-11"	11½"	7½"	10"	12"	7'-11½"	2.818	437.70	96.86	
		7'	189	30'-0"		8"	10"		8'-11½"	2.954	470.78	101.87	
		8'	216	30'-1"		8½"	10"		9'-11½"	3.096	503.36	106.88	
		9'	243	30'-4½"		9½"	11"		10'-11½"	3.328	538.32	111.89	
		10'	270	30'-8½"		10¼"	12"		11'-11½"	3.601	586.90	116.90	
		11'	297	30'-10"		11"	12"		12'-11½"	3.798	621.99	121.91	
	3 @ 11'	6'	198	36'-0"	13½"	8"	10"	14"	8'-3½"	3.722	585.64	106.88	
		7'	231	36'-0"		8"	10"		9'-3½"	3.833	613.90	111.89	
		8'	264	36'-1½"		8¾"	10"		10'-3½"	3.992	652.64	116.90	
		9'	297	36'-5"		9½"	11"		11'-3½"	4.230	678.43	121.91	
		10'	330	36'-8½"		10¼"	12"		12'-3½"	4.489	724.85	126.92	
		11'	363	36'-10½"		11¼"	12"		13'-3½"	4.709	774.49	131.93	
		12'	396	37'-0"		12"	12"		14'-3½"	4.918	817.41	136.94	
Section "D" – 25'-0"	3 @ 7'	5'	105	23'-5½"	10"	6¾"	8"	10½"	6'-8½"	1.939	308.72	81.83	
		6'	126	23'-9"		7½"	9"		7'-8½"	2.114	335.92	86.84	
		7'	147	24'-0½"		8¼"	10"		8'-8½"	2.310	371.95	91.85	
		8'	168	24'-2"		9"	10"		9'-8½"	2.467	402.72	96.86	
		9'	189	24'-5½"		9¾"	11"		10'-8½"	2.700	435.22	101.87	
	3 @ 9'	6'	162	30'-0"	12½"	8"	10"	13"	8'-1½"	3.028	469.70	96.86	
		7'	189	30'-1"		8½"	10"		9'-1½"	3.167	500.45	101.87	
		8'	216	30'-2½"		9¼"	10"		10'-1½"	3.328	541.85	106.88	
		9'	243	30'-6"		10"	11"		11'-1½"	3.567	585.32	111.89	
		10'	270	30'-10"		11"	12"		12'-1½"	3.846	634.23	116.90	
		11'	297	31'-0"		12"	12"		13'-1½"	4.069	675.30	121.91	
	3 @ 11'	6'	198	36'-0"	14¾"	8"	10"	15¼"	8'-6"	4.000	642.61	113.56	
		7'	231	36'-1½"		8¾"	10"		9'-6"	4.155	669.46	118.57	
		8'	264	36'-3"		9½"	10"		10'-6"	4.319	709.38	123.58	
		9'	297	36'-7"		10½"	11"		11'-6"	4.582	735.96	128.59	
		10'	330	36'-10½"		11¼"	12"		12'-6"	4.850	783.32	133.60	
		11'	363	37'-0½"		12¼"	12"		13'-6"	5.076	833.73	138.61	
		12'	396	37'-2"		13"	12"		14'-6"	5.293	906.31	143.62	
Section "E" – 30'-0"	3 @ 7'	5'	105	23'-6"	10¾"	7"	8"	11¼"	6'-10"	2.059	328.11	81.83	
		6'	126	23'-10"		8"	9"		7'-10"	2.248	356.23	86.84	
		7'	147	24'-2"		9"	10"		8'-10"	2.462	393.18	91.85	
		8'	168	24'-3½"		9¾"	10"		9'-10"	2.625	424.41	96.86	
		9'	189	24'-7"		10½"	11"		10'-10"	2.864	469.07	101.87	

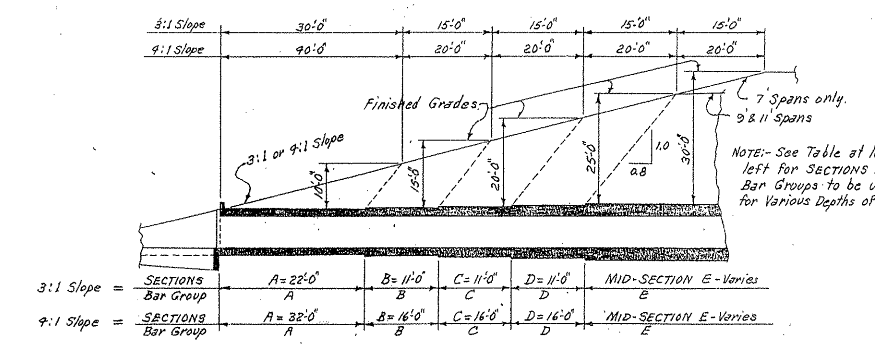


TYPICAL SECTION M-M

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2.



PART LONGITUDINAL SECTION



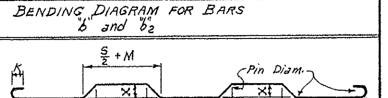
TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

NOTE:- This drawing to be used in conjunction with standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

Bar Size	Pin Diam.	K	Add for 2 Hooks
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

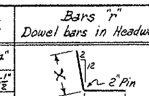
BENDING DIAGRAM FOR BARS "b" and "b2"



NOTE:- Dimensions are to centers of bars. ("b" and "b2").

Dowel Bars for Two Headwalls S	Size	Spacing	No. Req'd	Length	X
7'	#4	12"±	50	2'-8"	1'-4"
9'	#4	12"±	62	2'-11"	1'-5½"
11'	#4	12"±	74	3'-2"	1'-7"

Bars "r" Dowel bars in Headwalls.



GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n = 10) 1200#/□"
Reinforcing Steel 20,000#/□"

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C or D	4:1 Slopes Sections A	4:1 Slopes Sections B, C or D
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

*Variable, see Drawings for Skewed Culverts.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	Mid-Section and Bar Group
5.0' to 9.5'	✓				A
10.0' to 14.5'	✓				B
15.0' to 19.5'	✓	✓			C
20.0' to 25.0'	✓	✓	✓		D
25.0' to 30.0'	✓	✓	✓	✓	E

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

7', 9' & 11' SPANS — 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-300X-X3

Designed by:- W.C.H. 1-31-63. Checked by:- BHS 6-6-63
Drawn by:- W.C.H. 3-28-63 Checked by:- RHS 6-17-63
Quantities by:- W.C.H. 5-6-63 Checked by:- RHS 6-17-63

BAR LIST FOR VARIOUS SECTIONS OF BARREL

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be, and Bf.

"a" bars — STRAIGHT — In Top and Bottom Slabs of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars — BENT - See Diagram at Right. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

Section & Bar Group	Length of Section	Depth of Cover D	Clear Span S	Clear Height H	a Size	a Spacing	a No. 2:1	a No. 3:1	a No. 4:1	a Length	b Size	b Spacing	b No. 2:1	b No. 3:1	b No. 4:1	b Length	X	Y	Z
"A"	2:1=12'-0", 3:1=22'-0", & 4:1=32'-0"	0' TO 10'-0"	3@ 4'	2'	#4	12"	28	48	68	14'-1"	#4	12"	12	22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
			6'	3'	#4	11"	30	52	74	20'-1"	#5	11"	13	24	35	21'-5"	0'-3½"	3'-1"	4'-10¼"
			7'	4'	#5	12"	28	48	68	23'-1"	#5	12"	12	22	32	24'-6"	0'-4¼"	3'-5½"	5'-7"
			8'	4'	#5	12"	28	48	68	26'-1"	#6	12"	12	22	32	27'-9"	0'-5"	3'-10"	6'-4"
			9'	5'	#6	12"	28	48	68	29'-5"	#6	12"	12	22	32	31'-2"	0'-5¾"	4'-3½"	7'-2"
			10'	5'	#6	11"	30	52	74	32'-5"	#6	11"	13	24	35	34'-4"	0'-6½"	4'-8"	7'-11"
"B"	2:1=6'-0", 3:1=11'-0" & 4:1=16'-0"	10'-0" TO 15'-0"	4'	2'	#4	12"	12	22	32	14'-1"	#4	12"	6	11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
			6'	3'	#5	12"	12	22	32	20'-1"	#5	12"	6	11	16	21'-6"	0'-4"	3'-0"	4'-10¼"
			7'	4'	#5	12"	12	22	32	23'-1"	#6	12"	6	11	16	24'-9"	0'-5"	3'-4"	5'-7"
			8'	4'	#5	11"	14	24	36	26'-1"	#6	11"	6	12	17	27'-11"	0'-6"	3'-8"	6'-4"
			9'	5'	#6	11"	14	24	36	29'-5"	#6	11"	6	12	17	31'-4"	0'-6¾"	4'-1½"	7'-2"
			10'	5'	#6	13"	12	20	30	32'-5"	#7	13"	5	10	14	34'-7"	0'-7½"	4'-6"	7'-11"
"C"	2:1=6'-0", 3:1=11'-0" & 4:1=16'-0"	15'-0" TO 20'-0"	4'	2'	#4	11"	14	24	36	14'-1"	#4	11"	6	12	17	15'-3"	0'-2¾"	2'-2½"	3'-4¼"
			6'	3'	#5	12"	12	22	32	20'-1"	#6	12"	6	11	16	21'-8"	0'-4½"	2'-11"	4'-10"
			7'	4'	#5	11"	14	24	36	23'-1"	#6	11"	6	12	17	24'-10"	0'-5¾"	3'-2½"	5'-7"
			8'	4'	#6	11"	12	24	34	26'-1"	#6	11"	7	12	18	28'-1"	0'-7"	3'-6"	6'-4"
			9'	5'	#7	13"	10	20	30	29'-5"	#7	13"	6	10	15	31'-8"	0'-7¾"	3'-11½"	7'-2"
			10'	5'	#7	12"	12	22	32	32'-5"	#7	12"	6	11	16	34'-9"	0'-8¾"	4'-3½"	7'-11"
"D"	2:1=6'-0", 3:1=11'-0" & 4:1=16'-0"	20'-0" TO 25'-0"	4'	2'	#4	12"	12	22	32	14'-1"	#5	12"	6	11	16	15'-5"	0'-3¼"	2'-1½"	3'-4¼"
			6'	3'	#5	11"	14	24	36	20'-1"	#6	11"	6	12	17	21'-10"	0'-5¼"	2'-9½"	4'-10"
			7'	4'	#6	13"	10	20	30	23'-1"	#7	13"	6	10	15	25'-1"	0'-6¼"	3'-1½"	5'-7"
			8'	4'	#6	12"	12	22	32	26'-1"	#7	12"	6	11	16	28'-4"	0'-7¾"	3'-4½"	6'-4"
			9'	5'	#7	12"	12	22	32	29'-5"	#7	12"	6	11	16	31'-9"	0'-8¾"	3'-9½"	7'-2"
			10'	5'	#7	11"	12	24	34	32'-5"	#7	11"	7	12	18	34'-11"	0'-10"	4'-1"	7'-11"
"E"	2:1=6'-0", 3:1=11'-0" & 4:1=16'-0"	25'-0" TO 30'-0"	4'	2'	#4	11"	12	24	34	14'-1"	#5	11"	7	12	18	15'-5"	0'-3½"	2'-1"	3'-4¼"
			6'	3'	#5	10"	14	28	38	20'-1"	#6	10"	8	13	19	21'-10"	0'-5¾"	2'-8½"	4'-10"
			7'	4'	#6	12"	12	22	32	23'-1"	#7	12"	6	11	16	25'-2"	0'-7"	3'-0"	5'-7"
			8'	4'	#6	11"	14	24	36	26'-1"	#7	11"	6	12	17	28'-5"	0'-8½"	3'-3"	6'-4"
				5'			"	"	"	26'-5"			"	"	"	28'-9"	"	3'-4"	6'-5"
				6'			"	"	"	26'-7"			"	"	"	28'-11"	"	"	6'-6"
				7'			"	"	"	26'-11"			"	"	"	29'-3"	"	3'-5"	6'-7"
				8'			"	"	"	27'-0"			"	"	"	29'-4"	"	"	6'-7½"
				9'			"	"	"	27'-4"			"	"	"	29'-8"	"	3'-6"	6'-8½"
				10'			14	24	36	27'-8"			6	12	17	30'-0"	0'-8½"	3'-7"	6'-9½"
			9'	5'	#7	11"	14	26	34	29'-5"	#7	11"	6	12	17	31'-11"	0'-9½"	3'-8"	7'-2"
				6'			"	"	"	29'-9"			"	"	"	32'-3"	"	3'-9"	7'-3"
				7'			"	"	"	29'-11"			"	"	"	32'-5"	"	"	7'-4"
				8'			"	"	"	30'-1"			"	"	"	32'-7"	"	"	7'-5"
				9'			"	"	"	30'-5"			"	"	"	32'-11"	"	3'-10"	7'-6"
				10'			"	"	"	30'-9"			"	"	"	33'-3"	"	3'-11"	7'-7"
				11'			14	26	34	30'-11"			6	12	17	33'-5"	0'-9½"	3'-11"	7'-8"
	Varies		10'	5'	#7	10"	Varies with Length of Barrel.			32'-6"	#7	10"	Varies with Length of Barrel.			35'-2"	0'-11"	3'-11"	7'-11½"
				6'						32'-9"						35'-5"	"	4'-0"	8'-0"
				7'						32'-11"						35'-7"	"	"	8'-1"
				8'						33'-1"						35'-9"	"	"	8'-2"
				9'						33'-5"						36'-1"	"	4'-1"	8'-3"
				10'						33'-9"						36'-5"	0'-11"	4'-2"	8'-4"
"F"	2:1=6'-0", 3:1=11'-0" & 4:1=16'-0"	30'-0" TO 35'-0"	4'	2'	#5	12"	12	22	32	14'-1"	#5	12"	6	11	16	15'-6"	0'-4"	2'-0"	3'-4¼"
			6'	3'	#5	10"	14	26	38	20'-1"	#6	10"	7	13	19	22'-0"	0'-6½"	2'-7"	4'-10"
			7'	4'	#6	11"	14	26	34	23'-2"	#7	11"	6	12	17	25'-5"	0'-7¾"	2'-10½"	5'-7½"
				5'			"	"	"	23'-4"			"	"	"	25'-7"	"	"	5'-8½"
				6'			"	"	"	23'-7"			"	"	"	25'-10"	"	2'-11½"	5'-9"
				7'			"	"	"	23'-11"			"	"	"	26'-2"	"	3'-0½"	5'-10"
				8'			"	"	"	24'-1"			"	"	"	26'-4"	"	"	5'-11"
				9'			14	26	34	24'-5"			6	12	17	26'-8"	0'-7¾"	3'-1½"	6'-0"
			8'	4'	#6	10"	14	28	38	26'-2"	#7	10"	8	13	19	28'-7"	0'-9¼"	3'-2"	6'-4"
				5'			"	"	"	26'-6"			"	"	"	28'-11"	"	3'-3"	6'-5"
				6'			"	"	"	26'-8"			"	"	"	29'-1"	"	"	6'-6"
				7'			"	"	"	27'-0"			"	"	"	29'-5"	"	3'-4"	6'-7"
				8'			"	"	"	27'-2"			"	"	"	29'-7"	"	"	6'-8"
				9'			"	"	"	27'-6"			"	"	"	29'-11"	"	3'-5"	6'-9"
				10'			14	28	38	27'-10"			8	13	19	30'-3"	0'-9¼"	3'-6"	6'-10"
	Varies		9'	5'	#7	10"				29'-6"	#7	10"				32'-1"	0'-10¼"	3'-7"	7'-2"
				6'						29'-10"						32'-5"	"	3'-8"	7'-3"
				7'						30'-0"						32'-7"	"	"	7'-4"
				8'						30'-2"						32'-9"	"	"	7'-5"
				9'						30'-6"						33'-1"	0'-10¼"	3'-9"	7'-6"
"G"	Varies with Length of Barrel.	35'-0" TO 40'-0"	4'	2'	#5	12"	Varies with Length of Barrel.			14'-1"	#5	12"	Varies with Length of Barrel.			15'-7"	0'-4½"	1'-11"	3'-4¼"
			6'	3'	#6	12"				20'-1"	#7	12"				22'-2"	0'-6¾"	2'-6½"	4'-10"
				4'						20'-2"						22'-3"	"	"	4'-10½"
				5'						20'-4"						22'-5"	"	"	4'-11½"
				6'						20'-8"						22'-9"	"	2'-7½"	5'-0½"
				7'						21'-0"						23'-1"	"	2'-8½"	5'-1½"
				8'						21'-2"						23'-3"	0'-6¾"	2'-8½"	5'-2½"
			7'	4'	#6	11"				23'-3"	#7	11"				25'-7"	0'-8½"	2'-9"	5'-8"
				5'						23'-5"						25'-9"	"	"	5'-9"
				6'						23'-9"						26'-1"	"	2'-10"	5'-10"
				7'						24'-1"						26'-5"	"	2'-11"	5'-11"
				8'						24'-3"						26'-7"	"	"	6'-0"
				9'						24'-7"						26'-11"	0'-8½"	3'-0"	6'-1"
			8'	4'	#7	11"				26'-4"	#7	11"				29'-0"	0'-10"	3'-0½"	6'-5"
				5'						26'-8"						29'-4"	"	3'-1½"	6'-6"
				6'						26'-10"						29'-6"	"	"	6'-7"
				7'						27'-2"						29'-10"	"	3'-2½"	6'-8"
				8'						27'-4"						30'-0"	"	"	6'-9"
				9'						27'-8"						30'-4"	"	3'-3½"	6'-10"
				10'						28'-0"						30'-8"	0'-10"	3'-4½"	6'-11"

"b2" bars — BENT - See Diagram at Right. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars — STRAIGHT — In Top and Bottom Slabs of Barrel. Alternate with "b" and "b2" bars.

Sect.	S	H	b2 Size	b2 Spacing	b2 No. 2:1	b2 No. 3:1	b2 No. 4:1	b2 Length	X	Y	Z	c Size	c Spacing	c No. 2:1	c No. 3:1	c No. 4:1	c Length
A	4'	2'	#4	12"	12	22	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	24	44	64	9'-4"
A	6'	3'	#5	11"	13	24	35	21'-5"	0'-3½"	3'-1"	4'-10¼"	#5	11"	26	48	70	13'-4"
A	7'	4'	#5	12"	12	22	32	24'-6"	0'-4½"	3'-5"	5'-7"	#6	12"	24	44	64	15'-4"
A	8'	4'	#6	12"	12	22	32	27'-10"	0'-5½"	3'-9"	6'-4"	#6	12"	24	44	64	17'-4"
A	9'	5'	#6	12"	12	22	32	31'-3"	0'-6¼"	4'-2½"	7'-2"	#7	12"	24	44	64	19'-6"
A	10'	5'	#6	11"	13	24	35	34'-5"	0'-7"	4'-7"	7'-11"	#7	12"	26	48	70	21'-6"
B	4'	2'	#4	12"	6	11	16	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#5	12"	12	22	32	9'-4"
B	6'	3'	#5	12"	6	11	16	21'-7"	0'-4½"	2'-11"	4'-10½"	#6	12"	12	22	32	13'-4"
B	7'	4'	#6	12"	6	11	16	24'-10"	0'-5½"	3'-3"	5'-7"	#6	12"	12	22	32	15'-4"
B	8'	4'	#6	11"	6	12	17	28'-0"	0'-6½"	3'-7"	6'-4"	#6	11"	14	24	36	17'-4"
B	9'	5'	#7	11"	6	12	17	31'-5"	0'-7¼"	4'-0½"	7'-2"	#7	11"	14	24	36	19'-6"
B	10'	5'	#7	13"	5	10	14	34'-8"	0'-8"	4'-5"	7'-11"	#8	13"	12	20	30	21'-6"
C	4'	2'	#4	11"	6	12	17	15'-4"	0'-3¼"	2'-1½"	3'-4¼"	#5	11"	14	24	36	9'-4"
C	6'	3'	#6	12"	6	11	16	21'-9"	0'-5"	2'-10"	4'-10"	#6	12"	12	22	32	13'-4"
C	7'	4'	#6	11"	6	12	17	24'-11"	0'-6¼"	3'-1½"	5'-7"	#6	11"	14	24	36	15'-4"
C	8'	4'	#6	11"	7	12	18	28'-2"	0'-7½"	3'-5"	6'-4"	#7	11"	12	24	34	17'-4"
C	9'	5'	#7	13"	6	10	15	31'-9"	0'-8¼"	3'-10½"	7'-2"	#8	13"	10	20	30	19'-6"
C	10'	5'	#7	12"	6	11	16	34'-10"	0'-9¼"	4'-2½"	7'-11"	#8	12"	12	22	32	21'-6"
D	4'	2'	#5	12"	6	11	16	15'-5"	0'-3½"	2'-1"	3'-4¼"	#5	12"	12	22	32	9'-4"
D	6'	3'	#6	11"	6	12	17	21'-10"	0'-5¾"	2'-8½"	4'-10"	#6	11"	14	24	36	13'-4"
D	7'	4'	#7	13"	6	10	15	25'-2"	0'-6¾"	3'-0½"	5'-7"	#7	13"	10	20	30	15'-4"
D	8'	4'	#7	12"	6	11	16	28'-5"	0'-8¼"	3'-3½"	6'-4"	#7	12"	12	22	32	17'-4"
D	9'	5'	#7	12"	6	11	16	31'-10"	0'-9¼"	3'-8½"	7'-2"	#8	12"	12	22	32	19'-6"
D	10'	5'	#7	11"	7	12	18	35'-0"	0'-10½"	4'-0"	7'-11"	#8	11"	12	24	34	21'-6"
E	4'	2'	#5	11"	7	12	18	15'-6"	0'-4"	2'-0"	3'-4¼"	#5	11"	12	24	34	9'-4"
E	6'	3'	#6	10"	8	13	19	21'-11"	0'-6¼"	2'-7½"	4'-10"	#6	10"	14	28	38	13'-4"
E	7'	4'	#7	12"	6	11	16	25'-3"	0'-7½"	2'-11"	5'-7"	#7	12"	12	22	32	15'-4"
E	8'	4'	#7	11"	6	12	17	28'-6"	0'-9"	3'-2"	6'-4"	#7	11"	14	24	36	17'-4"
E		5'			"	"	"	28'-10"	"	3'-3"	6'-5"			"	"	"	17'-6"
E		6'			"	"	"	29'-0"	"	"	6'-6"			"	"	"	"
E		7'			"	"	"	29'-4"	"	3'-4"	6'-7"			"	"	"	17'-8"
E		8'			"	"	"	29'-5"	"	"	6'-7½"			"	"	"	"
E		9'			"	"	"	29'-9"	"	3'-5"	6'-8½"			"	"	"	17'-10"
E		10'			6	12	17	30'-1"	0'-9"	3'-6"	6'-9½"			14	24	36	18'-0"
E	9'	5'	#7	11"	6	12	17	32'-0"	0'-10"	3'-7"	7'-2"	#8	11"	14	26	34	19'-6"
E		6'			"	"	"	32'-4"	"	3'-8"	7'-3"			"	"	"	19'-8"
E		7'			"	"	"	32'-6"	"	"	7'-4"			"	"	"	"
E		8'			"	"	"	32'-8"	"	"	7'-5"			"	"	"	"
E		9'			"	"	"	33'-0"	"	3'-9"	7'-6"			"	"	"	19'-10"
E		10'			"	"	"	33'-4"	"	3'-10"	7'-7"			"	"	"	20'-0"
E		11'			6	12	17	33'-6"	0'-10"	3'-10"	7'-8"			14	26	34	20'-0"
E	10'	5'	#7	10"	Varies with Length of Barrel.			35'-3"	0'-11½"	3'-10"	7'-11½"	#8	10"	Varies with Length of Barrel			21'-6"
E		6'						35'-6"	"	3'-11"	8'-0"						21'-8"
E		7'						35'-8"	"	"	8'-1"						"
E		8'						35'-10"	"	"	8'-2"						"
E		9'						36'-2"	"	4'-0"	8'-3"						21'-10"
E		10'						36'-6"	0'-11½"	4'-1"	8'-4"						22'-0"
F	4'	2'	#5	12"	6	11	16	15'-7"	0'-4½"	1'-11"	3'-4¼"	#6	12"	12	22	32	9'-4"
F	6'	3'	#6	10"	7	13	19	22'-1"	0'-7"	2'-6"	4'-10"	#6	10"	14	26	38	13'-4"
F	7'	4'	#7	11"	6	12	17	25'-6"	0'-8¼"	2'-9½"	5'-7½"	#7	11"	14	26	34	15'-4"
F		5'			"	"	"	25'-8"	"	"	5'-8½"			"	"	"	"
F		6'			"	"	"	25'-11"	"	2'-10½"	5'-9"			"	"	"	15'-6"
F		7'			"	"	"	26'-3"	"	2'-11½"	5'-10"			"	"	"	15'-8"
F		8'			"	"	"	26'-5"	"	"	5'-11"			"	"	"	"
F		9'			6	12	17	26'-9"	0'-8¼"	3'-0½"	6'-0"			14	26	34	15'-10"
F	8'	4'	#7	10"	8	13	19	28'-8"	0'-9¾"	3'-1"	6'-4"	#7	10"	14	28	38	17'-4"
F		5'			"	"	"	29'-0"	"	3'-2"	6'-5"			"	"	"	17'-6"
F		6'			"	"	"	29'-2"	"	"	6'-6"			"	"	"	"
F		7'			"	"	"	29'-6"	"	3'-3"	6'-7"			"	"	"	17'-8"
F		8'			"	"	"	29'-8"	"	"	6'-8"			"	"	"	"
F		9'			"	"	"	30'-0"	"	3'-4"	6'-9"			"	"	"	17'-10"
F		10'			8	13	19	30'-4"	0'-9¾"	3'-5"	6'-10"			14	28	38	18'-0"
F	9'	5'	#7	10"				32'-2"	0'-10¾"	3'-6"	7'-2"	#8	10"	Varies with Length of Barrel.			19'-6"
F		6'						32'-6"	"	3'-7"	7'-3"						19'-8"
F		7'						32'-8"	"	"	7'-4"						"
F		8'						32'-10"	"	"	7'-5"						"
F		9'						33'-2"	0'-10¾"	3'-8"	7'-6"						19'-10"
G	4'	2'	#5	12"	Varies with Length of Barrel.			15'-7"	0'-5"	1'-10"	3'-4¼"	#6	12"				9'-4"
G	6'	3'	#7	12"				22'-3"	0'-7¼"	2'-5½"	4'-10"	#7	12"				13'-4"
G		4'						22'-4"	"	"	4'-10½"						13'-4"
G		5'						22'-6"	"	"	4'-11½"						13'-4"
G		6'						22'-10"	"	2'-6½"	5'-0½"						13'-6"
G		7'						23'-2"	"	2'-7½"	5'-1½"						13'-8"
G		8'						23'-4"	0'-7¼"	2'-7½"	5'-2½"						13'-8"
G	7'	4'	#7	11"				25'-8"	0'-9"	2'-8"	5'-8"	#7	11"				15'-4"
G		5'						25'-10"	"	"	5'-9"						"
G		6'						26'-2"	"	2'-9"	5'-10"						15'-6"
G		7'						26'-6"	"	2'-10"	5'-11"						15'-8"
G		8'						26'-8"	"	"	6'-0"						"
G		9'						27'-0"	0'-9"	2'-11"	6'-1"						15'-10"
G	8'	4'	#7	11"				29'-1"	0'-10½"	2'-11½"	6'-5"	#8	12"				17'-4"
G		5'						29'-5"	"	3'-0½"	6'-6"						17'-6"
G		6'						29'-7"	"	"	6'-7"						"
G		7'						29'-11"	"	3'-1½"	6'-8"						17'-8"
G		8'						30'-1"	"	"	6'-9"						"
G		9'						30'-5"	"	3'-2½"	6'-10"						17'-10"
G		10'						30'-9"	0'-10½"	3'-3½"	6'-11"						18'-0"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel.
"d1" bars — STRAIGHT — Longitudinal in Sidewalls and Division Walls.
"e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel.
"f" bars — STRAIGHT — Vertical in Sidewalls and Division Walls.

Sect.	S	H	d Size	d Spacing	d No. Req'd	d Length	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length	f Size	f Spacing	f No. 2:1	f No. 3:1	f No. 4:1	f Length
A	4'	2'	#4	12"	22	33'-3" for 32'-0" Sect.	#4	12"	12	33'-3" for 32'-0" Sect.	#4	12"	22	34'-3" for 32'-0" Sect.	#4	12"	72	132	192	2'-9"
A	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	"	"	"	3'-11"
A	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	"	"	"	5'-1"
A	8'	4'	#4	12"	37		#4	12"	24		#4	12"	37		#4	12"	"	"	"	5'-2"
A	9'	5'	#4	12"	40		#4	12"	30		#4	12"	40		#4	12"	"	"	"	6'-4"
A	10'	5'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	72	132	192	6'-5"
B	4'	2'	#4	12"	22	34'-3" for 33'-0" Length Section.	#4	12"	12	34'-3" for 33'-0" Length Section.	#4	12"	22	34'-3" for 33'-0" Length Section.	#4	12"	36	66	96	2'-9"
B	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	"	"	"	4'-0"
B	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	"	"	"	5'-2"
B	8'	4'	#4	12"	37		#4	12"	24		#4	12"	37		#4	12"	"	"	"	5'-4"
B	9'	5'	#4	12"	40		#4	12"	30		#4	12"	40		#4	12"	"	"	"	6'-6"
B	10'	5'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	36	66	96	6'-8"
C	4'	2'	#4	12"	22		#4	12"	12		#4	12"	22		#4	12"	36	66	96	2'-9"
C	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	"	"	"	4'-1"
C	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	"	"	"	5'-4"
C	8'	4'	#4	12"	37		#4	12"	24		#4	12"	37		#4	12"	"	"	"	5'-6"
C	9'	5'	#4	12"	40		#4	12"	30		#4	12"	40		#4	12"	"	"	"	6'-8"
C	10'	5'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	36	66	96	6'-10"
D	4'	2'	#4	12"	22		#4	12"	12		#4	12"	22		#4	12"	36	66	96	2'-10"
D	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	"	"	"	4'-3"
D	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	"	"	"	5'-5"
D	8'	4'	#4	12"	37		#4	12"	24		#4	12"	37		#4	12"	"	"	"	5'-8"
D	9'	5'	#4	12"	40		#4	12"	30		#4	12"	40		#4	12"	"	"	"	6'-10"
D	10'	5'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	36	66	96	7'-1"
E	4'	2'	#4	12"	22		#4	12"	12		#4	12"	22		#4	12"	36	66	96	2'-11"
E	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	"	"	"	4'-4"
E	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	36	66	96	5'-7"
E	8'	4'	#4	12"	37		#4	12"	24		#4	12"	37		#4	12"	36	66	96	5'-10"
E		5'			"				30				"		#4	10"	48	84	120	6'-10"
E		6'			"				36				"		#5	12"	36	66	96	7'-10"
E		7'			"				42				"		#6	12"	36	66	96	8'-10"
E		8'			"				48				"		#6	10"	48	84	120	9'-10"
E		9'			"				54				"		#7	11"	42	72	108	10'-10"
E		10'			37				60				37		#7	10"	48	84	120	11'-10"
E	9'	5'	#4	11"	43		#4	12"	30		#4	11"	43		#4	11"	36	72	108	7'-0"
E		6'			"				36				"		#5	12"	36	66	96	8'-0"
E		7'			"				42				"		#5	11"	36	72	108	9'-0"
E		8'			"				48				"		#6	11"	36	72	108	10'-0"
E		9'			"				54				"		#7	12"	36	66	96	11'-0"
E		10'			"				60				"		#7	10"	42	84	120	12'-0"
E		11'			43				66				43		#8	12"	36	66	96	13'-0"
E	10'	5'	#4	11"	46	Varies	#4	12"	30	Varies	#4	11"	46	Varies	#4	12"	Varies with Length of Barrel.			7'-3"
E		6'			"				36				"		#4	10"				8'-3"
E		7'			"				42				"		#5	11"				9'-3"
E		8'			"				48				"		#6	12"				10'-3"
E		9'			"				54				"		#6	10"				11'-3"
E		10'			46				60				46		#7	11"				12'-3"
F	4'	2'	#4	12"	22	34'-3" for 33'-0" Length Section.	#4	12"	12	34'-3" for 33'-0" Length Section.	#4	12"	22	34'-3" for 33'-0" Length Section.	#4	12"	36	66	96	3'-0"
F	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"	36	66	96	4'-5"
F	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	11"	36	72	108	5'-8"
F		5'			34				30				"		#4	10"	48	84	120	6'-8"
F		6'			34				36				"		#5	11"	36	72	108	7'-8"
F		7'			34				42				"		#6	12"	36	66	96	8'-8"
F		8'			34				48				"		#6	9"	48	84	126	9'-8"
F		9'			34				54				34		#7	10"	42	78	120	10'-8"
F	8'	4'	#4	11"	40		#4	12"	24		#4	11"	40		#4	12"	36	66	96	5'-11"
F		5'			"				30				"		#4	10"	42	84	120	6'-11"
F		6'			"				36				"		#5	12"	36	66	96	7'-11"
F		7'			"				42				"		#6	12"	36	66	96	8'-11"
F		8'			"				48				"		#6	10"	42	84	120	9'-11"
F		9'			"				54				"		#7	11"	36	72	108	10'-11"
F		10'			40				60				40		#8	12"	36	66	96	11'-11"
F	9'	5'	#4	10"	46	Varies with Length of Barrel.	#4	12"	30	Varies with Length of Barrel.	#4	10"	46	Varies with Length of Barrel.	#4	10"	Varies with Length of Barrel.			7'-1"
F		6'			"				36				"		#5	12"				8'-1"
F		7'			"				42				"		#5	10"				9'-1"
F		8'			"				48				"		#6	11"				10'-1"
F		9'			46				54				46		#7	12"				11'-1"
G	4'	2'	#4	12"	22		#4	12"	12		#4	12"	22		#4	12"				3'-1"
G	6'	3'	#4	12"	28		#4	12"	18		#4	12"	28		#4	12"				4'-6"
G		4'			"				24				"		#4	11"				5'-6"
G		5'			"				30				"		#4	10"				6'-6"
G		6'			"				36				"		#5	10"				7'-6"
G		7'			"				42				"		#6	11"				8'-6"
G		8'			28				48				28		#7	12"				9'-6"
G	7'	4'	#4	12"	34		#4	12"	24		#4	12"	34		#4	11"				5'-10"
G		5'			"				30				"		#4	10"				6'-10"
G		6'			"				36				"		#5	11"				7'-10"
G		7'			"				42				"		#6	12"				8'-10"
G		8'			"				48				"		#6	9"				9'-10"
G		9'			34				54				34		#7	10"				10'-10"
G	8'	4'	#4	10"	43		#4	12"	24		#4	10"	43		#4	12"				6'-1"
G		5'			"				30				"		#4	10"				7'-1"
G		6'			"				36				"		#5	12"				8'-1"
G		7'			"				42				"		#6	12"				9'-1"
G		8'			"				48				"		#6	10"				10'-1"
G		9'			"				54				"		#7	11"				11'-1"
G		10'			43				60				43		#8	12"				12'-1"

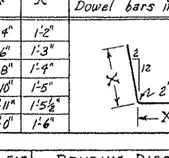
DIMENSIONS — QUANTITIES

Max. Design Depth of Cover D	Clear Span S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel Cu. Yd.	Reinf. Steel per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.	Additional Two Headwalls & Aprons Lb.
SECT. "A" = 10'-0"	3@ 4'	2'	24	14'-4"	6"	6"	8"	6"	3'-0"	0.704	100.09	46.76	151.41
	6'	3'	54	20'-4"	7"	6"	8"	7"	4'-2"	1.138	173.98	61.79	214.87
	7'	4'	84	23'-4"	7¾"	6"	8"	8"	5'-3¾"	1.480	227.15	76.82	323.54
	8'	4'	96	26'-4"	8½"	6"	8"	9"	5'-5½"	1.768	276.14	81.83	369.28
	9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	2.234	360.70	91.85	523.81
	10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	2.561	418.24	96.86	579.23
SECT. "B" = 15'-0"	4'	2'	24	14'-4"	6"	6"	8"	6"	3'-0"	0.704	107.09	46.76	151.41
	6'	3'	54	20'-4"	7½"	6"	8"	8"	4'-3½"	1.232	192.35	61.79	275.12
	7'	4'	84	23'-4"	8½"	6"	8"	9"	5'-5½"	1.606	250.85	76.82	323.54
	8'	4'	96	26'-4"	9½"	6"	8"	10"	5'-7½"	1.930	294.48	81.83	369.28
	9'	5'	135	29'-8"	10¼"	7"	9"	10¾"	6'-9"	2.417	385.72	91.85	523.81
	10'	5'	150	32'-8"	11¼"	7"	9"	11¾"	6'-11"	2.813	430.73	96.86	579.23
SECT. "C" = 20'-0"	4'	2'	24	14'-4"	6"	6"	8"	6½"	3'-0½"	0.726	112.48	46.76	
	6'	3'	54	20'-4"	8"	6"	8"	8½"	4'-4½"	1.295	212.96	61.79	
	7'	4'	84	23'-4"	9¼"	6"	8"	9¾"	5'-7"	1.714	267.13	76.82	
	8'	4'	96	26'-4"	10½"	6"	8"	11"	5'-9½"	2.093	342.45	81.83	
	9'	5'	135	29'-8"	11½"	7"	9"	12"	6'-11½"	2.646	427.47	91.85	
	10'	5'	150	32'-8"	12½"	7"	9"	13"	7'-1½"	3.065	494.43	96.86	
SECT. "D" = 25'-0"	4'	2'	24	14'-4"	6½"	6"	8"	7"	3'-1½"	0.770	119.21	46.76	
	6'	3'	54	20'-4"	8¾"	6"	8"	9¼"	4'-6"	1.389	227.41	61.79	
	7'	4'	84	23'-4"	10"	6"	8"	10½"	5'-8½"	1.822	299.85	76.82	
	8'	4'	96	26'-4"	11½"	6"	8"	12"	5'-11½"	2.256	353.39	81.83	
	9'	5'	135	29'-8"	12½"	7"	9"	13"	7'-1½"	2.829	455.22	91.85	
	10'	5'	150	32'-8"	13¾"	7"	9"	14¼"	7'-4"	3.317	531.59	96.86	
SECTION "E" = 30'-0"	4'	2'	24	14'-4"	7"	6"	8"	7½"	3'-2½"	0.814	126.04	46.76	
	6'	3'	54	20'-4"	9¼"	6"	8"	9¾"	4'-7"	1.452	243.99	61.79	
	7'	4'	84	23'-4"	10¾"	6"	8"	11¼"	5'-10"	1.930	319.04	76.82	
	8'	4'	96	26'-4"	12¼"	6"	8"	12¾"	6'-1"	2.378	378.54	81.83	
		5'	120	26'-8"		7"	9"		7'-1"	2.551	395.35	86.84	
		6'	144	26'-10"		8"	9"		8'-1"	2.700	416.80	91.85	
		7'	168	27'-2"		9"	10"		9'-1"	2.917	454.72	96.86	
		8'	192	27'-3½"		9¾"	10"		10'-1"	3.081	486.11	101.87	
		9'	216	27'-7½"		10¾"	11"		11'-1"	3.340	532.04	106.88	
		10'	240	27'-11½"		11¾"	12"		12'-1"	3.623	568.58	111.89	
	9'	5'	135	29'-8½"	13¼"	7½"	9"	13¾"	7'-3"	2.977	495.40	96.86	
		6'	162	30'-0½"		8¾"	10"		8'-3"	3.179	522.81	101.87	
		7'	189	30'-2"		9"	10"		9'-3"	3.335	539.68	106.88	
		8'	216	30'-4"		10"	10"		10'-3"	3.515	582.05	111.89	
		9'	243	30'-8"		11"	11"		11'-3"	3.778	626.59	116.90	
		10'	270	31'-0"		12"	12"		12'-3"	4.065	676.24	121.91	
		11'	297	31'-2"		13"	12"		13'-3"	4.295	713.39	126.92	
	10'	5'	150	32'-9"	14¾"	7½"	9"	15¼"	7'-6"	3.542	580.48	101.87	
		6'	180	33'-0½"		8½"	10"		8'-6"	3.735	598.63	106.88	
		7'	210	33'-2¾"		9½"	10"		9'-6"	3.907	627.74	111.89	
		8'	240	33'-4"		10"	10"		10'-6"	4.074	662.61	116.90	
		9'	270	33'-8"		11"	11"		11'-6"	4.340	700.24	121.91	
		10'	300	34'-0"		12"	12"		12'-6"	4.630	750.82	126.92	
SECTION "F" = 35'-0"	4'	2'	24	14'-4"	7½"	6"	8"	8"	3'-3½"	0.859	139.27	46.76	
	6'	3'	54	20'-4"	10"	6"	8"	10½"	4'-8½"	1.546	244.93	61.79	
	7'	4'	84	23'-5"	11½"	6½"	8"	12"	5'-11½"	2.056	344.07	76.82	
		5'	105	23'-7"		7½"	8"		6'-11½"	2.189	356.65	81.83	
		6'	126	23'-10½"		8¼"	9"		7'-11½"	2.371	383.61	86.84	
		7'	147	24'-2½"		9¼"	10"		8'-11½"	2.588	416.71	91.85	
		8'	168	24'-4½"		10¼"	10"		9'-11½"	2.768	460.06	96.86	
		9'	189	24'-8½"		11¼"	11"		10'-11½"	3.028	508.21	101.87	
	8'	4'	96	26'-5"	13"	6½"	8"	13½"	6'-2½"	2.519	412.97	86.84	
		5'	120	26'-9"		7½"	9"		7'-2½"	2.697	430.18	91.85	
		6'	144	26'-11"		8½"	9"		8'-2½"	2.850	451.88	96.86	
		7'	168	27'-3"		9½"	10"		9'-2½"	3.071	490.36	101.87	
		8'	192	27'-5"		10½"	10"		10'-2½"	3.255	522.37	106.88	
		9'	216	27'-9"		11½"	11"		11'-2½"	3.520	619.39	111.89	
		10'	240	28'-1"		12½"	12"		12'-2½"	3.809	674.16	116.90	
	9'	5'	135	29'-9½"	14"	7¾"	9"	14½"	7'-4½"	3.138	544.05	101.87	
		6'	162	30'-1½"		8¾"	10"		8'-4½"	3.344	567.69	106.88	
		7'	189	30'-3½"		9¾"	10"		9'-4½"	3.518	590.96	111.89	
		8'	216	30'-5½"		10¾"	10"		10'-4½"	3.704	627.52	116.90	
		9'	243	30'-9½"		11¾"	11"		11'-4½"	3.972	672.67	121.91	
SECTION "G" = 40'-0"	4'	2'	24	14'-4"	8"	6"	8"	8½"	3'-4½"	0.903	139.69	46.76	
	6'	3'	54	20'-4"	10½"	6"	8"	11"	4'-9½"	1.609	273.09	61.79	
		4'	72	20'-5½"		6¾"	8"		5'-9½"	1.722	283.70	66.80	
		5'	90	20'-7½"		7¾"	8"		6'-9½"	1.855	296.11	71.81	
		6'	108	20'-11½"		8¾"	9"		7'-9½"	2.048	328.22	76.82	
		7'	126	21'-3½"		9¾"	10"		8'-9½"	2.266	362.52	81.83	
		8'	144	21'-5½"		10¾"	10"		9'-9½"	2.449	400.65	86.84	
	7'	4'	84	23'-6"	12¼"	7"	8"	12¾"	6'-1"	2.184	345.81	76.82	
		5'	105	23'-8"		8"	8"		7'-1"	2.320	358.47	81.83	
		6'	126	24'-0"		9"	9"		8'-1"	2.519	386.41	86.84	
		7'	147	24'-4"		10"	10"		9'-1"	2.742	418.87	91.85	
		8'	168	24'-6"		11"	10"		10'-1"	2.927	463.72	96.86	
		9'	189	24'-10"		12"	11"		11'-1"	3.194	512.33	101.87	
	8'	4'	96	26'-7"	13¾"	7½"	8"	14¼"	6'-4"	2.680	445.79	91.85	
		5'	120	26'-11"		8½"	9"		7'-4"	2.866	463.43	96.86	
		6'	144	27'-1"		9½"	9"		8'-4"	3.026	485.44	101.87	
		7'	168	27'-5"		10½"	10"		9'-4"	3.255	524.66	106.88	
		8'	192	27'-7"		11½"	10"		10'-4"	3.445	557.35	111.89	
		9'	216	27'-11"		12½"	11"		11'-4"	3.718	604.54	116.90	
		10'	240	28'-3"		13½"	12"		12'-4"	4.015	657.78	121.91	

DOWEL BARS FOR TWO HEADWALLS

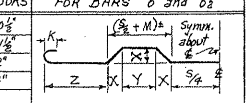
Span	Size	Spacing	No. Req'd	Length	X
4'	#4	12"±	30	2'-4"	1'-2"
6'	#4	12"±	42	2'-6"	1'-3"
7'	#4	12"±	48	2'-8"	1'-4"
8'	#4	12"±	54	2'-10"	1'-5"
9'	#4	12"±	60	2'-11"	1'-5½"
10'	#4	12"±	66	3'-0"	1'-6"

Bars "r" Dowel bars in Headwalls



Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" and "b2"



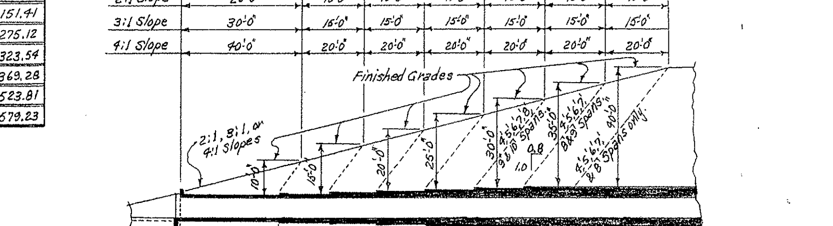
NOTE:- Dimensions are to centers of bars (b & b2).

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	2:1 Slopes Sections A	2:1 Slopes Sections B,C,D,E or F	3:1 Slopes Sections A	3:1 Slopes Sections B,C,D,E or F	4:1 Slopes Sections A	4:1 Slopes Sections B,C,D,E or F
0°	1.0	12.0'	6.0'	22.0'	11.0'	32.0'	16.0'
15°	1.0353	12.424'	6.212'	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	6.928'	*	12.702'	*	18.475'
45°	1.4142	*		*	15.556'	*	22.627'

* Variable, see Drawings for Skewed Culverts.

2:1 Slope	20'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
3:1 Slope	30'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"
4:1 Slope	40'-0"	20'-0"	20'-0"	20'-0"	20'-0"	20'-0"	20'-0"



	Sections / Bar Group						
2:1 Slope =	SECTIONS	A=12'-0"	B=6'-0"	C=6'-0"	D=6'-0"	E=6'-0"	F=6'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G
3:1 Slope =	SECTIONS	A=22'-0"	B=11'-0"	C=11'-0"	D=11'-0"	E=11'-0"	F=11'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope =	SECTIONS	A=32'-0"	B=16'-0"	C=16'-0"	D=16'-0"	E=16'-0"	F=16'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

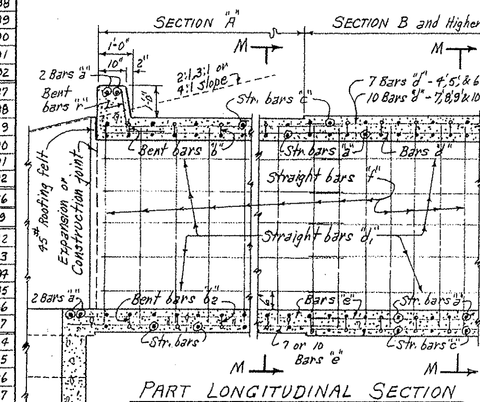
NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

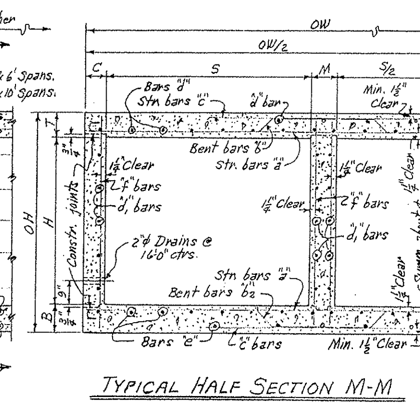
Depths of Cover	A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

Depths of Cover	A	B	C	D	E	F	Mid-Section and Bar Group
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G



PART LONGITUDINAL SECTION



TYPICAL HALF SECTION M-M

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20000#/□"

NOTE:-
This drawing to be used in conjunction with Std. Wing Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, & W-X004-1 or W-X004-2.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diam. min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
ADD'L 4', 6', 7', 8', 9' & 10' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER
STANDARD DRAWING NO. R-300X-X4

Designed by:- W.C.H. 1-12-65. Checked by:-
Drawn by:- W.C.H. 1-15-65. Checked by:-
Quantities by:- W.C.H. 1-22-65. Checked by:-

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

Depth of Cover (D): 0'-0" TO 5'-0" MAXIMUM

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall – Each.
"b" bars – BENT – See Diagram below. In Bottom of Top Slab bent up over Division Walls – hooked. Alternate with "a" and "c" bars.

S	H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
4 @ 4'	2'	#5	12"	128	128	18'-9"	#5	12"	59	59	20'-2"	0'-3"	2'-2"	3'-4¼"
	3'			128	128	18'-9"			59	59	20'-2"	0'-3"	2'-2"	3'-4¼"
	4'			128	128	18'-9"			59	59	20'-2"	0'-3"	2'-2"	3'-4¼"
	5'			128	128	18'-9			59	59	20'-2"	0'-3"	2'-2"	3'-4¼"
	6'			128	128	19'-2"			59	59	20'-7"	0'-3"	2'-3"	3'-5¼"
4 @ 5'	3'	#6	12"	128	128	22'-9"	#5	12"	59	59	24'-3"	0'-3½"	2'-7"	4'-1¼"
	4'			128	128	22'-9"			59	59	24'-3"	0'-3½"	2'-7"	4'-1¼"
	5'			128	128	22'-9"			59	59	24'-3"	0'-3½"	2'-7"	4'-1¼"
	6'			128	128	23'-2"			59	59	24'-8"	0'-3½"	2'-8"	4'-2¼"
	7'			128	128	23'-6"			59	59	25'-0"	0'-3½"	2'-9"	4'-2¾"
4 @ 6'	3'	#6	11"	140	140	26'-9"	#5	11"	65	65	28'-4"	0'-4"	3'-0"	4'-10¼"
	4'			140	140	26'-9"			65	65	28'-4"	0'-4"	3'-0"	4'-10¼"
	5'			140	140	26'-9"			65	65	28'-4"	0'-4"	3'-0"	4'-10¼"
	6'			140	140	27'-2"			65	65	28'-9"	0'-4"	3'-1"	4'-11¼"
	7'			140	140	27'-6"			65	65	29'-1"	0'-4"	3'-2"	4'-11¾"
	8'			140	140	27'-7"			65	65	29'-2"	0'-4"	3'-2"	5'-0¼"
4 @ 7'	4'	#6	12"	128	128	30'-9"	#6	12"	59	59	32'-8"	0'-4½"	3'-5"	5'-7"
	5'			128	128	30'-9"			59	59	32'-8"	0'-4½"	3'-5"	5'-7"
	6'			128	128	31'-2"			59	59	33'-1"	0'-4½"	3'-6"	5'-8"
	7'			128	128	31'-6"			59	59	33'-5"	0'-4½"	3'-7"	5'-8½"
	8'			128	128	31'-7"			59	59	33'-6"	0'-4½"	3'-7"	5'-9"
	9'			128	128	32'-0"			59	59	33'-11"	0'-4½"	3'-8"	5'-10"
4 @ 8'	4'	#6	11"	140	140	34'-9"	#6	11"	65	65	36'-9"	0'-5"	3'-10"	6'-4"
	5'			140	140	35'-2"			65	65	37'-2"	0'-5"	3'-11"	6'-5"
	6'			140	140	35'-2"			65	65	37'-2"	0'-5"	3'-11"	6'-5"
	7'			140	140	35'-6"			65	65	37'-6"	0'-5"	4'-0"	6'-5½"
	8'			140	140	35'-7"			65	65	37'-7"	0'-5"	4'-0"	6'-6"
	9'			140	140	36'-0"			65	65	38'-0"	0'-5"	4'-1"	6'-7"
	10'			140	140	36'-5"			65	65	38'-5"	0'-5"	4'-2"	6'-8"
4 @ 9'	5'	⊛ #6	11"	280	280	20'-7"	⊛ #6	11"	130	130	21'-8"	0'-5½"	4'-4"	7'-2"
	6'			280	280	20'-9"			130	130	21'-10"	0'-5½"	4'-5"	7'-2½"
	7'			280	280	20'-9"			130	130	21'-10"	0'-5½"	4'-5"	7'-2½"
	8'			280	280	20'-10"			130	130	21'-10"	0'-5½"	4'-5"	7'-3"
	9'			280	280	21'-0"			130	130	22'-1"	0'-5½"	4'-6"	7'-4"
	10'			280	280	21'-3"			130	130	22'-3"	0'-5½"	4'-7"	7'-5"
	11'			280	280	21'-4"			130	130	22'-4"	0'-5½"	4'-7"	7'-6"
4 @ 10'	5'	⊛ #7	12"	256	256	22'-9"	⊛ #6	12"	118	118	23'-8"	0'-6"	4'-9"	7'-11"
	6'			256	256	22'-11"			118	118	23'-10"	0'-6"	4'-10"	7'-11½"
	7'			256	256	22'-11"			118	118	23'-10"	0'-6"	4'-10"	7'-11½"
	8'			256	256	23'-0"			118	118	23'-11"	0'-6"	4'-10"	8'-0"
	9'			256	256	23'-2"			118	118	24'-1"	0'-6"	4'-11"	8'-1"
	10'			256	256	23'-5"			118	118	24'-3"	0'-6"	5'-0"	8'-2"
	11'			256	256	23'-6"			118	118	24'-4"	0'-6"	5'-0"	8'-3"
	12'			256	256	23'-7"			118	118	24'-5"	0'-6"	5'-0"	8'-4"
4 @ 11'	6'	⊛ #7	11"	280	280	25'-0"	⊛ #6	11"	130	130	25'-11"	0'-6½"	5'-3"	8'-9"
	7'			280	280	25'-0"			130	130	25'-11"	0'-6½"	5'-3"	8'-9"
	8'			280	280	25'-0"			130	130	25'-11"	0'-6½"	5'-3"	8'-9"
	9'			280	280	25'-2"			130	130	26'-2"	0'-6½"	5'-4"	8'-10"
	10'			280	280	25'-5"			130	130	26'-4"	0'-6½"	5'-5"	8'-11"
	11'			280	280	25'-6"			130	130	26'-5"	0'-6½"	5'-5"	9'-0"
	12'			280	280	25'-7"			130	130	26'-6"	0'-6½"	5'-5"	9'-1"
4 @ 12'	6'	⊛ #7	11"	280	280	27'-0"	⊛ #6	11"	130	130	28'-0"	0'-7"	5'-8"	9'-6"
	7'			280	280	27'-0"			130	130	28'-0"	0'-7"	5'-8"	9'-6"
	8'			280	280	27'-0"			130	130	28'-0"	0'-7"	5'-8"	9'-6"
	9'			280	280	27'-2"			130	130	28'-3"	0'-7"	5'-9"	9'-7"
	10'			280	280	27'-5"			130	130	28'-5"	0'-7"	5'-10"	9'-8"
	11'			280	280	27'-6"			130	130	28'-6"	0'-7"	5'-10"	9'-9"
	12'			280	280	27'-7"			130	130	28'-7"	0'-7"	5'-10"	9'-10"

"b_2" bars – BENT – See Diagram below. In Top of Bottom Slab bent down under Division Walls – hooked. Alternate with "a" and "c" bars.
"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b_2" bars.

S	H	"b_2" Size	"b_2" Spacing	"b_2" No. 3:1	"b_2" No. 4:1	"b_2" Length	"b_2" X	"b_2" Y	"b_2" Z	"c" Size	"c" Spacing	"c" No. 3:1	"c" No. 4:1	"c" Length
4 @ 4'	2'	#5	12"	59	59	20'-1"	0'-2½"	2'-3"	3'-4¼"	#5	12"	120	120	14'-0"
	3'			59	59	20'-1"	0'-2½"	2'-3"	3'-4¼"			120	120	14'-0"
	4'			59	59	20'-1"	0'-2½"	2'-3"	3'-4¼"			120	120	14'-0"
	5'			59	59	20'-1"	0'-2½"	2'-3"	3'-4¼"			120	120	14'-0"
	6'			59	59	20'-6"	0'-2½"	2'-4"	3'-5¼"			120	120	14'-3"
4 @ 5'	3'	#5	12"	59	59	24'-2"	0'-3"	2'-8"	4'-1¼"	#6	12"	120	120	17'-0"
	4'			59	59	24'-2"	0'-3"	2'-8"	4'-1¼"			120	120	17'-0"
	5'			59	59	24'-2"	0'-3"	2'-8"	4'-1¼"			120	120	17'-0"
	6'			59	59	24'-7"	0'-3"	2'-9"	4'-2¼"			120	120	17'-3"
	7'			59	59	24'-11"	0'-3"	2'-10"	4'-2¾"			120	120	17'-6"
4 @ 6'	3'	#5	11"	65	65	28'-3"	0'-3½"	3'-1"	4'-10¼"	#6	11"	132	132	20'-0"
	4'			65	65	28'-3"	0'-3½"	3'-1"	4'-10¼"			132	132	20'-0"
	5'			65	65	28'-3"	0'-3½"	3'-1"	4'-10¼"			132	132	20'-0"
	6'			65	65	28'-8"	0'-3½"	3'-2"	4'-11¼"			132	132	20'-3"
	7'			65	65	29'-0"	0'-3½"	3'-3"	4'-11¾"			132	132	20'-6"
	8'			65	65	29'-1"	0'-3½"	3'-3"	5'-0¼"			132	132	20'-6"
4 @ 7'	4'	#6	12"	59	59	32'-7"	0'-4½"	3'-5½"	5'-7"	#6	12"	120	120	23'-0"
	5'			59	59	32'-7"	0'-4½"	3'-5½"	5'-7"			120	120	23'-0"
	6'			59	59	33'-0"	0'-4½"	3'-6½"	5'-8"			120	120	23'-3"
	7'			59	59	33'-4"	0'-4½"	3'-7½"	5'-8½"			120	120	23'-6"
	8'			59	59	33'-5"	0'-4½"	3'-7½"	5'-9"			120	120	23'-6"
	9'			59	59	33'-10"	0'-4½"	3'-8½"	5'-10"			120	120	23'-9"
4 @ 8'	4'	#6	11"	65	65	36'-9"	0'-5"	3'-10"	6'-4"	#6	11"	132	132	26'-0"
	5'			65	65	37'-2"	0'-5"	3'-11"	6'-5"			132	132	26'-3"
	6'			65	65	37'-2"	0'-5"	3'-11"	6'-5"			132	132	26'-3"
	7'			65	65	37'-6"	0'-5"	4'-0"	6'-5½"			132	132	26'-6"
	8'			65	65	37'-7"	0'-5"	4'-0"	6'-6"			132	132	26'-6"
	9'			65	65	38'-0"	0'-5"	4'-1"	6'-7"			132	132	26'-9"
	10'			65	65	38'-5"	0'-5"	4'-2"	6'-8"			132	132	27'-0"
4 @ 9'	5'	⊛ #6	11"	130	130	21'-8"	0'-5½"	4'-4"	7'-2"	#6	11"	132	132	29'-3"
	6'			130	130	21'-10"	0'-5½"	4'-5"	7'-2½"			132	132	29'-6"
	7'			130	130	21'-10"	0'-5½"	4'-5"	7'-2½"			132	132	29'-6"
	8'			130	130	21'-10"	0'-5½"	4'-5"	7'-3"			132	132	29'-6"
	9'			130	130	22'-1"	0'-5½"	4'-6"	7'-4"			132	132	29'-9"
	10'			130	130	22'-3"	0'-5½"	4'-7"	7'-5"			132	132	30'-0"
	11'			130	130	22'-4"	0'-5½"	4'-7"	7'-6"			132	132	30'-0"
4 @ 10'	5'	⊛ #6	12"	118	118	23'-8"	0'-6"	4'-9"	7'-11"	#7	12"	120	120	32'-3"
	6'			118	118	23'-10"	0'-6"	4'-10"	7'-11½"			120	120	32'-6"
	7'			118	118	23'-10"	0'-6"	4'-10"	7'-11½"			120	120	32'-6"
	8'			118	118	23'-11"	0'-6"	4'-10"	8'-0"			120	120	32'-6"
	9'			118	118	24'-1"	0'-6"	4'-11"	8'-1"			120	120	32'-9"
	10'			118	118	24'-3"	0'-6"	5'-0"	8'-2"			120	120	33'-0"
	11'			118	118	24'-4"	0'-6"	5'-0"	8'-3"			120	120	33'-0"
	12'			118	118	24'-5"	0'-6"	5'-0"	8'-4"			120	120	33'-0"
4 @ 11'	6'	⊛ #6	11"	130	130	26'-0"	0'-7"	5'-2"	8'-9"	#7	11"	132	132	35'-6"
	7'			130	130	26'-0"	0'-7"	5'-2"	8'-9"			132	132	35'-6"
	8'			130	130	26'-0"	0'-7"	5'-2"	8'-9"			132	132	35'-6"
	9'			130	130	26'-3"	0'-7"	5'-3"	8'-10"			132	132	35'-9"
	10'			130	130	26'-5"	0'-7"	5'-4"	8'-11"			132	132	36'-0"
	11'			130	130	26'-6"	0'-7"	5'-4"	9'-0"			132	132	36'-0"
	12'			130	130	26'-7"	0'-7"	5'-4"	9'-1"			132	132	36'-0"
4 @ 12'	6'	⊛ #6	11"	130	130	28'-1"	0'-8"	5'-6"	9'-6"	#7	11"	132	132	38'-6"
	7'			130	130	28'-1"	0'-8"	5'-6"	9'-6"			132	132	38'-6"
	8'			130	130	28'-1"	0'-8"	5'-6"	9'-6"			132	132	38'-6"
	9'			130	130	28'-4"	0'-8"	5'-7"	9'-7"			132	132	38'-9"
	10'			130	130	28'-6"	0'-8"	5'-8"	9'-8"			132	132	39'-0"
	11'			130	130	28'-7"	0'-8"	5'-8"	9'-9"			132	132	39'-0"
	12'			130	130	28'-8"	0'-8"	5'-8"	9'-10"			132	132	39'-0"

"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. Length: 2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap.)
"d_1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls. Length: 2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap.)
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. Length: 2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap.)
"f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls.

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d_1" Size	"d_1" Spacing	"d_1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd	"f" Size	"f" Spacing	"f" No. 3:1	"f" No. 4:1	"f" Length
4 @ 4'	2'	#5	12"	30	#4	12"	16	#4	12"	30	#4	12"	480	480	2'-10"
	3'			30			24			30			480	480	3'-10"
	4'			30			32			30			480	480	4'-10"
	5'			30			40			30			480	480	5'-10"
	6'			30			48			30			480	480	6'-10"
4 @ 5'	3'	#5	11½"	34	#4	12"	24	#4	12"	34	#4	12"	480	480	3'-11"
	4'			34			32			34			480	480	4'-11"
	5'			34			40			34			480	480	5'-11"
	6'			34			48			34			480	480	6'-11"
	7'			34			56			34			480	480	7'-11"
4 @ 6'	3'	#5	11½"	38	#4	12"	24	#4	12"	38	#4	12"	480	480	4'-0"
	4'			38			32			38			480	480	5'-0"
	5'			38			40			38			480	480	6'-0"
	6'			38			48			38			480	480	7'-0"
	7'			38			56			38			480	480	8'-0"
	8'			38			64			38		10"	576	576	9'-0"
4 @ 7'	4'	#5	11½"	44	#4	12"	32	#4	12"	42	#4	12"	480	480	5'-1"
	5'			44			40			42			480	480	6'-1"
	6'			44			48			42			480	480	7'-1"
	7'			44			56			42			480	480	8'-1"
	8'			44			64			42		10"	576	576	9'-1"
	9'			44			72			42	#5	12"	480	480	10'-1"
4 @ 8'	4'	#5	11½"	48	#4	12"	32	#4	12"	46	#4	12"	480	480	5'-2"
	5'			48			40			46			480	480	6'-2"
	6'			48			48			46			480	480	7'-2"
	7'			48			56			46			480	480	8'-2"
	8'			48			64			46		10"	576	576	9'-2"
	9'			48			72			46	#5	12"	480	480	10'-2"
	10'			48			80			46		11"	528	528	11'-2"
4 @ 9'	5'	#5	11½"	55	#4	12"	40	#4	12"	53	#4	12"	480	480	6'-3"
	6'			55			48			53			480	480	7'-3"
	7'			55			56			53			480	480	8'-3"
	8'			55			64			53		10"	576	576	9'-3"
	9'			55			72			53	#5	12"	480	480	10'-3"
	10'			55			80			53		11"	528	528	11'-3"
	11'			55			88			53		10"	576	576	12'-3"
4 @ 10'	5'	#5	11½"	59	#4	12"	40	#4	12"	57	#4	12"	480	480	6'-4"
	6'			59			48			57			480	480	7'-4"
	7'			59			56			57			480	480	8'-4"
	8'			59			64			57		10"	576	576	9'-4"
	9'			59			72			57	#5	12"	480	480	10'-4"
	10'			59			80			57		11"	528	528	11'-4"
	11'			59			88			57		10"	576	576	12'-4"
	12'			59			96			57	#6	12"	480	480	13'-4"
4 @ 11'	6'	#5	11½"	63	#4	12"	48	#4	12"	61	#4	12"	480	480	7'-5"
	7'			63			56			61			480	480	8'-5"
	8'			63			64			61		10"	576	576	9'-5"
	9'			63			72			61	#5	12"	480	480	10'-5"
	10'			63			80			61		11"	528	528	11'-5"
	11'			63			88			61		10"	576	576	12'-5"
	12'			63			96			61	#6	12"	480	480	13'-5"
4 @ 12'	6'	#5	11½"	67	#4	12"	48	#4	12"	65	#4	12"	480	480	7'-7"
	7'			67			56			65			480	480	8'-7"
	8'			67			64			65		10"	576	576	9'-7"
	9'			67			72			65	#5	12"	480	480	10'-7"
	10'			67			80			65		11"	528	528	11'-7"
	11'			67			88			65		10"	576	576	12'-7"
	12'			67			96			65	#6	12"	480	480	13'-7"

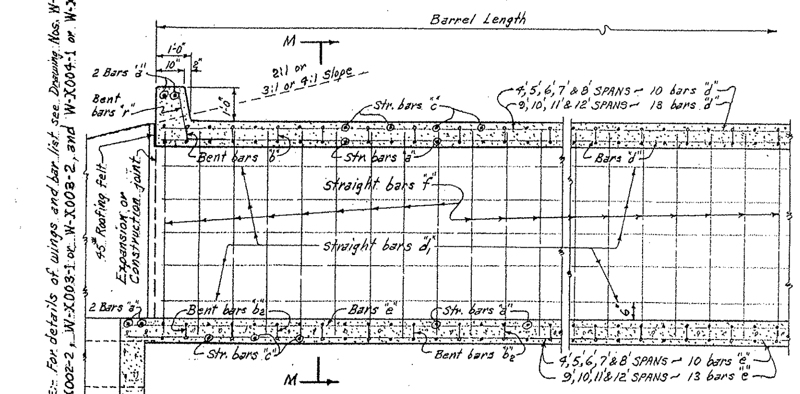
⊛ These "a", "b" and "b_2" bars are to be spliced at center of middle division wall to make a full length bar. Lap #6 bars 2'-0" min. and #7 bars 2'-4" min.

DIMENSIONS — QUANTITIES

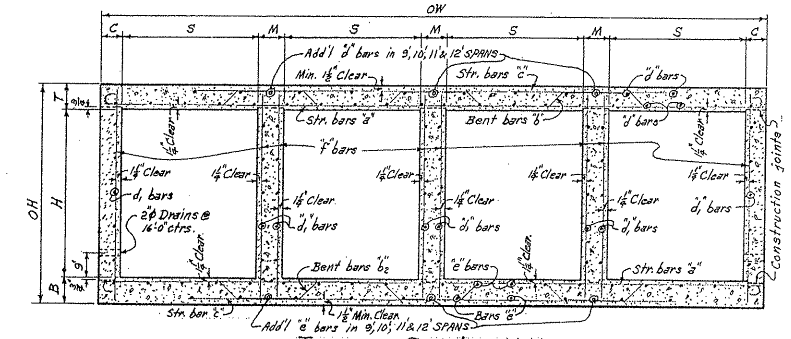
Max. Design Depth of Cover (D): 5'-0"

S (Clear Spans)	H (Clear Height)	A (Sq. Ft. Opening)	OW (Overall Width)	T (Thickness of Top Slab)	C (Thickness of Sidewalls)	M (Thickness of Division Walls)	B (Thickness of Bottom Slab)	OH (Overall Height)	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
4 @ 4'	2'	32	19'-0"	6½"	6"	8"	6"	3'-0½"	0.955	187.46	90.56	261.10
	3'	48	19'-0"		6"	8"		4'-0½"	1.066	198.14	97.24	261.10
	4'	64	19'-0"		6"	8"		5'-0½"	1.177	208.83	103.92	261.10
	5'	80	19'-0"		6"	8"		6'-0½"	1.289	219.52	110.60	261.10
	6'	96	19'-5"		7"	9"		7'-0½"	1.508	232.47	117.28	264.58
4 @ 5'	3'	60	23'-0"	7"	6"	8"	6½"	4'-1½"	1.292	265.05	107.53	398.95
	4'	80	23'-0"		6"	8"		5'-1½"	1.403	275.73	114.21	398.95
	5'	100	23'-0"		6"	8"		6'-1½"	1.514	286.42	120.89	398.95
	6'	120	23'-5"		7"	9"		7'-1½"	1.735	299.98	127.57	403.96
	7'	140	23'-9"		7½"	10"		8'-1½"	1.962	313.12	134.25	407.96
4 @ 6'	3'	72	27'-0"	7½"	6"	8"	7"	4'-2½"	1.542	320.01	117.83	468.83
	4'	96	27'-0"		6"	8"		5'-2½"	1.653	330.70	124.51	468.83
	5'	120	27'-0"		6"	8"		6'-2½"	1.764	341.39	131.19	468.83
	6'	144	27'-5"		7"	9"		7'-2½"	1.986	355.21	137.87	473.84
	7'	168	27'-9"		7½"	10"		8'-2½"	2.214	368.57	144.55	477.85
	8'	192	27'-10"		8"	10"		9'-2½"	2.381	389.34	151.23	478.85
4 @ 7'	4'	112	31'-0"	8"	6"	8"	7¾"	5'-3¾"	1.951	381.96	138.28	539.61
	5'	140	31'-0"		6"	8"		6'-3¾"	2.063	392.65	144.96	539.61
	6'	168	31'-5"		7"	9"		7'-3¾"	2.286	406.59	151.64	544.62
	7'	196	31'-9"		7½"	10"		8'-3¾"	2.516	420.03	158.32	548.62
	8'	224	31'-10"		8"	10"		9'-3¾"	2.683	440.93	165.00	549.62
	9'	252	32'-3"		9"	11"		10'-3¾"	2.984	475.41	171.68	553.63
4 @ 8'	4'	128	35'-0"	8½"	6"	8"	8½"	5'-5"	2.281	449.30	148.57	611.28
	5'	160	35'-5"		7"	9"		6'-5"	2.491	463.53	155.25	616.28
	6'	192	35'-5"		7"	9"		7'-5"	2.618	474.22	161.93	616.28
	7'	224	35'-9"		7½"	10"		8'-5"	2.848	487.91	168.61	620.29
	8'	256	35'-10"		8"	10"		9'-5"	3.016	508.95	175.29	621.29
	9'	288	36'-3"		9"	11"		10'-5"	3.319	543.89	181.97	626.30
	10'	320	36'-8"		10"	12"		11'-5"	3.652	569.59	188.65	631.30
4 @ 9'	5'	180	39'-5"	9"	7"	9"	9"	6'-6"	2.823	525.66	173.26	716.88
	6'	216	39'-9"		7½"	10"		7'-6"	3.042	539.35	179.94	720.89
	7'	252	39'-9"		7½"	10"		8'-6"	3.181	550.04	186.62	720.89
	8'	288	39'-10"		8"	10"		9'-6"	3.349	571.16	193.30	722.89
	9'	324	40'-3"		9"	11"		10'-6"	3.653	606.26	199.98	726.89
	10'	360	40'-8"		10"	12"		11'-6"	3.988	632.03	206.66	732.90
	11'	396	40'-10"		11"	12"		12'-6"	4.238	658.72	213.34	734.90
4 @ 10'	5'	200	43'-5"	9½"	7"	9"	9½"	6'-7"	3.179	620.21	183.56	991.62
	6'	240	43'-9"		7½"	10"		7'-7"	3.399	634.28	190.24	997.07
	7'	280	43'-9"		7½"	10"		8'-7"	3.538	644.97	196.92	997.07
	8'	320	43'-10"		8"	10"		9'-7"	3.706	666.82	203.60	999.80
	9'	360	44'-3"		9"	11"		10'-7"	4.012	701.92	210.28	1005.25
	10'	400	44'-8"		10"	12"		11'-7"	4.348	728.27	216.96	1013.92
	11'	440	44'-10"		11"	12"		12'-7"	4.598	755.12	223.64	1016.15
	12'	480	45'-0"		12"	12"		13'-7"	4.861	798.37	230.32	1018.87
4 @ 11'	6'	264	47'-10"	10"	8"	10"	10½"	7'-8½"	3.878	729.59	200.53	1091.98
	7'	308	47'-10"		8"	10"		8'-8½"	4.020	740.28	207.21	1091.98
	8'	352	47'-10"		8"	10"		9'-8½"	4.162	761.03	213.89	1091.98
	9'	396	48'-3"		9"	11"		10'-8½"	4.470	797.14	220.57	1096.93
	10'	440	48'-8"		10"	12"		11'-8½"	4.808	823.93	227.25	1105.11
	11'	484	48'-10"		11"	12"		12'-8½"	5.059	850.97	233.93	1107.83
	12'	528	49'-0"		12"	12"		13'-8½"	5.323	899.49	240.61	1110.56
4 @ 12'	6'	288	51'-10"	10½"	8"	10"	11½"	7'-10"	4.371	782.20	210.82	1184.05
	7'	336	51'-10"		8"	10"		8'-10"	4.513	792.88	217.50	1184.05
	8'	384	51'-10"		8"	10"		9'-10"	4.655	813.82	224.18	1184.05
	9'	432	52'-3"		9"	11"		10'-10"	4.965	850.25	230.86	1189.50
	10'	480	52'-8"		10"	12"		11'-10"	5.305	877.16	237.54	1197.68
	11'	528	52'-10"		11"	12"		12'-10"	5.557	904.35	244.22	1200.41
	12'	576	53'-0"		12"	12"		13'-10"	5.821	948.21	250.90	1203.13

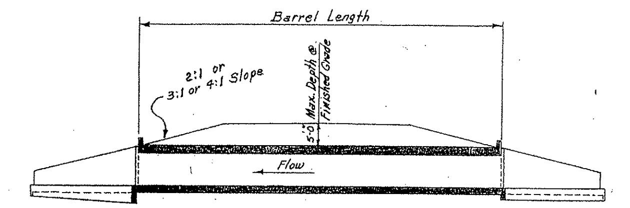
NOTE:- For details of wings and bar list see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2.



PART LONGITUDINAL SECTION



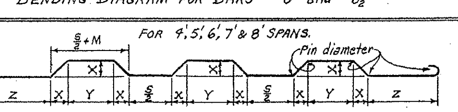
TYPICAL SECTION M-M



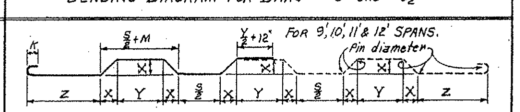
LONGITUDINAL SECTION

BAR SIZE	PIN DIAM.	K	ADD FOR HOOKS
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2" (2 Hooks)
#6	3"	5"	0'-7" (Hook)

BENDING DIAGRAM FOR BARS "b" and "b_2"



BENDING DIAGRAM FOR BARS "b" and "b_2"

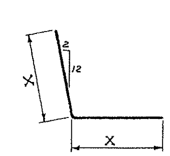


NOTE:- Dimensions are to centers of bars. ("b" and "b_2").

DOWEL BARS FOR TWO HEADWALLS

4 SPANS @	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	40	2'-5"	1'-2½"
5'	#4	12"±	48	2'-6"	1'-3"
6'	#4	12"±	56	2'-7"	1'-3½"
7'	#4	12"±	64	2'-8"	1'-4"
8'	#4	12"±	72	2'-9"	1'-4½"
9'	#4	12"±	80	2'-10"	1'-5"
10'	#4	12"±	88	2'-11"	1'-5½"
11'	#4	12"±	96	3'-0"	1'-6"
12'	#4	12"±	104	3'-1"	1'-6½"

Bars "r" Dowel bars in Headwalls.



GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS 3:1 OR 4:1 SLOPES
QUADRUPLES UNDER 5'-0" COVER
STANDARD DRAWING NO. R-400X-0

Designed By:- W.C.H. 1-23-63. Checked By:- RHS 5-21-63
Drawn By:- W.C.H. 3-18-63. Checked By:- RHS 5-24-63
Quantities By:- W.C.H. 3-20-63. Checked By:- RHS 5-24-63

BAR LIST FOR VARIOUS SECTIONS OF BARREL

- "a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
- "b" bars – BENT - See Diagram below – In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
- "b2" bars – BENT - See Diagram below – In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
- "c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars
- "d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
- "d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls
- "e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel
- "f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
Section "A" & Bar Group "A"	3:1 = 22'-0" 4:1 = 32'-0"	…0' TO 10'-0"	4 @ 4'	3'	#4	12"	48	68	18'-9"	#4	12"	22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				4'			48	68	18'-9"			22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				5'			48	68	18'-9"			22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				6'			48	68	19'-2"			22	32	20'-6"	0'-2¾"	2'-3½"	3'-5¼"
			4 @ 5'	3'	#4	11"	52	74	22'-9"	#4	11"	24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"
				4'			52	74	22'-9"			24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"
				5'			52	74	22'-9"			24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"
				6'			52	74	23'-2"			24	35	24'-7"	0'-3½"	2'-8½"	4'-2¼"
				7'			52	74	23'-6"			24	35	24'-11"	0'-3½"	2'-9½"	4'-2¾"
			4 @ 6'	4'	#5	13"	46	64	26'-9"	#5	13"	20	29	28'-3"	0'-3½"	3'-1"	4'-10¼"
				5'			46	64	26'-9"			20	29	28'-3"	0'-3½"	3'-1"	4'-10¼"
				6'			46	64	27'-2"			20	29	28'-8"	0'-3½"	3'-2"	4'-11¼"
				7'			46	64	27'-6"			20	29	29'-0"	0'-3½"	3'-3"	4'-11¾"
				8'			46	64	27'-7"			20	29	29'-1"	0'-3½"	3'-3"	5'-0¼"
Section "B" & Bar Group "B"	3:1 = 11'-0" 4:1 = 16'-0"	10'-0" TO 15'-0"	4 @ 4'	3'	#4	12"	22	32	18'-9"	#4	12"	11	16	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				4'			22	32	18'-9"			11	16	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				5'			22	32	18'-9"			11	16	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				6'			22	32	19'-2"			11	16	20'-6"	0'-2¾"	2'-3½"	3'-5¼"
			4 @ 5'	3'	#4	13"	20	30	22'-9"	#5	13"	10	14	24'-3"	0'-3½"	2'-7½"	4'-1½"
				4'			20	30	22'-9"			10	14	24'-3"	0'-3½"	2'-7½"	4'-1½"
				5'			20	30	22'-9"			10	14	24'-3"	0'-3½"	2'-7½"	4'-1½"
				6'			20	30	23'-2"			10	14	24'-8"	0'-3½"	2'-8½"	4'-2¼"
				7'			20	30	23'-6"			10	14	25'-0"	0'-3½"	2'-9½"	4'-2¾"
			4 @ 6'	4'	#5	12"	22	32	26'-9"	#5	12"	11	16	28'-5"	0'-4½"	2'-11½"	4'-10¼"
				5'			22	32	26'-9"			11	16	28'-5"	0'-4½"	2'-11½"	4'-10¼"
				6'			22	32	27'-2"			11	16	28'-10"	0'-4½"	3'-0½"	4'-11¼"
				7'			22	32	27'-6"			11	16	29'-2"	0'-4½"	3'-1½"	4'-11¾"
				8'			22	32	27'-7"			11	16	29'-3"	0'-4½"	3'-1½"	5'-0¼"
Section "C" & Bar Group "C"	3:1 = 11'-0" 4:1 = 16'-0"	15'-0" TO 20'-0"	4 @ 4'	3'	#4	13"	20	30	18'-9"	#5	13"	10	15	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				4'			20	30	18'-9"			10	15	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				5'			20	30	18'-9"			10	15	20'-1"	0'-2¾"	2'-2½"	3'-4¼"
				6'			20	30	19'-2"			10	15	20'-6"	0'-2¾"	2'-3½"	3'-5¼"
			4 @ 5'	3'	#4	12"	22	32	22'-9"	#5	12"	11	16	24'-4"	0'-3¾"	2'-6½"	4'-1½"
				4'			22	32	22'-9"			11	16	24'-4"	0'-3¾"	2'-6½"	4'-1½"
				5'			22	32	22'-9"			11	16	24'-4"	0'-3¾"	2'-6½"	4'-1½"
				6'			22	32	23'-2"			11	16	24'-9"	0'-3¾"	2'-7½"	4'-2¼"
				7'			22	32	23'-6"			11	16	25'-1"	0'-3¾"	2'-8½"	4'-2¾"
			4 @ 6'	4'	#5	12"	22	32	26'-9"	#5	12"	11	16	28'-6"	0'-4¾"	2'-10½"	4'-10¼"
				5'			22	32	26'-9"			11	16	28'-6"	0'-4¾"	2'-10½"	4'-10¼"
				6'			22	32	27'-2"			11	16	28'-11"	0'-4¾"	2'-11½"	4'-11¼"
				7'			22	32	27'-6"			11	16	29'-3"	0'-4¾"	3'-0½"	4'-11¾"
				8'			22	32	27'-7"			11	16	29'-4"	0'-4¾"	3'-0½"	5'-0¼"
Section "D" & Bar Group "D"	3:1 = 11'-0" 4:1 = 16'-0"	20'-0" TO 25'-0"	4 @ 4'	3'	#4	12"	22	32	18'-9"	#5	12"	11	16	20'-3"	0'-3¼"	2'-1½"	3'-4¼"
				4'			22	32	18'-9"			11	16	20'-3"	0'-3¼"	2'-1½"	3'-4¼"
				5'			22	32	18'-9"			11	16	20'-3"	0'-3¼"	2'-1½"	3'-4¼"
				6'			22	32	19'-2"			11	16	20'-8"	0'-3¼"	2'-2½"	3'-5¼"
			4 @ 5'	3'	#4	11"	24	34	22'-9"	#5	11"	12	18	24'-5"	0'-4¼"	2'-5½"	4'-1½"
				4'			24	34	22'-9"			12	18	24'-5"	0'-4¼"	2'-5½"	4'-1½"
				5'			24	34	22'-9"			12	18	24'-6"	0'-4¼"	2'-5½"	4'-1½"
				6'			24	34	23'-2"			12	18	24'-10"	0'-4¼"	2'-6½"	4'-2¼"
				7'			24	34	23'-7"			12	18	25'-3"	0'-4¼"	2'-7½"	4'-3¼"
			4 @ 6'	4'	#5	13"	20	30	26'-9"	#6	13"	10	15	28'-10"	0'-5½"	2'-9"	4'-10"
				5'			20	30	26'-10"			10	15	28'-11"	0'-5½"	2'-9"	4'-10½"
				6'			20	30	27'-2"			10	15	29'-4"	0'-5½"	2'-10"	4'-11¼"
				7'			20	30	27'-7"			10	15	29'-8"	0'-5½"	2'-11"	5'-0"
				8'			20	30	27'-8"			10	15	29'-10"	0'-5½"	2'-11"	5'-0¾"
Section "E" & Bar Group "E"	3:1 = 11'-0" 4:1 = 16'-0"	25'-0" TO 30'-0"	4 @ 4'	3'	#4	11"	26	36	18'-9"	#5	11"	12	17	20'-4"	0'-3¾"	2'-0½"	3'-4¼"
				4'			26	36	18'-9"			12	17	20'-4"	0'-3¾"	2'-0½"	3'-4¼"
				5'			26	36	18'-10"			12	17	20'-5"	0'-3¾"	2'-0½"	3'-4¾"
				6'			26	36	19'-3"			12	17	20'-10"	0'-3¾"	2'-1½"	3'-5¾"
			4 @ 5'	3'	#4	10"	28	40	22'-9"	#5	10"	13	19	24'-6"	0'-4¾"	2'-4½"	4'-1½"
				4'			28	40	22'-9"			13	19	24'-6"	0'-4¾"	2'-4½"	4'-1½"
				5'			28	40	22'-10"			13	19	24'-8"	0'-4¾"	2'-4½"	4'-2"
				6'			28	40	23'-3"			13	19	25'-0"	0'-4¾"	2'-5½"	4'-2¾"
				7'			28	40	23'-8"			13	19	25'-5"	0'-4¾"	2'-6½"	4'-3¾"
			4 @ 6'	4'	#5	12"	22	32	26'-9"	#6	12"	11	16	29'-0"	0'-6¼"	2'-7½"	4'-10"
				5'			22	32	26'-11"			11	16	29'-2"	0'-6¼"	2'-7½"	4'-11"
				6'			22	32	27'-4"			11	16	29'-7"	0'-6¼"	2'-8½"	5'-0"
				7'			22	32	27'-8"			11	16	29'-11"	0'-6¼"	2'-9½"	5'-0¾"
				8'			22	32	27'-10"			11	16	30'-1"	0'-6¼"	2'-9½"	5'-1½"
Section "F" & Bar Group "F"	Varies with Length of Barrel	30'-0" TO 35'-0"	4 @ 4'	3'	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	18'-9"	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	20'-5"	0'-4"	2'-0"	3'-4¼"
				4'					18'-9"					20'-5"	0'-4"	2'-0"	3'-4¾"
				5'					18'-11"					20'-7"	0'-4"	2'-0"	3'-5¾"
				6'					19'-4"					21'-0"	0'-4"	2'-1"	3'-6¼"
			4 @ 5'	3'	#5	13"			22'-9"	#6	13"			24'-10"	0'-5¼"	2'-3½"	4'-1"
				4'					22'-10"					24'-11"	0'-5¼"	2'-3½"	4'-1½"
				5'					22'-11"					25'-0"	0'-5¼"	2'-3½"	4'-2"
				6'					23'-4"					25'-5"	0'-5¼"	2'-4½"	4'-3"
				7'					23'-9"					25'-10"	0'-5¼"	2'-5½"	4'-4"
			4 @ 6'	4'	#5	11"			26'-10"	#6	11"			29'-2"	0'-6¾"	2'-6½"	4'-10½"
				5'					27'-0"					29'-4"	0'-6¾"	2'-6½"	4'-11½"
				6'					27'-5"					29'-9"	0'-6¾"	2'-7½"	5'-0½"
				7'					27'-10"					30'-2"	0'-6¾"	2'-8½"	5'-1½"
				8'					27'-11"					30'-4"	0'-6¾"	2'-8½"	5'-2¼"

Section	S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
A	4 @ 4'	3'	#4	12"	22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	44	64	14'-0"
A		4'			22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"			44	64	14'-0"
A		5'			22	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"			44	64	14'-0"
A		6'			22	32	20'-6"	0'-2¾"	2'-3½"	3'-5¼"			44	64	14'-3"
A	4 @ 5'	3'	#4	11"	24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"	#5	11"	48	70	17'-0"
A		4'			24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"			48	70	17'-0"
A		5'			24	35	24'-2"	0'-3½"	2'-7½"	4'-1½"			48	70	17'-0"
A		6'			24	35	24'-7"	0'-3½"	2'-8½"	4'-2¼"			48	70	17'-3"
A		7'			24	35	24'-11"	0'-3½"	2'-9½"	4'-2¾"			48	70	17'-6"
A	4 @ 6'	4'	#5	13"	20	29	28'-4"	0'-3¾"	3'-0½"	4'-10¼"	#6	13"	42	60	20'-0"
A		5'			20	29	28'-4"	0'-3¾"	3'-0½"	4'-10¼"			42	60	20'-0"
A		6'			20	29	28'-9"	0'-3¾"	3'-1½"	4'-11¼"			42	60	20'-3"
A		7'			20	29	29'-1"	0'-3¾"	3'-2½"	4'-11¾"			42	60	20'-6"
A		8'			20	29	29'-2"	0'-3¾"	3'-2½"	5'-0¼"			42	60	20'-6"
B	4 @ 4'	3'	#4	12"	11	16	20'-2"	0'-3"	2'-2"	3'-4¼"	#5	12"	22	32	14'-0"
B		4'			11	16	20'-2"	0'-3"	2'-2"	3'-4¼"			22	32	14'-0"
B		5'			11	16	20'-2"	0'-3"	2'-2"	3'-4¼"			22	32	14'-0"
B		6'			11	16	20'-7"	0'-3"	2'-2"	3'-5¼"			22	32	14'-3"
B	4 @ 5'	3'	#5	13"	10	14	24'-4"	0'-3¾"	2'-6½"	4'-1½"	#6	13"	20	30	17'-0"
B		4'			10	14	24'-4"	0'-3¾"	2'-6½"	4'-1½"			20	30	17'-0"
B		5'			10	14	24'-4"	0'-3¾"	2'-6½"	4'-1½"			20	30	17'-0"
B		6'			10	14	24'-9"	0'-3¾"	2'-7½"	4'-2¼"			20	30	17'-3"
B		7'			10	14	25'-1"	0'-3¾"	2'-8½"	4'-2¾"			20	30	17'-6"
B	4 @ 6'	4'	#5	12"	11	16	28'-6"	0'-4¾"	2'-10½"	4'-10¼"	#6	12"	22	32	20'-0"
B		5'			11	16	28'-6"	0'-4¾"	2'-10½"	4'-10¼"			22	32	20'-0"
B		6'			11	16	28'-11"	0'-4¾"	2'-11½"	4'-11¼"			22	32	20'-3"
B		7'			11	16	29'-3"	0'-4¾"	3'-0½"	4'-11¾"			22	32	20'-6"
B		8'			11	16	29'-4"	0'-4¾"	3'-0½"	5'-0¼"			22	32	20'-6"
C	4 @ 4'	3'	#5	13"	10	15	20'-3"	0'-3¼"	2'-1½"	3'-4¼"	#5	13"	20	30	14'-0"
C		4'			10	15	20'-3"	0'-3¼"	2'-1½"	3'-4¼"			20	30	14'-0"
C		5'			10	15	20'-3"	0'-3¼"	2'-1½"	3'-4¼"			20	30	14'-0"
C		6'			10	15	20'-8"	0'-3¼"	2'-2½"	3'-5¼"			20	30	14'-3"
C	4 @ 5'	3'	#5	12"	11	16	24'-5"	0'-4¼"	2'-5½"	4'-1½"	#6	12"	22	32	17'-0"
C		4'			11	16	24'-5"	0'-4¼"	2'-5½"	4'-1½"			22	32	17'-0"
C		5'			11	16	24'-5"	0'-4¼"	2'-5½"	4'-1½"			22	32	17'-0"
C		6'			11	16	24'-10"	0'-4¼"	2'-6½"	4'-2¼"			22	32	17'-3"
C		7'			11	16	25'-2"	0'-4¼"	2'-7½"	4'-2¾"			22	32	17'-6"
C	4 @ 6'	4'	#5	12"	11	16	28'-8"	0'-5¼"	2'-9½"	4'-10¼"	#7	12"	22	32	20'-0"
C		5'			11	16	28'-8"	0'-5¼"	2'-9½"	4'-10¼"			22	32	20'-0"
C		6'			11	16	29'-1"	0'-5¼"	2'-10½"	4'-11¼"			22	32	20'-3"
C		7'			11	16	29'-5"	0'-5¼"	2'-11½"	4'-11¾"			22	32	20'-6"
C		8'			11	16	29'-6"	0'-5¼"	2'-11½"	5'-0¼"			22	32	20'-6"
D	4 @ 4'	3'	#5	12"	11	16	20'-4"	0'-3¾"	2'-0½"	3'-4¼"	#5	12"	22	32	14'-0"
D		4'			11	16	20'-4"	0'-3¾"	2'-0½"	3'-4¼"			22	32	14'-0"
D		5'			11	16	20'-4"	0'-3¾"	2'-0½"	3'-4¼"			22	32	14'-0"
D		6'			11	16	20'-9"	0'-3¾"	2'-1½"	3'-5¼"			22	32	14'-3"
D	4 @ 5'	3'	#5	11"	12	18	24'-6"	0'-4¾"	2'-4½"	4'-1½"	#6	11"	24	34	17'-0"
D		4'			12	18	24'-6"	0'-4¾"	2'-4½"	4'-1½"			24	34	17'-0"
D		5'			12	18	24'-7"	0'-4¾"	2'-4½"	4'-1½"			24	34	17'-0"
D		6'			12	18	24'-11"	0'-4¾"	2'-5½"	4'-2¼"			24	34	17'-3"
D		7'			12	18	25'-4"	0'-4¾"	2'-6½"	4'-3¼"			24	34	17'-6"
D	4 @ 6'	4'	#6	13"	10	15	28'-11"	0'-6"	2'-8"	4'-10"	#7	13"	20	30	20'-0"
D		5'			10	15	29'-0"	0'-6"	2'-8"	4'-10½"			20	30	20'-0"
D		6'			10	15	29'-5"	0'-6"	2'-9"	4'-11¼"			20	30	20'-3"
D		7'			10	15	29'-9"	0'-6"	2'-10"	5'-0"			20	30	20'-6"
D		8'			10	15	29'-11"	0'-6"	2'-10"	5'-0¾"			20	30	20'-6"
E	4 @ 4'	3'	#5	11"	12	17	20'-5"	0'-4¼"	1'-11½"	3'-4¼"	#5	11"	26	36	14'-0"
E		4'			12	17	20'-5"	0'-4¼"	1'-11½"	3'-4¼"			26	36	14'-0"
E		5'			12	17	20'-6"	0'-4¼"	1'-11½"	3'-4¾"			26	36	14'-0"
E		6'			12	17	20'-11"	0'-4¼"	2'-0½"	3'-5¾"			26	36	14'-3"
E	4 @ 5'	3'	#5	10"	13	19	24'-8"	0'-5¼"	2'-3½"	4'-1½"	#6	10"	28	40	17'-0"
E		4'			13	19	24'-8"	0'-5¼"	2'-3½"	4'-1½"			28	40	17'-0"
E		5'			13	19	24'-9"	0'-5¼"	2'-3½"	4'-2"			28	40	17'-0"
E		6'			13	19	25'-2"	0'-5¼"	2'-4½"	4'-2¾"			28	40	17'-3"
E		7'			13	19	25'-7"	0'-5¼"	2'-5½"	4'-3¾"			28	40	17'-6"
E	4 @ 6'	4'	#6	12"	11	16	29'-1"	0'-6¾"	2'-6½"	4'-10"	#7	12"	22	32	20'-0"
E		5'			11	16	29'-3"	0'-6¾"	2'-6½"	4'-11"			22	32	20'-0"
E		6'			11	16	29'-8"	0'-6¾"	2'-7½"	5'-0"			22	32	20'-3"
E		7'			11	16	30'-1"	0'-6¾"	2'-8½"	5'-0¾"			22	32	20'-6"
E		8'			11	16	30'-2"	0'-6¾"	2'-8½"	5'-1½"			22	32	20'-6"
F	4 @ 4'	3'	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	20'-6"	0'-4½"	1'-11"	3'-4¼"	#6	12"	Varies with Length of Barrel	Varies with Length of Barrel	14'-0"
F		4'					20'-6"	0'-4½"	1'-11"	3'-4¾"					14'-0"
F		5'					20'-8"	0'-4½"	1'-11"	3'-5¾"					14'-0"
F		6'					21'-1"	0'-4½"	2'-0"	3'-6¼"					14'-3"
F	4 @ 5'	3'	#6	13"			24'-11"	0'-5¾"	2'-2½"	4'-1"	#7	13"			17'-0"
F		4'					25'-0"	0'-5¾"	2'-2½"	4'-1½"					17'-0"
F		5'					25'-1"	0'-5¾"	2'-2½"	4'-2"					17'-0"
F		6'					25'-6"	0'-5¾"	2'-3½"	4'-3"					17'-3"
F		7'					25'-11"	0'-5¾"	2'-4½"	4'-4"					17'-6"
F	4 @ 6'	4'	#6	11"			29'-3"	0'-7¼"	2'-5½"	4'-10½"	#7	11"			20'-0"
F		5'					29'-5"	0'-7¼"	2'-5½"	4'-11½"					20'-0"
F		6'					29'-10"	0'-7¼"	2'-6½"	5'-0½"					20'-3"
F		7'					30'-3"	0'-7¼"	2'-7½"	5'-1½"					20'-6"
F		8'					30'-5"	0'-7¼"	2'-7½"	5'-2¼"					20'-6"

Section	S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
A	4 @ 4'	3'	#4	12"	30	33'-3" for 32'-0" Section	#4	12"	24	33'-3" for 32'-0" Section	#4	12"	30	34'-3" for 32'-0" Section	#4	12"	176	256	3'-9"
A		4'			30				32				30				176	256	4'-9"
A		5'			30				40				30				176	256	5'-9"
A		6'			30				48				30				176	256	6'-9"
A	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	176	256	3'-10"
A		4'			34				32				34				176	256	4'-10"
A		5'			34				40				34				176	256	5'-10"
A		6'			34				48				34				176	256	6'-10"
A		7'			34				56				34		#5	12"	176	256	7'-10"
A	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"	176	256	4'-11"
A		5'			38				40				38				176	256	5'-11"
A		6'			38				48				38				176	256	6'-11"
A		7'			38				56				38		#5	12"	176	256	7'-11"
A		8'			38				64				38			11"	192	280	8'-11"
B	4 @ 4'	3'	#4	12"	30		#4	12"	24		#4	12"	30		#4	12"	88	128	3'-9"
B		4'			30				32				30				88	128	4'-9"
B		5'			30				40				30				88	128	5'-9"
B		6'			30				48				30		#5	12"	88	128	6'-9"
B	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	88	128	3'-11"
B		4'			34				32				34				88	128	4'-11"
B		5'			34				40				34				88	128	5'-11"
B		6'			34				48				34			10"	112	160	6'-11"
B		7'			34				56				34		#5	11"	96	144	7'-11"
B	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"	88	128	5'-1"
B		5'			38				40				38				88	128	6'-1"
B		6'			38				48				38			10"	112	160	7'-1"
B		7'			38				56				38		#5	11"	96	144	8'-1"
B		8'			38				64				38		#6	12"	88	128	9'-1"
C	4 @ 4'	3'	#4	12"	30	34'-3" for 33'-0" Length Section	#4	12"	24	34'-3" for 33'-0" Length Section	#4	12"	30	34'-3" for 33'-0" Length Section	#4	12"	88	128	3'-10"
C		4'			30				32				30				88	128	4'-10"
C		5'			30				40				30		#5	12"	88	128	5'-10"
C		6'			30				48				30			11"	96	144	6'-10"
C	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	88	128	4'-0"
C		4'			34				32				34				88	128	5'-0"
C		5'			34				40				34			10"	112	160	6'-0"
C		6'			34				48				34		#5	12"	88	128	7'-0"
C		7'			34				56				34		#6	12"	88	128	8'-0"
C	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"	88	128	5'-2"
C		5'			38				40				38			10"	112	160	6'-2"
C		6'			38				48				38		#5	12"	88	128	7'-2"
C		7'			38				56				38		#6	12"	88	128	8'-2"
C		8'			38				64				38			10"	112	162	9'-2"
D	4 @ 4'	3'	#4	12"	30		#4	12"	24		#4	12"	30		#4	12"	88	128	3'-11"
D		4'			30				32				30				88	128	4'-11"
D		5'			30				40				30		#5	11"	96	144	5'-11"
D		6'			30				48				30		#6	12"	88	128	6'-11"
D	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	88	128	4'-1"
D		4'			34				32				34				88	128	5'-1"
D		5'			34				40				34		#5	12"	88	128	6'-1"
D		6'			34				48				34		#6	12"	88	128	7'-1"
D		7'			34				56				34			11"	96	136	8'-1"
D	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"	88	128	5'-3"
D		5'			38				40				38			10"	104	152	6'-3"
D		6'			38				48				38		#5	11"	96	136	7'-3"
D		7'			38				56				38		#6	12"	88	128	8'-3"
D		8'			38				64				38			9"	112	176	9'-3"
E	4 @ 4'	3'	#4	12"	30		#4	12"	24		#4	12"	30		#4	12"	88	128	4'-0"
E		4'			30				32				30				88	128	5'-0"
E		5'			30				40				30		#5	11"	96	136	6'-0"
E		6'			30				48				30		#6	12"	88	128	7'-0"
E	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"	88	128	4'-2"
E		4'			34				32				34				88	128	5'-2"
E		5'			34				40				34		#5	12"	88	128	6'-2"
E		6'			34				48				34		#6	12"	88	128	7'-2"
E		7'			34				56				34			10"	112	160	8'-2"
E	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"	88	128	5'-5"
E		5'			38				40				38			10"	104	152	6'-5"
E		6'			38				48				38		#5	11"	96	144	7'-5"
E		7'			38				56				38		#6	12"	88	128	8'-5"
E		8'			38				64				38			9"	120	168	9'-5"
F	4 @ 4'	3'	#4	12"	30	Varies with Length of Barrel	#4	12"	24	Varies with Length of Barrel	#4	12"	30	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	Varies with Length of Barrel	4'-0"
F		4'			30				32				30						5'-0"
F		5'			30				40				30		#5	11"			6'-0"
F		6'			30				48				30		#6	12"			7'-0"
F	4 @ 5'	3'	#4	12"	34		#4	12"	24		#4	12"	34		#4	12"			4'-3"
F		4'			34				32				34						5'-3"
F		5'			34				40				34		#5	12"			6'-3"
F		6'			34				48				34		#6	12"			7'-3"
F		7'			34				56				34			10"			8'-3"
F	4 @ 6'	4'	#4	12"	38		#4	12"	32		#4	12"	38		#4	12"			5'-6"
F		5'			38				40				38			10"			6'-6"
F		6'			38				48				38		#5	11"			7'-6"
F		7'			38				56				38		#6	12"			8'-6"
F		8'			38				64				38			9"			9'-6"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

DIMENSIONS / QUANTITIES

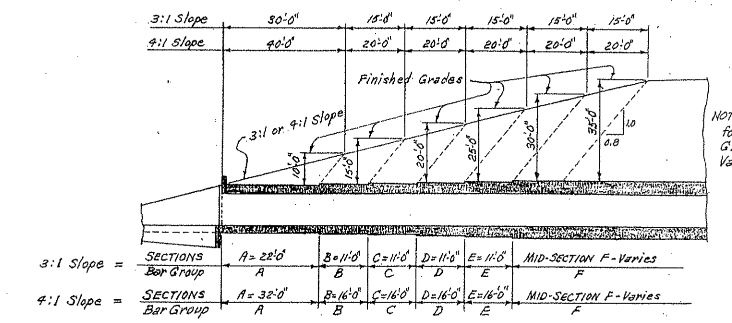
Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel CU. YD.	Reinforcing Steel per Lin. Ft. of Barrel LB.	Additional per Lap LB.	Additional Two Headwalls & Aprons LB.
Section "A" = 10'-0"	4 @ 4'	3'	48	19'-0"	6"	6"	8"	6"	4'-0"	1.037	146.74	70.14	199.51
		4'	64	19'-0"		6"	8"		5'-0"	1.148	157.43	76.82	199.51
		5'	80	19'-0"		6"	8"		6'-0"	1.259	168.11	83.50	199.51
		6	96	19'-5"		7"	9"		7'-0"	1.478	180.25	90.18	201.74
	4 @ 5'	3'	60	23'-0"	6½"	6"	8"	6½"	4'-1"	1.256	189.01	76.82	241.26
		4'	80	23'-0"		6"	8"		5'-1"	1.367	199.69	83.50	241.26
		5'	100	23'-0"		6"	8"		6'-1"	1.478	210.38	90.18	241.26
		6'	120	23'-5"		7"	9"		7'-1"	1.699	222.85	96.86	243.49
		7'	140	23'-9"		7½"	10"		8'-1"	1.925	258.58	103.54	245.27
	4 @ 6'	4'	96	27'-0"	7"	6"	8"	7¼"	5'-2¼"	1.632	259.86	90.18	364.15
		5'	120	27'-0"		6"	8"		6'-2¼"	1.743	270.55	96.86	364.15
		6'	144	27'-5"		7"	9"		7'-2¼"	1.965	283.54	103.54	367.63
		7'	168	27'-9"		7½"	10"		8'-2¼"	2.193	319.95	110.22	370.41
		8'	192	27'-10"		8"	10"		9'-2¼"	2.360	340.72	116.90	371.10
Section "B" = 15'-0"	4 @ 4'	3'	48	19'-0"	6"	6"	8"	6¼"	4'-0¼"	1.052	157.29	70.14	
		4'	64	19'-0"		6"	8"		5'-0¼"	1.163	167.98	76.82	
		5'	80	19'-0"		6"	8"		6'-0¼"	1.274	178.67	83.50	
		6'	96	19'-5"		7"	9"		7'-0¼"	1.493	211.24	90.18	
	4 @ 5'	3'	60	23'-0"	6¾"	6"	8"	7¼"	4'-2"	1.327	204.36	76.82	
		4'	80	23'-0"		6"	8"		5'-2"	1.438	215.05	83.50	
		5'	100	23'-0"		6"	8"		6'-2"	1.549	225.73	90.18	
		6'	120	23'-5"		7"	9"		7'-2"	1.771	245.82	96.86	
		7'	140	23'-9"		7½"	10"		8'-2"	1.998	280.62	103.54	
	4 @ 6'	4'	96	27'-0"	7¾"	6"	8"	8¼"	5'-4"	1.778	274.55	90.18	
		5'	120	27'-0"		6"	8"		6'-4"	1.889	285.24	96.86	
		6'	144	27'-5"		7"	9"		7'-4"	2.113	305.99	103.54	
		7'	168	27'-9"		7½"	10"		8'-4"	2.343	341.63	110.22	
		8'	192	27'-10"		8"	10"		9'-4"	2.510	382.89	116.90	
Section "C" = 20'-0"	4 @ 4'	3'	48	19'-0"	6¼"	6"	8"	6¾"	4'-1"	1.096	165.51	70.14	
		4'	64	19'-0"		6"	8"		5'-1"	1.207	176.20	76.82	
		5'	80	19'-0"		6"	8"		6'-1"	1.318	204.39	83.50	
		6'	96	19'-5"		7"	9"		7'-1"	1.538	225.06	90.18	
	4 @ 5'	3'	60	23'-0"	7¼"	6"	8"	7¾"	4'-3"	1.398	215.14	76.82	
		4'	80	23'-0"		6"	8"		5'-3"	1.509	225.83	83.50	
		5'	100	23'-0"		6"	8"		6'-3"	1.620	242.93	90.18	
		6'	120	23'-5"		7"	9"		7'-3"	1.848	270.38	96.86	
		7'	140	23'-9"		7½"	10"		8'-3"	2.072	315.34	103.54	
	4 @ 6'	4'	96	27'-0"	8¼"	6"	8"	8¾"	5'-5"	1.861	296.94	90.18	
		5'	120	27'-0"		6"	8"		6'-5"	1.972	314.22	96.86	
		6'	144	27'-5"		7"	9"		7'-5"	2.198	342.58	103.54	
		7'	168	27'-9"		7½"	10"		8'-5"	2.428	388.67	110.22	
		8'	192	27'-10"		8"	10"		9'-5"	2.596	428.40	116.90	
Section "D" = 25'-0"	4 @ 4'	3'	48	19'-0"	6¾"	6"	8"	7¼"	4'-2"	1.154	173.63	70.14	
		4'	64	19'-0"		6"	8"		5'-2"	1.265	184.31	76.82	
		5'	80	19'-0"		6"	8"		6'-2"	1.377	217.24	83.50	
		6'	96	19'-5"		7"	9"		7'-2"	1.598	253.79	90.18	
	4 @ 5'	3'	60	23'-0"	7¾"	6"	8"	8¼"	4'-4"	1.469	227.80	76.82	
		4'	80	23'-0"		6"	8"		5'-4"	1.580	238.49	83.50	
		5'	100	23'-0½"		6¼"	8"		6'-4"	1.701	267.62	90.18	
		6'	120	23'-5"		7"	9"		7'-4"	1.916	309.50	96.86	
		7'	140	23'-10"		8"	10"		8'-4"	2.171	338.07	103.54	
	4 @ 6'	4'	96	27'-0"	9"	6"	8"	9½"	5'-6½"	1.986	307.25	90.18	
		5'	120	27'-1"		6½"	8"		6'-6½"	2.117	325.01	96.86	
		6'	144	27'-5½"		7¼"	9"		7'-6½"	2.336	359.00	103.54	
		7'	168	27'-10"		8"	10"		8'-6½"	2.583	400.16	110.22	
		8'	192	27'-11½"		8¾"	10"		9'-6½"	2.769	455.19	116.90	
Section "E" = 30'-0"	4 @ 4'	3'	48	19'-0"	7¼"	6"	8"	7¾"	4'-3"	1.213	183.04	70.14	
		4'	64	19'-0"		6"	8"		5'-3"	1.324	193.73	76.82	
		5'	80	19'-1"		6½"	8"		6'-3"	1.454	227.28	83.50	
		6'	96	19'-6"		7½"	9"		7'-3"	1.681	264.24	90.18	
	4 @ 5'	3'	60	23'-0"	8¼"	6"	8"	8¾"	4'-5"	1.540	243.02	76.82	
		4'	80	23'-0"		6"	8"		5'-5"	1.651	253.70	83.50	
		5'	100	23'-1½"		6¾"	8"		6'-5"	1.792	283.34	90.18	
		6'	120	23'-6"		7½"	9"		7'-5"	2.011	325.85	96.86	
		7'	140	23'-11"		8½"	10"		8'-5"	2.270	365.45	103.54	
	4 @ 6'	4'	96	27'-0"	9¾"	6"	8"	10¼"	5'-8"	2.111	325.89	90.18	
		5'	120	27'-2"		7"	8"		6'-8"	2.263	344.29	96.86	
		6'	144	27'-7"		8"	9"		7'-8"	2.499	376.19	103.54	
		7'	168	27'-11½"		8¾"	10"		8'-8"	2.752	420.95	110.22	
		8'	192	28'-1"		9½"	10"		9'-8"	2.943	476.75	116.90	
Section "F" = 35'-0"	4 @ 4'	3'	48	19'-0"	7½"	6"	8"	8"	4'-3½"	1.242	201.33	70.14	
		4'	64	19'-0"		6"	8"		5'-3½"	1.353	212.02	76.82	
		5'	80	19'-2"		7"	8"		6'-3½"	1.503	245.96	83.50	
		6'	96	19'-7"		8"	9"		7'-3½"	1.733	283.29	90.18	
	4 @ 5'	3'	60	23'-0"	8¾"	6"	8"	9¼"	4'-6"	1.611	261.10	76.82	
		4'	80	23'-1"		6½"	8"		5'-6"	1.739	272.18	83.50	
		5'	100	23'-2"		7"	8"		6'-6"	1.873	302.01	90.18	
		6'	120	23'-7"		8"	9"		7'-6"	2.106	345.22	96.86	
		7'	140	24'-0"		9"	10"		8'-6"	2.370	385.31	103.54	
	4 @ 6'	4'	96	27'-1"	10¼"	6½"	8"	10¾"	5'-9"	2.212	347.51	90.18	
		5'	120	27'-3"		7½"	8"		6'-9"	2.368	366.07	96.86	
		6'	144	27'-8"		8½"	9"		7'-9"	2.608	401.43	103.54	
		7'	168	28'-1"		9½"	10"		8'-9"	2.879	449.07	110.22	
		8'	192	28'-2½"		10¼"	10"		9'-9"	3.075	500.22	116.90	

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	A	B	C	D	E		Mid-Section and Bar Group
5.0' to 9.5'	✓						A
10.0' to 14.5'	✓						B
15.0' to 19.5'	✓	✓					C
20.0' to 24.5'	✓	✓	✓				D
25.0' to 29.5'	✓	✓	✓	✓			E
30.0' to 35.0'	✓	✓	✓	✓	✓		F

(Columns A–E: Sections & Bar Groups for End Sections)

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

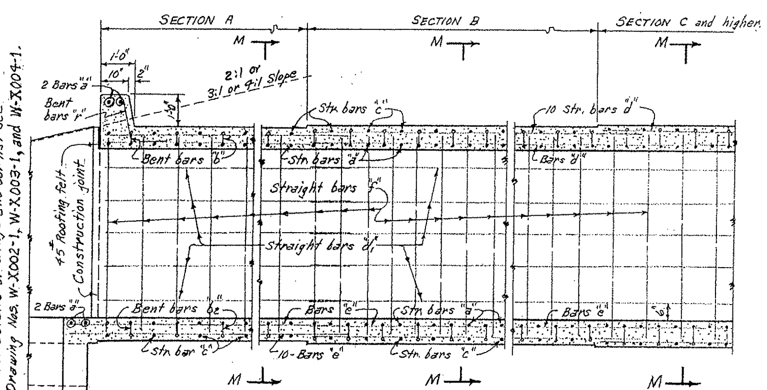


NOTE:- See Table above for SECTIONS and Bar Groups to be used for Various Depths of Cover.

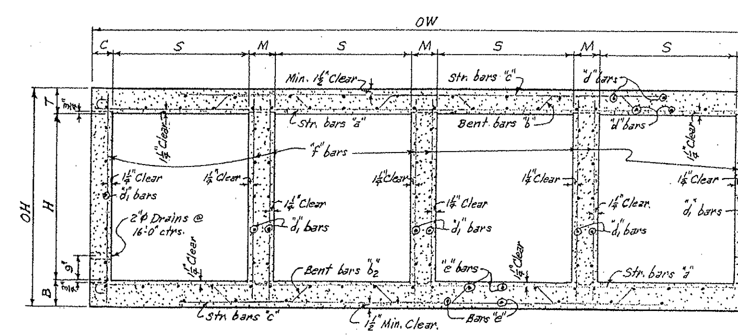
TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

NOTE:- For details of wings and bar list see Drawing Nos. W-X002-1, W-X003-1, and W-X004-1.



PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

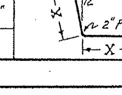
Class S Concrete (n = 10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X002-1, W-X003-1 and W-X004-1.

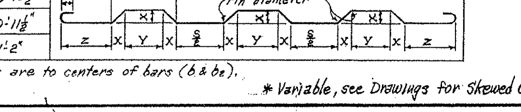
CLASS S CONCRETE

DOWEL BARS FOR TWO HEADWALLS

Span	Size	Spacing	No. Req'd	Length	X	Bars "r" Dowel bars in Headwalls
4'	#4	12½"	38	2'-4"	1'-2"	
5'	#4	12½"	46	2'-5"	1'-2½"	
6'	#4	12½"	54	2'-6"	1'-3"	

Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4½"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" and "b2"



NOTE:- Dimensions are to centers of bars (b & b2).

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C, D or E	4:1 Slopes Sections A	4:1 Slopes Sections B, C, D or E
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

* Variable, see Drawings for Skewed Culverts.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

Designed by:- W.C.H. 10-2-62 Checked by:- RHS 11-16-62
Drawn by:- W.C.H. 10-22-62 Checked by:- RHS 11-21-62
Quantities by:- W.C.H. 11-14-62 Checked by:- RHS 11-28-62

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS QUADRUPLES

3:1 OR 4:1 SLOPES OVER 5'-0" COVER

STANDARD DRAWING NO. R-400X-X1

BAR LIST FOR VARIOUS SECTIONS OF BARREL

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	Size	Spacing	Number Req'd 3:1	Number Req'd 4:1	Length
Section "A" & Bar Group "A"	3:1 = 22'-0" / 4:1 = 32'-0"	0' to 10'-0"	4 @ 7'	5'	#5	11"	46	64	30'-9"
				6'			46	64	31'-2"
				7'			46	64	31'-6"
				8'			46	64	31'-7"
				9'			46	64	32'-0"
			4 @ 8'	5'	#5	13"	46	64	35'-2"
				6'			46	64	35'-2"
				7'			46	64	35'-6"
				8'			46	64	35'-7"
				9'			46	64	36'-0"
				10'			46	64	36'-5"
			4 @ 9'	6'	#5	12"	48	68	39'-6"
				7'			48	68	39'-6"
				8'			48	68	39'-7"
				9'			48	68	40'-0"
				10'			48	68	40'-5"
				11'			48	68	40'-7"
Section "B" & Bar Group "B"	3:1 = 11'-0" / 4:1 = 16'-0"	10'-0" to 15'-0"	4 @ 7'	5'	#5	13"	20	30	30'-9"
				6'			20	30	31'-2"
				7'			20	30	31'-6"
				8'			20	30	31'-7"
				9'			20	30	32'-0"
			4 @ 8'	5'	#5	12"	22	32	35'-2"
				6'			22	32	35'-2"
				7'			22	32	35'-6"
				8'			22	32	35'-7"
				9'			22	32	36'-0"
				10'			22	32	36'-5"
			4 @ 9'	6'	#5	10"	28	40	39'-6"
				7'			28	40	39'-6"
				8'			28	40	39'-7"
				9'			28	40	40'-0"
				10'			28	40	40'-5"
				11'			28	40	40'-7"
Section "C" & Bar Group "C"	3:1 = 11'-0" / 4:1 = 16'-0"	15'-0" to 20'-0"	4 @ 7'	5'	#5	12"	22	32	30'-10"
				6'			22	32	31'-2"
				7'			22	32	31'-6"
				8'			22	32	31'-7"
				9'			22	32	32'-0"
			4 @ 8'	5'	#5	11"	24	34	35'-2"
				6'			24	34	35'-2"
				7'			24	34	35'-6"
				8'			24	34	35'-7"
				9'			24	34	36'-0"
				10'			24	34	36'-5"
			4 @ 9'	6'	#6	13"	20	30	39'-6"
				7'			20	30	39'-7"
				8'			20	30	39'-8"
				9'			20	30	40'-0"
				10'			20	30	40'-5"
				11'			20	30	40'-7"
Section "D" & Bar Group "D"	3:1 = 11'-0" / 4:1 = 16'-0"	20'-0" to 25'-0"	4 @ 7'	5'	#5	11"	24	34	30'-10"
				6'			24	34	31'-3"
				7'			24	34	31'-7"
				8'			24	34	31'-9"
				9'			24	34	32'-1"
	Varies with Length of Barrel		4 @ 8'	5'	#5	10"	Varies with length of Barrel.	Varies with length of Barrel.	35'-2"
				6'					35'-3"
				7'					35'-8"
				8'					35'-9"
				9'					36'-2"
				10'					36'-7"
			4 @ 9'	6'	#6	11"			39'-7"
				7'					39'-8"
				8'					39'-9"
				9'					40'-2"
				10'					40'-7"
				11'					40'-9"
Section "E" Bar Grp "E"		25'-0" to 30'-0"	4 @ 7'	5'	#5	10"			30'-11"
				6'					31'-4"
				7'					31'-9"
				8'					31'-10"
				9'					32'-3"

"b" bars – BENT – See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

Section	S	H	Size	Spacing	Number Req'd 3:1	Number Req'd 4:1	Length	X	Y	Z
A	4 @ 7'	5'	#5	11"	20	29	32'-5"	0'-4¼"	3'-5½"	5'-7"
		6'			20	29	32'-10"	0'-4¼"	3'-6½"	5'-8"
		7'			20	29	33'-2"	0'-4¼"	3'-7½"	5'-8½"
		8'			20	29	33'-3"	0'-4¼"	3'-7½"	5'-9"
		9'			20	29	33'-8"	0'-4¼"	3'-8½"	5'-10"
	4 @ 8'	5'	#6	13"	20	29	37'-2"	0'-5"	3'-11"	6'-5"
		6'			20	29	37'-2"	0'-5"	3'-11"	6'-5"
		7'			20	29	37'-6"	0'-5"	4'-0"	6'-5½"
		8'			20	29	37'-7"	0'-5"	4'-0"	6'-6"
		9'			20	29	38'-0"	0'-5"	4'-1"	6'-7"
		10'			20	29	38'-5"	0'-5"	4'-2"	6'-8"
	4 @ 9'	6'	(*) #6	12"	44	64	22'-0"	0'-6"	4'-4"	7'-2½"
		7'			44	64	22'-0"	0'-6"	4'-4"	7'-2½"
		8'			44	64	22'-1"	0'-6"	4'-4"	7'-3"
		9'			44	64	22'-3"	0'-6"	4'-5"	7'-4"
		10'			44	64	22'-6"	0'-6"	4'-6"	7'-5"
		11'			44	64	22'-7"	0'-6"	4'-6"	7'-6"
B	4 @ 7'	5'	#6	13"	10	15	32'-9"	0'-5"	3'-4"	5'-7"
		6'			10	15	33'-2"	0'-5"	3'-5"	5'-8"
		7'			10	15	33'-6"	0'-5"	3'-6"	5'-8½"
		8'			10	15	33'-7"	0'-5"	3'-6"	5'-9"
		9'			10	15	34'-0"	0'-5"	3'-7"	5'-10"
	4 @ 8'	5'	#6	12"	11	16	37'-4"	0'-6"	3'-9"	6'-5"
		6'			11	16	37'-4"	0'-6"	3'-9"	6'-5"
		7'			11	16	37'-8"	0'-6"	3'-10"	6'-5½"
		8'			11	16	37'-9"	0'-6"	3'-10"	6'-6"
		9'			11	16	38'-2"	0'-6"	3'-11"	6'-7"
		10'			11	16	38'-7"	0'-6"	4'-0"	6'-8"
	4 @ 9'	6'	(*) #6	10"	26	38	22'-1"	0'-7"	4'-2"	7'-2½"
		7'			26	38	22'-1"	0'-7"	4'-2"	7'-2½"
		8'			26	38	22'-2"	0'-7"	4'-2"	7'-3"
		9'			26	38	22'-4"	0'-7"	4'-3"	7'-4"
		10'			26	38	22'-7"	0'-7"	4'-4"	7'-5"
		11'			26	38	22'-8"	0'-7"	4'-4"	7'-6"
C	4 @ 7'	5'	#6	12"	11	16	33'-0"	0'-5¾"	3'-2½"	5'-7½"
		6'			11	16	33'-4"	0'-5¾"	3'-3½"	5'-8"
		7'			11	16	33'-8"	0'-5¾"	3'-4½"	5'-8½"
		8'			11	16	33'-9"	0'-5¾"	3'-4½"	5'-9½"
		9'			11	16	34'-2"	0'-5¾"	3'-5½"	5'-10"
	4 @ 8'	5'	#6	11"	12	18	37'-7"	0'-7¼"	3'-6½"	6'-5"
		6'			12	18	37'-8"	0'-7¼"	3'-6½"	6'-5¼"
		7'			12	18	38'-0"	0'-7¼"	3'-7½"	6'-5¾"
		8'			12	18	38'-1"	0'-7¼"	3'-7½"	6'-6¼"
		9'			12	18	38'-6"	0'-7¼"	3'-8½"	6'-7¼"
		10'			12	18	38'-11"	0'-7¼"	3'-9½"	6'-8¼"
	4 @ 9'	6'	(*) #7	13"	20	30	22'-3"	0'-8"	4'-0"	7'-2½"
		7'			20	30	22'-4"	0'-8"	4'-0"	7'-3"
		8'			20	30	22'-4"	0'-8"	4'-0"	7'-3½"
		9'			20	30	22'-7"	0'-8"	4'-1"	7'-4½"
		10'			20	30	22'-9"	0'-8"	4'-2"	7'-5½"
		11'			20	30	22'-10"	0'-8"	4'-2"	7'-6"
D	4 @ 7'	5'	#6	11"	12	18	33'-3"	0'-6¾"	3'-0½"	5'-7¾"
		6'			12	18	33'-7"	0'-6¾"	3'-1½"	5'-8½"
		7'			12	18	34'-0"	0'-6¾"	3'-2½"	5'-9¼"
		8'			12	18	34'-1"	0'-6¾"	3'-2½"	5'-10"
		9'			12	18	34'-6"	0'-6¾"	3'-3½"	5'-10¾"
	4 @ 8'	5'	#6	10"	Varies with length of Barrel.	Varies with length of Barrel.	37'-10"	0'-8¼"	3'-4½"	6'-5"
		6'					37'-11"	0'-8¼"	3'-4½"	6'-5¾"
		7'					38'-4"	0'-8¼"	3'-5½"	6'-6¼"
		8'					38'-5"	0'-8¼"	3'-5½"	6'-7¼"
		9'					38'-10"	0'-8¼"	3'-6½"	6'-8"
		10'					39'-3"	0'-8¼"	3'-7½"	6'-9"
	4 @ 9'	6'	(*) #7	11"			22'-5"	0'-9"	3'-10"	7'-3"
		7'					22'-6"	0'-9"	3'-10"	7'-3½"
		8'					22'-6"	0'-9"	3'-10"	7'-4¼"
		9'					22'-9"	0'-9"	3'-11"	7'-5"
		10'					22'-11"	0'-9"	4'-0"	7'-6"
		11'					23'-0"	0'-9"	4'-0"	7'-7"
E	4 @ 7'	5'	#6	10"			33'-5"	0'-7½"	2'-11"	5'-8"
		6'					33'-10"	0'-7½"	3'-0"	5'-9"
		7'					34'-3"	0'-7½"	3'-1"	5'-10"
		8'					34'-4"	0'-7½"	3'-1"	5'-10¾"
		9'					34'-9"	0'-7½"	3'-2"	5'-11½"

"b2" bars – BENT – See Diagram below. In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.

Section	S	H	Size	Spacing	Number Req'd 3:1	Number Req'd 4:1	Length	X	Y	Z
A	4 @ 7'	5'	#5	11"	20	29	32'-6"	0'-4¾"	3'-4½"	5'-7"
		6'			20	29	32'-11"	0'-4¾"	3'-5½"	5'-8"
		7'			20	29	33'-3"	0'-4¾"	3'-6½"	5'-8½"
		8'			20	29	33'-4"	0'-4¾"	3'-6½"	5'-9"
		9'			20	29	33'-9"	0'-4¾"	3'-7½"	5'-10"
	4 @ 8'	5'	#6	13"	20	29	37'-4"	0'-5¾"	3'-9½"	6'-5"
		6'			20	29	37'-4"	0'-5¾"	3'-9½"	6'-5"
		7'			20	29	37'-8"	0'-5¾"	3'-10½"	6'-5½"
		8'			20	29	37'-9"	0'-5¾"	3'-10½"	6'-6"
		9'			20	29	38'-2"	0'-5¾"	3'-11½"	6'-7"
		10'			20	29	38'-7"	0'-5¾"	4'-0½"	6'-8"
	4 @ 9'	6'	(*) #6	12"	44	64	22'-1"	0'-6½"	4'-3"	7'-2½"
		7'			44	64	22'-1"	0'-6½"	4'-3"	7'-2½"
		8'			44	64	22'-1"	0'-6½"	4'-3"	7'-3"
		9'			44	64	22'-4"	0'-6½"	4'-4"	7'-4"
		10'			44	64	22'-6"	0'-6½"	4'-5"	7'-5"
		11'			44	64	22'-7"	0'-6½"	4'-5"	7'-6"
B	4 @ 7'	5'	#6	13"	10	15	32'-10"	0'-5½"	3'-3"	5'-7"
		6'			10	15	33'-3"	0'-5½"	3'-4"	5'-8"
		7'			10	15	33'-7"	0'-5½"	3'-5"	5'-8½"
		8'			10	15	33'-8"	0'-5½"	3'-5"	5'-9"
		9'			10	15	34'-1"	0'-5½"	3'-6"	5'-10"
	4 @ 8'	5'	#6	12"	11	16	37'-6"	0'-6¾"	3'-7½"	6'-5"
		6'			11	16	37'-6"	0'-6¾"	3'-7½"	6'-5"
		7'			11	16	37'-10"	0'-6¾"	3'-8½"	6'-5½"
		8'			11	16	37'-11"	0'-6¾"	3'-8½"	6'-6"
		9'			11	16	38'-4"	0'-6¾"	3'-9½"	6'-7"
		10'			11	16	38'-9"	0'-6¾"	3'-10½"	6'-8"
	4 @ 9'	6'	(*) #6	10"	26	38	22'-2"	0'-7½"	4'-1"	7'-2½"
		7'			26	38	22'-2"	0'-7½"	4'-1"	7'-2½"
		8'			26	38	22'-3"	0'-7½"	4'-1"	7'-3"
		9'			26	38	22'-5"	0'-7½"	4'-2"	7'-4"
		10'			26	38	22'-8"	0'-7½"	4'-3"	7'-5"
		11'			26	38	22'-9"	0'-7½"	4'-3"	7'-6"
C	4 @ 7'	5'	#6	12"	11	16	33'-1"	0'-6¼"	3'-1½"	5'-7½"
		6'			11	16	33'-5"	0'-6¼"	3'-2½"	5'-8"
		7'			11	16	33'-9"	0'-6¼"	3'-3½"	5'-8½"
		8'			11	16	33'-10"	0'-6¼"	3'-3½"	5'-9½"
		9'			11	16	34'-3"	0'-6¼"	3'-4½"	5'-10"
	4 @ 8'	5'	#6	11"	12	18	37'-9"	0'-7¾"	3'-5½"	6'-5"
		6'			12	18	37'-9"	0'-7¾"	3'-5½"	6'-5¼"
		7'			12	18	38'-1"	0'-7¾"	3'-6½"	6'-5¾"
		8'			12	18	38'-2"	0'-7¾"	3'-6½"	6'-6¼"
		9'			12	18	38'-7"	0'-7¾"	3'-7½"	6'-7¼"
		10'			12	18	39'-0"	0'-7¾"	3'-8½"	6'-8¼"
	4 @ 9'	6'	(*) #7	13"	20	30	22'-4"	0'-8½"	3'-11"	7'-2½"
		7'			20	30	22'-5"	0'-8½"	3'-11"	7'-3"
		8'			20	30	22'-5"	0'-8½"	3'-11"	7'-3½"
		9'			20	30	22'-7"	0'-8½"	4'-0"	7'-4½"
		10'			20	30	22'-10"	0'-8½"	4'-1"	7'-5½"
		11'			30	30	22'-11"	0'-8½"	4'-1"	7'-6"
D	4 @ 7'	5'	#6	11"	12	18	33'-4"	0'-7¼"	2'-11½"	5'-7¾"
		6'			12	18	33'-8"	0'-7¼"	3'-0½"	5'-8½"
		7'			12	18	34'-1"	0'-7¼"	3'-1½"	5'-9¼"
		8'			12	18	34'-2"	0'-7¼"	3'-1½"	5'-10"
		9'			12	18	34'-7"	0'-7¼"	3'-2½"	5'-10¾"
	4 @ 8'	5'	#6	10"	Varies with length of Barrel.	Varies with length of Barrel.	37'-11"	0'-8¾"	3'-3½"	6'-5"
		6'					38'-1"	0'-8¾"	3'-3½"	6'-5¾"
		7'					38'-5"	0'-8¾"	3'-4½"	6'-6¼"
		8'					38'-7"	0'-8¾"	3'-4½"	6'-7¼"
		9'					38'-11"	0'-8¾"	3'-5½"	6'-8"
		10'					39'-4"	0'-8¾"	3'-6½"	6'-9"
	4 @ 9'	6'	(*) #7	11"			22'-6"	0'-9½"	3'-9"	7'-3"
		7'					22'-6"	0'-9½"	3'-9"	7'-3½"
		8'					22'-7"	0'-9½"	3'-9"	7'-4¼"
		9'					22'-9"	0'-9½"	3'-10"	7'-5"
		10'					23'-0"	0'-9½"	3'-11"	7'-6"
		11'					23'-1"	0'-9½"	3'-11"	7'-7"
E	4 @ 7'	5'	#6	10"			33'-6"	0'-8"	2'-10"	5'-8"
		6'					33'-11"	0'-8"	2'-11"	5'-9"
		7'					34'-4"	0'-8"	3'-0"	5'-10"
		8'					34'-5"	0'-8"	3'-0"	5'-10¾"
		9'					34'-10"	0'-8"	3'-1"	5'-11½"

"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.

Section	S	H	c Size	c Spacing	c No. 3:1	c No. 4:1	c Length	d Size	d Spacing	d No. Req'd	d Length
A	4 @ 7'	5'	#6	11"	42	60	23'-0"	#4	12"	45	33'-3" for 32'-0" Section.
		6'			42	60	23'-3"			45	
		7'			42	60	23'-6"			45	
		8'			42	60	23'-6"			45	
		9'			42	60	23'-9"			45	
	4 @ 8'	5'	#7	13"	42	60	26'-3"	#4	12"	49	
		6'			42	60	26'-3"			49	
		7'			42	60	26'-6"			49	
		8'			42	60	26'-6"			49	
		9'			42	60	26'-9"			49	
		10'			42	60	27'-0"			49	
	4 @ 9'	6'	#7	12"	44	64	29'-6"	#4	12"	53	
		7'			44	64	29'-6"			53	
		8'			44	64	29'-6"			53	
		9'			44	64	29'-9"			53	
		10'			44	64	30'-0"			53	
		11'			44	64	30'-0"			53	
B	4 @ 7'	5'	#7	13"	20	30	23'-0"	#4	12"	45	34'-3" for 33'-0" Length Section
		6'			20	30	23'-3"			45	
		7'			20	30	23'-6"			45	
		8'			20	30	23'-6"			45	
		9'			20	30	23'-9"			45	
	4 @ 8'	5'	#7	12"	22	32	26'-3"	#4	12"	49	
		6'			22	32	26'-3"			49	
		7'			22	32	26'-6"			49	
		8'			22	32	26'-6"			49	
		9'			22	32	26'-9"			49	
		10'			22	32	27'-0"			49	
	4 @ 9'	6'	#7	10"	28	40	29'-6"	#4	12"	53	
		7'			28	40	29'-6"			53	
		8'			28	40	29'-6"			53	
		9'			28	40	29'-9"			53	
		10'			28	40	30'-0"			53	
		11'			28	40	30'-0"			53	
C	4 @ 7'	5'	#7	12"	22	32	23'-0"	#4	12"	45	
		6'			22	32	23'-3"			45	
		7'			22	32	23'-6"			45	
		8'			22	32	23'-6"			45	
		9'			22	32	23'-9"			45	
	4 @ 8'	5'	#7	11"	24	34	26'-3"	#4	12"	49	
		6'			24	34	26'-3"			49	
		7'			24	34	26'-6"			49	
		8'			24	34	26'-6"			49	
		9'			24	34	26'-9"			49	
		10'			24	34	27'-0"			49	
	4 @ 9'	6'	#8	13"	20	30	29'-6"	#4	12"	53	
		7'			20	30	29'-6"			53	
		8'			20	30	29'-6"			53	
		9'			20	30	29'-9"			53	
		10'			20	30	30'-0"			53	
		11'			20	30	30'-0"			53	
D	4 @ 7'	5'	#7	11"	24	34	23'-0"	#4	12"	45	
		6'			24	34	23'-3"			45	
		7'			24	34	23'-6"			45	
		8'			24	34	23'-6"			45	
		9'			24	34	23'-9"			45	
	4 @ 8'	5'	#7	10"	Varies with length of Barrel.	Varies with length of Barrel.	26'-3"	#4	12"	49	Varies with length of Barrel.
		6'					26'-3"			49	
		7'					26'-6"			49	
		8'					26'-6"			49	
		9'					26'-9"			49	
		10'					27'-0"			49	
	4 @ 9'	6'	#8	11"			29'-6"	#4	12"	53	
		7'					29'-6"			53	
		8'					29'-6"			53	
		9'					29'-9"			53	
		10'					30'-0"			53	
		11'					30'-0"			53	
E	4 @ 7'	5'	#7	10"			23'-0"	#4	12"	45	
		6'					23'-3"			45	
		7'					23'-6"			45	
		8'					23'-6"			45	
		9'					23'-9"			45	

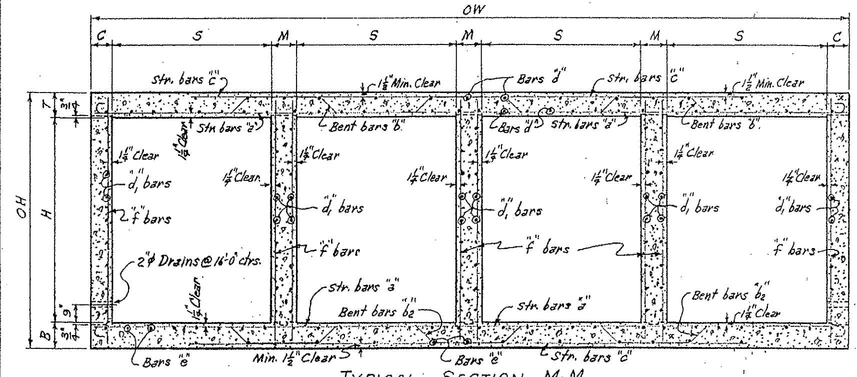
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls.
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
"f" bars – STRAIGHT – Vertical in Side walls and Division Wall.

Section	S	H	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length	f Size	f Spacing	f No. 3:1	f No. 4:1	f Length
A	4 @ 7'	5'	#4	12"	40	33'-3" for 32'-0" Section.	#4	12"	45	34'-3" for 32'-0" Section.	#4	12"	176	256	6'-1"
		6'			48				45				176	256	7'-1"
		7'			56				45		#5	12"	176	256	8'-1"
		8'			64				45			11"	192	280	9'-1"
		9'			72				45			10"	216	312	10'-1"
	4 @ 8'	5'	#4	12"	40		#4	12"	49		#4	12"	176	256	6'-3"
		6'			48				49				176	256	7'-3"
		7'			56				49			10"	216	312	8'-3"
		8'			64				49		#5	11"	192	280	9'-3"
		9'			72				49			10"	216	312	10'-3"
		10'			80				49		#6	12"	176	256	11'-3"
	4 @ 9'	6'	#4	12"	48		#4	12"	53		#4	12"	176	256	7'-4"
		7'			56				53			10"	216	312	8'-4"
		8'			64				53		#5	12"	176	256	9'-4"
		9'			72				53			10"	216	312	10'-4"
		10'			80				53		#6	12"	176	256	11'-4"
		11'			88				53			11"	192	280	12'-4"
B	4 @ 7'	5'	#4	12"	40	34'-3" for 33'-0" Length Section	#4	12"	45	34'-3" for 33'-0" Length Section.	#4	12"	88	128	6'-2"
		6'			48				45			11"	96	144	7'-2"
		7'			56				45		#5	12"	88	128	8'-2"
		8'			64				45		#6	12"	88	128	9'-2"
		9'			72				45			11"	96	136	10'-2"
	4 @ 8'	5'	#4	12"	40		#4	12"	49		#4	12"	88	128	6'-5"
		6'			48				49				88	128	7'-5"
		7'			56				49		#5	12"	88	128	8'-5"
		8'			64				49		#6	12"	88	128	9'-5"
		9'			72				49			11"	96	136	10'-5"
		10'			80				49			10"	112	160	11'-5"
	4 @ 9'	6'	#4	12"	48		#4	12"	53		#4	12"	88	128	7'-6"
		7'			56				53		#5	12"	88	128	8'-6"
		8'			64				53		#6	12"	88	128	9'-6"
		9'			72				53			11"	96	136	10'-6"
		10'			80				53			10"	112	160	11'-6"
		11'			88				53		#7	12"	88	128	12'-6"
C	4 @ 7'	5'	#4	12"	40		#4	12"	45		#4	12	88	128	6'-4"
		6'			48				45			10"	112	152	7'-4"
		7'			56				45		#5	10"	112	160	8'-4"
		8'			64				45		#6	10"	112	152	9'-4"
		9'			72				45		#7	12"	88	128	10'-4"
	4 @ 8'	5'	#4	12"	40		#4	12"	49		#4	12"	88	128	6'-7"
		6'			48				49				88	128	7'-7"
		7'			56				49		#5	11"	96	136	8'-7"
		8'			64				49		#6	11"	96	144	9'-7"
		9'			72				49			10"	104	152	10'-7"
		10'			80				49		#7	10"	104	152	11'-7"
	4 @ 9'	6'	#4	12"	48		#4	12"	53		#4	12"	88	128	7'-9"
		7'			56				53		#5	11"	96	136	8'-9"
		8'			64				53		#6	12"	88	128	9'-9"
		9'			72				53			10	104	152	10'-9"
		10'			80				53		#7	11"	96	136	11'-9"
		11'			88				53			10"	112	152	12'-9"
D	4 @ 7'	5'	#4	12"	40		#4	12"	45		#4	12"	88	128	6'-6"
		6'			48				45		#5	12"	88	128	7'-6"
		7'			56				45		#6	12"	88	128	8'-6"
		8'			64				45			10"	104	160	9'-6"
		9'			72				45		#7	12"	88	128	10'-6"
	4 @ 8'	5'	#4	12"	40	Varies with length of Barrel.	#4	12"	49	Varies with length of Barrel.	#4	12"	Varies with length of Barrel.	Varies with length of Barrel.	6'-9"
		6'			48				49			10"			7'-9"
		7'			56				49		#5	10"			8'-9"
		8'			64				49		#6	10"			9'-9"
		9'			72				49		#7	12"			10'-9"
		10'			80				49			10"			11'-9"
	4 @ 9'	6'	#4	12"	48		#4	12"	53		#4	11"			7'-11"
		7'			56				53		#5	11"			8'-11"
		8'			64				53		#6	11"			9'-11"
		9'			72				53		#7	12"			10'-11"
		10'			80				53			10"			11'-11"
		11'			88				53			9"			12'-11"
E	4 @ 7'	5'	#4	12"	40		#4	12"	45		#4	12"			6'-7"
		6'			48				45		#5	12"			7'-7"
		7'			56				45		#6	12"			8'-7"
		8'			64				45			10"			9'-7"
		9'			72				45		#7	11"			10'-7"

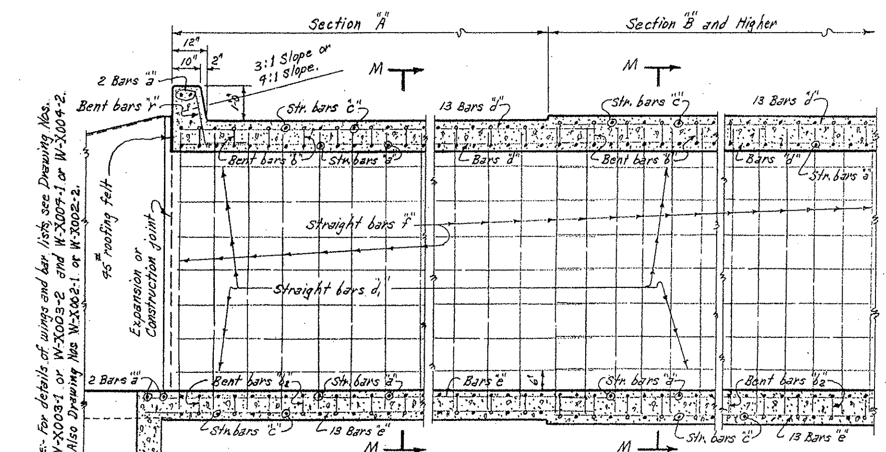
(*) These "b" and "b2" bars are to be spliced at center of middle division wall to make a full length bar. Lap bars 2'-4" min.

DIMENSIONS — QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel Cu. Yd.	Reinforcing Steel per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.	Additional Two Headwalls & Aprons Lb.
Section "A" – 10'-0"	4 @ 7'	5'	140	31'-0"	7¾"	6"	8"	8¼"	6'-4"	2.086	338.56	108.55	430.70
		6'	168	31'-5"		7"	9"		7'-4"	2.311	351.97	115.23	434.18
		7'	196	31'-9"		7½"	10"		8'-4"	2.540	389.24	121.91	436.96
		8'	224	31'-10"		8"	10"		9'-4"	2.708	410.20	128.59	437.66
		9'	252	32'-3"		9"	11"		10'-4"	3.009	436.54	135.27	441.13
	4 @ 8'	5'	160	35'-5"	8½"	7"	9"	9¼"	6'-5¾"	2.573	395.65	115.23	495.17
		6'	192	35'-5"		7"	9"		7'-5¾"	2.700	406.33	121.91	495.17
		7'	224	35'-9"		7½"	10"		8'-5¾"	2.931	428.35	128.59	497.95
		8'	256	35'-10"		8"	10"		9'-5¾"	3.099	465.38	135.27	498.64
		9'	288	36'-3"		9"	11"		10'-5¾"	3.403	492.05	141.95	502.12
		10'	320	36'-8"		10"	12"		11'-5¾"	3.737	532.85	148.63	505.60
	4 @ 9'	6'	216	39'-9"	9½"	7½"	10"	10"	7'-7½"	3.226	477.48	128.59	560.73
		7'	252	39'-9"		7½"	10"		8'-7½"	3.365	497.08	135.27	560.73
		8'	288	39'-10"		8"	10"		9'-7½"	3.533	527.28	141.95	561.42
		9'	324	40'-3"		9"	11"		10'-7½"	3.839	561.36	148.63	564.90
		10'	360	40'-8"		10"	12"		11'-7½"	4.176	602.56	155.31	568.38
		11'	396	40'-10"		11"	12"		12'-7½"	4.427	634.24	161.99	569.77
Section "B" – 15'-0"	4 @ 7'	5'	140	31'-0"	8½"	6"	8"	9"	6'-5½"	2.230	356.78	108.55	
		6'	168	31'-5"		7"	9"		7'-5½"	2.456	378.80	115.23	
		7'	196	31'-9"		7½"	10"		8'-5½"	2.687	408.01	121.91	
		8'	224	31'-10"		8"	10"		9'-5½"	2.855	455.75	128.59	
		9'	252	32'-3"		9"	11"		10'-5½"	3.159	487.12	135.27	
	4 @ 8'	5'	160	35'-5"	9½"	7"	9"	10¼"	6'-7¾"	2.792	419.54	115.23	
		6'	192	35'-5"		7"	9"		7'-7¾"	2.918	430.23	121.91	
		7'	224	35'-9"		7½"	10"		8'-7¾"	3.151	468.89	128.59	
		8'	256	35'-10"		8"	10"		9'-7¾"	3.320	517.58	135.27	
		9'	288	36'-3"		9"	11"		10'-7¾"	3.626	549.46	141.95	
		10'	320	36'-8"		10"	12"		11'-7¾"	3.963	586.02	148.63	
	4 @ 9'	6'	216	39'-9"	10½"	7½"	10"	11"	7'-9½"	3.471	546.06	128.59	
		7'	252	39'-9"		7½"	10"		8'-9½"	3.610	582.24	135.27	
		8'	288	39'-10"		8"	10"		9'-9½"	3.779	631.63	141.95	
		9'	324	40'-3"		9"	11"		10'-9½"	4.088	663.93	148.63	
		10'	360	40'-8"		10"	12"		11'-9½"	4.427	701.53	155.31	
		11'	396	40'-10"		11"	12"		12'-9½"	4.679	746.47	161.99	
Section "C" – 20'-0"	4 @ 7'	5'	140	31'-1"	9¼"	6½"	8"	9¾"	6'-7"	2.394	378.28	108.55	
		6'	168	31'-5"		7"	9"		7'-7"	2.602	399.58	115.23	
		7'	196	31'-9"		7½"	10"		8'-7"	2.834	449.01	121.91	
		8'	224	31'-10½"		8¼"	10"		9'-7"	3.017	500.91	128.59	
		9'	252	32'-3"		9"	11"		10'-7"	3.308	543.79	135.27	
	4 @ 8'	5'	160	35'-5"	10¾"	7"	9"	11¼"	6'-10"	3.038	447.89	115.23	
		6'	192	35'-5½"		7¼"	9"		7'-10"	3.176	458.72	121.91	
		7'	224	35'-9¼"		7¾"	10"		8'-10"	3.418	504.63	128.59	
		8'	256	35'-10½"		8¼"	10"		9'-10"	3.584	557.93	135.27	
		9'	288	36'-3½"		9¼"	11"		10'-10"	3.895	593.69	141.95	
		10'	320	36'-8½"		10¼"	12"		11'-10"	4.236	677.15	148.63	
	4 @ 9'	6'	216	39'-9"	11⅝"	7½"	10"	12¼"	8'-0"	3.778	567.47	128.59	
		7'	252	39'-10"		8"	10"		9'-0"	3.944	611.90	135.27	
		8'	288	39'-11"		8½"	10"		10'-0"	4.117	654.99	141.95	
		9'	324	40'-3½"		9¼"	11"		11'-0"	4.415	701.91	148.63	
		10'	360	40'-8½"		10½"	12"		12'-0"	4.759	765.81	155.31	
		11'	396	40'-10"		11"	12"		13'-0"	4.994	812.83	161.99	
Section "D" – 25'-0"	4 @ 7'	5'	140	31'-1⅛"	10¼"	6¾"	8"	10¾"	6'-9"	2.596	403.91	108.55	
		6'	168	31'-6"		7½"	9"		7'-9"	2.819	439.76	115.23	
		7'	196	31'-10½"		8¼"	10"		8'-9"	3.071	487.90	121.91	
		8'	224	32'-0"		9"	10"		9'-9"	3.259	528.74	128.59	
		9'	252	32'-4½"		9¾"	11"		10'-9"	3.557	572.03	135.27	
	4 @ 8'	5'	160	35'-5"	11¾"	7"	9"	12¼"	7'-0"	3.256	481.59	115.23	
		6'	192	35'-6½"		7¾"	9"		8'-0"	3.420	501.22	121.91	
		7'	224	35'-11"		8½"	10"		9'-0"	3.676	548.10	128.59	
		8'	256	36'-0½"		9¼"	10"		10'-0"	3.867	607.08	135.27	
		9'	288	36'-5"		10"	11"		11'-0"	4.170	651.24	141.95	
		10'	320	36'-10"		11"	12"		12'-0"	4.519	715.13	148.63	
	4 @ 9'	6'	216	39'-10"	12¾"	8"	10"	13¼"	8'-2"	4.048	650.91	128.59	
		7'	252	39'-11"		8⅛"	10"		9'-2"	4.219	691.91	135.27	
		8'	288	40'-0½"		9¼"	10"		10'-2"	4.411	746.72	141.95	
		9'	324	40'-5"		10"	11"		11'-2"	4.716	805.26	148.63	
		10'	360	40'-10"		11"	12"		12'-2"	5.067	870.61	155.31	
		11'	396	41'-0"		12"	12"		13'-2"	5.327	925.03	161.99	
Section "E" – 30'-0"	4 @ 7'	5'	140	31'-2"	11"	7"	8"	11½"	6'-10½"	2.751	432.85	108.55	
		6'	168	31'-7"		8"	9"		7'-10½"	2.990	470.06	115.23	
		7'	196	32'-0"		9"	10"		8'-10½"	3.259	519.04	121.91	
		8'	224	32'-1½"		9¾"	10"		9'-10½"	3.453	559.94	128.59	
		9'	252	32'-6"		10½"	11"		10'-10½"	3.757	619.66	135.27	

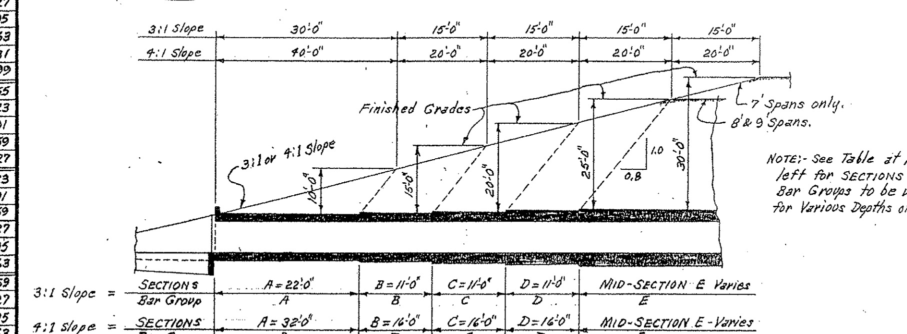


TYPICAL SECTION M-M
Scale reduced.



PART LONGITUDINAL SECTION

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos W-X002-1 or W-X002-2.



NOTE:- See Table at lower left for SECTIONS and Bar Groups to be used for Various Depths of Cover.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

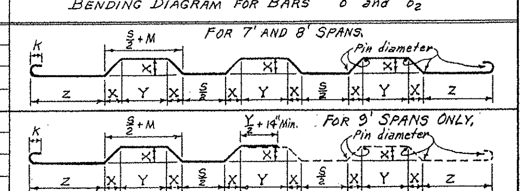
NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.

REVISIONS:- Size & spacing "a", "b", "b2", & "c" bar and quant. 2-28-64 W.C.H.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawing Nos. W-X002-1 or W-X002-2.

BENDING DIAGRAM FOR BARS "b" and "b2"

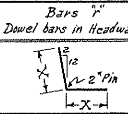
Bar Size	Pin Diam.	K	Add for Hooks
FOR 7' AND 8' SPANS.			
#6	3"	5"	1'-2"
FOR 9' SPANS ONLY.			
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"



NOTE:- Dimensions are to centers of bars. ("b" and "b2")

Dowel Bars for Two Headwalls S	Size	Spacing	No. Req'd	Length	X
7'	#4	12"±	64	2'-8"	1'-4"
8'	#4	12"±	72	2'-10"	1'-5"
9'	#4	12"±	80	3'-0"	1'-6"

Bars "r" – Dowel bars in Headwalls.



GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C or D	4:1 Slopes Sections A	4:1 Slopes Sections B, C or D
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

* Variable, see Drawings for Skewed Culverts.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	Sections & Bar Groups for End Sections A	B	C	D	Mid-Section and Bar Group
5.0' to 9.5'	✓				A
10.0' to 14.5'	✓				B
15.0' to 19.5'	✓	✓			C
20.0' to 25.0'	✓	✓	✓		D
25.0' to 30.0'	✓	✓	✓	✓	E

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

7', 8' & 9' SPANS — 3:1 OR 4:1 SLOPES
QUADRUPLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-400X-X2

Designed by:- W.C.H. 2-1-63. Checked by:- RHS 6-12-63
Drawn by:- W.C.H. 4-2-63. Checked by:- RHS 6-17-63
Quantities by:- W.C.H. 5-9-63. Checked by:- RHS 6-17-63

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

"a" bars: STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
"b" bars: BENT - See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	X	Y	Z
0'-0" TO 5'-0" MAXIMUM	5 @ 4'	2'	#5	12"	128	128	23'-5"	#5	12"	59	59	25'-0"	0'-3"	2'-2"	3'-4¼"
		3'			128	128	23'-5"			59	59	25'-0"	0'-3"	2'-2"	3'-4¼"
		4'			128	128	23'-5"			59	59	25'-0"	0'-3"	2'-2"	3'-4¼"
		5'			128	128	23'-5"			59	59	25'-0"	0'-3"	2'-2"	3'-4¼"
		6'			128	128	23'-11"			59	59	25'-6"	0'-3"	2'-3"	3'-5¼"
	5 @ 5'	3'	#6	12"	128	128	28'-5"	#5	12"	59	59	30'-2"	0'-3½"	2'-7"	4'-1¼"
		4'			128	128	28'-5"			59	59	30'-2"	0'-3½"	2'-7"	4'-1¼"
		5'			128	128	28'-5"			59	59	30'-2"	0'-3½"	2'-7"	4'-1¼"
		6'			128	128	28'-11"			59	59	30'-8"	0'-3½"	2'-8"	4'-2¼"
		7'			128	128	29'-4"			59	59	31'-1"	0'-3½"	2'-9"	4'-2¾"
	5 @ 6'	3'	#6	11"	140	140	33'-5"	#5	11"	65	65	35'-3"	0'-4"	3'-0"	4'-10½"
		4'			140	140	33'-5"			65	65	35'-3"	0'-4"	3'-0"	4'-10½"
		5'			140	140	33'-5"			65	65	35'-3"	0'-4"	3'-0"	4'-10½"
		6'			140	140	33'-11"			65	65	35'-9"	0'-4"	3'-1"	4'-11½"
		7'			140	140	34'-4"			65	65	36'-2"	0'-4"	3'-2"	4'-11¾"
		8'			140	140	34'-5"			65	65	36'-3"	0'-4"	3'-2"	5'-0½"
	5 @ 7'	4'	#6	12"	128	128	38'-5"	#6	12"	59	59	40'-7"	0'-4½"	3'-5"	5'-7"
		5'			128	128	38'-5"			59	59	40'-7"	0'-4½"	3'-5"	5'-7"
		6'			128	128	38'-11"			59	59	41'-1"	0'-4½"	3'-6"	5'-8"
		7'			128	128	39'-4"			59	59	41'-6"	0'-4½"	3'-7"	5'-8½"
		8'			128	128	39'-5"			59	59	41'-7"	0'-4½"	3'-7"	5'-9"
		9'			128	128	39'-11"			59	59	42'-1"	0'-4½"	3'-8"	5'-10"
	5 @ 8'	4'	⊛ #6	11"	280	280	22'-9"	⊛ #6	11"	130	130	23'-10"	0'-5"	3'-10"	6'-4"
		5'			280	280	23'-0"			130	130	24'-1"	0'-5"	3'-11"	6'-5"
		6'			280	280	23'-0"			130	130	24'-1"	0'-5"	3'-11"	6'-5"
		7'			280	280	23'-4"			130	130	24'-4"	0'-5"	4'-0"	6'-5½"
		8'			280	280	23'-4"			130	130	24'-4"	0'-5"	4'-0"	6'-6"
		9'			280	280	23'-6"			130	130	24'-7"	0'-5"	4'-1"	6'-7"
		10'			280	280	23'-9"			130	130	24'-10"	0'-5"	4'-2"	6'-8"
	5 @ 9'	5'	⊛ #6	11"	280	280	25'-6"	⊛ #6	11"	130	130	26'-8"	0'-5½"	4'-4"	7'-2"
		6'			280	280	25'-8"			130	130	26'-11"	0'-5½"	4'-5"	7'-2½"
		7'			280	280	25'-8"			130	130	26'-11"	0'-5½"	4'-5"	7'-2½"
		8'			280	280	25'-9"			130	130	26'-11"	0'-5½"	4'-5"	7'-3"
		9'			280	280	26'-0"			130	130	27'-2"	0'-5½"	4'-6"	7'-4"
		10'			280	280	26'-3"			130	130	27'-5"	0'-5½"	4'-7"	7'-5"
		11'			280	280	26'-4"			130	130	27'-6"	0'-5½"	4'-7"	7'-6"
	5 @ 10'	5'	⊛ #7	12"	256	256	28'-2"	⊛ #6	12"	118	118	29'-3"	0'-6"	4'-9"	7'-11"
		6'			256	256	28'-4"			118	118	29'-6"	0'-6"	4'-10"	7'-11½"
		7'			256	256	28'-4"			118	118	29'-6"	0'-6"	4'-10"	7'-11½"
		8'			256	256	28'-5"			118	118	29'-6"	0'-6"	4'-10"	8'-0"
		9'			256	256	28'-8"			118	118	29'-9"	0'-6"	4'-11"	8'-1"
		10'			256	256	28'-11"			118	118	30'-0"	0'-6"	5'-0"	8'-2"
		11'			256	256	29'-0"			118	118	30'-1"	0'-6"	5'-0"	8'-3"
		12'			256	256	29'-1"			118	118	30'-2"	0'-6"	5'-0"	8'-4"

"b2" bars: BENT - See Diagram below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars: STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.

S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	X	Y	Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
5 @ 4'	2'	#5	12"	59	59	24'-10"	0'-2½"	2'-3"	3'-4¼"	#5	12"	120	120	18'-8"
	3'			59	59	24'-10"	0'-2½"	2'-3"	3'-4¼"			120	120	18'-8"
	4'			59	59	24'-10"	0'-2½"	2'-3"	3'-4¼"			120	120	18'-8"
	5'			59	59	24'-10"	0'-2½"	2'-3"	3'-4¼"			120	120	18'-8"
	6'			59	59	25'-4"	0'-2½"	2'-4"	3'-5¼"			120	120	19'-0"
5 @ 5'	3'	#5	12"	59	59	30'-0"	0'-3"	2'-8"	4'-1¼"	#6	12"	120	120	22'-8"
	4'			59	59	30'-0"	0'-3"	2'-8"	4'-1¼"			120	120	22'-8"
	5'			59	59	30'-0"	0'-3"	2'-8"	4'-1¼"			120	120	22'-8"
	6'			59	59	30'-6"	0'-3"	2'-9"	4'-2¼"			120	120	23'-0"
	7'			59	59	30'-11"	0'-3"	2'-10"	4'-2¾"			120	120	23'-4"
5 @ 6'	3'	#5	11"	65	65	35'-2"	0'-3½"	3'-1"	4'-10½"	#6	11"	132	132	26'-8"
	4'			65	65	35'-2"	0'-3½"	3'-1"	4'-10½"			132	132	26'-8"
	5'			65	65	35'-2"	0'-3½"	3'-1"	4'-10½"			132	132	26'-8"
	6'			65	65	35'-8"	0'-3½"	3'-2"	4'-11½"			132	132	27'-0"
	7'			65	65	36'-1"	0'-3½"	3'-3"	4'-11¾"			132	132	27'-4"
	8'			65	65	36'-2"	0'-3½"	3'-3"	5'-0½"			132	132	27'-4"
5 @ 7'	4'	#6	12"	59	59	40'-6"	0'-4¼"	3'-5½"	5'-7"	#6	12"	120	120	30'-8"
	5'			59	59	40'-6"	0'-4¼"	3'-5½"	5'-7"			120	120	30'-8"
	6'			59	59	41'-0"	0'-4¼"	3'-6½"	5'-8"			120	120	31'-0"
	7'			59	59	41'-5"	0'-4¼"	3'-7½"	5'-8½"			120	120	31'-4"
	8'			59	59	41'-6"	0'-4¼"	3'-7½"	5'-9"			120	120	31'-4"
	9'			59	59	42'-0"	0'-4¼"	3'-8½"	5'-10"			120	120	31'-8"
5 @ 8'	4'	⊛ #6	11"	130	130	23'-10"	0'-5"	3'-10"	6'-4"	#6	11"	132	132	34'-8"
	5'			130	130	24'-1"	0'-5"	3'-11"	6'-5"			132	132	35'-0"
	6'			130	130	24'-1"	0'-5"	3'-11"	6'-5"			132	132	35'-0"
	7'			130	130	24'-4"	0'-5"	4'-0"	6'-5½"			132	132	35'-4"
	8'			130	130	24'-4"	0'-5"	4'-0"	6'-6"			132	132	35'-4"
	9'			130	130	24'-7"	0'-5"	4'-1"	6'-7"			132	132	35'-8"
	10'			130	130	24'-10"	0'-5"	4'-2"	6'-8"			132	132	36'-0"
5 @ 9'	5'	⊛ #6	11"	130	130	26'-8"	0'-5½"	4'-4"	7'-2"	#6	11"	132	132	39'-0"
	6'			130	130	26'-11"	0'-5½"	4'-5"	7'-2½"			132	132	39'-4"
	7'			130	130	26'-11"	0'-5½"	4'-5"	7'-2½"			132	132	39'-4"
	8'			130	130	26'-11"	0'-5½"	4'-5"	7'-3"			132	132	39'-4"
	9'			130	130	27'-2"	0'-5½"	4'-6"	7'-4"			132	132	39'-8"
	10'			130	130	27'-5"	0'-5½"	4'-7"	7'-5"			132	132	40'-0"
	11'			130	130	27'-6"	0'-5½"	4'-7"	7'-6"			132	132	40'-0"
5 @ 10'	5'	⊛ #6	12"	118	118	29'-3"	0'-6"	4'-9"	7'-11"	⊛ #7	12"	240	240	22'-8"
	6'			118	118	29'-6"	0'-6"	4'-10"	7'-11½"			240	240	22'-10"
	7'			118	118	29'-6"	0'-6"	4'-10"	7'-11½"			240	240	22'-10"
	8'			118	118	29'-6"	0'-6"	4'-10"	8'-0"			240	240	22'-10"
	9'			118	118	29'-9"	0'-6"	4'-11"	8'-1"			240	240	23'-0"
	10'			118	118	30'-0"	0'-6"	5'-0"	8'-2"			240	240	23'-2"
	11'			118	118	30'-1"	0'-6"	5'-0"	8'-3"			240	240	23'-2"
	12'			118	118	30'-2"	0'-6"	5'-0"	8'-4"			240	240	23'-2"

"d" bars: STRAIGHT – Longitudinal in Top Slab of Barrel. "d1" bars: STRAIGHT – Longitudinal in Sidewalls and Division Walls. "e" bars: STRAIGHT – Longitudinal in Bottom Slab of Barrel. "f" bars: STRAIGHT – Vertical in Sidewalls and Division Walls.

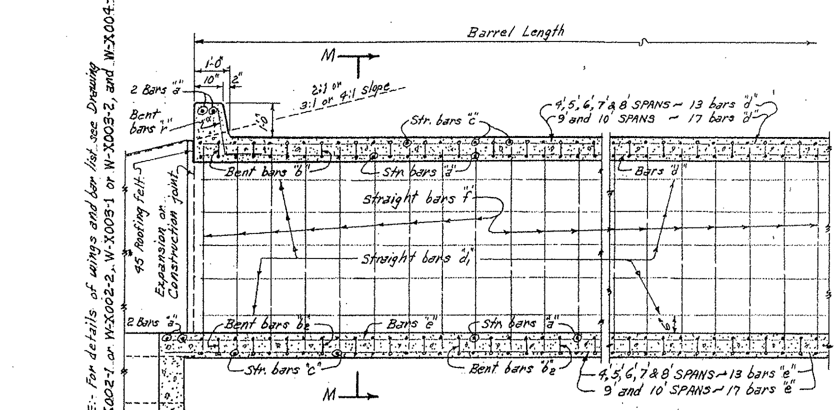
S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
5 @ 4'	2'	#5	12"	38	2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap.)	#4	12"	20	2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap.)	#4	12"	38	2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap.)	#4	12"	600	600	2'-10"
	3'			38				30				38				600	600	3'-10"
	4'			38				40				38				600	600	4'-10"
	5'			38				50				38				600	600	5'-10"
	6'			38				60				38				600	600	6'-10"
5 @ 5'	3'	#5	11½"	44		#4	12"	30		#4	12"	43		#4	12"	600	600	3'-11"
	4'			44				40				43				600	600	4'-11"
	5'			44				50				43				600	600	5'-11"
	6'			44				60				43				600	600	6'-11"
	7'			44				70				43				600	600	7'-11"
5 @ 6'	3'	#5	11½"	49		#4	12"	30		#4	12"	48		#4	12"	600	600	4'-0"
	4'			49				40				48				600	600	5'-0"
	5'			49				50				48				600	600	6'-0"
	6'			49				60				48				600	600	7'-0"
	7'			49				70				48				600	600	8'-0"
	8'			49				80				48			10"	720	720	9'-0"
5 @ 7'	4'	#5	11½"	54		#4	12"	40		#4	12"	53		#4	12"	600	600	5'-1"
	5'			54				50				53				600	600	6'-1"
	6'			54				60				53				600	600	7'-1"
	7'			54				70				53				600	600	8'-1"
	8'			54				80				53			10"	720	720	9'-1"
	9'			54				90				53		#5	12"	600	600	10'-1"
5 @ 8'	4'	#5	11½"	60		#4	12"	40		#4	12"	58		#4	12"	600	600	5'-2"
	5'			60				50				58				600	600	6'-2"
	6'			60				60				58				600	600	7'-2"
	7'			60				70				58				600	600	8'-2"
	8'			60				80				58			10"	720	720	9'-2"
	9'			60				90				58		#5	12"	600	600	10'-2"
	10'			60				100				58			11"	660	660	11'-2"
5 @ 9'	5'	#5	11½"	69		#4	12"	50		#4	12"	67		#4	12"	600	600	6'-3"
	6'			69				60				67				600	600	7'-3"
	7'			69				70				67				600	600	8'-3"
	8'			69				80				67			10"	720	720	9'-3"
	9'			69				90				67		#5	12"	600	600	10'-3"
	10'			69				100				67			11"	660	660	11'-3"
	11'			69				110				67			10"	720	720	12'-3"
5 @ 10'	5'	#5	11½"	74		#4	12"	50		#4	12"	72		#4	12"	600	600	6'-4"
	6'			74				60				72				600	600	7'-4"
	7'			74				70				72				600	600	8'-4"
	8'			74				80				72			10"	720	720	9'-4"
	9'			74				90				72			12"	600	600	10'-4"
	10'			74				100				72		#5	11"	660	660	11'-4"
	11'			74				110				72			10"	720	720	12'-4"
	12'			74				120				72		#6	12"	600	600	13'-4"

⊛ These "a", "b", "b2" and "c" bars are to be spliced at center of the middle span to make a full length bar. Lap #6 bars 2'-0" min. and #7 bars 2'-4" min.

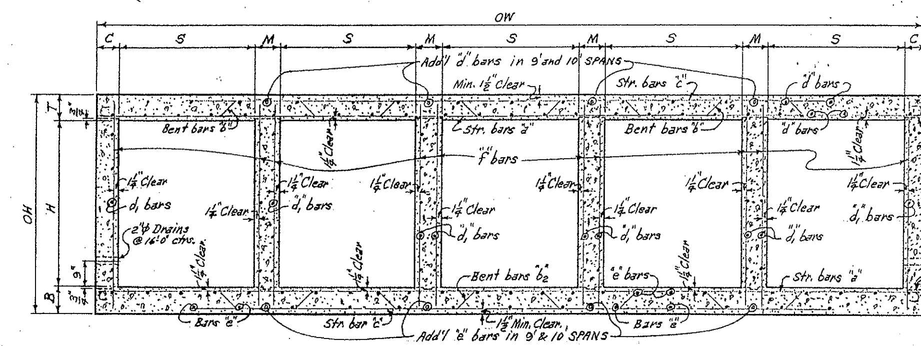
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
5'-0"	5 @ 4'	2'	40	23'-8"	6½"	6"	8"	6"	3'-0½"	1.185	237.07	114.93	326.87
		3'	60	23'-8"		6"	8"		4'-0½"	1.321	250.43	122.84	326.87
		4'	80	23'-8"		6"	8"		5'-0½"	1.456	263.79	131.19	326.87
		5'	100	23'-8"		6"	8"		6'-0½"	1.592	277.15	139.54	326.87
		6'	120	24'-2"		7"	9"		7'-0½"	1.858	293.29	147.89	331.05
	5 @ 5'	3'	75	28'-8"	7"	6"	8"	6½"	4'-1½"	1.602	337.03	137.44	499.10
		4'	100	28'-8"		6"	8"		5'-1½"	1.738	350.39	145.79	499.10
		5'	125	28'-8"		6"	8"		6'-1½"	1.873	363.75	159.14	499.10
		6'	150	29'-2"		7"	9"		7'-1½"	2.141	380.65	162.49	505.11
		7'	175	29'-7"		7½"	10"		8'-1½"	2.421	397.14	170.84	510.12
	5 @ 6'	3'	90	33'-8"	7½"	6"	8"	7"	4'-2½"	1.914	406.95	150.31	586.96
		4'	120	33'-8"		6"	8"		5'-2½"	2.050	420.31	158.66	586.96
		5'	150	33'-8"		6"	8"		6'-2½"	2.186	433.67	167.01	586.96
		6'	180	34'-2"		7"	9"		7'-2½"	2.455	450.90	175.36	592.97
		7'	210	34'-7"		7½"	10"		8'-2½"	2.736	467.67	183.71	597.98
		8'	240	34'-8"		8"	10"		9'-2½"	2.934	493.51	192.06	598.98
	5 @ 7'	4'	140	38'-8"	8"	6"	8"	7¾"	5'-3¾"	2.423	481.72	171.53	674.93
		5'	175	38'-8"		6"	8"		6'-3¾"	2.559	495.08	179.88	674.93
		6'	210	39'-2"		7"	9"		7'-3¾"	2.830	512.44	188.23	680.94
		7'	245	39'-7"		7½"	10"		8'-3¾"	3.112	529.31	196.58	685.95
		8'	280	39'-8"		8"	10"		9'-3¾"	3.311	555.30	204.93	686.95
		9'	315	40'-2"		9"	11"		10'-3¾"	3.675	598.35	213.28	692.95
	5 @ 8'	4'	160	43'-8"	8½"	6"	8"	8½"	5'-5"	2.834	581.98	186.13	789.55
		5'	200	44'-2"		7"	9"		6'-5"	3.089	599.21	194.98	795.55
		6'	240	44'-2"		7"	9"		7'-5"	3.293	612.57	202.83	795.55
		7'	280	44'-7"		7½"	10"		8'-5"	3.528	630.89	211.18	803.57
		8'	320	44'-8"		8"	10"		9'-5"	3.726	656.95	219.53	803.57
		9'	360	45'-2"		9"	11"		10'-5"	4.092	699.51	227.88	807.57
		10'	400	45'-8"		10"	12"		11'-5"	4.495	731.58	236.23	813.58
	5 @ 9'	5'	225	49'-2"	9"	7"	9"	9"	6'-6"	3.503	661.59	217.64	891.60
		6'	270	49'-7"		7½"	10"		7'-6"	3.773	678.77	225.99	895.60
		7'	315	49'-7"		7½"	10"		8'-6"	3.943	692.13	234.34	895.60
		8'	360	49'-8"		8"	10"		9'-6"	4.142	718.40	242.69	897.60
		9'	405	50'-2"		9"	11"		10'-6"	4.509	762.21	251.04	903.61
		10"	450	50'-8"		10"	12"		11'-6"	4.914	794.35	259.39	909.62
		11"	495	50'-10"		11"	12"		12'-6"	5.201	827.44	267.74	911.62
	5 @ 10'	5'	250	54'-2"	9½"	7"	9"	9½"	6'-7"	3.948	792.33	230.51	1231.67
		6'	300	54'-7"		7½"	10"		7'-7"	4.219	809.92	238.86	1237.12
		7'	350	54'-7"		7½"	10"		8'-7"	4.389	823.28	247.21	1237.12
		8'	400	54'-8"		8"	10"		9'-7"	4.588	849.79	255.56	1239.85
		9'	450	55'-2"		9"	11"		10'-7"	4.957	894.34	263.91	1248.02
		10'	500	55'-8"		10"	12"		11'-7"	5.363	927.10	272.26	1286.20
		11'	550	55'-10"		11"	12"		12'-7"	5.651	960.38	280.61	1258.93
		12'	600	56'-0"		12"	12"		13'-7"	5.951	1014.14	288.96	1261.65

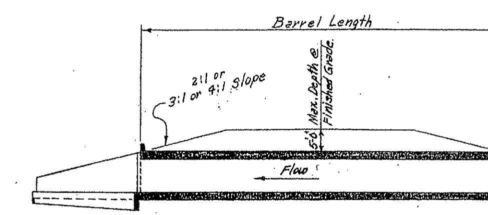
NOTE:- For details of wings and bar list see Drawing Nos. W-X002-1 or W-X002-2, W-X003-1 or W-X003-2, and W-X004-1 or W-X004-2.



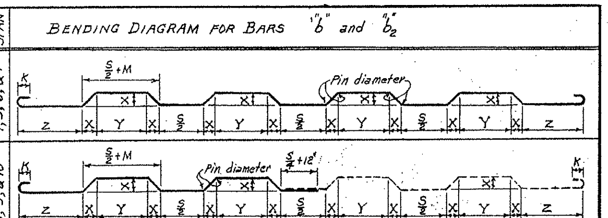
PART LONGITUDINAL SECTION



TYPICAL SECTION M-M

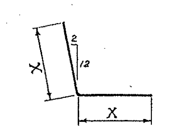


LONGITUDINAL SECTION

BAR SIZE	PIN DIAM.	K	ADD FOR HOOKS	SPAN	BENDING DIAGRAM FOR BARS "b" and "b2"
#5	2½"	4¼"	0'-11½"	4', 5', 6', & 7'	
#6	3"	5"	1'-2"		
#6	3"	5"	0'-7"	8', 9', & 10'	

NOTE:- Dimensions are to centers of bars. ("b" and "b2").

DOWEL BARS FOR TWO HEADWALLS

5 SPANS @	SIZE	SPACING	No. REQ'D	LENGTH	X	Bars "r" Dowel bars in Headwalls
4'	#4	12"±	50	2'-5"	1'-2½"	
5'	#4	12"±	60	2'-6"	1'-3"	
6'	#4	12"±	70	2'-7"	1'-3½"	
7'	#4	12"±	80	2'-8"	1'-4"	
8'	#4	12"±	90	2'-9"	1'-4½"	
9'	#4	12"±	100	2'-10"	1'-5"	
10'	#4	12"±	110	2'-11"	1'-5½"	

GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X003-1 or W-X003-2 and W-X004-1 or W-X004-2. Also Drawings Nos. W-X002-1 or W-X002-2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
4', 5', 6', 7', 8', 9' & 10' SPANS — 3:1 OR 4:1 SLOPES
QUINTUPLES — UNDER 5'-0" COVER
STANDARD DRAWING NO. R-500X-0

Designed By:- W.C.H. 1-23-63. Checked By:- 5-24-63 RHS
Drawn By:- W.C.H. 3-15-63. Checked By:- 5-27-63 RHS
Quantities By:- W.C.H. 3-18-63. Checked By:- 5-27-63 RHS

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR VARIOUS SECTIONS OF BARREL

- "a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. 2 Add'l in Apron and Headwall - Each.
- "b" bars – BENT - See Diagram below. – In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
- "b2" bars – BENT - See Diagram below. – In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
- "c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
- "d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.
- "d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls.
- "e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel.
- "f" bars – STRAIGHT – Vertical in Sidewalls and Division Walls.

Section & Bar Group	Lengths of Section	Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"b" Size	"b" Spacing	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b" Y	"b" Z
Section "A" & Bar Group "A"	3:1 = 22'-0"; 4:1 = 32'-0"	0' to 10'-0"	5 @ 4'	3'	#4	12"	48	68	23'-5"	#4	12"	22	32	24'-11"	0'-2¾"	2'-2⅛"	3'-4½"
				4'			48	68	23'-5"			22	32	24'-11"	0'-2¾"	2'-2½"	3'-4½"
				5'			48	68	23'-5"			22	32	24'-11"	0'-2¾"	2'-2½"	3'-4½"
				6'			48	68	23'-11"			22	32	25'-5"	0'-2¾"	2'-3½"	3'-5½"
			5 @ 5'	3'	#4	11"	52	74	28'-5"	#4	11"	24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"
				4'			52	74	28'-5"			24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"
				5'			52	74	28'-5"			24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"
				6'			52	74	28'-11"			24	35	30'-6"	0'-3¼"	2'-8½"	4'-2¼"
				7'			52	74	29'-4"			24	35	30'-11"	0'-3¼"	2'-9½"	4'-2¾"
			5 @ 6'	4'	#5	13"	46	64	33'-5"	#5	13"	20	29	35'-2"	0'-3½"	3'-1"	4'-10¼"
				5'			46	64	33'-5"			20	29	35'-2"	0'-3½"	3'-1"	4'-10¼"
				6'			46	64	33'-11"			20	29	35'-8"	0'-3½"	3'-2"	4'-11¼"
				7'			46	64	34'-4"			20	29	36'-1"	0'-3½"	3'-3"	4'-11¾"
				8'			46	64	34'-5"			20	29	36'-2"	0'-3½"	3'-3"	5'-0¼"
Section "B" & Bar Group "B"	3:1 = 11'-0"; 4:1 = 16'-0"	10'-0" to 15'-0"	5 @ 4'	3'	#4	12"	22	32	23'-5"	#4	12"	11	16	24'-11"	0'-2¾"	2'-2½"	3'-4½"
				4'			22	32	23'-5"			11	16	24'-11"	0'-2¾"	2'-2½"	3'-4½"
				5'			22	32	23'-5"			11	16	24'-11"	0'-2¾"	2'-2½"	3'-4½"
				6'			22	32	23'-11"			11	16	25'-5"	0'-2¾"	2'-3½"	3'-5½"
			5 @ 5'	3'	#4	13"	20	30	28'-5"	#5	13"	10	14	30'-1"	0'-3¼"	2'-7½"	4'-1½"
				4'			20	30	28'-5"			10	14	30'-1"	0'-3½"	2'-7½"	4'-1½"
				5'			20	30	28'-5"			10	14	30'-1"	0'-3½"	2'-7½"	4'-1½"
				6'			20	30	28'-11"			10	14	30'-7"	0'-3½"	2'-8½"	4'-2¼"
				7'			20	30	29'-4"			10	14	31'-0"	0'-3½"	2'-9½"	4'-2¾"
			5 @ 6'	4'	#5	12"	22	32	33'-5"	#5	12"	11	16	35'-4"	0'-4½"	2'-11½"	4'-10½"
				5'			22	32	33'-5"			11	16	35'-4"	0'-4½"	2'-11½"	4'-10½"
				6'			22	32	33'-11"			11	16	35'-10"	0'-4½"	3'-0½"	4'-11½"
				7'			22	32	34'-4"			11	16	36'-3"	0'-4½"	3'-1½"	4'-11¾"
				8'			22	32	34'-5"			11	16	36'-4"	0'-4½"	3'-1½"	5'-0¼"
Section "C" & Bar Group "C"	3:1 = 11'-0"; 4:1 = 16'-0"	15'-0" to 20'-0"	5 @ 4'	3'	#4	13"	20	30	23'-5"	#5	13"	10	15	24'-11"	0'-2¾"	2'-2½"	3'-4¼"
				4'			20	30	23'-5"			10	15	24'-11"	0'-2¾"	2'-2½"	3'-4¼"
				5'			20	30	23'-5"			10	15	24'-11"	0'-2¾"	2'-2½"	3'-4¼"
				6'			20	30	23'-11"			10	15	25'-5"	0'-2¾"	2'-3½"	3'-5¼"
			5 @ 5'	3'	#4	12"	22	32	28'-5"	#5	12"	11	16	30'-2"	0'-3¾"	2'-6½"	4'-1¼"
				4'			22	32	28'-5"			11	16	30'-2"	0'-3¾"	2'-6½"	4'-1¼"
				5'			22	32	28'-5"			11	16	30'-2"	0'-3¾"	2'-6½"	4'-1¼"
				6'			22	32	28'-11"			11	16	30'-8"	0'-3¾"	2'-7½"	4'-2¼"
				7'			22	32	29'-4"			11	16	31'-1"	0'-3¾"	2'-8½"	4'-2¾"
			5 @ 6'	4'	#5	12"	22	32	33'-5"	#5	12"	11	16	35'-6"	0'-4¾"	2'-10½"	4'-10½"
				5'			22	32	33'-5"			11	16	35'-6"	0'-4¾"	2'-10½"	4'-10½"
				6'			22	32	33'-11"			11	16	36'-0"	0'-4¾"	2'-11½"	4'-11½"
				7'			22	32	34'-4"			11	16	36'-5"	0'-4¾"	3'-0½"	4'-11¾"
				8'			22	32	34'-5"			11	16	36'-6"	0'-4¾"	3'-0½"	5'-0¼"
Section "D" & Bar Group "D"	3:1 = 11'-0"; 4:1 = 16'-0"	20'-0" to 25'-0"	5 @ 4'	3'	#4	12"	22	32	23'-5"	#5	12"	11	16	25'-1"	0'-3¼"	2'-1½"	3'-4¼"
				4'			22	32	23'-5"			11	16	25'-1"	0'-3¼"	2'-1½"	3'-4¼"
				5'			22	32	23'-5"			11	16	25'-1"	0'-3¼"	2'-1½"	3'-4¼"
				6'			22	32	23'-11"			11	16	25'-7"	0'-3¼"	2'-2½"	3'-5¼"
			5 @ 5'	3'	#4	11"	24	34	28'-5"	#5	11"	12	18	30'-4"	0'-4¼"	2'-5½"	4'-1¼"
				4'			24	34	28'-5"			12	18	30'-4"	0'-4¼"	2'-5½"	4'-1¼"
				5'			24	34	28'-5"			12	18	30'-5"	0'-4¼"	2'-5½"	4'-1½"
				6'			24	34	28'-11"			12	18	30'-10"	0'-4¼"	2'-6½"	4'-2¼"
				7'			24	34	29'-5"			12	18	31'-4"	0'-4¼"	2'-7½"	4'-3½"
			5 @ 6'	4'	#5	13"	20	30	33'-5"	#6	13"	10	15	35'-10"	0'-5½"	2'-9"	4'-10"
				5'			20	30	33'-6"			10	15	35'-11"	0'-5½"	2'-9"	4'-10½"
				6'			20	30	33'-11"			10	15	36'-5"	0'-5½"	2'-10"	4'-11½"
				7'			20	30	34'-5"			10	15	36'-10"	0'-5½"	2'-11"	5'-0"
				8'			20	30	34'-6"			10	15	37'-0"	0'-5½"	2'-11"	5'-0¾"
Section "E" & Bar Group "E"	3:1 = 11'-0"; 4:1 = 16'-0"	25'-0" to 30'-0"	5 @ 4'	3'	#4	11"	26	36	23'-5"	#5	11"	12	17	25'-2"	0'-3¾"	2'-0½"	3'-4¼"
				4'			26	36	23'-5"			12	17	25'-2"	0'-3¾"	2'-0½"	3'-4¼"
				5'			26	36	23'-6"			12	17	25'-3"	0'-3¾"	2'-0½"	3'-4¾"
				6'			26	36	24'-0"			12	17	25'-9"	0'-3¾"	2'-1½"	3'-5¾"
			5 @ 5'	3'	#4	10"	28	40	28'-5"	#5	10"	13	19	30'-6"	0'-4¾"	2'-4½"	4'-1¼"
				4'			28	40	28'-5"			13	19	30'-6"	0'-4¾"	2'-4½"	4'-1¼"
				5'			28	40	28'-6"			13	19	30'-7"	0'-4¾"	2'-4½"	4'-2"
				6'			28	40	29'-0"			13	19	31'-1"	0'-4¾"	2'-5½"	4'-2¾"
				7'			28	40	29'-6"			13	19	31'-7"	0'-4¾"	2'-6½"	4'-3¾"
			5 @ 6'	4'	#5	12"	22	32	33'-5"	#6	12"	11	16	36'-0"	0'-6½"	2'-7½"	4'-10"
				5'			22	32	33'-7"			11	16	36'-2"	0'-6½"	2'-7½"	4'-11"
				6'			22	32	34'-1"			11	16	36'-8"	0'-6½"	2'-8½"	5'-0"
				7'			22	32	34'-6"			11	16	37'-2"	0'-6½"	2'-9½"	5'-0¾"
				8'			22	32	34'-8"			11	16	37'-3"	0'-6½"	2'-9½"	5'-1½"
Section "F" & Bar Group "F"	Varies with Length of Barrel	30'-0" to 35'-0"	5 @ 4'	3'	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	23'-5"	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	25'-3"	0'-4"	2'-0"	3'-4½"
				4'					23'-5"					25'-3"	0'-4"	2'-0"	3'-4½"
				5'					23'-7"					25'-5"	0'-4"	2'-0"	3'-5½"
				6'					24'-1"					25'-11"	0'-4"	2'-1"	3'-6½"
			5 @ 5'	3'	#5	13"			28'-5"	#6	13"			30'-9"	0'-5¼"	2'-3½"	4'-1"
				4'					28'-6"					30'-10"	0'-5¼"	2'-3½"	4'-1½"
				5'					28'-7"					30'-11"	0'-5¼"	2'-3½"	4'-2"
				6'					29'-1"					31'-5"	0'-5¼"	2'-4½"	4'-3"
				7'					29'-7"					31'-11"	0'-5¼"	2'-5½"	4'-4"
			5 @ 6'	4'	#5	11"			33'-6"	#6	11"			36'-3"	0'-6¾"	2'-6½"	4'-10½"
				5'					33'-8"					36'-5"	0'-6¾"	2'-6½"	4'-11½"
				6'					34'-2"					36'-11"	0'-6¾"	2'-7½"	5'-0½"
				7'					34'-8"					37'-5"	0'-6¾"	2'-8½"	5'-1½"
				8'					34'-9"					37'-7"	0'-6¾"	2'-8½"	5'-2½"

Section & Bar Group	Clear Span S	Clear Height H	"b2" Size	"b2" Spacing	"b2" No. Req'd 3:1	"b2" No. Req'd 4:1	"b2" Length	"b2" X	"b2" Y	"b2" Z	"c" Size	"c" Spacing	"c" No. Req'd 3:1	"c" No. Req'd 4:1	"c" Length
"A"	5 @ 4'	3'	#4	12"	22	32	24'-11"	0'-2¾"	2'-2½"	3'-4½"	#4	12"	44	64	18'-8"
		4'			22	32	24'-11"	0'-2¾"	2'-2½"	3'-4½"			44	64	18'-8"
		5'			22	32	24'-11"	0'-2¾"	2'-2½"	3'-4½"			44	64	18'-8"
		6'			22	32	26'-5"	0'-2¾"	2'-3½"	3'-5½"			44	64	19'-0"
	5 @ 5'	3'	#4	11"	24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"	#5	11"	48	70	22'-8"
		4'			24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"			48	70	22'-8"
		5'			24	35	30'-0"	0'-3¼"	2'-7½"	4'-1¼"			48	70	22'-8"
		6'			24	35	30'-6"	0'-3¼"	2'-8½"	4'-2¼"			48	70	23'-0"
		7'			24	35	30'-11"	0'-3¼"	2'-9½"	4'-2¾"			48	70	23'-4"
	5 @ 6'	4'	#5	13"	20	29	35'-2"	0'-3¾"	3'-0½"	4'-10¼"	#6	13"	42	60	26'-8"
		5'			20	29	35'-2"	0'-3¾"	3'-0½"	4'-10¼"			42	60	26'-8"
		6'			20	29	35'-8"	0'-3¾"	3'-1½"	4'-11½"			42	60	27'-0"
		7'			20	29	36'-1"	0'-3¾"	3'-2½"	4'-11¾"			42	60	27'-4"
		8'			20	29	36'-2"	0'-3¾"	3'-2½"	5'-0¼"			42	60	27'-4"
"B"	5 @ 4'	3'	#4	12"	11	16	25'-0"	0'-3"	2'-2"	3'-4½"	#5	12"	22	32	18'-8"
		4'			11	16	25'-0"	0'-3"	2'-2"	3'-4½"			22	32	18'-8"
		5'			11	16	25'-0"	0'-3"	2'-2"	3'-4½"			22	32	18'-8"
		6'			11	16	25'-6"	0'-3"	2'-2"	3'-5½"			22	32	19'-0"
	5 @ 5'	3'	#5	13"	10	14	30'-2"	0'-3¾"	2'-6½"	4'-1¼"	#6	13"	20	30	22'-8"
		4'			10	14	30'-2"	0'-3¾"	2'-6½"	4'-1¼"			20	30	22'-8"
		5'			10	14	30'-2"	0'-3¾"	2'-6½"	4'-1¼"			20	30	22'-8"
		6'			10	14	30'-8"	0'-3¾"	2'-7½"	4'-2¼"			20	30	23'-0"
		7'			10	14	31'-1"	0'-3¾"	2'-8½"	4'-2¾"			20	30	23'-4"
	5 @ 6'	4'	#5	12"	11	16	35'-6"	0'-4¾"	2'-10½"	4'-10½"	#6	12"	22	32	26'-8"
		5'			11	16	35'-6"	0'-4¾"	2'-10½"	4'-10½"			22	32	26'-8"
		6'			11	16	36'-0"	0'-4¾"	2'-11½"	4'-11½"			22	32	27'-0"
		7'			11	16	36'-5"	0'-4¾"	3'-0½"	4'-11¾"			22	32	27'-4"
		8'			11	16	36'-6"	0'-4¾"	3'-0½"	5'-0¼"			22	32	27'-4"
"C"	5 @ 4'	3'	#5	13"	10	15	25'-1"	0'-3¼"	2'-1½"	3'-4¼"	#5	13"	20	30	18'-8"
		4'			10	15	25'-1"	0'-3¼"	2'-1½"	3'-4¼"			20	30	18'-8"
		5'			10	15	25'-1"	0'-3¼"	2'-1½"	3'-4¼"			20	30	18'-8"
		6'			10	15	25'-7"	0'-3¼"	2'-2½"	3'-5¼"			20	30	19'-0"
	5 @ 5'	3'	#5	12"	11	16	30'-4"	0'-4¼"	2'-5½"	4'-1¼"	#6	12"	22	32	22'-8"
		4'			11	16	30'-4"	0'-4¼"	2'-5½"	4'-1¼"			22	32	22'-8"
		5'			11	16	30'-4"	0'-4¼"	2'-5½"	4'-1¼"			22	32	22'-8"
		6'			11	16	30'-10"	0'-4¼"	2'-6½"	4'-2¼"			22	32	23'-0"
		7'			11	16	31'-3"	0'-4¼"	2'-7½"	4'-2¾"			22	32	23'-4"
	5 @ 6'	4'	#5	12"	11	16	35'-8"	0'-5¼"	2'-9½"	4'-10½"	#7	12"	22	32	26'-8"
		5'			11	16	35'-8"	0'-5¼"	2'-9½"	4'-10½"			22	32	26'-8"
		6'			11	16	36'-2"	0'-5¼"	2'-10½"	4'-11½"			22	32	27'-0"
		7'			11	16	36'-7"	0'-5¼"	2'-11½"	4'-11¾"			22	32	27'-4"
		8'			11	16	36'-8"	0'-5¼"	2'-11½"	5'-0¼"			22	32	27'-4"
"D"	5 @ 4'	3'	#5	12"	11	16	25'-2"	0'-3¾"	2'-0½"	3'-4¼"	#5	12"	22	32	18'-8"
		4'			11	16	25'-2"	0'-3¾"	2'-0½"	3'-4¼"			22	32	18'-8"
		5'			11	16	25'-2"	0'-3¾"	2'-0½"	3'-4¼"			22	32	18'-8"
		6'			11	16	25'-8"	0'-3¾"	2'-1½"	3'-5¼"			22	32	19'-0"
	5 @ 5'	3'	#5	11"	12	18	30'-6"	0'-4¾"	2'-4½"	4'-1¼"	#6	11"	24	34	22'-8"
		4'			12	18	30'-6"	0'-4¾"	2'-4½"	4'-1¼"			24	34	22'-8"
		5'			12	18	30'-6"	0'-4¾"	2'-4½"	4'-1½"			24	34	22'-8"
		6'			12	18	31'-0"	0'-4¾"	2'-5½"	4'-2¼"			24	34	23'-0"
		7'			12	18	31'-6"	0'-4¾"	2'-6½"	4'-3¼"			24	34	23'-4"
	5 @ 6'	4'	#6	13"	10	15	36'-0"	0'-6"	2'-8"	4'-10"	#7	13"	20	30	26'-8"
		5'			10	15	36'-1"	0'-6"	2'-8"	4'-10½"			20	30	26'-8"
		6'			10	15	36'-6"	0'-6"	2'-9"	4'-11½"			20	30	27'-0"
		7'			10	15	37'-0"	0'-6"	2'-10"	5'-0"			20	30	27'-4"
		8'			10	15	37'-1"	0'-6"	2'-10"	5'-0¾"			20	30	27'-4"
"E"	5 @ 4'	3'	#5	11"	12	17	25'-4"	0'-4¼"	1'-11½"	3'-4¼"	#5	11"	26	36	18'-8"
		4'			12	17	25'-4"	0'-4¼"	1'-11½"	3'-4¼"			26	36	18'-8"
		5'			12	17	25'-5"	0'-4¼"	1'-11½"	3'-4¾"			26	36	18'-8"
		6'			12	17	25'-11"	0'-4¼"	2'-0½"	3'-5¾"			26	36	19'-0"
	5 @ 5'	3'	#5	10"	13	19	30'-8"	0'-5¼"	2'-3½"	4'-1¼"	#6	10"	28	40	22'-8"
		4'			13	19	30'-8"	0'-5¼"	2'-3½"	4'-1¼"			28	40	22'-8"
		5'			13	19	30'-9"	0'-5¼"	2'-3½"	4'-2"			28	40	22'-8"
		6'			13	19	31'-3"	0'-5¼"	2'-4½"	4'-2¾"			28	40	23'-0"
		7'			13	19	31'-9"	0'-5¼"	2'-5½"	4'-3¾"			28	40	23'-4"
	5 @ 6'	4'	#6	12"	11	16	36'-2"	0'-6¾"	2'-6½"	4'-10"	#7	12"	22	32	26'-8"
		5'			11	16	36'-4"	0'-6¾"	2'-6½"	4'-11"			22	32	26'-8"
		6'			11	16	36'-10"	0'-6¾"	2'-7½"	5'-0"			22	32	27'-0"
		7'			11	16	37'-3"	0'-6¾"	2'-8½"	5'-0¾"			22	32	27'-4"
		8'			11	16	37'-5"	0'-6¾"	2'-8½"	5'-1½"			22	32	27'-4"
"F"	5 @ 4'	3'	#5	12"	Varies with Length of Barrel	Varies with Length of Barrel	25'-5"	0'-4½"	1'-11"	3'-4½"	#6	12"	Varies with Length of Barrel	Varies with Length of Barrel	18'-8"
		4'					25'-5"	0'-4½"	1'-11"	3'-4½"					18'-8"
		5'					25'-7"	0'-4½"	1'-11"	3'-5½"					18'-8"
		6'					26'-1"	0'-4½"	2'-0"	3'-6½"					19'-0"
	5 @ 5'	3'	#6	13"			30'-11"	0'-5¾"	2'-2½"	4'-1"	#7	13"			22'-8"
		4'					31'-0"	0'-5¾"	2'-2½"	4'-1½"					22'-8"
		5'					31'-1"	0'-5¾"	2'-2½"	4'-2"					22'-8"
		6'					31'-7"	0'-5¾"	2'-3½"	4'-3"					23'-0"
		7'					32'-1"	0'-5¾"	2'-4½"	4'-4"					23'-4"
	5 @ 6'	4'	#6	11"			36'-5"	0'-7¼"	2'-5½"	4'-10½"	#7	11"			26'-8"
		5'					36'-7"	0'-7¼"	2'-5½"	4'-11½"					26'-8"
		6'					37'-1"	0'-7¼"	2'-6½"	5'-0½"					27'-0"
		7'					37'-7"	0'-7¼"	2'-7½"	5'-1½"					27'-4"
		8'					37'-8"	0'-7¼"	2'-7½"	5'-2½"					27'-4"

Section & Bar Group	Clear Span S	Clear Height H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length
"A"	5 @ 4'	3'	#4	12"	38	33'-3" for 32'-0" Section	#4	12"	30	33'-3" for 32'-0" Section	#4	12"	38	34'-3" for 32'-0" Section	#4	12"	220	320	3'-9"
		4'			38				40				38				220	320	4'-9"
		5'			38				50				38				220	320	5'-9"
		6'			38				60				38				220	320	6'-9"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	220	320	3'-10"
		4'			43				40				43				220	320	4'-10"
		5'			43				50				43				220	320	5'-10"
		6'			43				60				43				220	320	6'-10"
		7'			43				70				43		#5	12"	220	320	7'-10"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"	220	320	4'-11"
		5'			48				50				48				220	320	5'-11"
		6'			48				60				48				220	320	6'-11"
		7'			48				70				48		#5	12"	220	320	7'-11"
		8'			48				80				48			11"	240	350	8'-11"
"B"	5 @ 4'	3'	#4	12"	38	34'-3" for 33'-0" Length Section (Sections B to E)	#4	12"	30	34'-3" for 33'-0" Length Section (Sections B to E)	#4	12"	38	34'-3" for 33'-0" Length Section (Sections B to E)	#4	12"	110	160	3'-9"
		4'			38				40				38				110	160	4'-9"
		5'			38				50				38				110	160	5'-9"
		6'			38				60				38		#5	12"	110	160	6'-9"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	110	160	3'-11"
		4'			43				40				43				110	160	4'-11"
		5'			43				50				43				110	160	5'-11"
		6'			43				60				43			10"	140	200	6'-11"
		7'			43				70				43		#5	11"	120	180	7'-11"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"	110	160	5'-1"
		5'			48				50				48				110	160	6'-1"
		6'			48				60				48			10"	140	200	7'-1"
		7'			48				70				48		#5	11"	120	180	8'-1"
		8'			48				80				48		#6	12"	110	160	9'-1"
"C"	5 @ 4'	3'	#4	12"	38		#4	12"	30		#4	12"	38		#4	12"	110	160	3'-10"
		4'			38				40				38				110	160	4'-10"
		5'			38				50				38		#5	12"	110	160	5'-10"
		6'			38				60				38			11"	120	180	6'-10"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	110	160	4'-0"
		4'			43				40				43				110	160	5'-0"
		5'			43				50				43			10"	140	200	6'-0"
		6'			43				60				43		#5	12"	110	160	7'-0"
		7'			43				70				43		#6	12"	110	160	8'-0"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"	110	160	5'-2"
		5'			48				50				48			10"	140	200	6'-2"
		6'			48				60				48		#5	12"	110	160	7'-2"
		7'			48				70				48		#6	12"	110	160	8'-2"
		8'			48				80				48			10"	140	190	9'-2"
"D"	5 @ 4'	3'	#4	12"	38		#4	12"	30		#4	12"	38		#4	12"	110	160	3'-11"
		4'			38				40				38				110	160	4'-11"
		5'			38				50				38		#5	11"	120	180	5'-11"
		6'			38				60				38		#6	12"	110	160	6'-11"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	110	160	4'-1"
		4'			43				40				43				110	160	5'-1"
		5'			43				50				43		#5	12"	110	160	6'-1"
		6'			43				60				43		#6	12"	110	160	7'-1"
		7'			43				70				43			11"	120	170	8'-1"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"	110	160	5'-3"
		5'			48				50				48			10"	130	190	6'-3"
		6'			48				60				48		#5	11"	120	170	7'-3"
		7'			48				70				48		#6	12"	110	160	8'-3"
		8'			48				80				48			9"	140	220	9'-3"
"E"	5 @ 4'	3'	#4	12"	38		#4	12"	30		#4	12"	38		#4	12"	110	160	4'-0"
		4'			38				40				38				110	160	5'-0"
		5'			38				50				38		#5	11"	120	170	6'-0"
		6'			38				60				38		#6	12"	110	160	7'-0"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"	110	160	4'-2"
		4'			43				40				43				110	160	5'-2"
		5'			43				50				43		#5	12"	110	160	6'-2"
		6'			43				60				43		#6	12"	110	160	7'-2"
		7'			43				70				43			10"	140	200	8'-2"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"	110	160	5'-5"
		5'			48				50				48			10"	130	190	6'-5"
		6'			48				60				48		#5	11"	120	180	7'-5"
		7'			48				70				48		#6	12"	110	160	8'-5"
		8'			48				80				48			9"	150	210	9'-5"
"F"	5 @ 4'	3'	#4	12"	38	Varies with Length of Barrel	#4	12"	30	Varies with Length of Barrel	#4	12"	38	Varies with Length of Barrel	#4	12"	Varies with Length of Barrel	Varies with Length of Barrel	4'-0"
		4'			38				40				38						5'-0"
		5'			38				50				38		#5	11"			6'-0"
		6'			38				60				38		#6	12"			7'-0"
	5 @ 5'	3'	#4	12"	43		#4	12"	30		#4	12"	43		#4	12"			4'-3"
		4'			43				40				43						5'-3"
		5'			43				50				43		#5	12"			6'-3"
		6'			43				60				43		#6	12"			7'-3"
		7'			43				70				43			10"			8'-3"
	5 @ 6'	4'	#4	12"	48		#4	12"	40		#4	12"	48		#4	12"			5'-6"
		5'			48				50				48			10"			6'-6"
		6'			48				60				48		#5	11"			7'-6"
		7'			48				70				48		#6	12"			8'-6"
		8'			48				80				48			9"			9'-6"

NOTE:- Bars for each Section to be marked with the Section letter, thus for Section B, the bars should be marked Ba, Bb, Bb2, Bc, Bd, Bd1, Be and Bf.

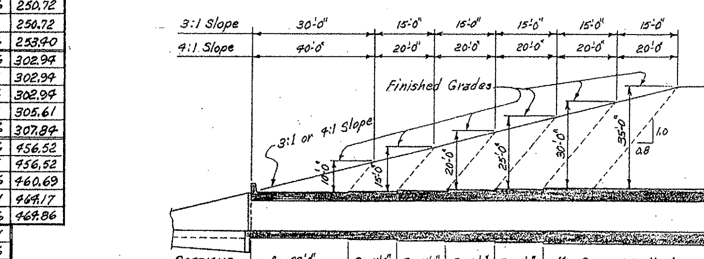
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
Section "A" = 10'-0"	5 @ 4'	3'	60	23'-8"	6"	6"	8"	6"	4'-0"	1.284	185.37	88.51	250.72
		4'	80	23'-8"		6"	8"		5'-0"	1.420	198.73	96.86	250.72
		5'	100	23'-8"		6"	8"		6'-0"	1.556	212.09	105.21	250.72
		6'	120	24'-2"		7"	9"		7'-0"	1.821	227.23	113.56	253.40
	5 @ 5'	3'	75	28'-8"	6½"	6"	8"	6½"	4'-1"	1.558	239.82	96.86	302.94
		4'	100	28'-8"		6"	8"		5'-1"	1.693	253.18	105.21	302.94
		5'	125	28'-8"		6"	8"		6'-1"	1.829	266.54	113.56	302.94
		6'	150	29'-2"		7"	9"		7'-1"	2.096	282.11	121.91	305.61
		7'	175	29'-7"		7½"	10"		8'-1"	2.375	326.82	130.26	307.84
	5 @ 6'	4'	120	33'-8"	7"	6"	8"	7¼"	5'-2¼"	2.024	329.70	113.56	456.52
		5'	150	33'-8"		6"	8"		6'-2¼"	2.160	343.06	121.91	456.52
		6'	180	34'-2"		7"	9"		7'-2¼"	2.429	359.27	130.26	460.69
		7'	210	34'-7"		7½"	10"		8'-2¼"	2.709	404.84	138.61	464.17
		8'	240	34'-8"		8"	10"		9'-2¼"	2.907	430.73	146.96	464.86
Section "B" = 15'-0"	5 @ 4'	3'	60	23'-8"	6"	6"	8"	6¼"	4'-0¼"	1.302	199.43	88.51	
		4'	80	23'-8"		6"	8"		5'-0¼"	1.438	212.79	96.86	
		5'	100	23'-8"		6"	8"		6'-0¼"	1.574	226.15	105.21	
		6'	120	24'-2"		7"	9"		7'-0¼"	1.840	266.85	113.56	
	5 @ 5'	3'	75	28'-8"	6¾"	6"	8"	7¼"	4'-2"	1.646	259.56	96.86	
		4'	100	28'-8"		6"	8"		5'-2"	1.782	272.92	105.21	
		5'	125	28'-8"		6"	8"		6'-2"	1.918	286.28	113.56	
		6'	150	29'-2"		7"	9"		7'-2"	2.186	311.38	121.91	
		7'	175	29'-7"		7½"	10"		8'-2"	2.467	354.93	130.26	
	5 @ 6'	4'	120	33'-8"	7¾"	6"	8"	8¼"	5'-4"	2.206	348.50	113.56	
		5'	150	33'-8"		6"	8"		6'-4"	2.342	361.86	121.91	
		6'	180	34'-2"		7"	9"		7'-4"	2.613	387.77	130.26	
		7'	210	34'-7"		7½"	10"		8'-4"	2.896	432.38	138.61	
		8'	240	34'-8"		8"	10"		9'-4"	3.095	483.87	146.96	
Section "C" = 20'-0"	5 @ 4'	3'	60	23'-8"	6¼"	6"	8"	6¾"	4'-1"	1.357	209.38	88.51	
		4'	80	23'-8"		6"	8"		5'-1"	1.493	222.74	96.86	
		5'	100	23'-8"		6"	8"		6'-1"	1.629	257.97	105.21	
		6'	120	24'-2"		7"	9"		7'-1"	1.896	283.78	113.56	
	5 @ 5'	3'	75	28'-8"	7¼"	6"	8"	7¾"	4'-3"	1.735	273.37	96.86	
		4'	100	28'-8"		6"	8"		5'-3"	1.870	286.73	105.21	
		5'	125	28'-8"		6"	8"		6'-3"	2.006	308.10	113.56	
		6'	150	29'-2"		7"	9"		7'-3"	2.276	342.41	121.91	
		7'	175	29'-7"		7½"	10"		8'-3"	2.558	398.66	130.26	
	5 @ 6'	4'	120	33'-8"	8¼"	6"	8"	8¾"	5'-5"	2.310	378.31	113.56	
		5'	150	33'-8"		6"	8"		6'-5"	2.445	399.91	121.91	
		6'	180	34'-2"		7"	9"		7'-5"	2.719	435.35	130.26	
		7'	210	34'-7"		7½"	10"		8'-5"	3.003	493.05	138.61	
		8'	240	34'-8"		8"	10"		9'-5"	3.202	542.63	146.96	
Section "D" = 25'-0"	5 @ 4'	3'	60	23'-8"	6¾"	6"	8"	7¼"	4'-2"	1.430	219.61	88.51	
		4'	80	23'-8"		6"	8"		5'-2"	1.566	232.97	96.86	
		5'	100	23'-8"		6"	8"		6'-2"	1.702	279.12	105.21	
		6'	120	24'-2"		7"	9"		7'-2"	1.970	319.78	113.56	
	5 @ 5'	3'	75	28'-8"	7¾"	6"	8"	8¼"	4'-4"	1.823	289.68	96.86	
		4'	100	28'-8"		6"	8"		5'-4"	1.959	303.04	105.21	
		5'	125	28'-8½"		6½"	8"		6'-4"	2.104	339.31	113.56	
		6'	150	29'-2"		7"	9"		7'-4"	2.366	391.79	121.91	
		7'	175	29'-8"		8"	10"		8'-4"	2.675	427.49	130.26	
	5 @ 6'	4'	120	33'-8"	9"	6"	8"	9½"	5'-6½"	2.466	390.49	113.56	
		5'	150	33'-9"		6½"	8"		6'-6½"	2.622	412.59	121.91	
		6'	180	34'-2½"		7¼"	9"		7'-6½"	2.888	454.99	130.26	
		7'	210	34'-8"		8"	10"		8'-6½"	3.189	506.58	138.61	
		8'	240	34'-9½"		8¾"	10"		9'-6½"	3.406	575.10	146.96	
Section "E" = 30'-0"	5 @ 4'	3'	60	23'-8"	7¼"	6"	8"	7¾"	4'-3"	1.503	231.60	88.51	
		4'	80	23'-8"		6"	8"		5'-3"	1.639	244.96	96.86	
		5'	100	23'-9"		6½"	8"		6'-3"	1.794	286.82	105.21	
		6'	120	24'-3"		7½"	9"		7'-3"	2.067	332.99	113.56	
	5 @ 5'	3'	75	28'-8"	8¼"	6"	8"	8¾"	4'-5"	1.912	309.14	96.86	
		4'	100	28'-8"		6"	8"		5'-5"	2.047	322.50	105.21	
		5'	125	28'-9½"		6¾"	8"		6'-5"	2.213	359.33	113.56	
		6'	150	29'-3"		7½"	9"		7'-5"	2.479	412.59	121.91	
		7'	175	29'-9"		8½"	10"		8'-5"	2.792	462.08	130.26	
	5 @ 6'	4'	120	33'-8"	9¾"	6"	8"	10¼"	5'-8"	2.621	414.15	113.56	
		5'	150	33'-10"		7"	8"		6'-8"	2.798	436.93	121.91	
		6'	180	34'-4"		8"	9"		7'-8"	3.082	480.47	130.26	
		7'	210	34'-9½"		8¾"	10"		8'-8"	3.390	532.79	138.61	
		8'	240	34'-11"		9½"	10"		9'-8"	3.612	602.36	146.96	
Section "F" = 35'-0"	5 @ 4'	3'	60	23'-8"	7½"	6"	8"	8"	4'-3½"	1.540	255.30	88.51	
		4'	80	23'-8"		6"	8"		5'-3½"	1.675	268.66	96.86	
		5'	100	23'-10"		7"	8"		6'-3½"	1.850	310.90	105.21	
		6'	120	24'-4"		8"	9"		7'-3½"	2.127	357.54	113.56	
	5 @ 5'	3'	75	28'-8"	8¾"	6"	8"	9¼"	4'-6"	2.000	331.63	96.86	
		4'	100	28'-9"		6½"	8"		5'-6"	2.153	345.38	105.21	
		5'	125	28'-10"		7"	8"		6'-6"	2.312	382.57	113.56	
		6'	150	29'-4"		8"	9"		7'-6"	2.593	436.56	121.91	
		7'	175	29'-10"		9"	10"		8'-6"	2.910	486.65	130.26	
	5 @ 6'	4'	120	33'-9"	10¼"	6½"	8"	10¾"	5'-9"	2.743	441.81	113.56	
		5'	150	33'-11"		7½"	8"		6'-9"	2.924	464.78	121.91	
		6'	180	34'-5"		8½"	9"		7'-9"	3.212	508.96	130.26	
		7'	210	34'-11"		9½"	10"		8'-9"	3.538	562.24	138.61	
		8'	240	35'-0½"		10¼"	10"		9'-9"	3.765	632.10	146.96	

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

Depths of Cover	A	B	C	D	E		Mid-Section and Bar Group
5.0' to 9.5'	✓						A
10.0' to 14.5'	✓						B
15.0' to 19.5'	✓	✓					C
20.0' to 24.5'	✓	✓	✓				D
25.0' to 29.5'	✓	✓	✓	✓			E
30.0' to 35.0'	✓	✓	✓	✓	✓		F

(Columns A–E: Sections & Bar Groups for End Sections)

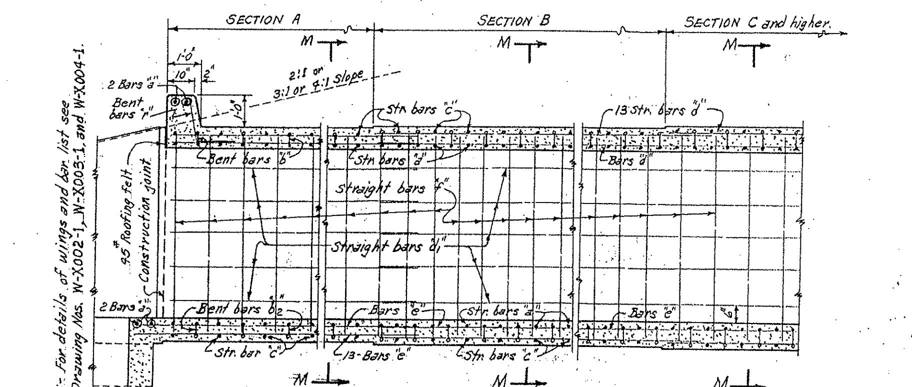


NOTE:- See Table above for SECTIONS and Bar Groups to be used for Various Depths of Cover.

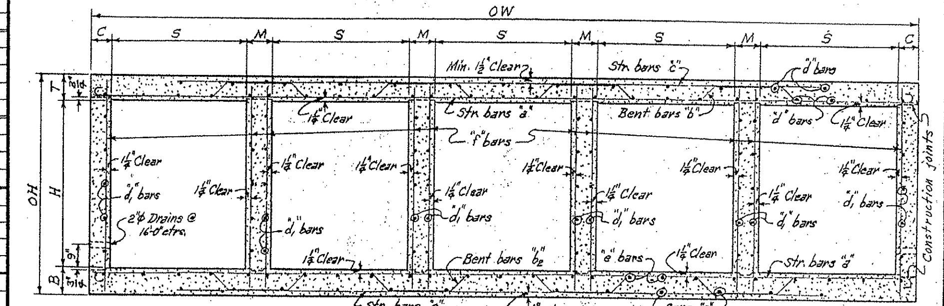
		A	B	C	D	E	
3:1 Slope =	Sections	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	Mid-Section F - Varies
	Bar Group	A	B	C	D	E	F
4:1 Slope =	Sections	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	Mid-Section F - Varies
	Bar Group	A	B	C	D	E	F

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections, with Bar Groups to be shown on Cross Section Sheets.



PART LONGITUDINAL SECTION

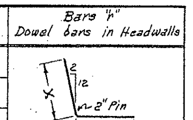


TYPICAL SECTION M-M

DOWEL BARS FOR TWO HEADWALLS

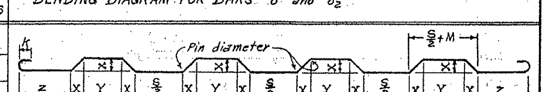
Span	Size	Spacing	No. Req'd	Length	X
4'	#4	12"±	48	2'-4"	1'-2"
5'	#4	12"±	58	2'-5"	1'-2½"
6'	#4	12"±	68	2'-6"	1'-3"

Bars "h" Dowel bars in Headwalls



Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4½"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" and "b2"



NOTE:- Dimensions are to centers of bars (b & b2).

LENGTH OF SECTIONS FOR SKEWED CULVERTS

Skew Angle	Sec. of Skew Angle	3:1 Slopes Sections A	3:1 Slopes Sections B, C, D or E	4:1 Slopes Sections A	4:1 Slopes Sections B, C, D or E
0°	1.0	22.0'	11.0'	32.0'	16.0'
15°	1.0353	22.776'	11.388'	33.129'	16.564'
30°	1.1547	*	12.702'	*	18.475'
45°	1.4142	*	15.556'	*	22.627'

* Variable, see Drawings for Skewed Culverts.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X002-1, W-X003-1 and W-X004-1.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

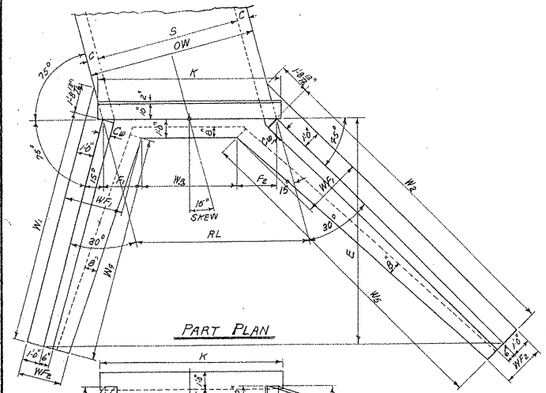
DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

4', 5' & 6' SPANS — 3:1 OR 4:1 SLOPES
QUINTUPLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-500X-X1

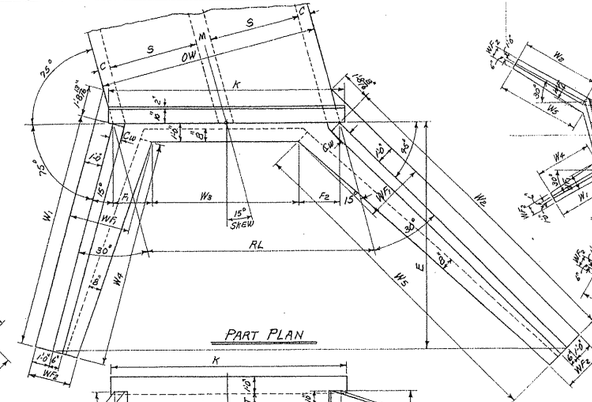
Designed by:- W.C.H. 10-3-62 — Checked by:- RHS 11-14-62
Drawn by:- W.C.H. 10-26-62 — Checked by:- RHS 11-26-62
Quantities by:- W.C.H. 11-16-62 — Checked by:- RHS 11-28-62

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



SINGLE BARREL CULVERT-15° SKEW RIGHT FORWARD

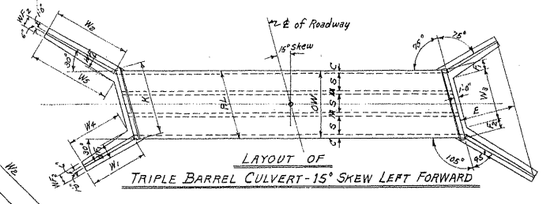
Details of Culvert with 15° Skew Left Forward is reversed, see Layout below.



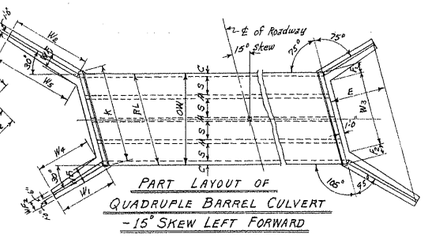
DOUBLE BARREL CULVERT-15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed, see Layout below.

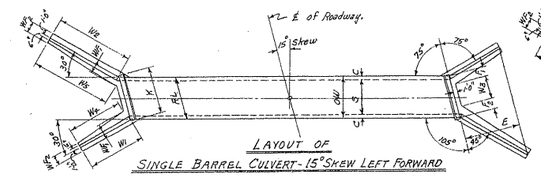
Note:- Plans and Elevations are not to scale.



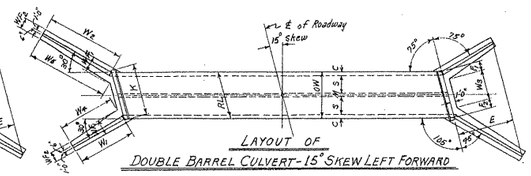
LAYOUT OF TRIPLE BARREL CULVERT-15° SKEW LEFT FORWARD



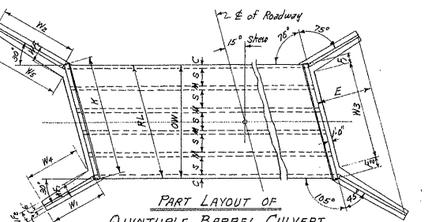
PART LAYOUT OF QUADRUPLE BARREL CULVERT -15° SKEW LEFT FORWARD



LAYOUT OF SINGLE BARREL CULVERT-15° SKEW LEFT FORWARD

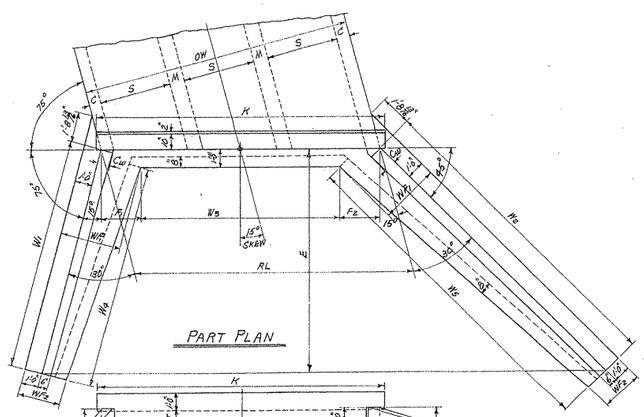


LAYOUT OF DOUBLE BARREL CULVERT-15° SKEW LEFT FORWARD



PART LAYOUT OF QUINTUPLE BARREL CULVERT -15° SKEW LEFT FORWARD

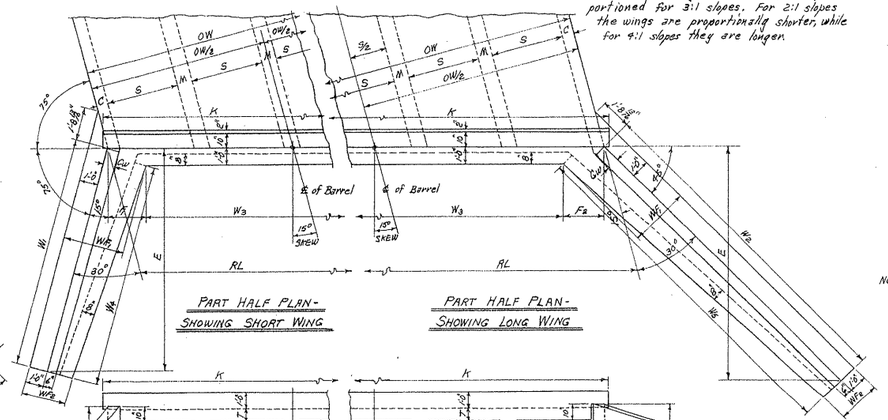
Note:- The length of the wings for the Plans, Elevations, and Layouts, as drawn, are proportioned for 3:1 slopes. For 2:1 slopes the wings are proportionally shorter, while for 4:1 slopes they are longer.



TRIPLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed, see Layout at top center of sheet.

Note:- Plans and Elevations are not to scale.



QUADRUPLE BARREL CULVERT- 15° SKEW RT. FWD.

Details of Culvert with 15° Skew Left Forward is reversed, see Layout at above center.

QUINTUPLE BARREL CULVERT- 15° SKEW RT. FWD.

Details of Culvert with 15° Skew Left Forward is reversed, see Layout above.

ROADWAY LENGTH RL — HEADWALL LENGTH K — APRON DIMENSION W_3

$RL = OW \times 1.035276$ — $K = RL + (6\frac{1}{2}'')$ — $W_3 = RL - (F_1 + F_2)$

USE WITH DRAWING No.	CLEAR SPAN S	CLEAR HEIGHT H	SUM OF SLOPE DIMENSIONS F_1 & F_2	SINGLE BARREL CULVERT OW	RL	K	W_3	DOUBLE BARREL CULVERT OW	RL	K	W_3	TRIPLE BARREL CULVERT OW	RL	K	W_3	QUADRUPLE BARREL CULVERT OW	RL	K	W_3	QUINTUPLE BARREL CULVERT OW	RL	K	W_3
W-X152-1, W-X153-1 OR W-X154-1 (FOR H=8'0" OR LESS)	4'	2'	2'-0"	5'-0"	5'-2 1/8"	5'-8 5/8"	3'-2 1/8"	9'-8"	10'-0"	10'-6 1/2"	8'-0"	14'-4"	14'-10"	15'-4 1/2"	12'-10"	19'-0"	19'-8"	20'-2 1/2"	17'-8"	23'-8"	24'-6"	25'-0 1/2"	22'-6"
		3'	2'-9 3/8"	5'-0"	"	"	2'-9 3/8"	9'-8"	"	"	7'-2 1/8"	14'-4"	"	"	12'-0 1/2"	19'-0"	"	"	16'-10 1/2"	23'-8"	"	"	21'-8 1/2"
		4'	3'-7 1/2"	5'-0"	"	"	1'-6 1/2"	9'-8"	"	"	6'-7 1/2"	14'-4"	"	"	11'-2 1/2"	19'-0"	"	"	16'-0 1/2"	23'-8"	"	"	20'-10 1/2"
		5'	4'-5 3/8"	5'-0"	"	"	0'-8 3/8"	9'-8"	"	"	5'-6 3/8"	14'-4"	"	"	10'-9 3/8"	19'-0"	"	"	15'-8 3/8"	23'-8"	"	"	20'-0 3/8"
		6'	5'-3 1/2"	5'-2"	5'-9 3/8"	5'-10 3/8"	0'-1"	9'-11"	10'-3 3/8"	10'-9 3/8"	5'-0"	14'-8"	15'-2 1/8"	15'-6 3/8"	9'-11"	19'-5"	20'-1 1/8"	20'-7 3/8"	14'-10"	24'-2"	25'-0 1/8"	25'-6 3/8"	19'-9"
	5'	3'	2'-9 3/8"	6'-0"	6'-2 1/2"	6'-9"	3'-4 1/2"	11'-8"	12'-1"	12'-7 1/2"	9'-3 1/8"	17'-4"	17'-11 3/8"	18'-3 3/8"	15'-1 1/2"	23'-0"	23'-9 3/8"	24'-4 3/8"	21'-0"	28'-8"	29'-8 1/8"	30'-2 1/2"	26'-10 1/2"
		4'	3'-7 1/2"	6'-0"	"	"	2'-7"	11'-8"	"	"	8'-5 1/8"	17'-4"	"	"	14'-3 1/8"	23'-0"	"	"	20'-2 1/8"	28'-8"	"	"	26'-0 1/8"
		5'	4'-5 3/8"	6'-0"	"	"	1'-9 1/8"	11'-8"	"	"	7'-7 1/8"	17'-4"	"	"	13'-6"	23'-0"	"	"	19'-4 1/2"	28'-8"	"	"	25'-2 1/2"
		6'	5'-3 1/2"	6'-2"	6'-9 1/2"	6'-11 1/8"	1'-1 1/2"	11'-11"	12'-4"	12'-10 1/8"	7'-10 1/8"	17'-8"	18'-3 1/2"	18'-10"	13'-10 1/8"	23'-5"	24'-2 1/8"	24'-9 1/2"	18'-11 3/8"	29'-2"	30'-2 1/2"	30'-8 1/2"	24'-11 1/8"
		7'	6'-5 1/2"	6'-3"	6'-5 3/8"	7'-0 1/8"	Ⓐ 0"	12'-1"	12'-6 1/8"	13'-0 1/2"	6'-0 1/8"	17'-11"	18'-6 1/8"	19'-1"	12'-0 1/8"	23'-9"	24'-7"	25'-1 1/2"	18'-1 1/8"	29'-7"	30'-7 1/2"	31'-2"	24'-1 1/8"
	6'	3'	2'-9 3/8"	7'-0"	7'-3"	7'-9 1/2"	4'-5 1/2"	13'-8"	14'-1 3/8"	14'-8 1/8"	11'-9"	20'-4"	21'-0 1/2"	21'-7"	18'-2 1/2"	27'-0"	27'-11 3/8"	28'-5 1/2"	25'-1 1/2"	33'-8"	34'-10 1/8"	35'-4 1/2"	32'-0 1/8"
		4'	3'-7 1/2"	7'-0"	"	"	3'-7 1/2"	13'-8"	"	"	10'-6 1/2"	20'-4"	"	"	17'-5"	27'-0"	"	"	24'-3 1/2"	33'-8"	"	"	31'-2 1/2"
		5'	4'-5 3/8"	7'-0"	"	"	2'-5 1/2"	13'-8"	"	"	9'-3 1/8"	20'-4"	"	"	14'-7 1/2"	27'-0"	"	"	23'-6"	33'-8"	"	"	30'-10 1/2"
		6'	5'-3 1/2"	7'-2"	7'-5"	7'-11 1/2"	2'-1 1/2"	13'-11"	14'-5"	14'-11 1/2"	9'-1 1/8"	20'-8"	21'-4 1/2"	21'-11 1/2"	16'-1 1/2"	27'-5"	28'-4 1/2"	28'-11"	23'-1 1/2"	34'-2"	35'-4 1/2"	35'-11"	30'-1 1/2"
		7'	6'-5 1/2"	7'-3"	7'-6"	8'-0 1/8"	1'-0 1/8"	14'-1"	14'-7"	15'-1 1/2"	8'-1 1/8"	20'-11"	21'-7 1/8"	22'-2 1/8"	15'-2"	27'-9"	28'-8 3/8"	29'-3 1/8"	22'-3"	34'-7"	35'-9 1/8"	36'-4"	29'-3 1/2"
		8'	7'-8 3/8"	7'-4"	7'-7 1/2"	8'-1 1/8"	Ⓐ 0"	14'-2"	14'-8"	15'-2 1/8"	6'-11 3/8"	21'-0"	21'-8 3/8"	22'-3 1/8"	14'-0 1/8"	27'-10"	28'-9 3/8"	29'-4 1/8"	21'-11 1/8"	34'-8"	35'-10 1/8"	36'-5"	28'-8"
	7'	4'	3'-7 1/2"	8'-0"	8'-3 3/8"	8'-9 3/8"	4'-7 1/8"	15'-8"	16'-2 1/8"	16'-9"	12'-7"	23'-4"	24'-1 1/8"	24'-10 1/8"	20'-6 1/8"	31'-0"	32'-1 1/8"	32'-7 1/8"	28'-5 1/2"	38'-8"	40'-0 3/8"	40'-6 3/8"	36'-7 3/8"
		5'	4'-5 3/8"	8'-0"	"	"	3'-10"	15'-8"	"	"	11'-3 1/8"	23'-4"	"	"	19'-8 1/8"	31'-0"	"	"	27'-7 1/8"	38'-8"	"	"	35'-7"
		6'	5'-3 1/2"	8'-2"	8'-5 1/2"	9'-0"	3'-2 1/8"	15'-11"	16'-5 3/8"	17'-0 1/8"	11'-2 1/8"	23'-8"	24'-4"	25'-0 1/8"	19'-2 1/8"	31'-5"	32'-6 1/8"	33'-0 1/8"	27'-3"	39'-2"	40'-6 1/8"	41'-1"	35'-3 1/2"
		7'	6'-5 1/2"	8'-3"	8'-6 1/2"	9'-1"	2'-0 1/8"	16'-1"	16'-7 1/8"	17'-2 1/8"	10'-2"	23'-11"	24'-9 1/8"	25'-3 1/2"	18'-3 1/8"	31'-9"	32'-10 1/8"	33'-5"	26'-4 1/8"	39'-7"	40'-11 1/8"	41'-6 1/8"	39'-6"
		8'	7'-8 3/8"	8'-4"	8'-7 1/2"	9'-2"	0'-11"	16'-2"	16'-8 1/8"	17'-3 1/8"	9'-0 1/8"	24'-0"	24'-10 1/8"	25'-3 1/2"	17'-1 1/8"	31'-10"	32'-11 1/2"	33'-6"	25'-3"	39'-8"	41'-0 1/8"	41'-7 1/8"	33'-9 1/2"
	8'	4'	3'-7 1/2"	9'-0"	9'-3 3/8"	9'-10 1/8"	5'-8 1/8"	17'-8"	18'-3 1/8"	18'-10"	14'-8"	26'-4"	27'-3 1/8"	27'-10 1/2"	23'-7 1/8"	35'-0"	36'-12 1/8"	36'-9 1/8"	32'-7 1/8"	43'-8"	45'-2 1/2"	45'-9"	41'-7"
		5'	4'-5 3/8"	9'-2"	9'-5 1/2"	10'-0 1/8"	5'-0 1/8"	17'-11"	18'-6 1/8"	19'-1"	14'-1 1/2"	26'-8"	27'-7 1/8"	28'-1 1/2"	23'-2"	35'-5"	36'-8"	37'-2 1/2"	32'-2 1/8"	44'-2"	45'-8 1/2"	46'-3 1/8"	41'-3 1/8"
		6'	5'-3 1/2"	9'-2"	"	"	4'-3 1/8"	17'-11"	"	"	13'-3 1/8"	26'-8"	"	"	22'-4"	36'-5"	"	"	31'-9 1/8"	44'-2"	"	"	40'-5 1/2"
		7'	6'-5 1/2"	9'-3"	9'-6 1/2"	10'-1 1/8"	3'-1"	18'-1"	18'-8 1/8"	19'-3"	12'-2 1/8"	26'-11"	27'-10 1/8"	28'-4 1/2"	21'-4 1/2"	35'-9"	37'-0 1/2"	37'-6 1/2"	30'-6 1/2"	44'-7"	46'-1 1/2"	46'-8 1/2"	39'-8"
		8'	7'-8 3/8"	9'-4"	9'-7"	10'-2 1/2"	1'-11 1/2"	18'-2"	18'-9 1/2"	19'-4 1/2"	11'-1 1/8"	27'-0"	27'-11 1/2"	28'-5 1/8"	20'-3 1/2"	35'-10"	37'-1 1/2"	37'-7 1/2"	29'-1 1/2"	44'-8"	46'-2 1/2"	46'-9 1/2"	38'-6 1/2"
	9'	5'	4'-5 3/8"	10'-2"	10'-6 1/2"	11'-0 1/8"	6'-1"	19'-11"	20'-7 1/2"	21'-2"	16'-2"	29'-8"	30'-8 1/2"	31'-3"	26'-3 1/2"	39'-5"	40'-9 1/2"	41'-4 1/2"	36'-9 1/2"	49'-2"	50'-10 1/2"	51'-5 1/2"	46'-5 1/2"
		6'	5'-3 1/2"	10'-3"	10'-7 3/8"	11'-1 3/8"	5'-9 1/8"	20'-1"	20'-9 1/2"	21'-4"	15'-6 1/8"	29'-11"	30'-11 1/8"	31'-6"	25'-8 1/2"	39'-9"	41'-1 1/2"	41'-8 1/8"	35'-10 1/2"	49'-7"	51'-4"	51'-10 1/2"	46'-0 1/8"
		7'	6'-5 1/2"	10'-3"	"	"	4'-7 1/2"	20'-1"	"	"	14'-9 3/8"	29'-11"	"	"	24'-5 1/8"	39'-9"	"	"	34'-1 8"	49'-7"	"	"	44'-1 1/8"
		8'	7'-8 3/8"	10'-4"	10'-8 3/8"	11'-2 3/8"	2'-11 3/8"	20'-2"	20'-10 1/2"	21'-5"	13'-2"	30'-0"	31'-0 3/8"	31'-7 1/8"	23'-9 1/8"	39'-10"	41'-2 1/2"	41'-9 1/8"	33'-4 1/8"	49'-8"	51'-5"	51'-11 1/2"	43'-3 1/8"
	10'	5'	4'-5 3/8"	11'-2"	11'-6 1/2"	12'-1 1/8"	7'-1 1/8"	21'-11"	22'-8 1/8"	23'-3 1/8"	18'-9"	32'-8"	33'-9 1/2"	34'-4 1/8"	29'-4 1/8"	43'-5"	44'-11 1/2"	45'-6"	40'-6"	54'-2"	56'-1"	56'-7 1/2"	51'-7 1/2"
		6'	5'-3 1/2"	11'-3"	11'-7 3/8"	12'-2 1/8"	6'-9 1/8"	22'-1"	22'-10 1/8"	23'-4 1/8"	17'-7 1/8"	32'-11"	34'-1"	34'-7 1/2"	28'-3 1/8"	43'-9"	45'-3 1/2"	45'-10"	40'-0 1/8"	54'-7"	56'-6"	57'-0 1/2"	51'-3"
		7'	6'-5 1/2"	11'-3"	"	"	5'-7 1/2"	22'-1"	"	"	16'-6 1/8"	32'-11"	"	"	27'-1"	43'-9"	"	"	38'-3 1/8"	54'-7"	"	"	50'-0 1/8"
		8'	7'-8 3/8"	11'-4"	11'-8 3/8"	12'-3 1/8"	4'-0 1/8"	22'-2"	22'-11 1/2"	23'-5 1/8"	15'-2 1/8"	33'-0"	34'-2"	34'-8 1/2"	26'-5 1/8"	43'-10"	45'-4 1/2"	45'-11"	37'-8"	54'-8"	56'-7 1/2"	57'-1 1/2"	48'-10 1/2"
	11'	6'	5'-3 1/2"	12'-0"	12'-3 1/2"	12'-9 1/2"	7'-6"	24'-2"	25'-0 1/2"	25'-6 1/2"	19'-9"	36'-0"	37'-3 1/2"	37'-9 1/2"	32'-0"	47'-10"	49'-6 1/2"	50'-0 1/2"	44'-3"	—	—	—	—
		7'	6'-5 1/2"	12'-0"	"	"	6'-3 1/2"	24'-2"	"	"	18'-6 1/2"	36'-0"	"	"	30'-9 1/2"	47'-10"	"	"	43'-0 1/2"	—	—	—	—
		8'	7'-8 3/8"	12'-0"	"	"	5'-0 1/8"	24'-2"	"	"	17'-3 1/8"	36'-0"	"	"	29'-6 1/2"	47'-10"	"	"	41'-9 1/8"	—	—	—	—
	12'	6'	5'-3 1/2"	13'-9"	13'-12 1/8"	14'-0"	8'-6 1/2"	26'-6"	27'-1"	27'-7 1/2"	21'-10"	39'-0"	40'-6 1/2"	40'-11"	35'-1 1/8"	51'-10"	53'-8"	54'-2 1/2"	48'-9 1/2"	—	—	—	—
		7'	6'-5 1/2"	13'-9"	"	"	7'-3 1/2"	26'-6"	"	"	20'-7 1/2"	39'-0"	"	"	33'-10 1/2"	51'-10"	"	"	46'-7 1/2"	—	—	—	—
		8'	7'-8 3/8"	13'-9"	"	"	6'-1"	26'-6"	"	"	19'-4 1/2"	39'-0"	"	"	32'-8"	51'-10"	"	"	45'-11 1/2"	—	—	—	—
W-X152-2, W-X153-2 OR W-X154-2 (FOR H=9'0" & OVER)	7'	9'	8'-11 1/8"	8'-6"	8'-9 3/8"	9'-4"	Ⓐ 0"	16'-5"	17'-0"	17'-6 1/2"	8'-0 1/8"	24'-4"	25'-2 1/2"	25'-8 1/8"	16'-3"	32'-8"	33'-4 1/2"	33'-11"	24'-5 1/2"	40'-2"	41'-7"	42'-1 1/2"	32'-7 1/8"
	8'	9'	8'-11 1/2"	9'-6"	9'-10"	10'-4 1/2"	0'-10 3/8"	18'-5"	19'-0 1/8"	19'-7 1/8"	10'-1 1/2"	27'-4"	28'-3 1/8"	28'-10"	19'-4 1/8"	36'-3"	37'-4 1/2"	38'-0 1/8"	28'-7"	45'-2"	46'-9 1/8"	47'-3 1/8"	37'-9 1/8"
		10'	10'-2"	9'-8"	10'-0 1/8"	10'-6 1/2"	Ⓐ 0"	18'-8"	19'-3 1/8"	19'-10 1/8"	9'-2"	27'-8"	28'-7 1/8"	29'-2 1/8"	18'-5 1/8"	36'-8"	37'-11 1/2"	38'-6"	27'-3 1/2"	45'-8"	47'-3 1/8"	47'-9 1/8"	37'-1 1/2"
	9'	9'	8'-11 1/8"	10'-6"	10'-10 1/8"	11'-5"	1'-11 1/8"	20'-5"	21'-1 1/8"	21'-8 1/8"	12'-2 1/2"	30'-4"	31'-5 1/8"	31'-11 1/2"	22'-5 1/2"	40'-3"	41'-8"	42'-2 1/2"	32'-8 1/2"	50'-2"	51'-11 1/2"	52'-5 1/2"	43'-0"
		10'	10'-2"	10'-8"	11'-0 1/2"	11'-7"	0'-10 1/8"	20'-8"	21'-3 1/8"	21'-11 1/8"	11'-2 1/8"	30'-8"	31'-9"	32'-3 1/2"	21'-7"	40'-8"	42'-1 1/2"	42'-7 1/8"	31'-11 1/2"	50'-8"	52'-5 1/2"	53'-0"	42'-3 1/2"
		11'	11'-0 3/8"	10'-10"	11'-2 1/8"	11'-9"	Ⓐ 0"	20'-10"	21'-6 1/8"	22'-1 1/8"	10'-2 1/8"	30'-10"	31'-11"	32'-5 1/2"	20'-4 1/2"	40'-10"	42'-3 1/8"	42'-9 1/8"	30'-10 1/8"	50'-10"	52'-7 1/2"	53'-2"	41'-2 1/8"
	10'	9'	8'-11 1/8"	11'-4"	11'-10 3/8"	12'-5 1/8"	2'-11 1/8"	22'-5"	23'-1 1/2"	23'-9"	14'-3 1/8"	33'-8"	34'-7 1/8"	35'-0 1/2"	25'-6 1/8"	44'-3"	45'-9 1/2"	46'-4 1/2"	36'-10 1/8"	55'-2"	57'-1 1/8"	57'-7 1/2"	48'-1 2"
		10'	10'-2"	11'-8"	12'-1"	12'-7 1/2"	1'-11"	22'-8"	23'-4 1/2"	24'-0"	13'-2 1/8"	33'-8"	34'-10 1/8"	35'-4 1/2"	26'-8 1/8"	44'-8"	46'-2 1/2"	46'-9 1/2"	34'-7"	55'-8"	57'-7 1/2"	58'-2"	47'-5 1/2"
		11'	11'-0 3/8"	11'-10"	12'-3"	12'-9 3/8"	0'-10 1/8"	22'-10"	23'-7 1/8"	24'-2"	12'-3"	33'-10"	35'-0 1/8"	35'-6 1/2"	23'-7 1/8"	44'-10"	46'-5"	46'-11 1/8"	35'-0 1/8"	55'-10"	57'-10 1/2"	58'-4"	46'-5"
		12'	12'-7 3/8"	12'-0"	12'-5 1/8"	12'-11 1/8"	Ⓐ 0"	23'-0"	23'-9 1/8"	24'-4 1/8"	11'-2 1/8"	34'-0"	35'-2 1/8"	35'-8 1/2"	22'-7"	45'-0"	46'-7"	47'-1 1/2"	33'-10 1/2"	56'-0"	57'-11 1/2"	58'-6"	45'-9 1/2"
	11'	9'	8'-11 1/8"	12'-6"	12'-10 1/2"	13'-5 1/8"	4'-0"	24'-5"	25'-3 1/8"	25'-9 1/8"	16'-4"	36'-4"	37'-7 1/8"	38'-1 3/8"	28'-8"	48'-3"	49'-10 1/8"	50'-5 1/8"	41'-0 1/2"	—	—	—	—
		10'	10'-2"	12'-8"	13'-1 1/8"	13'-7 1/8"	2'-11 1/8"	24'-8"	25'-6 1/2"	26'-1"	15'-2 1/8"	36'-8"	37'-11 1/2"	38'-6"	27'-9 1/2"	48'-8"	50'-4 1/8"	50'-11"	40'-2 1/2"	—	—	—	—
		11'	11'-0 3/8"	12'-10"	13'-3 1/8"	13'-10"	1'-10 1/8"	24'-10"	25'-8 1/8"	26'-3"	14'-3 1/8"	36'-10"	38'-1 1/8"	38'-8"	26'-9"	48'-10"	50'-6 1/8"	51'-1"	39'-1 2"	—	—	—	—
		12'	12'-7 3/8"	13'-0"	13'-5 1/8"	14'-0"	0'-10 1/8"	25'-0"	25'-10 1/8"	26'-5"	13'-3 1/8"	37'-0"	38'-3 1/8"	38'-10"	25'-8 1/8"	49'-0"	50'-8 1/8"	51'-3 1/8"	38'-1 1/2"	—	—	—	—
	12'	9'	8'-11 1/8"	13'-6"	13'-11 1/8"	14'-6 1/8"	5'-0 1/2"	26'-5"	27'-2 1/8"	27'-10 1/8"	18'-5"	39'-4"	40'-8 1/8"	41'-3"	31'-3 1/2"	52'-3"	54'-1 1/8"	54'-7 1/2"	45'-1 1/8"	—	—	—	—
		10'	10'-2"	13'-8"	14'-1 1/8"	14'-8 1/8"	3'-11 1/8"	26'-8"	27'-7 1/8"	28'-1 1/8"	17'-5 1/8"	39'-8"	41'-0 1/8"	41'-7 1/2"	30'-10 1/8"	52'-8"	54'-6 1/8"	55'-0 1/8"	42'-9 1/8"	—	—	—	—
		11'	11'-0 3/8"	13'-10"	14'-3 1/8"	14'-10 1/8"	2'-11 1/8"	26'-10"	27'-9 1/8"	28'-3 1/8"	16'-0 1/8"	39'-10"	41'-2 1/8"	41'-9 1/8"	29'-10 1/8"	52'-10"	54'-8 1/8"	55'-2 1/8"	40'-3 1/8"	—	—	—	—
		12'	12'-7 3/8"	14'-0"	14'-5 1/8"	15'-0 1/8"	1'-10 1/8"	27'-0"	27'-11 1/8"	28'-6"	15'-0"	40'-0"	41'-4 1/8"	41'-11 1/8"	28'-3 1/8"	53'-0"	54'-10 1/8"	55'-5 1/8"	38'-5"	—	—	—	—

Ⓐ Special case for these boxes, See Detail "A" and Table "A" for revised values of F_1, F_2, W_4 and W_5, when apron width is more than 1'-0 and $W_3 = 0$. For Detail "A" and Table "A" for each slope, see Drawing Nos. W-X152-1, W-X152-2, or W-X153-1, W-X153-2, or W-X154-1, W-X154-2.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawings for 15° skews for each slope as listed below.

2:1 Slopes	3:1 Slopes	4:1 Slopes
W-X152-1 or W-X152-2	W-X153-1 or W-X153-2	W-X154-1 or W-X154-2.

This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

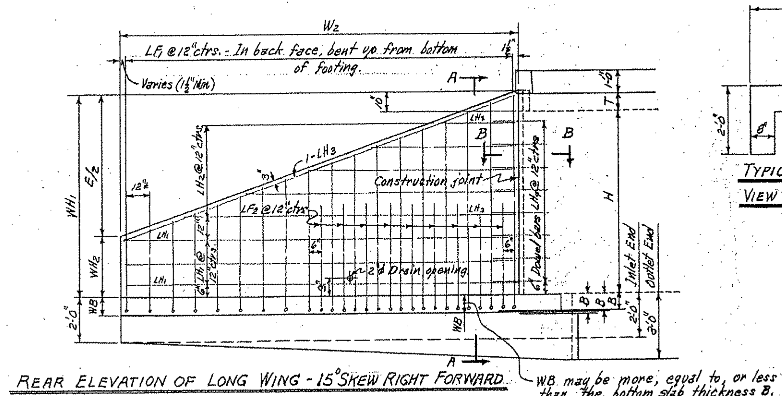
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 & 4:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER H=2', 3', 4', 5', 6', 7', 8', 9', 10', 11' & 12'.

STANDARD DRAWING NO. W-X15

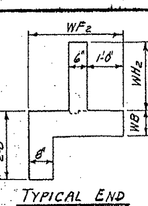
Designed by:- W.C.H. 5-22-63 Checked by:- Checked by:- J.E.M. 6-20-63 Checked by:-
Traced by:- W.C.H. 6-13-63 Quantities by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

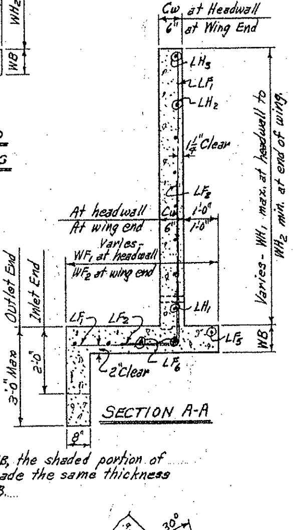


REAR ELEVATION OF LONG WING - 15° SKEW RIGHT FORWARD

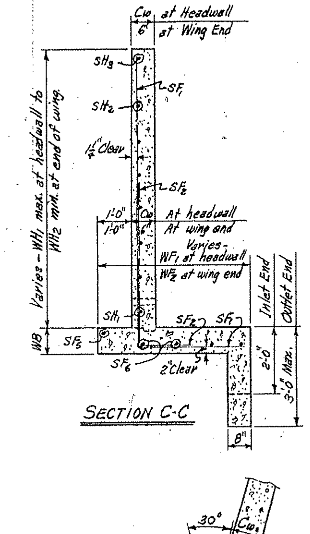
SHOWING BACK FACE REINFORCING



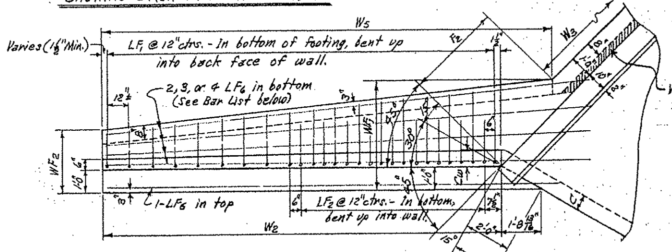
TYPICAL END VIEW OF WING



SECTION A-A

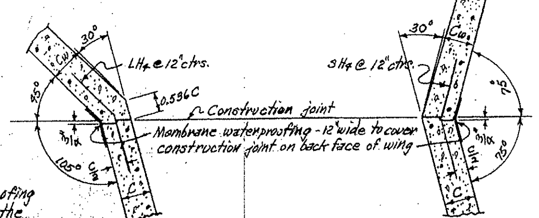


SECTION C-C



PLAN OF LONG WING - 15° SKEW RIGHT FORWARD

SHOWING FOOTING REINFORCING.

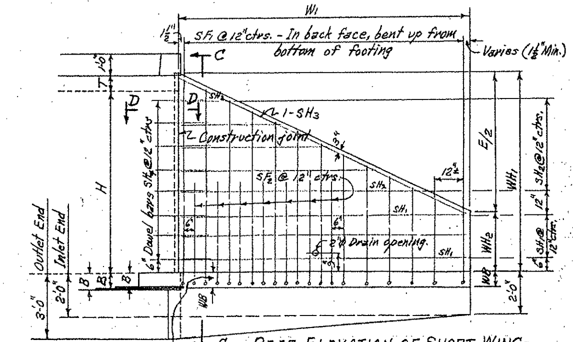


SECTION B-B

SECTION D-D

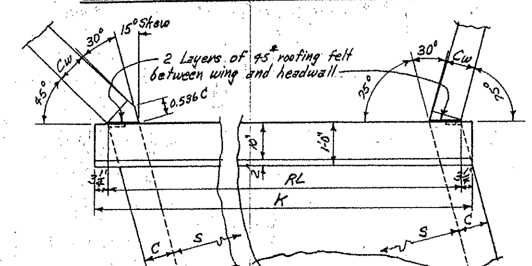
SECTIONS THRU CONSTRUCTION JOINTS

NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



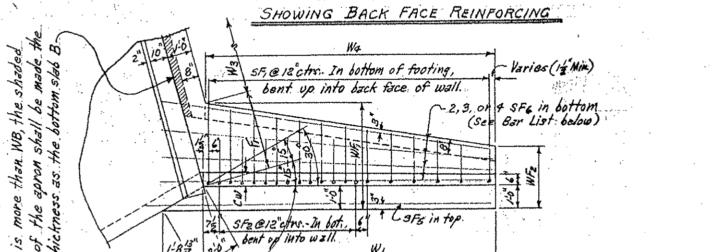
REAR ELEVATION OF SHORT WING - 15° SKEW RIGHT FORWARD

SHOWING BACK FACE REINFORCING



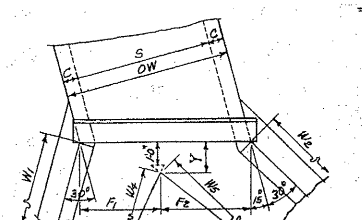
DETAILS AT TOP OF WINGS

15° SKEW RIGHT FORWARD



PLAN OF SHORT WING - 15° SKEW RIGHT FORWARD

SHOWING FOOTING REINFORCING



DETAIL "A"

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W4	W5	W3	Y
5'	7'	3'-0"	3'-5 5/8"	11'-2 1/4"	17'-3 1/2"	0"	1'-0 1/4"
6'	8'	3'-6"	4'-1 1/2"	12'-7 1/2"	19'-7"	0"	1'-1"

REGULAR WING DIMENSIONS - 2:1 SLOPES

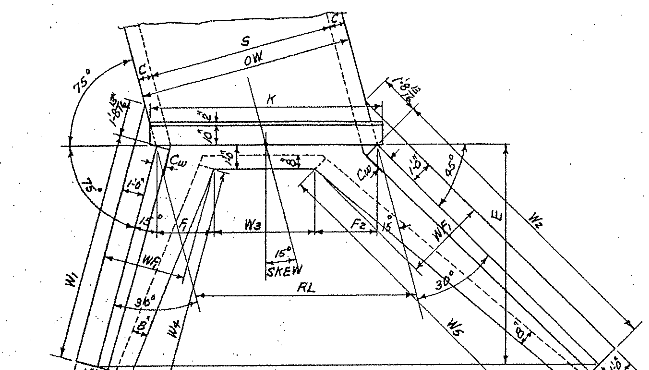
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL = C	WINGWALL HEIGHTS: AT HEADWALL	WINGWALL HEIGHTS: AT END OF WING	WIDTHS OF WING FOOTINGS: AT HEADWALL	WIDTHS OF WING FOOTINGS: AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL: SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL: LONG WING	PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS: SHORT WING	LENGTHS OF WINGWALLS: LONG WING	INSIDE FOOTING DIMENSIONS: SHORT WING	INSIDE FOOTING DIMENSIONS: LONG WING	* QUANTITY PER WING, CLASS S CONCRETE, INLET END: SHORT WING	INLET END: LONG WING	OUTLET END: SHORT WING	OUTLET END: LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-1 3/8"	0'-10 5/8"	4'-4"	4'-5 3/4"	6'-1 1/2"	3'-9 3/4"	6'-0 1/2"	0.533	0.744	0.593	0.825
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1 1/2"	1'-5 1/2"	1'-4 1/4"	5'-8"	5'-10 1/8"	8'-0 1/4"	5'-3 1/4"	8'-3 1/4"	0.802	1.124	0.879	1.233
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9 5/8"	1'-10"	7'-0"	7'-3"	9'-10 3/4"	6'-9"	10'-5 3/4"	1.118	1.567	1.214	1.703
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4 1/2"	2'-1 3/4"	2'-3 5/8"	8'-4"	8'-7 1/2"	11'-9 1/2"	8'-2 1/2"	12'-8 1/2"	1.480	2.080	1.595	2.244
		7"	5'-10"	1'-8"	3'-4"	2'-4 1/2"	2'-1 3/4"	2'-3 5/8"	8'-4"	8'-7 1/2"	11'-9 1/2"	8'-2 1/2"	12'-8 1/2"	1.542	2.169	1.656	2.332
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	9'-8"	10'-0"	13'-8"	9'-8 1/4"	14'-11"	2.055	2.883	2.188	3.074
		7 1/2"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	9'-8"	10'-0"	13'-8"	9'-8 1/4"	14'-11"	2.097	2.943	2.230	3.134
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	9'-8"	10'-0"	13'-8"	9'-8 1/4"	14'-11"	2.140	3.004	2.272	3.195
⊙ 7'	8 1/2"	7 1/2"	7'-10"	2'-4"	4'-2"	2'-7 1/2"	3'-0 1/8"	3'-5 3/4"	11'-0"	11'-4 3/4"	15'-6 3/4"	11'-2 1/2"	17'-3 3/4"	2.696	3.781	2.848	4.002
		8"	7'-10"	2'-4"	4'-2"	2'-7 1/2"	3'-0 1/8"	3'-5 3/4"	11'-0"	11'-4 3/4"	15'-6 3/4"	11'-2 1/2"	17'-3 3/4"	2.751	3.860	2.903	4.081
⊙ 8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-6 3/8"	4'-2 1/4"	12'-4"	12'-9 1/4"	17'-5 1/4"	12'-8 3/4"	19'-8 1/4"	3.447	4.832	3.618	5.082

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.
⊙ See Table "A" for special values of F1 & F2 and W4 & W5 for Single 5'x7' and 6'x8' Box Culverts.

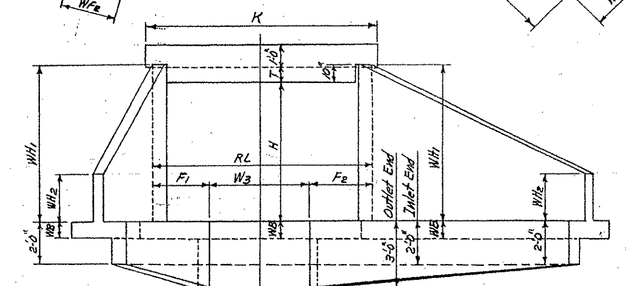
QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL - FOR 4 WINGS ⊛	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS): SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	83	3.51	4.50	5.50	6.49	7.48
	3'	6"	7"	126	4.75	5.73	6.73	7.72	8.71
	4'	6"	7"	190	6.20	7.18	8.18	9.17	10.17
	5'	6"	7"	264	7.88	8.87	9.86	10.86	11.85
	6'	7"	8"	434	10.59	11.61	12.63	13.65	14.67
5'	3'	6"	7"	126	4.96	6.16	7.37	8.58	9.79
	4'	6"	7"	190	6.42	7.62	8.82	10.03	11.24
	5'	6"	7"	264	8.10	9.30	10.51	11.71	12.92
	6'	7"	8"	434	10.81	12.04	13.28	14.52	15.76
	7'	7 1/2"	8 1/2"	841	13.78	15.07	16.30	17.56	18.82
6'	3'	6"	7"	126	5.18	6.62	8.02	9.45	10.88
	4'	6"	7"	190	6.63	8.07	9.47	10.90	12.33
	5'	6"	7"	264	8.32	9.75	11.15	12.59	14.01
	6'	7"	8"	434	11.04	12.49	13.93	15.39	16.84
	7'	7 1/2"	8 1/2"	841	14.01	15.49	16.95	18.43	19.91
	8'	8"	9"	1062	17.49	18.98	20.95	21.94	23.43
7'	4'	6"	7"	190	6.86	8.52	10.15	11.82	13.43
	5'	6"	7"	264	8.54	10.20	11.83	13.50	15.12
	6'	7"	8"	434	11.26	12.94	14.59	16.27	17.92
	7'	7 1/2"	8 1/2"	841	14.24	15.93	17.62	19.31	21.00
	8'	8"	9"	1062	17.72	19.43	21.12	22.83	24.52
8'	4'	6"	7"	190	7.09	8.99	10.85	12.75	14.57
	5'	7"	7"	264	9.10	11.02	12.90	14.82	16.66
	6'	7"	8"	434	11.49	13.41	15.29	17.20	19.05
	7'	7 1/2"	8 1/2"	841	14.46	16.39	18.29	20.23	22.09
	8'	8"	9"	1062	17.95	19.89	21.79	23.73	25.62
9'	5'	7"	7"	264	9.34	11.49	13.59	15.75	17.79
	6'	7 1/2"	8"	434	11.94	14.12	16.24	18.41	20.47
	7'	7 1/2"	8 1/2"	841	14.69	16.86	18.98	21.15	23.22
	8'	8"	9"	1062	18.18	20.35	22.48	24.64	26.71
10'	5'	7"	7"	264	9.57	11.97	14.30	16.58	18.93
	6'	7 1/2"	8"	434	12.18	14.59	16.94	19.24	21.61
	7'	7 1/2"	8 1/2"	841	14.92	17.33	19.68	21.99	24.36
	8'	8"	9"	1062	18.41	20.82	23.17	25.49	27.85
11'	6'	8"	8"	434	12.62	15.30	17.87	20.43	—
	7'	8"	8 1/2"	841	15.43	18.10	20.68	23.24	—
	8'	8"	9"	1062	18.63	21.30	23.88	26.44	—
12'	6'	8"	8"	434	12.86	15.79	18.59	21.41	—
	7'	8"	8 1/2"	841	15.66	18.59	21.40	24.22	—
	8'	8"	9"	1062	18.86	21.79	24.60	27.42	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawings listed below.



PART PLAN



END ELEVATION

SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed, see Drwg. No. W-X15.

TYPICAL WING DETAILS

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15. For values of RL, K, and W3 for each box, see the above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

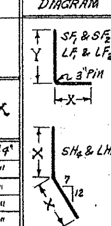
Reinforcing Steel 20,000 #/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED.

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 (BENT: In bottom of footing, bent up into back face of wing. One bar of each length.) SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 (BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.) SIZE	SPACING	NO. REQD	LENGTH	X	Y	SF5 & LF5 (STRAIGHT: Longitudinal in top of wing footing heel.) SIZE	NO. REQD	LENGTH	SF6 & LF6 (STRAIGHT: Longitudinal in bottom of wing footing toe.) SIZE	NO. REQD	LENGTH
H	SHORT OR LONG																					
2'	Short	#3	12"	5	1'-7"	3'-10"	0'-8"	1'-0"	1'-0"	2'-11"	—	—	—	—	—	—	#3	1	7'-0"	#3	2	5'-6"
	Long	#3	12"	7	1'-7"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—	#3	1	8'-8"	#3	2	7'-3"
3'	Short	#3	12"	7	1'-10"	5'-2"	0'-10"	1'-4"	1'-1"	3'-11"	—	—	—	—	—	—	#3	1	8'-4"	#3	2	7'-0"
	Long	#3	12"	9	1'-11"	5'-2"	0'-10"	1'-3"	1'-2"	4'-0"	—	—	—	—	—	—	#3	1	10'-6"	#3	2	9'-6"
4'	Short	#3	12"	8	2'-5"	6'-6"	0'-11"	1'-8"	1'-7"	4'-11"	—	—	—	—	—	—	#3	1	9'-9"	#3	3	8'-6"
	Long	#3	12"	11	2'-3"	6'-6"	0'-11"	1'-7"	1'-5"	5'-0"	—	—	—	—	—	—	#3	1	12'-5"	#3	3	11'-9"
5'	Short	#3	12"	9	3'-2"	7'-10"	1'-1"	2'-0"	2'-2"	5'-11"	#3	12"	3	3'-6"	1'-1"	2'-6"	#3	1	11'-1"	#3	3	10'-0"
	Long	#3	12"	12	3'-1"	7'-10"	1'-1"	1'-11"	2'-1"	6'-0"	#3	12"	3	3'-6"	1'-1"	2'-6"	#3	1	14'-3"	#3	3	14'-0"
6'	Short	#4	12"	11	3'-4"	9'-3"	1'-2"	2'-4"	2'-3"	7'-0"	#3	12"	3	4'-6"	1'-4"	3'-3"	#3	1	12'-6"	#3	3	11'-6"
	Long	#4	12"	14	3'-7"	9'-3"	1'-2"	2'-3"	2'-6"	7'-1"	#3	12"	3	4'-6"	1'-4"	3'-3"	#3	1	16'-2"	#3	3	16'-3"
7'	Short	#4	12"	12	3'-11"	10'-9"	1'-3"	2'-10"	2'-9"	8'-0"	#4	12"	5	5'-6"	1'-7"	4'-0"	#4	1	13'-10"	#4	4	13'-1"
	Long	#4	12"	16	3'-11"	10'-8"	1'-3"	2'-8"	2'-9"	8'-1"	#4	12"	6	5'-6"	1'-7"	4'-0"	#4	1	18'-0"	#4	4	18'-8"
8'	Short	#4	12"	13	4'-8"	12'-4"	1'-5"	3'-4"	3'-4"	9'-1"	#4	12"	7	6'-6"	1'-10"	4'-9"	#4	1	15'-3"	#4	4	14'-8"
	Long	#4	12"	18	4'-6"	12'-2"	1'-5"	3'-1"	3'-2"	9'-2"	#4	12"	9	6'-6"	1'-10"	4'-9"	#4	1	19'-11"	#4	4	21'-1"

CLEAR HEIGHT	WING LOCATION	SH1 & LH1 (STRAIGHT: Horizontal in back face of wing.) SIZE	SPACING	NO. REQD	LENGTH	SH2 & LH2 (STRAIGHT: Horizontal in back face of wing. One bar of each length) SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	LENGTHS VARY MIN.	SH3 & LH3 (STRAIGHT: In back face of wing at top - on slope.) SIZE	NO. REQD	LENGTH	SH4 & LH4 (BENT: Dowels thru construction joint at headwall.) SIZE	SPACING	NO. REQD	LENGTH	X	QUANTITY REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
H	SHORT OR LONG																			
2'	Short	#3	12"	1	4'-3"	#3	12"	1	—	2'-2"	#3	1	4'-8"	#3	12"	2	2'-8"	1'-4"	18.0	23.6
	Long	#3	12"	1	5'-10"	#3	12"	1	—	3'-0"	#3	1	6'-2"	#3	12"	2	"	"		
3'	Short	#3	12"	1	5'-7"	#3	12"	2	4'-3"	2'-2"	#3	1	6'-2"	#3	12"	3	"	"	27.4	35.4
	Long	#3	12"	1	7'-9"	#3	12"	2	5'-10"	3'-0"	#3	1	8'-2"	#3	12"	3	"	"		
4'	Short	#3	12"	1	7'-0"	#3	12"	3	6'-4"	2'-2"	#3	1	7'-9"	#3	12"	4	"	"	41.0	54.0
	Long	#3	12"	1	9'-7"	#3	12"	3	8'-8"	3'-0"	#3	1	10'-2"	#3	12"	4	"	"		
5'	Short	#3	12"	2	8'-4"	#3	12"	3	6'-4"	2'-2"	#3	1	9'-3"	#3	12"	5	"	"	57.6	74.5
	Long	#3	12"	2	11'-6"	#3	12"	3	8'-8"	3'-0"	#3	1	12'-2"	#3	12"	5	"	"		
6'	Short	#3	12"	2	9'-9"	#3	12"	4	8'-5"	2'-2"	#3	1	10'-10"	#3	12"	6	"	"	95.1	121.8
	Long	#3	12"	2	13'-5"	#3	12"	4	11'-6"	3'-0"	#3	1	14'-2"	#3	12"	6	2'-8"	1'-4"		
7'	Short	#4	12"	2	11'-1"	#4	12"	5	10'-6"	2'-2"	#4	1	12'-4"	#4	12"	7	3'-6"	1'-9"	181.9	238.4
	Long	#4	12"	2	15'-3"	#4	12"	5	14'-4"	3'-0"	#4	1	16'-2"	#4	12"	7	"	"		
8'	Short	#4	12"	3	12'-6"	#4	12"	5	10'-6"	2'-2"	#4	1	13'-10"	#4	12"	8	"	"	227.7	303.1
	Long	#4	12"	3	17'-2"	#4	12"	5	14'-4"	3'-0"	#4	1	18'-2"	#4	12"	8	3'-6"	1'-9"		

BAR BENDING DIAGRAM:



NOTE:- Dimensions are to bar centers.

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

NOTE:-
This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		

CLASS S CONCRETE

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

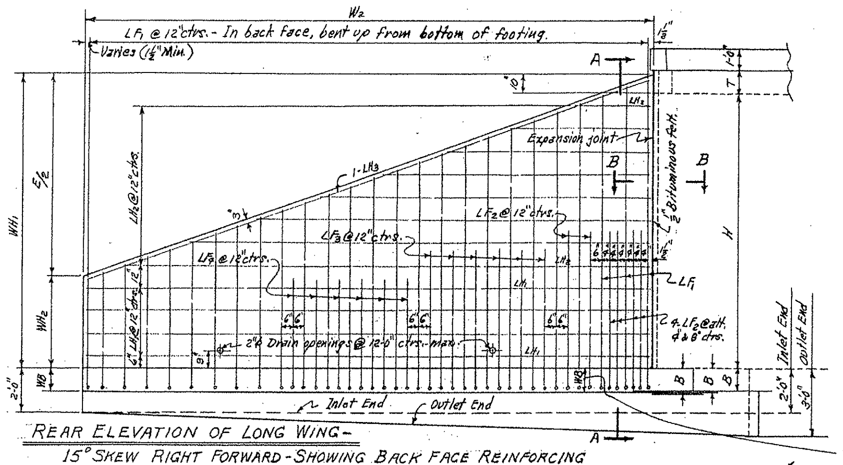
STANDARD DRAWING NO. W-X152-1

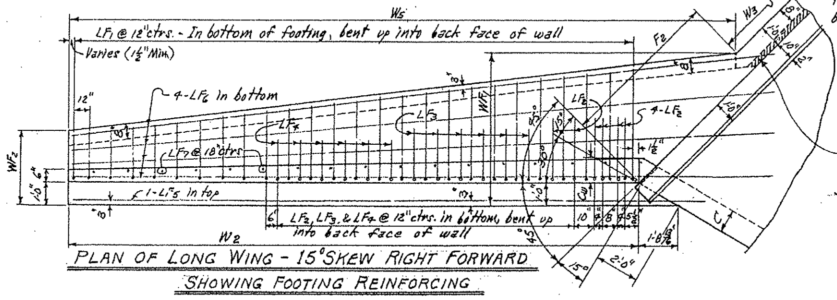
Designed By:- W.C.H. 5-13-63 Checked By:-
Drawn By:- W.C.H. 6-25-63 Checked By:- BHS 8-7-63
Quantities By:- W.C.H. 9-13-63 Checked By:-

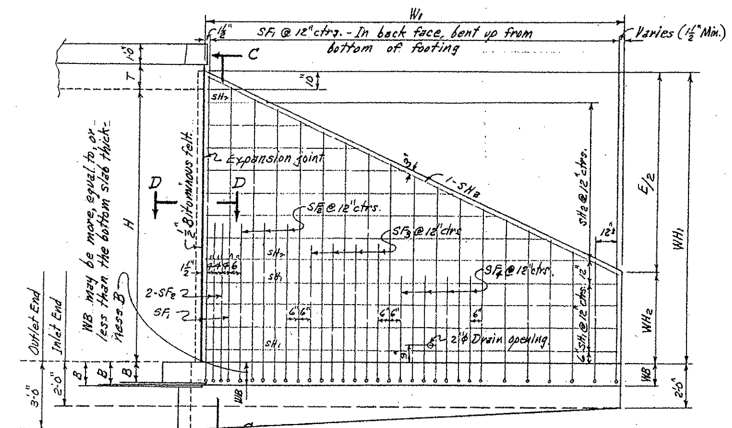
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

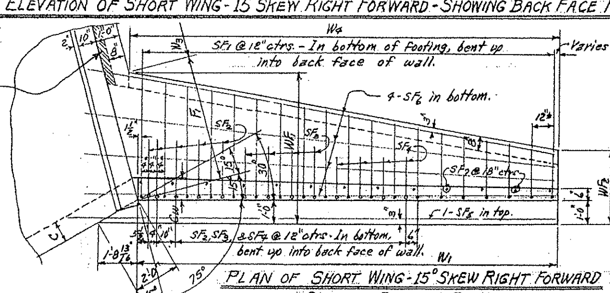
NOTE:- This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

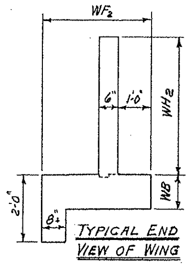
SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-516X-1
	R-215X-2	R-315X-2		

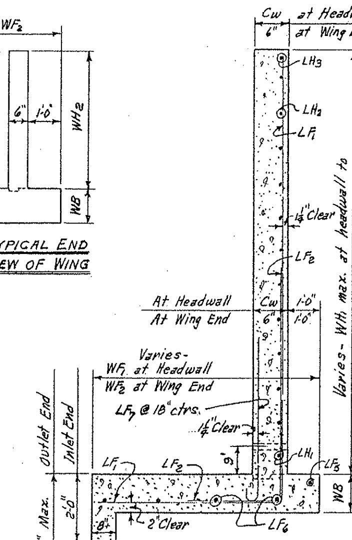


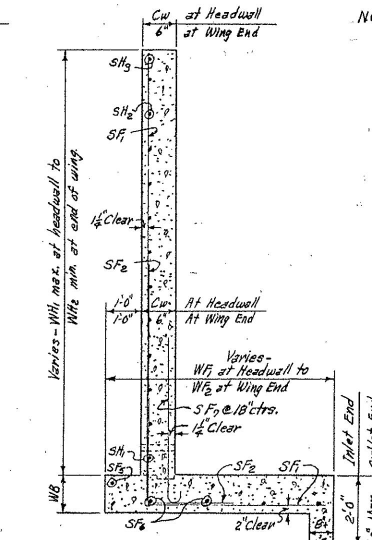












REGULAR WING DIMENSIONS - 2:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSIONS SHORT WING	INSIDE FOOTING DIMENSIONS LONG WING	* QUANTITY PER WING CLASS S CONCRETE INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH₁	WH₂	WF₁	WF₂	F₁	F₂	E	W₁	W₂	W₄	W₅	CU.YD.	CU.YD.	CU.YD.	CU.YD.
9' ✱	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-0½"	4'-10¾"	13'-8"	14'-1¾"	19'-4"	14'-2¾"	22'-1"	4.480	6.284	4.670	6.565
10' ✱	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-6¾"	5'-7¼"	15'-0"	15'-6¼"	21'-2½"	15'-9"	24'-5¼"	5.710	8.005	5.920	8.315
11' ✱	12"	11"	11'-10"	3'-8"	6'-2"	3'-1½"	5'-1"	6'-3⅝"	16'-4"	16'-11"	23'-1¼"	17'-3"	26'-10¼"	7.161	10.034	7.390	10.374
12' ✱	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-7⅛"	7'-0⅛"	17'-8"	18'-3¼"	24'-11¾"	18'-9¼"	29'-2¾"	8.840	12.380	9.088	12.750

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W₃.
✱ See Table "A" for special values of F₁ & F₂ and W₄ & W₅ for Single 7x9, 8x10, 9x11 and 10x12 Box Culverts.

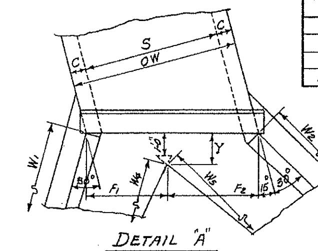
QUANTITIES

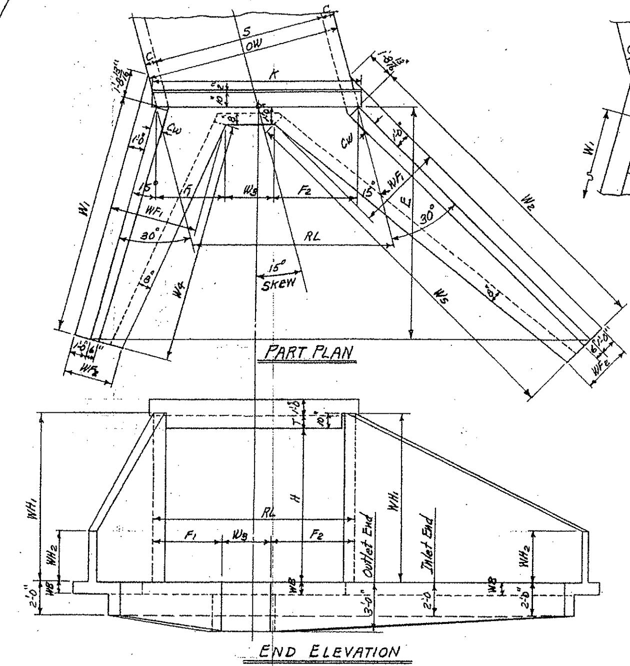
CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL ⊛ FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS) SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	1584	22.59	24.33	26.06	27.80	29.53
8'	9'	9"	10"	1584	22.83	24.79	26.73	28.69	30.64
	10'	10"	11"	1980	28.62	30.62	32.60	34.60	36.58
9'	9'	9"	10"	1584	23.06	25.25	27.40	29.58	31.74
	10'	10"	11"	1980	28.86	31.08	33.28	35.50	37.70
	11'	11"	12"	2401	35.71	37.95	40.17	42.41	44.64
10'	9'	9"	10"	1584	23.28	25.71	28.09	30.45	32.85
	10'	10"	11"	1980	29.09	31.54	33.96	36.38	38.82
	11'	11"	12"	2401	35.95	38.41	40.86	43.30	45.76
	12'	12"	13"	3011	43.88	46.37	48.84	51.31	53.80
11'	9'	9"	10"	1584	23.51	26.20	28.80	31.38	——
	10'	10"	11"	1980	29.31	32.02	34.64	37.28	——
	11'	11"	12"	2401	36.17	38.88	41.54	44.21	——
	12'	12"	13"	3011	44.12	46.84	49.53	52.23	——
12'	9'	9"	10"	1584	23.74	26.68	29.51	32.35	——
	10'	10"	11"	1980	29.54	32.50	35.35	38.22	——
	11'	11"	12"	2401	36.40	39.36	42.22	45.12	——
	12'	12"	13"	3011	44.35	47.31	50.22	53.15	——

⊛ For reinforcing steel in Headwalls and Aprons, see Drawings listed at top of sheet.

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F₁	F₂	W₃	Y	W₄	W₅
7'	9'	4'-0⅛"	4'-9½"	0"	1'-1"	14'-1¾"	21'-11½"
8'	10'	4'-6¼"	5'-5⅞"	0"	1'-1⅛"	15'-7¾"	24'-3¾"
9'	11'	5'-0⅜"	6'-2¼"	0"	1'-1¼"	17'-1¾"	26'-8¼"
10'	12'	5'-6⅝"	6'-10½"	0"	1'-1½"	18'-7¾"	29'-0¾"

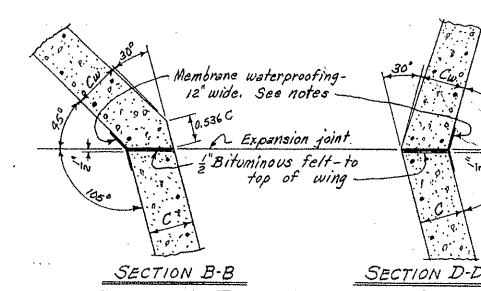




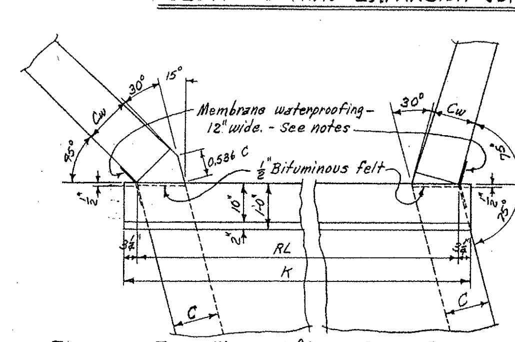
SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed, see Drawing No. W-X15.

TYPICAL WING DETAILS



SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WINGS - 15° SKEW RIGHT FORWARD

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15. For values of RL, K and W₃ for each box, see above Std. also.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF₁ & LF₁ — BENT: In bottom of footing, bent up into back face of wing. One bar of each length.
SF₂ & LF₂ — BENT: In bottom of footing, bent up into back face of wing. Alt. with F₁ bars.
SF₃ & LF₃ — BENT: In bottom of footing, bent up into back face of wing. Alt. with F₁ bars.
SF₄ & LF₄ — BENT: In bottom of footing, bent up into back face of wing. Alt. with F₁ bars.

CLEAR HEIGHT H	WING LOCATION (SHORT OR LONG)	SF₁&LF₁ SIZE	SPACING	No. REQD	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF₂&LF₂ SIZE	SPACING ⊙	No. REQD	LENGTH	X	Y
9'	Short	#5	12"	15	4'-11"	13'-11"	1'-6"	3'-10"	3'-6"	10'-2"	#5	12"	3	7'-6"	2'-1"	5'-6"
	Long	#5	12"	20	4'-11"	13'-8"	1'-6"	3'-6"	3'-6"	10'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"
10'	Short	#5	12"	16	5'-7"	15'-6"	1'-8"	4'-4"	4'-0"	11'-3"	#6	12"	3	8'-6"	2'-4"	6'-3"
	Long	#5	12"	22	5'-6"	15'-3"	1'-8"	4'-0"	3'-11"	11'-4"	#6	12"	4	8'-6"	2'-4"	6'-3"
11'	Short	#5	12"	18	5'-10"	17'-0"	1'-9"	4'-9"	4'-2"	12'-4"	#6	12"	5	8'-6"	2'-4"	6'-3"
	Long	#5	12"	24	5'-11"	16'-9"	1'-9"	4'-5"	4'-3"	12'-5"	#6	12"	6	8'-6"	2'-4"	6'-3"
12'	Short	#5	12"	19	6'-8"	18'-7"	1'-11"	5'-3"	4'-10"	13'-5"	#7	12"	5	9'-6"	2'-7"	7'-0"
	Long	#5	12"	26	6'-6"	18'-3"	1'-11"	4'-10"	4'-8"	13'-6"	#7	12"	6	9'-6"	2'-7"	7'-0"

H	WING	SF₃&LF₃ SIZE	SPACING	No. REQD	LENGTH	X	Y	SF₄&LF₄ SIZE	SPACING	No. REQD	LENGTH	X	Y
9'	Short	#4	12"	4	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#4	12"	6	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	2	7'-6"	2'-1"	5'-6"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#5	12"	2	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
12'	Short	#6	12"	4	8'-6"	2'-4"	6'-3"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#6	12"	6	8'-6"	2'-4"	6'-3"	#4	12"	6	6'-6"	1'-10"	4'-9"

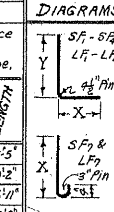
SF₅ & LF₅ — STRAIGHT: Longitudinal in top of wing footing heel.
SF₆ & LF₆ — STRAIGHT: Longitudinal in bottom of wing footing toe.
SF₇ & LF₇ — BENT: Footing dowels extending up into front face of wing.

H	WING	SF₅&LF₅ SIZE	No. REQD	LENGTH	SF₆&LF₆ SIZE	No. REQD	LENGTH	SF₇&LF₇ SIZE	SPACING	No. REQD	LENGTH	X
9'	Short	#4	1	16'-7"	#4	4	16'-3"	#4	18"	10	4'-0"	3'-6"
	Long	#4	1	21'-10"	#4	4	23'-6"	#4	18"	13	4'-0"	3'-6"
10'	Short	#4	1	18'-0"	#4	4	17'-10"	#4	18"	11	4'-4"	8'-10"
	Long	#4	1	23'-8"	#4	4	25'-11"	#4	18"	15	4'-4"	3'-10"
11'	Short	#4	1	19'-5"	#4	4	19'-5"	#4	18"	12	4'-8"	4'-2"
	Long	#4	1	25'-7"	#4	4	28'-4"	#4	18"	16	4'-8"	4'-2"
12'	Short	#4	1	20'-9"	#4	4	21'-0"	#4	18"	13	5'-0"	4'-6"
	Long	#4	1	27'-6"	#4	4	30'-9"	#4	18"	17	5'-0"	4'-6"

SH₁ & LH₁ — STRAIGHT: Horizontal in back face of wing.
SH₂ & LH₂ — STRAIGHT: Horizontal in back face of wing. One bar of each length.
SH₃ & LH₃ — In back face of wing at top - on slope.

H	WING	SH₁&LH₁ SIZE	SPACING	No. REQD	LENGTH	SH₂&LH₂ SIZE	SPACING	No. REQD	LENGTHS VARY MAX.	LENGTHS VARY MIN.	SH₃&LH₃ SIZE	No. REQD	LENGTH	QUANTITY REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
9'	Short	#4	12"	3	13'-10"	#4	12"	6	12'-7"	2'-2"	#4	1	15'-5"	337.0	455.2
	Long	#4	12"	3	19'-0"	#4	12"	6	17'-2"	3'-0"	#4	1	20'-2"		
10'	Short	#4	12"	3	15'-3"	#4	12"	7	14'-8"	2'-2"	#4	1	16'-11"	420.0	569.8
	Long	#4	12"	3	20'-11"	#4	12"	7	20'-0"	3'-0"	#4	1	22'-2"		
11'	Short	#4	12"	4	16'-7"	#4	12"	7	14'-8"	2'-2"	#4	1	18'-6"	517.3	683.4
	Long	#4	12"	4	22'-10"	#4	12"	7	20'-0"	3'-0"	#4	1	24'-2"		
12'	Short	#4	12"	4	18'-0"	#4	12"	8	16'-9"	2'-2"	#4	1	20'-0"	641.1	864.5
	Long	#4	12"	4	24'-8"	#4	12"	8	22'-10"	3'-0"	#4	1	26'-2"		

BAR BENDING DIAGRAMS



NOTE:- Dimensions are to bar centers.

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

⊙ Except as shown at headwall.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

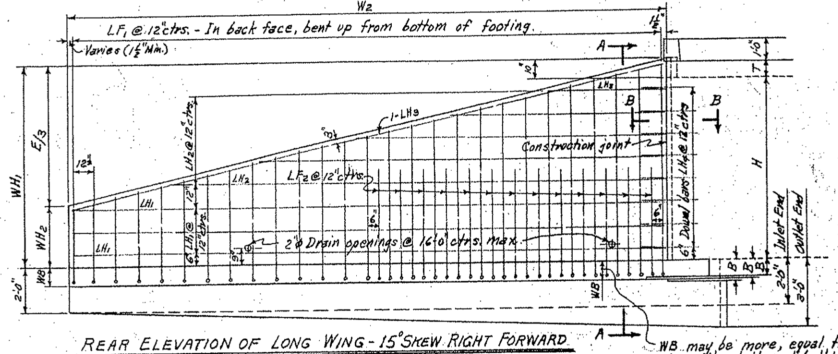
7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

STANDARD DRAWING NO. W-X152-2

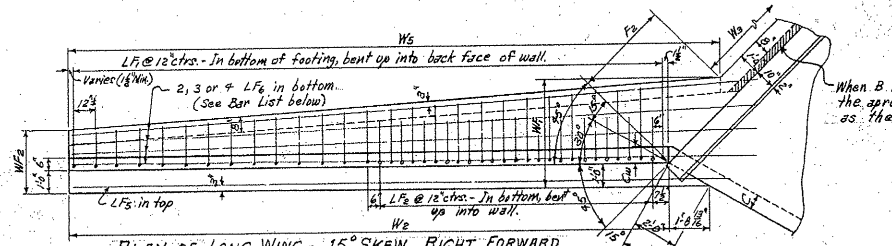
Designed by:- W.C.H. 5-13-63 Checked by:-
Drawn by:- W.C.H. 6-6-63 Checked by:- R.H.S. 7-31-63
Quantities by:- W.C.H. 9-17-63 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



REAR ELEVATION OF LONG WING - 15° SKEW RIGHT FORWARD

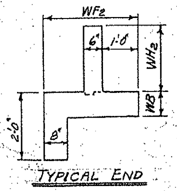
SHOWING BACK FACE REINFORCING



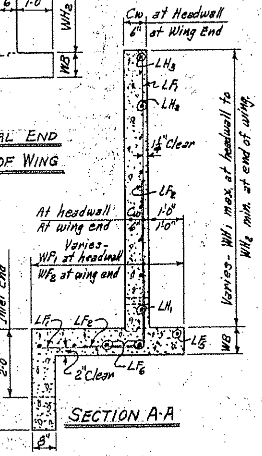
PLAN OF LONG WING - 15° SKEW RIGHT FORWARD

SHOWING FOOTING REINFORCING.

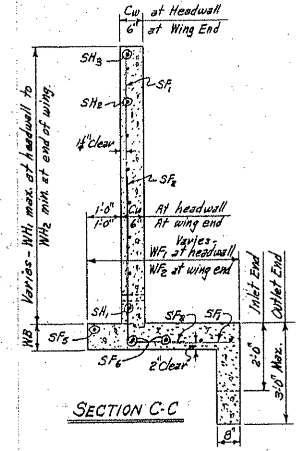
NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



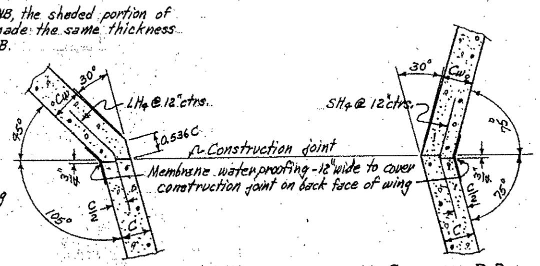
TYPICAL END VIEW OF WING



SECTION A-A



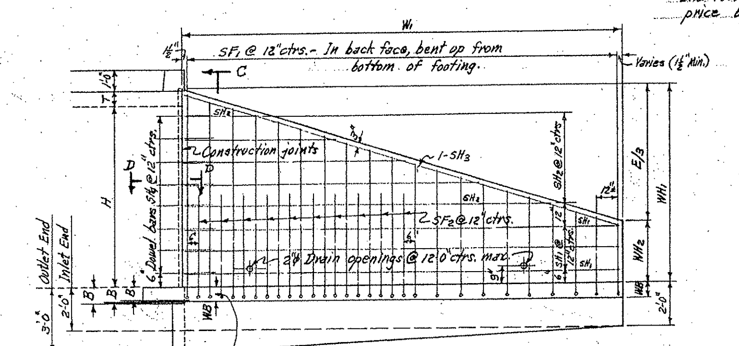
SECTION C-C



SECTION B-B

SECTION D-D

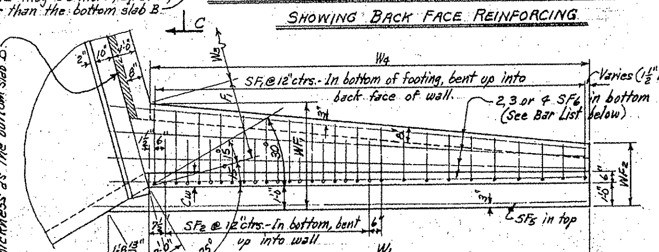
SECTIONS THRU CONSTRUCTION JOINTS



WB may be more, equal to, or less than the bottom slab B.

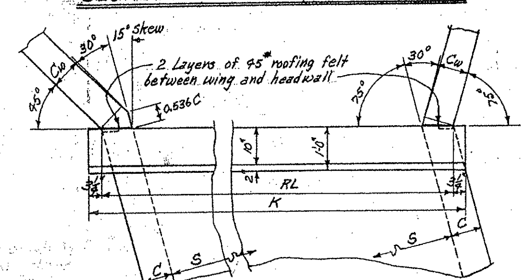
REAR ELEVATION OF SHORT WING - 15° SKEW RIGHT FORWARD

SHOWING BACK FACE REINFORCING



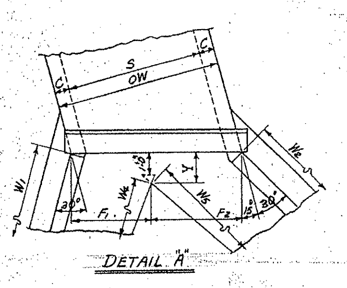
PLAN OF SHORT WING - 15° SKEW RIGHT FORWARD

SHOWING FOOTING REINFORCING



DETAILS AT TOP OF WINGS

15° SKEW RIGHT FORWARD



DETAIL "A"

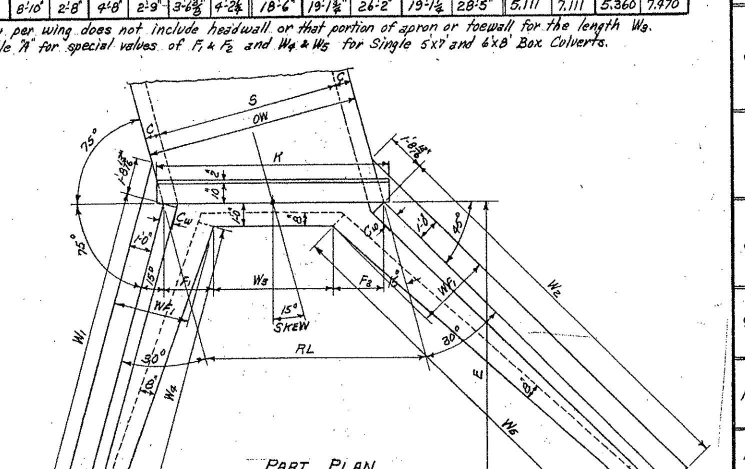
TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W4	W5	W3	Y
5'	7'	3'-0"	3'-5 5/8"	16'-10 1/2"	25'-0 3/4"	0"	1'-0 1/4"
6'	8'	3'-6"	4'-1 1/8"	19'-0 1/4"	28'-3 3/4"	0"	1'-1"

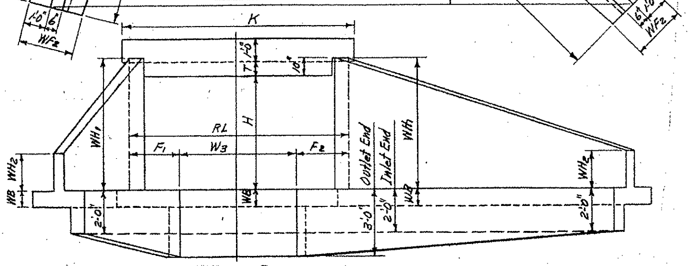
REGULAR WING DIMENSIONS - 3:1 SLOPES

Clear Height of Box	Thickness of Wing Footing	Thickness of Wing at Hdwl. = C	Wingwall Heights: At Headwall	Wingwall Heights: At End of Wing	Widths of Wing Footings: At Headwall	Widths of Wing Footings: At End of Wing	Footing Dimension Parallel with Headwall: Short Wing	Footing Dimension Parallel with Headwall: Long Wing	Perpendicular Dist. from Hdwl. to End of Wing	Lengths of Wingwalls: Short Wing	Lengths of Wingwalls: Long Wing	Inside Footing Dimensions: Short Wing	Inside Footing Dimensions: Long Wing	* Quantity per Wing, Class S Concrete, Inlet End: Short Wing	Inlet End: Long Wing	Outlet End: Short Wing	Outlet End: Long Wing
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-1 3/8"	0'-10 5/8"	6'-6"	6'-8 3/4"	9'-2 1/4"	6'-0 1/2"	9'-1 1/4"	0.789	1.094	0.876	1.212
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1 1/2"	1'-5 1/2"	1'-4 1/2"	8'-6"	8'-9 1/2"	12'-0 1/4"	8'-2 1/4"	12'-3 1/4"	1.186	1.650	1.300	1.808
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9 5/8"	1'-10"	10'-6"	10'-10 1/2"	14'-10 1/2"	10'-4 1/2"	15'-5 1/2"	1.656	2.305	1.797	2.502
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4 1/2"	2'-1 3/4"	2'-3 5/8"	12'-6"	12'-11 1/4"	17'-8 1/4"	12'-6 1/4"	18'-7 1/4"	2.196	3.059	2.363	3.295
		7"	5'-10"	1'-8"	3'-4"	2'-4 1/2"	2'-1 3/4"	2'-3 5/8"	12'-6"	12'-11 1/4"	17'-8 1/4"	12'-6 1/4"	18'-7 1/4"	2.287	3.188	2.455	3.424
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	14'-6"	15'-0 1/4"	20'-6"	14'-8 1/4"	21'-9"	3.052	4.242	3.246	4.517
		7 1/2"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	14'-6"	15'-0 1/4"	20'-6"	14'-8 1/4"	21'-9"	3.114	4.329	3.309	4.605
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5 7/8"	2'-9 1/4"	14'-6"	15'-0 1/4"	20'-6"	14'-8 1/4"	21'-9"	3.177	4.417	3.371	4.693
⊕ 7'	8 1/2"	7 1/2"	7'-10"	2'-4"	4'-2"	2'-7 1/2"	3'-0 1/8"	3'-5 3/4"	16'-6"	17'-1"	23'-4"	16'-10 3/4"	25'-1"	3.998	5.560	4.220	5.877
		8"	7'-10"	2'-4"	4'-2"	2'-7 1/2"	3'-0 1/8"	3'-5 3/4"	16'-6"	17'-1"	23'-4"	16'-10 3/4"	25'-1"	4.079	5.675	4.301	5.991
⊕ 8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-6 3/8"	4'-2 1/4"	18'-6"	19'-1 3/4"	26'-2"	19'-1 1/4"	28'-5"	5.111	7.111	5.360	7.470

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.
⊕ See Table "A" for special values of F1 & F2 and W4 & W5 for Single 5'x7' and 6'x8' Box Culverts.



PART PLAN



END ELEVATION

SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed, see Drwg. No. W-X15

TYPICAL WING DETAILS

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15. For values of RL, K, and W3 for each box, see the above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

QUANTITIES

Clear Span	Clear Height	Thickness of Wing at Headwall	Thickness of Wing Footing	Reinforcing Steel ⊛ for 4 Wings	Class S Concrete - 4 Wings (Headwalls, Wingwalls, Footings, Toewalls and Aprons): Single Barrel Culvert	Double Barrel Culvert	Triple Barrel Culvert	Quadruple Barrel Culvert	Quintuple Barrel Culvert
S	H	Cw	WB	Lb.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
4'	2'	6"	7"	117	4.79	5.78	6.77	7.77	8.76
	3'	6"	7"	176	6.65	7.64	8.63	9.63	10.62
	4'	6"	7"	267	8.85	9.84	10.84	11.83	12.82
	5'	6"	7"	379	11.40	12.38	13.38	14.37	15.36
	6'	7"	8"	626	15.95	16.46	17.48	18.51	19.53
5'	3'	6"	7"	176	6.87	8.07	9.28	10.48	11.69
	4'	6"	7"	267	9.08	10.28	11.48	12.69	13.90
	5'	6"	7"	379	11.61	12.81	14.02	15.23	16.44
	6'	7"	8"	626	15.67	16.90	18.14	19.38	20.61
	7'	7 1/2"	8 1/2"	1210	20.11	21.36	22.62	23.88	25.14
6'	3'	6"	7"	176	7.09	8.52	9.92	11.36	12.78
	4'	6"	7"	267	9.29	10.73	12.13	13.56	14.98
	5'	6"	7"	379	11.83	13.26	14.67	16.10	17.53
	6'	7"	8"	626	15.89	17.35	18.79	20.25	21.70
	7'	7 1/2"	8 1/2"	1210	20.33	21.81	23.28	24.76	26.24
	8'	8"	9"	1533	25.56	27.05	28.53	30.02	31.50
7'	4'	6"	7"	267	9.52	11.18	12.81	14.47	16.09
	5'	6"	7"	379	12.05	13.72	15.35	17.01	18.63
	6'	7"	8"	626	16.12	17.80	19.45	21.13	22.78
	7'	7 1/2"	8 1/2"	1210	20.56	22.26	23.94	25.64	27.33
	8'	8"	9"	1533	25.80	27.50	29.20	30.90	32.60
8'	4'	6"	7"	267	9.75	11.65	13.51	15.41	17.23
	5'	7"	7"	379	12.76	14.68	16.55	18.47	20.31
	6'	7"	8"	626	16.34	18.26	20.14	22.06	23.90
	7'	7 1/2"	8 1/2"	1210	20.78	22.72	24.62	26.55	28.42
	8'	8"	9"	1533	26.03	27.96	29.86	31.80	33.71
9'	5'	7"	7"	379	12.99	15.15	17.25	19.40	21.45
	6'	7 1/2"	8"	626	16.89	19.07	21.19	23.36	25.42
	7'	7 1/2"	8 1/2"	1210	21.01	23.19	25.31	27.48	29.54
	8'	8"	9"	1533	26.25	28.42	30.55	32.72	34.78
10'	5'	7"	7"	379	18.23	16.62	17.95	20.24	22.59
	6'	7 1/2"	8"	626	17.13	19.54	21.89	24.20	26.56
	7'	7 1/2"	8 1/2"	1210	21.44	23.66	26.01	28.32	30.68
	8'	8"	9"	1533	26.48	28.89	31.25	33.56	35.92
11'	6'	8"	8"	626	17.67	20.34	22.92	25.48	—
	7'	8"	8 1/2"	1210	21.88	24.55	27.13	29.69	—
	8'	8"	9"	1533	26.70	29.37	31.96	34.52	—
12'	6'	8"	8"	626	17.91	20.84	23.64	26.46	—
	7'	8"	8 1/2"	1210	22.11	25.04	27.85	30.67	—
	8'	8"	9"	1533	26.93	29.86	32.67	35.49	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawings listed below.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:-
This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

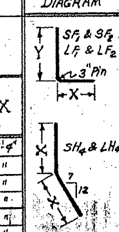
SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF1 & LF1 — Bent: In bottom of footing, bent up into back face of wing. One bar of each length.
SF2 & LF2 — Bent: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.
SF5 & LF5 — Straight: Longitudinal in top of wing footing heel.
SF6 & LF6 — Straight: Longitudinal in bottom of wing footing toe.
SH1 & LH1 — Straight: Horizontal in back face of wing.
SH2 & LH2 — Straight: Horizontal in back face of wing. One bar of each length.
SH3 & LH3 — Straight: In back face of wing at top - on slope.
SH4 & LH4 — Bent: Dowels thru construction joint at headwall.

Clear Height H	Wing Location (Short or Long)	SF1&LF1 Size	Spacing	No. Req'd	Lengths Vary Min.	Lengths Vary Max.	X Min.	X Max.	Y Min.	Y Max.	SF2&LF2 Size	Spacing	No. Req'd	Length	X	Y	SF5&LF5 Size	No. Req'd	Length	SF6&LF6 Size	No. Req'd	Length	SH1&LH1 Size	Spacing	No. Req'd	Length	SH2&LH2 Size	Spacing	No. Req'd	Lengths Vary Max.	Lengths Vary Min.	SH3&LH3 Size	No. Req'd	Length	SH4&LH4 Size	Spacing	No. Req'd	Length	X	Quantity: Reinforcing Steel per Wing - Lbs. Short Wing	Long Wing
2'	Short	#3	12"	7	1'-7"	3'-11"	0'-8"	1'-0"	1'-0"	3'-0"	—	—	—	—	—	—	#3	1	9'-2"	#3	2	7'-10"	#3	12"	1	6'-5"	#3	12"	1	—	3'-6"	#3	1	6'-10"	#3	12"	2	2'-8"	1'-4"	24.9	33.4
	Long	#3	12"	10	1'-7"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—	#3	1	11'-8"	#3	2	10'-10"	#3	12"	1	8'-11"	#3	12"	1	—	4'-8"	#3	1	9'-1"	#3	12"	2	"	"		
3'	Short	#3	12"	9	2'-2"	5'-3"	0'-10"	1'-4"	1'-5"	4'-0"	—	—	—	—	—	—	#3	1	11'-3"	#3	2	10'-0"	#3	12"	1	8'-6"	#3	12"	2	6'-7"	3'-6"	#3	1	9'-0"	#3	12"	3	"	"	37.7	50.3
	Long	#3	12"	13	1'-11"	5'-2"	0'-10"	1'-3"	1'-2"	4'-0"	—	—	—	—	—	—	#3	1	14'-6"	#3	2	14'-0"	#3	12"	1	11'-9"	#3	12"	2	8'-11"	4'-8"	#3	1	12'-0"	#3	12"	3	"	"		
4'	Short	#3	12"	11	2'-7"	6'-7"	0'-11"	1'-8"	1'-9"	5'-0"	—	—	—	—	—	—	#3	1	13'-4"	#3	3	12'-2"	#3	12"	1	10'-7"	#3	12"	3	9'-8"	3'-6"	#3	1	11'-2"	#3	12"	4	"	"	57.3	76.4
	Long	#3	12"	15	2'-6"	6'-6"	0'-11"	1'-7"	1'-8"	5'-0"	—	—	—	—	—	—	#3	1	17'-4"	#3	3	17'-2"	#3	12"	1	14'-7"	#3	12"	3	13'-2"	4'-8"	#3	1	14'-11"	#3	12"	4	"	"		
5'	Short	#3	12"	13	3'-1"	7'-11"	1'-1"	2'-0"	2'-1"	6'-0"	#3	12"	4	3'-6"	1'-1"	2'-6"	#3	1	15'-5"	#3	3	14'-4"	#3	12"	2	12'-8"	#3	12"	3	9'-8"	3'-6"	#3	1	13'-4"	#3	12"	5	"	"	81.1	108.4
	Long	#3	12"	18	3'-0"	7'-10"	1'-1"	1'-11"	2'-0"	6'-0"	#3	12"	5	3'-6"	1'-1"	2'-6"	#3	1	20'-2"	#3	3	20'-4"	#3	12"	2	17'-5"	#3	12"	3	13'-2"	4'-8"	#3	1	17'-10"	#3	12"	5	"	"		
6'	Short	#4	12"	16	3'-4"	9'-4"	1'-2"	2'-4"	2'-3"	7'-1"	#3	12"	4	4'-6"	1'-4"	3'-3"	#3	1	17'-6"	#3	3	16'-6"	#3	12"	2	14'-9"	#3	12"	4	12'-9"	3'-6"	#3	1	15'-6"	#3	12"	6	"	"	134.8	178.1
	Long	#4	12"	21	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	5	4'-6"	1'-4"	3'-3"	#3	1	23'-0"	#3	3	23'-6"	#3	12"	2	20'-3"	#3	12"	4	17'-5"	4'-8"	#3	1	20'-9"	#3	12"	6	2'-8"	1'-4"		
7'	Short	#4	12"	18	3'-9"	10'-10"	1'-3"	2'-10"	2'-7"	8'-1"	#4	12"	7	5'-6"	1'-7"	4'-0"	#4	1	19'-7"	#4	4	18'-9"	#4	12"	2	16'-10"	#4	12"	5	15'-10"	3'-6"	#4	1	17'-8"	#4	12"	7	3'-6"	1'-9"	259.5	345.2
	Long	#4	12"	24	3'-10"	10'-8"	1'-3"	2'-8"	2'-8"	8'-1"	#4	12"	9	5'-6"	1'-7"	4'-0"	#4	1	25'-10"	#4	4	26'-10"	#4	12"	2	23'-1"	#4	12"	5	21'-8"	4'-8"	#4	1	23'-8"	#4	12"	7	"	"		
8'	Short	#4	12"	20	4'-4"	12'-5"	1'-5"	3'-4"	3'-0"	9'-2"	#4	12"	10	6'-6"	1'-10"	4'-9"	#4	1	21'-8"	#4	4	21'-0"	#4	12"	3	18'-11"	#4	12"	5	15'-10"	3'-6"	#4	1	19'-10"	#4	12"	8	"	"	328.0	438.3
	Long	#4	12"	27	4'-4"	12'-8"	1'-5"	3'-2"	3'-0"	9'-2"	#4	12"	13	6'-6"	1'-10"	4'-9"	#4	1	28'-8"	#4	4	30'-3"	#4	12"	3	25'-11"	#4	12"	5	21'-8"	4'-8"	#4	1	26'-7"	#4	12"	8	3'-6"	1'-9"		

BAR BENDING DIAGRAM



Note:- Dimensions are to bar centers.

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

Designed By:- W.C.H. 5-13-63 Checked By:-
Drawn By:- W.C.H. 6-20-63 Checked By:- RHS 8-7-63
Quantities By:- W.C.H. 9-23-63 Checked By:-

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES

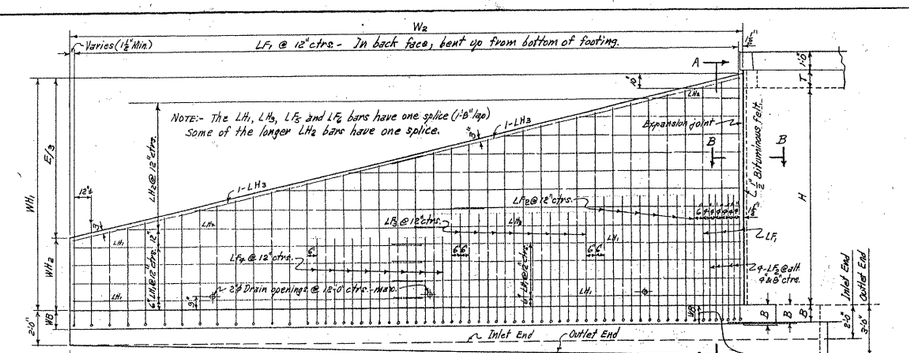
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

STANDARD DRAWING NO. W-X153-1

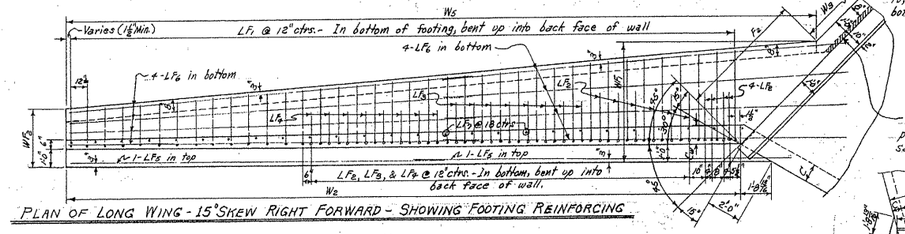
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		

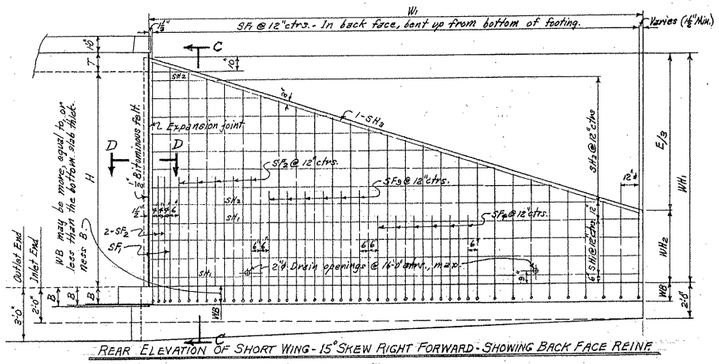


REAR ELEVATION OF LONG WING - 15° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING

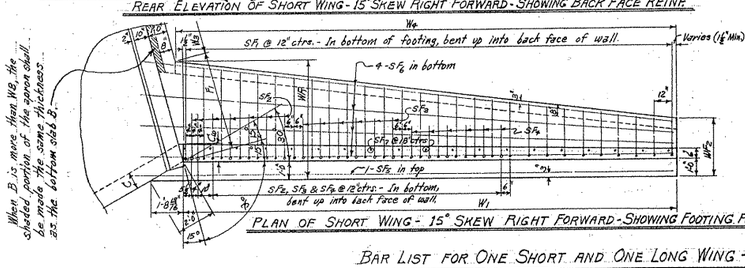


PLAN OF LONG WING - 15° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING

When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

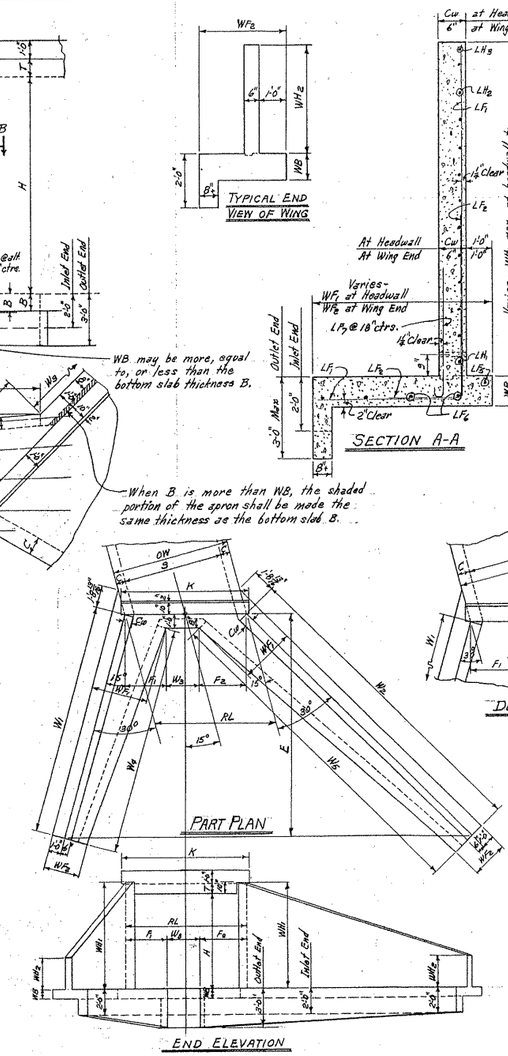


REAR ELEVATION OF SHORT WING - 15° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.



When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

PLAN OF SHORT WING - 15° SKEW RIGHT FORWARD - SHOWING FOOTING REINF.



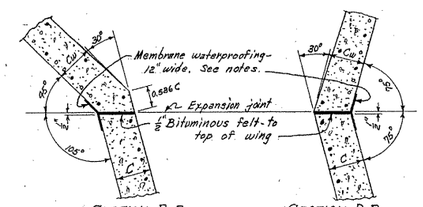
SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

Details of Culvert with 15° Skew Left Forward is reversed. See Drwg. No. W-X15.

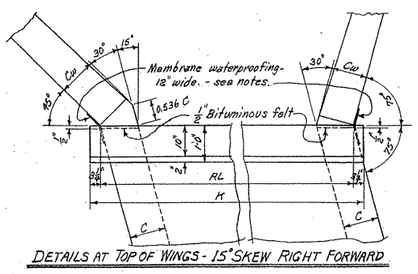
TYPICAL WING DETAILS

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
7'	9'	4'-0⅞"	4'-9⅞"	0"	1'-1⅞"	2'-1'-2⅞"	3'-1'-7⅞"
8'	10'	4'-6⅞"	5'-5⅞"	0"	1'-1⅞"	2'-3'-9⅞"	3'-4'-11"
9'	11'	5'-0⅞"	6'-2⅞"	0"	1'-1⅞"	2'-5'-7⅞"	3'-8'-2⅞"
10'	12'	5'-6⅞"	6'-10⅞"	0"	1'-1⅞"	2'-7'-9⅞"	4'-1'-6⅞"



SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WINGS - 15° SKEW RIGHT FORWARD

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15. For values of RL, K and W3 for each box, see above Std. also.

REGULAR WING DIMENSIONS - 3:1 SLOPES

Clear Height of Box	Thickness of Wing Footing	Thickness of Wing at Hdwl. & C.	Wingwall Heights: At Headwall	Wingwall Heights: At End of Wing	Widths of Wing Footings: At Headwall	Widths of Wing Footings: At End of Wing	Footing Dimension Parallel with Headwall	Footing Dimension Perpendicular Dist. from Hdwl. to End of Wing	Lengths of Wingwalls: Short Wing	Lengths of Wingwalls: Long Wing	Inside Footing Dimensions: Short Wing	Inside Footing Dimensions: Long Wing	* Quantity per Wing, Class S Concrete, Inlet End: Short Wing	Inlet End: Long Wing	Outlet End: Short Wing	Outlet End: Long Wing
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
9' ×	10"	9"	3'-10"	3'-0"	5'-2"	2'-10½"	4'-0⅞"	4'-9⅞"	20'-6"	21'-2⅜"	29'-0"	21'-3⅜"	31'-9"	6.651	9.248	6.928	9.647
10' ×	11"	10"	4'-10"	3'-4"	5'-8"	3'-0"	4'-6⅞"	5'-5⅞"	22'-6"	23'-3½"	31'-9⅜"	23'-6"	35'-0⅜"	8.477	11.784	8.782	12.225
11' ×	12"	11"	5'-10"	3'-8"	6'-2"	3'-1½"	5'-1"	6'-2⅞"	24'-6"	25'-4½"	34'-7⅜"	25'-8⅜"	38'-3⅜"	10.632	14.771	10.964	15.253
12' ×	13"	12"	6'-10"	4'-0"	6'-8"	3'-3"	5'-7⅞"	7'-0⅞"	26'-6"	27'-5⅜"	37'-5⅜"	27'-11"	41'-8⅜"	13.128	18.242	13.987	18.765

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.
* See Table "A" for special values of F1 & F2 and W4 & W5 for Single 7'x8', 8'x10', 9'x11' and 10'x12' Box Culverts.

QUANTITIES

Clear Span	Clear Height	Thickness of Wing at Headwall	Thickness of Wing Footing	⊛ Reinforcing Steel - For 4 Wings	Class S Concrete - 4 Wings, Headwalls, Wingwalls, Footings, Toewalls and Aprons: Single Barrel Culvert	Double Barrel Culvert	Triple Barrel Culvert	Quadruple Barrel Culvert	Quintuple Barrel Culvert
S	H	Cw	WB	LB.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
7'	9'	9"	10"	2362	33.07	34.81	36.53	38.27	40.00
	9'	9"	10"	2362	33.30	35.26	37.21	39.17	41.11
8'	10'	10"	11"	2932	41.94	43.94	45.92	47.82	49.90
9'	9'	10"	11"	2362	33.53	35.72	37.88	40.06	42.22
	10'	10"	11"	2932	42.18	44.39	46.60	48.81	51.02
	11'	11"	12"	3523	52.37	54.61	56.83	59.07	61.30
10'	9"	9"	10"	2362	33.76	36.19	38.56	40.92	43.32
	10'	10"	11"	2932	42.41	44.86	47.27	49.70	52.13
	11'	11"	12"	3523	52.61	55.07	57.52	59.96	62.42
	12'	12"	13"	4482	64.45	66.94	69.40	71.87	74.36
11'	9'	9"	10"	2362	33.99	36.47	39.28	41.86	—
	10'	10"	11"	2932	42.63	45.33	47.96	50.59	—
	11'	11"	12"	3523	52.83	55.54	58.20	60.87	—
	12'	12"	13"	4482	64.68	67.40	70.09	72.79	—
12'	9'	9"	10"	2362	34.21	37.16	39.99	42.83	—
	10'	10"	11"	2932	42.86	45.82	48.67	51.53	—
	11'	11"	12"	3523	53.07	56.02	58.88	61.78	—
	12'	12"	13"	4482	64.91	67.88	70.78	73.71	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawings listed at top of sheet.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel " 20,000 #/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

Clear Height	Wing Location	SF5 & LF5 Bent: In bottom of footing, bent up into back face of wing. One bar of each length. Size	Spacing	No. Reqd.	Lengths Vary Min.	Lengths Vary Max.	X Min.	X Max.	Y Min.	Y Max.	SF2 & LF2 Bent: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. Size ⊙	Spacing	No. Reqd.	Length	X	Y	SF3 & LF3 Bent: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. Size	Spacing	No. Reqd.	Length	X	Y	SF4 & LF4 Bent: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. Size	Spacing	No. Reqd.	Length	X	Y
H	Short or Long				Min.	Max.	Min.	Max.	Min.	Max.																		
9'	Short	#5	12"	22	4'-11"	14'-0"	1'-6"	3'-10"	3'-6"	10'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	30	4'-10"	13'-10"	1'-6"	3'-9"	3'-5"	10'-3"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	24	5'-6"	15'-9"	1'-8"	4'-9"	3'-11"	11'-8"	#6	12"	3	8'-6"	2'-4"	6'-8"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	33	5'-5"	15'-6"	1'-8"	4'-7"	3'-10"	11'-8"	#6	12"	4	8'-6"	2'-4"	6'-8"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	26	6'-0"	17'-2"	1'-9"	4'-10"	4'-2"	12'-5"	#6	12"	6	8'-6"	2'-4"	6'-8"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	35	6'-1"	16'-11"	1'-9"	4'-7"	4'-5"	12'-5"	#6	12"	8	8'-6"	2'-4"	6'-8"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	28	6'-8"	18'-9"	1'-11"	5'-4"	4'-10"	13'-6"	#7	12"	7	9'-6"	2'-7"	7'-10"	#6	12"	6	8'-6"	2'-4"	6'-8"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	38	6'-7"	18'-5"	1'-11"	5'-0"	4'-9"	13'-6"	#7	12"	10	9'-6"	2'-7"	7'-10"	#6	12"	8	8'-6"	2'-4"	6'-8"	#4	12"	8	6'-6"	1'-10"	4'-9"

Clear Height	Wing Location	SF5 & LF5 Straight: Longitudinal in top of wing footing back. Size	No. Reqd.	Length	SF6 & LF6 Straight: Longitudinal in bottom of wing footing too. Size	No. Reqd.	Length	SF7 & LF7 Bent: Footing dowels extending up into front face of wing. Size	Spacing	No. Reqd.	Length	X	SH1 & LH1 Horizontal in back face of wing. Size	Spacing	No. Reqd.	Length	SH2 & LH2 Straight: Horizontal in back face of wing. One bar of each length.* Size	Spacing	No. Reqd.	Lengths Vary Max.	Lengths Vary Min.	SH3 & LH3 In back face of wing at top - on slope. Size	No. Reqd.	Length
H	Short or Long																							
9'	Short	#4	1	23'-9"	#4	4	28'-8"	#4	18"	15	4'-0"	3'-6"	#4	12"	3	20'-11"	#4	12"	6	18'-11"	3'-6"	#4	1	22'-0"
	Long	#4	2	16'-7"	#4	8	17'-8"	#4	18"	20	4'-0"	3'-6"	#4	12"	6	15'-3"	#4	12"	6	25'-11"	4'-8"	#4	2	15'-6"
10'	Short	#4	1	26'-10"	#4	4	25'-6"	#4	18"	14	4'-4"	3'-10"	#4	12"	3	23'-0"	#4	12"	7	22'-0"	3'-6"	#4	1	24'-2"
	Long	#4	1	27'-11"	#4	4	27'-9"	#4	18"	22	4'-4"	3'-10"	#4	12"	6	16'-8"	#4	12"	7	*30'-6"	4'-8"	#4	2	17'-0"
11'	Short	#4	1	29'-5"	#4	8	21'-0"	#4	18"	18	4'-8"	4'-2"	#4	12"	4	25'-1"	#4	12"	7	22'-0"	3'-6"	#4	1	26'-4"
	Long	#4	2	19'-5"	#4	8	21'-0"	#4	18"	24	4'-8"	4'-2"	#4	12"	8	18'-1"	#4	12"	7	*30'-0"	4'-8"	#4	2	18'-6"
12'	Short	#4	1	30'-0"	#4	4	30'-0"	#4	18"	19	5'-0"	4'-6"	#4	12"	4	27'-2"	#4	12"	8	26'-1"	3'-6"	#4	1	28'-6"
	Long	#4	2	20'-10"	#4	8	22'-8"	#4	18"	26	5'-0"	4'-6"	#4	12"	8	19'-6"	#4	12"	8	*31'-5"	4'-8"	#4	2	20'-0"

Bar Bending Diagrams: SF5 - SF8, LF5 - LF8 (4½" Pin); SF9 & LF9 (3" Pin)

Quantity: Reinforcing Steel per Wing - Lbs. Short Wing	Long Wing
497.0	686.8
613.1	853.0
741.2	1020.5
941.4	1299.9

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

⊙ Except as shown at headwall.

* Lengths without splice. Bars over 29'-6" length may be spliced. (1'-8" lap.) Quantities include laps for LH2 bars over 29'-6" length.

CLASS S CONCRETE

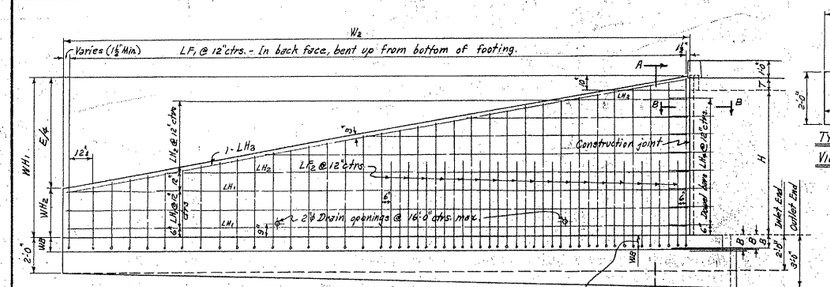
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
15° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

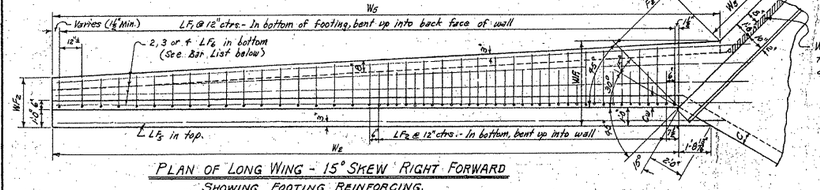
STANDARD DRAWING NO. W-X153-2

Designed by:- W.C.H. 5-13-63 Checked By:- RHS 8-7-63
Drawn by:- W.C.H. 6-12-63 Checked by:-
Quantities by:- W.C.H. 9-26-63 Checked by:-

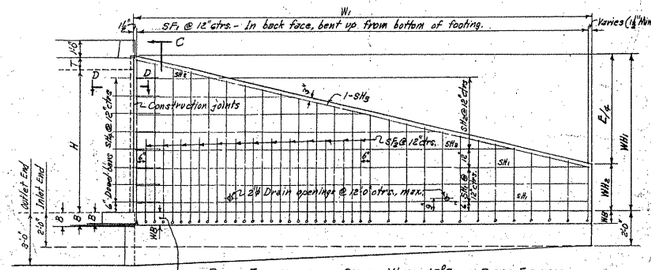
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



REAR ELEVATION OF LONG WING - 15° SKEW RIGHT FORWARD
SHOWING BACK FACE REINFORCING

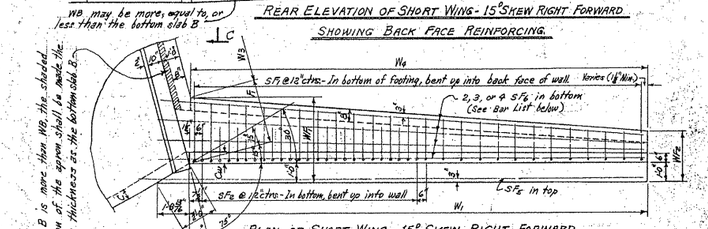


PLAN OF LONG WING - 15° SKEW RIGHT FORWARD
SHOWING FOOTING REINFORCING.

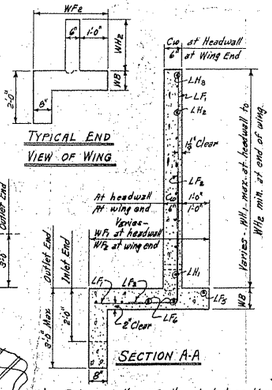


WB may be more, equal to, or less than the bottom slab B

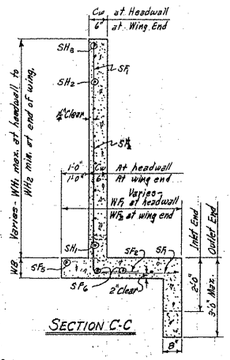
REAR ELEVATION OF SHORT WING - 15° SKEW RIGHT FORWARD
SHOWING BACK FACE REINFORCING.

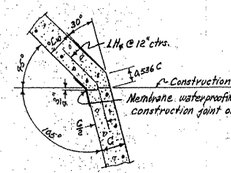


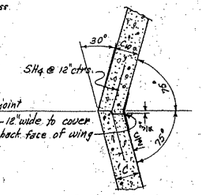
PLAN OF SHORT WING - 15° SKEW RIGHT FORWARD
SHOWING FOOTING REINFORCING



When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

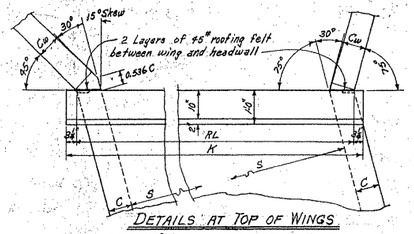






SECTIONS THRU CONSTRUCTION JOINTS

NOTE:- Payment for membrane waterproofing and roofing felt to be included in price bid for Class S Concrete.



DETAILS AT TOP OF WINGS
15° SKEW RIGHT FORWARD

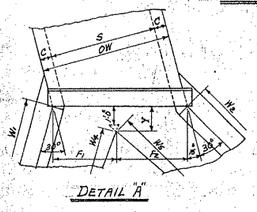


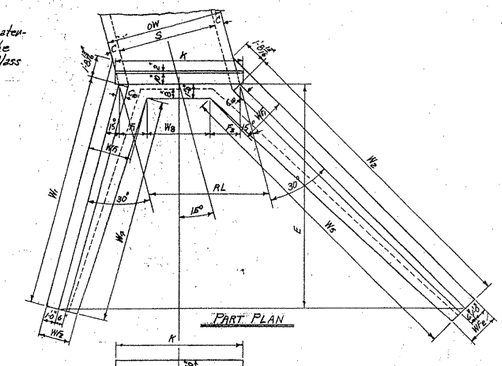
TABLE "A" - DIMENSIONS FOR DETAIL "A"

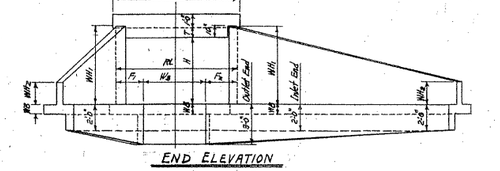
S	H	F1	F2	W4	W5	W3	Y
5'	7'	3'-0"	3'-5⅝"	22'-7"	32'-10"	0"	1'-0¼"
6'	8'	3'-6"	4'-1⅛"	25'-10⅜"	37'-0⅝"	0"	1'-1"

REGULAR WING DIMENSIONS - 4:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING		WINGWALL HEIGHTS		WIDTHS OF WING FOOTINGS		FOOTING DIMENSION PARALLEL WITH HEADWALL		PERPENDICULAR DIMENSION TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSIONS		* QUANTITY PER WING CLASS S CONCRETE			
			AT HEADWALL	AT END OF WING	AT HEADWALL	AT END OF WING	SHORT WING	LONG WING		SHORT WING	LONG WING	SHORT WING	LONG WING	INLET END		OUTLET END	
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	SHORT WING	LONG WING	SHORT WING	LONG WING
														CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-1⅜"	0'-10⅝"	8'-8"	8'-11⅜"	12'-3"	8'-3⅜"	12'-2"	1.044	1.443	1.161	1.600
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅝"	1'-5⅜"	1'-2⅝"	11'-4"	11'-8⅝"	16'-0⅝"	11'-1⅜"	16'-3⅝"	1.572	2.175	1.722	2.383
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	1'-9⅝"	1'-10"	14'-0"	14'-6"	19'-9⅝"	14'-0"	20'-0⅝"	2.196	3.039	2.381	3.297
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-1⅜"	2'-3⅜"	16'-8"	17'-8"	23'-6⅝"	16'-10½"	24'-5⅜"	2.913	4.039	3.134	4.393
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-1⅝"	2'-3⅜"	16'-8"	17'-8"	23'-6⅝"	16'-10½"	24'-5⅜"	3.039	4.204	3.255	4.513
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5⅜"	2'-9⅝"	19'-4"	20'-0⅝"	27'-4"	19'-8⅝"	28'-7"	4.046	5.601	4.302	5.961
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5⅜"	2'-9⅝"	19'-4"	20'-0⅝"	27'-4"	19'-8⅝"	28'-7"	4.129	5.716	4.389	6.075
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-5⅜"	2'-9⅝"	19'-4"	20'-0⅝"	27'-4"	19'-8⅝"	28'-7"	4.211	5.831	4.467	6.191
7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-0⅝"	3'-5⅜"	22'-0"	22'-9⅝"	31'-1⅝"	22'-7"	32'-10⅝"	5.300	7.391	5.592	7.753
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-0⅝"	3'-5⅜"	22'-0"	22'-9⅝"	31'-1⅝"	22'-7"	32'-10⅝"	5.407	7.491	5.699	7.904
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-6⅜"	4'-0⅝"	24'-8"	25'-6⅜"	34'-10⅝"	25'-5⅜"	37'-1⅜"	6.780	9.387	7.108	9.853

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W4.
⊙ See Table "A" for special values of F1 & F2 and W4 & W5 for Single 5'x7' and 6'x8' Box Culverts.





SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

TYPICAL WING DETAILS

Details of Culvert with 15° Skew Left Forward is reversed, see Drwg. No. W-X15.

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15.
For values of RL, K, and W5 for each box, see the above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING HEADWALL	THICKNESS OF WING FOOTING	REINFORCING ⊛ STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS: HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS					
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	149	6.07	7.06	8.05	9.04	10.04
	3'	6"	7"	226	8.56	9.55	10.54	11.54	12.53
	4'	6"	7"	346	11.51	12.50	13.49	14.48	15.48
	5'	6"	7"	487	14.91	15.89	16.89	17.88	18.88
	6'	7"	8"	809	20.30	21.31	22.34	23.36	24.38
5'	3'	6"	7"	226	8.78	9.98	11.19	12.39	13.60
	4'	6"	7"	346	11.73	12.93	14.14	15.34	16.55
	5'	6"	7"	487	15.13	16.33	17.53	18.74	19.95
	6'	7"	8"	809	20.52	21.75	22.99	24.23	25.46
	7'	7½"	8½"	1563	26.44	27.69	28.95	30.21	31.47
6'	3'	6"	7"	226	9.00	10.93	11.89	13.27	14.69
	4'	6"	7"	346	11.95	13.38	14.78	16.21	17.64
	5'	6"	7"	487	15.34	16.78	18.18	19.61	21.04
	6'	7"	8"	809	20.74	22.20	23.64	25.10	26.55
	7'	7½"	8½"	1563	26.66	28.14	29.61	31.09	32.57
	8'	8"	9"	1982	33.69	35.13	36.60	38.09	39.58
7'	4'	6"	7"	346	12.17	13.83	15.46	17.13	18.74
	5'	6"	7"	487	15.56	17.23	18.86	20.52	22.14
	6'	7"	8"	809	20.97	22.65	24.30	25.98	27.63
	7'	7½"	8½"	1563	26.89	28.59	30.27	31.97	33.66
	8'	8"	9"	1982	33.87	35.58	37.27	38.98	40.67
8'	4'	6"	7"	346	12.90	14.30	16.16	18.06	19.88
	5'	7"	7"	487	16.41	18.33	20.21	22.12	23.97
	6'	7"	8"	809	21.20	23.11	24.99	26.91	28.75
	7'	7½"	8½"	1563	27.11	29.05	30.95	32.88	34.75
	8'	8"	9"	1982	34.10	36.04	37.94	39.87	41.78
9'	5'	7"	7"	487	16.64	18.80	20.90	23.05	25.10
	6'	7½"	8"	809	21.84	24.02	26.14	28.31	30.37
	7'	7½"	8½"	1563	27.94	29.52	31.64	33.81	35.87
	8'	8"	9"	1982	34.33	36.50	38.62	40.79	42.86
10'	5'	7"	7"	487	16.88	19.27	21.60	23.89	26.24
	6'	7½"	8"	809	22.07	24.49	26.84	29.14	31.51
	7'	7½"	8½"	1563	27.58	29.99	32.34	34.65	37.01
	8'	8"	9"	1982	34.56	36.97	39.32	41.63	44.00
11'	6'	8"	8"	809	22.71	23.39	25.96	28.52	—
	7'	8"	8½"	1563	28.33	31.01	33.58	36.15	—
	8'	8"	9"	1982	34.78	37.45	40.03	42.59	—
12	6'	8"	8"	809	22.95	25.88	28.68	31.50	—
	7'	8"	8½"	1563	28.57	31.50	34.30	37.12	—
	8'	8"	9"	1982	35.01	37.94	40.75	43.57	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawings listed below.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:-
This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		

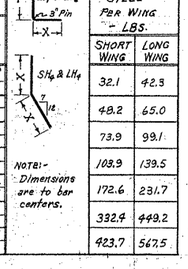
BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 BENT: In bottom of footing, bent up into back face of wing. One bar of each length.								SF2 & LF2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.					
		SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	MAX.	X MIN.	MAX.	Y MIN.	MAX.	SIZE	SPACING	NO. REQD	LENGTH	X	Y
H	SHORT OR LONG															
2'	Short	#3	12"	10	1'-6"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—
	Long	#3	12"	10	1'-5"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—
3'	Short	#3	12"	12	2'-1"	5'-3"	0'-10"	1'-9"	1'-8"	4'-0"	—	—	—	—	—	—
	Long	#3	12"	12	2'-0"	5'-3"	0'-10"	1'-3"	1'-8"	4'-0"	—	—	—	—	—	—
4'	Short	#3	12"	15	2'-5"	6'-7"	0'-11"	1'-8"	1'-7"	5'-0"	—	—	—	—	—	—
	Long	#3	12"	20	2'-6"	6'-6"	0'-11"	1'-7"	1'-8"	5'-0"	—	—	—	—	—	—
5'	Short	#3	12"	18	2'-10"	7'-11"	1'-0"	2'-0"	1'-11"	6'-0"	#3	12"	4	3'-6"	1'-1"	2'-6"
	Long	#3	12"	24	2'-10"	7'-10"	1'-0"	1'-11"	1'-11"	6'-0"	#3	12"	6	3'-6"	1'-1"	2'-6"
6'	Short	#4	12"	21	3'-4"	9'-2"	1'-2"	2'-4"	2'-3"	7'-1"	#3	12"	4	4'-6"	1'-4"	3'-3"
	Long	#4	12"	28	3'-4"	9'-3"	1'-2"	2'-3"	2'-3"	7'-1"	#3	12"	6	4'-6"	1'-4"	3'-3"
7'	Short	#4	12"	29	3'-11"	10'-10"	1'-3"	2'-10"	2'-8"	8'-1"	#4	12"	9	5'-6"	1'-7"	4'-0"
	Long	#4	12"	32	3'-9"	10'-8"	1'-3"	2'-8"	2'-10"	8'-1"	#4	12"	12	5'-6"	1'-7"	4'-0"
8'	Short	#4	12"	36	4'-6"	12'-3"	1'-5"	3'-4"	3'-2"	9'-2"	#4	12"	13	6'-6"	1'-10"	4'-9"
	Long	#4	12"	35	4'-6"	12'-3"	1'-5"	3'-2"	3'-2"	9'-2"	#4	12"	17	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	WING LOCATION	SF3 & LF3 STRAIGHT: Longitudinal in top of wing footing heel.			SF4 & LF4 STRAIGHT: Longitudinal in bottom of wing footing toe.			SH1 & LH1 STRAIGHT: Horizontal in back face of wing.				SH2 & LH2 STRAIGHT: Horizontal in back face of wing. One bar of each length.						SH3 & LH3 STRAIGHT: In back face of wing at top - on slope.		
		SIZE	NO. REQD	LENGTH	SIZE	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	MIN.		SIZE	NO. REQD	LENGTH
H	SHORT OR LONG																			
2'	Short	#3	1	11'-6"	#3	2	9'-10"	#3	12"	1	8'-9"	#3	12"	1	—	4'-6"		#3	1	9'-8"
	Long	#3	1	14'-9"	#3	2	12'-10"	#3	12"	1	12'-0"	#3	12"	1	—	6'-2"		#3	1	12'-0"
3'	Short	#3	1	16'-3"	#3	2	12'-8"	#3	12"	1	11'-6"	#3	12"	2	8'-8"	4'-6"		#3	1	11'-10"
	Long	#3	1	18'-6"	#3	2	17'-11"	#3	12"	1	15'-10"	#3	12"	2	11'-10"	6'-2"		#3	1	15'-10"
4'	Short	#3	1	17'-0"	#3	3	15'-6"	#3	12"	1	14'-3"	#3	12"	3	12'-10"	4'-6"		#3	1	14'-8"
	Long	#3	1	22'-3"	#3	3	22'-0"	#3	12"	1	19'-6"	#3	12"	3	17'-6"	6'-2"		#3	1	19'-8"
5'	Short	#3	1	19'-9"	#3	3	18'-0"	#3	12"	2	17'-0"	#3	12"	3	12'-10"	4'-6"		#3	1	17'-6"
	Long	#3	1	25'-0"	#3	3	26'-1"	#3	12"	2	23'-3"	#3	12"	3	17'-6"	6'-2"		#3	1	23'-0"
6'	Short	#3	1	22'-6"	#3	3	21'-8"	#3	12"	2	19'-9"	#3	12"	4	17'-0"	4'-6"		#3	1	20'-9"
	Long	#3	1	29'-9"	#3	3	30'-8"	#3	12"	2	27'-0"	#3	12"	4	23'-8"	6'-2"		#3	1	27'-0"
7'	Short	#4	1	25'-3"	#4	4	24'-11"	#4	12"	2	22'-6"	#3	12"	5	21'-2"	4'-6"		#4	1	23'-2"
	Long	#4	1	33'-2"	#4	4	34'-5"	#4	12"	2	30'-9"	#3	12"	5	28'-10"	6'-2"		#4	1	30'-11"
8'	Short	#4	1	28'-0"	#4	4	27'-10"	#4	12"	3	25'-3"	#4	12"	5	24'-2"	4'-6"		#4	1	26'-0"
	Long	#4	1	37'-3"	#4	4	38'-8"	#4	12"	3	34'-6"	#4	12"	5	32'-10"	6'-2"		#4	1	35'-0"

CLEAR HEIGHT	WING LOCATION	SH4 & LH4 BENT: Dowels thru construction joint at headwall.					QUANTITY REINFORCING STEEL PER WING - LBS.	
		SIZE	SPACING	NO. REQD	LENGTH	X	SHORT WING	LONG WING
H	SHORT OR LONG							
2'	Short	#3	12"	2	2'-8"	1'-9"	32.1	42.3
	Long	#3	12"	5	"	"		
3'	Short	#3	18"	3	"	"	48.2	65.0
	Long	#3	18"	4	"	"		
4'	Short	#3	18"	4	"	"	73.9	99.1
	Long	#3	18"	5	"	"		
5'	Short	#3	18"	5	"	"	103.9	139.5
	Long	#3	18"	6	"	"		
6'	Short	#3	18"	6	2'-8"	1'-9"	172.6	231.7
	Long	#3	18"	6	"	"		
7'	Short	#4	18"	7	3'-6"	1'-9"	332.4	449.2
	Long	#4	18"	7	"	"		
8'	Short	#4	18"	8	3'-6"	1'-9"	423.7	567.5
	Long	#4	18"	8	"	"		

BAR BENDING DIAGRAM



NOTE:- Dimensions are to bar centers.

Note:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
15° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

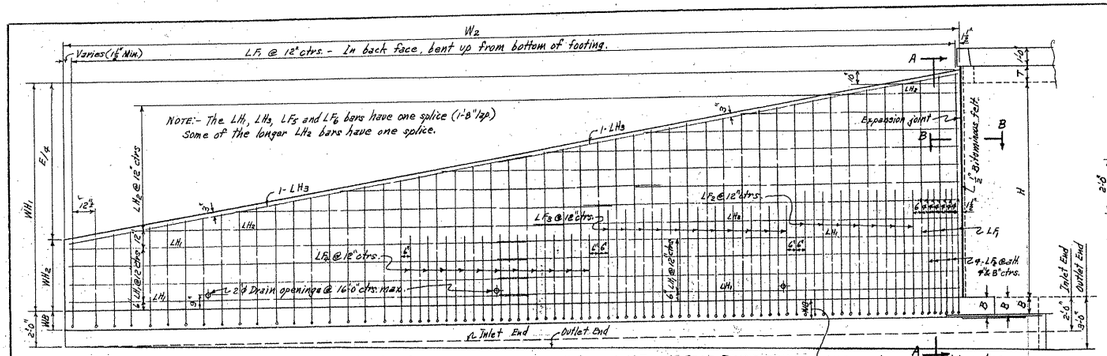
STANDARD DRAWING NO. W-X154-1

Designed By:- W.C.H. 5-18-63 Checked By:-
Drawn By:- W.C.H. 5-31-63 Checked By:- J.E.M. 7-2-63
Quantities By:- W.C.H. 9-23-63 Checked By:-

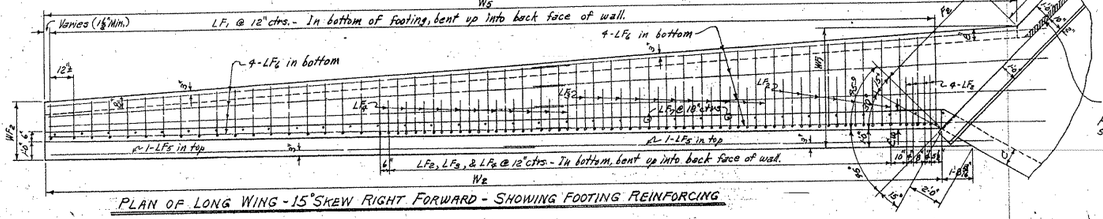
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- This drawing to be used in conjunction with Std. Barrel Sections, Drawing Nos.-

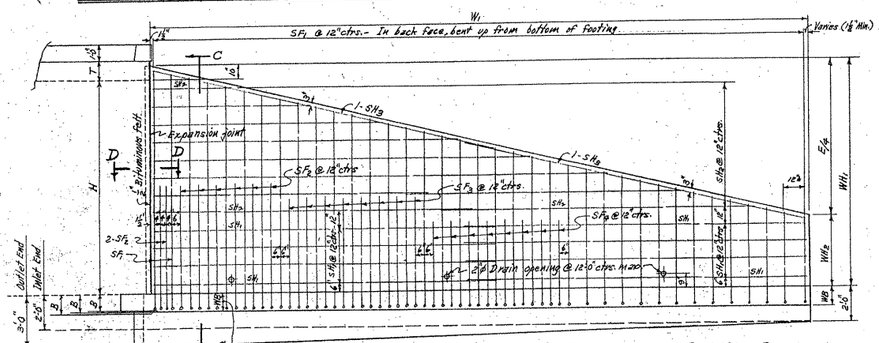
SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-115X-0	R-215X-0	R-315X-0	R-415X-0	R-515X-0
R-115X-1	R-215X-1	R-315X-1	R-415X-1	R-515X-1
	R-215X-2	R-315X-2		



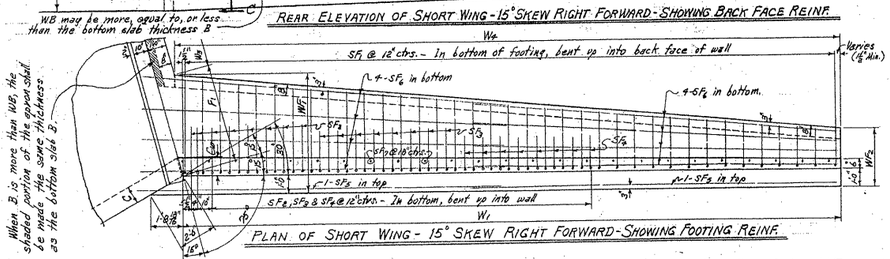
REAR ELEVATION OF LONG WING - 15° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



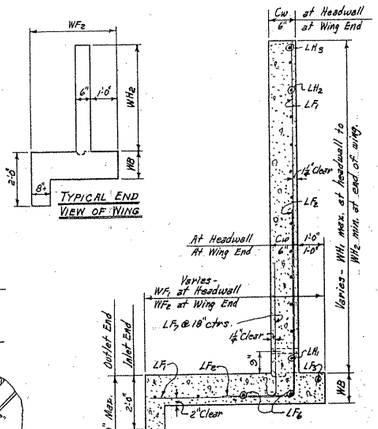
PLAN OF LONG WING - 15° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



REAR ELEVATION OF SHORT WING - 15° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.



PLAN OF SHORT WING - 15° SKEW RIGHT FORWARD - SHOWING FOOTING REINF.



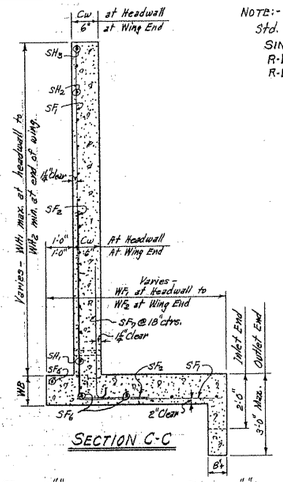
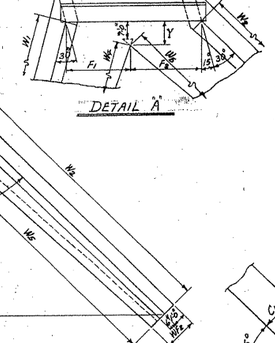
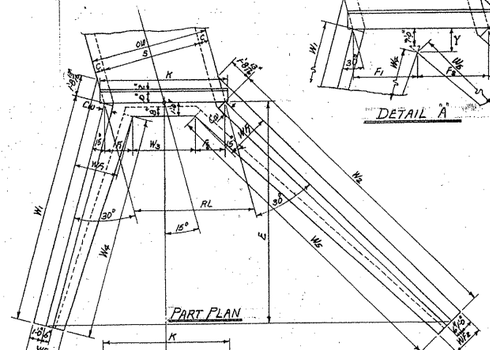
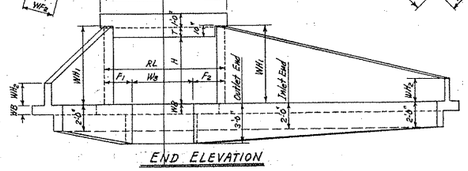


TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
7'	9'	4'-0⅝"	4'-9⅛"	0"	1'-1⅛"	28'-3⅝"	41'-3⅝"
8'	10'	4'-6⅝"	5'-5⅝"	0"	1'-1⅛"	31'-2"	45'-6⅝"
9'	11'	5'-0⅝"	6'-2⅝"	0"	1'-1⅛"	34'-0⅝"	49'-9⅝"
10'	12'	5'-6⅝"	6'-11⅝"	0"	1'-1⅛"	36'-11⅝"	54'-0⅝"



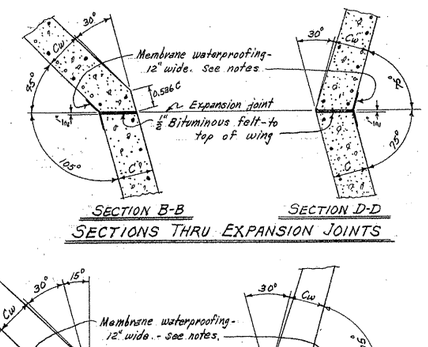




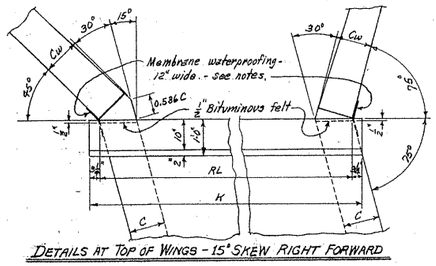
SINGLE BARREL CULVERT - 15° SKEW RIGHT FORWARD

TYPICAL WING DETAILS

Details of Culvert with 15° Skew Left Forward is reversed, see Std. Drawing No. W-X15.



SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WINGS - 15° SKEW RIGHT FORWARD

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X15. For values of RL, K and W5 for each bar, see above Std. also.

REGULAR WING DIMENSIONS - 4:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEAD = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	PERPENDICULAR DIST. FROM WING TO END OF WING	LENGTHS OF WINGWALLS SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSIONS SHORT WING	INSIDE FOOTING DIMENSIONS LONG WING	* QUANTITY PER WING CLASS S CONCRETE INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
9' ×	10"	9"	9'-10"	3'-0"	5'-2"	2'-10⅝"	4'-0⅝"	4'-10⅝"	27'-4"	28'-3½"	38'-7⅝"	28'-4½"	41'-5"	8.816	12.207	9.180	12.726
10' ×	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-6⅝"	5'-7⅝"	30'-0"	31'-0⅝"	42'-5"	31'-3⅝"	45'-8½"	11.246	15.565	11.696	16.136
11' ×	12"	11"	11'-10"	3'-8"	6'-2"	3'-1⅝"	5'-1"	6'-3⅝"	32'-8"	33'-9¾"	46'-2⅝"	34'-2"	49'-11½"	14.097	19.511	14.532	20.135
12' ×	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-7⅝"	7'-0⅝"	35'-4"	36'-7"	49'-11⅝"	37'-0⅝"	54'-2⅝"	17.916	24.103	17.888	24.781

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.
× See Table "A" for special values of F1, F2 and W4, W5 for Single 7'x9', 8'x10', 9'x11' and 10'x12' Box Culverts.

QUANTITIES

CLEAR SPAN S	CLEAR HEIGHT H	THICKNESS OF WING-AT HEADWALL Cw	THICKNESS OF WING FOOTING WB	⊕ REINFORCING STEEL FOR 4 WINGS LB.	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS SINGLE BARREL CULVERT Cu.Yd.	DOUBLE BARREL CULVERT Cu.Yd.	TRIPLE BARREL CULVERT Cu.Yd.	QUADRUPLE BARREL CULVERT Cu.Yd.	QUINTUPLE BARREL CULVERT Cu.Yd.
7'	9'	9"	10"	3063	43.52	45.26	47.99	48.73	50.46
8'	9'	9"	10"	3063	43.76	45.72	47.66	49.62	51.57
	10'	10"	11"	3824	55.26	57.26	59.25	61.24	63.23
9'	9'	9"	10"	3063	48.99	46.18	48.33	50.51	52.67
	10'	10"	11"	3824	55.50	57.72	59.92	62.19	64.34
	11'	11"	12"	4627	69.02	71.27	73.49	75.73	77.95
10'	9'	9"	10"	3063	44.21	46.44	49.02	51.38	53.78
	10'	10"	11"	3824	55.73	58.18	60.60	63.02	65.46
	11'	11"	12"	4627	69.24	71.73	74.17	76.62	79.08
	12'	12"	13"	5813	85.01	87.50	89.97	92.49	94.92
11'	9'	9"	10"	3063	44.44	47.13	49.73	52.31	——
	10'	10"	11"	3824	55.95	58.66	61.28	63.92	——
	11'	11"	12"	4627	69.49	72.19	74.85	77.53	——
	12'	12"	13"	5813	85.24	87.97	90.66	95.36	——
12'	9'	9"	10"	3063	44.67	47.61	50.44	53.28	——
	10'	10"	11"	3824	56.18	59.14	62.00	64.86	——
	11'	11"	12"	4627	69.72	72.68	75.53	78.44	——
	12'	12"	13"	5813	85.48	88.44	91.35	94.28	——

⊕ For reinforcing steel in Headwalls and Aprons, see Drawings list at top sheet.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mopings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT H	WING LOCATION SHORT OR LONG	SF1 & LF1 BENT In bottom of footing, bent up into back face of wing. One bar of each length. SIZE	SPACING	No. REQD	LENGTHS VARY MIN.	MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 BENT In bottom of footing, bent up into back face of wing. All with F1 bars. SIZE	⊕ SPACING	No. REQD	LENGTH	X	Y
9'	Short	#5	12"	29	4'-11"	16'-0"	1'-6"	3'-10"	3'-6"	10'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"
	Long	#5	12"	39	4'-11"	13'-10"	1'-6"	3'-8"	3'-6"	10'-3"	#5	12"	6	7'-6"	2'-1"	5'-6"
10'	Short	#5	12"	32	5'-5"	16'-7"	1'-8"	4'-4"	3'-10"	11'-9"	#6	12"	4	8'-6"	2'-9"	6'-3"
	Long	#5	12"	43	5'-5"	15'-4"	1'-8"	4'-1"	3'-11"	11'-9"	#6	12"	5	8'-6"	2'-9"	6'-3"
11'	Short	#5	12"	34	6'-1"	17'-8"	1'-9"	4'-10"	4'-5"	12'-5"	#6	12"	8	8'-6"	2'-9"	6'-3"
	Long	#5	12"	47	5'-11"	16'-11"	1'-9"	4'-7"	4'-3"	12'-5"	#6	12"	11	8'-6"	2'-9"	6'-3"
12'	Short	#5	12"	37	6'-8"	18'-9"	1'-11"	5'-4"	4'-10"	13'-6"	#7	12"	8	9'-6"	2'-7"	7'-0"
	Long	#5	12"	50	6'-8"	18'-5"	1'-11"	5'-0"	4'-10"	13'-6"	#7	12"	11	9'-6"	2'-7"	7'-0"

CLEAR HEIGHT H	WING LOCATION SHORT OR LONG	SF3 & LF3 BENT In bottom of footing, bent up into back face of wing. All with F1 bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	SF4 & LF4 BENT In bottom of footing, bent up into back face of wing. All with F1 bars. SIZE	SPACING	No. REQD	LENGTH	X	Y
9'	Short	#5	12"	8	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	11	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	11	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	11	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	8	8'-6"	2'-4"	6'-3"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	11	8'-6"	2'-4"	6'-3"	#4	12"	11	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT H	WING LOCATION SHORT OR LONG	SF5 & LF5 STRAIGHT Longitudinal in top of wing footing heel. SIZE	No. REQD	LENGTH	SF6 & LF6 STRAIGHT Longitudinal in bottom of wing footing toe. SIZE	No. REQD	LENGTH	SF7 & LF7 BENT Footing dowels extending up into front face of wing. SIZE	SPACING	No. REQD	LENGTH	X
9'	Short	#4	2	16'-8"	#4	8	15'-9"	#4	18"	19	4'-0"	3'-6"
	Long	#4	2	21'-8"	#4	8	22'-9"	#4	18"	26	4'-0"	3'-6"
10'	Short	#4	2	17'-8"	#4	8	17'-8"	#4	18"	21	4'-4"	3'-10"
	Long	#4	2	23'-8"	#4	8	24'-6"	#4	18"	29	4'-4"	3'-10"
11'	Short	#4	2	19'-0"	#4	8	18'-9"	#4	18"	23	4'-8"	4'-2"
	Long	#4	2	25'-2"	#4	8	26'-8"	#4	18"	31	4'-8"	4'-2"
12'	Short	#4	2	20'-4"	#4	8	20'-3"	#4	18"	25	5'-0"	4'-6"
	Long	#4	2	27'-1"	#4	8	28'-8"	#4	18"	34	5'-0"	4'-6"

CLEAR HEIGHT H	WING LOCATION SHORT OR LONG	SH1 & LH1 STRAIGHT Horizontal in back face of wing. SIZE	SPACING	No. REQD	LENGTH	SH2 & LH2 STRAIGHT Horizontal in back face of wing. One bar of each length. * SIZE	SPACING	No. REQD	LENGTHS VARY MAX.	MIN.	SH3 & LH3 In back face of wing at top - on slope SIZE	No. REQD	LENGTH
9'	Short	#4	12"	6	14'-10"	#4	12"	6	25'-4"	9'-6"	#4	2	15'-3"
	Long	#4	12"	6	20'-0"	#4	12"	6	34'-6"	6'-2"	#4	2	20'-3"
10'	Short	#4	12"	6	16'-3"	#4	12"	7	*29'-6"	9'-6"	#4	2	16'-8"
	Long	#4	12"	6	21'-11"	#4	12"	7	*40'-8"	6'-2"	#4	2	22'-8"
11'	Short	#4	12"	8	17'-7"	#4	12"	7	*29'-6"	9'-6"	#4	2	18'-1"
	Long	#4	12"	8	23'-9"	#4	12"	7	*40'-8"	6'-2"	#4	2	24'-1"
12'	Short	#4	12"	8	19'-0"	#4	12"	8	*33'-8"	9'-6"	#4	2	19'-6"
	Long	#4	12"	8	25'-8"	#4	12"	8	*45'-10"	6'-2"	#4	2	26'-0"

BAR BENDING DIAGRAMS: SF1 - SF4, LF1 - LF4 (Y, X, 4½" Pin); SF5 & LF7 (X, 3" Pin)

Note:- Dimensions are to bar centers.

QUANTITY REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
698.5	883.2
812.1	1099.7
976.4	1337.2
1233.3	1673.0

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

⊕ Except as shown at headwall.

* Lengths without splice. Bars over 29'-0" length may be spliced. (1'-8" lap). Quantities include laps for SH2 & LH2 bars over 29'-0" length.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

STANDARD DRAWING NO. W-X154-2

Designed By:- W.C.H. 5-13-63 Checked By:- J.E.M. 8-7-63
Drawn By:- W.C.H. 6-18-63 Checked By:- Checked By:-
Quantities By:- W.C.H. 9-24-63

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

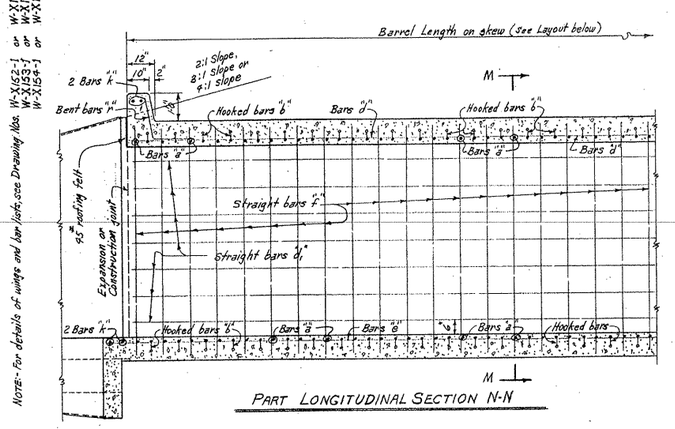
BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

Depth of Cover D	Clear Span S	Clear Height H	"a" bars Straight In Top and Bottom Slabs of Barrel. Size	Spacing	No. Reqd.	Length	"b" bars Bent - See Diagram. In Top and Bottom Slabs of Barrel. Alternate with "a" bars Size	Spacing	No. Reqd.	Length	X	"d" bars Longitudinal in Top Slab of Barrel. Size	Spacing	No. Reqd.	Length	"d₁" bars Straight Longitudinal in Sidewalls Size	Spacing	No. Reqd.	Length	"e" bars Longitudinal in Bottom Slab of Barrel Size	Spacing	No. Reqd.	Length	"f" bars Straight Verticals in Sidewalls Size	Spacing	No. Reqd.	Length	"k" bars Straight 2 in Top of Headwalls and Aprons - Each. Size	No. Reqd.	Length
0'-0" to 5'-0" Maximum	4'	2'			112	4'-11"			110	6'-0"	4'-10"			6				4				5				120	2'-11"		8	5'-5"	
		3'			112	4'-11"			110	6'-0"	4'-10"			6				6				5				120	4'-11"		8	5'-5"	
		4'	#5	13"	112	4'-11"	#6	13"	110	6'-0"	4'-10"	#5	10½"	6		#4	12"	8		#4	12"	5		#4	12"	120	5'-11"	#5	8	5'-5"	
		5'			112	4'-11"			110	6'-0"	4'-10"			6				10				5				120	6'-11"		8	5'-5"	
		6'			112	5'-1"			110	6'-2"	5'-0"			6				12				5							8	5'-7"	
	4'	3'			112	5'-11"			110	7'-1"	5'-11"			7				6				6				120	4'-0"		8	6'-6"	
		4'			112	5'-11"			110	7'-1"	5'-11"			7				8				6				120	5'-0"		8	6'-6"	
		5'	#6	13"	112	5'-11"	#6	13"	110	7'-1"	5'-11"	#5	10½"	7		#4	12"	10		#4	12"	6		#4	12"	120	6'-0"	#6	8	6'-6"	
		6'			112	6'-1"			110	7'-3"	6'-1"			7				12				6				120	7'-0"		8	6'-8"	
		7'			112	6'-2"			110	7'-4"	6'-2"			7				14				6				120	8'-0"		8	6'-9"	
	5'	3'			120	7'-0"			118	8'-1"	6'-11"			8				6				7				120	4'-1"		8	7'-6"	
		4'			120	7'-0"			118	8'-1"	6'-11"			8				8				7				120	5'-1"		8	7'-6"	
		5'	#6	12"	120	7'-0"	#6	12"	118	8'-1"	6'-11"	#5	10½"	8		#4	12"	10		#4	12"	7		#4	12"	120	6'-1"	#6	8	7'-8"	
		6'			120	7'-2"			118	8'-3"	7'-1"			8				12				7				120	7'-1"		8	7'-8"	
		7'			120	7'-3"			118	8'-4"	7'-2"			8				14				7				120	8'-1"		8	7'-9"	
		8'			120	7'-4"			118	8'-5"	7'-3"			8				16				7				120	9'-1"		8	7'-10"	
	6'	4'			132	8'-0"			130	9'-1"	7'-11"			9				8				8				120	5'-2"		8	8'-7"	
		5'			132	8'-0"			130	9'-1"	7'-11"			9				10				8				120	6'-2"		8	8'-7"	
		6'	#6	11"	132	8'-2"	#6	11"	130	9'-3"	8'-1"	#5	10½"	9		#4	12"	12		#4	12"	8		#4	12"	120	7'-2"	#6	8	8'-9"	
		7'			132	8'-3"			130	9'-4"	8'-2"			9				14				8				120	8'-2"		8	8'-10"	
		8'			132	8'-4"			130	9'-5"	8'-3"			9				16				8				10"	144	9'-2"	8	8'-11"	
		9'			132	8'-5"			130	9'-7"	8'-5"			9				18				8				12"	120	10'-2"	8	9'-1"	
	7'	4'			120	9'-1"			118	10'-2"	9'-0"			11				8				9				120	5'-4"		8	9'-7"	
		5'			120	9'-3"			118	10'-4"	9'-2"			11				10				9				120	6'-4"		8	9'-9"	
		6'	#7	12"	120	9'-3"	#6	12"	118	10'-4"	9'-2"	#5	10"	11		#4	12"	12		#4	12"	9		#4	12"	120	7'-4"	#7	8	9'-9"	
		7'			120	9'-4"			118	10'-5"	9'-3"			11				14				9				120	8'-4"		8	9'-10"	
		8'			120	9'-5"			118	10'-6"	9'-4"			11				16				9				10"	144	9'-6"	8	9'-11"	
		9'			120	9'-7"			118	10'-8"	9'-6"			11				18				9				12"	120	10'-6"	8	10'-1"	
		10'			120	9'-9"			118	10'-10"	9'-8"			11				20				9				11"	132	11'-6"	8	10'-3"	
	8'	5'			132	10'-3"			130	11'-4"	10'-2"			12				10				10				120	6'-5"		8	10'-9"	
		6'			132	10'-4"			130	11'-5"	10'-3"			12				12				10				120	7'-5"		8	10'-11"	
		7'	#7	11"	132	10'-5"	#6	11"	130	11'-6"	10'-4"	#5	10"	12		#4	12"	14		#4	12"	10		#4	12"	120	8'-5"	#7	8	10'-11"	
		8'			132	10'-6"			130	11'-8"	10'-6"			12				16				10				10"	144	9'-5"	8	11'-2"	
		9'			132	10'-7"			130	11'-10"	10'-8"			12				18				10				12"	120	10'-5"	8	11'-2"	
		10'			132	10'-9"			130	12'-0"	10'-10"			12				20				10				11"	132	11'-5"	8	11'-4"	
		11'			132	10'-11"			130	12'-2"	10'-10"			12				22				10				10"	144	12'-5"	8	11'-6"	
	9'	5'			120	11'-3"			118	12'-7"	11'-3"			13				10				11				120	6'-6"		8	11'-10"	
		6'			120	11'-4"			118	12'-8"	11'-4"			13				12				11				120	7'-6"		8	11'-11"	
		7'	#7	12"	120	11'-5"	#7	12"	118	12'-8"	11'-4"	#5	10½"	13		#4	12"	14		#4	12"	11		#4	12"	120	8'-6"	#7	8	11'-11"	
		8'			120	11'-5"			118	12'-9"	11'-5"			13				16				11				10"	144	9'-6"	8	12'-0"	
		9'			120	11'-8"			118	12'-11"	11'-7"			13				18				11				12"	120	10'-6"	8	12'-2"	
		10'			120	11'-10"			118	13'-1"	11'-9"			13				20				11				11"	132	11'-6"	8	12'-4"	
		11'			120	12'-0"			118	13'-3"	11'-11"			13				22				11				10"	144	12'-6"	8	12'-6"	
		12'			120	12'-2"			118	13'-5"	12'-1"			13				24				11				#6 12"	120	13'-6"	8	12'-9"	
	10'	6'			132	12'-6"			130	13'-9"	12'-5"			15				12				12				120	7'-7"		8	13'-0"	
		7'			132	12'-6"			130	13'-9"	12'-5"			15				14				12				120	8'-7"		8	13'-0"	
		8'	#7	11"	132	12'-6"	#7	11"	130	13'-9"	12'-5"	#5	9½"	15		#4	12"	16		#4	12"	12		#4	12"	10"	144	9'-7"	8	13'-0"	
		9'			132	12'-8"			130	13'-11"	12'-7"			15				18				12				12"	120	10'-7"	8	13'-2"	
		10'			132	12'-10"			130	14'-1"	12'-9"			15				20				12				11"	132	11'-7"	8	13'-4"	
		11'			132	13'-0"			130	14'-3"	12'-11"			15				22				12				10"	144	12'-7"	8	13'-7"	
		12'			132	13'-2"			130	14'-5"	13'-1"			15				24				12				#6 12"	120	13'-7"	8	13'-9"	
	11'	6'			120	13'-6"			118	14'-10"	13'-6"			16				12				13				120	7'-9"		8	14'-1"	
		7'			120	13'-6"			118	14'-10"	13'-6"			16				14				13				120	8'-9"		8	14'-1"	
		8'	#7	12"	120	13'-6"	#7	12"	118	14'-10"	13'-6"	#5	9½"	16		#4	12"	16		#4	12"	13		#4	12"	10"	144	9'-9"	8	14'-1"	
		9'			120	13'-8"			118	15'-0"	13'-8"			16				18				13				12"	120	10'-9"	8	14'-3"	
		10'			120	13'-10"			118	15'-2"	13'-10"			16				20				13				11"	132	11'-9"	8	14'-5"	
		11'			120	14'-0"			118	15'-4"	14'-0"			16				22				13				10"	144	12'-9"	8	14'-7"	
		12'			120	14'-2"			118	15'-6"	14'-2"			16				24				13				#6 12"	120	13'-9"	8	14'-9"	

NOTE:- The "a" and "b" bars are to be placed parallel with the headwalls, spacing to be parallel with barrel.

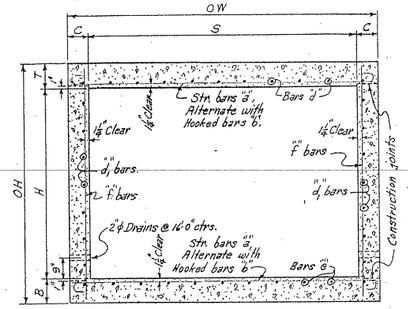
DIMENSIONS / QUANTITIES

Max. Design Depth of Cover D	Clear Span S	Clear Height H	Sq. Ft. of Opening A	Overall Width OW	Barrel Dimensions: Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	Unit Quantities: Class S Conc. per Lin. Ft. of Barrel Cu.Yd.	Reinforcing Steel per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.	Additional Two Headwalls and Aprons Lb.
5'-0"	4'	2'	8	5'-0"	7"	6"	6½"	3'-1½"	5'-2⅛"	5'-8⅝"	0.282	42.27	17.95	71.92
		3'	12	5'-0"		6"		4'-1½"	"	"	0.319	44.94	19.62	71.92
		4'	16	5'-0"		6"		5'-1½"	"	"	0.356	47.62	21.29	71.92
		5'	20	5'-0"		6"		6'-1½"	"	"	0.394	50.29	22.96	71.92
		6'	24	5'-2"		7"		7'-1⅛"	5'-4⅞"	5'-10⅝"	0.474	53.74	24.63	73.31
	5'	3'	15	6'-0"	7½"	6"	7"	4'-2½"	6'-2½"	6'-9⅜"	0.380	56.71	22.19	110.28
		4'	20	6'-0"		6"		5'-2½"	"	"	0.417	59.38	23.86	110.28
		5'	25	6'-0"		6"		6'-2½"	"	"	0.454	62.05	25.53	110.28
		6'	30	6'-2"		7"		7'-2½"	6'-4⅝"	6'-11⅛"	0.535	65.45	27.20	112.28
		7'	35	6'-3"		7½"		8'-2½"	6'-5⅝"	7'-0⅞"	0.604	68.78	28.87	113.28
	6'	3'	18	7'-0"	8"	6"	7½"	4'-3⅜"	7'-3"	7'-9⅜"	0.446	67.79	24.96	127.97
		4'	24	7'-0"		6"		5'-3⅜"	"	"	0.483	70.47	26.63	127.97
		5'	30	7'-0"		6"		6'-3⅜"	"	"	0.520	73.14	28.10	127.97
		6'	36	7'-2"		7"		7'-3⅜"	7'-5"	7'-11⅝"	0.602	76.81	29.77	129.98
		7'	42	7'-3"		7½"		8'-3⅜"	7'-6"	8'-0⅝"	0.671	79.98	31.44	130.98
		8'	48	7'-4"		8"		9'-3⅜"	7'-7⅛"	8'-1⅝"	0.746	83.97	33.11	131.98
	7'	4'	28	8'-0"	8½"	6"	8½"	5'-5"	8'-3⅝"	8'-9⅜"	0.568	82.36	29.01	146.89
		5'	35	8'-0"		6"		6'-5"	"	"	0.605	85.63	30.68	146.89
		6'	42	8'-2"		7"		7'-5"	8'-5½"	9'-0"	0.688	89.40	32.35	148.89
		7'	49	8'-3"		7½"		8'-5"	8'-6⅝"	9'-1"	0.757	92.62	34.02	149.90
		8'	56	8'-4"		8"		9'-5"	8'-7½"	9'-2"	0.832	96.28	35.69	150.90
		9'	63	8'-6"		9"		10'-5"	8'-9⅝"	9'-4"	0.946	107.22	37.36	152.90
	8'	4'	32	9'-0"	9½"	6"	9½"	5'-7"	9'-3⅜"	9'-10⅛"	0.676	97.69	33.32	207.70
		5'	40	9'-2"		7"		6'-7"	9'-5⅞"	10'-0⅛"	0.754	101.48	34.99	210.42
		6'	48	9'-2"		7"		7'-7"	"	"	0.797	104.15	36.66	210.42
		7'	56	9'-3"		7½"		8'-7"	9'-6⅝"	10'-1⅝"	0.867	107.92	38.33	211.79
		8'	64	9'-4"		8"		9'-7"	9'-8"	10'-2⅝"	0.942	113.17	40.00	213.15
		9'	72	9'-6"		9"		10'-7"	9'-10"	10'-4⅝"	1.057	122.28	41.67	215.87
		10'	80	9'-8"		10"		11'-7"	10'-0⅝"	10'-6⅝"	1.184	129.04	43.34	218.60
	9'	5'	45	10'-2"	10"	7"	10"	6'-8"	10'-6⅝"	11'-0⅝"	0.844	117.30	37.56	233.23
		6'	54	10'-3"		7½"		7'-8"	10'-7⅝"	11'-1⅝"	0.910	120.62	39.23	234.60
		7'	63	10'-3"		7½"		8'-8"	"	"	0.957	123.29	40.90	234.60
		8'	72	10'-4"		8"		9'-8"	10'-8⅝"	11'-2⅝"	1.033	129.12	42.57	235.94
		9'	81	10'-6"		9"		10'-8"	10'-10⅝"	11'-5"	1.148	138.38	44.24	240.05
		10'	90	10'-8"		10"		11'-8"	11'-0⅝"	11'-7"	1.276	145.26	45.91	242.77
		11'	99	10'-10"		11"		12'-8"	11'-2⅝"	11'-9"	1.416	152.98	47.58	245.50
	10'	5'	50	11'-2"	11½"	7"	11"	6'-9½"	11'-6⅝"	12'-1⅝"	0.957	133.70	40.13	257.63
		6'	60	11'-3"		7½"		7'-9½"	11'-7⅝"	12'-2⅝"	1.024	137.06	41.80	258.99
		7'	70	11'-3"		7½"		8'-9½"	"	"	1.071	139.73	43.47	258.99
		8'	80	11'-4"		8"		9'-9½"	11'-8⅝"	12'-3⅝"	1.147	145.62	45.14	264.35
		9'	90	11'-6"		9"		10'-9½"	11'-10⅝"	12'-5⅝"	1.263	155.33	46.81	263.08
		10'	100	11'-8"		10"		11'-9½"	12'-1"	12'-7⅝"	1.391	162.30	48.48	265.80
		11'	110	11'-10"		11"		12'-9½"	12'-3"	12'-9⅝"	1.532	170.12	50.15	268.53
		12'	120	12'-0"		12"		13'-9½"	12'-5⅝"	12'-11⅝"	1.685	182.08	51.82	271.25
	11'	6'	66	12'-4"	12"	8"	11½"	7'-10⅝"	12'-9⅝"	13'-3⅝"	1.153	158.87	46.12	283.61
		7'	77	12'-4"		8"		8'-10⅝"	"	"	1.202	161.55	47.79	283.61
		8'	88	12'-4"		8"		9'-10⅝"	"	"	1.252	166.78	49.46	283.61
		9'	99	12'-6"		9"		10'-10⅝"	12'-11⅝"	13'-5⅝"	1.368	176.31	51.13	286.33
		10'	110	12'-8"		10"		11'-10⅝"	13'-1⅝"	13'-7⅝"	1.497	183.92	52.80	289.06
		11'	121	12'-10"		11"		12'-10⅝"	13'-3⅝"	13'-10"	1.638	191.38	54.47	293.15
		12'	132	13'-0"		12"		13'-10⅝"	13'-5½"	14'-0"	1.792	203.51	56.14	295.87
	12'	6'	72	13'-4"	12½"	8"	12"	8'-0"	13'-9⅝"	14'-4"	1.284	176.47	48.69	378.98
		7'	84	13'-4"		8"		9'-0"	"	"	1.333	179.14	50.36	378.98
		8'	96	13'-4"		8"		10'-0"	"	"	1.383	184.42	52.03	378.98
		9'	108	13'-6"		9"		11'-0"	13'-11⅝"	14'-6⅝"	1.500	194.12	53.70	382.54
		10'	120	13'-8"		10"		12'-0"	14'-1⅝"	14'-8⅝"	1.630	201.34	55.37	386.10
		11'	132	13'-10"		11"		13'-0"	14'-3⅝"	14'-10⅝"	1.772	209.43	57.04	389.66
		12'	144	14'-0"		12"		14'-0"	14'-5⅝"	15'-0⅝"	1.926	221.72	58.71	393.22

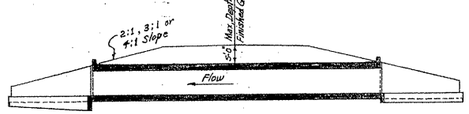


PART LONGITUDINAL SECTION N-N

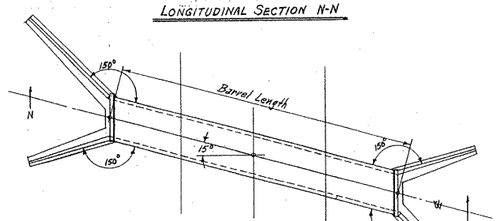
NOTE:- For details of wings and bar lists, see Drawing Nos. W-X152-1 or W-X152-2 and W-X15, W-X153-1 or W-X153-2 " " " W-X154-1 or W-X154-2 " " "



TYPICAL SECTION M-M



LONGITUDINAL SECTION N-N



LAYOUT OF SINGLE BARREL CULVERT
15° SKEW LEFT FORWARD
15° Skew Right Forward is reversed.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Drawing Nos. W-X152-1 or W-X152-2 ; W-X153-1 or W-X153-2 and W-X154-1 or W-X154-2. Also W-X15.

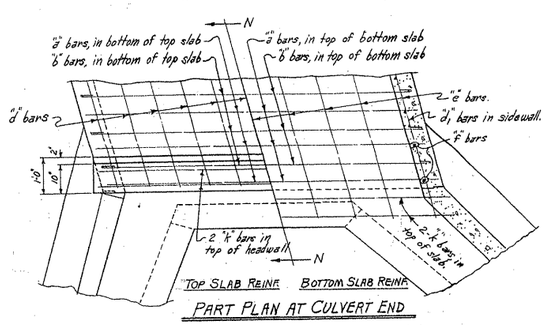
CLASS S CONCRETE

Bar Size	Pin Diam.	K	Add for 2 Hooks	Bending Diagram Bars "b"
#6	3"	5"	1'-2"	
#7	3½"	5¾"	1'-4"	

NOTE:- Dimensions are to centers of bars.

DOWEL BARS FOR TWO HEADWALLS

Span @	Size	Spacing	No. Reqd.	Length	X	Bars "j" Dowel bars in headwalls
4'	#4	11"⌀	12	2'-6"	1'-3"	
5'	#4	11"⌀	14	2'-7"	1'-3½"	
6'	#4	11"⌀	16	2'-8"	1'-4"	
7'	#4	11½"⌀	18	2'-9"	1'-4½"	
8'	#4	11½"⌀	20	2'-11"	1'-5½"	
9'	#4	11½"⌀	22	3'-0"	1'-6"	
10'	#4	12"⌀	24	3'-1"	1'-6½"	
11'	#4	12"⌀	26	3'-2"	1'-7"	
12'	#4	12"⌀	28	3'-3"	1'-7½"	



PART PLAN AT CULVERT END

ARKANSAS STATE HIGHWAY COMMISSION

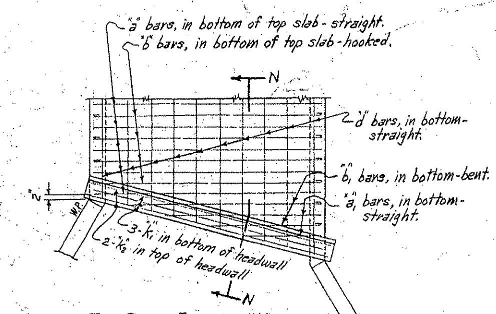
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
15° SKEW

4',5',6',7',8',9',10',11' & 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
SINGLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-115X-0

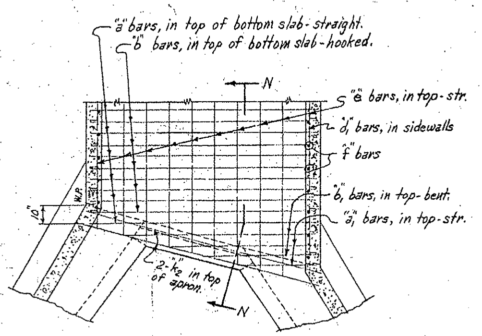
Designed By:- W.C.H. 1-23-63 Checked By:- R.M.S. 5-8-63
Drawn By:- W.C.H. 8-14-63 Checked By:- B.H. 10-7-63
Quantities By:- W.C.H. 8-21-63 Checked By:- R.G. 12-10-63

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



TOP SLAB REINFORCING

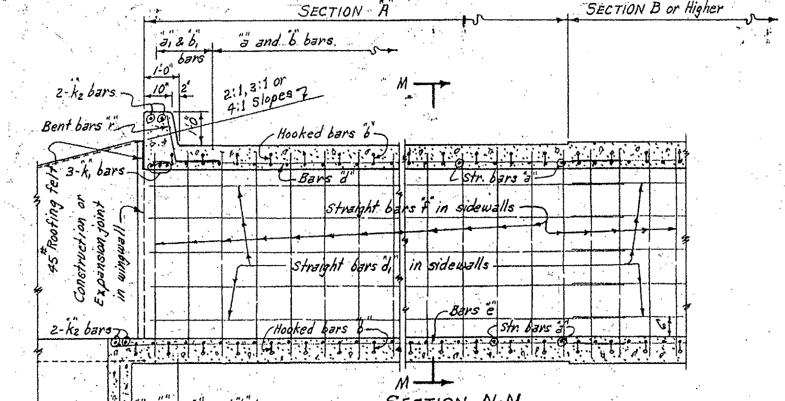
PART PLAN AT END OF CULVERT



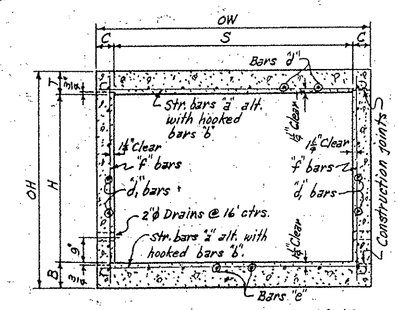
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

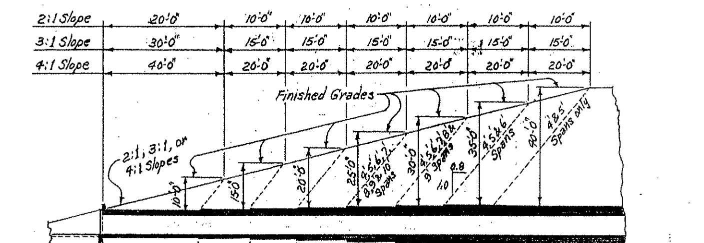
NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-9" into SECTION B.



SECTION N-N



TYPICAL SECTION M-M

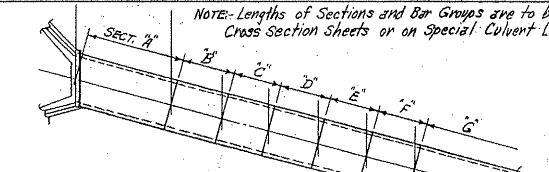


Slope		A	B	C	D	E	F	Mid-Section
2:1 Slope	Sections	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	F = 6'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
3:1 Slope	Sections	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope	Sections	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D, E & F	A	B, C, D, E & F	A	B, C, D, E & F
LENGTHS	12'-5"	6'-2½"	22'-9¾"	11'-4⅝"	33'-1½"	16'-6¾"

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-100X-X1 or R-100X-X2.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	Sections & Bar Groups for End Sections: A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	Sections & Bar Groups for End Sections: A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b"
#4	2"	4"	0'-10½"	K, Pin diam., X
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	
#7	3½"	5¾"	1'-4"	

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b1"
#4	2"	4"	0'-5¼"	K, Pin diam., X
#5	2½"	4¼"	0'-5¾"	
#6	3"	5"	0'-7"	
#7	3½"	5¾"	0'-8"	

NOTE:- Dimensions are to centers of bars ("b" and "b1").

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"±	6	2'-5"	1'-2½"	2, 12, X
5'	#4	12"±	7	2'-6"	1'-3"	
6'	#4	12"±	8	2'-7"	1'-3½"	
7'	#4	12"±	9	2'-8"	1'-4"	
8'	#4	12"±	10	2'-10"	1'-5"	
9'	#4	12"±	11	3'-0"	1'-6"	
10'	#4	12"±	12	3'-2"	1'-7"	

BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 12'-5", 3:1 = 22'-9¾", 4:1 = 33'-1½". Depth of Cover (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars: Straight, in Top and Bottom Slabs of Barrel. "a1" bars ◤: Straight, in Top and Bottom Slab of Barrel - (Two of each Length.) "b" bars: Bent - See Diagrams at Right; in Top and Bottom Slabs of Barrel - hooked. Alternate with "a" bars.

S	H	"a" Size	"a" Spacing	"a" No. 2:1	"a" No. 3:1	"a" No. 4:1	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.	"b" Size	"b" Spacing	"b" No. 2:1	"b" No. 3:1	"b" No. 4:1	"b" Length	"b" X
1@4'	2'	#4	12"	25	45	67	4'-9"	—	—	—	—	—	#4	12"	25	45	65	5'-7"	4'-8½"
	3'			25	45	67	"			—	—	—			25	45	65	"	"
	4'			25	45	67	"			—	—	—			25	45	65	"	"
	5'			25	45	67	"			—	—	—			25	45	65	"	"
	6'			25	45	67	4'-11"			—	—	—			25	45	65	5'-9"	4'-10½"
1@5'	3'	#5	12"	25	45	67	5'-9"	—	—	—	—	—	#5	12"	23	45	65	6'-8"	5'-8½"
	4'			25	45	67	"			—	—	—			23	45	65	"	"
	5'			25	45	67	"			—	—	—			23	45	65	"	"
	6'			25	45	67	5'-11"			—	—	—			23	45	65	6'-10"	5'-10½"
	7'			25	45	67	6'-0"			—	—	—			23	45	65	6'-11"	5'-11½"
1@6'	3'	#5	12"	25	45	67	6'-9"	#5	12"	2	3'-0"	—	#6	12"	23	45	65	7'-10"	6'-8"
	4'			25	45	67	"			2	"	—			23	45	65	"	"
	5'			25	45	67	"			2	"	—			23	45	65	"	"
	6'			25	45	67	6'-11"			2	3'-2"	—			23	45	65	8'-0"	6'-10"
	7'			25	45	67	7'-0"			2	3'-3"	—			23	45	65	8'-1"	6'-11"
	8'			25	45	67	7'-1"			2	3'-4"	—			23	45	65	8'-2"	7'-0"
1@7'	4'	#5	12"	25	45	65	7'-9"	#5	12"	2	4'-0"	—	#6	12"	23	45	65	8'-10"	7'-8"
	5'			25	45	65	"			2	"	—			23	45	65	"	"
	6'			25	45	65	7'-11"			2	4'-2"	—			23	45	65	9'-0"	7'-10"
	7'			25	45	65	8'-0"			2	4'-3"	—			23	45	65	9'-1"	7'-11"
	8'			25	45	65	8'-1"			2	4'-4"	—			23	45	65	9'-2"	8'-0"
	9'			25	45	65	8'-3"			2	4'-6"	—			23	45	65	9'-4"	8'-2"
1@8'	4'	#6	12"	25	45	65	8'-9"	#6	12"	2	5'-0"	—	#6	12"	23	43	65	9'-10"	8'-8"
	5'			25	45	65	8'-11"			2	5'-2"	—			23	43	65	10'-0"	8'-10"
	6'			25	45	65	"			2	"	—			23	43	65	"	"
	7'			25	45	65	9'-0"			2	5'-3"	—			23	43	65	10'-1"	8'-11"
	8'			25	45	65	9'-1"			2	5'-4"	—			23	43	65	10'-2"	9'-0"
	9'			25	45	65	9'-3"			2	5'-6"	—			23	43	65	10'-4"	9'-2"
	10'			25	45	65	9'-5"			2	5'-8"	—			23	43	65	10'-6"	9'-4"
1@9'	5'	#6	11"	25	49	71	9'-11"	#6	11"	4	6'-6"	3'-1"	#7	11"	25	47	69	11'-2"	9'-10"
	6'			25	49	71	10'-0"			4	6'-7"	3'-2"			25	47	69	11'-3"	9'-11"
	7'			25	49	71	"			4	"	"			25	47	69	"	"
	8'			25	49	71	10'-1"			4	6'-8"	3'-3"			25	47	69	11'-4"	10'-0"
	9'			25	49	71	10'-3"			4	6'-10"	3'-5"			25	47	69	11'-6"	10'-2"
	10'			25	49	71	10'-5"			4	7'-0"	3'-7"			25	47	69	11'-8"	10'-4"
	11'			25	49	71	10'-7"			4	7'-2"	3'-9"			25	47	69	11'-10"	10'-6"
1@10'	5'	#7	12"	23	45	65	10'-11"	#7	12"	4	7'-2"	3'-5"	#7	12"	23	43	63	12'-2"	10'-10"
	6'			23	45	65	11'-0"			4	7'-3"	3'-6"			23	43	63	12'-3"	10'-11"
	7'			23	45	65	"			4	"	"			23	43	63	"	"
	8'			23	45	65	11'-1"			4	7'-4"	3'-7"			23	43	63	12'-4"	11'-0"
	9'			23	45	65	11'-3"			4	7'-6"	3'-9"			23	43	63	12'-6"	11'-2"
	10'			23	45	65	11'-5"			4	7'-8"	3'-11"			23	43	63	12'-8"	11'-4"
	11'			23	45	65	11'-7"			4	7'-10"	4'-1"			23	43	63	12'-10"	11'-6"
	12'			23	45	65	11'-9"			4	8'-0"	4'-3"			23	43	63	13'-0"	11'-8"

"b1" bars ◤: Bent; in Top and Bottom Slabs of Barrel - one end hooked. (Two of each Length.) Alternate with "a1" bars. "d" bars: Straight, Longitudinal in Top Slab of Barrel. "d1" bars: Straight, Longitudinal in Sidewalls.

S	H	"b1" Size	"b1" Spacing	"b1" No. Req'd	"b1" Length Max.	"b1" Length Min.	"b1" X Max.	"b1" X Min.	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length
1@4'	2'	#4	12"	2	3'-3"	—	2'-10"	—	#4	12"	5	Lengths Vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"	#4	12"	4	Lengths Vary - Ave. Lengths; 2:1 = 14'-2"; 3:1 = 24'-6", 4:1 = 34'-10"
	3'			2	"	—	"	—			5				6	
	4'			2	"	—	"	—			5				8	
	5'			2	"	—	"	—			5				10	
	6'			2	3'-5"	—	3'-0"	—			5				12	
1@5'	3'	#5	12"	2	4'-4"	—	3'-10"	—	#4	12"	6		#4	12"	6	
	4'			2	"	—	"	—			6				8	
	5'			2	"	—	"	—			6				10	
	6'			2	4'-6"	—	4'-0"	—			6				12	
	7'			2	4'-7"	—	4'-1"	—			6				14	
1@6'	3'	#6	12"	2	5'-5"	—	4'-10"	—	#4	12"	7		#4	12"	6	
	4'			2	"	—	"	—			7				8	
	5'			2	"	—	"	—			7				10	
	6'			2	5'-7"	—	5'-0"	—			7				12	
	7'			2	5'-8"	—	5'-1"	—			7				14	
	8'			2	5'-9"	—	5'-2"	—			7				16	
1@7'	4'	#6	12"	2	6'-5"	—	5'-10"	—	#4	12"	8		#4	12"	8	
	5'			2	"	—	"	—			8				10	
	6'			2	6'-7"	—	6'-0"	—			8				12	
	7'			2	6'-8"	—	6'-1"	—			8				14	
	8'			2	6'-9"	—	6'-2"	—			8				16	
	9'			2	6'-11"	—	6'-4"	—			8				18	
1@8'	4'	#6	12"	4	7'-5"	3'-8"	6'-10"	3'-1"	#4	12"	9		#4	12"	8	
	5'			4	7'-7"	3'-10"	7'-0"	3'-3"			9				10	
	6'			4	"	"	"	"			9				12	
	7'			4	7'-8"	3'-11"	7'-1"	3'-4"			9				14	
	8'			4	7'-9"	4'-0"	7'-2"	3'-5"			9				16	
	9'			4	7'-11"	4'-2"	7'-4"	3'-7"			9				18	
	10'			4	8'-1"	4'-4"	7'-6"	3'-9"			9				20	
1@9'	5'	#7	11"	4	8'-8"	5'-3"	8'-0"	4'-7"	#4	12"	10		#4	12"	10	
	6'			4	8'-9"	5'-4"	8'-1"	4'-8"			10				12	
	7'			4	"	"	"	"			10				14	
	8'			4	8'-10"	5'-5"	8'-2"	4'-9"			10				16	
	9'			4	9'-0"	5'-7"	8'-4"	4'-11"			10				18	
	10'			4	9'-2"	5'-9"	8'-6"	5'-1"			10				20	
	11'			4	9'-4"	5'-11"	8'-8"	5'-3"			10				22	
1@10'	5'	#7	12"	4	9'-8"	5'-11"	9'-0"	5'-3"	#4	12"	11		#4	12"	10	
	6'			4	9'-9"	6'-0"	9'-1"	5'-4"			11				12	
	7'			4	"	"	"	"			11				14	
	8'			4	9'-10"	6'-1"	9'-2"	5'-5"			11				16	
	9'			4	10'-0"	6'-3"	9'-4"	5'-7"			11				18	
	10'			4	10'-2"	6'-5"	9'-6"	5'-9"			11				20	
	11'			4	10'-4"	6'-7"	9'-8"	5'-11"			11				22	
	12'			4	10'-6"	6'-9"	9'-10"	6'-1"			11				24	

"e" bars: Straight, Longitudinal in Bottom Slab of Barrel. "f" bars: Straight, Verticals in Sidewalls. "k1" bars: Straight, In Bottom of Headwall. "k2" bars ◤: Straight, In Top of Headwall and Apron. (2 Each)

S	H	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. 2:1	"f" No. 3:1	"f" No. 4:1	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length	"k2" Size	"k2" No. Req'd	"k2" Length
1@4'	2'	#4	12"	5	Lengths Vary - Ave Length; 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10"	#4	12"	26	46	67	2'-10"	#5	3	4'-11"	#5	4	5'-5"
	3'			5				26	46	67	3'-10"		3	"		4	"
	4'			5				26	46	67	4'-10"		3	"		4	"
	5'			5				26	46	67	5'-10"		3	"		4	"
	6'			5				26	46	67	6'-10"		3	5'-1"		4	5'-7"
1@5'	3'	#4	12"	6		#4	12"	26	46	67	3'-11"	#5	3	5'-11"	#5	4	6'-6"
	4'			6				26	46	67	4'-11"		3	"		4	"
	5'			6				26	46	67	5'-11"		3	"		4	"
	6'			6				26	46	67	6'-11"		3	6'-1"		4	6'-8"
	7'			6			10"	30	55	80	7'-11"		3	6'-2"		4	6'-9"
1@6'	3'	#4	12"	7		#4	12"	26	46	67	4'-0"	#5	3	7'-0"	#5	4	7'-6"
	4'			7				26	46	67	5'-0"		3	"		4	"
	5'			7				26	46	67	6'-0"		3	"		4	"
	6'			7				26	46	67	7'-0"		3	7'-2"		4	7'-8"
	7'			7			10"	30	55	80	8'-0"		3	7'-3"		4	7'-9"
	8'			7		#5	11"	28	50	73	9'-0"		3	7'-4"		4	7'-10"
1@7'	4'	#4	12"	8		#4	12"	26	46	67	5'-1"	#6	3	8'-0"	#6	4	8'-7"
	5'			8				26	46	67	6'-1"		3	"		4	"
	6'			8				26	46	67	7'-1"		3	8'-2"		4	8'-9"
	7'			8			11"	28	50	73	8'-1"		3	8'-3"		4	8'-10"
	8'			8		#5	12"	26	46	67	9'-1"		3	8'-4"		4	8'-11"
	9'			8			11"	28	50	73	10'-1"		3	8'-6"		4	9'-0"
1@8'	4'	#4	12"	9		#4	12"	26	46	67	5'-3"	#6	3	9'-0"	#6	4	9'-7"
	5'			9				26	46	67	6'-3"		3	9'-3"		4	9'-9"
	6'			9				26	46	67	7'-3"		3	"		4	"
	7'			9				26	46	67	8'-3"		3	9'-4"		4	9'-10"
	8'			9		#5	12"	26	46	67	9'-3"		3	9'-5"		4	9'-11"
	9'			9			11"	28	50	73	10'-3"		3	9'-7"		4	10'-1"
	10'			9			10"	30	55	80	11'-3"		3	9'-9"		4	10'-3"
1@9'	5'	#4	12"	10		#4	12"	26	46	67	6'-5"	#6	3	10'-3"	#6	4	10'-9"
	6'			10				26	46	67	7'-5"		3	10'-4"		4	10'-10"
	7'			10				26	46	67	8'-5"		3	"		4	"
	8'			10		#5	12"	26	46	67	9'-5"		3	10'-5"		4	10'-11"
	9'			10			11"	28	50	73	10'-5"		3	10'-7"		4	11'-2"
	10'			10			10"	30	55	80	11'-5"		3	10'-9"		4	11'-4"
	11'			10		#6	12"	26	46	67	12'-5"		3	10'-11"		4	11'-6"
1@10'	5'	#4	12"	11		#4	12"	26	46	67	6'-7"	#7	3	11'-3"	#7	4	11'-10"
	6'			11				26	46	67	7'-7"		3	11'-4"		4	11'-11"
	7'			11			11"	28	50	73	8'-7"		3	"		4	"
	8'			11		#5	12"	26	46	67	9'-7"		3	11'-5"		4	12'-0"
	9'			11				26	46	67	10'-7"		3	11'-8"		4	12'-2"
	10'			11			10"	30	55	80	11'-7"		3	11'-10"		4	12'-4"
	11'			11		#6	12"	26	46	67	12'-7"		3	12'-0"		4	12'-6"
	12'			11			11"	28	50	73	13'-7"		3	12'-2"		4	12'-8"

◤ These bars are in the skewed portion of barrel only. The length of "a1" bars and overall length X of "b1" bars vary by 3'-9" for 12" spacing and 3'-5" for 11" spacing.

MAX DESIGN DEPTH OF COVER (D)	CLEAR SPANS (S)	CLEAR HEIGHT (H)	SQ. FT. OPENING (A)	OVERALL WIDTH (OW)	THICKNESS OF TOP SLAB (T)	THICKNESS OF SIDEWALLS (C)	THICKNESS OF BOTTOM SLAB (B)	OVERALL HEIGHT (OH)	ROADWAY LENGTH (RL)	LENGTH OF HEADWALL (K)	* Class S Concrete, Barrel Only 2:1 (Cu.Yd.)	3:1 (Cu.Yd.)	4:1 (Cu.Yd.)	* Reinforcing Steel, Barrel, Apron and Headwall 2:1 (Lb.)	3:1 (Lb.)	4:1 (Lb.)
	1@4'	2'	8	5'-0"	6½"	6"	6½"	3'-1"	5'-2⅞"	5'-8⅝"	3.41	6.26	9.11	410	682	963
		3'	12	5'-0"		6"		4'-1"	"	"	3.87	7.10	10.34	446	746	1054
		4'	16	5'-0"		6"		5'-1"	"	"	4.33	7.95	11.56	482	809	1146
		5'	20	5'-0"		6"		6'-1"	"	"	4.79	8.79	12.79	518	873	1237
		6'	24	5'-2"		7"		7'-1"	5'-4⅛"	5'-10⅝"	5.80	10.63	15.47	562	947	1344
	1@5'	3'	15	6'-0"	7"	6"	7"	4'-2"	6'-2½"	6'-9"	4.59	8.43	12.26	619	1068	1518
		4'	20	6'-0"		6"		5'-2"	"	"	5.05	9.27	13.48	655	1132	1610
		5'	25	6'-0"		6"		6'-2"	"	"	5.51	10.11	14.71	691	1195	1701
		6'	30	6'-2"		7"		7'-2"	6'-9⅜"	6'-11⅛"	6.53	11.98	17.42	747	1287	1827
		7'	35	6'-3"		7½"		8'-2"	6'-5⅝"	7'-0⅛"	7.38	13.53	19.68	800	1395	1989
	1@6'	3'	18	7'-0"	7½"	6"	7½"	4'-3"	7'-3"	7'-9½"	5.40	9.91	14.41	800	1391	1975
		4'	24	7'-0"		6"		5'-3"	"	"	5.86	10.75	15.64	836	1454	2066
		5'	30	7'-0"		6"		6'-3"	"	"	6.32	11.59	16.86	872	1518	2158
		6'	36	7'-2"		7"		7'-3"	7'-5"	7'-11½"	7.34	13.46	19.58	921	1602	2279
		7'	42	7'-3"		7½"		8'-3"	7'-6"	8'-0½"	8.20	15.03	21.86	974	1714	2449
		8'	48	7'-4"		8"		9'-3"	7'-7⅛"	8'-1⅝"	9.13	16.74	24.35	1112	1943	2774
	1@7'	4'	28	8'-0"	8"	6"	8½"	5'-4½"	8'-3⅜"	8'-9⅞"	6.90	12.66	18.42	959	1646	2310
		5'	35	8'-0"		6"		6'-4½"	"	"	7.36	13.50	19.64	996	1710	2402
		6'	42	8'-2"		7"		7'-4½"	8'-5⅞"	9'-0"	8.38	15.37	22.36	1045	1795	2523
		7'	49	8'-3"		7½"		8'-4½"	8'-6⅜"	9'-1"	9.24	16.94	24.65	1098	1891	2662
		8'	56	8'-4"		8"		9'-4½"	8'-7½"	9'-2"	10.17	18.65	27.13	1218	2100	2964
		9'	63	8'-6"		9"		10'-4½"	8'-9⅜"	9'-4"	11.59	21.25	30.91	1298	2244	3173
	1@8'	4'	32	9'-0"	8½"	6"	9½"	5'-6"	9'-3⅜"	9'-10⅞"	8.05	14.76	21.47	1177	1985	2826
		5'	40	9'-2"		7"		6'-6"	9'-5⅞"	10'-0¼"	9.00	16.51	24.02	1229	2074	2953
		6'	48	9'-2"		7"		7'-6"	"	"	9.55	17.51	25.47	1265	2137	3044
		7'	56	9'-3"		7½"		8'-6"	9'-6⅞"	10'-1¼"	10.41	19.08	27.76	1309	2213	3154
		8'	64	9'-4"		8"		9'-6"	9'-8"	10'-2½"	11.35	20.81	30.28	1443	2449	3495
		9'	72	9'-6"		9"		10'-6"	9'-10"	10'-4½"	12.76	23.41	34.05	1526	2576	3669
		10'	80	9'-8"		10"		11'-6"	10'-0⅛"	10'-6⅞"	14.33	26.28	38.23	1613	2708	3847
	1@9'	5'	45	10'-2"	9½"	7"	10½"	6'-8"	10'-6¼"	11'-0¾"	10.48	19.22	27.96	1564	2716	3843
		6'	54	10'-3"		7½"		7'-8"	10'-7⅜"	11'-1¾"	11.30	20.72	30.14	1609	2796	3957
		7'	63	10'-3"		7½"		8'-8"	"	"	11.88	21.79	31.70	1646	2859	4048
		8'	72	10'-4"		8"		9'-8"	10'-8¾"	11'-2¾"	12.83	23.52	34.22	1783	3101	4398
		9'	81	10'-6"		9"		10'-8"	10'-10⅛"	11'-5"	14.25	26.14	38.03	1870	3258	4626
		10'	90	10'-8"		10"		11'-8"	11'-0½"	11'-7"	15.84	29.06	42.27	1961	3435	4878
		11'	99	10'-10"		11"		12'-8"	11'-2⅝"	11'-9"	17.58	32.24	46.91	2127	3703	5267
	1@10'	5'	50	11'-2"	10½"	7"	11½"	6'-10"	11'-6¾"	12'-1⅛"	12.09	22.18	32.26	1808	3105	4362
		6'	60	11'-3"		7½"		7'-10"	11'-7¾"	12'-2¼"	12.94	23.73	34.52	1854	3186	4477
		7'	70	11'-3"		7½"		8'-10"	"	"	13.51	24.78	36.04	1902	3272	4792
		8'	80	11'-4"		8"		9'-10"	11'-8¾"	12'-3¼"	14.47	26.53	38.59	2031	3496	4925
		9'	90	11'-6"		9"		10'-10"	11'-10⅞"	12'-5¾"	15.91	29.17	42.43	2098	3612	5091
		10'	100	11'-8"		10"		11'-10"	12'-1"	12'-7½"	17.50	32.08	46.67	2213	3837	5413
		11'	110	11'-10"		11"		12'-10"	12'-3"	12'-9½"	19.25	35.30	51.34	2382	4079	5746
		12'	120	12'-0"		12"		13'-10"	12'-5⅝"	12'-11½"	21.16	38.80	56.95	2502	4328	6126

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.
For Barrels of 4', 5' & 6' Spans, See Drawing No. R-100X-X1.
For Barrels of 7', 8', 9' & 10' Spans, See Drawing No. R-100X-X2.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
15° SKEW ~ SECTIONS "A" ONLY

4', 5', 6', 7', 8', 9' & 10' SPANS — 2:1, 3:1 OR 4:1 SLOPES
SINGLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-115X-1

Designed by:- W.C.H. 9-5-62. Checked by:- R.H.S. 11-8-62.
Drawn by:- W.C.H. 10-29-63. Checked by:-
Quantities by:- W.C.H. 12-6-63. Checked by:-

Fed. Road No.	State	Fed. Aid Project	Fiscal Year	Sheet No.	Total Sheets
6	ARK.				
Job No.					

Bar List for Barrel Section 60'-0" in Length

Depth of Cover	Clear Span	Clear Height	"a" bars — Straight — In Top and Bottom Slab of Barrel.				"b" bars — Bent - See Diagram below. — In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.						
D	S	H	Size	Spacing	No. Reqd	Length	Size	Spacing	No. Reqd	Length	X	Y	Z
0'-0" to 5'-0" Maximum	2 @ 4'	2'	#5	12"	120	9'-9"	#5	12"	59	10'-10"	0'-3"	2'-3½"	3'-5½"
		3'			120	9'-9"			59	10'-10"	"	2'-3½"	3'-5½"
		4'			120	9'-9"			59	10'-10"	"	2'-3½"	3'-5½"
		5'			120	9'-9"			59	10'-10"	"	2'-3½"	3'-5½"
		6'			120	10'-0"			59	11'-1"	0'-3"	2'-4½"	3'-6½"
	2 @ 5'	3'	#6	12"	120	11'-10"	#5	12"	59	12'-11"	0'-3½"	2'-8"	4'-3"
		4'			120	11'-10"			59	12'-11"	"	2'-8"	4'-3"
		5'			120	11'-10"			59	12'-11"	"	2'-8"	4'-3"
		6'			120	12'-1"			59	13'-2"	"	2'-9"	4'-4"
		7'			120	12'-3"			59	13'-4"	0'-3½"	2'-10"	4'-4½"
	2 @ 6'	3'	#6	11"	132	13'-11"	#5	11"	65	15'-0"	0'-4"	3'-2"	5'-0"
		4'			132	13'-11"			65	15'-0"	"	3'-2"	5'-0"
		5'			132	13'-11"			65	15'-0"	"	3'-2"	5'-0"
		6'			132	14'-2"			65	15'-3"	"	3'-3"	5'-1"
		7'			132	14'-4"			65	15'-5"	"	3'-4"	5'-1½"
		8'			132	14'-5"			65	15'-6"	0'-4"	3'-4"	5'-2"
	2 @ 7'	4'	#6	12"	120	15'-11"	#6	12"	59	17'-3"	0'-4½"	3'-7"	5'-9"
		5'			120	15'-11"			59	17'-3"	"	3'-7"	5'-9"
		6'			120	16'-2"			59	17'-6"	"	3'-8"	5'-10"
		7'			120	16'-4"			59	17'-8"	"	3'-9"	5'-10½"
		8'			120	16'-5"			59	17'-9"	"	3'-9"	5'-11"
		9'			120	16'-8"			59	18'-0"	0'-4½"	3'-10"	6'-0"
	2 @ 8'	4'	#6	11"	132	18'-0"	#6	11"	65	19'-5"	0'-5"	4'-0"	6'-6½"
		5'			132	18'-3"			65	19'-8"	"	4'-1"	6'-7½"
		6'			132	18'-3"			65	19'-8"	"	4'-1"	6'-7½"
		7'			132	18'-5"			65	19'-10"	"	4'-2"	6'-8"
		8'			132	18'-6"			65	19'-11"	"	4'-2"	6'-8½"
		9'			132	18'-9"			65	20'-2"	"	4'-3"	6'-9½"
		10'			132	19'-0"			65	20'-5"	0'-5"	4'-4"	6'-10½"
	2 @ 9'	5'	#6	11"	132	20'-4"	#6	11"	65	21'-9"	0'-5½"	4'-6"	7'-5"
		6'			132	20'-6"			65	21'-11"	"	4'-7"	7'-5½"
		7'			132	20'-6"			65	21'-11"	"	4'-7"	7'-5½"
		8'			132	20'-7"			65	22'-0"	"	4'-7"	7'-6"
		9'			132	20'-10"			65	22'-3"	"	4'-8"	7'-7"
		10'			132	21'-1"			65	22'-6"	"	4'-9"	7'-8"
		11'			132	21'-3"			65	22'-8"	0'-5½"	4'-9"	7'-9"
	2 @ 10'	5'	#7	12"	120	22'-5"	#6	12"	59	23'-11"	0'-6"	5'-0"	8'-2"
		6'			120	22'-7"			59	24'-1"	"	5'-1"	8'-2½"
		7'			120	22'-7"			59	24'-1"	"	5'-1"	8'-2½"
		8'			120	22'-8"			59	24'-2"	"	5'-1"	8'-3"
		9'			120	22'-11"			59	24'-5"	"	5'-2"	8'-4"
		10'			120	23'-2"			59	24'-8"	"	5'-3"	8'-5"
		11'			120	23'-4"			59	24'-10"	"	5'-3"	8'-6"
		12'			120	23'-6"			59	25'-0"	0'-6"	5'-3"	8'-7"
	2 @ 11'	6'	#7	12"	120	24'-9"	#6	12"	59	26'-3"	0'-6½"	5'-5"	9'-1"
		7'			120	24'-9"			59	26'-3"	"	5'-5"	9'-1"
		8'			120	24'-9"			59	26'-3"	"	5'-5"	9'-1"
		9'			120	25'-0"			59	26'-6"	"	5'-6"	9'-2"
		10'			120	25'-3"			59	26'-9"	"	5'-7"	9'-3"
		11'			120	25'-5"			59	26'-11"	"	5'-7"	9'-4"
		12'			120	25'-7"			59	27'-1"	0'-6½"	5'-7"	9'-5"
	2 @ 12'	6'	#7	11"	132	26'-10"	#6	11"	65	28'-4"	0'-7"	5'-11"	9'-10"
		7'			132	26'-10"			65	28'-4"	"	5'-11"	9'-10"
		8'			132	26'-10"			65	28'-4"	"	5'-11"	9'-10"
		9'			132	27'-1"			65	28'-7"	"	6'-0"	9'-11"
		10'			132	27'-4"			65	28'-10"	"	6'-1"	10'-0"
		11'			132	27'-6"			65	29'-0"	"	6'-1"	10'-1"
		12'			132	27'-8"			65	29'-2"	0'-7"	6'-1"	10'-2"

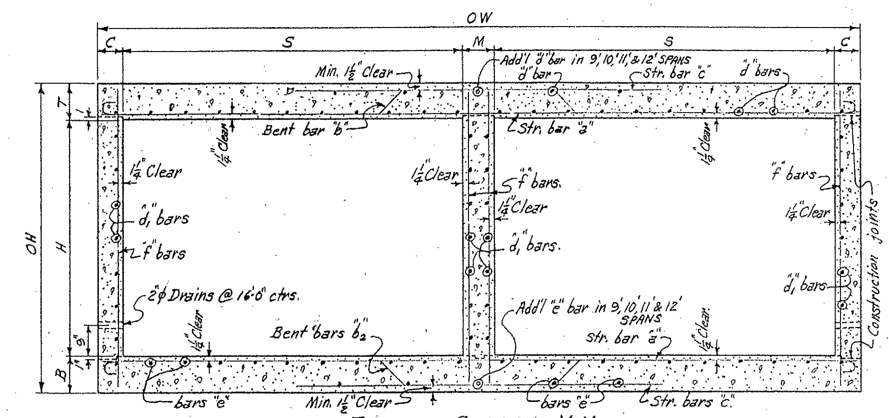
Clear Span	Clear Height	"b2" bars — Bent - See Diagram below — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.							"c" bars — Straight — In Top and Bottom Slab of Barrel. Alt. with "b" and "b2" bars.			
S	H	Size	Spacing	No. Reqd	Length	X	Y	Z	Size	Spacing	No. Reqd	Length
2 @ 4'	2'	#5	12"	59	10'-10"	0'-2½"	2'-4½"	3'-5½"	#5	12"	120	4'-10"
	3'			59	10'-10"	"	2'-4½"	3'-5½"			120	4'-10"
	4'			59	10'-10"	"	2'-4½"	3'-5½"			120	4'-10"
	5'			59	10'-10"	"	2'-4½"	3'-5½"			120	4'-10"
	6'			59	11'-1"	0'-2½"	2'-5½"	3'-6½"			120	4'-11"
2 @ 5'	3'	#5	12"	59	12'-11"	0'-3"	2'-9"	4'-3"	#6	12"	120	5'-10"
	4'			59	12'-11"	"	2'-9"	4'-3"			120	5'-10"
	5'			59	12'-11"	"	2'-9"	4'-3"			120	5'-10"
	6'			59	13'-2"	"	2'-10"	4'-4"			120	5'-11"
	7'			59	13'-4"	0'-3"	2'-11"	4'-4½"			120	6'-0"
2 @ 6'	3'	#5	11"	65	15'-0"	0'-4"	3'-2"	5'-0"	#6	11"	132	6'-11"
	4'			65	15'-0"	"	3'-2"	5'-0"			132	6'-11"
	5'			65	15'-0"	"	3'-2"	5'-0"			132	6'-11"
	6'			65	15'-3"	"	3'-3"	5'-1"			132	7'-0"
	7'			65	15'-5"	"	3'-4"	5'-1½"			132	7'-1"
	8'			65	15'-6"	0'-4"	3'-4"	5'-2"			132	7'-1"
2 @ 7'	4'	#6	12"	59	17'-3"	0'-4½"	3'-7"	5'-9"	#6	12"	120	7'-11"
	5'			59	17'-3"	"	3'-7"	5'-9"			120	7'-11"
	6'			59	17'-6"	"	3'-8"	5'-10"			120	8'-0"
	7'			59	17'-8"	"	3'-9"	5'-10½"			120	8'-1"
	8'			59	17'-9"	"	3'-9"	5'-11"			120	8'-1"
	9'			59	18'-0"	0'-4½"	3'-10"	6'-0"			120	8'-2"
2 @ 8'	4'	#6	11"	65	19'-5"	0'-5"	4'-0"	6'-6½"	#6	11"	132	9'-0"
	5'			65	19'-8"	"	4'-1"	6'-7½"			132	9'-0"
	6'			65	19'-8"	"	4'-1"	6'-7½"			132	9'-0"
	7'			65	19'-10"	"	4'-2"	6'-8"			132	9'-2"
	8'			65	19'-11"	"	4'-2"	6'-8½"			132	9'-2"
	9'			65	20'-2"	"	4'-3"	6'-9½"			132	9'-3"
	10'			65	20'-5"	0'-5"	4'-4"	6'-10½"			132	9'-4"
2 @ 9'	5'	#6	11"	65	21'-9"	0'-5¾"	4'-5½"	7'-5"	#6	11"	132	10'-1"
	6'			65	21'-11"	"	4'-6½"	7'-5½"			132	10'-2"
	7'			65	21'-11"	"	4'-6½"	7'-5½"			132	10'-2"
	8'			65	22'-0"	"	4'-6½"	7'-6"			132	10'-2"
	9'			65	22'-3"	"	4'-7½"	7'-7"			132	10'-3"
	10'			65	22'-6"	"	4'-8½"	7'-8"			132	10'-4"
	11'			65	22'-8"	0'-5¾"	4'-8½"	7'-9"			132	10'-4"
2 @ 10'	5'	#6	12"	59	23'-11"	0'-6½"	4'-11"	8'-2"	#7	12"	120	11'-2"
	6'			59	24'-1"	"	5'-0"	8'-2½"			120	11'-3"
	7'			59	24'-1"	"	5'-0"	8'-2½"			120	11'-3"
	8'			59	24'-2"	"	5'-0"	8'-3"			120	11'-3"
	9'			59	24'-5"	"	5'-1"	8'-4"			120	11'-4"
	10'			59	24'-8"	"	5'-2"	8'-5"			120	11'-5"
	11'			59	24'-10"	"	5'-2"	8'-6"			120	11'-5"
	12'			59	25'-0"	0'-6½"	5'-2"	8'-7"			120	11'-5"
2 @ 11'	6'	#6	12"	59	26'-4"	0'-7½"	5'-3"	9'-1"	#7	12"	120	12'-3"
	7'			59	26'-4"	"	5'-3"	9'-1"			120	12'-3"
	8'			59	26'-4"	"	5'-3"	9'-1"			120	12'-3"
	9'			59	26'-7"	"	5'-4"	9'-2"			120	12'-4"
	10'			59	26'-10"	"	5'-5"	9'-3"			120	12'-5"
	11'			59	27'-0"	"	5'-5"	9'-4"			120	12'-5"
	12'			59	27'-2"	0'-7½"	5'-5"	9'-5"			120	12'-5"
2 @ 12'	6'	#6	11"	65	28'-6"	0'-8½"	5'-8"	9'-10"	#7	11"	132	13'-3"
	7'			65	28'-6"	"	5'-8"	9'-10"			132	13'-3"
	8'			65	28'-6"	"	5'-8"	9'-10"			132	13'-3"
	9'			65	28'-9"	"	5'-9"	9'-11"			132	13'-4"
	10'			65	29'-0"	"	5'-10"	10'-0"			132	13'-6"
	11'			65	29'-2"	"	5'-10"	10'-1"			132	13'-6"
	12'			65	29'-4"	0'-8½"	5'-10"	10'-2"			132	13'-6"

Clear Span	Clear Height	"d" bars — Straight — Longitudinal in Top Slab of Barrel				"d1" bars — Straight — Longitudinal in Sidewalls and Division Wall				"e" bars — Straight — Longitudinal in Bottom Slab of Barrel				"f" bars — Straight — Verticals in Sidewalls and Division Wall				"k" bars — Straight — 2 in Top of Headwalls and Aprons-Each.		
S	H	Size	Spacing	No. Reqd	Length	Size	Spacing	No. Reqd	Length	Size	Spacing	No. Reqd	Length	Size	Spacing	No. Reqd	Length	Size	No. Reqd	Length
2 @ 4'	2'	#5	12"	14	2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap)	#4	12"	8	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	14	2 @ 31'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	240	2'-10"	#5	8	10'-3"
	3'			14				12				14				240	3'-10"		8	"
	4'			14				16				14				240	4'-10"		8	"
	5'			14				20				14				240	5'-10"		8	"
	6'			14				24				14				240	6'-10"		8	10'-6"
2 @ 5'	3'	#5	11½"	16		#4	12"	12		#4	12"	16		#4	12"	240	3'-11"	#6	8	12'-4"
	4'			16				16				16				240	4'-11"		8	"
	5'			16				20				16				240	5'-11"		8	"
	6'			16				24				16				240	6'-11"		8	12'-7"
	7'			16				28				16				240	7'-11"		8	12'-9"
2 @ 6'	3'	#5	11½"	18		#4	12"	12		#4	12"	18		#4	12"	240	4'-0"	#6	8	14'-5"
	4'			18				16				18				240	5'-0"		8	"
	5'			18				20				18				240	6'-0"		8	"
	6'			18				24				18				240	7'-0"		8	14'-8"
	7'			18				28				18				240	8'-0"		8	14'-10"
	8'			18				32				18			10"	288	9'-0"		8	14'-11"
2 @ 7'	4'	#5	11½"	20		#4	12"	16		#4	12"	20		#4	12"	240	5'-1"	#6	8	16'-6"
	5'			20				20				20				240	6'-1"		8	"
	6'			20				24				20				240	7'-1"		8	16'-9"
	7'			20				28				20				240	8'-1"		8	16'-11"
	8'			20				32				20			10"	288	9'-1"		8	17'-0"
	9'			20				36				20		#5	12"	240	10'-1"		8	17'-3"
2 @ 8'	4'	#5	11½"	23		#4	12"	16		#4	12"	22		#4	12"	240	5'-2"	#6	8	18'-7"
	5'			23				20				22				240	6'-2"		8	18'-10"
	6'			23				24				22				240	7'-2"		8	"
	7'			23				28				22				240	8'-2"		8	19'-0"
	8'			23				32				22			10"	288	9'-2"		8	19'-1"
	9'			23				36				22		#5	12"	240	10'-2"		8	19'-4"
	10'			23				40				22			11"	264	11'-2"		8	19'-7"
2 @ 9'	5'	#5	11½"	26		#4	12"	20		#4	12"	25		#4	12"	240	6'-3"	#6	8	20'-11"
	6'			26				24				25				240	7'-3"		8	21'-1"
	7'			26				28				25				240	8'-3"		8	"
	8'			26				32				25			10"	288	9'-3"		8	21'-2"
	9'			26				36				25		#5	12"	240	10'-3"		8	21'-5"
	10'			26				40				25			11"	264	11'-3"		8	21'-8"
	11'			26				44				25			10"	288	12'-3"		8	21'-10"
2 @ 10'	5'	#5	11½"	28		#4	12"	20		#4	12"	27		#4	12"	240	6'-4"	#7	8	22'-11"
	6'			28				24				27				240	7'-4"		8	23'-1"
	7'			28				28				27				240	8'-4"		8	"
	8'			28				32				27			10"	288	9'-4"		8	23'-2"
	9'			28				36				27		#5	12"	240	10'-4"		8	23'-6"
	10'			28				40				27			11"	264	11'-4"		8	23'-9"
	11'			28				44				27			10"	288	12'-4"		8	23'-11"
	12'			28				48				27		#6	12"	240	13'-4"		8	24'-1"
2 @ 11'	6'	#5	11½"	30		#4	12"	24		#4	12"	29		#4	12"	240	7'-6"	#7	8	25'-3"
	7'			30				28				29				240	8'-6"		8	"
	8'			30				32				29			10"	288	9'-6"		8	"
	9'			30				36				29		#5	12"	240	10'-6"		8	25'-6"
	10'			30				40				29			11"	264	11'-6"		8	25'-10"
	11'			30				44				29			10"	288	12'-6"		8	26'-0"
	12'			30				48				29		#6	12"	240	13'-6"		8	26'-2"
2 @ 12'	6'	#5	11½"	32		#4	12"	24		#4	12"	31		#4	12"	240	7'-7"	#7	8	27'-4"
	7'			32				28				31				240	8'-7"		8	"
	8'			32				32				31			10"	288	9'-7"		8	"
	9'			32				36				31		#5	12"	240	10'-7"		8	27'-7"
	10'			32				40				31			11"	264	11'-7"		8	27'-10"
	11'			32				44				31			10"	288	12'-7"		8	28'-0"
	12'			32				48				31		#6	12	240	13'-7"		8	28'-3"

NOTE:- The "a", "b", "b2", and "c" bars are to be placed parallel with the headwalls, spacing to be parallel with barrel.

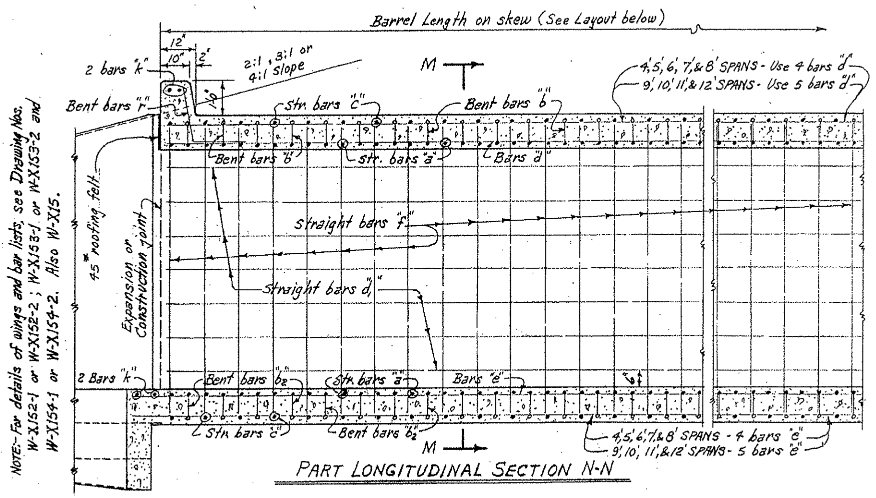
Dimensions / Quantities

Max. Design Depth of Cover	Clear Span	Barrel Dimensions — Clear Height	Sq. Ft. Opening	Overall Width	Thickness of Top Slab	Thickness of Sidewalls	Thickness of Division Wall	Thickness of Bottom Slab	Overall Height	Roadway Length	Length of Headwall	Unit Quantities — Class S Conc. per Lin. Ft. of Barrel	Reinforcing Steel — Per Lin. Ft. of Barrel	Additional — Per Lap	Additional — Two Headwalls & Aprons
D	S	H	A	OW	T	C	M	B	OH	RL	K	Cu. Yd.	LB.	LB.	LB.
5'-0"	2 @ 4'	2'	16	9'-8"	6½"	6"	8"	6"	3'-0½"	10'-0"	10'-6½"	0.496	89.89	42.71	136.52
		3'	24	9'-8"		6"	8"		4'-0½"	"	"	0.558	95.23	46.05	136.52
		4'	32	9'-8"		6"	8"		5'-0½"	"	"	0.620	100.58	49.39	136.52
		5'	40	9'-8"		6"	8"		6'-0½"	"	"	0.682	105.92	52.73	136.52
		6'	48	9'-11"		7"	9"		7'-0½"	10'-3⅛"	10'-9⅝"	0.809	112.48	56.07	138.60
	2 @ 5'	3'	30	11'-8"	7"	6"	8"	6½"	4'-1½"	12'-1"	12'-7½"	0.671	125.87	51.19	209.65
		4'	40	11'-8"		6"	8"		5'-1½"	"	"	0.733	131.22	54.53	209.65
		5'	50	11'-8"		6"	8"		6'-1½"	"	"	0.795	136.56	57.87	209.65
		6'	60	11'-11"		7"	9"		7'-1½"	12'-4"	12'-10½"	0.922	143.43	61.21	212.66
		7'	70	12'-1"		7½"	10"		8'-1½"	12'-6⅜"	13'-0½"	1.044	149.87	64.55	214.66
	2 @ 6'	3'	36	13'-8"	7½"	6"	8"	7½"	4'-3"	14'-1¾"	14'-8¼"	0.818	151.91	56.34	245.60
		4'	48	13'-8"		6"	8"		5'-3"	"	"	0.880	157.25	59.68	245.60
		5'	60	13'-8"		6"	8"		6'-3"	"	"	0.941	162.60	63.02	245.60
		6'	72	13'-11"		7"	9"		7'-3"	14'-5"	14'-11½"	1.070	169.60	66.36	248.60
		7'	84	14'-1"		7½"	10"		8'-3"	14'-7"	15'-1½"	1.192	176.15	69.70	250.61
		8'	96	14'-2"		8"	10"		9'-3"	14'-8"	15'-2½"	1.298	186.76	73.04	251.61
	2 @ 7'	4'	56	15'-8"	8"	6"	8"	8"	5'-4"	16'-2⅝"	16'-9"	1.021	181.91	64.83	281.99
		5'	70	15'-8"		6"	8"		6'-4"	"	"	1.082	187.25	68.17	281.99
		6'	84	15'-11"		7"	9"		7'-4"	16'-5⅜"	17'-0½"	1.212	194.35	71.51	284.99
		7'	98	16'-1"		7½"	10"		8'-4"	16'-7⅜"	17'-2¼"	1.334	200.94	74.85	286.99
		8'	112	16'-2"		8"	10"		9'-4"	16'-8⅞"	17'-3¼"	1.440	211.64	78.19	288.00
		9'	126	16'-5"		9"	11"		10'-4"	17'-0"	17'-6½"	1.616	229.01	81.53	291.00
	2 @ 8'	4'	64	17'-8"	8½"	6"	8"	8½"	5'-5"	18'-3½"	18'-10"	1.174	215.29	71.71	322.50
		5'	80	17'-11"		7"	9"		6'-5"	18'-6⅝"	19'-1"	1.295	222.27	75.05	325.50
		6'	96	17'-11"		7"	9"		7'-5"	"	"	1.366	227.62	78.39	325.50
		7'	112	18'-1"		7½"	10"		8'-5"	18'-8⅝"	19'-3"	1.489	234.60	81.73	327.50
		8'	128	18'-2"		8"	10"		9'-5"	18'-9¾"	19'-4½"	1.595	245.39	85.07	328.50
		9'	144	18'-5"		9"	11"		10'-5"	19'-0¾"	19'-7¼"	1.772	268.00	88.41	331.51
		10'	160	18'-8"		10"	12"		11'-5"	19'-3⅞"	19'-10½"	1.967	275.99	91.75	334.51
	2 @ 9'	5'	90	19'-11"	9"	7"	9"	9¼"	6'-6¼"	20'-7⅛"	21'-2"	1.477	244.83	82.77	364.23
		6'	108	20'-1"		7½"	10"		7'-6¼"	20'-9⅛"	21'-4"	1.594	251.54	86.11	366.23
		7'	126	20'-1"		7½"	10"		8'-6¼"	"	"	1.671	256.89	89.45	366.23
		8'	144	20'-2"		8"	10"		9'-6¼"	20'-10⅛"	21'-5"	1.778	267.72	92.79	367.23
		9'	162	20'-5"		9"	11"		10'-6¼"	21'-1⅝"	21'-8¼"	1.956	285.41	96.13	370.24
		10'	180	20'-8"		10"	12"		11'-6¼"	21'-4⅞"	21'-11¼"	2.152	298.43	99.47	373.24
		11'	198	20'-10"		11"	12"		12'-6¼"	21'-6⅞"	22'-1½"	2.328	312.32	102.81	375.24
	2 @ 10'	5'	100	21'-11"	9½"	7"	9"	10"	6'-7½"	22'-8¼"	23'-2¾"	1.674	286.66	87.92	500.43
		6'	120	22'-1"		7½"	10"		7'-7½"	22'-10⅜"	23'-4¾"	1.792	298.52	91.26	503.15
		7'	140	22'-1"		7½"	10"		8'-7½"	"	"	1.869	298.87	94.60	503.15
		8'	160	22'-2"		8"	10"		9'-7½"	22'-11⅜"	23'-5¾"	1.976	309.79	97.94	504.52
		9'	180	22'-5"		9"	11"		10'-7½"	23'-2⅛"	23'-9"	2.155	327.76	101.28	509.97
		10'	200	22'-8"		10"	12"		11'-7½"	23'-5⅝"	24'-0"	2.352	341.02	104.62	514.06
		11'	220	22'-10"		11"	12"		12'-7½"	23'-7⅝"	24'-2"	2.529	355.04	107.96	516.78
		12'	240	23'-0"		12"	12"		13'-7½"	23'-9⅜"	24'-4¼"	2.718	377.25	111.30	519.51
	2 @ 11'	6'	132	24'-2"	10"	8"	10"	11"	7'-9"	25'-0⅛"	25'-6¾"	2.048	316.97	96.41	551.83
		7'	154	24'-2"		8"	10"		8'-9"	"	"	2.128	322.31	99.75	551.83
		8'	176	24'-2"		8"	10"		9'-9"	"	"	2.208	332.74	103.09	551.83
		9'	198	24'-5"		9"	11"		10'-9"	25'-3⅜"	25'-9¾"	2.388	350.87	106.43	555.92
		10'	220	24'-8"		10"	12"		11'-9"	25'-6⅛"	26'-1"	2.586	364.19	109.77	561.37
		11'	242	24'-10"		11"	12"		12'-9"	25'-8⅛"	26'-3"	2.764	378.28	113.11	564.10
		12'	264	25'-0"		12"	12"		13'-9"	25'-10⅝"	26'-5"	2.954	400.66	116.45	566.82
	2 @ 12'	6'	144	26'-2"	10½"	8"	10"	12"	7'-10½"	27'-1"	27'-7½"	2.299	362.26	101.55	599.59
		7'	168	26'-2"		8"	10"		8'-10½"	"	"	2.379	367.60	104.89	599.59
		8'	192	26'-2"		8"	10"		9'-10½"	"	"	2.459	378.07	108.23	599.59
		9'	216	26'-5"		9"	11"		10'-10½"	27'-4⅛"	27'-10¾"	2.640	396.47	111.57	603.68
		10'	240	26'-8"		10"	12"		11'-10½"	27'-7⅛"	28'-1¾"	2.840	410.39	114.91	607.77
		11'	264	26'-10"		11"	12"		12'-10½"	27'-9⅜"	28'-3¾"	3.018	424.63	118.25	610.49
		12'	288	27'-0"		12"	12"		13'-10½"	27'-11⅜"	28'-6"	3.208	447.20	121.59	614.58



TYPICAL SECTION M-M

NOTE:- For details of wings and bar lists, see Drawing Nos. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2 and W-X154-1 or W-X154-2. Also W-X15.



PART LONGITUDINAL SECTION N-N

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

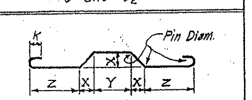
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, side walls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

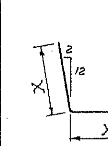
Bar Size	Pin Diam.	K	Add for 2 Hooks	Bending Diagram for Bars "b" and "b2"
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	

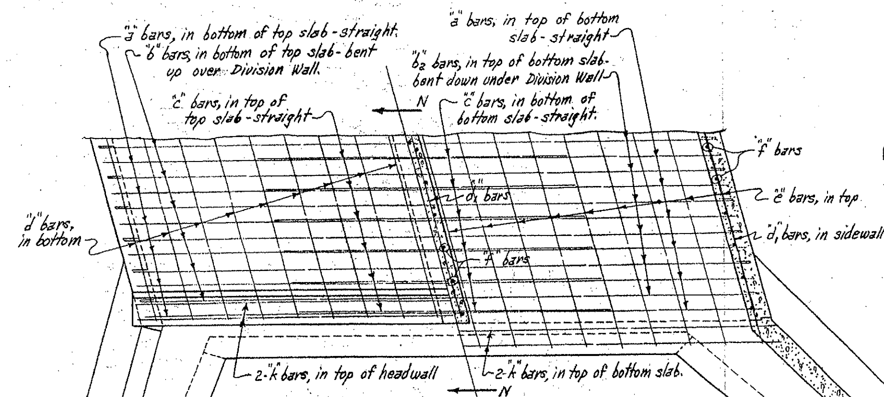


NOTE:- Dimensions are to centers of bars.

Dowel Bars for Two Headwalls

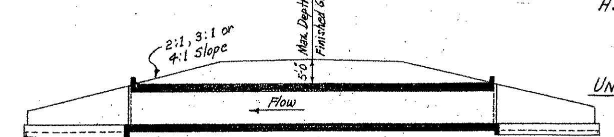
2 Spans @	Size	Spacing	No. Reqd	Length	X	Bars "r" Dowel bars in Headwalls
4'	#4	12"±	20	2'-5"	1'-2½"	
5'	#4	12"±	24	2'-6"	1'-3"	
6'	#4	12"±	28	2'-7"	1'-3½"	
7'	#4	12"±	32	2'-8"	1'-4"	
8'	#4	12"±	38	2'-9"	1'-4½"	
9'	#4	12"±	42	2'-10"	1'-5"	
10'	#4	12"±	46	2'-11"	1'-5½"	
11'	#4	12"±	50	3'-0"	1'-6"	
12'	#4	12"±	54	3'-1"	1'-6½"	



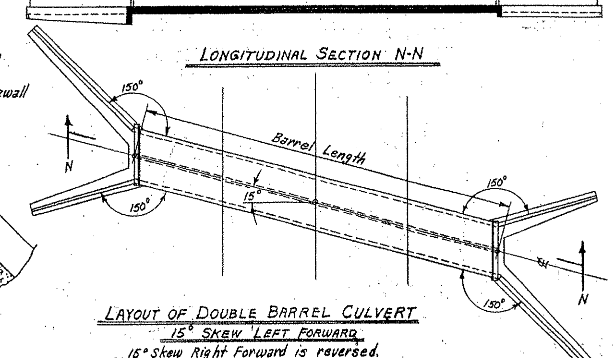


PART PLAN AT END OF CULVERT

NOTE:- The "a", "b", "b2" and "c" bars are placed parallel with the headwall. The "d" bars in top of top slab and "e" bars in bottom of bottom slab are not shown.



LONGITUDINAL SECTION N-N



LAYOUT OF DOUBLE BARREL CULVERT
15° SKEW LEFT FORWARD
15° Skew Right Forward is reversed.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

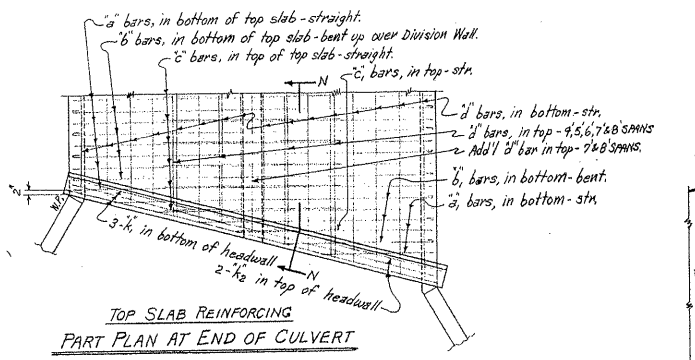
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
DOUBLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-215X-O

Designed by:- W.C.H. 1-17-63.
Drawn by:- W.C.H. 8-23-63.
Quantities by:- W.C.H. 8-26-63.
Checked by:- R.H.S. 5-14-63
Checked by:- R.H.S. 10-7-63
Checked by:- R.G. 12-16-63

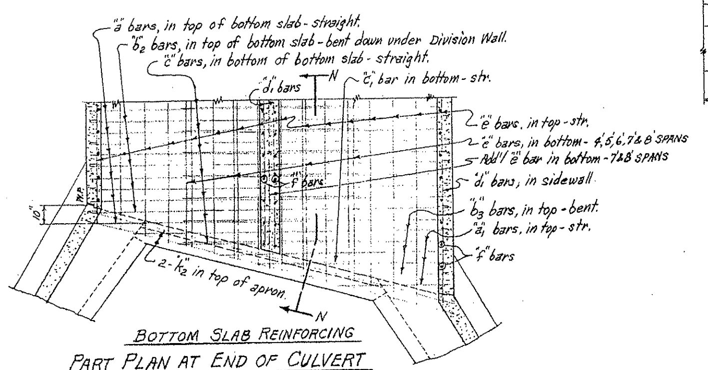
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.



TOP SLAB REINFORCING

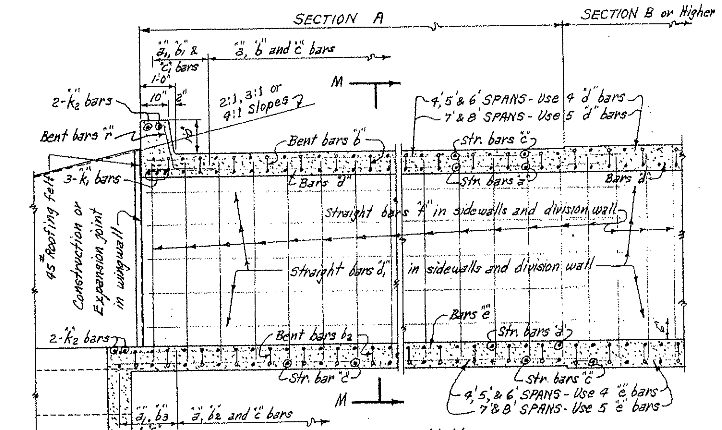
PART PLAN AT END OF CULVERT



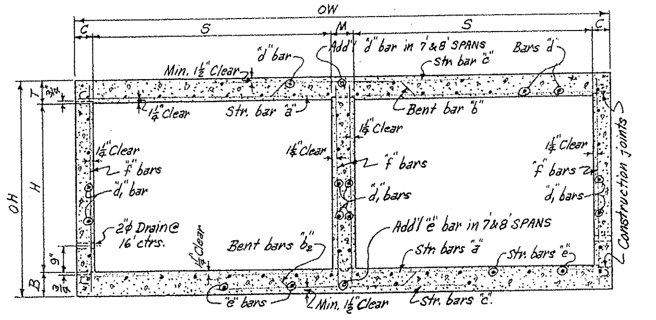
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

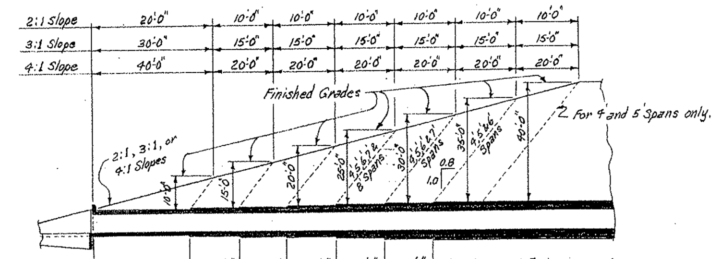
NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-9" into SECTION B.



SECTION N-N



TYPICAL SECTION M-M

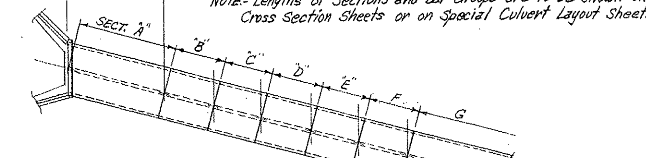


Slope		A	B	C	D	E	F	
2:1 Slope	= Sections / Bar Group	A = 12'-0" / A	B = 6'-0" / B	C = 6'-0" / C	D = 6'-0" / D	E = 6'-0" / E	F = 6'-0" / F	MID-SECTION G - Varies / G
3:1 Slope	= Sections / Bar Group	A = 22'-0" / A	B = 11'-0" / B	C = 11'-0" / C	D = 11'-0" / D	E = 11'-0" / E	F = 11'-0" / F	MID-SECTION G - Varies / G
4:1 Slope	= Sections / Bar Group	A = 32'-0" / A	B = 16'-0" / B	C = 16'-0" / C	D = 16'-0" / D	E = 16'-0" / E	F = 16'-0" / F	MID-SECTION G - Varies / G

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D, E & F	A	B, C, D, E & F	A	B, C, D, E & F
LENGTHS	12'-5"	6'-2½"	22'-9¼"	11'-4⅝"	33'-1½"	16'-6¾"

NOTE:- For Details and Bar Lists for Sections B thru G, see Barrel Drawing Nos. R-200X-X1, R-200X-X2, or R-200X-X3.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 19.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 39.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

BARREL DIMENSIONS — Max. Design Depth of Cover (D): SECTION "A" = 10'-0"

Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	* Class S Concrete, Barrel Only 2:1 Cu.Yd.	3:1 Cu.Yd.	4:1 Cu.Yd.	Reinforcing Steel, Barrel, Apron and Headwall 2:1 Lb.	3:1 Lb.	4:1 Lb.
2 @ 4'	2'	16	9'-8"	6"	6"	8"	6"	3'-0"	10'-0"	10'-6½"	5.97	10.95	15.93	967	1629	2303
	3'	24	9'-8"		6"	8"		4'-0"	"	"	6.74	12.36	17.99	1039	1756	2485
	4'	32	9'-8"		6"	8"		5'-0"	"	"	7.51	13.78	20.04	1112	1882	2668
	5'	40	9'-8"		6"	8"		6'-0"	"	"	8.28	15.19	22.09	1184	2009	2850
	6'	48	9'-11"		7"	9"		7'-0"	10'-3⅜"	10'-9⅝"	9.85	18.06	26.27	1270	2157	3062
2 @ 5'	3'	30	11'-8"	6½"	6"	8"	6½"	4'-1"	12'-1"	12'-7⅞"	8.11	14.87	21.63	1396	2386	3409
	4'	40	11'-8"		6"	8"		5'-1"	"	"	8.88	16.28	23.68	1468	2513	3592
	5'	50	11'-8"		6"	8"		6'-1"	"	"	9.65	17.69	25.74	1541	2640	3775
	6'	60	11'-11"		7"	9"		7'-1"	12'-4"	12'-10⅞"	11.22	20.58	29.94	1630	2795	3997
	7'	70	12'-1"		7½"	10"		8'-1"	12'-6⅜"	13'-0½"	12.73	23.34	33.95	1868	3213	4602
2 @ 6'	3'	36	13'-8"	7¼"	6"	8"	7¾"	4'-3"	14'-1¾"	14'-8¼"	10.16	18.63	27.10	1580	2732	3898
	4'	48	13'-8"		6"	8"		5'-3"	"	"	10.93	20.04	29.15	1653	2859	4080
	5'	60	13'-8"		6"	8"		6'-3"	"	"	11.68	21.43	31.17	1725	2986	4263
	6'	72	13'-11"		7"	9"		7'-3"	14'-5"	14'-11½"	13.29	24.36	35.44	1815	3142	4486
	7'	84	14'-1"		7½"	10"		8'-3"	14'-7"	15'-1½"	14.80	27.14	39.48	2056	3565	5100
	8'	96	14'-2"		8"	10"		9'-3"	14'-8"	15'-2½"	16.12	29.56	43.00	2190	3772	5381
2 @ 7'	4'	56	15'-8"	8¼"	6"	8"	8¾"	5'-5"	16'-2⅝"	16'-9"	13.27	24.34	35.41	2136	3667	5154
	5'	70	15'-8"		6"	8"		6'-5"	"	"	14.04	25.75	37.46	2209	3794	5337
	6'	84	15'-11"		7"	9"		7'-5"	16'-5¾"	17'-0¼"	15.66	28.71	41.77	2302	3956	5568
	7'	98	16'-1"		7½"	10"		8'-5"	16'-7⅜"	17'-2¼"	17.18	31.51	45.84	2549	4390	6196
	8'	112	16'-2"		8"	10"		9'-5"	16'-8⅞"	17'-3¼"	18.50	33.93	49.36	2686	4638	6558
	9'	126	16'-5"		9"	11"		10'-5"	17'-0"	17'-6½"	20.70	37.96	55.22	2846	4950	7000
2 @ 8'	4'	64	17'-8"	9¼"	6"	8"	9¾"	5'-7"	18'-3½"	18'-10"	15.93	29.21	42.50	2384	4168	5973
	5'	80	17'-11"		7"	9"		6'-7"	18'-6⅝"	19'-1"	17.46	32.02	46.57	2640	4493	6369
	6'	96	17'-11"		7"	9"		7'-7"	"	"	18.34	33.63	48.93	2712	4620	6552
	7'	112	18'-1"		7½"	10"		8'-7"	18'-8⅝"	19'-3"	19.88	36.46	53.03	2847	4875	6919
	8'	128	18'-2"		8"	10"		9'-7"	18'-9⅞"	19'-4¾"	21.20	38.87	56.54	3064	5235	7441
	9'	144	18'-5"		9"	11"		10'-7"	19'-0⅜"	19'-7¼"	23.42	42.95	62.47	3224	5523	7866
	10'	160	18'-8"		10"	12"		11'-7"	19'-3⅜"	19'-10½"	25.85	47.41	68.97	3568	6116	8714

* QUANTITIES - ONE SECTION "A". * For remainder of quantities see Std. Wing and Barrel Drawings listed below.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 12'-5", 3:1 = 22'-9¼", 4:1 = 33'-1½". Depth of Cover (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars (▼) — STRAIGHT — In Top and Bottom Slab of Barrel - (Two of each Length.)

S	H	"a" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"a1" Size	Spacing	No. Req'd	Length Max.	Min.
2 @ 4'	2'	#4	13"	23	41	61	9'-5"	#4	13"	2	5'-5"	—
	3'			23	41	61	"			2	"	—
	4'			23	41	61	"			2	"	—
	5'			23	41	61	"			2	"	—
	6'			23	41	61	9'-8"			2	5'-8"	—
2 @ 5'	3'	#4	11"	25	47	71	11'-5"	#4	11"	4	8'-0"	4'-7"
	4'			25	47	71	"			4	"	"
	5'			25	47	71	"			4	"	"
	6'			25	47	71	11'-8"			4	8'-3"	4'-10"
	7'			25	47	71	11'-10"			4	8'-5"	5'-0"
2 @ 6'	3'	#4	12"	23	43	65	13'-5"	#4	12"	4	9'-8"	5'-11"
	4'			23	43	65	"			4	"	"
	5'			23	43	65	"			4	"	"
	6'			23	43	65	13'-8"			4	9'-11"	6'-2"
	7'			23	43	65	13'-10"			4	10'-1"	6'-4"
	8'			23	43	65	13'-11"			4	10'-2"	6'-5"
2 @ 7'	4'	#4	12"	23	43	63	15'-5"	#4	12"	6	11'-8"	4'-2"
	5'			23	43	63	"			6	"	"
	6'			23	43	63	15'-8"			6	11'-11"	4'-5"
	7'			23	43	63	15'-10"			6	12'-1"	4'-7"
	8'			23	43	63	15'-11"			6	12'-2"	4'-8"
	9'			23	43	63	16'-2"			6	12'-5"	4'-11"
2 @ 8'	4'	#5	13"	21	39	59	17'-5"	#5	13"	6	13'-5"	5'-5"
	5'			21	39	59	17'-8"			6	13'-8"	5'-8"
	6'			21	39	59	"			6	"	"
	7'			21	39	59	17'-10"			6	13'-10"	5'-10"
	8'			21	39	59	17'-11"			6	13'-11"	5'-11"
	9'			21	39	59	18'-2"			6	14'-2"	6'-2"
	10'			21	39	59	18'-5"			6	14'-5"	6'-5"

"b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. "b1" bars (▼) — In Bottom of Top Slab - may or may not be bent up over Division Wall - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b1" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
2 @ 4'	2'	#4	13"	10	20	29	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	2	8'-0"	3'-10"	7'-5"	3'-5"
	3'			10	20	29	"	"	"	"			2	"	"	"	"
	4'			10	20	29	"	"	"	"			2	"	"	"	"
	5'			10	20	29	"	"	"	"			2	"	"	"	"
	6'			10	20	29	10'-8"	0'-2¾"	2'-2"	3'-6"			2	8'-3"	4'-1"	7'-8"	3'-8"
2 @ 5'	3'	#5	11"	12	23	34	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	2	10'-4"	6'-10"	9'-8"	6'-3"
	4'			12	23	34	"	"	"	"			2	"	"	"	"
	5'			12	23	34	"	"	"	"			2	"	"	"	"
	6'			12	23	34	12'-9"	"	2'-7½"	4'-3"			2	10'-7"	7'-1"	9'-11"	6'-6"
	7'			12	23	34	12'-11"	0'-3"	2'-8½"	4'-3½"			2	10'-9"	7'-4"	10'-1"	6'-9"
2 @ 6'	3'	#5	12"	10	21	31	14'-7"	0'-3¾"	2'-11"	4'-11"	#5	12"	3	12'-2"	4'-6"	11'-6"	4'-0"
	4'			10	21	31	"	"	"	"			3	"	"	"	"
	5'			10	21	31	"	"	"	"			3	"	"	"	"
	6'			10	21	31	14'-10"	"	3'-0"	5'-0"			3	12'-5"	4'-9"	11'-9"	4'-5"
	7'			10	21	31	15'-0"	"	3'-1"	5'-0½"			3	12'-7"	4'-11"	11'-11"	4'-5"
	8'			10	21	31	15'-1"	0'-3¾"	3'-1"	5'-1"			3	12'-8"	5'-0"	12'-0"	4'-6"
2 @ 7'	4'	#6	12"	10	21	31	16'-10"	0'-4¾"	3'-4½"	5'-7"	#6	12"	3	14'-5"	6'-7"	13'-6"	6'-0"
	5'			10	21	31	"	"	"	"			3	"	"	"	"
	6'			10	21	31	17'-1"	"	3'-5½"	5'-8"			3	14'-8"	6'-10"	13'-9"	6'-3"
	7'			10	21	31	17'-3"	"	3'-6½"	5'-8½"			3	14'-10"	7'-0"	13'-11"	6'-5"
	8'			10	21	31	17'-4"	"	3'-6½"	5'-9"			3	14'-11"	7'-1"	14'-0"	6'-6"
	9'			10	21	31	17'-7"	0'-4¾"	3'-7½"	5'-10"			3	15'-2"	7'-4"	14'-3"	6'-9"
2 @ 8'	4'	#6	13"	9	19	28	18'-10"	0'-5¾"	3'-7"	6'-5"	#6	13"	4	16'-4"	4'-0"	15'-5"	3'-5"
	5'			9	19	28	19'-1"	"	3'-8"	6'-6"			4	16'-7"	4'-3"	15'-8"	3'-8"
	6'			9	19	28	"	"	"	"			4	"	"	"	"
	7'			9	19	28	19'-3"	"	3'-9"	6'-6½"			4	16'-9"	4'-5"	15'-10"	3'-10"
	8'			9	19	28	19'-4"	"	3'-9"	6'-7"			4	16'-10"	4'-6"	15'-11"	3'-11"
	9'			9	19	28	19'-7"	"	3'-10"	6'-8"			4	17'-1"	4'-9"	16'-2"	4'-2"
	10'			9	19	28	19'-10"	0'-5¾"	3'-11"	6'-9"			4	17'-4"	5'-0"	16'-5"	4'-5"

"b2" bars — BENT - See Diagrams below — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b3" bars (▼) — In Top of Bottom Slab - may or may not be bent down under Division Wall - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b3" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
2 @ 4'	2'	#4	13"	11	21	30	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	2	8'-0"	3'-10"	7'-5"	3'-5"
	3'			11	21	30	"	"	"	"			2	"	"	"	"
	4'			11	21	30	"	"	"	"			2	"	"	"	"
	5'			11	21	30	"	"	"	"			2	"	"	"	"
	6'			11	21	30	10'-8"	0'-2¾"	2'-2"	3'-6"			2	8'-3"	4'-1"	7'-8"	3'-8"
2 @ 5'	3'	#5	11"	13	24	35	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	2	10'-4"	6'-10"	9'-8"	6'-3"
	4'			13	24	35	"	"	"	"			2	"	"	"	"
	5'			13	24	35	"	"	"	"			2	"	"	"	"
	6'			13	24	35	12'-9"	"	2'-7½"	4'-3"			2	10'-7"	7'-1"	9'-11"	6'-6"
	7'			13	24	35	12'-11"	0'-3"	2'-8½"	4'-3½"			2	10'-9"	7'-4"	10'-1"	6'-9"
2 @ 6'	3'	#5	12"	11	22	32	14'-7"	0'-4½"	2'-10"	4'-11"	#5	12"	3	12'-3"	4'-6"	11'-6"	4'-0"
	4'			11	22	32	"	"	"	"			3	"	"	"	"
	5'			11	22	32	"	"	"	"			3	"	"	"	"
	6'			11	22	32	14'-10"	"	2'-11"	5'-0"			3	12'-6"	4'-9"	11'-9"	4'-3"
	7'			11	22	32	15'-0"	"	3'-0"	5'-0½"			3	12'-8"	4'-11"	11'-11"	4'-5"
	8'			11	22	32	15'-1"	0'-4½"	3'-0"	5'-1"			3	12'-9"	5'-0"	12'-0"	4'-6"
2 @ 7'	4'	#6	12"	11	22	32	16'-10"	0'-5⅛"	3'-3½"	5'-7"	#6	12"	3	14'-5"	6'-7"	13'-6"	6'-0"
	5'			11	22	32	"	"	"	"			3	"	"	"	"
	6'			11	22	32	17'-1"	"	3'-4½"	5'-8"			3	14'-8"	6'-10"	13'-9"	6'-3"
	7'			11	22	32	17'-3"	"	3'-5½"	5'-8½"			3	14'-10"	7'-0"	13'-11"	6'-5"
	8'			11	22	32	17'-4"	"	3'-5½"	5'-9"			3	14'-11"	7'-1"	14'-0"	6'-6"
	9'			11	22	32	17'-7"	0'-5⅛"	3'-6½"	5'-10"			3	15'-2"	7'-4"	14'-3"	6'-9"
2 @ 8'	4'	#6	13"	10	20	29	18'-11"	0'-6⅛"	3'-6"	6'-5"	#6	13"	4	16'-5"	4'-0"	15'-5"	3'-5"
	5'			10	20	29	19'-2"	"	3'-7"	6'-6"			4	16'-8"	4'-3"	15'-8"	3'-8"
	6'			10	20	29	"	"	"	"			4	"	"	"	"
	7'			10	20	29	19'-4"	"	3'-8"	6'-6½"			4	16'-10"	4'-5"	15'-10"	3'-10"
	8'			10	20	29	19'-5"	"	3'-8"	6'-7"			4	16'-11"	4'-6"	15'-11"	3'-11"
	9'			10	20	29	19'-8"	"	3'-9"	6'-8"			4	17'-2"	4'-9"	16'-2"	4'-2"
	10'			10	20	29	19'-11"	0'-6⅛"	3'-10"	6'-9"			4	17'-5"	5'-0"	16'-5"	4'-5"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"c1" Size	Spacing	No. Req'd	Length Max.	Min.
2 @ 4'	2'	#5	13"	23	41	61	4'-8"	#5	13"	2	3'-1"	—
	3'			23	41	61	"			2	"	—
	4'			23	41	61	"			2	"	—
	5'			23	41	61	"			2	"	—
	6'			23	41	61	4'-9"			2	3'-3"	—
2 @ 5'	3'	#5	11"	25	47	71	5'-8"	#5	11"	2	5'-1"	—
	4'			25	47	71	"			2	"	—
	5'			25	47	71	"			2	"	—
	6'			25	47	71	5'-9"			2	5'-3"	—
	7'			25	47	71	5'-10"			2	5'-4"	—
2 @ 6'	3'	#6	12"	23	43	65	6'-8"	#6	12"	2	6'-4"	—
	4'			23	43	65	"			2	"	—
	5'			23	43	65	"			2	"	—
	6'			23	43	65	6'-9"			2	6'-6"	—
	7'			23	43	65	6'-10"			2	6'-7"	—
	8'			23	43	65	6'-10"			2	6'-8"	—
2 @ 7'	4'	#6	12"	25	45	65	7'-8"	#6	12"	2	4'-1"	—
	5'			25	45	65	"			2	"	—
	6'			25	45	65	7'-9"			2	4'-3"	—
	7'			25	45	65	7'-10"			2	4'-4"	—
	8'			25	45	65	7'-10"			2	4'-5"	—
	9'			25	45	65	7'-11"			2	4'-7"	—
2 @ 8'	4'	#7	13"	23	41	61	8'-8"	#7	13"	2	5'-1"	—
	5'			23	41	61	8'-9"			2	5'-3"	—
	6'			23	41	61	"			2	"	—
	7'			23	41	61	8'-10"			2	5'-4"	—
	8'			23	41	61	8'-10"			2	5'-5"	—
	9'			23	41	61	8'-11"			2	5'-7"	—
	10'			23	41	61	9'-0"			2	5'-9"	—

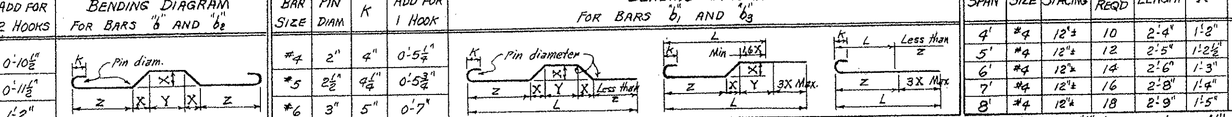
"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Wall. "e" bars — Longitudinal in Bottom Slab of Barrel.

"d" bar length: Lengths Vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10". "d1" bar length: Lengths Vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10". "e" bar length: Lengths Vary - Ave. Length: 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10".

S	H	"d" Size	Spacing	No. Req'd	"d1" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd
2 @ 4'	2'	#4	12"	14	#4	12"	8	#4	12"	14
	3'			14			12			14
	4'			14			16			14
	5'			14			20			14
	6'			14			24			14
2 @ 5'	3'	#4	12"	16	#4	12"	12	#4	12"	16
	4'			16			16			16
	5'			16			20			16
	6'			16			24			16
	7'			16			28			16
2 @ 6'	3'	#4	12"	18	#4	12"	12	#4	12"	18
	4'			18			16			18
	5'			18			20			18
	6'			18			24			18
	7'			18			28			18
	8'			18			32			18
2 @ 7'	4'	#4	12"	21	#4	12"	16	#4	12"	21
	5'			21			20			21
	6'			21			24			21
	7'			21			28			21
	8'			21			32			21
	9'			21			36			21
2 @ 8'	4'	#4	12"	23	#4	12"	16	#4	12"	23
	5'			23			20			23
	6'			23			24			23
	7'			23			28			23
	8'			23			32			23
	9'			23			36			23
	10'			23			40			23

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Wall. "k1" bars (▼) — STRAIGHT — In Bottom of Headwall. "k2" bars (▼) — In Top of Headwall and Apron. (2 Each)

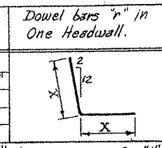
S	H	"f" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"k1" Size	No. Req'd	Length	"k2" Size	No. Req'd	Length
2 @ 4'	2'	#4	12"	52	92	134	2'-9"	#5	3	9'-9"	#5	4	10'-3"
	3'			52	92	134	3'-9"		3	"		4	"
	4'			52	92	134	4'-9"		3	"		4	"
	5'			52	92	134	5'-9"		3	"		4	"
	6'			52	92	134	6'-9"		3	10'-0"		4	10'-6"
2 @ 5'	3'	#4	12"	52	92	134	3'-10"	#5	3	11'-10"	#5	4	12'-4"
	4'			52	92	134	4'-10"		3	"		4	"
	5'			52	92	134	5'-10"		3	"		4	"
	6'			52	92	134	6'-10"		3	12'-1"		4	12'-7"
	7'	#5	12"	52	92	134	7'-10"		3	12'-3"		4	12'-9"
2 @ 6'	3'	#4	12"	52	92	134	4'-0"	#5	3	13'-10"	#5	4	14'-5"
	4'			52	92	134	5'-0"		3	"		4	"
	5'			52	92	134	6'-0"		3	"		4	"
	6'			52	92	134	7'-0"		3	14'-2"		4	14'-8"
	7'	#5	12"	52	92	134	8'-0"		3	14'-4"		4	14'-10"
	8'		11"	56	100	146	9'-0"		3	14'-5"		4	14'-11"
2 @ 7'	4'	#4	12"	52	92	134	5'-2"	#6	3	15'-11"	#6	4	16'-6"
	5'			52	92	134	6'-2"		3	"		4	"
	6'			52	92	134	7'-2"		3	16'-2"		4	16'-9"
	7'	#5	12"	52	92	134	8'-2"		3	16'-4"		4	16'-11"
	8'		11"	56	100	146	9'-2"		3	16'-6"		4	17'-0"
	9'		10"	60	110	160	10'-2"		3	16'-9"		4	17'-3"
2 @ 8'	4'	#4	12"	52	92	134	5'-4"	#6	3	18'-0"	#6	4	18'-7"
	5'			52	92	134	6'-4"		3	18'-3"		4	18'-10"
	6'			52	92	134	7'-4"		3	"		4	"
	7'		10"	60	110	160	8'-4"		3	18'-5"		4	19'-0"
	8'	#5	12"	52	92	134	9'-4"		3	18'-6"		4	19'-1"
	9'		11"	56	100	146	10'-4"		3	18'-9"		4	19'-4"
	10'	#6	12"	52	92	134	11'-4"		3	19'-0"		4	19'-7"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" AND "b2"
#4	2"	4"	0'-10½"	
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b1" AND "b3"
#4	2"	4"	0'-5¼"	
#5	2½"	4¼"	0'-5¾"	
#6	3"	5"	0'-7"	

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	10	2'-4"	1'-2"
5'	#4	12"±	12	2'-5"	1'-2½"
6'	#4	12"±	14	2'-6"	1'-3"
7'	#4	12"±	16	2'-8"	1'-4"
8'	#4	12"±	18	2'-9"	1'-5"

Dowel bars "r" in One Headwall.



NOTE:- Dimensions are to centers of bars. (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 4'-0" for 13" spacing, 3'-9" for 12" spacing, and 3'-5" for 11" spacing.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.

For Barrels of 4', 5' & 6' Spans, see Drawing No. R-200X-X1, of 7' Spans Drawing No. R-200X-X3, and of 8' Spans Drawing No. R-200X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS

FOR

REINFORCED CONCRETE BOX CULVERTS

15° SKEW ~ SECTIONS "A" ONLY

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES

DOUBLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-215X-1

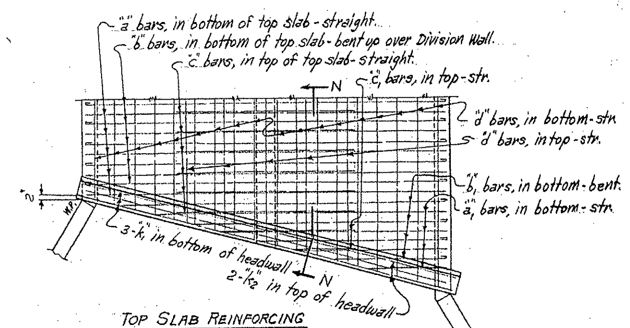
Designed by:- W.C.H. 9-17-62 — Checked by:- R.H.S. 11-12-62

Drawn by:- W.C.H. 10-3-63 — Checked by:-

Quantities by:- W.C.H. 12-6-63 — Checked by:-

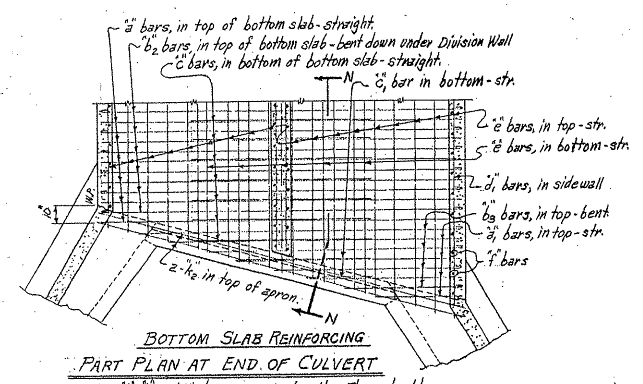
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2, Also W-X15.



TOP SLAB REINFORCING

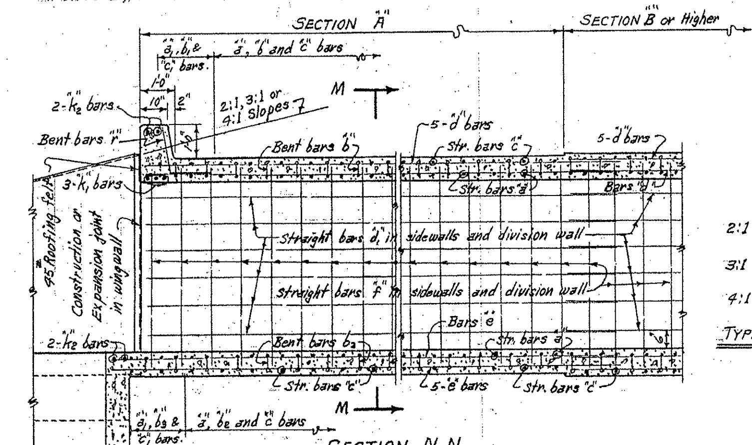
PART PLAN AT END OF CULVERT



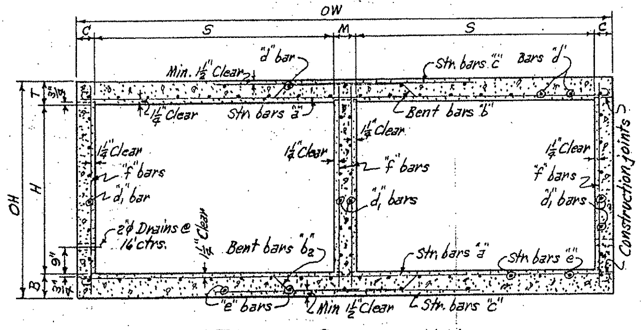
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

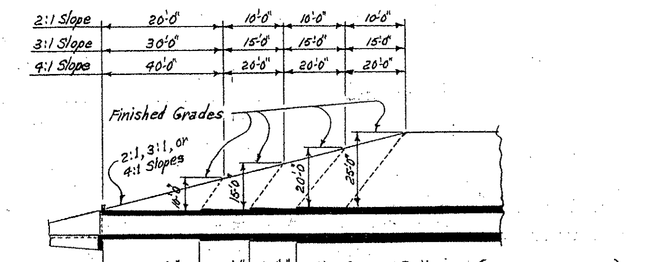
NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-9" into SECTION "B".



SECTION N-N



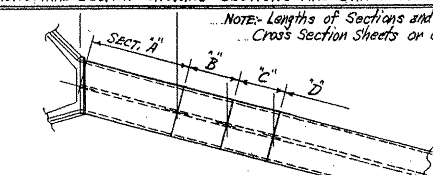
TYPICAL SECTION M-M



		A	B	C	Mid-Section	
2:1 Slope =	Sections / Bar Group	A = 12'-0" / A	B = 6'-0" / B	C = 6'-0" / C	MID-SECTION D - Varies / D	These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below
3:1 Slope =	Sections / Bar Group	A = 22'-0" / A	B = 11'-0" / B	C = 11'-0" / C	MID-SECTION D - Varies / D	
4:1 Slope =	Sections / Bar Group	A = 32'-0" / A	B = 16'-0" / B	C = 16'-0" / C	MID-SECTION D - Varies / D	

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B & C	A	B & C	A	B & C
LENGTHS	12'-5"	6'-2½"	22'-9¼"	11'-4⅝"	33'-1½"	16'-6¾"

NOTE:- For Details and Bar Lists for SECTIONS B, C & D, see Barrel Drawing Nos. R-200X-X2 and R-200X-X3.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	B	C		D

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	2@C			D

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONCRETE, BARREL ONLY 2:1 CU.YD.	3:1 CU.YD.	4:1 CU.YD.	REINFORCING STEEL, BARREL, APRON AND HEADWALL 2:1 LB.	3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	2 @ 9'	5'	90	19'-11"	10"	7"	9"	10¾"	6'-8¾"	20'-7⅛"	21'-2"	20.24	37.12	53.99	3124	5433	7767
		6'	108	20'-1"		7½"	10"		7'-8¾"	20'-9½"	21'-4"	21.72	39.83	57.94	3216	5593	7997
		7'	126	20'-1"		7½"	10"		8'-8¾"	"	"	22.67	41.58	60.49	3334	5821	8326
		8'	144	20'-2"		8"	10"		9'-8¾"	20'-10⅞"	21'-5"	24.01	44.04	64.06	3553	6185	8853
		9'	162	20'-5"		9"	11"		10'-8¾"	21'-1⅝"	21'-8¼"	26.24	48.11	69.99	3760	6587	9432
		10'	180	20'-8"		10"	12"		11'-8¾"	21'-4⅜"	21'-11¼"	28.69	52.62	76.55	4066	7083	10,151
		11'	198	20'-10"		11"	12"		12'-8¾"	21'-6⅞"	22'-1½"	30.91	56.68	82.45	4744	7933	10,776
	2 @ 10'	5'	100	21'-11"	10¾"	7"	9"	11½"	6'-10¼"	22'-8⅛"	23'-2¾"	23.09	42.35	61.61	3404	5835	8206
		6'	120	22'-1"		7½"	10"		7'-10¼"	22'-10⅜"	23'-4⅜"	24.57	45.06	65.55	3496	6044	8531
		7'	140	22'-1"		7½"	10"		8'-10¼"	"	"	25.54	46.84	68.14	3615	6274	8863
		8'	160	22'-2"		8"	10"		9'-10¼"	22'-11⅜"	23'-5¾"	26.87	49.28	71.68	3836	6641	9394
		9'	180	22'-5"		9"	11"		10'-10¼"	23'-2⅛"	23'-9"	29.12	53.40	77.68	4045	7047	9978
		10'	200	22'-8"		10"	12"		11'-10¼"	23'-5⅛"	24'-0"	31.59	57.93	84.27	4354	7545	10,714
		11'	220	22'-10"		11"	12"		12'-10¼"	23'-7⅝"	24'-2"	33.80	61.98	90.17	4560	7924	11,253
		12'	240	23'-0"		12"	12"		13'-10¼"	23'-9¾"	24'-4¼"	36.17	66.33	96.49	4779	8531	12,211
	2 @ 11'	6'	132	24'-2"	11¾"	8"	10"	12½"	8'-0¼"	25'-0¼"	25'-6¾"	28.43	52.15	75.86	4078	7251	10,216
		7'	154	24'-2"		8"	10"		9'-0¼"	"	"	29.43	53.97	78.51	4174	7424	10,468
		8'	176	24'-2"		8"	10"		10'-0¼"	"	"	30.43	55.81	81.19	4413	7841	11,071
		9'	198	24'-5"		9"	11"		11'-0¼"	25'-3⅜"	25'-9¾"	32.69	59.96	87.22	4627	8258	11,669
		10'	220	24'-8"		10"	12"		12'-0¼"	25'-6½"	26'-1"	35.19	64.53	93.88	4942	8834	12,539
		11'	242	24'-10"		11"	12"		13'-0¼"	25'-8⅝"	26'-3"	37.41	68.61	99.81	5154	9155	12,972
		12'	264	25'-0"		12"	12"		14'-0¼"	25'-10⅝"	26'-5"	39.78	72.96	106.13	5541	9854	13,980
	2 @ 12'	6'	144	26'-2"	12½"	8"	10"	13½"	8'-2"	27'-1"	27'-7¼"	32.05	58.77	85.50	4640	8153	11,686
		7'	168	26'-2"		8"	10"		9'-2"	"	"	33.05	60.62	88.18	4712	8280	11,868
		8'	192	26'-2"		8"	10"		10'-2"	"	"	34.05	62.94	90.83	4978	8749	12,549
		9'	216	26'-5"		9"	11"		11'-2"	27'-4⅜"	27'-10⅞"	36.32	66.60	96.89	5197	9169	13,155
		10'	240	26'-8"		10"	12"		12'-2"	27'-7¼"	28'-1¾"	38.84	71.23	103.61	5519	9692	13,911
		11'	264	26'-10"		11"	12"		13'-2"	27'-9¾"	28'-3¾"	41.07	75.33	109.58	5732	10,083	14,482
		12'	288	27'-0"		12"	12"		14'-2"	27'-11⅜"	28'-6"	43.46	79.70	115.94	6125	10,791	15,507

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 12'-5", 3:1 = 22'-9¼", 4:1 = 33'-1½". Depth of Cover (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a1" bars ▼ – STRAIGHT – In Top and Bottom Slab of Barrel - (Two of each Length).

Clear Span S	Clear Height H	"a" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"a1" Size	Spacing	No. Req'd	Length Max.	Min.
2 @ 9'	5'	#5	11"	23	45	69	19'-8"	#5	11"	8	16'-3"	6'-0"
	6'			23	45	69	19'-10"			8	16'-5"	6'-2"
	7'			23	45	69	19'-10"			8	16'-5"	"
	8'			23	45	69	19'-11"			8	16'-6"	6'-3"
	9'			23	45	69	20'-2"			8	16'-9"	6'-6"
	10'			23	45	69	20'-5"			8	17'-0"	6'-9"
	11'			23	45	69	20'-7"			8	17'-2"	6'-11"
2 @ 10'	5'	#5	12"	21	41	61	21'-8"	#5	12"	8	17'-11"	6'-8"
	6'			21	41	61	21'-10"			8	18'-1"	6'-10"
	7'			21	41	61	21'-10"			8	18'-1"	"
	8'			21	41	61	21'-11"			8	18'-2"	6'-11"
	9'			21	41	61	22'-2"			8	18'-5"	7'-2"
	10'			21	41	61	22'-5"			8	18'-8"	7'-5"
	11'			21	41	61	22'-7"			8	18'-10"	7'-7"
	12'			21	41	61	22'-9"			8	19'-0"	7'-9"
2 @ 11'	6'	#5	12"	19	41	61	23'-11"	#5	12"	10	20'-2"	5'-2"
	7'			19	41	61	23'-11"			10	20'-2"	"
	8'			19	41	61	23'-11"			10	20'-2"	"
	9'			19	41	61	24'-2"			10	20'-5"	5'-5"
	10'			19	41	61	24'-5"			10	20'-8"	5'-8"
	11'			19	41	61	24'-7"			10	20'-10"	5'-10"
	12'			19	41	61	24'-9"			10	21'-0"	6'-0"
2 @ 12'	6'	#5	11"	21	43	67	25'-11"	#5	11"	12	22'-6"	5'-5"
	7'			21	43	67	25'-11"			12	22'-6"	"
	8'			21	43	67	25'-11"			12	22'-6"	"
	9'			21	43	67	26'-2"			12	22'-9"	5'-8"
	10'			21	43	67	26'-5"			12	23'-0"	5'-11"
	11'			21	43	67	26'-7"			12	23'-2"	6'-1"
	12'			21	43	67	26'-9"			12	23'-4"	6'-3"

"b" bars – BENT - See Diagrams below – In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. "b1" bars ▼ – In Bottom of Top Slab - some bent up over Division Wall - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b1" Size	Spacing	No. Req'd	Length L Max.	Min.	Max.	Min.
2 @ 9'	5'	#6	11"	10	22	33	21'-2"	0'-6⅛"	4'-2"	7'-2"	#6	11"	5	18'-11"	4'-10"	17'-11"	4'-3"
	6'			10	22	33	21'-4"	"	4'-3"	7'-2½"			5	19'-1"	5'-0"	18'-1"	4'-5"
	7'			10	22	33	21'-4"	"	"	7'-2½"			5	19'-1"	"	"	"
	8'			10	22	33	21'-5"	"	"	7'-3"			5	19'-2"	5'-1"	18'-2"	4'-6"
	9'			10	22	33	21'-8"	"	4'-4"	7'-4"			5	19'-5"	5'-4"	18'-5"	4'-9"
	10'			10	22	33	21'-11"	"	4'-5"	7'-5"			5	19'-8"	5'-7"	18'-8"	5'-0"
	11'			10	22	33	22'-1"	0'-6⅛"	4'-5"	7'-6"			5	19'-10"	5'-9"	18'-10"	5'-2"
2 @ 10'	5'	#6	12"	9	20	30	23'-2"	0'-7¼"	4'-6½"	7'-11"	#6	12"	5	20'-10"	5'-4"	19'-9"	4'-9"
	6'			9	20	30	23'-4"	"	4'-7½"	7'-11½"			5	21'-0"	5'-6"	19'-11"	4'-11"
	7'			9	20	30	23'-4"	"	"	"			5	21'-0"	"	"	"
	8'			9	20	30	23'-5"	"	"	8'-0"			5	21'-1"	5'-7"	20'-0"	5'-0"
	9'			9	20	30	23'-8"	"	4'-8½"	8'-1"			5	21'-4"	5'-10"	20'-3"	5'-3"
	10'			9	20	30	23'-11"	"	4'-9½"	8'-2"			5	21'-7"	6'-1"	20'-6"	5'-6"
	11'			9	20	30	24'-1"	"	4'-9½"	8'-3"			5	21'-9"	6'-3"	20'-8"	5'-8"
	12'			9	20	30	24'-3"	0'-7¼"	4'-9½"	8'-4"			5	21'-11"	6'-5"	20'-10"	5'-10"
2 @ 11'	6'	#7	12"	9	20	30	25'-8"	0'-8"	5'-0"	8'-9"	#7	12"	6	23'-2"	3'-11"	22'-0"	3'-3"
	7'			9	20	30	25'-8"	"	"	"			6	23'-2"	"	"	"
	8'			9	20	30	25'-8"	"	"	"			6	23'-2"	"	"	"
	9'			9	20	30	25'-11"	"	5'-1"	8'-10"			6	23'-5"	4'-2"	22'-3"	3'-6"
	10'			9	20	30	26'-2"	"	5'-2"	8'-11"			6	23'-8"	4'-5"	22'-6"	3'-9"
	11'			9	20	30	26'-4"	"	5'-2"	9'-0"			6	23'-10"	4'-7"	22'-8"	3'-11"
	12'			9	20	30	26'-6"	0'-8"	5'-2"	9'-1"			6	24'-0"	4'-9"	22'-10"	4'-1"
2 @ 12'	6'	#7	11"	9	21	32	27'-8"	0'-8¾"	5'-4½"	9'-6"	#7	11"	7	25'-5"	4'-4"	24'-2"	3'-8"
	7'			9	21	32	27'-8"	"	"	"			7	25'-5"	"	"	"
	8'			9	21	32	27'-8"	"	"	"			7	25'-5"	"	"	"
	9'			9	21	32	27'-11"	"	5'-5½"	9'-7"			7	25'-8"	4'-7"	24'-5"	3'-11"
	10'			9	21	32	28'-2"	"	5'-6½"	9'-8"			7	25'-11"	4'-10"	24'-8"	4'-2"
	11'			9	21	32	28'-4"	"	5'-6½"	9'-9"			7	26'-1"	5'-0"	24'-10"	4'-4"
	12'			9	21	32	28'-6"	0'-8¾"	5'-6½"	9'-10"			7	26'-3"	5'-2"	25'-0"	4'-6"

"b2" bars – BENT - See Diagrams below – In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b3" bars ▼ – In Top of Bottom Slab - some bent down under Division Wall - one end hooked. Alt. with "a1" and "c" or c1 bars.

S	H	"b2" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b3" Size	Spacing	No. Req'd	Length L Max.	Min.	Max.	Min.
2 @ 9'	5'	#6	11"	11	23	34	21'-3"	0'-7⅛"	4'-0½"	7'-2"	#6	11"	5	19'-0"	4'-10"	17'-11"	4'-3"
	6'			11	23	34	21'-5"	"	4'-1½"	7'-2½"			5	19'-2"	5'-0"	18'-1"	4'-5"
	7'			11	23	34	21'-5"	"	"	7'-2½"			5	"	"	"	"
	8'			11	23	34	21'-6"	"	"	7'-3"			5	19'-3"	5'-1"	18'-2"	4'-6"
	9'			11	23	34	21'-9"	"	4'-2½"	7'-4"			5	19'-6"	5'-4"	18'-5"	4'-9"
	10'			11	23	34	22'-0"	"	4'-3½"	7'-5"			5	19'-9"	5'-7"	18'-8"	5'-0"
	11'			11	23	34	22'-2"	0'-7⅛"	4'-3½"	7'-6"			5	19'-11"	5'-9"	18'-10"	5'-2"
2 @ 10'	5'	#6	12"	10	21	31	23'-3"	0'-8"	4'-5"	7'-11"	#6	12"	5	20'-10"	5'-4"	19'-9"	4'-9"
	6'			10	21	31	23'-5"	"	4'-6"	7'-11½"			5	21'-0"	5'-6"	19'-11"	4'-11"
	7'			10	21	31	"	"	"	"			5	"	"	"	"
	8'			10	21	31	23'-6"	"	"	8'-0"			5	21'-1"	5'-7"	20'-0"	5'-0"
	9'			10	21	31	23'-9"	"	4'-7"	8'-1"			5	21'-4"	5'-10"	20'-3"	5'-3"
	10'			10	21	31	24'-0"	"	4'-8"	8'-2"			5	21'-7"	6'-1"	20'-6"	5'-6"
	11'			10	21	31	24'-2"	"	4'-8"	8'-3"			5	21'-9"	6'-3"	20'-8"	5'-8"
	12'			10	21	31	24'-4"	0'-8"	4'-8"	8'-4"			5	21'-11"	6'-5"	20'-10"	5'-10"
2 @ 11'	6'	#7	12"	10	21	31	25'-9"	0'-8¾"	4'-10⅞"	8'-9"	#7	12"	6	23'-3"	3'-11"	22'-0"	3'-3"
	7'			10	21	31	"	"	"	"			6	"	"	"	"
	8'			10	21	31	"	"	"	"			6	"	"	"	"
	9'			10	21	31	26'-0"	"	4'-11⅞"	8'-10"			6	23'-6"	4'-2"	22'-3"	3'-6"
	10'			10	21	31	26'-3"	"	5'-0⅞"	8'-11"			6	23'-9"	4'-5"	22'-6"	3'-9"
	11'			10	21	31	26'-5"	"	5'-0⅞"	9'-0"			6	23'-11"	4'-7"	22'-8"	3'-11"
	12'			10	21	31	26'-7"	0'-8¾"	5'-0⅞"	9'-1"			6	24'-1"	4'-9"	22'-10"	4'-1"
2 @ 12'	6'	#7	11"	10	22	33	27'-9"	0'-9¾"	5'-2⅞"	9'-6"	#7	11"	7	25'-6"	4'-4"	24'-2"	3'-8"
	7'			10	22	33	"	"	"	"			7	"	"	"	"
	8'			10	22	33	"	"	"	"			7	"	"	"	"
	9'			10	22	33	28'-0"	"	5'-3⅞"	9'-7"			7	25'-9"	4'-7"	24'-5"	3'-11"
	10'			10	22	33	28'-3"	"	5'-4⅞"	9'-8"			7	26'-0"	4'-10"	24'-8"	4'-2"
	11'			10	22	33	28'-5"	"	5'-4⅞"	9'-9"			7	26'-2"	5'-0"	24'-10"	4'-4"
	12'			10	22	33	28'-7"	0'-9¾"	5'-4⅞"	9'-10"			7	26'-4"	5'-2"	25'-0"	4'-6"

"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars ▼ – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"c1" Size	Spacing	No. Req'd	Length Max.	Min.
2 @ 9'	5'	#7	11"	25	47	71	9'-9"	#7	11"	4	7'-11"	4'-6"
	6'			25	47	71	9'-10"			4	8'-0"	4'-7"
	7'			25	47	71	"			4	"	"
	8'			25	47	71	"			4	8'-1"	4'-8"
	9'			25	47	71	9'-11"			4	8'-3"	4'-10"
	10'			25	47	71	10'-0"			4	8'-5"	5'-0"
	11'			25	47	71	"			4	8'-6"	5'-1"
2 @ 10'	5'	#8	12"	23	43	63	10'-9"	#8	12"	4	8'-9"	5'-0"
	6'			23	43	63	10'-10"			4	8'-10"	5'-1"
	7'			23	43	63	"			4	"	"
	8'			23	43	63	"			4	8'-11"	5'-2"
	9'			23	43	63	10'-11"			4	9'-1"	5'-4"
	10'			23	43	63	11'-0"			4	9'-3"	5'-6"
	11'			23	43	63	"			4	9'-4"	5'-7"
	12'			23	43	63	"			4	9'-5"	5'-8"
2 @ 11'	6'	#8	12"	21	43	63	11'-10"	#8	12"	4	10'-5"	6'-8"
	7'			21	43	63	"			4	"	"
	8'			21	43	63	"			4	"	"
	9'			21	43	63	11'-11"			4	10'-7"	6'-10"
	10'			21	43	63	12'-0"			4	10'-9"	7'-0"
	11'			21	43	63	"			4	10'-10"	7'-1"
	12'			21	43	63	"			4	10'-11"	7'-2"
2 @ 12'	6'	#8	11"	23	45	69	12'-10"	#8	11"	6	12'-7"	5'-9"
	7'			23	45	69	"			6	"	"
	8'			23	45	69	"			6	"	"
	9'			23	45	69	12'-11"			6	12'-9"	5'-11"
	10'			28	45	69	13'-0"			6	12'-11"	6'-1"
	11'			25	47	71	"			4	9'-7"	6'-2"
	12'			25	47	71	"			4	9'-8"	6'-3"

"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. "d1" bars – Longitudinal in Sidewalls and Division Wall. "e" bars – Longitudinal in Bottom Slab of Barrel.

S	H	"d" Size	Spacing	No. Req'd	"d1" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd
2 @ 9'	5'	#4	12"	25	#4	12"	20	#4	12"	25
	6'			25			24			25
	7'			25			28			25
	8'			25			32			25
	9'			25			36			25
	10'			25			40			25
	11'			25			44			25
2 @ 10'	5'	#4	12"	27	#4	12"	20	#4	12"	27
	6'			27			24			27
	7'			27			28			27
	8'			27			32			27
	9'			27			36			27
	10'			27			40			27
	11'			27			44			27
	12'			27			48			27
2 @ 11'	6'	#4	12"	29	#4	12"	24	#4	12"	29
	7'			29			28			29
	8'			29			32			29
	9'			29			36			29
	10'			29			40			29
	11'			29			44			29
	12'			29			48			29
2 @ 12'	6'	#4	12"	31	#4	12"	24	#4	12"	31
	7'			31			28			31
	8'			31			32			31
	9'			31			36			31
	10'			31			40			31
	11'			81			44			31
	12'			31			48			31

"d" bars Length: Lengths Vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"

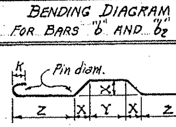
"d1" bars Length: Lengths Vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"

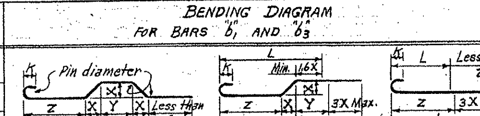
"e" bars Length: Lengths Vary - Ave. Length; 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10"

"f" bars – STRAIGHT – Verticals in Sidewalls and Division Wall. "k1" bars ▼ – STRAIGHT – In Bottom of Headwall. "k2" bars – In Top of Headwall and Apron. (2 Each)

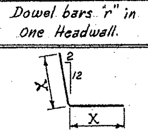
S	H	"f" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"k1" Size	No. Req'd	Length	"k2" Size	No. Req'd	Length
2 @ 9'	5'	#4	12"	52	92	134	6'-5"	#6	3	20'-4"	#6	4	20'-11"
	6'			52	92	134	7'-5"		3	20'-6"		4	21'-1"
	7'		10"	60	110	160	8'-5"		3	"		4	"
	8'	#5	12"	52	92	134	9'-5"		3	20'-7"		4	21'-2"
	9'		10"	60	110	160	10'-5"		3	20'-10"		4	21'-5"
	10'	#6	12"	52	92	134	11'-5"		3	21'-1"		4	21'-8"
	11'		11"	56	100	146	12'-5"		3	21'-3"		4	21'-10"
2 @ 10'	5'	#4	12"	52	92	134	6'-7"	#6	3	22'-5"	#6	4	22'-11"
	6'			52	92	134	7'-7"		3	22'-7"		4	23'-1"
	7'		10"	60	110	160	8'-7"		3	"		4	"
	8'	#5	12"	52	92	134	9'-7"		3	22'-8"		4	23'-2"
	9'		10"	60	110	160	10'-7"		3	22'-11"		4	23'-6"
	10'	#6	12"	52	92	134	11'-7"		3	23'-2"		4	23'-9"
	11'		11"	56	100	146	12'-7"		3	23'-4"		4	23'-11"
	12'		10"	60	110	160	13'-7"		3	23'-6"		4	24'-1"
2 @ 11'	6'	#4	12"	52	92	134	7'-9"	#6	3	24'-9"	#6	4	25'-3"
	7'		11"	56	100	146	8'-9"		3	"		4	"
	8'	#5	12"	52	92	134	9'-9"		3	"		4	"
	9'		10"	60	110	160	10'-9"		3	25'-0"		4	25'-6"
	10'	#6	12"	52	92	134	11'-9"		3	25'-3"		4	25'-10"
	11'		11"	56	100	146	12'-9"		3	25'-5"		4	26'-0"
	12'		9"	68	122	178	13'-9"		3	25'-7"		4	26'-2"
2 @ 12'	6'	#4	12"	52	92	134	7'-11"	#6	3	26'-10"	#6	4	27'-4"
	7'			52	92	134	8'-11"		3	"		4	"
	8'	#5	12"	52	92	134	9'-11"		3	"		4	"
	9'		10"	60	110	160	10'-11"		3	27'-1"		4	27'-7"
	10'	#6	12"	52	92	134	11'-11"		3	27'-4"		4	27'-10"
	11'		11"	56	100	146	12'-11"		3	27'-6"		4	28'-0"
	12'		9"	68	122	178	13'-11"		3	27'-8"		4	28'-3"

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 3'-9" for 12" spacing and 3'-5" for 11" spacing.

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" AND "b2"
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	
#7	3½"	5¾"	1'-4"	

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b1" AND "b3"
#5	2½"	4¼"	0'-5¾"	
#6	3"	5"	0'-7"	
#7	3½"	5¾"	0'-8"	

NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
9'	#4	12"	21	3'-1"	1'-6½"	
10'	#4	12"	23	3'-2"	1'-7"	
11'	#4	12"	26	3'-4"	1'-8"	
12'	#4	12"	28	3'-6"	1'-9"	

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.
For Barrels of 10' and 12' spans, See Drawing No. R-200X-X2.
For " " 9' and 11' Spans, " " No. R-200X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW - SECTIONS "A" ONLY

9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

DOUBLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-215X-2

Designed by:- W.C.H. 1-29-63, 6-29-62. Checked by:- R.H.S. 5-29-63, 7-20-62
Drawn by:- W.C.H. 10-30-63. Checked by:-
Quantities by:- W.C.H. 12-6-63. Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

DEPTH OF COVER	CLEAR SPAN	CLEAR HEIGHT	"a" bars				"b" bars							
			STRAIGHT — In Top and Bottom Slab of Barrel				BENT — See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.							
D	S	H	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	W	X	Y	Z
0'-0" TO 5'-0" MAXIMUM	3 @ 4'	2'	#5	12"	120	14'-7"	#5	12"	59	15'-10"	2'-1"	0'-3"	2'-3"	3'-5½"
		3'			120	14'-7"			59	15'-10"	2'-1"	"	2'-3"	3'-5½"
		4'			120	14'-7"			59	15'-10"	2'-1"	"	2'-3"	3'-5½"
		5'			120	14'-7"			59	15'-10"	2'-1"	"	2'-3"	3'-5½"
		6'			120	14'-11"			59	16'-2"	2'-1"	0'-3"	2'-4"	3'-6½"
	3 @ 5'	3'	#6	12"	120	17'-8"	#5	12"	59	19'-0"	2'-7"	0'-3½"	2'-8"	4'-3"
		4'			120	17'-8"			59	19'-0"	2'-7"	"	2'-8"	4'-3"
		5'			120	17'-8"			59	19'-0"	2'-7"	"	2'-8"	4'-3"
		6'			120	18'-0"			59	19'-4"	2'-7"	"	2'-9"	4'-4"
		7'			120	18'-3"			59	19'-7"	2'-7"	0'-3½"	2'-10"	4'-4½"
	3 @ 6'	3'	#6	11"	132	20'-9"	#5	11"	65	22'-2"	3'-1½"	0'-4"	3'-1½"	5'-0"
		4'			132	20'-9"			65	22'-2"	3'-1½"	"	3'-1½"	5'-0"
		5'			132	20'-9"			65	22'-2"	3'-1½"	"	3'-1½"	5'-0"
		6'			132	21'-1"			65	22'-6"	3'-1½"	"	3'-2½"	5'-1"
		7'			132	21'-4"			65	22'-9"	3'-1½"	"	3'-3½"	5'-1½"
		8'			132	21'-5"			65	22'-10"	3'-1½"	0'-4"	3'-3½"	5'-2"
	3 @ 7'	4'	#6	12"	120	23'-11"	#6	12"	59	25'-6"	3'-7½"	0'-4½"	3'-7"	5'-9"
		5'			120	23'-11"			59	25'-6"	3'-7½"	"	3'-7"	5'-9"
		6'			120	24'-3"			59	25'-10"	3'-7½"	"	3'-8"	5'-10"
		7'			120	24'-6"			59	26'-1"	3'-7½"	"	3'-9"	5'-10½"
		8'			120	24'-7"			59	26'-2"	3'-7½"	"	3'-9"	5'-11"
		9'			120	24'-11"			59	26'-6"	3'-7½"	0'-4½"	3'-10"	6'-0"
	3 @ 8'	4'	#6	11"	132	27'-0"	#6	11"	65	28'-9"	4'-1½"	0'-5"	4'-0"	6'-7"
		5'			132	27'-4"			65	29'-1"	4'-1½"	"	4'-1"	6'-8"
		6'			132	27'-4"			65	29'-1"	4'-1½"	"	4'-1"	6'-8"
		7'			132	27'-7"			65	29'-4"	4'-1½"	"	4'-2"	6'-8½"
		8'			132	27'-8"			65	29'-5"	4'-1½"	"	4'-2"	6'-9"
		9'			132	28'-0"			65	29'-9"	4'-1½"	"	4'-3"	6'-10"
		10'			132	28'-4"			65	30'-1"	4'-1½"	0'-5"	4'-4"	6'-11"
	3 @ 9'	5'	#6	11"	132	30'-5"	#6	11"	65	32'-2"	4'-8"	0'-5½"	4'-6"	7'-5"
		6'			132	30'-8"			65	32'-5"	4'-8"	"	4'-7"	7'-5½"
		7'			132	30'-8"			65	32'-5"	4'-8"	"	4'-7"	7'-5½"
		8'			132	30'-9"			65	32'-6"	4'-8"	"	4'-7"	7'-6"
		9'			132	31'-1"			65	32'-10"	4'-8"	"	4'-8"	7'-7"
		10'			132	31'-6"			65	33'-2"	4'-8"	"	4'-9"	7'-8"
		11'			132	31'-8"			65	33'-4"	4'-8"	0'-5½"	4'-9"	7'-9"
	3 @ 10'	5'	#7	12"	120	33'-7"	#6	12"	59	35'-5"	5'-2"	0'-6"	4'-11"	8'-3"
		6'			120	33'-10"			59	35'-8"	5'-2"	"	5'-0"	8'-3½"
		7'			120	33'-10"			59	35'-8"	5'-2"	"	5'-0"	8'-3½"
		8'			120	33'-11"			59	35'-9"	5'-2"	"	5'-0"	8'-4"
		9'			120	34'-3"			59	36'-1"	5'-2"	"	5'-1"	8'-5"
		10'			120	34'-7"			59	36'-5"	5'-2"	"	5'-2"	8'-6"
		11'			120	34'-9"			59	36'-7"	5'-2"	"	5'-2"	8'-7"
		12'			120	34'-11"			59	36'-9"	5'-2"	0'-6"	5'-2"	8'-8"
	3 @ 11'	6'	#7	11"	132	37'-0"	#6	11"	65	38'-11"	5'-8"	0'-6½"	5'-5½"	9'-1"
		7'			132	37'-0"			65	38'-11"	5'-8"	"	5'-5½"	9'-1"
		8'			132	37'-0"			65	38'-11"	5'-8"	"	5'-5½"	9'-1"
		9'			132	37'-4"			65	39'-3"	5'-8"	"	5'-6½"	9'-2"
		10'			132	37'-8"			65	39'-7"	5'-8"	"	5'-7½"	9'-3"
		11'			132	37'-10"			65	39'-9"	5'-8"	"	5'-7½"	9'-4"
		12'			132	38'-0"			65	39'-11"	5'-8"	0'-6½"	5'-7½"	9'-5"
	3 @ 12'	6'	⊕ #7	11"	132	40'-1"	⊕ #6	11"	65	42'-1"	6'-3"	0'-7"	5'-10½"	9'-10"
		7'			132	40'-1"			65	42'-1"	6'-3"	"	5'-10½"	9'-10"
		8'			132	40'-1"			65	42'-1"	6'-3"	"	5'-10½"	9'-10"
		9'			132	40'-5"			65	42'-5"	6'-3"	"	5'-11½"	9'-11"
		10'			132	40'-9"			65	42'-9"	6'-3"	"	6'-0½"	10'-0"
		11'			132	40'-11"			65	42'-11"	6'-3"	"	6'-0½"	10'-1"
		12'			132	41'-1"			65	43'-1"	6'-3"	0'-7"	6'-0½"	10'-2"

CLEAR SPAN	CLEAR HEIGHT	"b_2" bars								"c" bars			
		BENT — See Diagram below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.								STRAIGHT — In Top and Bottom Slab of Barrel. Alt. with "b" and "b_2" bars.			
S	H	SIZE	SPACING	No. REQ'D	LENGTH	W	X	Y	Z	SIZE	SPACING	No. REQ'D	LENGTH
3 @ 4'	2'	#5	12"	59	15'-9"	2'-1"	0'-2½"	2'-4"	3'-5½"	#5	12"	120	9'-8"
	3'			59	15'-9"	2'-1"	"	2'-4"	3'-5½"			120	9'-8"
	4'			59	15'-9"	2'-1"	"	2'-4"	3'-5½"			120	9'-8"
	5'			59	15'-9"	2'-1"	"	2'-4"	3'-5½"			120	9'-8"
	6'			59	16'-1"	2'-1"	0'-2½"	2'-5"	3'-6½"			120	9'-10"
3 @ 5'	3'	#5	12"	59	18'-11"	2'-7"	0'-3"	2'-9"	4'-3"	#6	12"	120	11'-9"
	4'			59	18'-11"	2'-7"	"	2'-9"	4'-3"			120	11'-9"
	5'			59	18'-11"	2'-7"	"	2'-9"	4'-3"			120	11'-9"
	6'			59	19'-3"	2'-7"	"	2'-10"	4'-4"			120	11'-11"
	7'			59	19'-6"	2'-7"	0'-3"	2'-11"	4'-4½"			120	12'-1"
3 @ 6'	3'	#5	11"	65	22'-1"	3'-1½"	0'-3½"	3'-2½"	5'-0"	#6	11"	132	13'-10"
	4'			65	22'-1"	3'-1½"	"	3'-2½"	5'-0"			132	13'-10"
	5'			65	22'-1"	3'-1½"	"	3'-2½"	5'-0"			132	13'-10"
	6'			65	22'-5"	3'-1½"	"	3'-3½"	5'-1"			132	14'-0"
	7'			65	22'-8"	3'-1½"	"	3'-4½"	5'-1½"			132	14'-2"
	8'			65	22'-9"	3'-1½"	0'-3½"	3'-4½"	5'-2"			132	14'-2"
3 @ 7'	4'	#6	12"	59	25'-6"	3'-7½"	0'-4¼"	3'-7½"	5'-9"	#6	12"	120	15'-10"
	5'			59	25'-6"	3'-7½"	"	3'-7½"	5'-9"			120	15'-10"
	6'			59	25'-10"	3'-7½"	"	3'-8½"	5'-10"			120	16'-0"
	7'			59	26'-1"	3'-7½"	"	3'-9½"	5'-10½"			120	16'-2"
	8'			59	26'-2"	3'-7½"	"	3'-9½"	5'-11"			120	16'-2"
	9'			59	26'-6"	3'-7½"	0'-4¼"	3'-10½"	6'-0"			120	16'-4"
3 @ 8'	4'	#6	11"	65	28'-9"	4'-1½"	0'-5"	4'-0"	6'-7"	#6	11"	132	17'-11"
	5'			65	29'-1"	4'-1½"	"	4'-1"	6'-8"			132	18'-1"
	6'			65	29'-1"	4'-1½"	"	4'-1"	6'-8"			132	18'-1"
	7'			65	29'-4"	4'-1½"	"	4'-2"	6'-8½"			132	18'-3"
	8'			65	29'-5"	4'-1½"	"	4'-2"	6'-9"			132	18'-3"
	9'			65	29'-9"	4'-1½"	"	4'-3"	6'-10"			132	18'-5"
	10'			65	30'-1"	4'-1½"	0'-5"	4'-4"	6'-11"			132	18'-7"
3 @ 9'	5'	#6	11"	65	32'-2"	4'-8"	0'-5½"	4'-6"	7'-5"	#6	11"	132	20'-2"
	6'			65	32'-5"	4'-8"	"	4'-7"	7'-5½"			132	20'-4"
	7'			65	32'-5"	4'-8"	"	4'-7"	7'-5½"			132	20'-4"
	8'			65	32'-6"	4'-8"	"	4'-7"	7'-6"			132	20'-4"
	9'			65	32'-10"	4'-8"	"	4'-8"	7'-7"			132	20'-6"
	10'			65	33'-2"	4'-8"	"	4'-9"	7'-8"			132	20'-8"
	11'			65	33'-4"	4'-8"	0'-5½"	4'-9"	7'-9"			132	20'-8"
3 @ 10'	5'	#6	12"	59	35'-5"	5'-2"	0'-6"	4'-11"	8'-3"	#7	12"	120	22'-3"
	6'			59	35'-8"	5'-2"	"	5'-0"	8'-3½"			120	22'-5"
	7'			59	35'-8"	5'-2"	"	5'-0"	8'-3½"			120	22'-5"
	8'			59	35'-9"	5'-2"	"	5'-0"	8'-4"			120	22'-5"
	9'			59	36'-1"	5'-2"	"	5'-1"	8'-5"			120	22'-7"
	10'			59	36'-5"	5'-2"	"	5'-2"	8'-6"			120	22'-9"
	11'			59	36'-7"	5'-2"	"	5'-2"	8'-7"			120	22'-9"
	12'			59	36'-9"	5'-2"	0'-6"	5'-2"	8'-8"			120	22'-9"
3 @ 11'	6'	#6	11"	65	38'-11"	5'-8"	0'-6½"	5'-5½"	9'-1"	#7	11"	132	24'-6"
	7'			65	38'-11"	5'-8"	"	5'-5½"	9'-1"			132	24'-6"
	8'			65	38'-11"	5'-8"	"	5'-5½"	9'-1"			132	24'-6"
	9'			65	39'-3"	5'-8"	"	5'-6½"	9'-2"			132	24'-8"
	10'			65	39'-7"	5'-8"	"	5'-7½"	9'-3"			132	24'-10"
	11'			65	39'-9"	5'-8"	"	5'-7½"	9'-4"			132	24'-10"
	12'			65	39'-11"	5'-8"	0'-6½"	5'-7½"	9'-5"			132	24'-10"
3 @ 12'	6'	⊕ #6	11"	65	42'-1"	6'-3"	0'-7"	5'-10½"	9'-10"	#7	11"	132	26'-7"
	7'			65	42'-1"	6'-3"	"	5'-10½"	9'-10"			132	26'-7"
	8'			65	42'-1"	6'-3"	"	5'-10½"	9'-10"			132	26'-7"
	9'			65	42'-5"	6'-3"	"	5'-11½"	9'-11"			132	26'-9"
	10'			65	42'-9"	6'-3"	"	6'-0½"	10'-0"			132	26'-11"
	11'			65	42'-11"	6'-3"	"	6'-0½"	10'-1"			132	26'-11"
	12'			65	43'-1"	6'-3"	0'-7"	6'-0½"	10'-2"			132	26'-11"

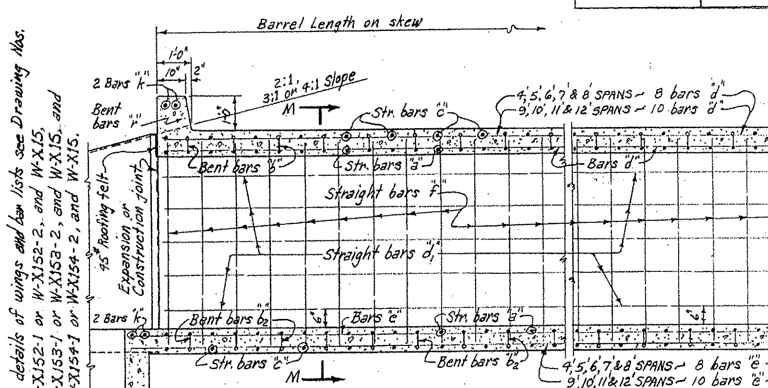
CLEAR SPAN	CLEAR HEIGHT	"d" bars				"d_1" bars				"e" bars				"f" bars				"k" bars		
		STRAIGHT — Longitudinal in Top Slab of Barrel.				STRAIGHT — Longitudinal in Sidewalls and Division Walls				STRAIGHT — Longitudinal in Bottom Slab of Barrel.				STRAIGHT — Verticals in Sidewalls and Division Walls				STRAIGHT — 2 in Top of Headwalls and Aprons - Each.		
S	H	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	No. REQ'D	LENGTH
3 @ 4'	2'	#5	12"	22	2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap).	#4	12"	12	2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap).	#4	12"	22	2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap.)	#4	12"	360	2'-10"	#5	8	15'-1"
	3'			22				18				22				360	3'-10"		8	15'-1"
	4'			22				24				22				360	4'-10"		8	15'-1"
	5'			22				30				22				360	5'-10"		8	15'-1"
	6'			22				36				22				360	6'-10"		8	15'-5"
3 @ 5'	3'	#5	11½"	26		#4	12"	18		#4	12"	25		#4	12"	360	3'-11"	#6	8	18'-2"
	4'			26				24				25				360	4'-11"		8	18'-2"
	5'			26				30				25				360	5'-11"		8	18'-2"
	6'			26				36				25				360	6'-11"		8	18'-7"
	7'			26				42				25				360	7'-11"		8	18'-10"
3 @ 6'	3'	#5	11½"	30		#4	12"	18		#4	12"	28		#4	12"	360	4'-0"	#6	8	21'-4"
	4'			30				24				28				360	5'-0"		8	21'-4"
	5'			30				30				28				360	6'-0"		8	21'-4"
	6'			30				36				28				360	7'-0"		8	21'-8"
	7'			30				42				28				360	8'-0"		8	21'-11"
	8'			30				48				28			10"	432	9'-0"		8	22'-0"
3 @ 7'	4'	#5	11½"	32		#4	12"	24		#4	12"	31		#4	12"	360	5'-1"	#6	8	24'-5"
	5'			32				30				31				360	6'-1"		8	24'-5"
	6'			32				36				31				360	7'-1"		8	24'-9"
	7'			32				42				31				360	8'-1"		8	25'-0"
	8'			32				48				31			10"	432	9'-1"		8	25'-1"
	9'			32				54				31		#5	12"	360	10'-1"		8	25'-5"
3 @ 8'	4'	#5	11½"	36		#4	12"	24		#4	12"	35		#4	12"	360	5'-2"	#6	8	27'-6"
	5'			36				30				35				360	6'-2"		8	27'-10"
	6'			36				36				35				360	7'-2"		8	27'-10"
	7'			36				42				35				360	8'-2"		8	28'-1"
	8'			36				48				35			10"	432	9'-2"		8	28'-2"
	9'			36				54				35		#5	12"	360	10'-2"		8	28'-7"
	10'			36				60				35			11"	396	11'-2"		8	28'-11"
3 @ 9'	5'	#5	11½"	41		#4	12"	30		#4	12"	40		#4	12"	360	6'-3"	#6	8	31'-0"
	6'			41				36				40				360	7'-3"		8	31'-3"
	7'			41				42				40				360	8'-3"		8	31'-3"
	8'			41				48				40			10"	432	9'-3"		8	31'-4"
	9'			41				54				40		#5	12"	360	10'-3"		8	31'-8"
	10'			41				60				40			11"	396	11'-3"		8	32'-0"
	11'			41				66				40			10"	432	12'-3"		8	32'-2"
3 @ 10'	5'	#5	11½"	44		#4	12"	30		#4	12"	43		#4	12"	360	6'-4"	#7	8	34'-1"
	6'			44				36				43				360	7'-4"		8	34'-4"
	7'			44				42				43				360	8'-4"		8	34'-4"
	8'			44				48				43			10"	432	9'-4"		8	34'-5"
	9'			44				54				43		#5	12"	360	10'-4"		8	34'-9"
	10'			44				60				43			11"	396	11'-4"		8	35'-1"
	11'			44				66				43			10"	432	12'-4"		8	35'-3"
	12'			44				72				43		#6	12"	360	13'-4"		8	35'-5"
3 @ 11'	6'	#5	11½"	48		#4	12"	36		#4	12"	46		#4	12"	360	7'-5"	#7	8	37'-6"
	7'			48				42				46				360	8'-5"		8	37'-6"
	8'			48				48				46			10"	432	9'-5"		8	37'-6"
	9'			48				54				46		#5	12"	360	10'-5"		8	37'-10"
	10'			48				60				46			11"	396	11'-5"		8	38'-3"
	11'			48				66				46			10"	432	12'-5"		8	38'-5"
	12'			48				72				46		#6	12"	360	13'-5"		8	38'-7"
3 @ 12'	6'	#5	11½"	51		#4	12"	36		#4	12"	49		#4	12"	360	7'-6"	⊕ #7	8	40'-8"
	7'			51				42				49				360	8'-6"		8	40'-8"
	8'			51				48				49			10"	432	9'-6"		8	40'-8"
	9'			51				54				49		#5	12"	360	10'-6"		8	41'-0"
	10'			51				60				49			11"	396	11'-6"		8	41'-4"
	11'			51				66				49			10"	432	12'-6"		8	41'-6"
	12'			51				72				49		#6	12"	360	13'-6"		8	41'-8"

NOTE:- The "a", "b", "b_2", and "c" bars are to be placed parallel with the headwalls, spacing to be parallel with barrel. ⊕ These bars may be spliced at ℄ of one division wall. (2'-4" and 2'-0" laps.)

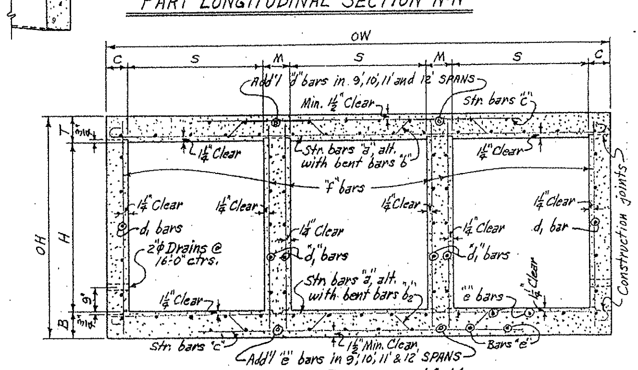
DIMENSIONS / QUANTITIES

MAX. DESIGN DEPTH OF COVER	CLEAR SPAN	BARREL DIMENSIONS										UNIT QUANTITIES			
		CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	CLASS S CONC. PER LIN. FT. OF BARREL	REINFORCING STEEL PER LIN. FT. OF BARREL	ADDITIONAL PER LAP	ADDITIONAL TWO HEADWALLS & APRONS
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU. YD.	LB.	LB.	LB.
5'-0"	3 @ 4'	2'	24	14'-4"	6½"	6"	8"	6"	3'-0½"	14'-10"	15'-4½"	0.726	140.54	66.63	203.68
		3'	36	14'-4"		6"	8"		4'-0½"	"	"	0.812	148.56	71.64	203.68
		4'	48	14'-4"		6"	8"		5'-0½"	"	"	0.899	156.57	76.65	203.68
		5'	60	14'-4"		6"	8"		6'-0½"	"	"	0.985	164.59	81.66	208.68
		6'	72	14'-8"		7"	9"		7'-0½"	15'-2¼"	15'-8¾"	1.158	174.34	86.67	206.46
	3 @ 5'	3'	45	17'-4"	7"	6"	8"	6½"	4'-1½"	17'-11⅜"	18'-5¾"	0.981	199.46	81.10	311.81
		4'	60	17'-4"		6"	8"		5'-1½"	"	"	1.068	207.47	86.11	311.81
		5'	75	17'-4"		6"	8"		6'-1½"	"	"	1.154	215.49	91.12	311.81
		6'	90	17'-8"		7"	9"		7'-1½"	18'-3½"	18'-10"	1.329	225.70	96.13	316.82
		7'	105	17'-11"		7½"	10"		8'-1½"	18'-6⅝"	19'-1"	1.503	235.49	101.14	319.82
	3 @ 6'	3'	54	20'-4"	7½"	6"	8"	7"	4'-2½"	21'-0⅝"	21'-7"	1.169	241.73	90.56	366.23
		4'	72	20'-4"		6"	8"		5'-2½"	"	"	1.256	249.75	95.57	366.23
		5'	90	20'-4"		6"	8"		6'-2½"	"	"	1.342	257.76	100.58	366.23
		6'	108	20'-8"		7"	9"		7'-2½"	21'-4¾"	21'-11¼"	1.517	268.18	105.59	370.23
		7'	126	20'-11"		7½"	10"		8'-2½"	21'-7⅞"	22'-2¼"	1.692	278.13	110.60	373.24
		8'	144	21'-0"		8"	10"		9'-2½"	21'-8⅞"	22'-3¼"	1.829	293.82	115.61	379.24
	3 @ 7'	4'	84	23'-4"	8"	6"	8"	7¾"	5'-3¾"	24'-1⅞"	24'-8¼"	1.480	286.50	101.55	420.31
		5'	105	23'-4"		6"	8"		6'-3¾"	"	"	1.566	294.52	106.56	420.31
		6'	126	23'-8"		7"	9"		7'-3¾"	24'-6"	25'-0½"	1.743	305.04	111.57	424.32
		7'	147	23'-11"		7½"	10"		8'-3¾"	24'-9⅛"	25'-3½"	1.919	315.06	116.58	427.32
		8'	168	24'-0"		8"	10"		9'-3¾"	24'-10⅛"	25'-4½"	2.056	330.85	121.59	428.32
		9'	189	24'-4"		9"	11"		10'-3¾"	25'-2¼"	25'-8¾"	2.294	356.78	126.60	432.33
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	8½"	5'-5"	27'-3⅞"	27'-9½"	1.727	339.08	111.85	480.07
		5'	120	26'-8"		7"	9"		6'-5"	27'-7⅛"	28'-1⅜"	1.893	349.83	116.86	484.08
		6'	144	26'-8"		7"	9"		7'-5"	27'-7⅛"	"	1.992	357.84	121.87	484.08
		7'	168	26'-11"		7½"	10"		8'-5"	27'-10⅜"	28'-4¾"	2.168	368.04	126.88	487.08
		8'	192	27'-0"		8"	10"		9'-5"	27'-11⅜"	28'-5¾"	2.306	383.95	131.89	488.08
		9'	216	27'-4"		9"	11"		10'-5"	28'-3⅝"	28'-10"	2.545	410.23	136.90	493.09
		10'	240	27'-8"		10"	12"		11'-5"	28'-7⅞"	29'-2¼"	2.810	429.58	141.91	497.09
	3 @ 9'	5'	135	29'-8"	9"	7"	9"	9"	6'-6"	30'-8½"	31'-3"	2.142	385.75	129.72	543.28
		6'	162	29'-11"		7½"	10"		7'-6"	30'-11⅝"	31'-6"	2.310	395.95	134.73	546.29
		7'	189	29'-11"		7½"	10"		8'-6"	"	"	2.418	403.97	139.74	546.29
		8'	216	30'-0"		8"	10"		9'-6"	31'-0⅝"	31'-7¼"	2.556	419.95	144.75	547.29
		9'	243	30'-4"		9"	11"		10'-6"	31'-4⅞"	31'-11¼"	2.796	446.34	149.76	551.29
		10'	270	30'-8"		10"	12"		11'-6"	31'-9"	32'-3½"	3.062	466.01	154.77	555.30
		11'	297	30'-10"		11"	12"		12'-6"	31'-11"	32'-5½"	3.275	486.30	159.78	557.30
	3 @ 10'	5'	150	32'-8"	9½"	7"	9"	9½"	6'-7"	33'-9¾"	34'-4¼"	2.409	454.68	137.44	747.27
		6'	180	32'-11"		7½"	10"		7'-7"	34'-1"	34'-7½"	2.578	465.15	142.45	751.35
		7'	210	32'-11"		7½"	10"		8'-7"	"	"	2.686	473.17	147.46	751.35
		8'	240	33'-0"		8"	10"		9'-7"	34'-2"	34'-8½"	2.824	489.25	152.47	752.72
		9'	270	33'-4"		9"	11"		10'-7"	34'-6⅛"	35'-0½"	3.066	516.08	157.48	758.17
		10'	300	33'-8"		10"	12"		11'-7"	34'-10¼"	35'-4¾"	3.332	535.84	162.49	763.62
		11'	330	33'-10"		11"	12"		12'-7"	35'-0⅜"	35'-6¾"	3.546	556.28	167.50	766.34
		12'	360	34'-0"		12"	12"		13'-7"	35'-2⅜"	35'-8¾"	3.772	589.01	172.51	769.07
	3 @ 11'	6'	198	36'-0"	10"	8"	10"	10"	7'-8"	37'-3¼"	37'-9¾"	2.889	536.37	151.91	822.95
		7'	231	36'-0"		8"	10"		8'-8"	"	"	3.000	544.38	156.92	822.95
		8'	264	36'-0"		8"	10"		9'-8"	"	"	3.111	559.95	161.93	822.95
		9'	297	36'-4"		9"	11"		10'-8"	37'-7⅜"	38'-1⅜"	3.354	587.18	166.94	828.40
		10'	330	36'-8"		10"	12"		11'-8"	37'-11½"	38'-6"	3.621	607.26	171.95	835.22
		11'	363	36'-10"		11"	12"		12'-8"	38'-1⅝"	38'-8"	3.835	627.86	176.96	837.94
		12'	396	37'-0"		12"	12"		13'-8"	38'-3⅝"	38'-10"	4.062	660.82	181.97	840.67
	3 @ 12'	6'	216	39'-0"	10½"	8"	10"	10½"	7'-9"	40'-4½"	40'-11"	3.194	575.25	159.63	895.22
		7'	252	39'-0"		8"	10"		8'-9"	"	"	3.306	583.27	164.64	895.22
		8'	288	39'-0"		8"	10"		9'-9"	"	"	3.417	598.90	169.65	895.22
		9'	324	39'-4"		9"	11"		10'-9"	40'-8⅜"	41'-3"	3.660	626.25	174.66	900.67
		10'	360	39'-8"		10"	12"		11'-9"	41'-0¾"	41'-7¼"	3.929	646.38	179.67	906.12
		11'	396	39'-10"		11"	12"		12'-9"	41'-2⅞"	41'-9⅛"	4.144	667.04	184.68	908.85
		12'	432	40'-0"		12"	12"		13'-9"	41'-4⅞"	41'-11⅛"	4.370	700.13	189.69	911.57

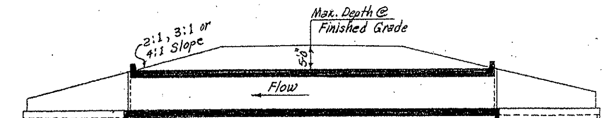
NOTE:- For details of wings and bar lists see Drawing Nos. W-X152-1 or W-X152-2, and W-X15, W-X153-1 or W-X153-2, and W-X15, and W-X154-1 or W-X154-2, and W-X15.



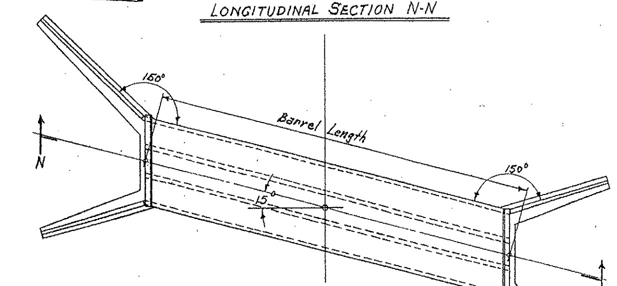
PART LONGITUDINAL SECTION N-N



TYPICAL SECTION M-M



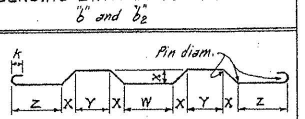
LONGITUDINAL SECTION N-N



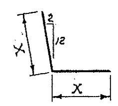
LAYOUT OF TRIPLE BARREL CULVERT

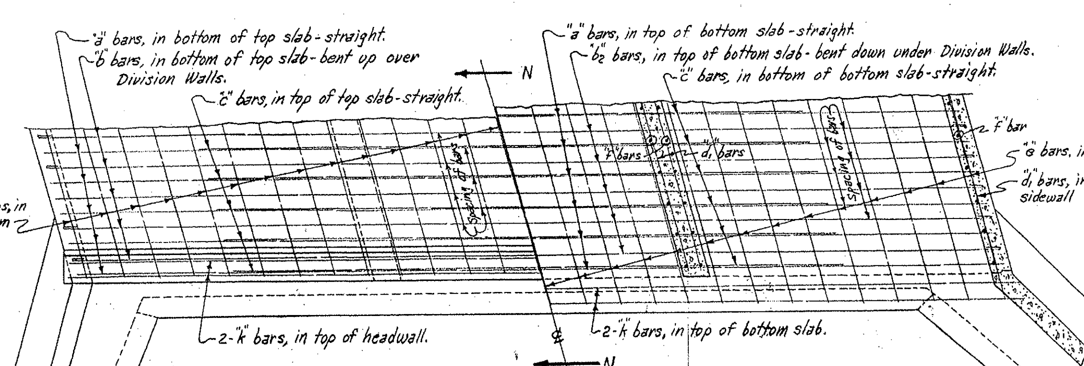
15° SKEW LEFT FORWARD

15° Skew Right Forward is reversed

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" and "b_2"
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	

NOTE:- Dimensions are to centers of bars.

3 SPANS @	SIZE	SPACING	No. REQ'D	LENGTH	X	Bars "r" Dowel bars in headwalls.
4'	#4	12"±	30	2'-5"	1'-2½"	
5'	#4	12"±	36	2'-6"	1'-3"	
6'	#4	12"±	42	2'-7"	1'-3½"	
7'	#4	12"±	48	2'-8"	1'-4"	
8'	#4	12"±	56	2'-9"	1'-4½"	
9'	#4	12"±	62	2'-10"	1'-5"	
10'	#4	12"±	68	2'-11"	1'-5½"	
11'	#4	12"±	74	3'-0"	1'-6"	
12'	#4	12"±	80	3'-1"	1'-6½"	



PART PLAN AT END OF CULVERT

NOTE:- The "a", "b", "b_2" and "c" bars are placed parallel with the headwall. The "d" bars in top of top slab, and "e" bars in bottom of bottom slab are not shown.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING.

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2 and W-X154-1 or W-X154-2. Also Drawing No. W-X15.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

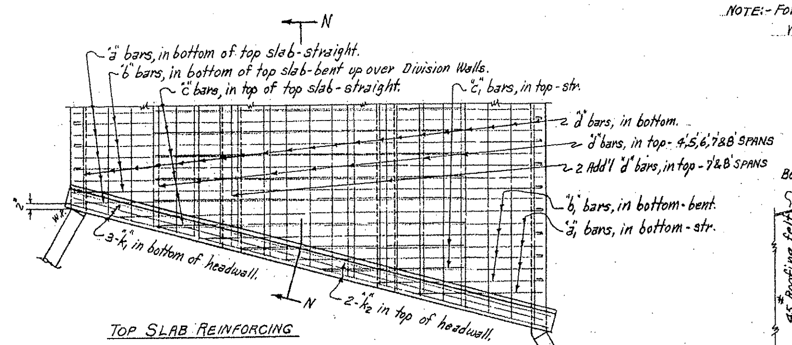
TRIPLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-315X-0

Designed By:- W.C.H. 1-22-63. Checked By:- R.H.S. 5-17-63

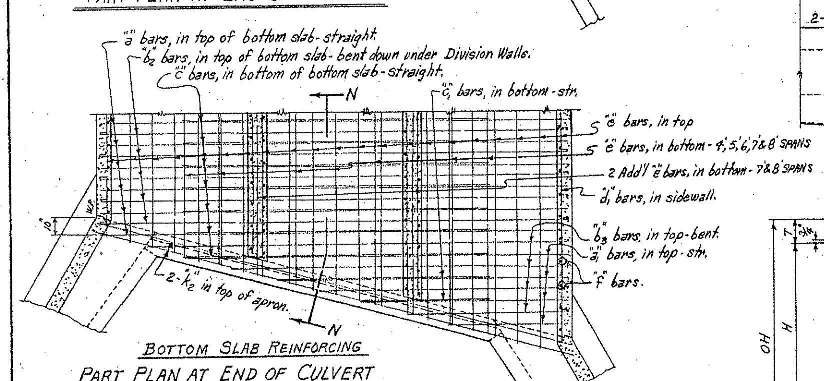
Drawn By:- W.C.H. 8-28-63. Checked By:- RHS. 10-7-63

Quantities By:- W.C.H. 8-30-63. Checked By:- R.G. 12-30-63



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

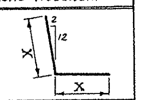


BOTTOM SLAB REINFORCING

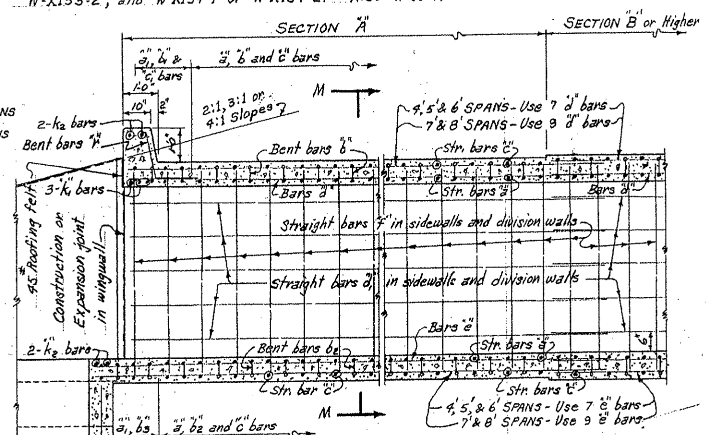
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" into SECTION "B".

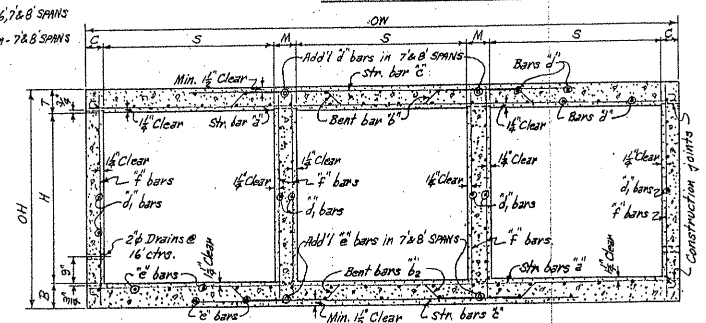
DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"±	15	2'-4"	1'-2"	
5'	#4	12"±	18	2'-5"	1'-2½"	
6'	#4	12"±	21	2'-6"	1'-3"	
7'	#4	12"±	25	2'-8"	1'-4"	
8'	#4	12"±	27	2'-9"	1'-5"	

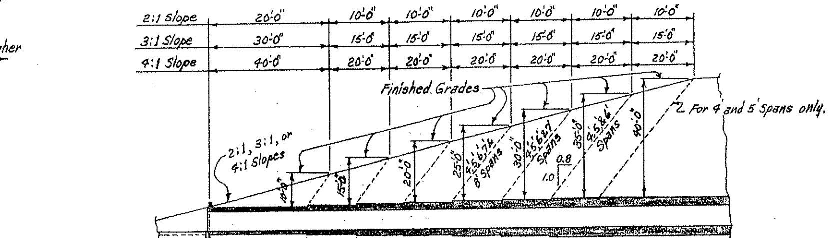
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.



SECTION N-N



TYPICAL SECTION M-M

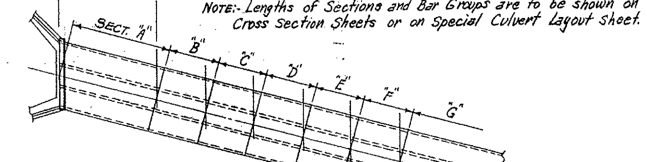


	SECTIONS / Bar Group							
2:1 Slope	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	F = 6'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
3:1 Slope	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D, E & F	A	B, C, D, E & F	A	B, C, D, E & F
LENGTHS	12'-5"	6'-2½"	22'-9¼"	11'-4⅝"	33'-1½"	16'-6¾"

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-300X-X1, R-300X-X2, or R-300X-X3.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
	SECTIONS & BAR GROUPS FOR END SECTIONS						
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
	SECTIONS & BAR GROUPS FOR END SECTIONS						
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* CLASS S CONCRETE, BARREL ONLY 2:1	3:1	4:1	REINFORCING STEEL, BARREL, APRON AND HEADWALL 2:1	3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	CU.YD.	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	3 @ 4'	2'	24	14'-4"	6"	6"	8"	6"	3'-0"	14'-10"	15'-4½"	8.74	16.03	23.32	1469	2503	3553
		3'	36	14'-4"		6"	8"		4'-0"	"	"	9.81	17.99	26.17	1578	2693	3826
		4'	48	14'-4"		6"	8"		5'-0"	"	"	10.89	19.97	29.05	1686	2883	4100
		5'	60	14'-4"		6"	8"		6'-0"	"	"	11.96	21.93	31.90	1795	3074	4374
		6'	72	14'-8"		7"	9"		7'-0"	15'-2¼"	15'-8¾"	14.11	25.87	37.63	1922	3293	4689
	3 @ 5'	3'	45	17'-4"	6½"	6"	8"	6½"	4'-1"	17'-11⅜"	18'-5¾"	11.86	21.75	31.63	1986	3436	4840
		4'	60	17'-4"		6"	8"		5'-1"	"	"	12.93	23.70	34.48	2095	3627	5114
		5'	75	17'-4"		6"	8"		6'-1"	"	"	14.01	25.69	37.36	2204	3817	5388
		6'	90	17'-8"		7"	9"		7'-1"	18'-3½"	18'-10"	16.15	29.62	43.09	2335	4044	5720
		7'	105	17'-11"		7½"	10"		8'-1"	18'-6⅝"	19'-1"	18.31	33.59	48.86	2690	4668	6637
	3 @ 6'	3'	54	20'-4"	7"	6"	8"	7"	4'-2"	20'-0⅝"	21'-7"	14.13	25.91	37.70	2464	4269	6065
		4'	72	20'-4"		6"	8"		5'-2"	"	"	15.20	27.87	40.54	2573	4459	6339
		5'	90	20'-4"		6"	8"		6'-2"	"	"	16.28	29.85	43.43	2682	4650	6613
		6'	108	20'-8"		7"	9"		7'-2"	21'-4¾"	21'-11¼"	18.45	33.84	49.22	2820	4886	6949
		7'	126	20'-11"		7½"	10"		8'-2"	21'-7⅞"	22'-2¼"	20.61	37.80	54.99	3181	5521	7878
		8'	144	21'-0"		8"	10"		9'-2"	21'-8⅞"	22'-3¼"	22.30	40.90	59.49	3380	5869	8369
	3 @ 7'	4'	84	23'-4"	7¾"	6"	8"	8"	5'-3¾"	24'-1⅞"	24'-8¾"	18.22	33.42	48.61	3304	5634	7922
		5'	105	23'-4"		6"	8"		6'-3¾"	"	"	19.44	35.66	51.87	3413	5824	8196
		6'	126	23'-8"		7"	9"		7'-3¾"	24'-6"	25'-0½"	21.64	39.69	57.74	3544	6056	8530
		7'	147	23'-11"		7½"	10"		8'-3¾"	24'-9⅜"	25'-3¾"	23.83	43.70	63.57	3978	6769	9533
		8'	168	24'-0"		8"	10"		9'-3¾"	24'-10⅜"	25'-4½"	25.53	46.82	68.10	4127	7083	10,014
		9'	189	24'-4"		9"	11"		10'-3¾"	25'-2¼"	25'-8¾"	28.48	52.24	75.99	4367	7547	10,674
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	9"	5'-5½"	27'-3⅜"	27'-9½"	21.95	40.26	58.56	4000	6772	9552
		5'	120	26'-8"		7"	9"		6'-5½"	27'-7⅝"	28'-1¾"	24.01	44.04	64.06	4047	6873	9758
		6'	144	26'-8"		7"	9"		7'-5½"	"	"	25.24	46.29	67.34	4106	7063	10,032
		7'	168	26'-11"		7½"	10"		8'-5½"	27'-10⅜"	28'-4¾"	27.44	50.32	73.21	4458	7596	10,731
		8'	192	27'-0"		8"	10"		9'-5½"	27'-11⅜"	28'-5¾"	29.14	53.44	77.74	4776	8125	11,499
		9'	216	27'-4"		9"	11"		10'-5½"	28'-3⅜"	28'-10"	32.12	58.91	85.69	5017	8555	12,122
		10'	240	27'-8"		10"	12"		11'-5½"	28'-7⅜"	29'-2¼"	35.41	64.94	94.47	5530	9438	13,393

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A" — LENGTH OF SECTION: 4:1 = 33'-1½", 3:1 = 22'-9¼", 2:1 = 12'-5" — DEPTH OF COVER D: 0'-0" TO 10'-0" MAXIMUM

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars — STRAIGHT — In Top and Bottom Slab of Barrel. (Two of each Length.)

S	H	"a" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
3 @ 4'	2'	#4	12"	23	43	65	14'-1"	#4	12"	4	10'-4"	6'-7"
	3'			23	43	65	"			4	"	"
	4'			23	43	65	"			4	"	"
	5'			23	43	65	"			4	"	"
	6'			23	43	65	14'-5"			4	10'-8"	6'-11"
3 @ 5'	3'	#4	11"	23	47	69	17'-1"	#4	11"	8	13'-8"	3'-5"
	4'			23	47	69	"			8	"	"
	5'			23	47	69	"			8	"	"
	6'			23	47	69	17'-5"			8	14'-0"	3'-9"
	7'			23	47	69	17'-8"			8	14'-3"	4'-0"
3 @ 6'	3'	#4	11"	23	45	67	20'-1"	#4	11"	8	16'-8"	6'-5"
	4'			23	45	67	"			8	"	"
	5'			23	45	67	"			8	"	"
	6'			23	45	67	20'-5"			8	17'-0"	6'-9"
	7'			23	45	67	20'-8"			8	17'-3"	7'-0"
	8'			23	45	67	20'-9"			8	17'-4"	7'-1"
3 @ 7'	4'	#5	12"	21	41	61	23'-1"	#5	12"	10	19'-4"	4'-4"
	5'			21	41	61	"			10	"	"
	6'			21	41	61	23'-5"			10	19'-8"	4'-8"
	7'			21	41	61	23'-8"			10	19'-11"	4'-11"
	8'			21	41	61	23'-9"			10	20'-0"	5'-0"
	9'			21	41	61	24'-1"			10	20'-4"	5'-4"
3 @ 8'	4'	#5	12"	19	41	61	26'-1"	#5	12"	12	22'-4"	3'-7"
	5'			19	41	61	26'-5"			12	22'-8"	3'-11"
	6'			19	41	61	"			12	"	"
	7'			19	41	61	26'-8"			12	22'-11"	4'-2"
	8'			19	41	61	26'-9"			12	23'-0"	4'-3"
	9'			19	41	61	27'-1"			12	23'-4"	4'-7"
	10'			19	41	61	27'-5"			12	23'-8"	4'-11"

"b" bars — BENT - See Diagrams below. — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b1" bars — In Bottom of Top Slab - may or may not be bent up over Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
3 @ 4'	2'	#4	12"	10	21	31	15'-3"	0'-2⅜"	2'-2⅛"	3'-4⅞"	#4	12"	3	12'-11"	5'-2"	12'-2"	4'-8"
	3'			10	21	31	"	"	"	"			3	"	"	"	"
	4'			10	21	31	"	"	"	"			3	"	"	"	"
	5'			10	21	31	"	"	"	"			3	"	"	"	"
	6'			10	21	31	15'-7"	0'-2⅜"	2'-3⅛"	3'-5⅛"			3	13'-3"	5'-6"	12'-6"	5'-0"
3 @ 5'	3'	#4	11"	11	22	33	18'-4"	0'-3⅜"	2'-7⅛"	4'-1⅛"	#4	11"	4	16'-2"	5'-8"	15'-4"	5'-1"
	4'			11	22	33	"	"	"	"			4	"	"	"	"
	5'			11	22	33	"	"	"	"			4	"	"	"	"
	6'			11	22	33	18'-8"	"	2'-8½"	4'-2¼"			4	16'-6"	6'-0"	15'-8"	5'-5"
	7'			11	22	33	18'-11"	0'-3⅜"	2'-9½"	4'-2¾"			4	16'-9"	6'-3"	15'-11"	5'-8"
3 @ 6'	3'	#5	11"	10	22	33	21'-5"	0'-3½"	3'-1"	4'-10¾"	#5	11"	5	19'-3"	5'-2"	18'-4"	4'-8"
	4'			10	22	33	"	"	"	"			5	"	"	"	"
	5'			10	22	33	"	"	"	"			5	"	"	"	"
	6'			10	22	33	21'-9"	"	3'-2"	4'-11½"			5	19'-7"	5'-6"	18'-8"	5'-0"
	7'			10	22	33	22'-0"	"	3'-3"	4'-11¾"			5	19'-10"	5'-9"	18'-11"	5'-3"
	8'			10	22	33	22'-1"	0'-3½"	3'-3"	5'-0¼"			5	19'-11"	5'-10"	19'-0"	5'-4"
3 @ 7'	4'	#5	12"	9	20	30	24'-6"	0'-4⅛"	3'-5½"	5'-7"	#5	12"	5	22'-2"	6'-8"	21'-2"	6'-2"
	5'			9	20	30	"	"	"	"			5	"	"	"	"
	6'			9	20	30	24'-10"	"	3'-6½"	5'-8"			5	22'-6"	7'-0"	21'-6"	6'-6"
	7'			9	20	30	25'-1"	"	3'-7½"	5'-8½"			5	22'-9"	7'-3"	21'-9"	6'-9"
	8'			9	20	30	25'-2"	"	3'-7½"	5'-9"			5	22'-10"	7'-4"	21'-10"	6'-10"
	9'			9	20	30	25'-6"	0'-4⅛"	3'-8½"	5'-10"			5	23'-2"	7'-8"	22'-2"	7'-2"
3 @ 8'	4'	#6	12"	9	19	29	27'-9"	0'-5"	3'-10"	6'-4"	#6	12"	6	25'-4"	6'-0"	24'-2"	5'-5"
	5'			9	19	29	28'-1"	"	3'-11"	6'-5"			6	25'-8"	6'-4"	24'-6"	5'-9"
	6'			9	19	29	"	"	"	"			6	"	"	"	"
	7'			9	19	29	28'-4"	"	4'-0"	6'-5½"			6	25'-11"	6'-7"	24'-9"	6'-0"
	8'			9	19	29	28'-5"	"	4'-0"	6'-6"			6	26'-0"	6'-8"	24'-10"	6'-1"
	9'			9	19	29	28'-9"	"	4'-1"	6'-7"			6	26'-4"	7'-0"	25'-2"	6'-5"
	10'			9	19	29	29'-1"	0'-5"	4'-2"	6'-8"			6	26'-8"	7'-4"	25'-6"	6'-9"

"b2" bars — BENT - See Diagrams below. — In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. "b3" bars — In Top of Bottom Slab - may or may not be bent down under Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
3 @ 4'	2'	#4	12"	11	22	32	15'-3"	0'-2⅜"	2'-2⅛"	3'-4⅞"	#4	12"	3	12'-11"	5'-2"	12'-2"	4'-8"
	3'			11	22	32	"	"	"	"			3	"	"	"	"
	4'			11	22	32	"	"	"	"			3	"	"	"	"
	5'			11	22	32	"	"	"	"			3	"	"	"	"
	6'			11	22	32	15'-7"	0'-2⅜"	2'-3⅛"	3'-5⅛"			3	13'-3"	5'-6"	12'-6"	5'-0"
3 @ 5'	3'	#4	11"	12	23	34	18'-4"	0'-3⅜"	2'-7⅛"	4'-1⅛"	#4	11"	4	16'-2"	5'-8"	15'-4"	5'-1"
	4'			12	23	34	"	"	"	"			4	"	"	"	"
	5'			12	23	34	"	"	"	"			4	"	"	"	"
	6'			12	23	34	18'-8"	"	2'-8½"	4'-2¼"			4	16'-6"	6'-0"	15'-8"	5'-5"
	7'			12	23	34	18'-11"	0'-3⅜"	2'-9½"	4'-2¾"			4	16'-9"	6'-3"	15'-11"	5'-8"
3 @ 6'	3'	#5	11"	11	23	34	21'-5"	0'-3½"	3'-1"	4'-10¾"	#5	11"	5	19'-3"	5'-2"	18'-4"	4'-8"
	4'			11	23	34	"	"	"	"			5	"	"	"	"
	5'			11	23	34	"	"	"	"			5	"	"	"	"
	6'			11	23	34	21'-9"	"	3'-2"	4'-11½"			5	19'-7"	5'-6"	18'-8"	5'-0"
	7'			11	23	34	22'-0"	"	3'-3"	4'-11¾"			5	19'-10"	5'-9"	18'-11"	5'-3"
	8'			11	23	34	22'-1"	0'-3½"	3'-3"	5'-0¼"			5	19'-11"	5'-10"	19'-0"	5'-4"
3 @ 7'	4'	#5	12"	10	21	31	24'-6"	0'-4⅛"	3'-5"	5'-7"	#5	12"	5	22'-2"	6'-8"	21'-2"	6'-2"
	5'			10	21	31	"	"	"	"			5	"	"	"	"
	6'			10	21	31	24'-10"	"	3'-6"	5'-8"			5	22'-6"	7'-0"	21'-6"	6'-6"
	7'			10	21	31	25'-1"	"	3'-7"	5'-8½"			5	22'-9"	7'-3"	21'-9"	6'-9"
	8'			10	21	31	25'-2"	"	3'-7"	5'-9"			5	22'-10"	7'-4"	21'-10"	6'-10"
	9'			10	21	31	25'-6"	0'-4⅛"	3'-8"	5'-10"			5	23'-2"	7'-8"	22'-2"	7'-2"
3 @ 8'	4'	#6	12"	10	20	30	27'-10"	0'-5⅝"	3'-9"	6'-4"	#6	12"	6	25'-5"	6'-0"	24'-2"	5'-5"
	5'			10	20	30	28'-2"	"	3'-10"	6'-5"			6	25'-9"	6'-4"	24'-6"	5'-9"
	6'			10	20	30	"	"	"	"			6	"	"	"	"
	7'			10	20	30	28'-5"	"	3'-11"	6'-5½"			6	26'-0"	6'-7"	24'-9"	6'-0"
	8'			10	20	30	28'-6"	"	3'-11"	6'-6"			6	26'-1"	6'-8"	24'-10"	6'-1"
	9'			10	20	30	28'-10"	"	4'-0"	6'-7"			6	26'-5"	7'-0"	25'-2"	6'-5"
	10'			10	20	30	29'-2"	0'-5⅝"	4'-1"	6'-8"			6	26'-9"	7'-4"	25'-6"	6'-9"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
3 @ 4'	2'	#4	12"	23	43	65	9'-4"	#4	12"	4	8'-0"	4'-3"
	3'			23	43	65	"			4	"	"
	4'			23	43	65	"			4	"	"
	5'			23	43	65	"			4	"	"
	6'			23	43	65	9'-6"			4	8'-3"	4'-6"
3 @ 5'	3'	#5	11"	23	47	69	11'-4"	#5	11"	6	10'-10"	4'-0"
	4'			23	47	69	"			6	"	"
	5'			23	47	69	"			6	"	"
	6'			23	47	69	11'-6"			6	11'-1"	4'-3"
	7'			23	47	69	11'-8"			6	11'-3"	4'-5"
3 @ 6'	3'	#5	11"	25	47	71	13'-4"	#5	11"	6	9'-11"	3'-1"
	4'			25	47	71	"			6	"	"
	5'			25	47	71	"			6	"	"
	6'			25	47	71	13'-6"			6	10'-2"	3'-4"
	7'			25	47	71	13'-8"			6	10'-4"	3'-6"
	8'			25	47	71	13'-8"			6	10'-5"	3'-7"
3 @ 7'	4'	#6	12"	23	43	63	15'-4"	#6	12"	6	11'-9"	4'-3"
	5'			23	43	63	"			6	"	"
	6'			23	43	63	15'-6"			6	12'-0"	4'-6"
	7'			23	43	63	15'-8"			6	12'-2"	4'-8"
	8'			23	43	63	15'-8"			6	12'-3"	4'-9"
	9'			23	43	63	15'-10"			6	12'-6"	5'-0"
3 @ 8'	4'	#6	12"	23	41	61	17'-4"	#6	12"	8	14'-3"	3'-0"
	5'			23	41	61	17'-6"			8	14'-7"	3'-4"
	6'			23	41	61	"			8	"	"
	7'			23	41	61	17'-8"			8	14'-8"	3'-5"
	8'			23	41	61	17'-8"			8	14'-9"	3'-6"
	9'			23	41	61	17'-10"			8	15'-0"	3'-9"
	10'			23	41	61	18'-0"			8	15'-3"	4'-0"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Walls. "e" bars — Longitudinal in Bottom Slab of Barrel.

S	H	"d" SIZE	SPACING	No. REQ'D	LENGTH	"d1" SIZE	SPACING	No. REQ'D	LENGTH	"e" SIZE	SPACING	No. REQ'D	LENGTH
3 @ 4'	2'	#4	12"	22	Lengths vary - Ave. Lengths; 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"	#4	12"	12	Lengths vary - Ave. Lengths; 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"	#4	12"	22	Lengths vary - Ave. Lengths; 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10"
	3'			22				18				22	
	4'			22				24				22	
	5'			22				30				22	
	6'			22				36				22	
3 @ 5'	3'	#4	12"	25		#4	12"	18		#4	12"	25	
	4'			25				24				25	
	5'			25				30				25	
	6'			25				36				25	
	7'			25				42				25	
3 @ 6'	3'	#4	12"	28		#4	12"	18		#4	12"	28	
	4'			28				24				28	
	5'			28				30				28	
	6'			28				36				28	
	7'			28				42				28	
	8'			28				48				28	
3 @ 7'	4'	#4	12"	33		#4	12"	24		#4	12"	33	
	5'			33				30				33	
	6'			33				36				33	
	7'			33				42				33	
	8'			33				48				33	
	9'			33				54				33	
3 @ 8'	4'	#4	12"	36		#4	12"	24		#4	12"	36	
	5'			36				30				36	
	6'			36				36				36	
	7'			36				42				36	
	8'			36				48				36	
	9'			36				54				36	
	10'			36				60				36	

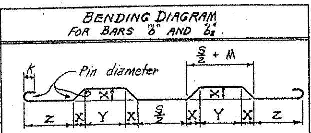
"f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. "k1" bars — STRAIGHT — In Bottom of Headwall. "k2" bars — In Top of Headwall and Apron. (2 Each)

S	H	"f" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	No. REQ'D	LENGTH	"k2" SIZE	No. REQ'D	LENGTH
3 @ 4'	2'	#4	12"	78	138	201	2'-9"	#5	3	14'-7"	#5	4	15'-1"
	3'			78	138	201	3'-9"		3	"		4	"
	4'			78	138	201	4'-9"		3	"		4	"
	5'			78	138	201	5'-9"		3	"		4	"
	6'			78	138	201	6'-9"		3	14'-11"		4	15'-5"
3 @ 5'	3'	#4	12"	78	138	201	3'-10"	#5	3	17'-8"	#5	4	18'-2"
	4'			78	138	201	4'-10"		3	"		4	"
	5'			78	138	201	5'-10"		3	"		4	"
	6'			78	138	201	6'-10"		3	18'-0"		4	18'-7"
	7'	#5	12"	78	138	201	7'-10"		3	18'-3"		4	18'-10"
3 @ 6'	3'	#4	12"	78	138	201	3'-11"	#5	3	19'-9"	#5	4	21'-4"
	4'			78	138	201	4'-11"		3	"		4	"
	5'			78	138	201	5'-11"		3	"		4	"
	6'			78	138	201	6'-11"		3	21'-1"		4	21'-8"
	7'	#5	12"	78	138	201	7'-11"		3	21'-5"		4	21'-11"
	8'		11"	84	150	219	8'-11"		3	21'-6"		4	22'-0"
3 @ 7'	4'	#4	12"	78	138	201	5'-1"	#6	3	23'-11"	#6	4	24'-5"
	5'			78	138	201	6'-1"		3	"		4	"
	6'			78	138	201	7'-1"		3	24'-3"		4	24'-9"
	7'	#5	12"	78	138	201	8'-1"		3	24'-6"		4	25'-0"
	8'		11"	84	150	219	9'-1"		3	24'-7"		4	25'-1"
	9'		10"	90	165	240	10'-1"		3	24'-11"		4	25'-5"
3 @ 8'	4'	#4	12"	78	138	201	5'-2"	#6	3	27'-0"	#6	4	27'-6"
	5'			78	138	201	6'-2"		3	27'-4"		4	27'-10"
	6'			78	138	201	7'-2"		3	"		4	"
	7'		10"	90	165	240	8'-2"		3	27'-7"		4	28'-1"
	8'	#5	12"	78	138	201	9'-2"		3	27'-8"		4	28'-2"
	9'		11"	84	150	219	10'-2"		3	28'-0"		4	28'-7"
	10'	#6	12"	78	138	201	11'-2"		3	28'-4"		4	28'-11"

◤ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 3'-9" for 12" spacing and 3'-5" for 11" spacing.

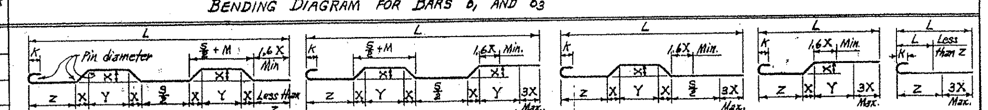
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b2".



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b1" AND "b3"



NOTE:- Dimensions are to centers of bars. (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n = 10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.
For Barrels of 4', 5' & 6' Spans, see Drawing No. R-300X-X1.
For " " 7' Spans, see Drawing No. R-300X-X3.
For " " 8' Spans, see Drawing No. R-300X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW - SECTIONS "A" ONLY

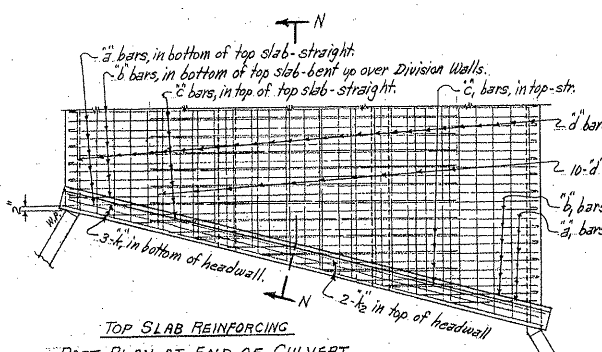
4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES

TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-315X-1

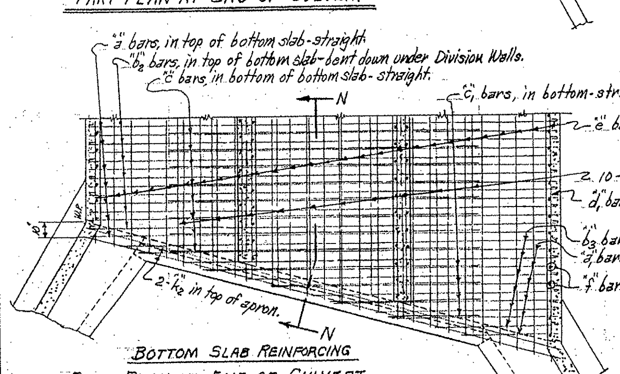
Designed by:- W.C.H. 9-24-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 11-4-63 Checked by:-
Quantities by:- W.C.H. 12-6-63 Checked by:-

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT



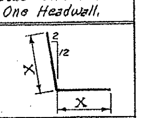
BOTTOM SLAB REINFORCING

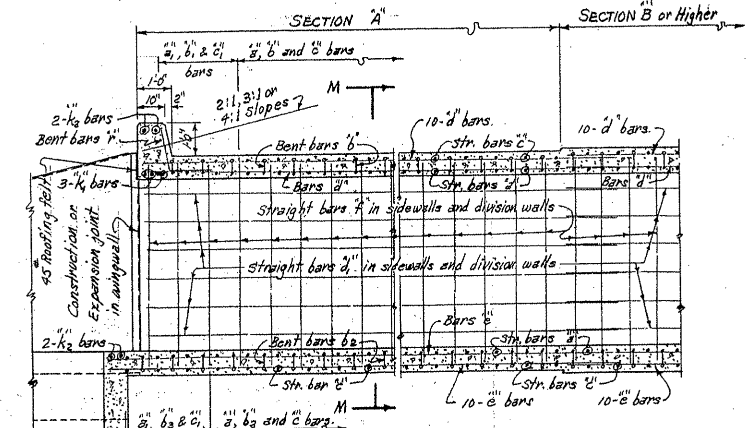
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" into SECTION "B"

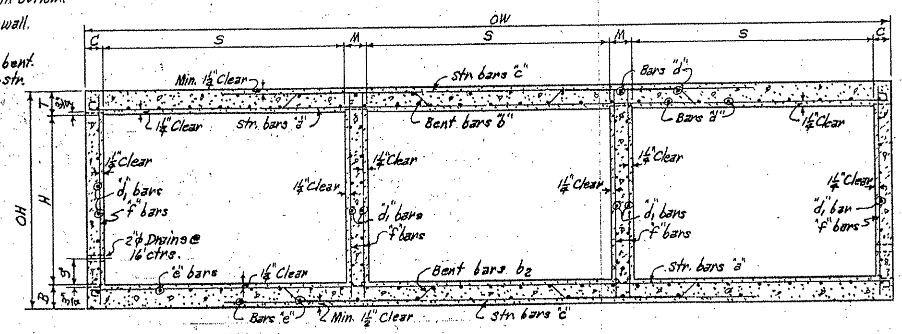
DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
9'	#4	12"±	31	2'-11"	1'-5½"	
10'	#4	12"±	34	3'-0"	1'-6"	
11'	#4	12"±	38	3'-2"	1'-7"	
12	#4	12"±	41	3'-4"	1'-8"	

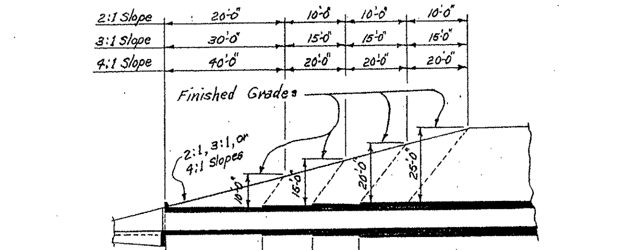




SECTION N-N



TYPICAL SECTION M-M

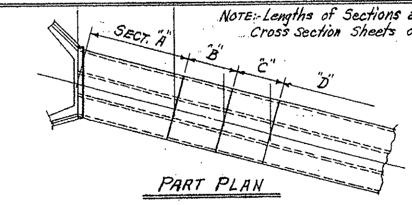


2:1 Slope =	SECTIONS / Bar Group	A = 12'-0" / A	B = 6'-6" / B	C = 6'-6" / C	MID-SECTION D-Varies / D
3:1 Slope =	SECTIONS / Bar Group	A = 22'-0" / A	B = 11'-6" / B	C = 11'-6" / C	MID-SECTION D-Varies / D
4:1 Slope =	SECTIONS / Bar Group	A = 32'-0" / A	B = 16'-6" / B	C = 16'-6" / C	MID-SECTION D-Varies / D

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B and C, see Barrel Drawing Nos. R-300X-X2 and R-300X-X3.

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B & C	A	B & C	A	B & C
LENGTHS	12'-5"	6'-2½"	22'-9¾"	11'-4⅝"	33'-1½"	16'-6¾"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A			A
10.0' to 14.5'	A			B
15.0' to 19.5'	A	B		C
20.0' to 25.0'	A	B	C	D

OR ALT.

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A			A
10.0' to 14.5'	A			B
15.0' to 19.5'	A	B		C
20.0' to 25.0'	A	2@C		D

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED
9-2-71	501-9-2-71		

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER (D)	CLEAR SPANS (S)	CLEAR HEIGHT (H)	SQ. FT. OPENING (A)	OVERALL WIDTH (OW)	THICKNESS OF TOP SLAB (T)	THICKNESS OF SIDEWALLS (C)	THICKNESS OF DIVISION WALLS (M)	THICKNESS OF BOTTOM SLAB (B)	OVERALL HEIGHT (OH)	ROADWAY LENGTH (RL)	LENGTH OF HEADWALL (K)	CLASS S CONCRETE BARREL ONLY 2:1 CU.YD.	3:1 CU.YD.	4:1 CU.YD.	REINFORCING STEEL BARREL, APRON AND HEADWALL 2:1 LB.	3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	3 @ 9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	30'-8½"	31'-3"	27.74	50.87	74.00	4999	8724	12,369
		6'	162	29'-11"		7½"	10"		7'-7"	30'-11⅝"	31'-6"	29.84	54.72	79.60	4870	8699	12,449
		7'	189	29'-11"		7½"	10"		8'-7"	"	"	31.18	57.18	83.18	5046	9121	13,103
		8'	216	30'-0"		8"	10"		9'-7"	31'-0¾"	31'-7¼"	32.88	60.30	87.71	5695	9852	14,206
		9'	243	30'-4"		9"	11"		10'-7"	31'-4⅞"	31'-11⅛"	35.88	65.81	95.73	5958	10,459	14,865
		10'	270	30'-8"		10"	12"		11'-7"	31'-9"	32'-3½"	39.19	71.86	104.54	6418	11,200	15,938
		11'	297	30'-10"		11"	12"		12'-7"	31'-11"	32'-5⅛"	41.84	73.74	111.63	6717	11,754	16,749
	3 @ 10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	33'-9¾"	34'-4⅜"	31.80	58.32	84.83	5782	10,010	13,136
		6'	180	32'-11"		7½"	10"		7'-8½"	34'-1"	34'-7⅜"	33.91	62.19	90.46	5912	10,223	14,833
		7'	210	32'-11"		7½"	10"		8'-8½"	"	"	35.25	64.65	94.04	6088	10,588	15,275
		8'	240	33'-0"		8"	10"		9'-8½"	34'-2"	34'-8⅜"	36.96	67.79	98.61	6409	11,124	16,056
		9'	270	33'-4"		9"	11"		10'-8½"	34'-6⅜"	35'-0⅜"	39.98	73.32	106.66	6736	11,748	16,948
		10'	300	33'-8"		10"	12"		11'-8½"	34'-10⅝"	35'-4⅜"	43.31	79.42	115.54	7204	12,500	18,038
		11'	330	33'-10"		11"	12"		12'-8½"	35'-0⅝"	35'-6⅜"	45.97	84.30	122.63	7511	13,062	18,860
		12'	360	34'-0"		12"	12"		13'-8½"	35'-2⅜"	35'-8¾"	48.78	89.47	130.15	7840	13,723	19,798
	3 @ 11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	37'-3⅜"	37'-9¾"	38.63	70.84	103.05	6484	11,417	16,413
		7'	231	36'-0"		8"	10"		8'-10"	"	"	40.01	73.37	106.73	6628	11,676	16,790
		8'	264	36'-0"		8"	10"		9'-10"	"	"	41.38	75.90	110.41	6983	12,293	17,683
		9'	297	36'-4"		9"	11"		10'-10"	37'-7⅜"	38'-1¾"	44.93	81.47	118.52	7307	12,920	18,581
		10'	330	36'-8"		10"	12"		11'-10"	37'-11½"	38'-6"	47.78	87.62	127.46	7783	13,684	19,687
		11'	363	36'-10"		11"	12"		12'-10"	38'-1⅝"	38'-8"	50.95	92.52	134.59	8093	14,252	20,517
		12'	396	37'-0"		12"	12"		13'-10"	38'-3⅝"	38'-10"	53.27	97.69	142.11	8667	15,284	22,013
	3 @ 12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	40'-4⅞"	40'-11"	43.40	79.58	115.77	7452	12,961	18,706
		7'	252	39'-0"		8"	10"		8'-11½"	"	"	44.77	82.11	119.45	7561	13,151	18,980
		8'	288	39'-0"		8"	10"		9'-11½"	"	"	46.16	84.66	123.16	7953	13,842	19,983
		9'	324	39'-4"		9"	11"		10'-11½"	40'-9⅝"	41'-3"	49.22	90.26	131.31	8284	14,478	20,894
		10'	360	39'-8"		10"	12"		11'-11½"	41'-0⅜"	41'-7¼"	52.58	96.43	140.28	8767	15,252	22,015
		11'	396	39'-10"		11"	12"		12'-11½"	41'-2⅞"	41'-9⅛"	55.27	101.35	147.44	9081	15,825	22,851
		12'	432	40'-0"		12"	12"		13'-11½"	41'-4⅞"	41'-11⅛"	58.10	106.54	154.99	9659	16,865	24,358

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR SECTION A ON 15° SKEW - ONE END ONLY

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 12'-5", 3:1 = 22'-9¾", 4:1 = 33'-1½". Depth of Cover (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars (▼) — STRAIGHT — In Top and Bottom Slab of Barrel. (Two of each Length)

S	H	"a" SIZE	SPACING	No. 2:1	No. 3:1	No. 4:1	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
3 @ 9'	5'	#6	12"	19	39	59	29'-5"	#6	12"	14	25'-8"	3'-2"
	6'			19	39	59	29'-8"			14	25'-11"	3'-5"
	7'			19	39	59	"			14	"	"
	8'			19	39	59	29'-9"			14	26'-0"	3'-6"
	9'			19	39	59	30'-1"			14	26'-4"	3'-10"
	10'			19	39	59	30'-5"			14	26'-8"	4'-2"
	11'			19	39	59	30'-7"			14	26'-10"	4'-4"
3 @ 10'	5'	#6	11"	19	41	65	32'-5"	#6	11"	16	29'-0"	5'-1"
	6'			19	41	65	32'-8"			16	29'-3"	5'-4"
	7'			19	41	65	"			16	"	"
	8'			19	41	65	32'-9"			16	29'-4"	5'-5"
	9'			19	41	65	33'-1"			16	29'-8"	5'-9"
	10'			19	41	65	33'-5"			16	30'-0"	6'-1"
	11'			19	41	65	33'-7"			16	30'-2"	6'-3"
	12'			19	41	65	33'-9"			16	30'-4"	6'-5"
3 @ 11'	6'	#6	12"	17	37	59	35'-9"	#6	12"	16	32'-0"	5'-9"
	7'			17	37	59	"			16	"	"
	8'			17	37	59	"			16	"	"
	9'			17	37	59	36'-1"			16	32'-4"	6'-1"
	10'			17	37	59	36'-5"			16	32'-8"	6'-5"
	11'			17	37	59	36'-7"			16	32'-10"	6'-7"
	12'			17	37	59	36'-9"			16	33'-0"	6'-9"
3 @ 12'	6'	#6	11"	17	39	63	38'-9"	#6	11"	20	35'-4"	4'-7"
	7'			17	39	63	"			20	"	"
	8'			17	39	63	"			20	"	"
	9'			17	39	63	39'-1"			20	35'-8"	4'-11"
	10'			17	39	63	39'-5"			20	36'-0"	5'-3"
	11'			17	39	63	39'-7"			20	36'-2"	5'-5"
	12'			17	39	63	39'-9"			20	36'-4"	5'-7"

"b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b1" bars (▼) — In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b" SIZE	SPACING	No. 2:1	No. 3:1	No. 4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	12"	8	19	29	31'-2"	0'-5¾"	4'-3½"	7'-2"	#6	12"	7	28'-9"	5'-7"	27'-6"	5'-0"
	6'			8	19	29	31'-5"	"	4'-4½"	7'-2½"			7	29'-0"	5'-10"	27'-9"	5'-3"
	7'			8	19	29	"	"	"	"			7	"	"	"	"
	8'			8	19	29	31'-6"	"	"	7'-3"			7	29'-1"	5'-11"	27'-10"	5'-4"
	9'			8	19	29	31'-10"	"	4'-5½"	7'-4"			7	29'-5"	6'-3"	28'-2"	5'-8"
	10'			8	19	29	32'-2"	"	4'-6½"	7'-5"			7	29'-9"	6'-7"	28'-6"	6'-0"
	11'			8	19	29	32'-4"	0'-5¾"	4'-6½"	7'-6"			7	29'-11"	6'-9"	28'-8"	6'-2"
3 @ 10'	5'	#6	11"	9	20	31	34'-3"	0'-6½"	4'-8"	7'-11"	#6	11"	9	32'-1"	3'-11"	30'-8"	3'-4"
	6'			9	20	31	34'-6"	"	4'-9"	7'-11½"			9	32'-4"	4'-2"	30'-11"	3'-7"
	7'			9	20	31	"	"	"	"			9	"	"	"	"
	8'			9	20	31	34'-7"	"	"	8'-0"			9	32'-5"	4'-3"	31'-0"	3'-8"
	9'			9	20	31	34'-11"	"	4'-10"	8'-1"			9	32'-9"	4'-7"	31'-4"	4'-0"
	10'			9	20	31	35'-3"	"	4'-11"	8'-2"			9	33'-1"	4'-11"	31'-8"	4'-4"
	11'			9	20	31	35'-5"	"	4'-11"	8'-3"			9	33'-3"	5'-1"	31'-10"	4'-6"
	12'			9	20	31	35'-7"	0'-6½"	4'-11"	8'-4"			9	33'-5"	5'-3"	32'-0"	4'-8"
3 @ 11'	6'	#7	12"	7	18	28	37'-10"	0'-7"	5'-2"	8'-9"	#7	12"	9	35'-4"	4'-11"	33'-10"	4'-3"
	7'			7	18	28	"	"	"	"			9	"	"	"	"
	8'			7	18	28	"	"	"	"			9	"	"	"	"
	9'			7	18	28	38'-2"	"	5'-3"	8'-10"			9	35'-8"	5'-3"	34'-2"	4'-7"
	10'			7	18	28	38'-6"	"	5'-4"	8'-11"			9	36'-0"	5'-7"	34'-6"	4'-11"
	11'			7	18	28	38'-8"	"	5'-4"	9'-0"			9	36'-2"	5'-9"	34'-8"	5'-1"
	12'			7	18	28	38'-10"	0'-7"	5'-4"	9'-1"			9	36'-4"	5'-11"	34'-10"	5'-3"
3 @ 12'	6'	#7	11"	8	19	30	40'-11"	0'-7¾"	5'-6½"	9'-6"	#7	11"	10	38'-8"	6'-11"	37'-0"	6'-3"
	7'			8	19	30	"	"	"	"			10	"	"	"	"
	8'			8	19	30	"	"	"	"			10	"	"	"	"
	9'			8	19	30	41'-3"	"	5'-7½"	9'-7"			10	39'-0"	7'-3"	37'-4"	6'-7"
	10'			8	19	30	41'-7"	"	5'-8½"	9'-8"			10	39'-4"	7'-7"	37'-8"	6'-11"
	11'			8	19	30	41'-9"	"	5'-8½"	9'-9"			10	39'-6"	7'-9"	37'-10"	7'-1"
	12'			8	19	30	41'-11"	0'-7¾"	5'-8½"	9'-10"			10	39'-8"	7'-11"	38'-0"	7'-3"

"b2" bars — BENT - See Diagrams below — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b3" bars (▼) — In Top of Bottom Slab - some bent down under Division Wall - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b2" SIZE	SPACING	No. 2:1	No. 3:1	No. 4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	12"	9	20	30	31'-3"	0'-6¼"	4'-2½"	7'-2"	#6	12"	7	28'-10"	5'-7"	27'-6"	5'-0"
	6'			9	20	30	31'-6"	"	4'-3½"	7'-2½"			7	29'-1"	5'-10"	27'-9"	5'-3"
	7'			9	20	30	"	"	"	7'-0½"			7	"	"	"	"
	8'			9	20	30	31'-7"	"	"	7'-3"			7	29'-2"	5'-11"	27'-10"	5'-4"
	9'			9	20	30	31'-11"	"	4'-4½"	7'-4"			7	29'-6"	6'-3"	28'-2"	5'-8"
	10'			9	20	30	32'-2"	"	4'-5½"	7'-5"			7	29'-10"	6'-7"	28'-6"	6'-0"
	11'			9	20	30	32'-5"	0'-6¼"	4'-5½"	7'-6"			7	30'-0"	6'-9"	28'-8"	6'-2"
3 @ 10'	5'	#6	11"	10	21	32	34'-4"	0'-7"	4'-7"	7'-11"	#6	11"	9	32'-2"	3'-11"	30'-8"	3'-4"
	6'			10	21	32	34'-7"	"	4'-8"	7'-11½"			9	32'-5"	4'-2"	30'-11"	3'-7"
	7'			10	21	32	"	"	"	"			9	"	"	30'-11"	"
	8'			10	21	32	34'-8"	"	"	8'-0"			9	32'-6"	4'-3"	31'-0"	3'-8"
	9'			10	21	32	35'-0"	"	4'-9"	8'-1"			9	32'-10"	4'-7"	31'-4"	4'-0"
	10'			10	21	32	35'-4"	"	4'-10"	8'-2"			9	33'-2"	4'-11"	31'-8"	4'-4"
	11'			10	21	32	35'-6"	"	4'-10"	8'-3"			9	33'-4"	5'-1"	31'-10"	4'-6"
	12'			10	21	32	35'-8"	0'-7"	4'-10"	8'-4"			9	33'-6"	5'-3"	32'-0"	4'-8"
3 @ 11'	6'	#7	12"	8	19	29	37'-11"	0'-7½"	5'-1"	8'-9"	#7	12"	9	35'-5"	4'-11"	33'-10"	4'-3"
	7'			8	19	29	"	"	"	"			9	"	"	"	"
	8'			8	19	29	"	"	"	"			9	"	"	"	"
	9'			8	19	29	38'-3"	"	5'-2"	8'-10"			9	35'-9"	5'-3"	34'-2"	4'-7"
	10'			8	19	29	38'-7"	"	5'-3"	8'-11"			9	36'-1"	5'-7"	34'-6"	4'-11"
	11'			8	19	29	38'-9"	"	5'-3"	9'-0"			9	36'-3"	5'-9"	34'-8"	5'-1"
	12'			8	19	29	38'-11"	0'-7½"	5'-3"	9'-1"			9	36'-5"	5'-11"	34'-10"	5'-3"
3 @ 12'	6'	#7	11"	9	20	31	41'-0"	0'-8¼"	5'-5½"	9'-6"	#7	11"	10	38'-9"	6'-11"	37'-0"	6'-3"
	7'			9	20	31	"	"	"	"			10	"	"	"	"
	8'			9	20	31	"	"	"	"			10	"	"	"	"
	9'			9	20	31	41'-4"	"	5'-6½"	9'-7"			10	39'-1"	7'-3"	37'-4"	6'-7"
	10'			9	20	31	41'-8"	"	5'-7½"	9'-8"			10	39'-5"	7'-7"	37'-8"	6'-11"
	11'			9	20	31	41'-10"	"	5'-7½"	9'-9"			10	39'-7"	7'-9"	37'-10"	7'-1"
	12'			9	20	31	42'-0"	0'-8¼"	5'-7½"	9'-10"			10	39'-9"	7'-11"	38'-0"	7'-3"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" SIZE	SPACING	No. 2:1	No. 3:1	No. 4:1	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
3 @ 9'	5'	#7	12"	21	41	61	19'-6"	#7	12"	8	17'-0"	5'-9"
	6'			21	41	61	19'-8"			8	17'-2"	5'-11"
	7'			21	41	61	"			8	"	"
	8'			21	41	61	"			8	17'-3"	6'-0"
	9'			21	41	61	19'-10"			8	17'-6"	6'-3"
	10'			21	41	61	20'-0"			8	17'-9"	6'-6"
	11'			21	41	61	20'-0"			8	17'-10"	6'-7"
3 @ 10'	5'	#7	11"	21	43	67	21'-6"	#7	11"	10	20'-2"	6'-6"
	6'			21	43	67	21'-8"			10	20'-4"	6'-8"
	7'			21	43	67	"			10	"	"
	8'			21	43	67	"			10	20'-5"	6'-9"
	9'			21	43	67	21'-10"			10	20'-8"	7'-0"
	10'			21	43	67	22'-0"			10	20'-11"	7'-3"
	11'			21	43	67	"			10	21'-0"	7'-4"
	12'			21	43	67	"			10	21'-1"	7'-5"
3 @ 11'	6'	#7	12"	19	39	61	23'-8"	#7	12"	12	22'-3"	3'-6"
	7'			19	39	61	"			12	"	"
	8'			19	39	61	"			12	"	"
	9'			19	39	61	23'-10"			12	22'-6"	3'-9"
	10'			19	39	61	24'-0"			12	22'-9"	4'-0"
	11'			19	39	61	"			12	22'-10"	4'-1"
	12'			19	39	61	"			12	22'-11"	4'-2"
3 @ 12'	6'	#7	11"	19	41	65	25'-8"	#7	11"	14	25'-5"	4'-11"
	7'			19	41	65	"			14	"	"
	8'			19	41	65	"			14	"	"
	9'			19	41	65	25'-10"			14	25'-8"	5'-2"
	10'			19	41	65	26'-0"			14	25'-11"	5'-5"
	11'			21	43	67	"			12	22'-7"	5'-6"
	12'			21	43	67	"			12	22'-8"	5'-7"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Walls. "e" bars — Longitudinal in Bottom Slab of Barrel.

S	H	"d" SIZE	SPACING	No. REQ'D	"d1" SIZE	SPACING	No. REQ'D	"e" SIZE	SPACING	No. REQ'D
3 @ 9'	5'	#4	12"	40	#4	12"	30	#4	12"	40
	6'			40			36			40
	7'			40			42			40
	8'			40			48			40
	9'			40			54			40
	10'			40			60			40
	11'			40			66			40
3 @ 10'	5'	#4	12"	43	#4	12"	30	#4	12"	43
	6'			43			36			43
	7'			43			42			43
	8'			43			48			43
	9'			43			54			43
	10'			43			60			43
	11'			43			66			43
	12'			43			72			43
3 @ 11'	6'	#4	12"	46	#4	12"	36	#4	12"	46
	7'			46			42			46
	8'			46			48			46
	9'			46			54			46
	10'			46			60			46
	11'			46			66			46
	12'			46			72			46
3 @ 12'	6'	#4	12"	49	#4	12"	36	#4	12"	49
	7'			49			42			49
	8'			49			48			49
	9'			49			54			49
	10'			49			60			49
	11'			49			66			49
	12'			49			72			49

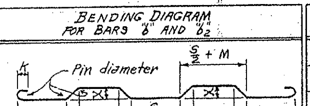
"d" bars LENGTH: Lengths vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"
"d1" bars LENGTH: Lengths vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"
"e" bars LENGTH: Lengths vary - Ave. Lengths: 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10"

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. "k1" bars (▼) — STRAIGHT — In Bottom of Headwall. "k2" bars (▼) — In Top of Headwall and Apron. (2 Each)

S	H	"f" SIZE	SPACING	No. 2:1	No. 3:1	No. 4:1	LENGTH	"k1" SIZE	No. REQ'D	LENGTH	"k2" SIZE	No. REQ'D	LENGTH
3 @ 9'	5'	#4	12"	78	138	201	6'-4"	#6	3	30'-4"	#6	4	30'-11"
	6'			78	138	201	7'-4"		3	30'-8"		4	31'-3"
	7'		10"	90	165	240	8'-4"		3	30'-8"		4	31'-3"
	8'	#5	12"	78	138	201	9'-4"		3	30'-9"		4	31'-4"
	9'		10"	90	165	240	10'-4"		3	31'-1"		4	31'-8"
	10'	#6	12"	78	138	201	11'-4"		3	31'-5"		4	32'-0"
	11'		11"	84	150	219	12'-4"		3	31'-7"		4	32'-2"
3 @ 10'	5'	#4	12"	78	138	201	6'-5"	#6	3	33'-6"	#6	4	34'-1"
	6'			78	138	201	7'-5"		3	33'-9"		4	34'-4"
	7'		10"	90	165	240	8'-5"		3	33'-9"		4	34'-4"
	8'	#5	12"	78	138	201	9'-5"		3	33'-10"		4	34'-5"
	9'		10"	90	165	240	10'-5"		3	34'-2"		4	34'-9"
	10'	#6	12"	78	138	201	11'-5"		3	34'-6"		4	35'-1"
	11'		11"	84	150	219	12'-5"		3	34'-8"		4	35'-3"
	12'		10"	90	165	240	13'-5"		3	34'-10"		4	35'-5"
3 @ 11'	6'	#4	12"	78	138	201	7'-7"	#6	3	36'-11"	#6	4	37'-6"
	7'		11"	84	150	219	8'-7"		3	36'-11"		4	37'-6"
	8'	#5	12"	78	138	201	9'-7"		3	36'-11"		4	37'-6"
	9'		10"	90	165	240	10'-7"		3	37'-3"		4	37'-10"
	10'	#6	12"	78	138	201	11'-7"		3	37'-7"		4	38'-2"
	11'		11"	84	150	219	12'-7"		3	37'-9"		4	38'-4"
	12'		9"	102	183	267	13'-7"		3	38'-0"		4	38'-7"
3 @ 12'	6'	#4	12"	78	138	201	7'-8"	#6	3	40'-0"	#6	4	40'-7"
	7'			78	138	201	8'-8"		3	40'-0"		4	40'-7"
	8'	#5	12"	78	138	201	9'-8"		3	40'-0"		4	40'-7"
	9'		10"	90	165	240	10'-8"		3	40'-5"		4	41'-0"
	10'	#6	12"	78	138	201	11'-8"		3	40'-9"		4	41'-4"
	11'		11"	84	150	219	12'-8"		3	40'-11"		4	41'-6"
	12'		9"	102	183	267	13'-8"		3	41'-1"		4	41'-8"

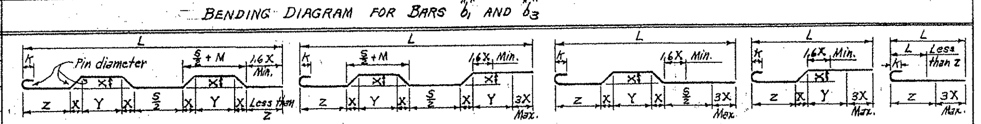
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3"



NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars.

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and b3 bars vary by 3'-9" for 12" spacing and 3'-5" for 11" spacing.

9-2-71 Revised K1 & K2 lengths

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.
For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW ~ SECTIONS "A" ONLY

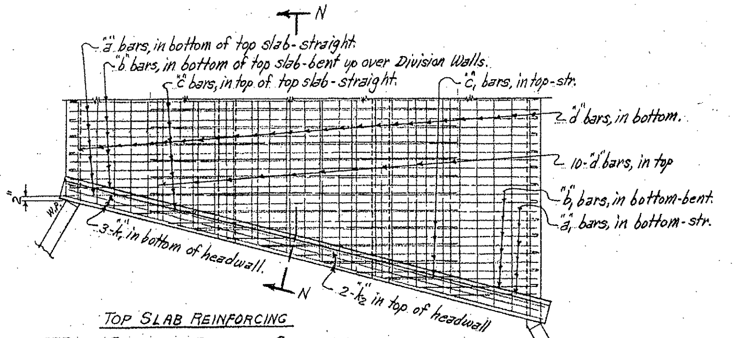
9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

TRIPLES — OVER 5'-0" COVER

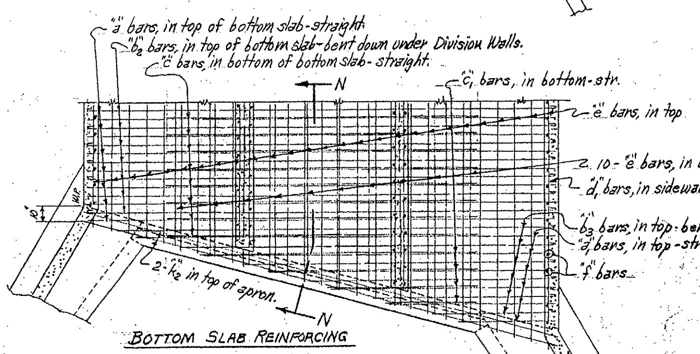
STANDARD DRAWING No. R-315X-2

Designed by:- W.C.H. 9-17-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 10-9-63 Checked by:-
Quantities by:- W.C.H. 12-6-63 Checked by:-

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.



TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



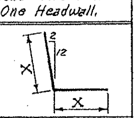
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

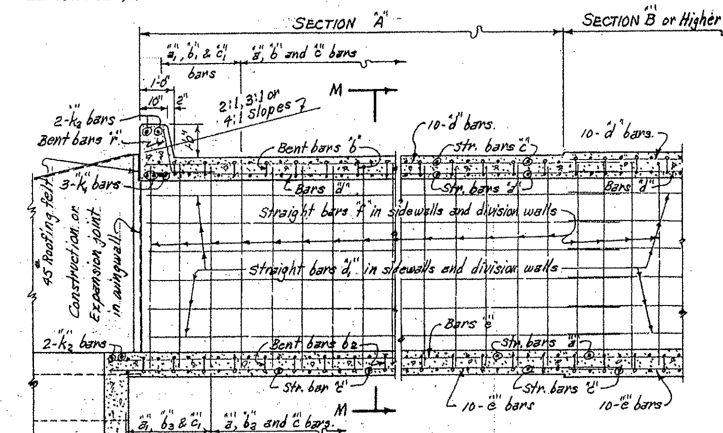
NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" into SECTION "B"

DOWEL BARS FOR ONE HEADWALL

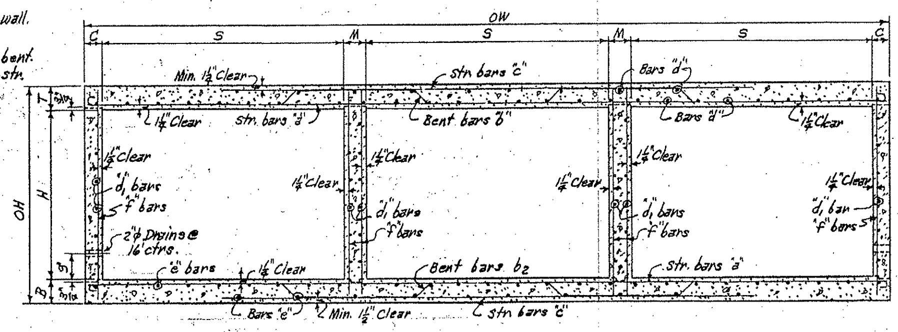
SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#4	12"±	31	2'-11"	1'-5⅛"
10'	#4	12"±	34	3'-0"	1'-6"
11'	#4	12"±	38	3'-2"	1'-7"
12	#4	12"±	41	3'-4"	1'-8"

Dowel bars "r" in One Headwall.

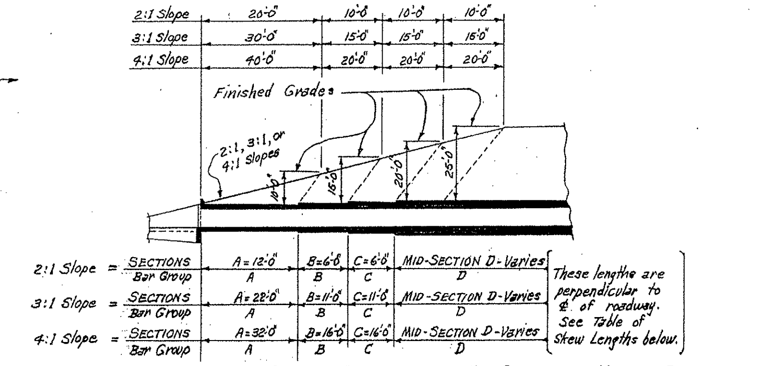




SECTION N-N

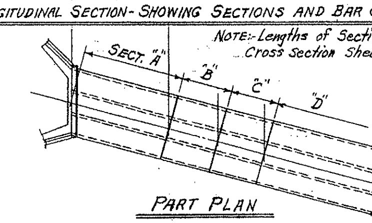


TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B and C, see Barrel Drawing Nos. R-300X-X2 and R-300X-X3.

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B&C	A	B&C	A	B&C
LENGTHS	12'-5"	6'-2½"	22'-9¼"	11'-4⅝"	33'-1½"	16'-6¾"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	B	C		D

OR ALT.

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	2@C			D

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

Max. Design Depth of Cover (D): SECTION "A" = 10'-0"

Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	Class S Concrete, Barrel Only 2:1 Cu.Yd.	3:1 Cu.Yd.	4:1 Cu.Yd.	Reinforcing Steel, Barrel, Apron and Headwall 2:1 Lb.	3:1 Lb.	4:1 Lb.
3 @ 9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	30'-8¼"	31'-3"	27.74	50.87	74.00	4999	8724	12,369
	6'	162	29'-11"		7½"	10"		7'-7"	30'-11⅝"	31'-6"	29.84	54.72	79.60	4870	8699	12,449
	7'	189	29'-11"		7½"	10"		8'-7"	"	"	31.18	57.18	83.18	5046	9121	13,103
	8'	216	30'-0"		8"	10"		9'-7"	31'-0¾"	31'-7¼"	32.88	60.30	87.71	5695	9852	14,206
	9'	243	30'-4"		9"	11"		10'-7"	31'-4⅜"	31'-11⅛"	35.88	65.81	95.73	5958	10,459	14,865
	10'	270	30'-8"		10"	12"		11'-7"	31'-9"	32'-3⅛"	39.19	71.86	104.54	6418	11,200	15,938
	11'	297	30'-10"		11"	12"		12'-7"	31'-11"	32'-5⅛"	41.84	73.74	111.63	6717	11,754	16,749
3 @ 10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	33'-9¾"	34'-4⅛"	31.80	58.32	84.83	5782	10,010	13,136
	6'	180	32'-11"		7½"	10"		7'-8½"	34'-1"	34'-7½"	33.91	62.19	90.46	5912	10,223	14,833
	7'	210	32'-11"		7½"	10"		8'-8½"	"	"	35.25	64.65	94.04	6088	10,588	15,275
	8'	240	33'-0"		8"	10"		9'-8½"	34'-2"	34'-8½"	36.96	67.79	98.61	6409	11,124	16,056
	9'	270	33'-4"		9"	11"		10'-8½"	34'-6⅛"	35'-0⅛"	39.98	73.32	106.66	6736	11,748	16,948
	10'	300	33'-8"		10"	12"		11'-8½"	34'-10⅛"	35'-4¾"	43.31	79.42	115.54	7204	12,500	18,038
	11'	330	33'-10"		11"	12"		12'-8½"	35'-0⅜"	35'-6⅝"	45.97	84.30	122.63	7511	13,062	18,860
	12'	360	34'-0"		12"	12"		13'-8½"	35'-2¾"	35'-8¾"	48.78	89.47	130.15	7840	13,723	19,798
3 @ 11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	37'-3⅜"	37'-9¾"	38.63	70.84	103.05	6484	11,417	16,413
	7'	231	36'-0"		8"	10"		8'-10"	"	"	40.01	73.37	106.73	6628	11,676	16,790
	8'	264	36'-0"		8"	10"		9'-10"	"	"	41.38	75.90	110.41	6983	12,293	17,683
	9'	297	36'-4"		9"	11"		10'-10"	37'-7⅜"	38'-1⅜"	44.93	81.97	118.52	7307	12,920	18,581
	10'	330	36'-8"		10"	12"		11'-10"	37'-11½"	38'-6"	47.78	87.62	127.46	7783	13,684	19,687
	11'	363	36'-10"		11"	12"		12'-10"	38'-1⅝"	38'-8"	50.45	92.52	134.59	8093	14,252	20,517
	12'	396	37'-0"		12"	12"		13'-10"	38'-3⅝"	38'-10"	53.27	97.69	142.11	8667	15,284	22,013
3 @ 12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	40'-4½"	40'-11"	43.40	79.58	115.77	7452	12,961	18,706
	7'	252	39'-0"		8"	10"		8'-11½"	"	"	44.77	82.11	119.45	7561	13,151	18,980
	8'	288	39'-0"		8"	10"		9'-11½"	"	"	46.16	84.66	123.16	7953	13,842	19,983
	9'	324	39'-4"		9"	11"		10'-11½"	40'-9⅝"	41'-3"	49.22	90.26	131.31	8284	14,478	20,894
	10'	360	39'-8"		10"	12"		11'-11½"	41'-0¾"	41'-7⅛"	52.58	96.43	140.28	8767	15,252	22,015
	11'	396	39'-10"		11"	12"		12'-11½"	41'-2⅞"	41'-9⅛"	55.27	101.35	147.44	9081	15,825	22,851
	12'	432	40'-0"		12"	12"		13'-11½"	41'-4⅞"	41'-11⅛"	58.10	106.54	154.99	9659	16,865	24,358

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

BAR LIST FOR SECTION A ON 15° SKEW - ONE END ONLY

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 12'-5", 3:1 = 22'-9¼", 4:1 = 33'-1½". Depth of Cover (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars (▼) — STRAIGHT — In Top and Bottom Slab of Barrel. (Two of each Length)

S	H	"a" Size	Spacing	No. 2:1	No. 3:1	No. 4:1	Length	"a1" Size	Spacing	No. Req'd	Length Max.	Length Min.
3 @ 9'	5'	#6	12"	19	39	59	29'-5"	#6	12"	14	25'-8"	3'-2"
	6'			19	39	59	29'-8"			14	25'-11"	3'-5"
	7'			19	39	59	"			14	"	"
	8'			19	39	59	29'-9"			14	26'-0"	3'-6"
	9'			19	39	59	30'-1"			14	26'-4"	3'-10"
	10'			19	39	59	30'-5"			14	26'-8"	4'-2"
	11'			19	39	59	30'-7"			14	26'-10"	4'-4"
3 @ 10'	5'	#6	11"	19	41	65	32'-5"	#6	11"	16	29'-0"	5'-1"
	6'			19	41	65	32'-8"			16	29'-3"	5'-4"
	7'			19	41	65	"			16	"	"
	8'			19	41	65	32'-9"			16	29'-4"	5'-5"
	9'			19	41	65	33'-1"			16	29'-8"	5'-9"
	10'			19	41	65	33'-5"			16	30'-0"	6'-1"
	11'			19	41	65	33'-7"			16	30'-2"	6'-3"
	12'			19	41	65	33'-9"			16	30'-4"	6'-5"
3 @ 11'	6'	#6	12"	17	37	59	35'-9"	#6	12"	16	32'-0"	5'-9"
	7'			17	37	59	"			16	"	"
	8'			17	37	59	"			16	"	"
	9'			17	37	59	36'-1"			16	32'-4"	6'-1"
	10'			17	37	59	36'-5"			16	32'-8"	6'-5"
	11'			17	37	59	36'-7"			16	32'-10"	6'-7"
	12'			17	37	59	36'-9"			16	33'-0"	6'-9"
3 @ 12'	6'	#6	11"	17	39	63	38'-9"	#6	11"	20	35'-4"	4'-7"
	7'			17	39	63	"			20	"	"
	8'			17	39	63	"			20	"	"
	9'			17	39	63	39'-1"			20	35'-8"	4'-11"
	10'			17	39	63	39'-5"			20	36'-0"	5'-3"
	11'			17	39	63	39'-7"			20	36'-2"	5'-5"
	12'			17	39	63	39'-9"			20	36'-4"	5'-7"

"b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b1" bars (▼) — In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b" Size	Spacing	No. 2:1	No. 3:1	No. 4:1	Length	X	Y	Z	"b1" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
3 @ 9'	5'	#6	12"	8	19	29	31'-2"	0'-5¾"	4'-3½"	7'-2"	#6	12"	7	28'-9"	5'-7"	27'-6"	5'-0"
	6'			8	19	29	31'-5"	"	4'-4½"	7'-2½"			7	29'-0"	5'-10"	27'-9"	5'-3"
	7'			8	19	29	"	"	"	"			7	"	"	"	"
	8'			8	19	29	31'-6"	"	"	7'-3"			7	29'-1"	5'-11"	27'-10"	5'-4"
	9'			8	19	29	31'-10"	"	4'-5½"	7'-4"			7	29'-5"	6'-3"	28'-2"	5'-8"
	10'			8	19	29	32'-2"	"	4'-6½"	7'-5"			7	29'-9"	6'-7"	28'-6"	6'-0"
	11'			8	19	29	32'-4"	0'-5¾"	4'-6½"	7'-6"			7	29'-11"	6'-9"	28'-8"	6'-2"
3 @ 10'	5'	#6	11"	9	20	31	34'-3"	0'-6½"	4'-8"	7'-11"	#6	11"	9	32'-1"	3'-11"	30'-8"	3'-4"
	6'			9	20	31	34'-6"	"	4'-9"	7'-11½"			9	32'-4"	4'-2"	30'-11"	3'-7"
	7'			9	20	31	"	"	"	"			9	"	"	"	"
	8'			9	20	31	34'-7"	"	"	8'-0"			9	32'-5"	4'-3"	31'-0"	3'-8"
	9'			9	20	31	34'-11"	"	4'-10"	8'-1"			9	32'-9"	4'-7"	31'-4"	4'-0"
	10'			9	20	31	35'-3"	"	4'-11"	8'-2"			9	33'-1"	4'-11"	31'-8"	4'-4"
	11'			9	20	31	35'-5"	"	4'-11"	8'-3"			9	33'-3"	5'-1"	31'-10"	4'-6"
	12'			9	20	31	35'-7"	0'-6½"	4'-11"	8'-4"			9	33'-5"	5'-3"	32'-0"	4'-8"
3 @ 11'	6'	#7	12"	7	18	28	37'-10"	0'-7"	5'-2"	8'-9"	#7	12"	9	35'-4"	4'-11"	33'-10"	4'-3"
	7'			7	18	28	"	"	"	"			9	"	"	"	"
	8'			7	18	28	"	"	"	"			9	"	"	"	"
	9'			7	18	28	38'-2"	"	5'-3"	8'-10"			9	35'-8"	5'-3"	34'-2"	4'-7"
	10'			7	18	28	38'-6"	"	5'-4"	8'-11"			9	36'-0"	5'-7"	34'-6"	4'-11"
	11'			7	18	28	38'-8"	"	5'-4"	9'-0"			9	36'-2"	5'-9"	34'-8"	5'-1"
	12'			7	18	28	38'-10"	0'-7"	5'-4"	9'-1"			9	36'-4"	5'-11"	34'-10"	5'-3"
3 @ 12'	6'	#7	11"	8	19	30	40'-11"	0'-7¾"	5'-6½"	9'-6"	#7	11"	10	38'-8"	6'-11"	37'-0"	6'-3"
	7'			8	19	30	"	"	"	"			10	"	"	"	"
	8'			8	19	30	"	"	"	"			10	"	"	"	"
	9'			8	19	30	41'-3"	"	5'-7½"	9'-7"			10	39'-0"	7'-3"	37'-4"	6'-7"
	10'			8	19	30	41'-7"	"	5'-8½"	9'-8"			10	39'-4"	7'-7"	37'-8"	6'-11"
	11'			8	19	30	41'-9"	"	5'-8½"	9'-9"			10	39'-6"	7'-9"	37'-10"	7'-1"
	12'			8	19	30	41'-11"	0'-7¾"	5'-8½"	9'-10"			10	39'-8"	7'-11"	38'-0"	7'-3"

"b2" bars — BENT - See Diagrams below — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b3" bars (▼) — In Top of Bottom Slab - some bent down under Division Wall - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b2" Size	Spacing	No. 2:1	No. 3:1	No. 4:1	Length	X	Y	Z	"b3" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
3 @ 9'	5'	#6	12"	9	20	30	31'-3"	0'-6¼"	4'-2½"	7'-2"	#6	12"	7	28'-10"	5'-7"	27'-6"	5'-0"
	6'			9	20	30	31'-6"	"	4'-3½"	7'-2½"			7	29'-1"	5'-10"	27'-9"	5'-3"
	7'			9	20	30	"	"	"	[illegible]			7	"	"	"	"
	8'			9	20	30	31'-7"	"	"	7'-3"			7	29'-2"	5'-11"	27'-10"	5'-4"
	9'			9	20	30	31'-11"	"	4'-4½"	7'-4"			7	29'-6"	6'-3"	28'-2"	5'-8"
	10'			9	20	30	32'-2"	"	4'-5½"	7'-5"			7	29'-10"	6'-7"	28'-6"	6'-0"
	11'			9	20	30	32'-5"	0'-6¼"	4'-5½"	7'-6"			7	30'-0"	6'-9"	28'-8"	6'-2"
3 @ 10'	5'	#6	11"	10	21	32	34'-4"	0'-7"	4'-7"	7'-11"	#6	11"	9	32'-2"	3'-11"	30'-8"	3'-4"
	6'			10	21	32	34'-7"	"	4'-8"	7'-11½"			9	32'-5"	4'-2"	30'-11"	3'-7"
	7'			10	21	32	"	"	"	"			9	"	"	30'-11"	"
	8'			10	21	32	34'-8"	"	"	8'-0"			9	32'-6"	4'-3"	31'-0"	3'-8"
	9'			10	21	32	35'-0"	"	4'-9"	8'-1"			9	32'-10"	4'-7"	31'-4"	4'-0"
	10'			10	21	32	35'-4"	"	4'-10"	8'-2"			9	33'-2"	4'-11"	31'-8"	4'-4"
	11'			10	21	32	35'-6"	"	4'-10"	8'-3"			9	33'-4"	5'-1"	31'-10"	4'-6"
	12'			10	21	32	35'-8"	0'-7"	4'-10"	8'-4"			9	33'-6"	5'-3"	32'-0"	4'-8"
3 @ 11'	6'	#7	12"	8	19	29	37'-11"	0'-7½"	5'-1"	8'-9"	#7	12"	9	35'-5"	4'-11"	33'-10"	4'-3"
	7'			8	19	29	"	"	"	"			9	"	"	"	"
	8'			8	19	29	"	"	"	"			9	"	"	"	"
	9'			8	19	29	38'-3"	"	5'-2"	8'-10"			9	35'-9"	5'-3"	34'-2"	4'-7"
	10'			8	19	29	38'-7"	"	5'-3"	8'-11"			9	36'-1"	5'-7"	34'-6"	4'-11"
	11'			8	19	29	38'-9"	"	5'-3"	9'-0"			9	36'-3"	5'-9"	34'-8"	5'-1"
	12'			8	19	29	38'-11"	0'-7½"	5'-3"	9'-1"			9	36'-5"	5'-11"	34'-10"	5'-3"
3 @ 12'	6'	#7	11"	9	20	31	41'-0"	0'-8⅛"	5'-5½"	9'-6"	#7	11"	10	38'-9"	6'-11"	37'-0"	6'-3"
	7'			9	20	31	"	"	"	"			10	"	"	"	"
	8'			9	20	31	"	"	"	"			10	"	"	"	"
	9'			9	20	31	41'-4"	"	5'-6½"	9'-7"			10	39'-1"	7'-3"	37'-4"	6'-7"
	10'			9	20	31	41'-8"	"	5'-7½"	9'-8"			10	39'-5"	7'-7"	37'-8"	6'-11"
	11'			9	20	31	41'-10"	"	5'-7½"	9'-9"			10	39'-7"	7'-9"	37'-10"	7'-1"
	12'			9	20	31	42'-0"	0'-8⅛"	5'-7½"	9'-10"			10	39'-9"	7'-11"	38'-0"	7'-3"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" Size	Spacing	No. 2:1	No. 3:1	No. 4:1	Length	"c1" Size	Spacing	No. Req'd	Length Max.	Length Min.
3 @ 9'	5'	#7	12"	21	41	61	19'-6"	#7	12"	8	17'-0"	5'-9"
	6'			21	41	61	19'-8"			8	17'-2"	5'-11"
	7'			21	41	61	"			8	"	"
	8'			21	41	61	"			8	17'-3"	6'-0"
	9'			21	41	61	19'-10"			8	17'-6"	6'-3"
	10'			21	41	61	20'-0"			8	17'-9"	6'-6"
	11'			21	41	61	20'-0"			8	17'-10"	6'-7"
3 @ 10'	5'	#7	11"	21	43	67	21'-6"	#7	11"	10	20'-2"	6'-6"
	6'			21	43	67	21'-8"			10	20'-4"	6'-8"
	7'			21	43	67	"			10	"	"
	8'			21	43	67	"			10	20'-5"	6'-9"
	9'			21	43	67	21'-10"			10	20'-8"	7'-0"
	10'			21	43	67	22'-0"			10	20'-11"	7'-3"
	11'			21	43	67	"			10	21'-0"	7'-4"
	12'			21	43	67	"			10	21'-1"	7'-5"
3 @ 11'	6'	#7	12"	19	39	61	23'-8"	#7	12"	12	22'-3"	3'-6"
	7'			19	39	61	"			12	"	"
	8'			19	39	61	"			12	"	"
	9'			19	39	61	23'-10"			12	22'-6"	3'-9"
	10'			19	39	61	24'-0"			12	22'-9"	4'-0"
	11'			19	39	61	"			12	22'-10"	4'-1"
	12'			19	39	61	"			12	22'-11"	4'-2"
3 @ 12'	6'	#7	11"	19	41	65	25'-8"	#7	11"	14	25'-5"	4'-11"
	7'			19	41	65	"			14	"	"
	8'			19	41	65	"			14	"	"
	9'			19	41	65	25'-10"			14	25'-8"	5'-2"
	10'			19	41	65	26'-0"			14	25'-11"	5'-5"
	11'			21	43	67	"			12	22'-7"	5'-6"
	12'			21	43	67	"			12	22'-8"	5'-7"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Walls. "e" bars — Longitudinal in Bottom Slab of Barrel.

Length ("d" bars): Lengths vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"
Length ("d1" bars): Lengths vary - Ave. Lengths: 2:1 = 14'-2", 3:1 = 24'-6", 4:1 = 34'-10"
Length ("e" bars): Lengths vary - Ave. Lengths: 2:1 = 15'-2", 3:1 = 25'-6", 4:1 = 35'-10"

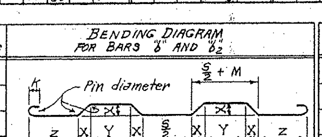
S	H	"d" Size	Spacing	No. Req'd	"d1" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd
3 @ 9'	5'	#4	12"	40	#4	12"	30	#4	12"	40
	6'			40			36			40
	7'			40			42			40
	8'			40			48			40
	9'			40			54			40
	10'			40			60			40
	11'			40			66			40
3 @ 10'	5'	#4	12"	43	#4	12"	30	#4	12"	43
	6'			43			36			43
	7'			43			42			43
	8'			43			48			43
	9'			43			54			43
	10'			43			60			43
	11'			43			66			43
	12'			43			72			43
3 @ 11'	6'	#4	12"	46	#4	12"	36	#4	12"	46
	7'			46			42			46
	8'			46			48			46
	9'			46			54			46
	10'			46			60			46
	11'			46			66			46
	12'			46			72			46
3 @ 12'	6'	#4	12"	49	#4	12"	36	#4	12"	49
	7'			49			42			49
	8'			49			48			49
	9'			49			54			49
	10'			49			60			49
	11'			49			66			49
	12'			49			72			49

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. "k1" bars (▼) — STRAIGHT — In Bottom of Headwall. "k2" bars (▼) — In Top of Headwall and Apron. (2 Each)

S	H	"f" Size	Spacing	No. 2:1	No. 3:1	No. 4:1	Length	"k1" Size	No. Req'd	Length	"k2" Size	No. Req'd	Length
3 @ 9'	5'	#4	12"	78	138	201	6'-4"	#6	3	30'-4"	#6	4	30'-11"
	6'	#4	12"	78	138	201	7'-4"		3	30'-8"		4	31'-3"
	7'	#4	10"	90	165	240	8'-4"		3	30'-8"		4	31'-3"
	8'	#5	12"	78	138	201	9'-4"		3	30'-9"		4	31'-4"
	9'	#5	10"	90	165	240	10'-4"		3	31'-1"		4	31'-8"
	10'	#6	12"	78	138	201	11'-4"		3	31'-5"		4	32'-0"
	11'	#6	11"	84	150	219	12'-4"		3	31'-7"		4	32'-2"
3 @ 10'	5'	#4	12"	78	138	201	6'-5"	#6	3	33'-6"	#6	4	34'-1"
	6'	#4	12"	78	138	201	7'-5"		3	33'-9"		4	34'-4"
	7'	#4	10"	90	165	240	8'-5"		3	33'-9"		4	34'-4"
	8'	#5	12"	78	138	201	9'-5"		3	33'-10"		4	34'-5"
	9'	#5	10"	90	165	240	10'-5"		3	34'-2"		4	34'-9"
	10'	#6	12"	78	138	201	11'-5"		3	34'-6"		4	35'-1"
	11'	#6	11"	84	150	219	12'-5"		3	34'-8"		4	35'-3"
	12'	#6	10"	90	165	240	13'-5"		3	34'-10"		4	35'-5"
3 @ 11'	6'	#4	12"	78	138	201	7'-7"	#6	3	36'-11"	#6	4	37'-6"
	7'	#4	11"	84	150	219	8'-7"		3	36'-11"		4	37'-6"
	8'	#5	12"	78	138	201	9'-7"		3	36'-11"		4	37'-6"
	9'	#5	10"	90	165	240	10'-7"		3	37'-3"		4	37'-10"
	10'	#6	12"	78	138	201	11'-7"		3	37'-7"		4	38'-2"
	11'	#6	11"	84	150	219	12'-7"		3	37'-9"		4	38'-4"
	12'	#6	9"	102	183	267	13'-7"		3	38'-0"		4	38'-7"
3 @ 12'	6'	#4	12"	78	138	201	7'-8"	#6	3	40'-0"	#6	4	40'-7"
	7'	#4	12"	78	138	201	8'-8"		3	40'-0"		4	40'-7"
	8'	#5	12"	78	138	201	9'-8"		3	40'-0"		4	40'-7"
	9'	#5	10"	90	166	240	10'-8"		3	40'-5"		4	41'-0"
	10'	#6	12"	78	138	201	11'-8"		3	40'-9"		4	41'-4"
	11'	#6	11"	84	150	219	12'-8"		3	40'-11"		4	41'-6"
	12'	#6	9"	102	183	267	13'-8"		3	41'-1"		4	41'-8"

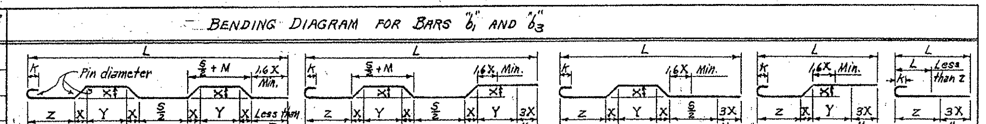
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3"



NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars.

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and b3 bars vary by 3'-9" for 12" spacing and 3'-5" for 11" spacing.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.
For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

CLASS S CONCRETE

Designed by:- W.C.H. 9-17-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 10-7-63 Checked by:-
Quantities by:- W.C.H. 12-6-63 Checked by:-

9-2-71 Revised K1 & K2 lengths

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW ~ SECTIONS "A" ONLY

9', 10', 11' AND 12' SPANS TRIPLES

2:1, 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

STANDARD DRAWING NO. R-315X-2

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

"a" bars: STRAIGHT — In Top and Bottom Slab of Barrel.
"b" bars: BENT – See Diagram below. — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" SIZE	"a" SPACING	"a" No. REQ'D	"a" LENGTH	"b" SIZE	"b" SPACING	"b" No. REQ'D	"b" LENGTH	W	X	Y	Z
0'-0" TO 5'-0" MAXIMUM	4 @ 4'	2'	#5	12"	120	19'-5"	#5	12"	59	20'-9"	2'-1"	0'-3"	2'-3"	3'-5½"
		3'			120	19'-5"			59	20'-9"	2'-1"	"	2'-3"	3'-5½"
		4'			120	19'-5"			59	20'-9"	2'-1"	"	2'-3"	3'-5½"
		5'			120	19'-5"			59	20'-9"	2'-1"	"	2'-3"	3'-5½"
		6'			120	19'-10"			59	21'-2"	2'-1"	0'-3"	2'-4"	3'-6½"
	4 @ 5'	3'	#6	12"	120	23'-6"	#5	12"	59	25'-0"	2'-7"	0'-3½"	2'-8"	4'-3"
		4'			120	23'-6"			59	25'-0"	2'-7"	"	2'-8"	4'-3"
		5'			120	23'-6"			59	25'-0"	2'-7"	"	2'-8"	4'-3"
		6'			120	24'-0"			59	25'-5"	2'-7"	"	2'-9"	4'-4"
		7'			120	24'-4"			59	25'-9"	2'-7"	0'-3½"	2'-10"	4'-4½"
	4 @ 6'	3'	#6	11"	132	27'-8"	#5	11"	65	29'-3"	3'-1½"	0'-4"	3'-1½"	5'-0"
		4'			132	27'-8"			65	29'-3"	3'-1½"	"	3'-1½"	5'-0"
		5'			132	27'-8"			65	29'-3"	3'-1½"	"	3'-1½"	5'-0"
		6'			132	28'-1"			65	29'-8"	3'-1½"	"	3'-2½"	5'-1"
		7'			132	28'-5"			65	30'-0"	3'-1½"	"	3'-3½"	5'-1½"
		8'			132	28'-6"			65	30'-1"	3'-1½"	0'-4"	3'-3½"	5'-2"
	4 @ 7'	4'	#6	12"	120	31'-10"	#6	12"	59	33'-9"	3'-7½"	0'-4½"	3'-7"	5'-9"
		5'			120	31'-10"			59	33'-9"	3'-7½"	"	3'-7"	5'-9"
		6'			120	32'-3"			59	34'-2"	3'-7½"	"	3'-8"	5'-10"
		7'			120	32'-7"			59	34'-6"	3'-7½"	"	3'-9"	5'-10½"
		8'			120	32'-8"			59	34'-7"	3'-7½"	"	3'-9"	5'-11"
		9'			120	33'-1"			59	35'-0"	3'-7½"	0'-4½"	3'-10"	6'-0"
	4 @ 8'	4'	#6	11"	132	36'-0"	#6	11"	65	38'-0"	4'-1½"	0'-5"	4'-0"	6'-7"
		5'			132	36'-5"			65	38'-5"	4'-1½"	"	4'-1"	6'-8"
		6'			132	36'-5"			65	38'-5"	4'-1½"	"	4'-1"	6'-8"
		7'			132	36'-9"			65	38'-9"	4'-1½"	"	4'-2"	6'-8½"
		8'			132	36'-10"			65	38'-10"	4'-1½"	"	4'-2"	6'-9"
		9'			132	37'-3"			65	39'-3"	4'-1½"	"	4'-3"	6'-10"
		10'			132	37'-8"			65	39'-8"	4'-1½"	0'-5"	4'-4"	6'-11"
	4 @ 9'	5'	⊛ #6	11"	264	21'-3"	⊛ #6	11"	130	22'-4"	4'-8"	0'-5½"	4'-6"	7'-5"
		6'			264	21'-5"			130	22'-6"	4'-8"	"	4'-7"	7'-5½"
		7'			264	21'-5"			130	22'-6"	4'-8"	"	4'-7"	7'-5½"
		8'			264	21'-6"			130	22'-6"	4'-8"	"	4'-7"	7'-6"
		9'			264	21'-8"			130	22'-9"	4'-8"	"	4'-8"	7'-7"
		10'			264	21'-11"			130	22'-11"	4'-8"	"	4'-9"	7'-8"
		11'			264	22'-0"			130	23'-0"	4'-8"	0'-5½"	4'-9"	7'-9"
	4 @ 10'	5'	⊛ #7	12"	240	23'-6"	⊛ #6	12"	118	24'-5"	5'-2"	0'-6"	4'-11"	8'-3"
		6'			240	23'-8"			118	24'-7"	5'-2"	"	5'-0"	8'-3½"
		7'			240	23'-8"			118	24'-7"	5'-2"	"	5'-0"	8'-3½"
		8'			240	23'-9"			118	24'-8"	5'-2"	"	5'-0"	8'-4"
		9'			240	23'-11"			118	24'-10"	5'-2"	"	5'-1"	8'-5"
		10'			240	24'-2"			118	25'-1"	5'-2"	"	5'-2"	8'-6"
		11'			240	24'-3"			118	25'-2"	5'-2"	"	5'-2"	8'-7"
		12'			240	24'-4"			118	25'-3"	5'-2"	0'-6"	5'-2"	8'-8"
	4 @ 11'	6'	⊛ #7	11"	264	25'-10"	⊛ #6	11"	130	26'-9"	5'-8"	0'-6½"	5'-5½"	9'-1"
		7'			264	25'-10"			130	26'-9"	5'-8"	"	5'-5½"	9'-1"
		8'			264	25'-10"			130	26'-9"	5'-8"	"	5'-5½"	9'-1"
		9'			264	26'-0"			130	27'-0"	5'-8"	"	5'-6½"	9'-2"
		10'			264	26'-3"			130	27'-2"	5'-8"	"	5'-7½"	9'-3"
		11'			264	26'-4"			130	27'-3"	5'-8"	"	5'-7½"	9'-4"
		12'			264	26'-5"			130	27'-4"	5'-8"	0'-6½"	5'-7½"	9'-5"
	4 @ 12'	6'	⊛ #7	11"	264	27'-11"	⊛ #6	11"	130	28'-11"	6'-3"	0'-7"	5'-10½"	9'-10"
		7'			264	27'-11"			130	28'-11"	6'-3"	"	5'-10½"	9'-10"
		8'			264	27'-11"			130	28'-11"	6'-3"	"	5'-10½"	9'-10"
		9'			264	28'-1"			130	29'-2"	6'-3"	"	5'-11½"	9'-11"
		10'			264	28'-4"			130	29'-4"	6'-3"	"	6'-0½"	10'-0"
		11'			264	28'-5"			130	29'-5"	6'-3"	"	6'-0½"	10'-1"
		12'			264	28'-6"			130	29'-6"	6'-3"	0'-7"	6'-0½"	10'-2"

"b_2" bars: BENT – See Diagram below. — In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"c" bars: STRAIGHT — In Top and Bottom Slab of Barrel. Alt. with "b" and "b_2" bars.

S	H	"b_2" SIZE	SPACING	No. REQ'D	LENGTH	W	X	Y	Z	"c" SIZE	SPACING	No. REQ'D	LENGTH
4 @ 4'	2'	#5	12"	59	20'-8"	2'-1"	0'-2½"	2'-4"	3'-5½"	#5	12"	120	14'-6"
	3'			59	20'-8"	2'-1"	"	2'-4"	3'-5½"			120	14'-6"
	4'			59	20'-8"	2'-1"	"	2'-4"	3'-5½"			120	14'-6"
	5'			59	20'-8"	2'-1"	"	2'-4"	3'-5½"			120	14'-6"
	6'			59	21'-1"	2'-1"	0'-2½"	2'-5"	3'-6½"			120	14'-9"
4 @ 5'	3'	#5	12"	59	24'-11"	2'-7"	0'-3"	2'-9"	4'-3"	#6	12"	120	17'-7"
	4'			59	24'-11"	2'-7"	"	2'-9"	4'-3"			120	17'-7"
	5'			59	24'-11"	2'-7"	"	2'-9"	4'-3"			120	17'-7"
	6'			59	25'-4"	2'-7"	"	2'-10"	4'-4"			120	17'-10"
	7'			59	25'-8"	2'-7"	0'-3"	2'-11"	4'-4½"			120	18'-1"
4 @ 6'	3'	#5	11"	65	29'-2"	3'-1½"	0'-3½"	3'-2½"	5'-0"	#6	11"	132	20'-9"
	4'			65	29'-2"	3'-1½"	"	3'-2½"	5'-0"			132	20'-9"
	5'			65	29'-2"	3'-1½"	"	3'-2½"	5'-0"			132	20'-9"
	6'			65	29'-7"	3'-1½"	"	3'-3½"	5'-1"			132	21'-0"
	7'			65	29'-11"	3'-1½"	"	3'-4½"	5'-1½"			132	21'-3"
	8'			65	30'-0"	3'-1½"	0'-3½"	3'-4½"	5'-2"			132	21'-3"
4 @ 7'	4'	#6	12"	59	33'-8"	3'-7½"	0'-4½"	3'-7½"	5'-9"	#6	12"	120	23'-10"
	5'			59	33'-8"	3'-7½"	"	3'-7½"	5'-9"			120	23'-10"
	6'			59	34'-1"	3'-7½"	"	3'-8½"	5'-10"			120	24'-1"
	7'			59	34'-5"	3'-7½"	"	3'-9½"	5'-10½"			120	24'-4"
	8'			59	34'-6"	3'-7½"	"	3'-9½"	5'-11"			120	24'-4"
	9'			59	34'-11"	3'-7½"	0'-4½"	3'-10½"	6'-0"			120	24'-7"
4 @ 8'	4'	#6	11"	65	38'-0"	4'-1½"	0'-5"	4'-0"	6'-7"	#6	11"	132	26'-11"
	5'			65	38'-5"	4'-1½"	"	4'-1"	6'-8"			132	27'-2"
	6'			65	38'-5"	4'-1½"	"	4'-1"	6'-8"			132	27'-2"
	7'			65	38'-9"	4'-1½"	"	4'-2"	6'-8½"			132	27'-5"
	8'			65	38'-10"	4'-1½"	"	4'-2"	6'-9"			132	27'-5"
	9'			65	39'-3"	4'-1½"	"	4'-3"	6'-10"			132	27'-8"
	10'			65	39'-8"	4'-1½"	0'-5"	4'-4"	6'-11"			132	27'-11"
4 @ 9'	5'	⊛ #6	11"	130	22'-4"	4'-8"	0'-5½"	4'-6"	7'-5"	#6	11"	132	30'-3"
	6'			130	22'-6"	4'-8"	"	4'-7"	7'-5½"			132	30'-6"
	7'			130	22'-6"	4'-8"	"	4'-7"	7'-5½"			132	30'-6"
	8'			130	22'-6"	4'-8"	"	4'-7"	7'-6"			132	30'-6"
	9'			130	22'-9"	4'-8"	"	4'-8"	7'-7"			132	30'-9"
	10'			130	22'-11"	4'-8"	"	4'-9"	7'-8"			132	31'-0"
	11'			130	23'-0"	4'-8"	0'-5½"	4'-9"	7'-9"			132	31'-0"
4 @ 10'	5'	⊛ #6	12"	118	24'-5"	5'-2"	0'-6"	4'-11"	8'-3"	#7	12"	120	33'-5"
	6'			118	24'-7"	5'-2"	"	5'-0"	8'-3½"			120	33'-8"
	7'			118	24'-7"	5'-2"	"	5'-0"	8'-3½"			120	33'-8"
	8'			118	24'-8"	5'-2"	"	5'-0"	8'-4"			120	33'-8"
	9'			118	24'-10"	5'-2"	"	5'-1"	8'-5"			120	33'-11"
	10'			118	25'-1"	5'-2"	"	5'-2"	8'-6"			120	34'-2"
	11'			118	25'-2"	5'-2"	"	5'-2"	8'-7"			120	34'-2"
	12'			118	25'-3"	5'-2"	0'-6"	5'-2"	8'-8"			120	34'-2"
4 @ 11'	6'	⊛ #6	11"	130	26'-10"	5'-8"	0'-7"	5'-4½"	9'-1"	#7	11"	132	36'-9"
	7'			130	26'-10"	5'-8"	"	5'-4½"	9'-1"			132	36'-9"
	8'			130	26'-10"	5'-8"	"	5'-4½"	9'-1"			132	36'-9"
	9'			130	27'-0"	5'-8"	"	5'-5½"	9'-2"			132	37'-0"
	10'			130	27'-3"	5'-8"	"	5'-6½"	9'-3"			132	37'-3"
	11'			130	27'-4"	5'-8"	"	5'-6½"	9'-4"			132	37'-3"
	12'			130	27'-5"	5'-8"	0'-7"	5'-6½"	9'-5"			132	37'-3"
4 @ 12'	6'	⊛ #6	11"	130	29'-0"	6'-3"	0'-8"	5'-8½"	9'-10"	#7	11"	132	39'-10"
	7'			130	29'-0"	6'-3"	"	5'-8½"	9'-10"			132	39'-10"
	8'			130	29'-0"	6'-3"	"	5'-8½"	9'-10"			132	39'-10"
	9'			130	29'-3"	6'-3"	"	5'-9½"	9'-11"			132	40'-1"
	10'			130	29'-5"	6'-3"	"	5'-10½"	10'-0"			132	40'-4"
	11'			130	29'-6"	6'-3"	"	5'-10½"	10'-1"			132	40'-4"
	12'			130	29'-7"	6'-3"	0'-8"	5'-10½"	10'-2"			132	40'-4"

"d" bars: STRAIGHT — Longitudinal in Top Slab of Barrel.
"d_1" bars: STRAIGHT — Longitudinal in Sidewalls and Division Walls.
"e" bars: STRAIGHT — Longitudinal in Bottom Slab of Barrel.
"f" bars: STRAIGHT — Verticals in Sidewalls and Division Walls.
"k" bars: STRAIGHT — 2 in Top of Headwalls and Aprons - Each.

S	H	"d" SIZE	SPACING	No. REQ'D	LENGTH	"d_1" SIZE	SPACING	No. REQ'D	LENGTH	"e" SIZE	SPACING	No. REQ'D	LENGTH	"f" SIZE	SPACING	No. REQ'D	LENGTH	"k" SIZE	No. REQ'D	LENGTH
4 @ 4'	2'	#5	12"	30	2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap)	#4	12"	16	2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap)	#4	12"	30	2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap)	#4	12"	480	2'-10"	#5	8	19'-11"
	3'			30				24				30				480	3'-10"		8	"
	4'			30				32				30				480	4'-10"		8	"
	5'			30				40				30				480	5'-10"		8	"
	6'			30				48				30				480	6'-10"		8	20'-4"
4 @ 5'	3'	#5	11½"	34		#4	12"	24		#4	12"	34		#4	12"	480	3'-11"	#6	8	24'-1"
	4'			34				32				34				480	4'-11"		8	"
	5'			34				40				34				480	5'-11"		8	"
	6'			34				48				34				480	6'-11"		8	24'-6"
	7'			34				56				34				480	7'-11"		8	24'-10"
4 @ 6'	3'	#5	11½"	38		#4	12"	24		#4	12"	38		#4	12"	480	4'-0"	#6	8	28'-2"
	4'			38				32				38				480	5'-0"		8	"
	5'			38				40				38				480	6'-0"		8	"
	6'			38				48				38				480	7'-0"		8	28'-8"
	7'			38				56				38				480	8'-0"		8	29'-0"
	8'			38				64				38			10"	576	9'-0"		8	29'-1"
4 @ 7'	4'	#5	11½"	44		#4	12"	32		#4	12"	42		#4	12"	480	5'-1"	#6	8	32'-4"
	5'			44				40				42				480	6'-1"		8	"
	6'			44				48				42				480	7'-1"		8	32'-9"
	7'			44				56				42				480	8'-1"		8	33'-2"
	8'			44				64				42			10"	576	9'-1"		8	33'-3"
	9'			44				72				42		#5	12"	480	10'-1"		8	33'-8"
4 @ 8'	4'	#5	11½"	48		#4	12"	32		#4	12"	46		#4	12"	480	5'-2"	#6	8	36'-6"
	5'			48				40				46				480	6'-2"		8	36'-11"
	6'			48				48				46				480	7'-2"		8	"
	7'			48				56				46				480	8'-2"		8	37'-3"
	8'			48				64				46			10"	576	9'-2"		8	37'-4"
	9'			48				72				46		#5	12"	480	10'-2"		8	37'-9"
	10'			48				80				46			11"	528	11'-2"		8	38'-3"
4 @ 9'	5'	#5	11½"	55		#4	12"	40		#4	12"	53		#4	12"	480	6'-3"	⊛ #6	16	21'-7"
	6'			55				48				53				480	7'-3"		16	21'-9"
	7'			55				56				53				480	8'-3"		16	"
	8'			55				64				53			10"	576	9'-3"		16	21'-10"
	9'			55				72				53		#5	12"	480	10'-3"		16	22'-0"
	10'			55				80				53			11"	528	11'-3"		16	22'-3"
	11'			55				88				53			10"	576	12'-3"		16	22'-4"
4 @ 10'	5'	#5	11½"	59		#4	12"	40		#4	12"	57		#4	12"	480	6'-4"	⊛ #7	16	23'-10"
	6'			59				48				57				480	7'-4"		16	24'-0"
	7'			59				56				57				480	8'-4"		16	"
	8'			59				64				57			10"	576	9'-4"		16	"
	9'			59				72				57		#5	12"	480	10'-4"		16	24'-3"
	10'			59				80				57			11"	528	11'-4"		16	24'-5"
	11'			59				88				57			10"	576	12'-4"		16	24'-6"
	12'			59				96				57		#6	12"	480	13'-4"		16	24'-7"
4 @ 11'	6'	#5	11½"	63		#4	12"	48		#4	12"	61		#4	12"	480	7'-5"	⊛ #7	16	26'-1"
	7'			63				56				61				480	8'-5"		16	"
	8'			63				64				61			10"	576	9'-5"		16	"
	9'			63				72				61		#5	12"	480	10'-5"		16	26'-4"
	10'			63				80				61			11"	528	11'-5"		16	26'-6"
	11'			63				88				61			10"	576	12'-5"		16	26'-7"
	12'			63				96				61		#6	12"	480	13'-5"		16	26'-8"
4 @ 12'	6'	#5	11½"	67		#4	12"	48		#4	12"	65		#4	12"	480	7'-7"	⊛ #7	16	28'-2"
	7'			67				56				65				480	8'-7"		16	"
	8'			67				64				65			10"	576	9'-7"		16	"
	9'			67				72				65		#5	12"	480	10'-7"		16	28'-4"
	10'			67				80				65			11"	528	11'-7"		16	28'-7"
	11'			67				88				65			10"	576	12'-7"		16	28'-8"
	12'			67				96				65		#6	12"	480	13'-7"		16	28'-9"

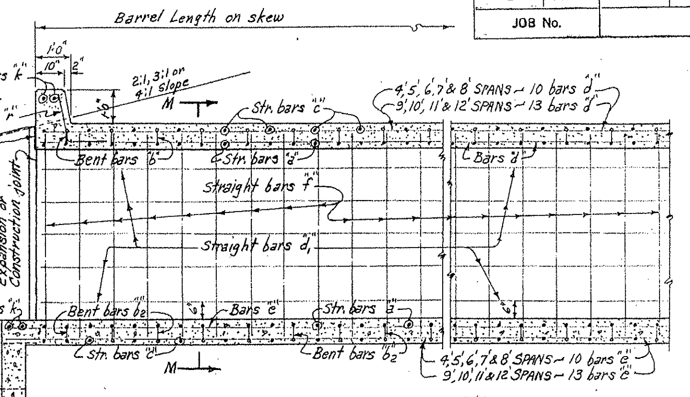
NOTE:- The "a", "b", "b_2" and "c" bars are to be placed parallel with the headwalls, spacing to be parallel with the barrel.

⊛ These "a", "b", "b_2" and "k" bars are to be spliced at center of middle division wall to make a full length bar. Lap #6 bars 2'-0" min. and #7 bars 2'-4" min.

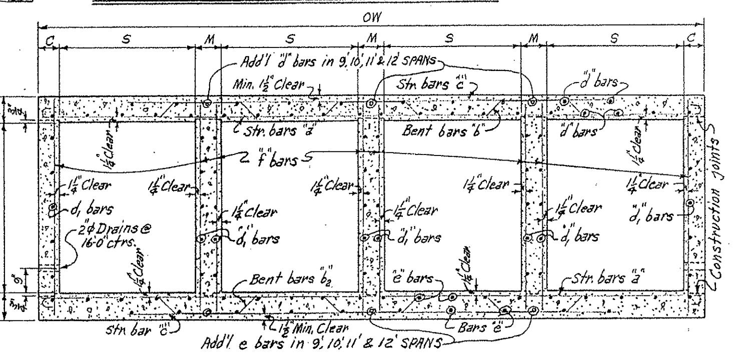
DIMENSIONS — QUANTITIES

MAX. DESIGN DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	Sq.Ft. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONC. PER LIN. FT. OF BARREL Cu.Yd.	REINFORCING STEEL PER LIN. FT. OF BARREL LB.	ADDITIONAL PER LONG. LAP LB.	ADDITIONAL TWO HEADWALLS & APRONS LB.
5'-0"	4 @ 4'	2'	32	19'-0"	6½"	6"	8"	6"	3'-0½"	19'-8"	20'-2½"	0.955	191.11	90.56	270.84
		3'	48	19'-0"		6"	8"		4'-0½"	"	"	1.066	201.80	97.24	270.84
		4'	64	19'-0"		6"	8"		5'-0½"	"	"	1.177	212.48	103.92	270.84
		5'	80	19'-0"		6"	8"		6'-0½"	"	"	1.289	223.17	110.60	270.84
		6'	96	19'-5"		7"	9"		7'-0½"	20'-1¼"	20'-7¾"	1.508	236.12	117.28	279.31
	4 @ 5'	3'	60	23'-0"	7"	6"	8"	6½"	4'-1½"	23'-9¾"	24'-4¼"	1.292	270.61	107.53	419.97
		4'	80	23'-0"		6"	8"		5'-1½"	"	"	1.403	281.30	114.21	419.97
		5'	100	23'-0"		6"	8"		6'-1½"	"	"	1.514	291.99	120.89	419.97
		6'	120	23'-5"		7"	9"		7'-1½"	24'-2¾"	24'-9¼"	1.735	305.80	127.57	419.98
		7'	140	23'-9"		7½"	10"		8'-1½"	24'-7"	25'-1¼"	1.962	318.94	134.25	423.98
	4 @ 6'	3'	72	27'-0"	7½"	6"	8"	7"	4'-2½"	27'-11⅜"	28'-5⅜"	1.542	327.56	117.83	485.86
		4'	96	27'-0"		6"	8"		5'-2½"	"	"	1.653	338.25	124.51	485.86
		5'	120	27'-0"		6"	8"		6'-2½"	"	"	1.764	348.94	131.19	485.86
		6'	144	27'-5"		7"	9"		7'-2½"	28'-4⅝"	28'-11"	1.986	362.76	137.87	491.87
		7'	168	27'-9"		7½"	10"		8'-2½"	28'-8¾"	29'-3¼"	2.214	376.11	144.55	495.87
		8'	192	27'-10"		8"	10"		9'-2½"	28'-9¾"	29'-4¼"	2.381	396.88	151.23	496.87
	4 @ 7'	4'	112	31'-0"	8"	6"	8"	7¾"	5'-3¾"	32'-1⅛"	32'-7½"	1.951	390.97	138.28	562.20
		5'	140	31'-0"		6"	8"		6'-3¾"	"	"	2.063	401.66	144.96	562.20
		6'	168	31'-5"		7"	9"		7'-3¾"	32'-6¼"	33'-0¾"	2.286	415.60	151.64	567.20
		7'	196	31'-9"		7½"	10"		8'-3¾"	32'-10½"	33'-5"	2.516	429.04	158.32	572.21
		8'	224	31'-10"		8"	10"		9'-3¾"	32'-11½"	33'-6"	2.683	449.94	165.00	573.21
		9'	252	32'-3"		9"	11"		10'-3¾"	33'-4⅝"	33'-11"	2.984	489.93	171.68	578.22
	4 @ 8'	4'	128	35'-0"	8½"	6"	8"	8½"	5'-5"	36'-2⅞"	36'-9⅛"	2.281	460.49	148.57	635.98
		5'	160	35'-5"		7"	9"		6'-5"	36'-8"	37'-2½"	2.491	474.73	155.25	640.98
		6'	192	35'-5"		7"	9"		7'-5"	"	"	2.618	485.42	161.93	640.98
		7'	224	35'-9"		7½"	10"		8'-5"	37'-0⅛"	37'-6½"	2.848	499.11	168.61	644.99
		8'	256	35'-10"		8"	10"		9'-5"	37'-1⅛"	37'-7½"	3.016	520.14	175.29	645.99
		9'	288	36'-3"		9"	11"		10'-5"	37'-6⅜"	38'-0¾"	3.319	555.08	181.97	651.00
		10'	320	36'-8"		10"	12"		11'-5"	37'-11½"	38'-6"	3.652	580.79	188.65	657.01
	4 @ 9'	5'	180	39'-5"	9"	7"	9"	9"	6'-6"	40'-9¾"	41'-4¼"	2.823	537.67	173.26	744.70
		6'	216	39'-9"		7½"	10"		7'-6"	41'-1¾"	41'-8¼"	3.042	551.37	179.94	748.70
		7'	252	39'-9"		7½"	10"		8'-6"	"	"	3.181	562.05	186.62	748.70
		8'	288	39'-10"		8"	10"		9'-6"	41'-2⅞"	41'-9¼"	3.349	583.17	193.30	750.71
		9'	324	40'-3"		9"	11"		10'-6"	41'-8"	42'-2½"	3.653	618.28	199.98	754.71
		10'	360	40'-8"		10"	12"		11'-6"	42'-1¼"	42'-7¾"	3.988	649.05	206.66	760.72
		11'	396	40'-10"		11"	12"		12'-6"	42'-3¼"	42'-9¾"	4.238	670.74	213.34	762.72
	4 @ 10'	5'	200	43'-5"	9½"	7"	9"	9½"	6'-7"	44'-11½"	45'-6"	3.179	635.62	183.56	1039.84
		6'	240	43'-9"		7½"	10"		7'-7"	45'-3½"	45'-10"	3.399	649.69	190.24	1040.30
		7'	280	43'-9"		7½"	10"		8'-7"	"	"	3.538	660.38	196.92	1040.30
		8'	320	43'-10"		8"	10"		9'-7"	45'-4½"	45'-11"	3.706	682.22	203.60	1040.30
		9'	360	44'-3"		9"	11"		10'-7"	45'-9¾"	46'-4¼"	4.072	717.32	210.28	1048.47
		10'	400	44'-8"		10"	12"		11'-7"	46'-2⅞"	46'-9½"	4.348	744.18	216.96	1053.92
		11'	440	44'-10"		11"	12"		12'-7"	46'-5"	46'-11½"	4.598	771.03	223.64	1056.65
		12'	480	45'-0"		12"	12"		13'-7"	46'-7"	47'-1½"	4.861	814.28	230.32	1059.37
	4 @ 11'	6'	264	47'-10"	10"	8"	10"	10½"	7'-8½"	49'-6⅜"	50'-0¾"	3.878	748.06	200.53	1134.93
		7'	308	47'-10"		8"	10"		8'-8½"	"	"	4.020	758.75	207.21	1134.93
		8'	352	47'-10"		8"	10"		9'-8½"	"	"	4.162	779.50	213.89	1134.93
		9'	396	48'-3"		9"	11"		10'-8½"	49'-11⅜"	50'-5¾"	4.470	815.34	220.57	1143.10
		10'	440	48'-8"		10"	12"		11'-8½"	50'-4⅜"	50'-11"	4.808	842.40	227.25	1148.55
		11'	484	48'-10"		11"	12"		12'-8½"	50'-6⅜"	51'-1"	5.059	869.44	233.93	1151.28
		12'	528	49'-0"		12"	12"		13'-8½"	50'-8¾"	51'-3¼"	5.323	912.96	240.61	1154.00
	4 @ 12'	6'	288	51'-10"	10½"	8"	10"	11½"	7'-10"	53'-8"	54'-2½"	4.371	802.33	210.82	1230.45
		7'	336	51'-10"		8"	10"		8'-10"	"	"	4.513	813.02	217.50	1230.45
		8'	384	51'-10"		8"	10"		9'-10"	"	"	4.655	833.95	224.18	1230.45
		9'	432	52'-3"		9"	11"		10'-10"	54'-1⅛"	54'-7½"	4.965	870.11	230.86	1235.90
		10'	480	52'-8"		10"	12"		11'-10"	54'-6⅝"	55'-0¾"	5.305	897.29	237.54	1244.07
		11'	528	52'-10"		11"	12"		12'-10"	54'-8¾"	55'-2¾"	5.557	924.98	244.22	1246.80
		12'	576	53'-0"		12"	12"		13'-10"	54'-10⅝"	55'-4¾"	5.821	968.34	250.90	1249.52

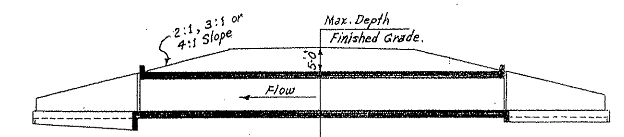
NOTE:- For details of wings and bar list see Drawing Nos. W-X152-1 or W-X152-2 and W-X15; W-X153-1 or W-X153-2 and W-X15; and W-X154-1 or W-X154-2 and W-X15.



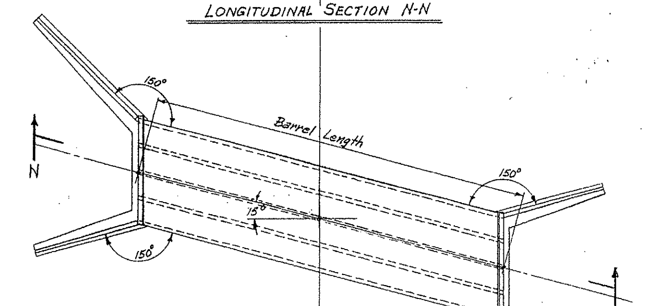
PART LONGITUDINAL SECTION N-N



TYPICAL SECTION M-M



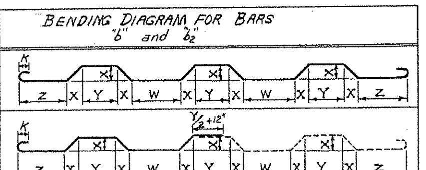
LONGITUDINAL SECTION N-N



LAYOUT OF QUADRUPLE BARREL CULVERT
15° SKEW LEFT FORWARD
15° Skew Right Forward is reversed.

BAR SIZE	PIN DIAM.	K	ADD FOR HOOKS	SPAN
#5	2½"	4¼"	0'-11½"	4,5,6,7 & 8
#6	3"	5"	1'-2" (2 Hooks)	4,5,6,7 & 8
#6	3"	5"	0'-7" (1 Hook)	9,10,11 & 12

BENDING DIAGRAM FOR BARS "b" and "b_2"

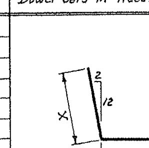


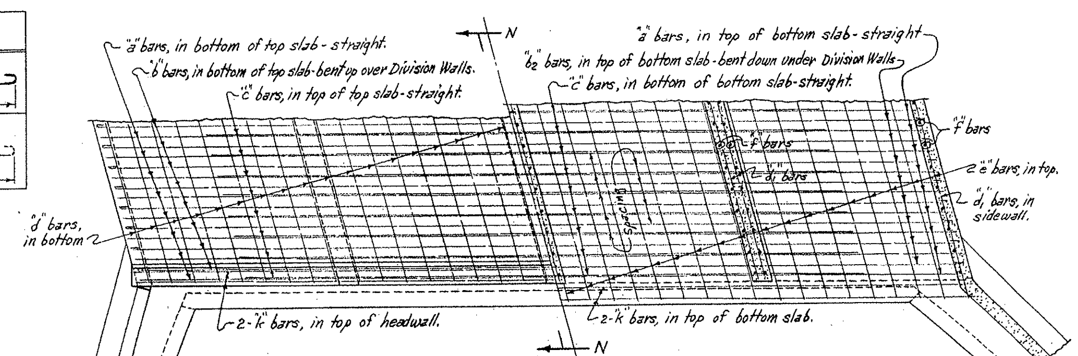
NOTE:- Dimensions are to centers of bars. ("b" and "b_2")

DOWEL BARS FOR TWO HEADWALLS

4 SPANS @	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"±	40	2'-5"	1'-2½"
5'	#4	12"±	48	2'-6"	1'-3"
6'	#4	12"±	56	2'-7"	1'-3½"
7'	#4	12"±	66	2'-8"	1'-4"
8'	#4	12"±	74	2'-9"	1'-4½"
9'	#4	12"±	82	2'-10"	1'-5"
10'	#4	12"±	92	2'-11"	1'-5½"
11'	#4	12"±	100	3'-0"	1'-6"
12'	#4	12"±	108	3'-1"	1'-6½"

Bars "r" Dowel bars in Headwalls.





TOP SLAB REINFORCING — BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

NOTE:- The "a", "b", "b_2" and "c" bars are to be placed parallel with the headwall. The "d" bars in top of top slab and "e" bars in bottom of bottom slab are not shown.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2 and W-X154-1 or W-X154-2. Also W-X15.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

15° SKEW

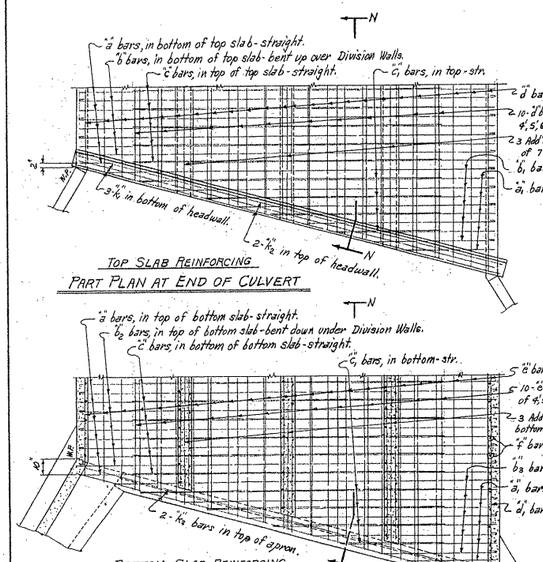
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUADRUPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-415X-0

Designed By:- W.C.H. 1-23-63. Checked By:- R.H.S. 5-21-63
Drawn By:- W.C.H. 9-4-63. Checked By:- RHS. 10-7-63
Quantities By:- W.C.H. 9-5-63. Checked By:- R.G. 1-8-64

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

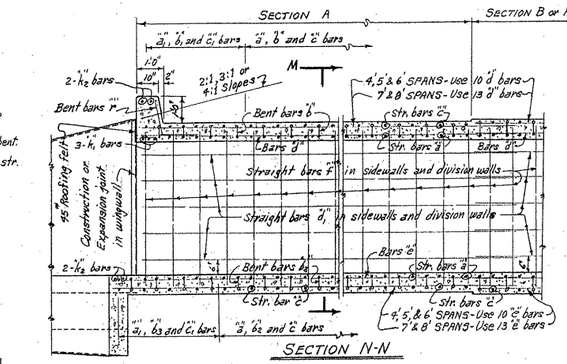
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.

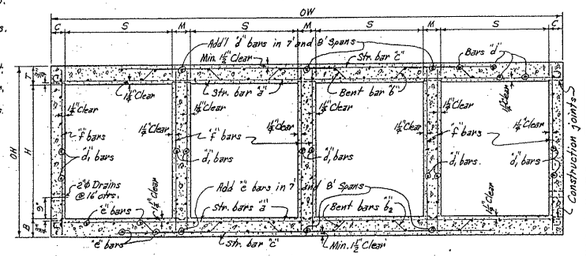


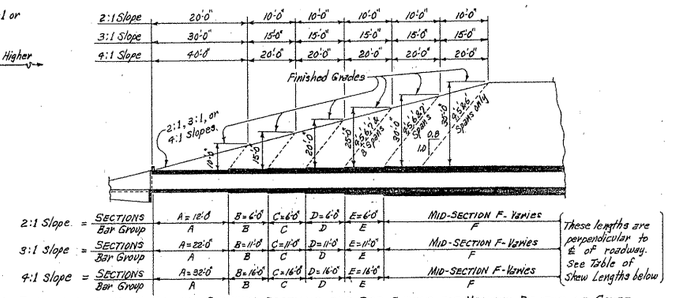
NOTE:- The "d", d₁ and "e" bars vary in length. They should be extended 1'-0" into SECTION "B".

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D.	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"	20	2'-4"	1'-2"	
5'	#4	12"	24	2'-5"	1'-2½"	
6'	#4	12"	28	2'-6"	1'-3"	
7'	#4	12"	33	2'-8"	1'-4"	
8'	#4	12"	37	2'-9"	1'-5"	







NOTE:- For Details and Bar Lists for Sections B thru F, see Barrel Drawing Nos. R-400X-X1 & R-400X-X2.

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D, & E	A	B, C, D & E	A	B, C, D & E
LENGTHS	12'-5"	6'-2½"	22'-9¾"	11'-4⅞"	33'-1½"	16'-6¾"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	B	C			D
25.0' to 29.5'	A	B	C	D		E
30.0' to 35.0'	A	B	C	D	E	F

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	2@C				D
25.0' to 29.5'	A	B	2@D			E
30.0' to 35.0'	A	2@C		2@E		F

MAX. DESIGN DEPTH OF COVER		BARREL DIMENSIONS												* QUANTITIES - ONE SECTION "A"					
	CLEAR SPANS		SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	CLASS S CONCRETE			REINFORCING STEEL		
												BARREL ONLY			BARREL, APRON AND HEADWALL		
D	S	H	A	OW	T	C	M	B	OH	RL	K	2:1	3:1	4:1	2:1	3:1	4:1
												CU.YD.	CU.YD.	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	4 @ 4'	2'	32	19'-0"	6"	6"	8"	6"	3'-0"	19'-8"	20'-2½"	11.50	21.09	30.67	2012	3433	4818
		3'	48	19'-0"		6"	8"		4'-0"	"	"	12.88	23.61	39.25	2157	3687	5183
		4'	64	19'-0"		6"	8"		5'-0"	"	"	14.25	26.14	38.08	2302	3941	5548
		5'	80	19'-0"		6"	8"		6'-0"	"	"	15.63	28.67	41.70	2447	4194	5913
		6'	96	19'-5"		7"	9"		7'-0"	20'-1½"	20'-7¾"	18.85	33.65	48.96	2615	4486	6331
	4 @ 5'	3'	60	23'-0"	6"	6"	8"	6½"	4'-1"	23'-9¾"	24'-4½"	15.60	28.60	41.60	2752	4672	6634
		4'	80	23'-0"		6"	8"		5'-1"	"	"	16.97	31.13	45.28	2898	4926	6999
		5'	100	23'-0"		6"	8"		6'-1"	"	"	18.35	33.66	48.96	3043	5180	7364
		6'	120	23'-5"		7"	9"		7'-1"	24'-2⅝"	24'-9¾"	21.10	38.69	56.28	3218	5537	7907
		7'	140	23'-9"		7½"	10"		8'-1"	24'-7"	25'-1½"	23.90	43.83	63.77	3439	6316	9005
	4 @ 6'	3'	72	27'-0"	7"	6"	8"	7½"	4'-2⅛"	27'-1⅜"	28'-5⅝"	18.89	29.63	50.88	3502	6152	8752
		4'	96	27'-0"		6"	8"		5'-2⅛"	"	"	20.26	37.16	54.06	3647	6412	9117
		5'	120	27'-0"		6"	8"		6'-2⅛"	"	"	21.64	39.69	57.74	3792	6659	9648
		6'	144	27'-5"		7"	9"		7'-2⅛"	28'-4⅝"	28'-11"	24.40	44.76	65.09	3976	6975	9933
		7'	168	27'-9"		7½"	10"		8'-2⅛"	28'-8⅝"	29'-3⅝"	27.25	49.94	72.64	4462	7829	11,168
		8'	192	27'-10"		8"	10"		9'-2⅛"	28'-9⅝"	29'-4⅝"	29.08	53.74	78.17	4727	8311	11,871
	4 @ 7'	4'	112	31'-0"	7"	6"	8"	8½"	5'-4"	32'-1⅛"	32'-7½"	24.52	44.97	65.92	4660	8117	11,955
		5'	140	31'-0"		6"	8"		6'-4"	"	"	25.90	47.50	69.10	4805	8378	11,820
		6'	168	31'-5"	7¾"	7"	9"		7'-4"	32'-6⅛"	33'-0⅝"	28.63	52.62	76.55	4997	8645	12,232
		7'	196	31'-9"		7½"	10"		8'-4"	32'-10⅝"	33'-5"	31.54	57.84	84.14	5497	9577	13,554
		8'	224	31'-10"		8"	10"		9'-4"	32'-11½"	33'-6"	32.42	61.66	89.70	5765	10,069	14,263
		9'	252	32'-3"		9"	11"		10'-4"	33'-4⅝"	33'-11"	37.84	69.52	99.47	6088	10,689	15,151
	4 @ 8'	4'	128	35'-0"	8"	6"	8"	9¼"	5'-5⅝"	34'-2⅞"	36'-9⅝"	29.33	53.78	78.24	5399	9471	13,497
		5'	160	35'-5"		7"	9"		6'-5⅝"	34'-8"	37'-2⅝"	31.95	58.59	85.23	5596	9808	13,925
		6'	192	35'-5"		7"	9"		7'-5⅝"	"	"	33.52	61.48	89.44	5741	10,069	14291
		7'	224	35'-9"	8½"	7½"	10"		8'-5⅝"	37'-0⅝"	37'-4⅝"	36.39	66.74	97.09	6018	10,585	15,039
		8'	256	35'-10"		8"	10"		9'-5⅝"	37'-1⅛"	37'-7⅝"	38.48	70.57	102.65	6444	11,291	16,064
		9'	288	36'-3"		9"	11"		10'-5⅝"	37'-6⅝"	38'-0⅝"	42.25	77.49	112.72	6766	11,868	16,900
		10'	320	36'-5"		10"	12"		11'-5⅝"	37'-8⅝"	38'-6"	46.40	85.10	123.79	7454	13,054	18,606

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

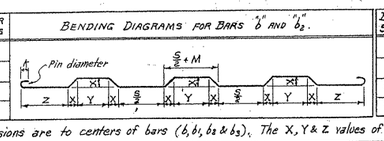
BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

SECTION & BAR GROUP	LENGTH OF SECTION	DEPTH OF COVER	CLEAR HEIGHT	"a" bars STRAIGHT In Top and Bottom Slab of Barrel.					"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel - (two of each Length.)				"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls-hooked. Alternate with "a" and "c" bars.								"b₁" bars BENT - See Diagrams below. In Bottom of Top Slab-may or may not be bent up over Division Walls-one end hooked. Alternate with a₁ and c or c₁ bars				
				SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
SECTION "A" & BAR GROUP "A"	4'-1" = 33-1/2"	0'-0" TO 10'-0" MAXIMUM	2'-0"			21	43	63	18'-9"			8	15'-0"	3'-9"		10	20	30	20'-1"	0'-2⅝"	2'-2½"	3'-4½"	#4	12"	5	17'-9"	6'-1"	16'-10"	5'-7"
			3'			21	43	63	"			8	"	"		10	20	30	"	"	"	"			5	"	"	"	"
			4'			21	43	63	"			8	"	"		10	20	30	"	"	"	"			5	"	"	"	"
			5'			21	43	63	"			8	"	"		10	20	30	"	"	"	"			5	"	"	"	"
			6'			21	43	63	19'-2"			8	15'-5"	4'-2"		10	20	30	20'-6"	0'-2⅝"	2'-3½"	3'-5⅝"			5	18'-2"	6'-6"	17'-8"	6'-0"
	4'-1" = 33-1/2"	0'-0" TO 10'-0" MAXIMUM	3'			23	45	67	22'-9"			10	19'-4"	5'-8"		10	21	33	24'-2"	0'-3⅝"	2'-7½"	4'-1⅛"	#4	11"	6	21'-11"	4'-9"	21'-0"	3'-11"
			4'			23	45	67	"			10	"	"		10	21	33	"	"	"	"			6	"	"	"	"
			5'			23	45	67	23'-2"			10	"	"		10	21	33	"	"	"	"			6	"	"	"	"
			6'			23	45	67	23'-6"			10	19'-9"	6'-1"		10	21	33	24'-7"	"	2'-8⅝"	4'-2⅝"			6	22'-8"	5'-0"	20'-9"	4'-8"
			7'			23	45	67	23'-6"			10	20'-1"	6'-5"		10	21	33	24'-11"	0'-3⅝"	2'-9½"	4'-2⅝"			6	22'-8"	5'-0"	20'-9"	4'-8"
	4'-1" = 33-1/2"	0'-0" TO 10'-0" MAXIMUM	3'			17	37	57	26'-9"			10	22'-9"	6'-9"		8	18	27	28'-9"	0'-3⅝"	3'-1"	4'-10⅝"			6	25'-10"	5'-3"	24'-9"	4'-9"
			4'			17	37	57	"			10	"	"		8	18	27	"	"	"	"			6	"	"	"	"
			5'			17	37	57	"			10	"	"		8	18	27	"	"	"	"			6	26'-3"	5'-8"	25'-2"	5'-2"
			6'			17	37	57	27'-2"			10	23'-2"	7'-2"		8	18	27	28'-8"	"	3'-2"	4'-11⅝"			6	26'-7"	6'-0"	25'-6"	5'-6"
			7'			17	37	57	27'-6"			10	23'-6"	7'-6"		8	18	27	29'-0"	"	3'-3"	4'-11⅝"			6	26'-8"	6'-1"	25'-7"	5'-7"
			8'			17	37	57	27'-7"			10	23'-7"	7'-7"		8	18	27	29'-1"	0'-3⅝"	3'-3"	5'-0⅝"			6	26'-9"	6'-1"	25'-7"	5'-7"
	4'-1" = 33-1/2"	0'-0" TO 10'-0" MAXIMUM	4'			19	43	65	30'-9"			14	27'-6"	6'-10"		9	20	31	32'-5"	0'-4⅝"	3'-5⅝"	5'-7"			8	30'-3"	5'-7"	29'-0"	5'-1"
			5'			19	43	65	"			14	"	"		9	20	31	"	"	"	"			8	"	"	"	"
			6'			19	43	65	31'-2"			14	27'-9"	7'-3"		9	20	31	32'-10"	"	3'-6⅝"	5'-8"			8	30'-8"	6'-0"	29'-5"	5'-6"
			7'			19	43	65	31'-6"			14	28'-1"	7'-7"		9	20	31	33'-2"	"	3'-6⅝"	5'-8⅝"			8	31'-0"	6'-4"	29'-9"	5'-6"
			8'			19	43	65	31'-7"			14	28'-2"	7'-8"		9	20	31	33'-3"	"	3'-7⅝"	5'-9"			8	31'-1"	6'-5"	29'-10"	5'-6"
			9'			19	43	65	32'-0"			14	28'-7"	8'-1"		9	20	31	33'-8"	0'-4⅝"	3'-8⅝"	5'-10"			8	31'-6"	6'-10"	30'-3"	5'-6"
	4'-1" = 33-1/2"	0'-0" TO 10'-0" MAXIMUM	4'			15	35	55	34'-9"			14	30'-9"	6'-9"		7	17	26	36'-9"	0'-5"	3'-10"	6'-4"			8	34'-3"	5'-4"	32'-9"	4'-9"
			5'			15	35	55	35'-2"			14	"	"		7	17	26	37'-2"	"	3'-11"	6'-5"			8	34'-8"	5'-9"	33'-2"	5'-2"
			6'			15	35	55	"			14	"	"		7	17	26	"	"	"	"			8	"	"	"	"
			7'			15	35	55	35'-6"			14	31'-6"	7'-6"		7	17	26	37'-6"	"	4'-0"	6'-5⅝"			8	35'-0"	6'-1"	33'-6"	5'-6"
			8'			15	35	55	35'-7"			14	31'-7"	7'-7"		7	17	26	37'-7"	"	4'-0"	6'-6"			8	35'-1"	6'-2"	33'-7"	5'-7"
			9'			15	35	55	36'-0"			14	32'-0"	8'-0"		7	17	26	38'-0"	"	4'-1"	6'-7"			8	35'-6"	6'-3"	34'-0"	5'-8"
			10'			15	35	55	36'-5"			14	32'-5"	8'-5"		7	17	26	38'-5"	0'-5"	4'-2"	6'-8"			8	35'-11"	7'-0"	34'-5"	5'-5"

SECTION & BAR GROUP	"b₂" bars STRAIGHT In Top of Bottom Slab bent down under Division Wall-hooked. Alternate with "a" and "c" bars.												"b₃" bars STRAIGHT In Top of Bottom Slab-may or may not be bent down under Division Walls-one end hooked. Alternate with b₁ & b₂ bars. (two of each Length)												"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars.								"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with b₁ & b₃ bars. (two of each Length)							
	SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.	SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH	SIZE	SPACING	No. REQ'D	LENGTH
SECTION "A" & BAR GROUP "A"	#4	12"	11	21	31	20'-1"	0'-2⅝"	2'-2½"	3'-4½"	#4	12"	5	17'-9"	6'-1"	16'-10"	5'-7"	#4	12"	21	43	63	14'-8"	#4	12"	6	12'-8"	5'-2"	#4	12"	30										
			11	21	31	"	"	"	"			5	"	"	"	"			21	43	63	"			6	"	"			30										
			11	21	31	"	"	"	"			5	"	"	"	"			21	43	63	"			6	"	"			30										
			11	21	31	"	"	"	"			5	"	"	"	"			21	43	63	"			6	"	"			30										
			11	21	31	20'-6"	0'-2⅝"	2'-3½"	3'-5⅝"			5	18'-2"	6'-6"	17'-8"	6'-0"			21	43	63	14'-3"			6	13'-0"	5'-6"			30										
	#4	11"	11	22	34	24'-2"	0'-3⅝"	2'-7½"	4'-1⅛"	#4	11"	6	21'-11"	4'-9"	21'-0"	3'-11"	#4	11"	23	45	67	17'-0"	#4	11"	8	16'-6"	6'-3"	#5	11"	34										
			11	22	34	"	"	"	"			6	"	"	"	"			23	45	67	"			8	"	"			34										
			11	22	34	"	"	"	"			6	"	"	"	"			23	45	67	"			8	"	"			34										
			11	22	34	24'-7"	"	2'-8⅝"	4'-2⅝"			6	22'-8"	5'-0"	20'-9"	4'-8"			23	45	67	17'-5"			8	16'-10"	6'-7"			34										
			11	22	34	24'-11"	0'-3⅝"	2'-9½"	4'-2⅝"			6	22'-8"	5'-0"	20'-9"	4'-8"			23	45	67	17'-6"			8	17'-1"	6'-10"			34										
	#4	11"	9	19	28	28'-9"	0'-3⅝"	3'-1"	4'-10⅝"	#5	13"	6	25'-10"	5'-3"	24'-9"	4'-9"	#5	13"	17	37	57	20'-5"			10	19'-5"	3'-5"	#6	13"	38										
			9	19	28	"	"	"	"			6	"	"	"	"			17	37	57	"			10	"	"			38										
			9	19	28	"	"	"	"			6	"	"	"	"			17	37	57	"			10	"	"			38										
			9	19	28	28'-9"	"	3'-1⅝"	4'-11⅝"			6	26'-3"	5'-8"	25'-2"	5'-2"			17	37	57	20'-3"			10	19'-9"	3'-9"			38										
			9	19	28	29'-1"	"	3'-2⅝"	4'-11⅝"			6	26'-7"	6'-0"	25'-6"	5'-6"			17	37	57	20'-6"			10	20'-0"	4'-0"			38										
			9	19	28	29'-2"	0'-3⅝"	3'-2⅝"	5'-0⅝"			6	26'-8"	6'-1"	25'-7"	5'-7"			17	37	57	20'-6"			10	20'-1"	4'-1"			38										
	#4	11"	10	21	32	32'-6"	0'-4⅝"	3'-6⅝"	5'-7"	#5	11"	8	30'-3"	5'-7"	29'-0"	5'-1"	#5	11"	21	45	67	23'-3"			10	20'-1"	6'-5"	#6	11"	45										
			10	21	32	"	"	"	"			8	"	"	"	"			21	45	67	"			10	"	"			45										
			10	21	32	32'-11"	"	3'-5⅝"	5'-8"			8	30'-8"	6'-0"	29'-5"	5'-6"			21	45	67	23'-6"			10	20'-5"	6'-9"			45										
			10	21	32	33'-3"	"	3'-6⅝"	5'-8⅝"			8	31'-0"	6'-4"	29'-9"	5'-6"			21	45	67	23'-6"			10	20'-8"	7'-0"			45										
			10	21	32	33'-8"	"	3'-6⅝"	5'-9"			8	31'-1"	6'-5"	29'-10"	5'-6"			21	45	67	23'-6"			10	20'-9"	7'-1"			45										
			10	21	32	33'-9"	0'-4⅝"	3'-7⅝"	5'-10"			8	31'-7"	6'-10"	30'-3"	5'-6"			21	45	67	23'-6"			10	21'-1"	7'-5"			45										
	#4	11"	8	18	27	36'-11"	0'-5⅝"	3'-8⅝"	6'-4"			8	34'-3"	5'-4"	32'-9"	4'-9"			17	37	57	26'-0"			10	22'-5"	6'-5"			49										
			8	18	27	37'-4"	"	3'-9⅝"	6'-5"			8	34'-10"	5'-9"	33'-2"	5'-2"			17	37.	57	26'-3"			10	22'-9"	6'-9"			49										
			8	18	27	"	"	"	"			8	"	"	"	"			17	37	57	"			10	"	"			49										
			8	18	27	37'-8"	"	3'-10⅝"	6'-5⅝"			8	35'-2"	6'-1"	33'-6"	5'-6"			17	37	57	26'-6"			10	23'-0"	7'-0"			49										
			8	18	27	37'-9"	"	3'-10⅝"	6'-6"			8	35'-3"	6'-2"	33'-7"	5'-7"			17	37	57	26'-6"			10	23'-1"	7'-1"			49										
			8	18	27	38'-2"	"	4'-1"	6'-7"			8	35'-8"	6'-3"	34'-0"	5'-8"			17	37	57	26'-9"			10	23'-5"	7'-3"			49										
			8	18	27	38'-7"	0'-5⅝"	4'-2⅝"	6'-8"			8	36'-1"	7'-0"	34'-5"	5'-8"			17	37	57	27'-0"			10	23'-9"	7'-9"			49										

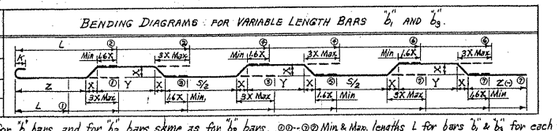
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10⅝"
#5	2½"	4½"	0'-11⅞"
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b₂"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5⅛"
#5	2½"	4½"	0'-6⅜"
#6	3"	5"	0'-7"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b₁" AND "b₃"



NOTE:- Dimensions are to centers of bars (b, b₁, b₂ & b₃). The X, Y & Z values of "b₁" bars are same as for "b" bars, and for "b₃" bars same as for "b₂" bars.

These bars are in the skewed portion of barrel only. The length of a₁ and c₁ bars and overall length L of b₁ and b₃ bars vary by 4'-0 for 15° spacing, 3'-9" for 12" spacing, and 3'-5" for 11" spacing.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.R.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or. W-X154-2. Also W-X15.
For Barrels of 4', 5' & 6' Spans, see Drawing No. R-400X-X1.
For Barrels of 7' & 8' Spans, see Drawing No. R-400X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
15° SKEW - SECTIONS "A" ONLY
4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUADRUPLES — OVER 5'-0" COVER
STANDARD DRAWING NO. R-415X-1

Designed by:- W.C.H. 10-2-62 Checked by:- R.H.S. 11-16-62
Drawn by:- W.C.H. 10-14-63 Checked by:-
Quantities by:- W.C.H. 12-6-63 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH

"a" bars: STRAIGHT. In Top and Bottom Slab of Barrel.

D (Depth of Cover)	S (Clear Span)	H (Clear Height)	a Size	a Spacing	a No. Req'd	a Length
0'-0" to 5'-0" Maximum	5 @ 4'	2'	#5	12"	120	24'-3"
		3'			120	24'-3"
		4'			120	24'-3"
		5'			120	24'-3"
		6'			120	24'-9"
	5 @ 5'	3'	#6	12"	120	29'-5"
		4'			120	29'-5"
		5'			120	29'-5"
		6'			120	29'-11"
		7'			120	30'-4"
	5 @ 6'	3'	#6	11"	132	34'-7"
		4'			132	34'-7"
		5'			132	34'-7"
		6'			132	35'-1"
		7'			132	35'-6"
		8'			132	35'-7"
	5 @ 7'	4'	⊛ #6	12"	240	20'-11"
		5'			240	20'-11"
		6'			240	21'-2"
		7'			240	21'-5"
		8'			240	21'-5"
		9'			240	21'-8"
	5 @ 8'	4'	⊛ #6	11"	264	23'-6"
		5'			264	23'-9"
		6'			264	23'-9"
		7'			264	24'-0"
		8'			264	24'-0"
		9'			264	24'-3"
		10'			264	24'-6"
	5 @ 9'	5'	⊛ #6	11"	264	26'-4"
		6'			264	26'-6"
		7'			264	26'-6"
		8'			264	26'-7"
		9'			264	26'-10"
		10'			264	27'-1"
		11'			264	27'-2"
	5 @ 10'	5'	⊛ #7	12"	240	29'-1"
		6'			240	29'-4"
		7'			240	29'-4"
		8'			240	29'-4"
		9'			240	29'-7"
		10'			240	29'-10"
		11'			240	29'-11"
		12'			240	30'-0"

"b" bars: BENT - See Diagram below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	Size	Spacing	No. Req'd	Length	W	X	Y	Z
5 @ 4'	2'	#5	12"	59	25'-10"	2'-1"	0'-3"	2'-3"	3'-5½"
	3'			59	25'-10"	2'-1"	"	2'-3"	3'-5½"
	4'			59	25'-10"	2'-1"	"	2'-3"	3'-5½"
	5'			59	25'-10"	2'-1"	"	2'-3"	3'-5½"
	6'			59	26'-4"	2'-1"	0'-3"	2'-4"	3'-6½"
5 @ 5'	3'	#5	12"	59	31'-1"	2'-7"	0'-3½"	2'-8"	4'-3½"
	4'			59	31'-1"	2'-7"	"	2'-8"	4'-3½"
	5'			59	31'-1"	2'-7"	"	2'-8"	4'-3½"
	6'			59	31'-7"	2'-7"	"	2'-9"	4'-4½"
	7'			59	32'-0"	2'-7"	0'-3½"	2'-10"	4'-5"
5 @ 6'	3'	#5	11"	65	36'-5"	3'-1½"	0'-4"	3'-1½"	5'-0"
	4'			65	36'-5"	3'-1½"	"	3'-1½"	5'-0"
	5'			65	36'-5"	3'-1½"	"	3'-1½"	5'-0"
	6'			65	36'-11"	3'-1½"	"	3'-2½"	5'-1"
	7'			65	37'-4"	3'-1½"	"	3'-3½"	5'-1½"
	8'			65	37'-5"	3'-1½"	0'-4"	3'-3½"	5'-2"
5 @ 7'	4'	⊛ #6	12"	118	22'-0"	3'-7½"	0'-4½"	3'-7"	5'-9"
	5'			118	22'-0"	3'-7½"	"	3'-7"	5'-9"
	6'			118	22'-3"	3'-7½"	"	3'-8"	5'-10"
	7'			118	22'-5"	3'-7½"	"	3'-9"	5'-10½"
	8'			118	22'-6"	3'-7½"	"	3'-9"	5'-11"
	9'			118	22'-9"	3'-7½"	0'-4½"	3'-10"	6'-0"
5 @ 8'	4'	⊛ #6	11"	130	24'-8"	4'-1½"	0'-5"	4'-0"	6'-7"
	5'			130	24'-11"	4'-1½"	"	4'-1"	6'-8"
	6'			130	24'-11"	4'-1½"	"	4'-1"	6'-8"
	7'			130	25'-1"	4'-1½"	"	4'-2"	6'-8½"
	8'			130	25'-2"	4'-1½"	"	4'-2"	6'-9"
	9'			130	25'-5"	4'-1½"	"	4'-3"	6'-10"
	10'			130	25'-8"	4'-1½"	0'-5"	4'-4"	6'-11"
5 @ 9'	5'	⊛ #6	11"	130	27'-6"	4'-8"	0'-5½"	4'-6"	7'-5½"
	6'			130	27'-9"	4'-8"	"	4'-7"	7'-6"
	7'			130	27'-9"	4'-8"	"	4'-7"	7'-6"
	8'			130	27'-9"	4'-8"	"	4'-7"	7'-6½"
	9'			130	28'-0"	4'-8"	"	4'-8"	7'-7½"
	10'			130	28'-3"	4'-8"	"	4'-9"	7'-8½"
	11'			130	28'-4"	4'-8"	0'-5½"	4'-9"	7'-9½"
5 @ 10'	5'	⊛ #6	12"	118	30'-3"	5'-2"	0'-6"	4'-11"	8'-3½"
	6'			118	30'-5"	5'-2"	"	5'-0"	8'-4"
	7'			118	30'-5"	5'-2"	"	5'-0"	8'-4"
	8'			118	30'-6"	5'-2"	"	5'-0"	8'-4½"
	9'			118	30'-9"	5'-2"	"	5'-1"	8'-5½"
	10'			118	31'-0"	5'-2"	"	5'-2"	8'-6½"
	11'			118	31'-1"	5'-2"	"	5'-2"	8'-7½"
	12'			118	31'-2"	5'-2"	0'-6"	5'-2"	8'-8½"

"b2" bars: BENT - See Diagram below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	Size	Spacing	No. Req'd	Length	W	X	Y	Z
5 @ 4'	2'	#5	12"	59	25'-8"	2'-1"	0'-2½"	2'-4"	3'-5½"
	3'			59	25'-8"	2'-1"	"	2'-4"	3'-5½"
	4'			59	25'-8"	2'-1"	"	2'-4"	3'-5½"
	5'			59	25'-8"	2'-1"	"	2'-4"	3'-5½"
	6'			59	26'-2"	2'-1"	0'-2½"	2'-5"	3'-6½"
5 @ 5'	3'	#5	12"	59	31'-0"	2'-7"	0'-3"	2'-9"	4'-3½"
	4'			59	31'-0"	2'-7"	"	2'-9"	4'-3½"
	5'			59	31'-0"	2'-7"	"	2'-9"	4'-3½"
	6'			59	31'-6"	2'-7"	"	2'-10"	4'-4½"
	7'			59	31'-11"	2'-7"	0'-3"	2'-11"	4'-5"
5 @ 6'	3'	#5	11"	65	36'-4"	3'-1½"	0'-3½"	3'-2½"	5'-0"
	4'			65	36'-4"	3'-1½"	"	3'-2½"	5'-0"
	5'			65	36'-4"	3'-1½"	"	3'-2½"	5'-0"
	6'			65	36'-10"	3'-1½"	"	3'-3½"	5'-1"
	7'			65	37'-3"	3'-1½"	"	3'-4½"	5'-1½"
	8'			65	37'-4"	3'-1½"	0'-3½"	3'-4½"	5'-2"
5 @ 7'	4'	⊛ #6	12"	118	21'-11"	3'-7½"	0'-4½"	3'-7½"	5'-9"
	5'			118	21'-11"	3'-7½"	"	3'-7½"	5'-9"
	6'			118	22'-2"	3'-7½"	"	3'-8½"	5'-10"
	7'			118	22'-5"	3'-7½"	"	3'-9½"	5'-10½"
	8'			118	22'-5"	3'-7½"	"	3'-9½"	5'-11"
	9'			118	22'-8"	3'-7½"	0'-4½"	3'-10½"	6'-0"
5 @ 8'	4'	⊛ #6	11"	130	24'-8"	4'-1½"	0'-5"	4'-0"	6'-7"
	5'			130	24'-11"	4'-1½"	"	4'-1"	6'-8"
	6'			130	24'-11"	4'-1½"	"	4'-1"	6'-8"
	7'			130	25'-1"	4'-1½"	"	4'-2"	6'-8½"
	8'			130	25'-2"	4'-1½"	"	4'-2"	6'-9"
	9'			130	25'-5"	4'-1½"	"	4'-3"	6'-10"
	10'			130	25'-8"	4'-1½"	0'-5"	4'-4"	6'-11"
5 @ 9'	5'	⊛ #6	11"	130	27'-6"	4'-8"	0'-5½"	4'-6"	7'-5½"
	6'			130	27'-9"	4'-8"	"	4'-7"	7'-6"
	7'			130	27'-9"	4'-8"	"	4'-7"	7'-6"
	8'			130	27'-9"	4'-8"	"	4'-7"	7'-6½"
	9'			130	28'-0"	4'-8"	"	4'-8"	7'-7½"
	10'			130	28'-3"	4'-8"	"	4'-9"	7'-8½"
	11'			130	28'-4"	4'-8"	0'-5½"	4'-9"	7'-9½"
5 @ 10'	5'	⊛ #6	12"	118	30'-3"	5'-2"	0'-6"	4'-11"	8'-3½"
	6'			118	30'-5"	5'-2"	"	5'-0"	8'-4"
	7'			118	30'-5"	5'-2"	"	5'-0"	8'-4"
	8'			118	30'-6"	5'-2"	"	5'-0"	8'-4½"
	9'			118	30'-9"	5'-2"	"	5'-1"	8'-5½"
	10'			118	31'-0"	5'-2"	"	5'-2"	8'-6½"
	11'			118	31'-1"	5'-2"	"	5'-2"	8'-7½"
	12'			118	31'-2"	5'-2"	0'-6"	5'-2"	8'-8½"

"c" bars: STRAIGHT. In Top and Bottom Slab of Barrel. Alt. with "b" and "b2" bars.
"d" bars: Longitudinal in Top Slab of Barrel.

S	H	c Size	c Spacing	c No. Req'd	c Length	d Size	d Spacing	d No. Req'd	d Length
5 @ 4'	2'	#5	12"	120	19'-4"	#5	12"	38	2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap)
	3'			120	19'-4"			38	
	4'			120	19'-4"			38	
	5'			120	19'-4"			38	
	6'			120	19'-8"			38	
5 @ 5'	3'	#6	12"	120	23'-5"	#5	11½"	44	
	4'			120	23'-5"			44	
	5'			120	23'-5"			44	
	6'			120	23'-9"			44	
	7'			120	24'-2"			44	
5 @ 6'	3'	#6	11"	132	27'-7"	#5	11½"	49	
	4'			132	27'-7"			49	
	5'			132	27'-7"			49	
	6'			132	27'-11"			49	
	7'			132	28'-3"			49	
	8'			132	28'-3"			49	
5 @ 7'	4'	#6	12"	120	31'-9"	#5	11½"	54	
	5'			120	31'-9"			54	
	6'			120	32'-1"			54	
	7'			120	32'-5"			54	
	8'			120	32'-5"			54	
	9'			120	32'-9"			54	
5 @ 8'	4'	#6	11"	132	35'-11"	#5	11½"	60	
	5'			132	36'-3"			60	
	6'			132	36'-3"			60	
	7'			132	36'-7"			60	
	8'			132	36'-7"			60	
	9'			132	36'-11"			60	
	10'			132	37'-3"			60	
5 @ 9'	5'	⊛ #6	11"	264	21'-2"	#5	11½"	69	
	6'			264	21'-4"			69	
	7'			264	21'-4"			69	
	8'			264	21'-4"			69	
	9'			264	21'-6"			69	
	10'			264	21'-8"			69	
	11'			264	21'-8"			69	
5 @ 10'	5'	⊛ #7	12"	240	23'-5"	#5	11½"	74	
	6'			240	23'-7"			74	
	7'			240	23'-7"			74	
	8'			240	23'-7"			74	
	9'			240	23'-9"			74	
	10'			240	23'-11"			74	
	11'			240	23'-11"			74	
	12'			240	23'-11"			74	

"d1" bars: Longitudinal in Sidewalls and Division Walls.
"e" bars: Longitudinal in Bottom Slab of Barrel.

S	H	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length
5 @ 4'	2'	#4	12"	20	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	38	2 @ 31'-6" for 60'-0" Length Barrel. (1'-3" Lap)
	3'			30				38	
	4'			40				38	
	5'			50				38	
	6'			60				38	
5 @ 5'	3'	#4	12"	30		#4	12"	43	
	4'			40				43	
	5'			50				43	
	6'			60				43	
	7'			70				43	
5 @ 6'	3'	#4	12"	30		#4	12"	48	
	4'			40				48	
	5'			50				48	
	6'			60				48	
	7'			70				48	
	8'			80				48	
5 @ 7'	4'	#4	12"	40		#4	12"	53	
	5'			50				53	
	6'			60				53	
	7'			70				53	
	8'			80				53	
	9'			90				53	
5 @ 8'	4'	#4	12"	40		#4	12"	58	
	5'			50				58	
	6'			60				58	
	7'			70				58	
	8'			80				58	
	9'			90				58	
	10'			100				58	
5 @ 9'	5'	#4	12"	50		#4	12"	67	
	6'			60				67	
	7'			70				67	
	8'			80				67	
	9'			90				67	
	10'			100				67	
	11'			110				67	
5 @ 10'	5'	#4	12"	50		#4	12"	72	
	6'			60				72	
	7'			70				72	
	8'			80				72	
	9'			90				72	
	10'			100				72	
	11'			110				72	
	12'			120				72	

"f" bars: STRAIGHT. Verticals in Sidewalls and Division Walls.
"k" bars: STRAIGHT. 2 in Top of Headwalls and Aprons - Each.

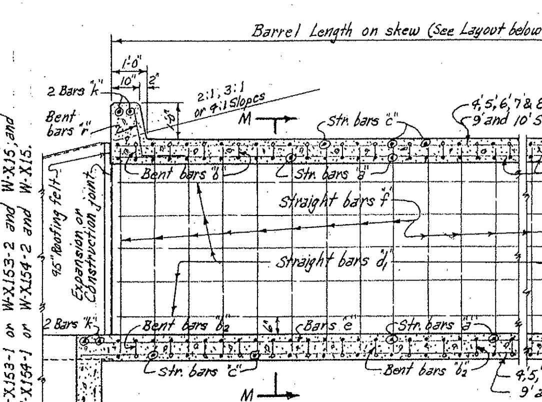
S	H	f Size	f Spacing	f No. Req'd	f Length	k Size	k No. Req'd	k Length
5 @ 4'	2'	#4	12"	600	2'-10"	#5	8	24'-9"
	3'			600	3'-10"		8	"
	4'			600	4'-10"		8	"
	5'			600	5'-10"		8	"
	6'			600	6'-10"		8	25'-3"
5 @ 5'	3'	#4	12"	600	3'-11"	#6	8	29'-11"
	4'			600	4'-11"		8	"
	5'			600	5'-11"		8	"
	6'			600	6'-11"		8	30'-5"
	7'			600	7'-11"		8	30'-11"
5 @ 6'	3'	#4	12"	600	4'-0"	#6	8	35'-1"
	4'			600	5'-0"		8	"
	5'			600	6'-0"		8	"
	6'			600	7'-0"		8	35'-8"
	7'			600	8'-0"		8	36'-1"
	8'		10"	720	9'-0"		8	36'-2"
5 @ 7'	4'	#4	12"	600	5'-1"	⊛ #6	16	21'-2"
	5'			600	6'-1"		16	"
	6'			600	7'-1"		16	21'-5"
	7'			600	8'-1"		16	21'-7"
	8'		10"	720	9'-1"		16	21'-8"
	9'	#5	12"	600	10'-1"		16	21'-11"
5 @ 8'	4'	#4	12"	600	5'-2"	⊛ #6	16	23'-9"
	5'			600	6'-2"		16	24'-0"
	6'			600	7'-2"		16	"
	7'			600	8'-2"		16	24'-3"
	8'		10"	720	9'-2"		16	24'-4"
	9'	#5	12"	600	10'-2"		16	24'-6"
	10'		11"	660	11'-2"		16	24'-9"
5 @ 9'	5'	#4	12"	600	6'-3"	⊛ #6	16	26'-7"
	6'			600	7'-3"		16	26'-10"
	7'			600	8'-3"		16	"
	8'		10"	720	9'-3"		16	26'-11"
	9'	#5	12"	600	10'-3"		16	27'-1"
	10'		11"	660	11'-3"		16	27'-5"
	11'		10"	720	12'-3"		16	27'-6"
5 @ 10'	5'	#4	12"	600	6'-4"	⊛ #7	16	29'-4"
	6'			600	7'-4"		16	29'-7"
	7'			600	8'-4"		16	"
	8'		10"	720	9'-4"		16	29'-8"
	9'	#5	12"	600	10'-4"		16	29'-11"
	10'		11"	660	11'-4"		16	30'-2"
	11'		10"	720	12'-4"		16	30'-3"
	12'	#6	12"	600	13'-4"		16	30'-4"

NOTE:- The "a", "b", "b2" and "c" bars are to be placed parallel with the headwalls, spacing to be parallel with barrel.

⊛ These "a", "b", "b2", "c", and "k" bars are to be spliced at center of middle span to make a full length bar. Lap #6 bars 2'-0" min. and #7 bars 2'-4" min.

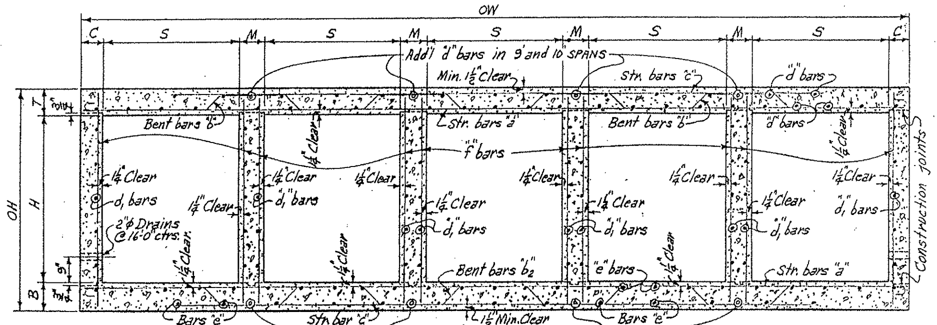
DIMENSIONS / QUANTITIES

D (Max. Design Depth of Cover)	S (Clear Spans)	H (Clear Height)	A (Sq. Ft. Opening)	OW (Overall Width)	T (Thickness of Top Slab)	C (Thickness of Sidewalls)	M (Thickness of Division Walls)	B (Thickness of Bottom Slab)	OH (Overall Height)	RL (Roadway Length)	K (Length of Headwall)	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel per Lin. Ft. of Barrel (Lb.)	Additional per Long. Lap (Lb.)	Additional Two Headwalls & Aprons (Lb.)
	5 @ 4'	2'	40	23'-8"	6½"	6"	8"	6"	3'-0½"	24'-6"	25'-0½"	1.185	241.93	114.49	338.00
		3'	60	23'-8"		6"	8"		4'-0½"	"	"	1.321	255.29	122.84	338.00
		4'	80	23'-8"		6"	8"		5'-0½"	"	"	1.456	268.65	131.19	338.00
		5'	100	23'-8"		6"	8"		6'-0½"	"	"	1.592	282.01	139.54	338.00
		6'	120	24'-2"		7"	9"		7'-0½"	25'-0⅛"	25'-6⅜"	1.858	298.16	147.89	342.17
	5 @ 5'	3'	75	28'-8"	7"	6"	8"	6½"	4'-1½"	29'-8⅜"	30'-2½"	1.602	344.28	137.44	517.13
		4'	100	28'-8"		6"	8"		5'-1½"	"	"	1.738	357.64	145.79	517.13
		5'	125	28'-8"		6"	8"		6'-1½"	"	"	1.873	371.00	154.14	517.13
		6'	150	29'-2"		7"	9"		7'-1½"	30'-2⅜"	30'-8¾"	2.141	387.91	162.49	523.14
		7'	175	29'-7"		7½"	10"		8'-1½"	30'-7⅛"	31'-2"	2.421	404.64	170.84	529.14
	5 @ 6'	3'	90	33'-8"	7½"	6"	8"	7"	4'-2½"	34'-10¼"	35'-4¾"	1.914	416.43	150.31	609.94
		4'	120	33'-8"		6"	8"		5'-2½"	"	"	2.050	429.79	158.66	609.94
		5'	150	33'-8"		6"	8"		6'-2½"	"	"	2.186	443.15	167.01	609.94
		6'	180	34'-2"		7"	9"		7'-2½"	35'-4½"	35'-11"	2.455	460.38	175.36	616.95
		7'	210	34'-7"		7½"	10"		8'-2½"	35'-9⅝"	36'-4"	2.736	477.15	183.71	621.95
		8'	240	34'-8"		8"	10"		9'-2½"	35'-10⅝"	36'-5"	2.934	503.00	192.06	622.95
	5 @ 7'	4'	140	38'-8"	8"	6"	8"	7¾"	5'-3¾"	40'-0⅜"	40'-6⅝"	2.423	505.37	171.53	725.55
		5'	175	38'-8"		6"	8"		6'-3¾"	"	"	2.559	518.73	179.88	725.55
		6'	210	39'-2"		7"	9"		7'-3¾"	40'-6⅝"	41'-1"	2.830	536.10	188.23	731.56
		7'	245	39'-7"		7½"	10"		8'-3¾"	40'-11⅝"	41'-6½"	3.112	553.21	196.58	735.57
		8'	280	39'-8"		8"	10"		9'-3¾"	41'-0⅜"	41'-7¼"	3.311	578.96	204.93	737.57
		9'	315	40'-2"		9"	11"		10'-3¾"	41'-7"	42'-1½"	3.675	622.00	213.28	743.58
	5 @ 8'	4'	160	43'-8"	8½"	6"	8"	8½"	5'-5"	45'-2¼"	45'-9"	2.834	595.95	186.13	817.25
		5'	200	44'-2"		7"	9"		6'-5"	45'-8¾"	46'-3¼"	3.089	613.68	194.48	823.26
		6'	240	44'-2"		7"	9"		7'-5"	"	"	3.243	627.04	202.83	823.26
		7'	280	44'-7"		7½"	10"		8'-5"	46'-1⅜"	46'-8½"	3.528	644.23	211.18	829.27
		8'	320	44'-8"		8"	10"		9'-5"	46'-2⅞"	46'-9½"	3.726	670.38	219.53	831.27
		9'	360	45'-2"		9"	11"		10'-5"	46'-9⅜"	47'-3½"	4.092	713.99	227.88	835.28
		10'	400	45'-8"		10"	12"		11'-5"	47'-3⅜"	47'-9¾"	4.495	746.05	236.23	841.28
	5 @ 9'	5'	225	49'-2"	9"	7"	9"	9"	6'-6"	50'-10¾"	51'-5¼"	3.503	683.44	217.64	925.20
		6'	270	49'-7"		7½"	10"		7'-6"	51'-4"	51'-10½"	3.773	700.62	225.99	931.21
		7'	315	49'-7"		7½"	10"		8'-6"	"	"	3.943	713.98	234.34	931.21
		8'	360	49'-8"		8"	10"		9'-6"	51'-5"	51'-11½"	4.142	740.24	242.69	933.21
		9'	405	50'-2"		9"	11"		10'-6"	51'-11⅜"	52'-5¾"	4.509	784.05	251.04	937.22
		10'	450	50'-8"		10"	12"		11'-6"	52'-5½"	53'-0"	4.914	816.20	259.39	945.23
		11'	495	50'-10"		11"	12"		12'-6"	52'-7½"	53'-2"	5.201	849.29	267.74	947.23
	5 @ 10'	5'	250	54'-2"	9½"	7"	9"	9½"	6'-7"	56'-1"	56'-7½"	3.948	811.97	230.51	1277.62
		6'	300	54'-7"		7½"	10"		7'-7"	56'-6"	57'-0½"	4.219	829.74	238.86	1285.80
		7'	350	54'-7"		7½"	10"		8'-7"	"	"	4.389	843.10	247.21	1285.80
		8'	400	54'-8"		8"	10"		9'-7"	56'-7⅛"	57'-1½"	4.588	869.43	255.56	1288.52
		9'	450	55'-2"		9"	11"		10'-7"	57'-1⅜"	57'-7¾"	4.957	913.97	263.91	1296.70
		10'	500	55'-8"		10"	12"		11'-7"	57'-7⅝"	58'-2"	5.363	946.74	272.26	1304.87
		11'	550	55'-10"		11"	12"		12'-7"	57'-9⅝"	58'-4"	5.651	980.01	280.61	1307.60
		12'	600	56'-8"		12"	12"		13'-7"	57'-11¾"	58'-6"	5.951	1033.78	288.96	1310.32



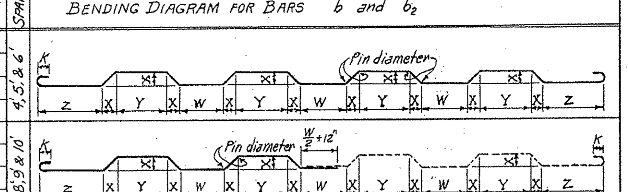
NOTE:- For details of wings and bar list, see Drawing Nos. W-X152-1 or W-X152-2 and W-X15; W-X153-1 or W-X153-2 and W-X15; and W-X154-1 or W-X154-2 and W-X15.

PART LONGITUDINAL SECTION N-N



TYPICAL SECTION M-M

BAR SIZE	PIN DIAM.	K	ADD FOR HOOKS	SPAN
#5	2½"	4¼"	0'-11½"	4', 5' & 6'
#6	3"	5"	1'-2"	
#6	3"	5"	0'-7"	7', 8', 9' & 10'

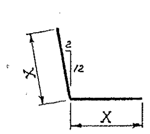


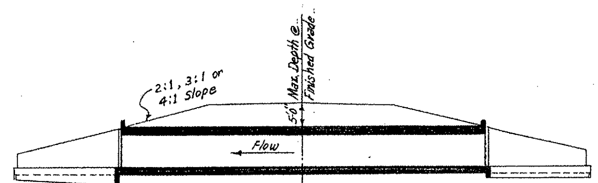
NOTE:- Dimensions are to centers of bars. ("b" and "b2").

DOWEL BARS FOR TWO HEADWALLS

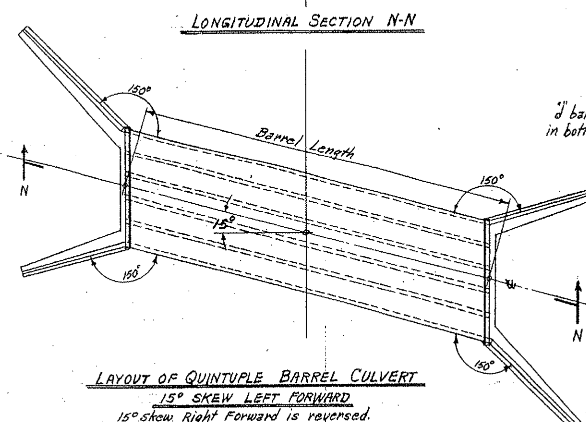
5 SPANS @	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"±	50	2'-5"	1'-2½"
5'	#4	12"±	60	2'-6"	1'-3"
6'	#4	12"±	72	2'-7"	1'-3½"
7'	#4	12"±	82	2'-8"	1'-4"
8'	#4	12"±	92	2'-9"	1'-4½"
9'	#4	12"±	104	2'-10"	1'-5"
10'	#4	12"±	114	2'-11"	1'-5½"

Bars "r" Dowel bars in Headwalls





LONGITUDINAL SECTION N-N



LAYOUT OF QUINTUPLE BARREL CULVERT
15° SKEW LEFT FORWARD
15° skew Right Forward is reversed.

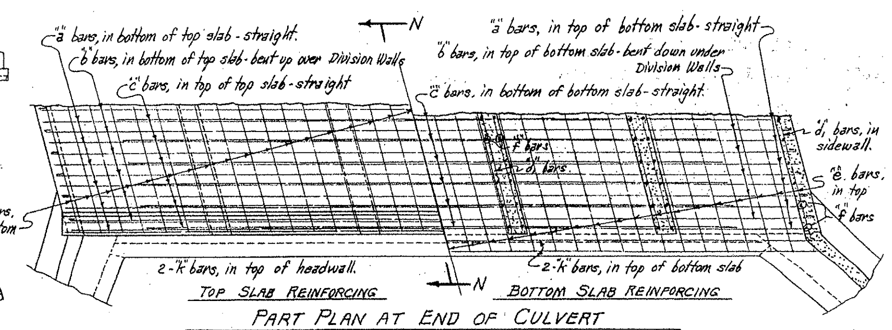
DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.



TOP SLAB REINFORCING — BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

NOTE:- The "a", "b", "b2" and "c" bars are to be placed parallel with the headwall. The "d" bars in top of top slab and "e" bars in bottom slab are not shown.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, W-X154-1 or W-X154-2. Also W-X15.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

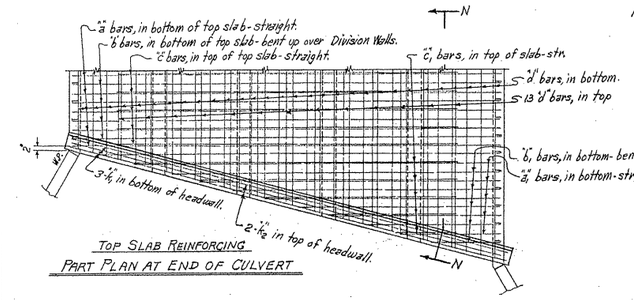
DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS 15° SKEW

4', 5', 6', 7', 8', 9' & 10' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUINTUPLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-515X-0

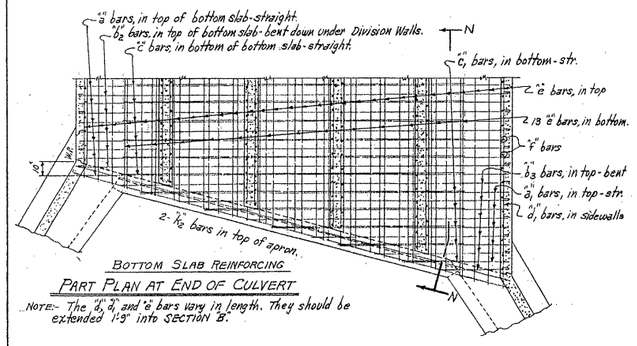
Designed By:- W.C.H. 1-23-63 Checked By:- R.H.S. 5-24-63
Drawn By:- W.C.H. 9-9-63 Checked By:- RHS. 10-7-63
Quantities By:- W.C.H. 9-11-63 Checked By:- R.G. 1-14-64

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

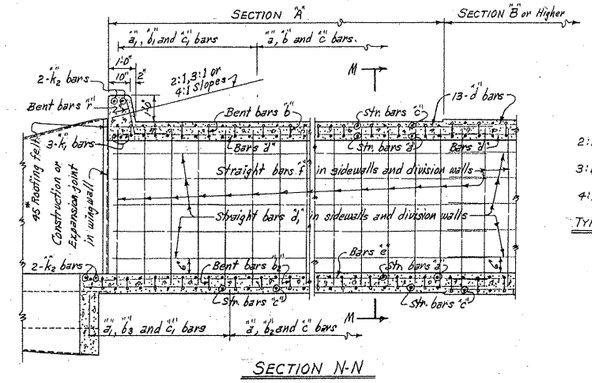


BOTTOM SLAB REINFORCING

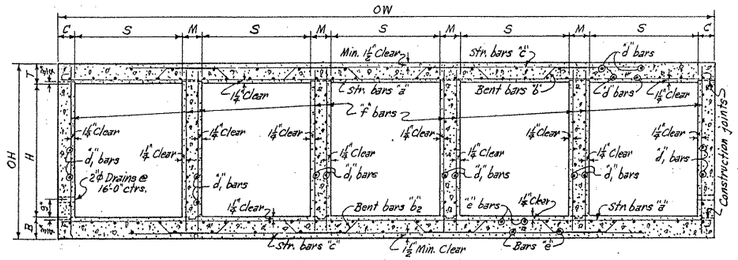
PART PLAN AT END OF CULVERT

NOTE:- The "a₁", "d₁" and "e" bars vary in length. They should be extended 1'-9" into SECTION "B".

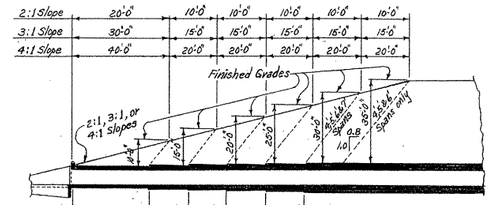
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X152-1 or W-X152-2; W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.



SECTION N-N



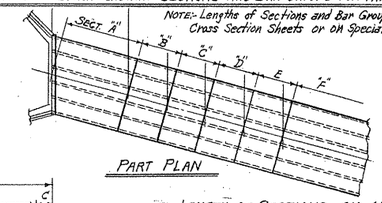
TYPICAL SECTION M-M



2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	MID-SECTION F, Varies	These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.
	Bar Group	A	B	C	D	E	F	
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	MID-SECTION F, Varies	
	Bar Group	A	B	C	D	E	F	
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	MID-SECTION F-Varies	
	Bar Group	A	B	C	D	E	F	

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 15° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D & E	A	B, C, D & E	A	B, C, D & E
LENGTHS	12'-5"	6'-2½"	22'-9½"	11'-4¾"	33'-1½"	16'-6¾"

NOTE:- For Details and Bar Lists for SECTIONS B thru F, see Barrel Drawing Nos. R-500X-X1.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 19.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	B	C			D
25.0 to 29.5'	A	B	C	D		E
30.0 to 35.0'	A	B	C	D	E	F

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 19.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	2@C				D
25.0 to 29.5'	A	B	2@D			E
30.0 to 35.0'	A	2@C		2@E		F

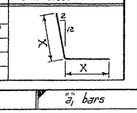
MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	* QUANTITIES - ONE SECTION "A" CLASS S CONCRETE BARREL ONLY 2:1 CU.YD.	3:1 CU.YD.	4:1 CU.YD.	REINFORCING STEEL BARREL, APRON AND HEADWALL 2:1 LB.	3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	4@6	2'	40	23'-6"	6"	6"	8"	6"	3'-6"	24'-6"	25'-0½"	14.25	26.14	38.03	2598	4290	6090
		3'	60	23'-8"		6"	8"		4'-0"	"	"	15.94	29.24	42.53	2730	4607	6543
		4'	80	23'-8"		6"	8"		5'-0"	"	"	17.63	32.33	47.04	2911	4924	6996
		5'	100	23'-8"		6"	8"		6'-0"	"	"	19.32	35.43	51.54	3093	5242	7449
		6'	120	24'-2"		7"	9"		7'-0"	25'-0½"	25'-6¾"	22.61	41.47	60.32	3306	5608	7965
	5@5	3'	75	28'-8"	6½"	6"	8"	6½"	4'-1"	29'-0½"	30'-2¾"	19.35	35.48	51.61	3471	5906	8381
		4'	100	28'-8"		6"	8"		5'-1"	"	"	21.02	38.55	56.08	3652	6223	8996
		5'	125	28'-8"		6"	8"		6'-1"	"	"	22.71	41.65	60.59	3839	6541	9449
		6'	150	29'-2"		7"	9"		7'-1"	30'-2¾"	30'-8¾"	26.02	47.73	69.43	4068	6938	9839
		7'	175	29'-7"		7½"	10"		8'-1"	30'-7½"	31'-2"	29.49	54.08	78.67	4682	7997	11,353
	5@6	3'	90	33'-8"	7"	6"	8"	7½"	4'-2½"	34'-10½"	35'-4¾"	23.44	42.99	62.54	4515	7728	11,018
		4'	120	33'-8"		6"	8"		5'-2½"	"	"	25.19	46.09	67.04	4694	8045	11,471
		5'	150	33'-8"		6"	8"		6'-2½"	"	"	26.82	49.18	71.55	4878	8362	11,924
		6'	180	34'-2"		7"	9"		7'-2½"	35'-10½"	35'-11"	30.16	55.31	80.46	5110	8760	12,497
		7'	210	34'-7"		7½"	10"		8'-2½"	35'-9½"	36'-1"	33.64	61.63	89.74	5721	9829	14,015
		8'	240	34'-8"		8"	10"		9'-2½"	35'-10½"	36'-5"	36.09	66.19	96.29	6062	10,429	14,886
	5@7	4'	140	38'-8"	7¾"	6"	8"	8¼"	5'-4"	40'-0¾"	40'-6¾"	30.96	55.86	81.26	5879	10,098	14,389
		5'	175	38'-8"		6"	8"		6'-4"	"	"	32.13	58.93	85.73	6061	10,365	14,942
		6'	210	39'-2"		7"	9"		7'-4"	40'-6¾"	41'-1"	35.51	65.12	94.76	6306	10,781	15,929
		7'	245	39'-7"		7½"	10"		8'-4"	40'-11¾"	41'-6¾"	39.03	71.57	104.12	6936	11,829	16,999
		8'	280	39'-8"		8"	10"		9'-4"	41'-0¾"	41'-7¾"	41.50	76.10	110.70	7271	12,986	17,877
		9'	315	40'-2"		9"	11"		10'-4"	41'-7"	42'-1¾"	46.02	84.39	122.76	7680	13,323	19,040

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"φ	25	2'-4"	1'-2"
5'	#4	12"φ	30	2'-5"	1'-2½"
6'	#4	12"φ	35	2'-6"	1'-3"
7'	#4	12"φ	41	2'-8"	1'-4"

Dowel bars "f" in One Headwall.



BAR LIST FOR SECTION "A" ON 15° SKEW - ONE END ONLY.

SECTION & BAR GROUP	LENGTH OF SECTION D	DEPTH OF COVER S	CLEAR SPAN H	"a" bars (STRAIGHT, In Top and Bottom Slab of Barrel.) SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a₁" bars (STRAIGHT, In Top and Bottom Slab of Barrel. (Two of each Length.)) SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
SECTION "A" AND BAR GROUP "A" 4'-1 = 33'-1½" 2:1 = 12'-5" 3:1 = 22'-9½" 4:1 = 33'-1½" 0'-0" TO 10'-0" MAXIMUM	4@6	2'												
		3'												
		4'												
		5'												
		6'												
	5@5	3'												
		4'												
		5'												
		6'												
		7'												
	5@6	3'												
		4'												
		5'												
		6'												
		7'												
	5@7	4'												
		5'												
		6'												
		7'												
		8'												
		9'												

SECTION & BAR GROUP	"b" bars (BENT - See Diagrams below; In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.) SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b₁" bars (BENT - See Diagrams below; In Bottom of Top Slab - may or may not be bent up over Division Wall - one end hooked. Alt. with "a₁" and "c₁" or "c" bars.) SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
SECTION "A" AND BAR GROUP "A"																

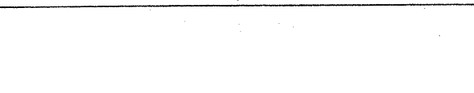
SECTION & BAR GROUP	"b₂" bars (BENT - See Diagrams below; In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars) SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b₃" bars (In Top of Bottom Slab - may or may not be bent down under Division Wall - one end hooked. Alt. with "a₁" and "c" or "c₁" bars.) SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
SECTION "A" AND BAR GROUP "A"																

SECTION & BAR GROUP	"c" bars (STRAIGHT, In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars.) SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c₁" bars (STRAIGHT, In Top and Bottom Slab of Barrel. Alt. with "a₁" and "b₃" bars. (Two of each Length)) SIZE	SPACING	No. REQ'D	LENGTH	"d" bars (STRAIGHT, Longitudinal in Top Slab of Barrel.) SIZE	SPACING	No. REQ'D	LENGTH	"d₁" bars (STRAIGHT, Longitudinal in Sidewalls and Division Walls.) SIZE	SPACING	No. REQ'D	LENGTH	"e" bars (STRAIGHT, Longitudinal in Bottom Slab of Barrel.) SIZE	SPACING	No. REQ'D	LENGTH
SECTION "A" AND BAR GROUP "A"																						

SECTION & BAR GROUP	"f" bars (STRAIGHT, Vertical in Sidewalls and Division Wall.) SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"f₁" bars (STRAIGHT, In Bottom of Headwall.) SIZE	No. REQ'D	LENGTH	"f₂" bars (STRAIGHT, In Top of Headwall and Apron. 2 Each) SIZE	No. REQ'D	LENGTH
SECTION "A" AND BAR GROUP "A"												

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10⅛"
#5	2½"	4¾"	0'-11⅝"

BENDING DIAGRAMS FOR BARS "b" AND "b₂"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5⅛"
#5	2½"	4¾"	0'-5⅝"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b₁" AND "b₃"

NOTE:- Dimensions are to centers of bars (b, b₁, b₂ & b₃). The X, Y & Z values of "b₁" bars are same as for "b" bars, and for "b₃" bars same as for "b₂" bars. ⓪-⑥ Min. & Max. lengths L for bars "b₁" & "b₃" for each type bend.

These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length L of "b₁" and "b₃" bars vary by 4'-0" for 13" spacing, 3'-9" for 12" spacing and 3'-5" for 11" spacing.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two - 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X152-1 or W-X152-2, W-X153-1 or W-X153-2, and W-X154-1 or W-X154-2. Also W-X15.

For Barrels of 4', 5' & 6' Spans, see Drawing No. R-500X-X1.

For Barrels of 7' Spans, see Drawing No. ----------

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS

FOR

REINFORCED CONCRETE BOX CULVERTS

15° SKEW - SECTIONS "A" ONLY

4', 5', 6' AND 7' SPANS — 2:1, 3:1 OR 4:1 SLOPES

QUINTUPLES — OVER 5'-0" COVER

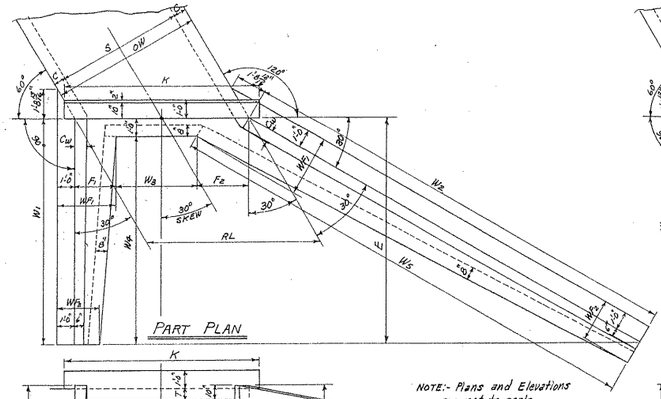
STANDARD DRAWING NO. R-515X-1

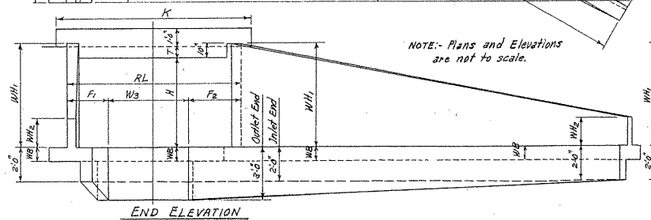
Designed by:- W.C.H. 10-3-62 Checked by:- R.H.S. 11-14-62

Drawn by:- W.C.H. 10-21-63 Checked by:-

Quantities by:- W.C.H. 12-6-63 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

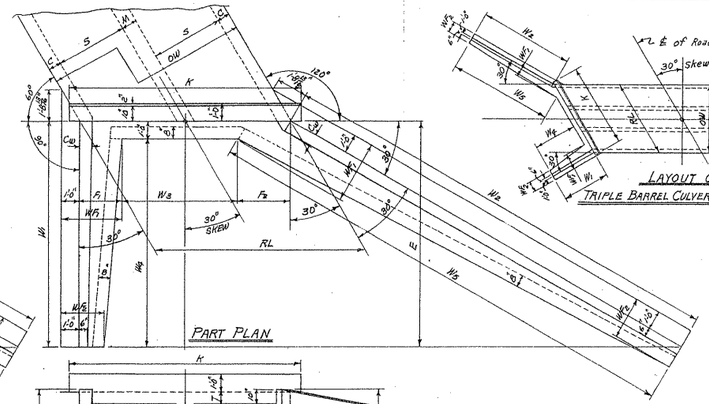


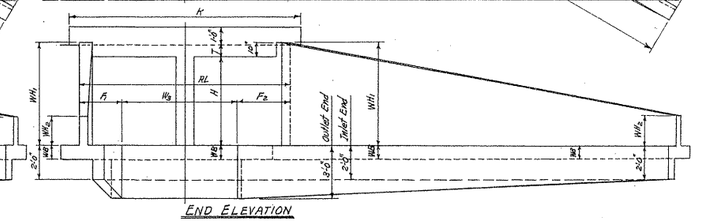


END ELEVATION

SINGLE BARREL CULVERT-30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Layout below.

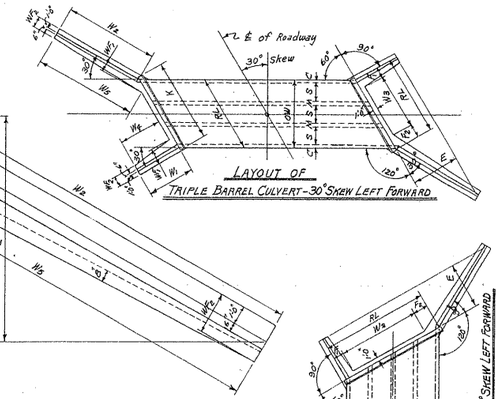




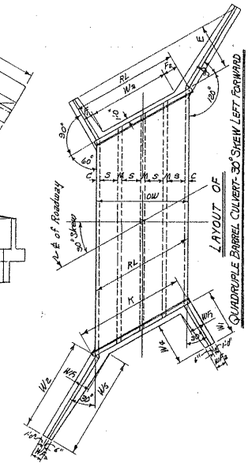
END ELEVATION

DOUBLE BARREL CULVERT-30° SKEW RIGHT FORWARD

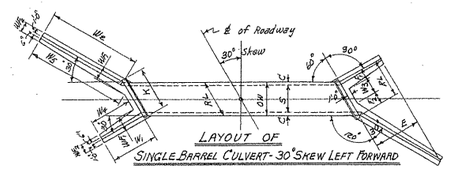
Details of Culvert with 30° Skew Left Forward is reversed, see Layout below.



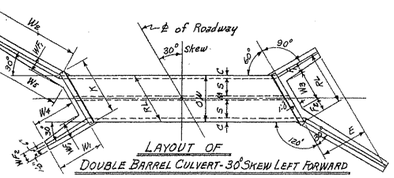
LAYOUT OF TRIPLE BARREL CULVERT-30° SKEW LEFT FORWARD



LAYOUT OF QUADRUPLE BARREL CULVERT-30° SKEW LEFT FORWARD

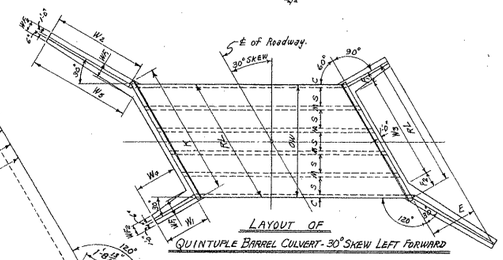


LAYOUT OF SINGLE BARREL CULVERT-30° SKEW LEFT FORWARD

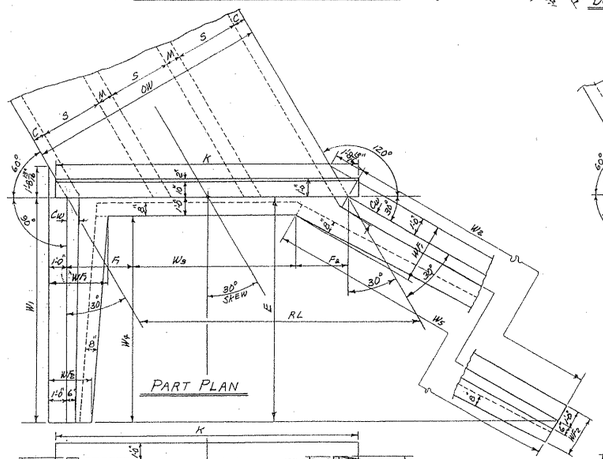


LAYOUT OF DOUBLE BARREL CULVERT-30° SKEW LEFT FORWARD

NOTE:- The length of the wings for the Plans, Elevations, and Layouts, as drawn, are proportioned for 3:1 slopes. For 2:1 slopes the wings are proportionally shorter, while for 4:1 slopes they are longer.



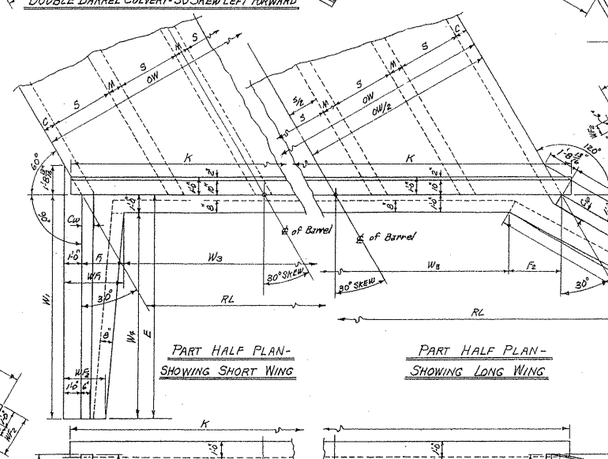
LAYOUT OF QUINTUPLE BARREL CULVERT-30° SKEW LEFT FORWARD



END ELEVATION

TRIPLE BARREL CULVERT-30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Layout at top center of sheet.



PART END ELEVATION

QUADRUPLE BARREL CULVERT-30° SKEW RT. FWD.

Details of Culvert with 30° Skew Left Forward is reversed, see Layout at above center.

PART END ELEVATION

QUINTUPLE BARREL CULVERT-30° SKEW RT. FWD.

Details of Culvert with 30° Skew Left Forward is reversed, see Layout above.

NOTE:- Plans and Elevations are not to scale.

USE WITH DRAWING No.	CLEAR SPAN S	CLEAR HEIGHT H	SUM OF FOOTING DIMENSIONS F_1+F_2	SINGLE BARREL CULVERT (RL = OW x 1.154+7) OW	RL	K	W_3	DOUBLE BARREL CULVERT OW	RL	K	W_3	TRIPLE BARREL CULVERT (K = RL + (2'-1 3/8")) OW	RL	K	W_3	QUADRUPLE BARREL CULVERT (W_3 = RL - (F_1 + F_2)) OW	RL	K	W_3	QUINTUPLE BARREL CULVERT OW	RL	K	W_3
W-X302-1, W-X303-1 OR W-X304-1.	4'	2'	2'-3 1/4"	5'-0"	5'-9 1/4"	6'-11 1/8"	3'-6"	9'-8"	11'-2"	12'-3 3/8"	8'-10 3/8"	14'-6"	16'-6 5/8"	17'-8 1/2"	14'-3 3/8"	19'-0"	21'-11 1/8"	23'-1"	19'-8"	23'-8"	27'-4"	28'-5 5/8"	25'-0 3/8"
		3'	2'-3 1/4"	5'-0"	"	"	2'-6"	9'-8"	"	"	7'-10 3/8"	14'-9"	"	"	13'-3 3/8"	19'-0"	"	"	18'-8"	28'-8"	"	"	29'-4 1/8"
		4'	4'-3 1/4"	5'-0"	"	"	1'-6"	9'-8"	"	"	6'-10 3/8"	14'-9"	"	"	12'-3 3/8"	19'-0"	"	"	17'-8"	23'-8"	"	"	23'-10 5/8"
		5'	5'-3 1/4"	5'-0"	5'-9 1/4"	6'-11 1/8"	0'-6"	9'-8"	11'-2"	12'-3 3/8"	5'-10 3/8"	14'-9"	16'-6 5/8"	17'-8 1/2"	11'-3 3/8"	19'-0"	21'-11 1/8"	23'-1"	16'-8"	23'-8"	27'-4"	28'-5 5/8"	22'-0 3/8"
		6'	6'-3 1/4"	5'-2"	5'-11 5/8"	7'-1 1/2"	Ⓐ 0"	9'-11"	11'-5 1/4"	12'-7 1/2"	5'-2 1/8"	14'-8"	16'-11 1/8"	18'-1"	10'-8"	19'-5"	22'-5"	23'-7"	16'-3 1/8"	24'-2"	27'-10 5/8"	29'-0 3/8"	21'-7 3/8"
	5'	3'	3'-3 1/4"	6'-0"	6'-11 5/8"	8'-1"	3'-7 1/8"	11'-8"	13'-5 3/8"	14'-7 1/2"	10'-2 5/8"	17'-4"	20'-0 1/8"	21'-2"	16'-9"	23'-0"	26'-6 3/8"	27'-8 1/2"	23'-3 1/8"	28'-8"	33'-1 1/4"	34'-3"	29'-4"
		4'	4'-3 1/4"	6'-0"	"	"	2'-7 3/8"	11'-8"	"	"	9'-12 5/8"	17'-4"	"	"	15'-9"	23'-0"	"	"	22'-3 1/8"	28'-8"	"	"	28'-10"
		5'	5'-3 1/4"	6'-0"	6'-11 5/8"	8'-1"	1'-7 3/8"	11'-8"	13'-5 3/8"	14'-7 1/2"	8'-12 5/8"	17'-4"	20'-0 1/8"	21'-2"	14'-9"	23'-0"	26'-6 3/8"	27'-8 1/2"	21'-3 1/8"	28'-8"	33'-1 1/4"	34'-3"	27'-10"
		6'	6'-3 1/4"	6'-2"	7'-1 1/2"	8'-3 1/4"	0'-10 5/8"	11'-11"	13'-9 1/8"	14'-11"	7'-5 3/8"	17'-8"	20'-4 3/8"	21'-6 1/2"	14'-1 1/2"	23'-5"	27'-0 1/2"	28'-2 1/2"	20'-9 1/2"	29'-2"	33'-8 1/2"	34'-10"	27'-5"
		7'	7'-9 1/4"	6'-3"	7'-2 5/8"	8'-4 1/4"	Ⓐ 0"	12'-1"	13'-11 1/2"	15'-1 1/8"	6'-2 1/8"	17'-11"	20'-8 1/8"	21'-10"	12'-11"	23'-9"	27'-5 1/2"	28'-7"	19'-8"	29'-12"	34'-2"	35'-3 1/2"	26'-9 3/8"
	6'	3'	3'-3 1/4"	7'-0"	8'-1"	9'-2 1/2"	4'-9 3/8"	13'-8"	15'-9 3/8"	16'-11 1/8"	12'-6 1/8"	20'-4"	23'-5 5/8"	24'-7 1/2"	20'-2 1/2"	27'-0"	31'-2 1/2"	32'-4"	27'-11"	33'-8"	38'-10 5/8"	40'-0 1/2"	35'-7 3/8"
		4'	4'-3 1/4"	7'-0"	"	"	3'-9 3/8"	13'-8"	"	"	11'-6 1/8"	20'-4"	"	"	19'-2 5/8"	27'-0"	"	"	26'-11"	33'-8"	"	"	34'-7 1/2"
		5'	5'-3 1/4"	7'-0"	8'-1"	9'-2 1/2"	2'-9 3/8"	13'-8"	15'-9 3/8"	16'-11 1/8"	10'-6 1/8"	20'-4"	23'-5 5/8"	24'-7 1/2"	18'-2 1/2"	27'-0"	31'-2 1/2"	32'-4"	25'-11"	33'-8"	38'-10 5/8"	40'-0 1/2"	33'-7 1/2"
		6'	6'-3 1/4"	7'-2"	8'-3 1/4"	9'-5 1/2"	2'-0"	13'-11"	16'-0 5/8"	17'-2 3/8"	9'-9 1/8"	20'-8"	23'-10 5/8"	25'-0 1/2"	17'-7 1/2"	27'-5"	31'-7 1/2"	32'-9 3/8"	25'-0 3/8"	34'-2"	39'-5 1/2"	40'-7 1/2"	33'-2 1/2"
		7'	7'-9 1/4"	7'-3"	8'-4 1/4"	9'-6 3/8"	0'-7 1/2"	14'-1"	16'-3 1/8"	17'-5"	8'-1"	20'-11"	24'-1 1/2"	25'-3 3/8"	16'-4 1/2"	27'-9"	32'-0 1/2"	33'-2 1/2"	24'-3 1/2"	34'-7"	39'-11 1/2"	41'-1"	32'-2"
		8'	9'-3 1/4"	7'-4"	8'-5 5/8"	9'-7 1/2"	Ⓐ 0"	14'-2"	16'-4 5/8"	17'-6 1/2"	7'-1"	21'-0"	24'-3"	25'-4 3/8"	14'-11 3/8"	27'-10"	32'-1"	33'-3 1/2"	22'-10 1/2"	34'-8"	40'-0 3/8"	41'-2 1/2"	30'-9 1/2"
	7'	4'	4'-3 1/4"	8'-0"	9'-2 1/2"	10'-4 3/8"	4'-11 3/8"	15'-8"	18'-1 1/2"	19'-3"	13'-9 3/8"	23'-4"	26'-11 3/8"	28'-1 1/2"	22'-8"	31'-0"	35'-9 1/2"	36'-11 1/2"	31'-6"	38'-8"	44'-7 1/2"	45'-9 3/8"	40'-4 1/2"
		5'	5'-3 1/4"	8'-0"	9'-2 1/2"	10'-4 3/8"	3'-11 3/8"	15'-8"	18'-1 1/2"	19'-3"	12'-9 3/8"	23'-4"	26'-11 3/8"	28'-1 1/2"	21'-8"	31'-0"	35'-9 1/2"	36'-11 1/2"	30'-6"	38'-8"	44'-7 1/2"	45'-9 3/8"	39'-4 1/2"
		6'	6'-3 1/4"	8'-2"	9'-5 1/2"	10'-7"	3'-2"	15'-11"	18'-4 1/2"	19'-6 1/2"	12'-1 1/8"	23'-8"	27'-1"	28'-3 1/2"	21'-0 3/8"	31'-5"	36'-3 1/2"	37'-5 1/2"	30'-0"	39'-2"	45'-2 1/2"	46'-4 1/2"	38'-11 1/2"
		7'	7'-9 1/4"	8'-3"	9'-6 1/2"	10'-8 1/2"	1'-9"	16'-1"	18'-6 1/2"	19'-8 1/2"	10'-3 1/8"	23'-11"	27'-2 3/8"	28'-9 1/2"	19'-10 1/8"	31'-9"	36'-8"	37'-9 1/2"	28'-10 1/8"	39'-7"	45'-8 1/2"	46'-10 1/8"	37'-11 1/8"
		8'	9'-3 1/4"	8'-4"	9'-7 1/2"	10'-9 3/8"	0'-7 1/8"	16'-2"	18'-8"	19'-9 3/8"	9'-4 3/8"	24'-0"	27'-8 1/2"	28'-10 1/2"	18'-5 1/8"	31'-10"	36'-9 1/2"	37'-11"	27'-6"	39'-8"	45'-9 1/8"	46'-11 1/8"	36'-6 1/8"
(FOR H=8'-0" OR LESS)	8'	4'	4'-3 1/4"	9'-0"	10'-4 3/8"	11'-6 1/2"	6'-1 1/8"	17'-8"	20'-9 3/8"	21'-6 3/8"	16'-1 1/8"	26'-4"	30'-4 3/8"	31'-6 1/8"	26'-1 1/8"	35'-0"	40'-5"	41'-6 1/8"	36'-1 1/8"	43'-8"	50'-5 5/8"	51'-7"	46'-1 3/8"
		5'	5'-3 1/4"	9'-2"	10'-7"	11'-8 1/2"	5'-3 1/2"	17'-11"	20'-8 1/8"	21'-9"	15'-5"	26'-8"	30'-9 1/2"	31'-11 1/8"	25'-6 1/8"	35'-5"	40'-10 3/8"	42'-0 1/2"	35'-7 1/2"	44'-2"	51'-0"	52'-1 1/8"	45'-8 1/8"
		6'	6'-3 1/4"	9'-2"	10'-7"	11'-8 1/2"	4'-3 1/2"	17'-11"	20'-8 1/8"	21'-10"	14'-5"	26'-8"	30'-9 1/2"	31'-11 1/8"	24'-6 1/8"	35'-5"	40'-10 3/8"	42'-0 1/2"	34'-7 1/2"	44'-2"	51'-0"	52'-1 1/8"	44'-8 1/8"
		7'	7'-9 1/4"	9'-3"	10'-8 1/8"	11'-10"	2'-11"	18'-1"	20'-10 1/8"	22'-0 1/2"	13'-1 1/8"	26'-11"	31'-1"	32'-2 3/8"	23'-3 1/8"	35'-9"	41'-3 1/8"	42'-5 1/8"	33'-6 1/2"	44'-7"	51'-5 3/8"	52'-7 1/2"	43'-8 1/8"
		8'	9'-3 1/4"	9'-4"	10'-9 3/8"	11'-11 1/8"	1'-6 1/8"	18'-2"	20'-11 1/8"	22'-1 1/8"	11'-8 1/2"	27'-0"	31'-2 1/8"	32'-4"	21'-11"	35'-10"	41'-7 1/2"	42'-9 1/2"	32'-1 1/8"	44'-8"	51'-7 1/2"	52'-8 3/8"	42'-3 3/8"
	9'	5'	5'-3 1/4"	10'-2"	11'-8 1/2"	12'-10 1/2"	6'-5 3/8"	19'-11"	23'-0"	24'-1 1/2"	17'-0 3/8"	29'-8"	34'-3 3/8"	35'-5"	28'-11 1/8"	39'-5"	45'-1 1/2"	46'-8"	40'-3"	49'-2"	56'-3 1/2"	57'-11 1/8"	51'-6"
		6'	6'-3 1/4"	10'-3"	11'-10"	13'-0"	5'-6 1/2"	20'-1"	23'-2 1/8"	24'-4 1/2"	16'-1 1/8"	29'-11"	34'-6 5/8"	35'-8 1/2"	28'-3 1/8"	39'-9"	45'-8 1/2"	47'-0 1/8"	39'-7 1/2"	49'-7"	57'-1 3/8"	58'-5"	50'-11 3/8"
		7'	7'-9 1/4"	10'-3"	11'-10"	13'-0"	4'-0 1/2"	20'-1"	23'-2 1/8"	24'-4"	15'-5"	29'-11"	34'-6 5/8"	35'-8 1/2"	26'-9 1/8"	39'-9"	45'-10 3/8"	47'-0 1/8"	38'-1 1/2"	49'-7"	57'-1 3/8"	58'-5"	49'-5 1/8"
		8'	9'-3 1/4"	10'-4"	11'-11 5/8"	13'-1"	2'-8"	20'-2"	23'-3 5/8"	24'-5 1/2"	14'-10 1/8"	30'-0"	34'-7 3/8"	35'-9 1/2"	25'-9 1/2"	39'-10"	46'-0"	47'-1 1/8"	36'-8 3/8"	49'-8"	57'-2 1/8"	58'-6"	48'-1"
	10'	5'	5'-3 1/4"	11'-2"	12'-10 3/8"	14'-0 1/2"	7'-7 1/2"	21'-8"	25'-3 3/8"	26'-5 1/2"	20'-0 1/8"	32'-8"	37'-8 3/8"	38'-10 1/2"	32'-5 1/2"	43'-5"	50'-1 3/8"	51'-3 1/2"	44'-10 1/2"	54'-2"	62'-6 1/2"	63'-8 1/2"	57'-3 1/2"
		6'	6'-3 1/4"	11'-3"	12'-11 1/8"	14'-1 3/8"	6'-8 3/8"	22'-1"	25'-6"	26'-7 3/8"	19'-2 3/8"	32'-11"	38'-0 1/8"	39'-2"	31'-9"	43'-9"	50'-6 1/2"	51'-8"	44'-1"	54'-7"	63'-0 1/2"	64'-2 1/2"	56'-9"
		7'	7'-9 1/4"	11'-3"	12'-11 1/8"	14'-1 3/8"	5'-2 3/8"	22'-1"	25'-6"	26'-7 3/8"	17'-8 3/8"	32'-11"	38'-0 1/8"	39'-2"	30'-3"	43'-9"	50'-6 1/2"	51'-8"	42'-9"	54'-7"	63'-0 1/2"	64'-2 1/2"	55'-8"
		8'	9'-3 1/4"	11'-4"	12'-1"	14'-2"	3'-9 3/8"	22'-2"	25'-7 1/2"	26'-9"	16'-4"	33'-0"	38'-1 1/8"	39'-3"	28'-10"	43'-10"	50'-7 1/2"	51'-9 1/2"	41'-9 1/2"	54'-8"	63'-1 1/2"	64'-3 1/2"	53'-10 1/2"
	11'	6'	6'-3 1/4"	12'-4"	14'-2 5/8"	15'-6 1/2"	7'-11 1/2"	24'-2"	27'-10 5/8"	29'-0 3/8"	21'-7 3/8"	36'-0"	41'-6 1/8"	42'-8 1/2"	35'-3 1/2"	47'-11"	55'-2 1/2"	56'-4 1/2"	48'-11 1/2"	—	—	—	—
		7'	7'-9 1/4"	12'-4"	"	"	6'-5 3/8"	24'-2"	"	"	20'-1 1/8"	36'-0"	"	"	33'-3 3/8"	47'-11"	"	"	47'-5 1/2"	—	—	—	—
		8'	9'-3 1/4"	12'-4"	"	"	4'-11 1/2"	24'-2"	"	"	18'-7 3/8"	36'-0"	"	"	32'-3 3/8"	47'-11"	"	"	45'-11 1/2"	—	—	—	—
	12'	6'	6'-3 1/4"	13'-4"	15'-9 3/8"	16'-11 1/2"	9'-1 1/2"	26'-2"	30'-2 5/8"	31'-9 1/2"	23'-11 1/8"	39'-10"	45'-5 3/8"	46'-12 1/2"	38'-9 1/2"	51'-10"	59'-10 1/2"	61'-0"	53'-2"	—	—	—	—
		7'	7'-9 1/4"	13'-4"	"	"	7'-7 1/2"	26'-2"	"	"	22'-5 1/2"	39'-10"	"	"	37'-1 3/8"	51'-10"	"	"	52'-1"	—	—	—	—
		8'	9'-3 1/4"	13'-4"	"	"	6'-1 1/2"	26'-2"	"	"	20'-11 1/8"	39'-10"	"	"	35'-9 3/8"	51'-10"	"	"	50'-7"	—	—	—	—
(FOR H=9'-0" & OVER) W-X302-2, W-X303-2 OR W-X304-2.	7'	9'	10'-9 1/4"	8'-6"	9'-9 3/8"	10'-11 1/8"	Ⓐ 0"	16'-5"	19'-11 1/2"	20'-1 1/8"	8'-2 1/8"	28'-4"	28'-11 1/2"	29'-3"	17'-9"	32'-3"	37'-2 3/8"	38'-9 3/8"	26'-5 3/8"	40'-2"	46'-9 3/8"	47'-6 1/2"	35'-7 1/2"
	8'	9'	10'-9 1/4"	9'-6"	10'-11 1/8"	12'-1 1/2"	0'-2 3/8"	18'-5"	21'-3 1/2"	22'-5"	10'-6"	27'-10"	31'-6 3/8"	32'-8 1/2"	20'-9 1/2"	36'-3"	41'-10 1/8"	43'-0 1/2"	31'-1"	45'-2"	52'-1 1/2"	53'-3 1/8"	41'-8 1/8"
		10'	12'-3 1/4"	9'-8"	11'-2"	12'-3 3/8"	Ⓐ 0"	18'-8"	21'-6 3/8"	22'-8 1/2"	9'-3 1/2"	27'-8"	31'-11 3/8"	33'-1 1/2"	19'-8 1/8"	36'-8"	42'-1 1/2"	43'-3"	30'-0 3/8"	45'-8"	52'-8 1/2"	53'-10 1/8"	40'-5 1/2"
	9'	9'	10'-9 1/4"	10'-6"	12'-1 1/2"	13'-3 1/4"	1'-9 1/8"	20'-5"	23'-6 5/8"	24'-8 3/8"	12'-9 3/8"	30'-9"	35'-0 1/8"	36'-2 1/2"	22'-3"	40'-3"	46'-5 1/2"	47'-7 1/2"	35'-8 1/2"	50'-2"	57'-11 1/8"	59'-1"	47'-2"
		10'	12'-3 1/4"	10'-8"	12'-3 3/8"	13'-5 3/8"	0'-10 5/8"	20'-8"	23'-10 3/8"	25'-0 1/2"	11'-7 1/8"	30'-8"	35'-9 1/2"	36'-11 1/8"	23'-1 1/8"	40'-8"	46'-11 1/8"	48'-1 1/8"	34'-8 1/8"	50'-8"	58'-6"	59'-8"	46'-12 3/8"
		11'	13'-9 1/4"	10'-10"	12'-6 1/8"	13'-8"	Ⓐ 0"	20'-10"	24'-0 3/8"	25'-2 1/2"	10'-3 1/2"	30'-10"	35'-7 1/8"	36'-9"	21'-10"	40'-10"	47'-1 1/8"	48'-3 1/8"	33'-9 1/2"	50'-10"	58'-10 3/8"	59'-10 1/2"	44'-11 1/2"
	10'	9'	10'-9 1/4"	11'-6"	13'-2 3/8"	14'-5 1/2"	2'-6 1/2"	22'-5"	25'-10 3/8"	27'-0 1/2"	15'-1 3/8"	33'-4"	38'-5 3/8"	39'-7 1/2"	27'-8 1/2"	44'-3"	51'-1 1/8"	52'-3"	40'-9"	55'-2"	63'-8 1/2"	64'-10 1/2"	52'-11 1/8"
		10'	12'-3 1/4"	11'-8"	13'-5 3/8"	14'-7 1/2"	1'-2 1/2"	22'-8"	26'-2 1/2"	27'-4"	13'-3 1/2"	33'-8"	38'-10 1/2"	40'-0"	26'-7 1/2"	44'-8"	51'-7"	52'-8 1/2"	39'-3 1/2"	55'-8"	64'-3 1/2"	65'-5 1/2"	52'-10"
		11'	13'-9 1/4"	11'-10"	13'-8"	14'-9 3/8"	Ⓐ 0"	22'-10"	26'-4 1/2"	27'-6"	12'-7 1/2"	33'-10"	39'-0 1/8"	40'-2 1/2"	25'-3 1/2"	44'-10"	51'-9 1/2"	52'-11"	38'-0"	55'-10"	64'-5 1/2"	65'-7 1/2"	50'-8 1/2"
		12'	15'-3 1/4"	12'-0"	13'-10 1/2"	15'-0 1/8"	Ⓐ 0"	23'-0"	26'-6 1/2"	27'-8 1/2"	11'-3 3/8"	34'-0"	39'-3 1/8"	40'-5"	24'-0"	45'-0"	51'-11 1/2"	53'-1 1/2"	36'-8 1/2"	56'-0"	64'-8"	65'-9 1/2"	49'-10 3/8"
	11'	9'	10'-9 1/4"	12'-6"	14'-5 1/2"	15'-7"	3'-8"	24'-5"	28'-2 3/8"	29'-4 1/2"	17'-5"	36'-4"	41'-11 1/2"	43'-1 1/2"	31'-2 1/2"	49'-3"	55'-10 1/2"	56'-10 1/2"	44'-11 1/2"	—	—	—	—
		10'	12'-3 1/4"	12'-8"	14'-7 1/2"	15'-9 1/2"	2'-9 1/2"	24'-8"	28'-5 1/2"	29'-7 1/2"	15'-2 1/2"	36'-8"	42'-3 1/2"	43'-4"	30'-1 1/2"	49'-8"	56'-2 1/2"	57'-4 1/2"	43'-1 1/2"	—	—	—	—
		11'	13'-9 1/4"	12'-10"	14'-9 3/8"	15'-11 1/2"	1'-0 3/8"	24'-10"	28'-8 1/2"	29'-10"	14'-1"	36'-10"	42'-6 1/2"	43'-8"	28'-9 1/2"	49'-10"	56'-5 1/2"	57'-6 1/2"	42'-1 1/2"	—	—	—	—
		12'	15'-3 1/4"	13'-0"	15'-0 1/8"	16'-2"	Ⓐ 0"	25'-0"	28'-10 3/8"	30'-0 1/2"	13'-7 1/2"	37'-0"	42'-9 3/8"	43'-10 1/2"	27'-5 1/2"	49'-0"	56'-7"	57'-8 1/2"	41'-3 3/8"	—	—	—	—
	12'	9'	10'-9 1/4"	13'-6"	15'-7 1/2"	16'-9"	4'-9 3/8"	26'-5"	30'-6"	31'-8"	19'-8 3/8"	39'-3"	45'-5"	46'-7"	34'-7 1/2"	52'-3"	60'-9"	61'-3 1/2"	49'-6 1/2"	—	—	—	—
		10'	12'-3 1/4"	13'-8"	15'-9 3/8"	16'-11 1/8"	3'-6 3/8"	26'-8"	30'-9 1/2"	31'-11 1/8"	18'-4 3/8"	39'-8"	45'-9 3/8"	46'-10 1/2"	33'-6 1/2"	52'-8"	60'-9 3/8"	61'-11 1/2"	48'-6 1/2"	—	—	—	—
		11'	13'-9 1/4"	13'-10"	15'-11 1/8"	17'-1 1/2"	2'-2 1/2"	26'-10"	30'-11 1/8"	32'-1 1/2"	17'-2 1/2"	39'-10"	46'-0"	47'-1 1/2"	32'-2 1/2"	52'-10"	61'-0 1/8"	62'-2"	47'-2 1/2"	—	—	—	—
		12'	15'-3 1/4"	14'-0"	16'-2"	17'-3 1/2"	0'-10 5/8"	27'-0"	31'-2 1/2"	32'-4"	15'-11"	40'-0"	46'-2 1/2"	47'-4"	30'-11"	53'-0"	61'-2 1/2"	62'-4 1/2"	45'-11 1/2"	—	—	—	—

Designed by - W.C.H. 5-16-63 Checked by -
Drawn by - W.C.H. 7-15-63 Checked by - RMS - 8-21-63
Quantities by - Checked by -

Ⓐ Special case for these boxes. See Detail 'A' and Table 'A' for revised values of F_1, F_2, W_2 and W_3, when apron width is more than 1'-0" and W_3=0".
For Details 'A' and Tables 'A' for each slope, see Drawing Nos. W-X302-1, W-X302-2, or W-X303-1, W-X303-2, or W-X304-1, W-X304-2.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawings for 30° Skews for each slope as listed below.

2:1 Slopes	3:1 Slopes	4:1 Slopes
W-X302-1 or W-X302-2	W-X303-1 or W-X303-2	W-X304-1 or W-X304-2.

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

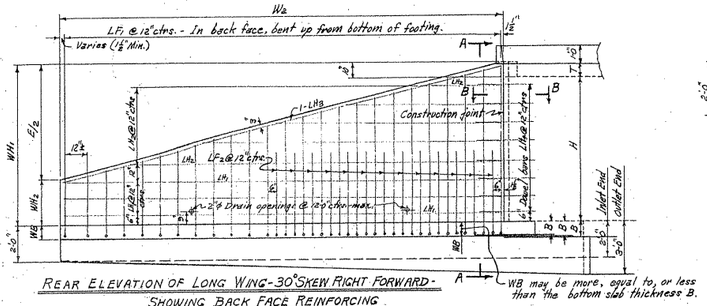
CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

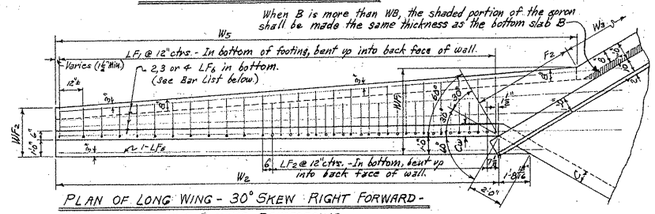
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 & 4:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER H=2', 3', 4', 5', 6', 7', 8', 9', 10', 11' & 12'.

STANDARD DRAWING No. W-X30

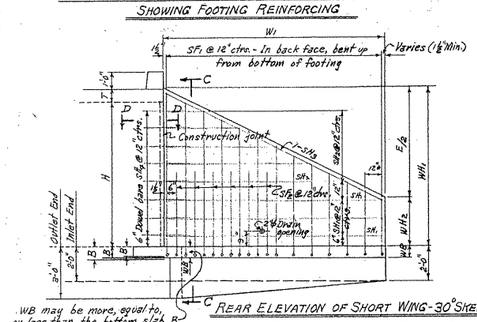
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



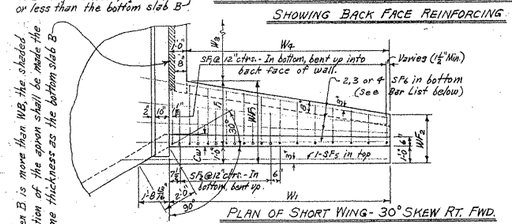
REAR ELEVATION OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



PLAN OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



REAR ELEVATION OF SHORT WING - 30° SKEW RT. FWD. SHOWING BACK FACE REINFORCING



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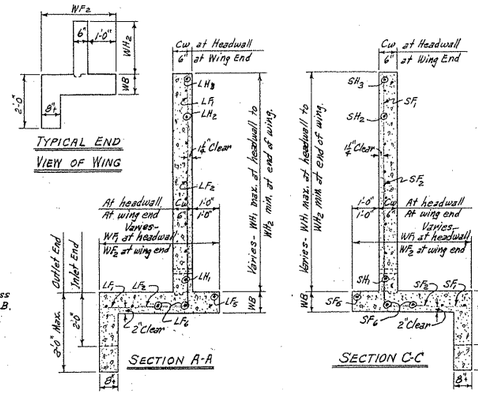
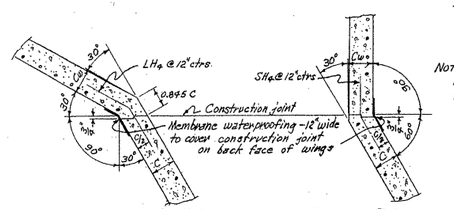
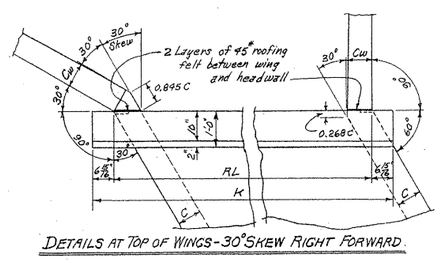




SECTION B-B SECTION D-D

SECTIONS THRU CONSTRUCTION JOINTS

Note:- Payment for the membrane waterproofing and roofing felt shall be included in unit price bid for Class S Concrete.



DETAILS AT TOP OF WINGS - 30° SKEW RIGHT FORWARD

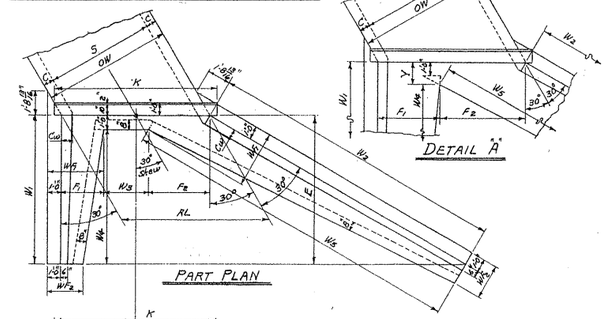
REGULAR WING DIMENSIONS - 2:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT TOP = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL	PERPENDICULAR DIST. FROM HEAD TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSIONS		* QUANTITY PER WING CLASS S CONCRETE INLET END		OUTLET END	
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E		W1	W2	W4	W5		
									SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING
													CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-8"	2'-0"	1'-4"	0'-11⅝"	4'-4"		4'-4"	8'-8"	3'-4"	8'-11⅞"	0.505	1.054	0.562	1.169
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅝"	1'-8"	1'-7⅝"	5'-8"		5'-8"	11'-0"	4'-8"	12'-2¾"	0.757	1.595	0.831	1.750
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	2'-0"	2'-3⅝"	7'-0"		7'-0"	14'-0"	6'-0"	15'-5½"	1.056	2.229	1.147	2.429
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-6½"	2'-4"	2'-11⅝"	8'-4"		8'-4"	16'-8"	7'-4"	18'-8½"	1.402	2.957	1.509	3.193
		7"	5'-10"	1'-8"	3'-4"	2'-6½"	2'-4"	2'-11⅝"	8'-4"		8'-4"	16'-8"	7'-4"	18'-8½"	1.458	3.083	1.565	3.318
* 6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7½"	9'-8"		9'-8"	19'-4"	8'-8"	21'-11½"	1.948	4.101	2.071	4.377
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7½"	9'-8"		9'-8"	19'-4"	8'-8"	21'-11½"	1.984	4.186	2.110	4.462
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7½"	9'-8"		9'-8"	19'-4"	8'-8"	21'-11½"	2.025	4.272	2.149	4.547
* 7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7½"	11'-0"		11'-0"	22'-0"	10'-0"	25'-5¾"	2.552	5.377	2.693	5.696
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7½"	11'-0"		11'-0"	22'-0"	10'-0"	25'-5¾"	2.603	5.487	2.743	5.807
* 8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7½"	12'-4"		12'-4"	24'-8"	11'-4"	29'-0½"	3.264	6.875	3.422	7.239

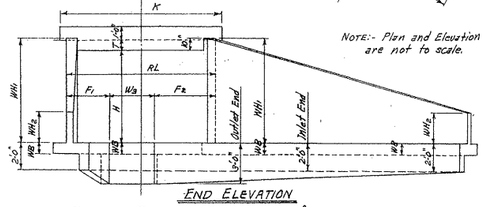
* Quantity per wing does not include headwall or that portion of apron or toewall for the length W5.
* See Table "A" for special values of F1 & F2 and W4 & W5 for Single 4'x6', 5'x7' and 6'x8' Box Culverts.

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
4'	6'	2'-7⅜"	3'-3⅜"	0"	1'-1⅜"	8'-6⅝"	21'-7⅝"
5'	7'	3'-1⅞"	4'-1⅞"	0"	1'-3"	9'-9"	24'-11"
6'	8'	3'-7⅞"	4'-10⅞"	0"	1'-4⅜"	10'-11⅞"	28'-2⅝"



Note:- Plan and Elevation are not to scale.



SINGLE BARREL CULVERT - 30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Drawing No. W-X30.

TYPICAL WING DETAILS

Note:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X30.
For values of RL, K and W3 for each box, see above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints.

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL - FOR 4 WINGS ®	CLASS S CONCRETE - 4 WINGS: HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS				
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	100	4.23	5.34	6.94	7.55	8.66
	3'	6"	7"	151	5.74	6.84	7.95	9.06	10.17
	4'	6"	7"	232	7.53	8.68	9.73	10.84	11.95
	5'	6"	7"	321	9.59	10.69	11.80	12.91	14.02
	6'	7"	8"	522	12.91	14.05	15.19	16.33	17.47
5'	3'	6"	7"	151	5.99	7.33	8.67	10.02	11.36
	4'	6"	7"	232	7.77	9.11	10.46	11.80	13.15
	5'	6"	7"	321	9.84	11.18	12.52	13.87	15.22
	6'	7"	8"	522	13.16	14.53	15.91	17.29	18.67
	7'	7½"	8½"	1023	16.76	18.18	19.59	21.00	22.40
6'	3'	6"	7"	151	6.23	7.83	9.39	10.99	12.58
	4'	6"	7"	232	8.01	9.61	11.18	12.77	19.36
	5'	6"	7"	321	10.08	11.68	13.24	14.84	16.43
	6'	7"	8"	522	13.41	15.03	16.64	18.26	19.88
	7'	7½"	8½"	1023	17.08	18.69	20.32	21.97	23.62
	8'	8"	9"	1285	21.26	22.98	24.42	26.28	27.94
7'	4'	6"	7"	232	8.24	10.12	11.94	13.79	15.60
	5'	6"	7"	321	10.33	12.18	14.00	15.84	17.66
	6'	7"	8"	522	13.66	15.54	17.38	19.25	21.09
	7'	7½"	8½"	1023	17.29	19.18	21.06	22.95	24.83
	8'	8"	9"	1285	21.57	23.48	25.36	27.27	29.16
8'	4'	6"	7"	232	8.52	10.64	12.71	14.83	16.86
	5'	7"	7"	321	10.98	13.12	15.22	17.36	19.41
	6'	7"	8"	522	13.91	16.05	18.15	20.29	22.34
	7'	7½"	8½"	1023	17.54	19.70	21.82	23.98	26.05
	8'	8"	9"	1285	21.83	23.98	26.11	28.26	30.38
9'	5'	7"	7"	321	11.24	13.65	15.99	18.39	20.67
	6'	7½"	8"	522	14.44	16.86	19.23	21.65	23.95
	7'	7½"	8½"	1023	17.79	20.22	22.59	25.01	27.31
	8'	8"	9"	1285	22.08	24.50	26.87	29.29	31.60
10'	5'	7"	7"	321	11.50	14.17	16.77	19.32	21.94
	6'	7½"	8"	522	14.70	17.39	20.01	22.58	25.22
	7'	7½"	8½"	1023	18.05	20.74	23.37	25.94	28.58
	8'	8"	9"	1285	22.33	25.02	27.65	30.23	32.87
11'	6'	8"	8"	522	15.21	18.20	21.07	23.93	——
	7'	8"	8½"	1023	18.64	21.62	24.50	27.36	——
	8'	8"	9"	1285	22.58	24.56	28.94	31.80	——
12'	6'	8"	8"	522	15.49	18.75	21.88	25.02	——
	7'	8"	8½"	1023	18.90	22.17	25.30	28.45	——
	8'	8"	9"	1285	22.84	26.10	29.24	32.39	——

® For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos. -

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

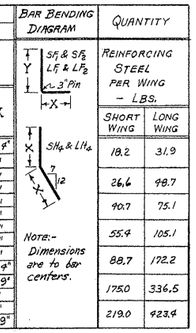
BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 BENT: In bottom of footing, bent up into back face of wing. One bar of each length.								SF2 & LF2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						SF5 & LF5 STRAIGHT: Longitudinal in top of wing footing heel.			SF6 & LF6 STRAIGHT: Longitudinal in bottom of wing footing toe.		
H	SHORT OR LONG	SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SIZE	SPACING	NO. REQD	LENGTH	X	Y	SIZE	NO. REQD	LENGTH	SIZE	NO. REQD	LENGTH
2'	Short	#3	12"	5	1'-6"	3'-11"	0'-8"	1'-1"	0'-11"	2'-11"	—	—	—	—	—	—	#3	1	6'-10"	#3	2	6'-0"
	Long	#3	12"	9	1'-7"	3'-11"	0'-8"	1'-0"	1'-0"	3'-0"	—	—	—	—	—	—	#3	1	11'-2"	#3	2	11'-2"
3'	Short	#3	12"	6	2'-2"	5'-3"	0'-10"	1'-5"	1'-5"	3'-11"	—	—	—	—	—	—	#3	1	8'-2"	#3	2	7'-9"
	Long	#3	12"	12	2'-0"	5'-8"	0'-10"	1'-9"	1'-3"	4'-0"	—	—	—	—	—	—	#3	1	18'-10"	#3	2	18'-6"
4'	Short	#3	12"	8	2'-3"	6'-7"	0'-11"	1'-9"	1'-5"	4'-11"	—	—	—	—	—	—	#3	1	9'-6"	#3	2	8'-6"
	Long	#3	12"	15	2'-8"	6'-6"	0'-11"	1'-7"	1'-6"	5'-0"	—	—	—	—	—	—	#3	1	16'-6"	#3	3	17'-10"
5'	Short	#3	12"	9	2'-10"	7'-11"	1'-0"	2'-1"	1'-11"	5'-11"	#3	12"	2	3'-6"	1'-1"	2'-6"	#3	1	10'-10"	#3	3	10'-0"
	Long	#3	12"	17	2'-11"	7'-10"	1'-0"	1'-11"	2'-0"	6'-0"	#3	12"	5	8'-6"	1'-1"	2'-6"	#3	1	19'-6"	#3	3	21'-2"
6'	Short	#4	12"	10	3'-7"	9'-9"	1'-2"	2'-5"	2'-4"	7'-0"	#3	12"	2	4'-6"	1'-4"	3'-3"	#3	1	12'-2"	#3	3	11'-8"
	Long	#4	12"	20	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	5	9'-6"	1'-4"	3'-3"	#3	1	21'-10"	#3	3	24'-4"
7'	Short	#4	12"	12	3'-8"	10'-10"	1'-3"	2'-11"	2'-6"	8'-0"	#4	12"	4	5'-6"	1'-7"	4'-0"	#4	1	13'-6"	#4	4	12'-8"
	Long	#4	12"	23	3'-9"	10'-8"	1'-3"	2'-8"	2'-7"	8'-1"	#4	12"	9	5'-6"	1'-7"	4'-0"	#4	1	24'-6"	#4	4	28'-0"
8'	Short	#4	12"	13	4'-5"	12'-5"	1'-5"	3'-5"	3'-1"	9'-1"	#4	12"	6	6'-6"	1'-10"	4'-9"	#4	1	14'-10"	#4	4	14'-0"
	Long	#4	12"	25	4'-6"	12'-2"	1'-5"	3'-1"	3'-2"	9'-2"	#4	12"	13	6'-6"	1'-10"	4'-9"	#4	1	27'-2"	#4	4	31'-6"

CLEAR HEIGHT	WING LOCATION	SH1 & LH1 STRAIGHT: Horizontal in back face of wing.				SH2 & LH2 STRAIGHT: Horizontal in back face of wing. One bar of each length.				SH3 & LH3 STRAIGHT: In back face of wing at top - on slope				SH4 & LH4 BENT: Dowels thru construction joint at headwall.					
H	SHORT OR LONG	SIZE	SPACING	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTH MAX.	LENGTH MIN.	SIZE	SPACING	NO. REQD	LENGTH	SIZE	SPACING	NO. REQD	LENGTH	X
2'	Short	#3	12"	1	4'-1"	#3	12"	1	—	2'-2"	#3	1	4'-6"	#3	12"	2	2'-8"	1'-9"
	Long	#3	12"	1	8'-4"	#3	12"	1	—	4'-4"	#3	1	8'-8"	#3	12"	2	"	"
3'	Short	#3	12"	1	5'-5"	#3	12"	2	4'-2"	2'-2"	#3	1	6'-0"	#3	12"	3	"	"
	Long	#3	12"	1	11'-0"	#3	12"	2	8'-8"	4'-4"	#3	1	11'-6"	#3	12"	3	"	"
4'	Short	#3	12"	1	6'-9"	#3	12"	3	6'-8"	2'-2"	#3	1	7'-6"	#3	12"	4	"	"
	Long	#3	12"	1	13'-8"	#3	12"	3	12'-9"	4'-4"	#3	1	14'-8"	#3	12"	4	"	"
5'	Short	#3	12"	1	8'-1"	#3	12"	3	6'-8"	2'-2"	#3	1	9'-0"	#3	12"	5	"	"
	Long	#3	12"	1	16'-4"	#3	12"	3	12'-9"	4'-4"	#3	1	16'-11"	#3	12"	5	"	"
6'	Short	#3	12"	1	9'-5"	#3	12"	4	8'-2"	2'-2"	#3	1	10'-6"	#3	12"	6	"	"
	Long	#3	12"	1	19'-0"	#3	12"	4	16'-4"	4'-4"	#3	1	19'-8"	#3	12"	6	2'-8"	1'-9"
7'	Short	#4	12"	2	10'-9"	#4	12"	5	10'-2"	2'-2"	#4	1	12'-0"	#4	12"	7	3'-6"	1'-9"
	Long	#4	12"	2	21'-8"	#4	12"	5	20'-4"	4'-4"	#4	1	22'-5"	#4	12"	7	"	"
8'	Short	#4	12"	3	12'-1"	#4	12"	5	10'-2"	2'-2"	#4	1	13'-6"	#4	12"	8	"	"
	Long	#4	12"	3	24'-6"	#4	12"	5	20'-4"	4'-4"	#4	1	25'-2"	#4	12"	8	3'-6"	1'-9"

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

BAR BENDING DIAGRAM



QUANTITY: REINFORCING STEEL PER WING - LBS.	
SHORT WING	LONG WING
18.2	31.9
26.6	48.7
40.7	75.1
55.4	105.1
88.7	172.2
175.0	336.5
219.0	423.4

CLASS S CONCRETE

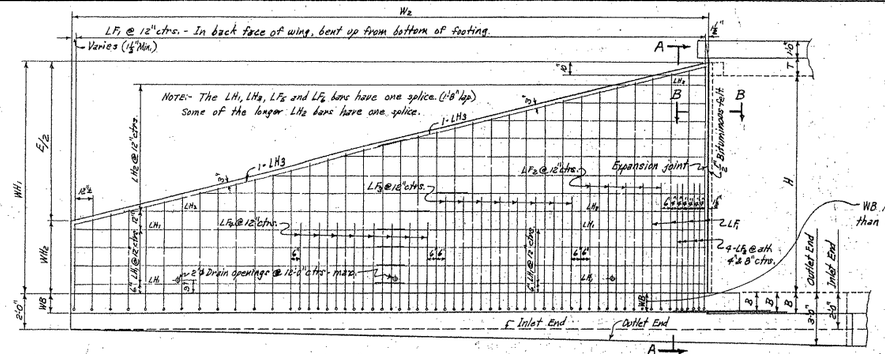
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

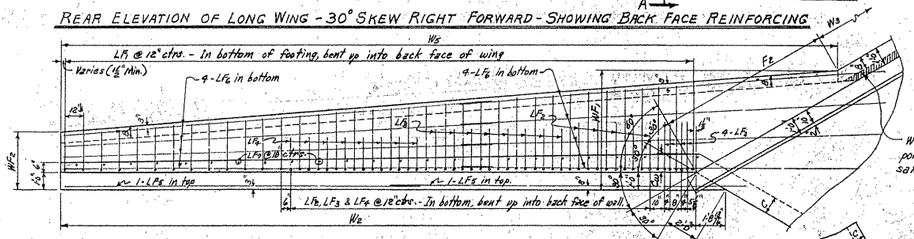
STANDARD DRAWING NO. W-X302-1

Designed By:- W.C.H. 5-13-63 Checked By:- 8-21-63
Drawn By:- W.C.H. 7-30-63 Checked By:- DMT 7-15-64
Quantities By:- W.C.H. 1-7-64 Checked By:-

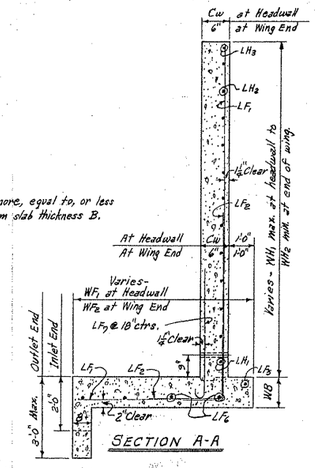
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



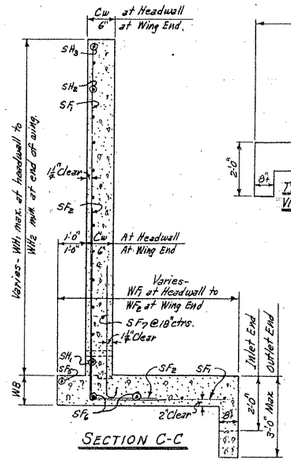
REAR ELEVATION OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



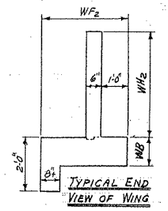
PLAN OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



SECTION A-A



SECTION C-C



TYPICAL END VIEW OF WING

NOTE:- This drawing is to be used in conjunction with Standard Barrel Sections, Drawing Nos.—

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

REGULAR WING DIMENSIONS - 2:1 SLOPES

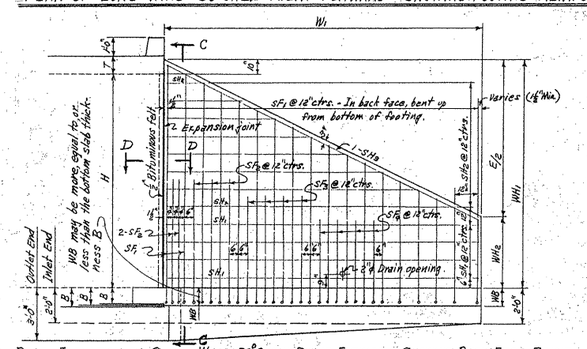
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL.	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	LENGTHS OF WINGWALLS PERPENDICULAR DIST. FROM HDWL. TO END OF WING SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSIONS SHORT WING	INSIDE FOOTING DIMENSIONS LONG WING	* QUANTITY PER WING CLASS S CONCRETE INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
9' ※	10"	9"	9'-10"	3'-8"	5'-2"	2'-10⅞"	4'-2"	6'-7⅞"	13'-8"	15'-8"	27'-4"	12'-0"	32'-6⅞"	4.245	8.934	4.420	9.341
10' ※	11"	10"	10'-10"	3'-8"	5'-8"	3'-0"	4'-8"	7'-7⅞"	15'-0"	15'-0"	30'-0"	14'-0"	36'-1"	5.414	11.385	5.605	11.836
11' ※	12"	11"	11'-10"	3'-8"	6'-2"	3'-1⅝"	5'-2"	8'-7⅞"	16'-4"	16'-4"	32'-8"	15'-4"	39'-7⅞"	6.786	14.262	6.934	14.757
12' ※	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-8"	9'-7⅞"	17'-8"	17'-8"	35'-4"	16'-8"	43'-1⅞"	8.379	17.600	8.605	18.139

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W4.
※ See Table "A" for special values of F1 & F2 and W4 & W5 for Single 7'x9', 8'x10', 9'x11', 10'x11', 10'x12' and 11'x12' Box Culverts.

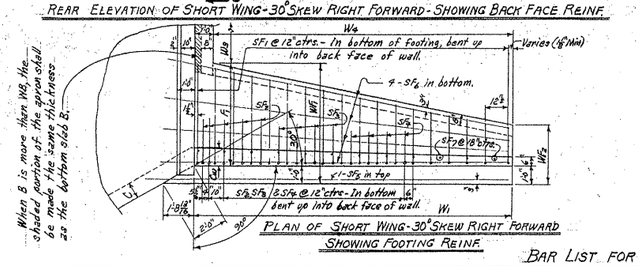
QUANTITIES

CLEAR SPAN S	CLEAR HEIGHT H	THICKNESS OF WING AT HEADWALL Cw	THICKNESS OF WING FOOTING WB	REINFORCING STEEL ⊕ FOR 4 WINGS LB.	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT Cu.Yd.	DOUBLE BARREL CULVERT Cu.Yd.	TRIPLE BARREL CULVERT Cu.Yd.	QUADRUPLE BARREL CULVERT Cu.Yd.	QUINTUPLE BARREL CULVERT Cu.Yd.
7'	9'	9"	10"	1947	27.44	29.47	31.39	33.33	35.26
8'	9'	9"	10"	1947	27.79	29.97	32.14	34.33	36.50
	10'	10"	11"	2457	34.78	37.12	39.33	41.56	43.77
9'	9'	9"	10"	1947	28.04	30.49	32.89	35.32	37.73
	10'	10"	11"	2457	35.15	37.63	40.08	42.56	45.01
	11'	11"	12"	2934	43.37	46.01	48.49	50.99	53.47
10'	9'	9"	10"	1947	28.29	31.00	33.66	36.29	38.96
	10'	10"	11"	2457	35.41	38.14	40.84	43.54	46.26
	11'	11"	12"	2934	43.78	46.53	49.25	51.98	54.73
	12'	12"	13"	3700	53.33	56.28	59.03	61.79	64.56
11'	9'	9"	10"	1947	28.54	31.54	34.44	37.32	——
	10'	10"	11"	2457	35.66	38.67	41.60	44.54	——
	11'	11"	12"	2934	44.03	47.05	50.01	53.00	——
	12'	12"	13"	3700	53.75	56.80	59.80	62.81	——
12'	9'	9"	10"	1947	28.80	32.08	34.95	38.41	——
	10'	10"	11"	2457	35.91	39.21	42.40	45.59	——
	11'	11"	12"	2934	44.29	47.59	50.77	54.01	——
	12'	12"	13"	3700	54.02	57.38	60.57	63.83	——

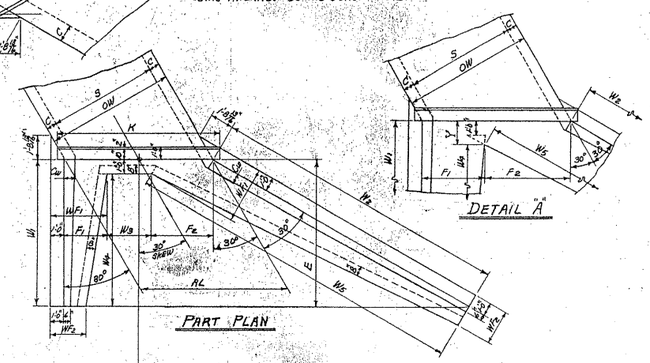
⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed at top of sheet.

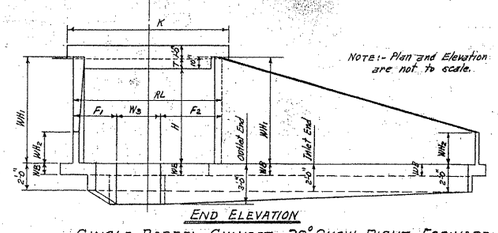


REAR ELEVATION OF SHORT WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.



PLAN OF SHORT WING - 30° SKEW RIGHT FORWARD SHOWING FOOTING REINF.





END ELEVATION

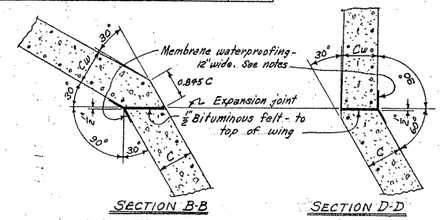
SINGLE BARREL CULVERT - 30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Drawing No. W-X 30.

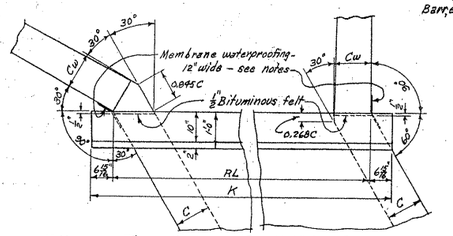
TYPICAL WING DETAILS

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
7'	9'	4'-1⅛"	5'-8⅝"	0"	1'-5⅜"	12'-2⅜"	31'-1"
8'	10'	4'-6⅞"	6'-7⅞"	0"	1'-5⅜"	13'-6"	34'-11⅞"
9'	11'	5'-0⅝"	7'-5⅞"	0"	1'-6⅜"	14'-9⅞"	38'-4"
10'	11'	5'-2"	8'-6"	0"	1'-0⅛"	15'-3⅜"	39'-6"
10'	12'	5'-6⅞"	8'-3⅝"	0"	1'-7⅜"	16'-0⅞"	41'-8⅜"
11'	12'	5'-7⅞"	9'-0⅝"	0"	1'-1⅜"	16'-6⅞"	42'-10⅝"



SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WINGS - 30° SKEW RIGHT FORWARD

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X 30.
For values of RL, K and W3 for each box, see above Std. also.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mopgoings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.
Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT H	WING LOCATION: SHORT OR LONG	SF1 & LF1 BENT — In bottom of footing, bent up into back face of wing. One bar of each length. SIZE	SPACING	No. READ	LENGTHS VARY MIN.	MAX.	X MIN.	MAX.	Y MIN.	MAX.	SF2 & LF2 BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING ⊕	No. READ	LENGTH	X	Y	SF3 & LF3 BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	No. READ	LENGTH	X	Y	SF4 & LF4 BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	No. READ	LENGTH	X	Y
9'	Short	#5	12"	14	5'-1"	13'-11"	1'-6"	3'-10"	3'-8"	10'-2"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	4	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	28	4'-11"	13'-8"	1'-6"	3'-6"	3'-6"	10'-3"	#5	12"	5	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	16	5'-4"	15'-6"	1'-8"	4'-4"	3'-9"	11'-3"	#6	12"	3	8'-6"	2'-4"	6'-3"	#5	12"	2	7'-6"	2'-1"	5'-6"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#5	12"	81	5'-5"	15'-2"	1'-8"	3'-11"	3'-10"	11'-4"	#6	12"	5	8'-6"	2'-4"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	17	6'-0"	17'-0"	1'-9"	4'-9"	4'-2"	12'-9"	#6	12"	5	8'-6"	2'-9"	6'-3"	#5	12"	2	7'-6"	2'-1"	5'-6"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#5	12"	33	6'-1"	16'-8"	1'-9"	4'-4"	4'-5"	12'-5"	#6	12"	9	8'-6"	2'-9"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	18	6'-9"	18'-7"	1'-11"	5'-3"	4'-11"	13'-5"	#7	12"	5	9'-6"	2'-7"	7'-0"	#6	12"	4	8'-6"	2'-9"	6'-3"	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#5	12"	36	6'-7"	18'-2"	1'-11"	5'-1"	4'-9"	13'-6"	#7	12"	9	9'-6"	2'-7"	7'-0"	#6	12"	8	8'-6"	2'-9"	6'-3"	#4	12"	8	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT H	WING LOCATION	SF5 & LF5 STRAIGHT — Longitudinal in top of wing footing heel. SIZE	No. READ	LENGTH	SF6 & LF6 STRAIGHT — Longitudinal in bottom of wing footing toe. SIZE	No. READ	LENGTH	SF7 & LF7 BENT — Footing dowels extending up into front face of wing. SIZE	SPACING	No. READ	LENGTH	X	SH1 & LH1 STRAIGHT — Horizontal in back face of wing. SIZE	SPACING	No. READ	LENGTH	SH2 & LH2 STRAIGHT — Horizontal in back face of wing. One bar of each length. SIZE	SPACING	No. READ	LENGTHS VARY MAX.	MIN.	SH3 & LH3 — In back face of wing at top - on slope. SIZE	No. READ	LENGTH
9'	Short	#4	1	16'-2"	#4	4	15'-4"	#4	18"	10	4'-0"	3'-6"	#4	12"	3	13'-4"	#4	12"	6	12'-2"	2'-2"	#4	1	15'-0"
	Long	#4	2	15'-9"	#4	8	15'-5"	#4	18"	19	4'-0"	3'-6"	#4	12"	6	14'-4"	#4	12"	6	24'-6"	4'-4"	#4	2	16'-10"
10'	Short	#4	1	17'-6"	#4	4	16'-8"	#4	18"	11	4'-4"	3'-10"	#4	12"	3	14'-8"	#4	12"	7	14'-2"	2'-2"	#4	1	16'-6"
	Long	#4	1	18'-10"	#4	4	18'-0"	#4	18"	21	4'-4"	3'-10"	#4	12"	6	15'-8"	#4	12"	7	*28'-4"	4'-4"	#4	2	16'-9"
11'	Short	#4	1	20'-2"	#4	4	19'-4"	#4	18"	12	5'-0"	4'-6"	#4	12"	4	17'-4"	#4	12"	7	16'-0"	2'-2"	#4	1	17'-11"
	Long	#4	2	19'-9"	#4	8	23'-9"	#4	18"	24	5'-0"	4'-6"	#4	12"	8	18'-6"	#4	12"	8	*32'-4"	4'-4"	#4	2	19'-0"

BAR BENDING DIAGRAMS	QUANTITY REINFORCING STEEL PER WING LBS. SHORT WING	LONG WING
SF1 - SF4, LF1 - LF4	323.5	650.1
SF5 & LF5	411.8	816.9
SF6 & LF6	488.6	978.1
SH1 & LH1, SH2 & LH2, SH3 & LH3	616.8	1233.3

Note:- Dimensions are to bar centers.

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

⊕ Except as shown at headwall.

* Lengths without splice. Bars over 28'-0" length may be spliced. (1'-8" lap) Quantities include laps for LH2 bars over 28'-0" length.

CLASS S CONCRETE

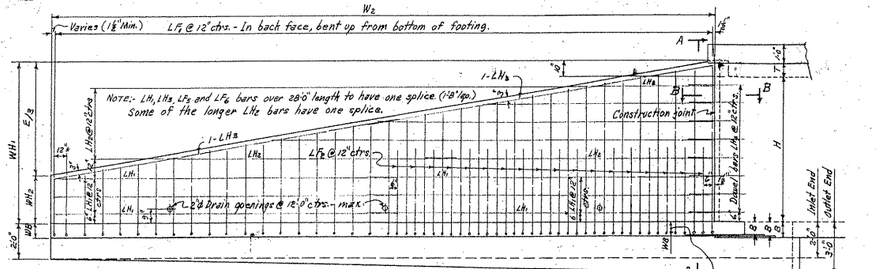
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

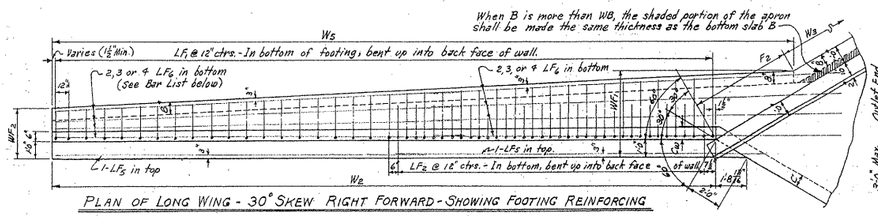
STANDARD DRAWING No. W-X 302-2

Designed By:- W.C.H. 5-16-63 Checked By:-
Drawn By:- W.C.H. 7-10-63 Checked By:- BMS 8-21-63
Quantities By:- W.C.H. 1-7-64 Checked By:- DMT 7-15-64

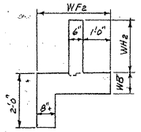
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



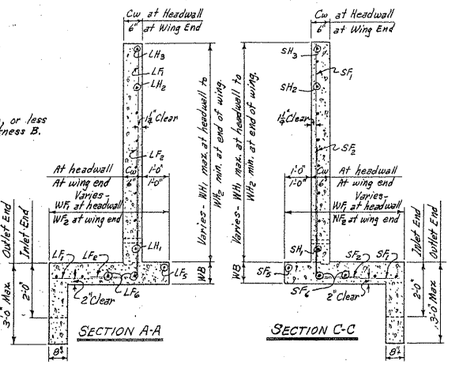
REAR ELEVATION OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING

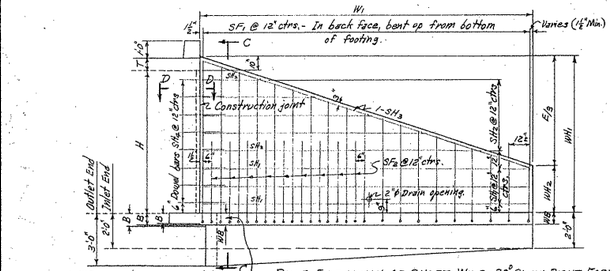


PLAN OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING

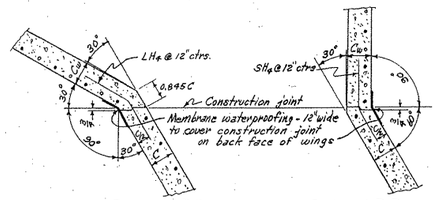


TYPICAL END VIEW OF WING



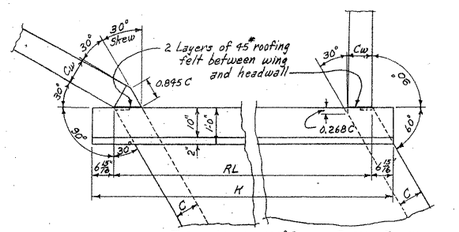


REAR ELEVATION OF SHORT WING - 30° SKEW RIGHT FORWARD SHOWING BACK FACE REINFORCING

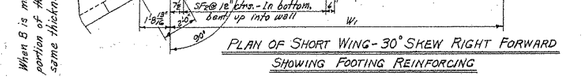


SECTIONS THRU CONSTRUCTION JOINTS

NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



DETAILS AT TOP OF WINGS - 30° SKEW RIGHT FORWARD



PLAN OF SHORT WING - 30° SKEW RIGHT FORWARD SHOWING FOOTING REINFORCING

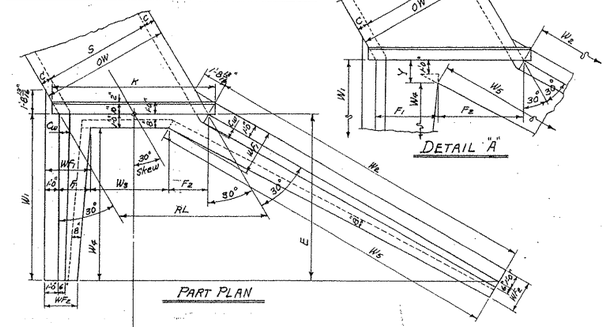
REGULAR WING DIMENSIONS - 3:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEAD = C	WINGWALL HEIGHTS		WIDTHS OF WING FOOTINGS		FOOTING PARALLEL WITH HEADWALL		PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSION		* QUANTITY PER WING CLASS S CONCRETE			
			AT HEADWALL	AT END OF WING	AT HEADWALL	AT END OF WING	SHORT WING	LONG WING						INLET END		OUTLET END	
														SHORT WING	LONG WING	SHORT WING	LONG WING
H	WB	Cw	WH1	WH2	WF3	WF4	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-6"	2'-0"	1'-4"	0'-11⅛"	6'-6"	6'-6"	13'-0"	5'-6"	13'-3⅜"	0.752	1.599	0.836	1.717
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1½"	1'-8"	1'-7⅛"	8'-6"	8'-6"	17'-0"	7'-6"	17'-10⅜"	1.130	2.340	1.239	2.565
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	2'-0"	2'-3⅛"	10'-6"	10'-6"	21'-0"	9'-6"	22'-5⅛"	1.577	3.270	1.711	3.552
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11⅛"	12'-6"	12'-6"	25'-0"	11'-6"	27'-0½"	2.093	4.341	2.252	4.680
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11⅛"	12'-6"	12'-6"	25'-0"	11'-6"	27'-0½"	2.179	4.524	2.337	4.862
⊛ 6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7⅛"	2.908	6.029	3.092	6.419
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7⅛"	2.944	6.147	3.150	6.549
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7⅛"	3.025	6.272	3.208	6.667
7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7⅛"	16'-6"	16'-6"	33'-0"	15'-6"	36'-5⅜"	3.811	7.895	4.019	8.350
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7⅛"	16'-6"	16'-6"	33'-0"	15'-6"	36'-5⅜"	3.887	8.057	4.095	8.512
⊛ 8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7⅛"	18'-6"	18'-6"	37'-0"	17'-6"	41'-4⅛"	4.874	10.097	5.107	10.612

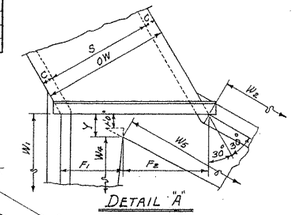
* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_5.
⊛ See Table "A" for special values of F_1 & F_2 and W_4 & W_5 for Single 4x6, 5x7 and 6x8 Box Culverts.

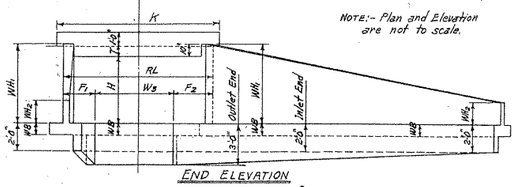
TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
4'	6'	2'-7⅞"	3'-3⅜"	0"	1'-1⅞"	13'-4⅛"	31'-3⅜"
5'	7'	3'-1⅞"	4'-1"	0"	1'-3⅜"	15'-2⅜"	35'-10⅜"
6'	8'	3'-7⅞"	4'-10⅛"	0"	1'-4⅝"	17'-1⅛"	40'-6"



NOTE:- Plan and Elevation are not to scale.





END ELEVATION

SINGLE BARREL CULVERT - 30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Drawing No. W-X30.

TYPICAL WING DETAILS

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X30.
For values of RL, K and W_5 for each box, see above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints of wings.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊛ REINFORCING STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS				
					SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	141	5.80	6.90	8.01	9.12	10.23
	3'	6"	7"	213	8.08	9.18	10.29	11.40	12.51
	4'	6"	7"	327	10.78	11.88	12.99	14.10	15.21
	5'	6"	7"	460	13.90	15.00	16.11	17.22	18.32
	6'	7"	8"	762	18.85	19.99	21.13	22.27	23.41
5'	3'	6"	7"	213	8.33	9.47	11.01	12.36	13.70
	4'	6"	7"	327	11.03	12.36	13.71	15.06	16.40
	5'	6"	7"	460	14.14	15.48	16.83	18.17	19.52
	6'	7"	8"	762	19.11	20.48	21.86	23.24	24.62
	7'	7½"	8½"	1474	24.51	25.94	27.35	28.75	30.16
6'	3'	6"	7"	213	8.57	10.17	11.73	13.33	14.92
	4'	6"	7"	327	11.27	12.86	14.43	16.03	17.62
	5'	6"	7"	460	14.38	15.98	17.55	19.15	20.73
	6'	7"	8"	762	19.35	20.98	22.59	24.21	25.83
	7'	7½"	8½"	1474	24.79	26.44	28.08	29.73	31.38
	8'	8"	9"	1870	31.15	32.87	34.51	36.17	37.83
7'	4'	6"	7"	327	11.52	13.37	15.19	17.05	18.85
	5'	6"	7"	460	14.63	16.49	18.31	20.16	21.97
	6'	7"	8"	762	19.61	21.48	23.32	25.20	27.04
	7'	7½"	8½"	1474	25.05	26.94	28.82	30.71	32.59
	8'	8"	9"	1870	31.47	33.37	35.25	37.16	39.05
8'	4'	6"	7"	327	11.77	13.89	15.97	18.09	20.12
	5'	7"	7"	460	15.46	17.60	19.70	21.83	23.89
	6'	7"	8"	762	19.86	21.98	24.05	26.17	28.20
	7'	7½"	8½"	1474	25.30	27.46	29.58	31.73	33.81
	8'	8"	9"	1870	31.72	33.88	36.00	38.16	40.27
9'	5'	7"	7"	460	15.72	18.13	20.47	22.87	25.15
	6'	7½"	8"	762	20.50	22.93	25.29	27.71	30.01
	7'	7½"	8½"	1474	25.55	27.98	30.34	32.76	35.07
	8'	8"	9"	1870	31.97	34.39	36.76	39.18	41.49
10'	5'	7"	7"	460	15.98	18.65	21.25	23.80	26.92
	6'	7½"	8"	762	20.74	23.45	26.07	28.64	31.28
	7'	7½"	8½"	1474	25.81	28.50	31.12	33.70	36.34
	8'	8"	9"	1870	32.22	34.91	37.54	40.12	42.76
11'	6'	8"	8"	762	21.39	24.38	27.25	30.11	—
	7'	8"	8½"	1474	26.55	29.53	32.41	35.27	—
	8'	8"	9"	1870	32.47	35.45	38.33	41.19	—
12'	6'	8"	8"	762	21.66	24.93	28.05	31.20	—
	7'	8"	8½"	1474	26.81	30.08	33.21	36.36	—
	8'	8"	9"	1870	32.73	35.99	39.13	42.28	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.
UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing steel 20,000#/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 BENT In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length							SF2 & LF2 BENT In bottom of footing, bent up into back face of wing. Alt. with F1 bars.						SF3 & LF3 STRAIGHT Longitudinal in top of wing footing heel.			SF4 & LF4 STRAIGHT Longitudinal in bottom of wing footing toe.		
		SIZE	SPACING	NO. READ	LENGTHS VARY MIN.	MAX.	X MIN.	X MAX.	SIZE	SPACING	NO. READ	LENGTH	X	Y	SIZE	NO. READ	LENGTH	SIZE	NO. READ	LENGTH
H	SHORT OR LONG						Y MIN.	Y MAX.												
2'	Short	#3	12"	7	1'-7"	3'-11"	0'-8"	1'-0"	3'-0"	—	—	—	—	—	#3	1	9'-0"	#3	2	8'-0"
	Long	#3	12"	14	1'-5"	3'-11"	0'-8"	1'-0"	6'-10"	3'-0"	—	—	—	—	#3	1	15'-6"	#3	2	15'-6"
3'	Short	#3	12"	9	2'-1"	5'-3"	0'-10"	1'-4"	1'-9"	4'-0"	—	—	—	—	#3	1	11'-0"	#3	2	10'-6"
	Long	#3	12"	18	1'-11"	5'-3"	0'-10"	1'-4"	1'-2"	4'-0"	—	—	—	—	#3	1	19'-4"	#3	2	20'-2"
4'	Short	#3	12"	11	2'-6"	6'-7"	0'-11"	1'-8"	1'-9"	5'-0"	—	—	—	—	#3	1	13'-0"	#3	3	12'-0"
	Long	#3	12"	22	2'-4"	6'-6"	0'-11"	1'-7"	1'-6"	5'-0"	—	—	—	—	#3	1	23'-6"	#3	3	24'-6"
5'	Short	#3	12"	13	2'-11"	7'-11"	1'-0"	2'-0"	2'-0"	6'-0"	#3	12"	3	3'-6"	1'-11"	2'-6"	#3	1	15'-0"
	Long	#3	12"	26	2'-9"	7'-10"	1'-0"	1'-11"	1'-10"	6'-0"	#3	12"	6	3'-6"	1'-11"	2'-6"	#3	1	27'-6"
6'	Short	#4	12"	15	3'-6"	9'-4"	1'-2"	2'-6"	2'-5"	7'-1"	#3	12"	3	4'-6"	1'-4"	3'-3"	#3	1	17'-0"
	Long	#4	12"	30	3'-4"	9'-3"	1'-2"	2'-5"	2'-3"	7'-1"	#3	12"	6	4'-6"	1'-4"	3'-3"	#3	2	16'-8"
7'	Short	#4	12"	17	3'-11"	10'-10"	1'-8"	2'-10"	2'-9"	8'-1"	#4	12"	6	5'-6"	1'-7"	4'-0"	#4	1	19'-0"
	Long	#4	12"	34	3'-9"	10'-8"	1'-8"	2'-8"	2'-7"	8'-1"	#4	12"	12	5'-6"	1'-7"	4'-0"	#4	2	18'-8"
8'	Short	#4	12"	19	4'-6"	12'-5"	1'-5"	3'-4"	3'-2"	9'-2"	#4	12"	9	6'-6"	1'-10"	4'-9"	#4	1	21'-0"
	Long	#4	12"	38	4'-4"	12'-3"	1'-5"	3'-2"	3'-0"	9'-2"	#4	12"	18	6'-6"	1'-10"	4'-9"	#4	2	20'-8"

CLEAR HEIGHT	WING LOCATION	SH1 & LH1 STRAIGHT Horizontal in back face of wing.				SH2 & LH2 STRAIGHT Horizontal in back face of wing. One bar of each length.				SH3 & LH3 In back face of wing at top - on slope.			SH4 & LH4 BENT Dowels thru construction joint at headwall.					BAR BENDING DIAGRAM	QUANTITY REINFORCING STEEL PER WING - LBS.	
		SIZE	SPACING	NO. READ	LENGTH	SIZE	SPACING	NO. READ	LENGTHS VARY MAX.	MIN.	SIZE	NO. READ	LENGTH	SIZE	SPACING	NO. READ	LENGTH	X	SF5 & SF6 LF5 & LF6 Y 3" Pin X	SHORT WING	LONG WING
H	SHORT OR LONG																		SH4 & LH4 X X 1/2		
2'	Short	#3	12"	1	6'-3"	#3	12"	1	—	3'-3"	#3	1	6'-7"	#3	12"	2	2'-8"	1'-4"	NOTE:- Dimensions are to bar centers.	29.7	45.6
	Long	#3	12"	1	12'-8"	#3	12"	1	—	6'-6"	#3	1	12'-11"	#3	12"	2	"	"			
3'	Short	#3	12"	2	8'-3"	#3	12"	2	6'-3"	3'-3"	#3	1	8'-8"	#3	12"	3	"	"		37.0	69.5
	Long	#3	12"	2	16'-8"	#3	18"	2	12'-6"	6'-6"	#3	1	16'-11"	#3	12"	3	"	"			
4'	Short	#3	12"	1	10'-3"	#3	12"	3	9'-3"	3'-3"	#3	1	10'-9"	#3	12"	4	"	"		56.2	107.2
	Long	#3	12"	1	20'-8"	#3	12"	3	18'-6"	6'-6"	#3	1	21'-0"	#3	12"	4	"	"			
5'	Short	#3	12"	2	12'-3"	#3	12"	3	9'-3"	3'-3"	#3	1	12'-11"	#3	12"	5	"	"		78.0	152.2
	Long	#3	12"	2	24'-6"	#3	12"	3	18'-6"	6'-6"	#3	1	25'-1"	#3	12"	5	"	"			
6'	Short	#3	12"	2	14'-3"	#3	12"	4	12'-3"	3'-3"	#3	1	15'-0"	#3	12"	6	"	"		127.8	253.1
	Long	#3	12"	4	15'-2"	#3	12"	4	24'-6"	6'-6"	#3	2	15'-6"	#3	12"	6	2'-8"	1'-4"			
7'	Short	#4	12"	2	16'-3"	#4	12"	5	15'-3"	3'-3"	#4	1	17'-1"	#4	12"	7	3'-6"	1'-9"		267.0	989.8
	Long	#4	12"	4	17'-2"	#4	12"	5	30'-6"	6'-6"	#4	2	17'-5"	#4	12"	7	"	"			
8'	Short	#4	12"	2	18'-3"	#4	12"	5	15'-3"	3'-3"	#4	1	19'-3"	#4	12"	8	"	"		312.9	622.3
	Long	#4	12"	6	19'-2"	#4	12"	5	30'-6"	6'-6"	#4	2	19'-6"	#4	12"	8	3'-6"	1'-9"			

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

* Length without splice. Bars over 28'-0" length may be spliced. (1'-8" lgs.)

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

Designed By:- W.C.H. 5-13-63 Checked By:- EBWS 8-19-63
Drawn By:- W.C.H. 7-26-63 Checked By:- DMT 7-15-68
Quantities By:- W.C.H. 1-7-69 Checked By:-

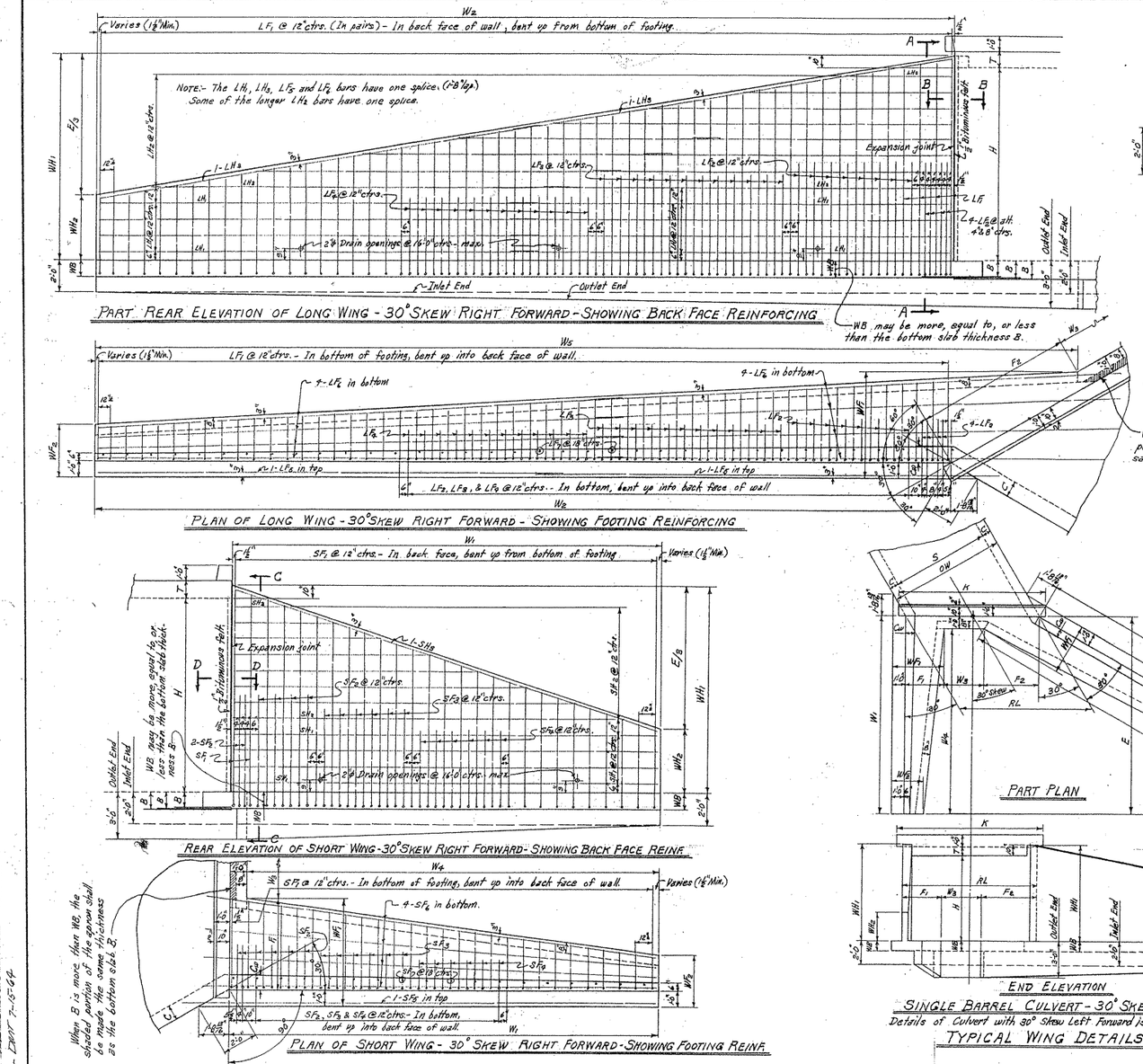
CLASS S CONCRETE

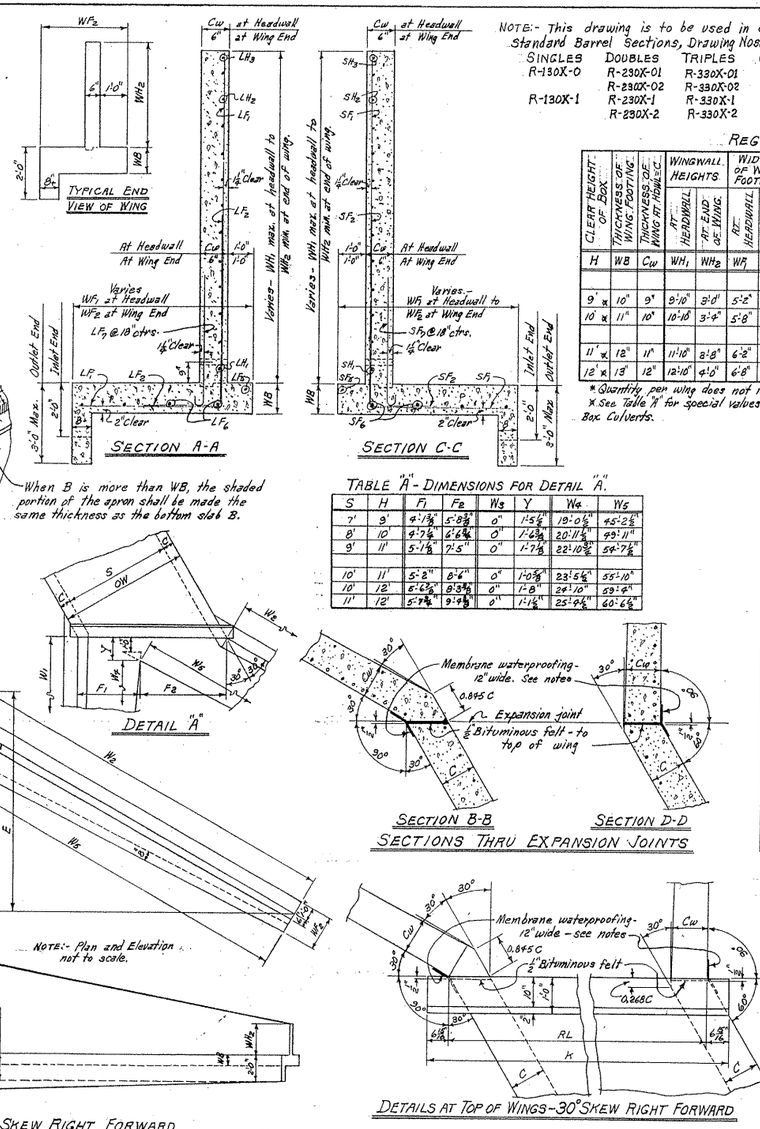
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES.
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

STANDARD DRAWING No. W-X303-1

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					





NOTE:- This drawing is to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

TABLE "A" - DIMENSIONS FOR DETAIL "A".

S	H	F_1	F_2	W_3	Y	W_4	W_5
7'	9'	4'-1⅜"	5'-8⅜"	0"	1'-5⅛"	18'-0½"	45'-2⅝"
8'	10'	4'-7⅝"	6'-6⅝"	0"	1'-6⅜"	20'-11⅞"	49'-11"
9'	11'	5'-1⅞"	7'-5"	0"	1'-7⅞"	22'-10⅜"	54'-7⅞"
10'	11'	5'-2"	8'-4"	0"	1'-0⅜"	23'-5⅛"	55'-10"
10'	12'	5'-6⅝"	8'-3⅜"	0"	1'-8"	24'-10"	59'-4"
11'	12'	5'-7⅞"	9'-3⅜"	0"	1'-1⅛"	25'-4⅞"	60'-6⅞"

REGULAR WING DIMENSIONS - 3:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	WINGWALL HEIGHTS: AT HEADWALL	WINGWALL HEIGHTS: AT END OF WING	WIDTHS OF WING FOOTINGS: AT HEADWALL	WIDTHS OF WING FOOTINGS: AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL	PERPENDICULAR DIST. FROM HEADL. TO END OF WING	LENGTHS OF WINGWALLS: SHORT WING	LENGTHS OF WINGWALLS: LONG WING	INSIDE FOOTING DIMENSIONS: SHORT WING	INSIDE FOOTING DIMENSIONS: LONG WING	* QUANTITY PER WING, CLASS S CONCRETE: INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH_1	WH_2	WF_1	WF_2	F_1	F_2	E	W_1	W_2	W_4	W_5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
9' x	10"	9"	9'-10"	9'-0"	5'-2"	2'-10½"	4'-2"	6'-7⅝"	20'-6"	20'-6"	41'-0"	19'-6"	46'-2⅝"	6.339	13.125	6.598	13.701
10 x	11"	10"	10'-10"	9'-9"	5'-8"	3'-0"	4'-8"	7'-7⅝"	22'-6"	22'-6"	45'-0"	21'-6"	51'-1"	8.085	16.731	8.369	17.367
11' x	12"	11"	11'-10"	9'-8"	6'-2"	3'-11⅛"	5'-2"	8'-7⅝"	24'-6"	24'-6"	49'-0"	23'-6"	55'-11⅝"	10.137	20.967	10.495	21.663
12' x	13"	12"	12'-10"	9'-10"	6'-8"	3'-3"	5'-8"	9'-7⅝"	26'-6"	26'-6"	53'-0"	25'-6"	60'-3⅜"	12.520	25.885	12.853	26.641

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_3.
* See Table "A" for special values of F_1 & F_2 and W_4 & W_5 for Single 7'x9', 8'x10', 9'x11', 10'x11', 10'x12' and 11'x12' Box Culverts.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING ® STEEL PER 4 WINGS	CLASS S CONCRETE - 4 WINGS: HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	2823	40.26	42.29	44.21	46.15	48.08
8'	9'	9"	10"	2823	40.61	42.79	44.96	47.15	49.32
	10'	10"	11"	3544	51.09	53.93	55.64	57.87	60.08
9'	9'	9"	10"	2823	40.86	43.81	45.71	48.14	50.55
	10'	10"	11"	3544	51.47	53.94	56.40	58.87	61.33
	11'	11"	12"	4280	63.77	66.93	68.91	71.91	73.88
10'	9'	9"	10"	2823	41.11	43.88	46.48	49.11	51.78
	10'	10"	11"	3544	51.72	54.95	57.15	59.85	62.57
	11'	11"	12"	4280	64.19	66.94	69.67	72.90	75.14
	12'	12"	13"	5394	78.98	81.95	84.21	86.96	89.78
11'	9'	9"	10"	2823	41.36	44.36	47.26	50.15	——
	10'	10"	11"	3544	51.97	54.99	57.91	60.86	——
	11'	11"	12"	4280	64.44	67.46	70.43	73.41	——
	12'	12"	13"	5394	78.93	81.97	84.98	87.99	——
12'	9'	9"	10"	2823	41.62	44.90	48.06	51.23	——
	10'	10"	11"	3544	52.22	55.53	58.71	61.90	——
	11'	11"	12"	4280	64.70	68.00	71.19	74.42	——
	12'	12"	13"	5394	79.20	82.50	85.74	89.01	——

® For reinforcing steel in headwalls and aprons, see Drawing Nos. of Barrel Sections listed at top of sheet.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X30. For values of RL, K and W_3 for each box, see above std. also.

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF_1 & LF_1 BENT: In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length. SIZE	SPACING	No. REQD.	LENGTHS VARY MIN.	MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF_2 & LF_2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F_1 bars. SIZE ®	SPACING	No. REQD.	LENGTH	X	Y
H	SHORT OR LONG															
9'	Short	#5	12"	21	5'-0"	14'-0"	1'-6"	3'-10"	3'-7"	10'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"
	Long	#5	12"	42	4'-10"	13'-9"	1'-6"	3'-7"	3'-5"	10'-3"	#5	12"	6	7'-10"	2'-1"	5'-6"
10'	Short	#5	12"	23	5'-7"	15'-7"	1'-8"	4'-4"	4'-0"	11'-9"	#6	12"	3	8'-6"	2'-4"	6'-3"
	Long	#5	12"	46	5'-5"	15'-6"	1'-8"	4'-1"	3'-10"	11'-9"	#6	12"	6	8'-6"	2'-4"	6'-3"
11'	Short	#5	12"	25	6'-1"	17'-2"	1'-9"	4'-10"	4'-5"	12'-5"	#6	12"	6	8'-6"	2'-4"	6'-3"
	Long	#5	12"	50	5'-11"	16'-10"	1'-9"	4'-6"	4'-3"	12'-5"	#6	12"	12	8'-6"	2'-4"	6'-3"
12'	Short	#5	12"	27	6'-8"	18'-9"	1'-11"	5'-4"	4'-10"	13'-6"	#7	12"	6	9'-6"	2'-7"	7'-0"
	Long	#5	12"	54	6'-6"	18'-4"	1'-11"	4'-11"	4'-8"	13'-6"	#7	12"	12	9'-6"	2'-7"	7'-0"

CLEAR HEIGHT	WING LOCATION	SF_3 & LF_3 BENT: In bottom of footing, bent up into back face of wing. Alt. with F_1 bars. SIZE	SPACING	No. REQD.	LENGTH	X	Y	SF_4 & LF_4 BENT: In bottom of footing, bent up into back face of wing. Alt. with F_1 bars. SIZE	SPACING	No. REQD.	LENGTH	X	Y
H	SHORT OR LONG												
9'	Short	#4	12"	6	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#4	12"	12	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	6	7'-10"	2'-1"	5'-6"	#4	12"	12	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	6	7'-10"	2'-1"	5'-6"	#4	12"	12	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	6	8'-6"	2'-4"	6'-3"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	12	8'-6"	2'-4"	6'-3"	#4	12"	12	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	WING LOCATION	SF_5 & LF_5 STRAIGHT: Longitudinal in top of wing footing heel. SIZE	No. REQD.	LENGTH	SF_6 & LF_6 STRAIGHT: Longitudinal in bottom of wing footing toe. SIZE	No. REQD.	LENGTH	SF_7 & LF_7 BENT: Footing dowels extending up into front face of wing. SIZE	SPACING	No. REQD.	LENGTH	X
H	SHORT OR LONG											
9'	Short	#4	1	23'-0"	#4	4	22'-0"	#4	18"	14	4'-0"	3'-6"
	Long	#4	2	22'-8"	#4	8	25'-2"	#4	18"	28	4'-0"	3'-6"
10'	Short	#4	1	25'-0"	#4	4	24'-0"	#4	18"	16	4'-9"	3'-10"
	Long	#4	2	24'-8"	#4	8	27'-7"	#4	18"	31	4'-9"	3'-10"
11'	Short	#4	1	27'-0"	#4	4	26'-0"	#4	18"	17	4'-8"	4'-2"
	Long	#4	2	26'-8"	#4	8	30'-1"	#4	18"	33	4'-8"	4'-2"
12'	Short	#4	1	29'-0"	#4	4	28'-0"	#4	18"	18	5'-0"	4'-6"
	Long	#4	2	28'-8"	#4	8	32'-6"	#4	18"	36	5'-0"	4'-6"

CLEAR HEIGHT	WING LOCATION	SH_1 & LH_1 STRAIGHT: Horizontal in back face of wing. SIZE	SPACING	No. REQD.	LENGTH	SH_2 & LH_2 STRAIGHT: Horizontal in back face of wing. One bar of each length.* SIZE	SPACING	No. REQD.	LENGTHS VARY MAX.	MIN.	SH_3 & LH_3 STRAIGHT: In back face of wing at top - on slope. SIZE	No. REQD.	LENGTH
H	SHORT OR LONG												
9'	Short	#4	12"	3	20'-8"	#4	12"	6	18'-3"	3'-3"	#4	1	21'-9"
	Long	#4	12"	6	21'-2"	#4	12"	6	*36'-6"	6'-6"	#4	2	21'-6"
10'	Short	#4	12"	3	22'-8"	#4	12"	7	21'-3"	3'-3"	#4	1	23'-5"
	Long	#4	12"	6	23'-2"	#4	12"	7	*42'-6"	6'-6"	#4	2	23'-6"
11'	Short	#4	12"	4	24'-3"	#4	12"	7	21'-3"	3'-3"	#4	1	25'-7"
	Long	#4	12"	8	25'-2"	#4	12"	7	*42'-6"	6'-6"	#4	2	25'-7"
12'	Short	#4	12"	4	26'-3"	#4	12"	8	24'-3"	3'-3"	#4	1	27'-8"
	Long	#4	12"	8	27'-2"	#4	12"	8	*48'-6"	6'-6"	#4	2	27'-7"

BAR BENDING DIAGRAMS: SF_1-SF_6, LF_1-LF_6 (Y, X, 4½" Pin); SF_7 & LF_7 (X, 3" Pin)

NOTE:- Dimensions are to bar centers.

QUANTITY: REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
967.1	997.6
586.4	1185.7
708.9	1451.3
893.5	1803.3

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

® Except as shown at headwall.

* Lengths without splice. Bars over 28'-0" length may be spliced (1'-8" lap). Quantities include laps for LH2 bars over 28'-0" length.

Designed By:- W.C.H. 5-16-63 Checked By:-
Drawn By:- W.C.H. 7-22-63 Checked By:- RHS 8-20-63
Quantities By:- W.C.H. 1-7-64 Checked By:- DWT 7-15-64

CLASS S CONCRETE

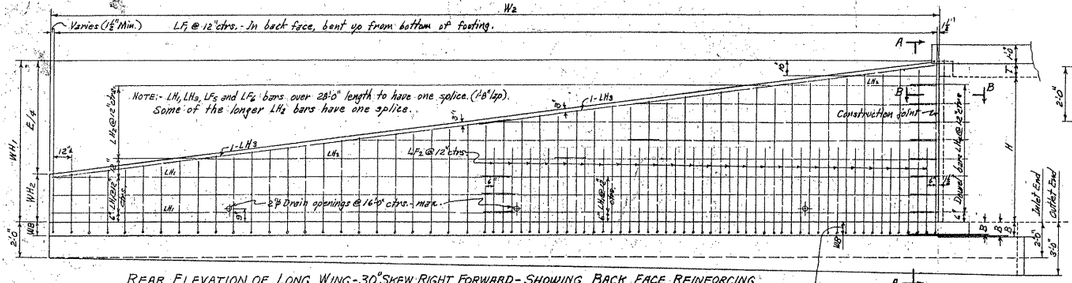
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

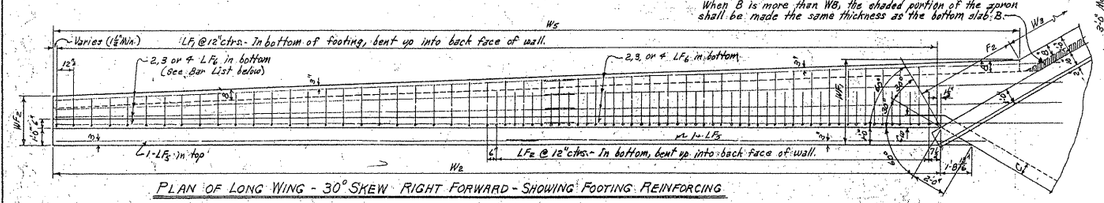
STANDARD DRAWING No. W-X303-2

364-710

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



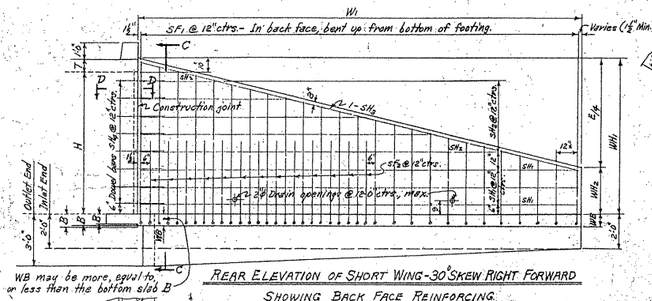
REAR ELEVATION OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



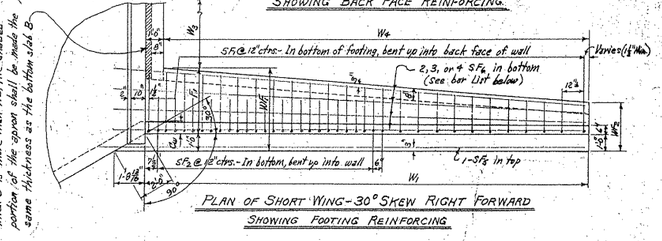
PLAN OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING

WB may be more, equal to, or less than the bottom slab B

When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

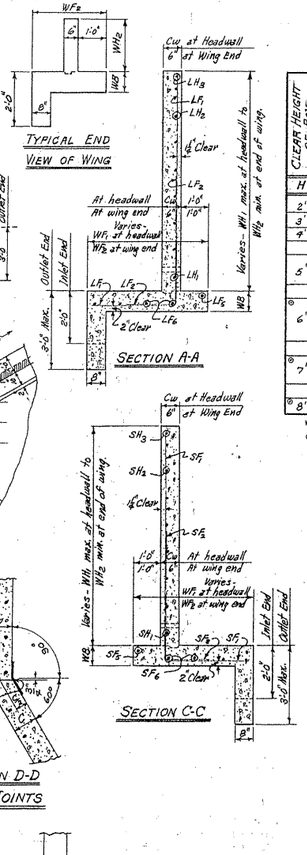


REAR ELEVATION OF SHORT WING - 30° SKEW RIGHT FORWARD SHOWING BACK FACE REINFORCING

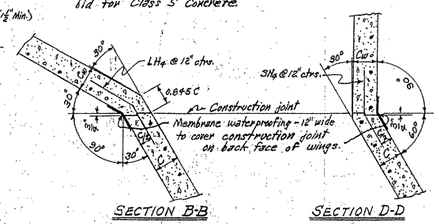


PLAN OF SHORT WING - 30° SKEW RIGHT FORWARD SHOWING FOOTING REINFORCING

When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

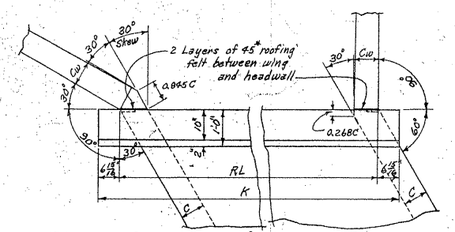


NOTE:- Payment for membrane waterproofing and roofing felt to be included in price bid for Class S Concrete.



SECTION B-B SECTION D-D

SECTIONS THRU CONSTRUCTION JOINTS



DETAILS AT TOP OF WINGS - 30° SKEW RIGHT FORWARD

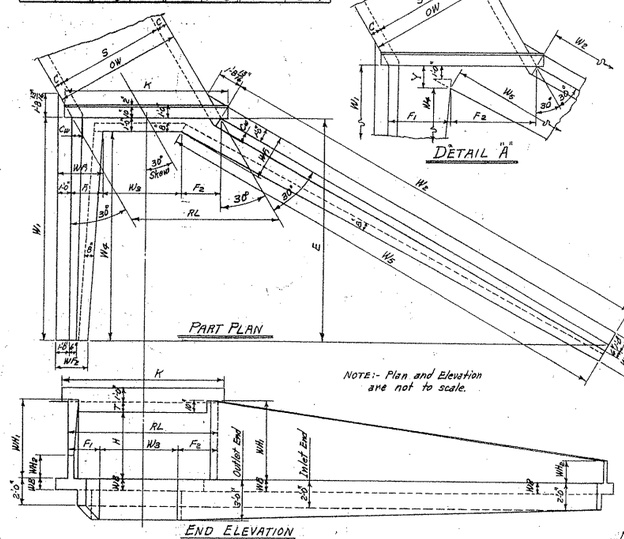
REGULAR WING DIMENSIONS - 4:1 SLOPES

CLEAR HEIGHT OF BOX H	THICKNESS OF WING FOOTING WB	THICKNESS OF WING AT HEADWALL Cw	WINGWALL HEIGHTS AT HEADWALL WH₁	WINGWALL HEIGHTS AT END OF WING WH₂	WIDTHS OF WING FOOTINGS AT HEADWALL WF₁	WIDTHS OF WING FOOTINGS AT END OF WING WF₂	FOOTING DIMENSION - PARALLEL WITH HEADWALL SHORT WING F₁	FOOTING DIMENSION - PARALLEL WITH HEADWALL LONG WING F₂	PERPENDICULAR DIST. FROM HEADWALL TO END OF WING E	LENGTHS OF WINGWALLS SHORT WING W₁	LENGTHS OF WINGWALLS LONG WING W₂	INSIDE FOOTING DIMENSION SHORT WING W₄	INSIDE FOOTING DIMENSION LONG WING W₅	* QUANTITY PER WING - CLASS S CONCRETE - INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
														CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-4"	0'-11½"	8'-6"	8'-8"	17'-4"	7'-8"	17'-7⅝"	1.000	2.093	1.110	2.266
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅛"	1'-8"	1'-7⅛"	11'-4"	11'-4"	22'-8"	10'-4"	23'-6⅝"	1.502	3.085	1.644	3.380
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-2"	2'-0"	2'-3⅜"	14'-0"	14'-0"	28'-0"	13'-0"	29'-5½"	2.097	4.312	2.274	4.680
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-2"	2'-11⅛"	16'-8"	16'-8"	33'-4"	15'-8"	35'-4⅝"	2.785	5.725	2.995	6.166
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11⅛"	16'-8"	16'-8"	33'-4"	15'-8"	35'-4⅝"	2.899	5.965	3.109	6.406
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3⅜"	3.869	7.996	4.112	8.460
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3⅜"	3.947	8.109	4.190	8.623
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅛"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3⅜"	4.025	8.272	4.267	8.787
⊙ 7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7⅛"	3'-2"	4'-7⅛"	22'-0"	22'-0"	44'-0"	21'-0"	47'-5⅝"	5.069	10.414	5.345	11.005
		8"	7'-10"	2'-4"	4'-2"	2'-7⅛"	3'-2"	4'-7⅛"	22'-0"	22'-0"	44'-0"	21'-0"	47'-5⅝"	5.171	10.626	5.447	11.217
⊙ 8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7⅛"	24'-8"	24'-8"	49'-4"	23'-8"	53'-8⅝"	6.484	13.319	6.793	13.987

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W₃.
⊙ See Table "A" for special values of F₁ & F₂ and W₄ & W₅ for Single 4'x6', 5'x7' and 6'x8' Box Culverts.

TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F₁	F₂	W₃	Y	W₄	W₅
4'	6'	2'-7⅜"	3'-3⅝"	0"	1'-7⅜"	18'-2"	40'-11⅝"
5'	7'	3'-1⅜"	4'-0⅛"	0"	1'-3⅝"	20'-8⅝"	44'-10⅛"
6'	8'	3'-7⅝"	4'-10"	0"	1'-4⅝"	23'-3"	52'-9⅜"



SINGLE BARREL CULVERT - 30° SKEW RIGHT FORWARD
Details of Culvert with 30° Skew Left Forward is reversed, see Drawing No. W-X30.

TYPICAL WING DETAILS

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X30.
For values of RL, K and W₃ for each box, see above Std. also.

MEMBRANE:- A membrane waterproofing 18" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

QUANTITIES

CLEAR SPAN S	CLEAR HEIGHT H	THICKNESS OF WING AT HEADWALL Cw	THICKNESS OF WING FOOTING WB	REINFORCING STEEL - LB. FOR 4 WINGS ⊛	CLASS S CONCRETE - 4 WINGS - HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
					CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	179	7.36	8.96	9.57	10.68	11.79
	3'	6"	7"	274	10.92	11.52	12.63	13.74	14.85
	4'	6"	7"	428	14.03	15.13	16.24	17.35	18.46
	5'	6"	7"	603	18.20	19.30	20.41	21.52	22.63
	6'	7"	8"	994	24.80	25.94	27.08	28.22	29.36
5'	3'	6"	7"	274	10.67	12.01	13.35	14.70	16.04
	4'	6"	7"	428	14.28	15.62	16.96	18.31	19.66
	5'	6"	7"	603	18.45	19.79	21.13	22.48	23.83
	6'	7"	8"	994	25.05	26.43	27.80	29.18	30.56
	7'	7½"	8½"	1926	32.27	33.70	35.11	36.51	37.92
6'	3'	6"	7"	274	10.91	12.51	14.07	15.67	17.26
	4'	6"	7"	428	14.52	16.12	17.68	19.28	20.87
	5'	6"	7"	603	18.69	20.29	21.85	23.45	25.04
	6'	7"	8"	994	25.30	26.92	28.53	30.14	31.78
	7'	7½"	8½"	1926	32.55	34.20	35.84	37.49	39.14
	8'	8"	9"	2442	41.04	42.76	44.40	46.06	47.72
7'	4'	6"	7"	428	14.77	16.63	18.45	20.30	22.10
	5'	6"	7"	603	18.94	20.79	22.61	24.47	26.27
	6'	7"	8"	994	25.55	27.43	29.27	31.14	32.98
	7'	7½"	8½"	1926	32.81	34.70	36.58	38.47	40.35
	8'	8"	9"	2442	41.86	43.26	45.15	47.05	48.94
8'	4'	6"	7"	428	15.03	17.14	19.22	21.34	23.37
	5'	7"	7"	603	19.34	22.08	24.17	26.81	28.37
	6'	7"	8"	994	26.80	27.92	30.00	32.12	34.15
	7'	7½"	8½"	1926	33.06	35.21	37.33	39.49	41.57
	8'	8"	9"	2442	41.61	43.77	45.89	48.05	50.16
9'	5'	7"	7"	603	21.20	22.60	24.95	27.35	29.63
	6'	7½"	8"	994	26.56	28.99	31.35	33.77	36.08
	7'	7½"	8½"	1926	33.81	35.73	38.10	40.52	42.83
	8'	8"	9"	2442	41.96	44.29	46.66	49.08	51.38
10'	5'	7"	7"	603	20.46	23.13	25.73	28.28	30.90
	6'	7½"	8"	994	26.88	29.51	32.14	34.71	37.34
	7'	7½"	8½"	1926	33.57	36.26	38.88	41.96	44.10
	8'	8"	9"	2442	42.11	44.80	47.43	50.01	52.65
11'	6'	8"	8"	994	27.57	30.56	33.43	36.28	—
	7'	8"	8½"	1926	34.46	37.44	40.32	43.18	—
	8'	8"	9"	2442	42.36	45.84	48.22	51.08	—
12'	6'	8"	8"	994	27.84	31.11	34.23	37.38	—
	7'	8"	8½"	1926	34.72	37.93	41.12	44.27	—
	8'	8"	9"	2442	42.62	45.88	49.02	52.17	—

⊛ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.

GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-130X-0	R-230X-01	R-330X-01	R-430X-01	R-530X-01
	R-230X-02	R-330X-02	R-430X-02	R-530X-02
R-130X-1	R-230X-1	R-330X-1	R-430X-1	R-530X-1
	R-230X-2	R-330X-2		

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT H	WING LOCATION	SF₁ & LF₁ BENT - In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length. SIZE	SPACING	No. REQD.	LENGTHS VARY X MIN.	X MAX.	Y MIN.	Y MAX.	SF₂ & LF₂ BENT - In bottom of footing, bent up into back face of wing. Alt. with F₁ bars. SIZE	SPACING	No. REQD.	LENGTH	X	Y	SF₃ & LF₃ STRAIGHT - Longitudinal in top of wing footing heel. SIZE	No. REQD.	LENGTH	SF₄ & LF₄ STRAIGHT - Longitudinal in bottom of wing footing toe. SIZE	No. REQD.	LENGTH	SH₁ & LH₁ - Horizontal in back face of wing. SIZE	SPACING	No. REQD.	LENGTH
2'	Short	#3	12"	9	1'-7"	3'-1"	0'-8"	1'-0"	—	—	—	—	—	—	#3	1	11'-2"	#3	2	10'-6"	#3	12"	1	8'-4"
	Long	#3	12"	18	1'-5"	3'-1"	0'-8"	1'-0"	—	—	—	—	—	—	#3	1	19'-8"	#3	2	19'-4"	#3	12"	1	17'-0"
3'	Short	#3	12"	12	2'-0"	5'-3"	0'-10"	1'-9"	—	—	—	—	—	—	#3	1	13'-10"	#3	2	13'-10"	#3	12"	1	11'-0"
	Long	#3	12"	23	2'-0"	5'-3"	0'-10"	1'-9"	—	—	—	—	—	—	#3	1	25'-0"	#3	2	25'-6"	#3	12"	1	22'-4"
4'	Short	#3	12"	15	2'-4"	6'-7"	0'-11"	1'-8"	—	—	—	—	—	—	#3	1	16'-6"	#3	3	15'-8"	#3	12"	1	13'-8"
	Long	#3	12"	29	2'-4"	6'-6"	0'-11"	1'-7"	—	—	—	—	—	—	#3	2	16'-0"	#3	6	16'-7"	#3	12"	1	27'-8"
5'	Short	#3	12"	17	2'-11"	7'-11"	1'-0"	2'-0"	2'-0"	12"	5	3'-6"	1'-1"	2'-6"	#3	1	19'-2"	#3	3	18'-6"	#3	12"	2	16'-4"
	Long	#3	12"	34	2'-9"	7'-10"	1'-0"	1'-11"	2'-0"	12"	8	3'-6"	1'-1"	2'-6"	#3	2	18'-8"	#3	6	19'-7"	#3	12"	4	17'-6"
6'	Short	#4	12"	20	3'-5"	9'-4"	1'-2"	2'-4"	2'-4"	12"	8	4'-6"	1'-4"	3'-3"	#3	1	21'-10"	#3	3	21'-0"	#3	12"	4	19'-0"
	Long	#4	12"	39	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	12"	8	4'-6"	1'-4"	3'-3"	#3	2	21'-2"	#3	6	22'-9"	#3	12"	4	20'-0"
7'	Short	#4	12"	23	3'-9"	10'-0"	1'-3"	2'-10"	2'-7"	12"	9	5'-6"	1'-7"	4'-0"	#4	1	24'-6"	#4	3	23'-8"	#4	12"	2	21'-8"
	Long	#4	12"	45	3'-9"	10'-8"	1'-3"	2'-8"	2'-7"	12"	16	5'-6"	1'-7"	4'-0"	#4	2	24'-0"	#4	8	25'-8"	#4	12"	4	22'-8"
8'	Short	#4	12"	25	4'-6"	12'-5"	1'-5"	3'-4"	3'-2"	12"	13	6'-6"	1'-10"	4'-9"	#4	1	27'-2"	#4	4	26'-9"	#4	12"	3	24'-8"
	Long	#4	12"	50	4'-6"	12'-3"	1'-5"	3'-2"	3'-0"	12"	24	6'-6"	1'-10"	4'-9"	#4	2	26'-8"	#4	8	28'-3"	#4	12"	6	25'-4"

CLEAR HEIGHT H	WING LOCATION	SH₂ & LH₂ STRAIGHT - Horizontal in back face of wing. One bar on each slope. SIZE	SPACING	No. REQD.	LENGTHS VARY MAX.	MIN.	SH₃ & LH₃ STRAIGHT - In back face of wing at top-on slope. SIZE	No. REQD.	LENGTH	SH₄ & LH₄ BENT - Dowels thru construction joint at headwall. SIZE	SPACING	No. REQD.	LENGTH	X
2'	Short	#3	12"	1	—	4'-4"	#3	1	8'-8"	#3	12"	2	2'-8"	1'-4"
	Long	#3	12"	1	—	8'-8"	#3	1	17'-2"	#3	12"	2	"	"
3'	Short	#3	12"	2	8'-9"	4'-4"	#3	1	11'-5"	#3	12"	3	"	"
	Long	#3	12"	2	16'-8"	8'-8"	#3	1	22'-7"	#3	12"	3	"	"
4'	Short	#3	12"	3	12'-9"	4'-4"	#3	1	14'-2"	#3	12"	4	"	"
	Long	#3	12"	3	24'-8"	8'-8"	#3	1	27'-11"	#3	12"	4	"	"
5'	Short	#3	12"	3	12'-9"	4'-4"	#3	1	16'-11"	#3	12"	5	"	"
	Long	#3	12"	3	24'-8"	8'-8"	#3	2	17'-6"	#3	12"	5	"	"
6'	Short	#3	12"	4	16'-6"	4'-4"	#3	1	19'-8"	#3	12"	6	"	"
	Long	#3	12"	4	32'-8"	8'-8"	#3	2	20'-2"	#3	12"	6	2'-8"	1'-4"
7'	Short	#4	12"	5	20'-6"	4'-4"	#4	1	22'-5"	#4	12"	7	3'-6"	1'-9"
	Long	#4	12"	5	40'-8"	8'-8"	#4	2	23'-0"	#4	12"	7	"	"
8'	Short	#4	12"	5	20'-6"	4'-4"	#4	1	25'-2"	#4	12"	8	"	"
	Long	#4	12"	5	40'-8"	8'-8"	#4	2	25'-8"	#4	12"	8	3'-6"	1'-9"

BAR BENDING DIAGRAM: SF₁ & SF₂, LF₁ & LF₂, 3" Pin, X; SH₂ & LH₂, 7/12, X

NOTE:- Dimensions are to bar centers.

QUANTITY - REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
31.3	58.3
47.5	89.5
72.9	141.3
102.1	199.4
168.8	328.4
326.2	637.0
411.7	809.6

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

* Length without splice. Bars over 28'-0" length may be spliced. (1'-8" lap)

REVISIONS:- Membrane added. 5-10-66 W.C.H.

CLASS S CONCRETE

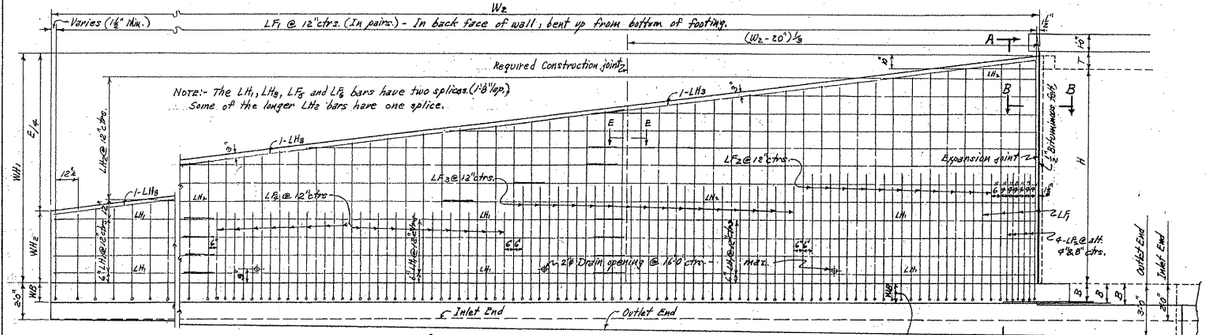
ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

4, 5, 6, 7, 8, 9, 10, 11 & 12' SPANS — 4:1 SLOPES
SINGLES, DOUBLES, TRIPLES, — ALL DEPTHS OF COVER
QUADRUPLES & QUINTUPLES. — FOR H = 8'-0" OR LESS

STANDARD DRAWING NO. W-X304-1

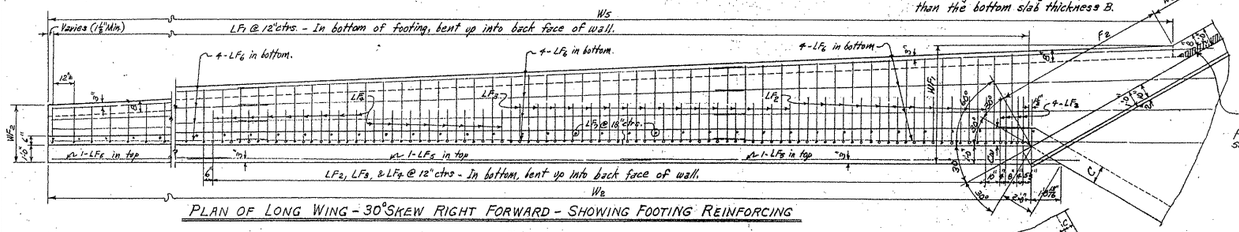
Designed By:- W.C.H. 5-13-63 Checked By:- 8-20-63
Drawn By:- W.C.H. 9-17-63 Checked By:- 1-13-65
Quantities By:- W.C.H. 1-7-64 Checked By:- DWT 7-13-65

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



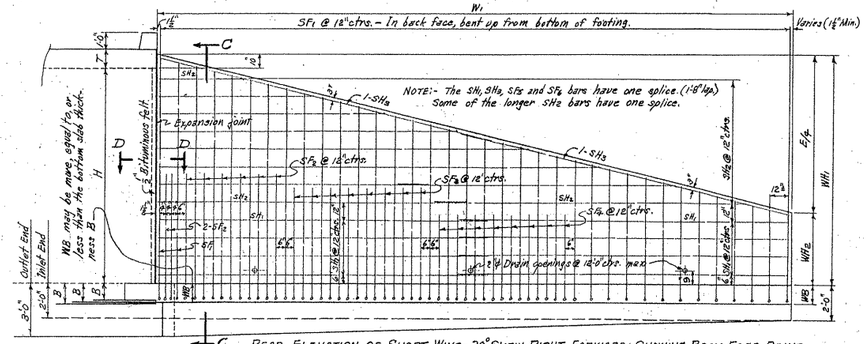
PART REAR ELEVATION OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING

WB may be more, equal to, or less than the bottom slab thickness B.



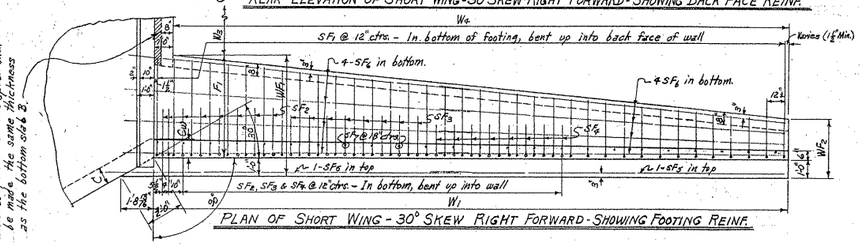
PLAN OF LONG WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING

When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.

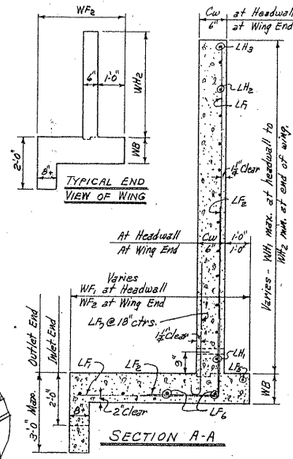


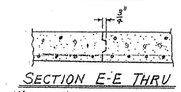
REAR ELEVATION OF SHORT WING - 30° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.

When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.



PLAN OF SHORT WING - 30° SKEW RIGHT FORWARD - SHOWING FOOTING REINF.



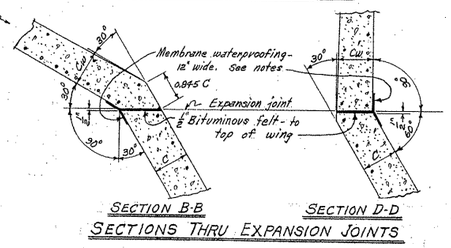


SECTION E-E THRU WING CONSTRUCTION JOINT

DETAIL "A"

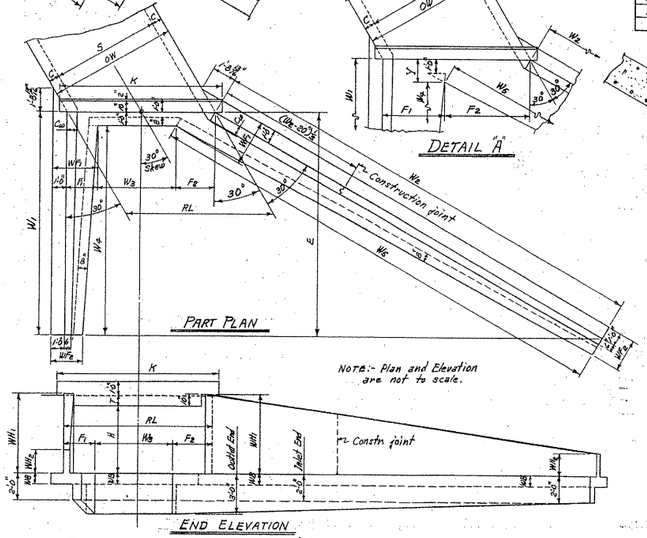
TABLE "A" - DIMENSIONS FOR DETAIL "A"

S	H	F1	F2	W3	Y	W4	W5
7'	9'	4'-1⅛"	5'-0⅛"	0"	1'-5⅜"	25'-10⅛"	58'-10⅛"
8'	10'	4'-7⅞"	6'-6⅛"	0"	1'-6⅞"	28'-5⅛"	64'-10⅜"
9'	11'	5'-1⅛"	7'-4⅜"	0"	1'-7⅞"	31'-0⅛"	70'-11"
10'	11'	5'-2"	8'-6"	0"	1'-0⅜"	31'-7⅛"	72'-2"
10'	12'	5'-7⅞"	8'-8⅞"	0"	1'-8⅜"	33'-7⅛"	76'-11⅜"
11'	12'	5'-7⅞"	9'-4⅞"	0"	1'-1⅛"	34'-2⅛"	78'-2⅛"



SECTION B-B SECTION D-D

SECTIONS THRU EXPANSION JOINTS



PART PLAN

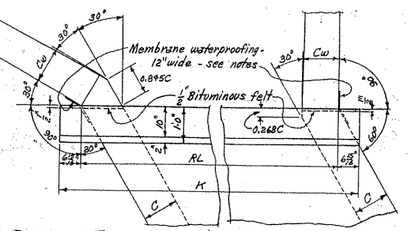
Note:- Plan and Elevation are not to scale.

END ELEVATION

SINGLE BARREL CULVERT - 30° SKEW RIGHT FORWARD

Details of Culvert with 30° Skew Left Forward is reversed, see Drawing No. W-X.30.

TYPICAL WING DETAILS



DETAILS AT TOP OF WINGS - 30° SKEW RIGHT FORWARD

NOTE:- For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X.30. For values of RL, K and W3 for each box, see above Std. also.

REGULAR WING DIMENSIONS - 4:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL.* C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT FT. END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL		PERPENDICULAR DIST. FROM HDWL. TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSIONS		* QUANTITY PER WING CLASS S CONCRETE INLET END		QUANTITY PER WING CLASS S CONCRETE OUTLET END	
							SHORT WING	LONG WING		SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
9' ×	10"	9"	9'-10"	3'-0"	5'-2"	2'-10⅜"	4'-2"	6'-7⅝"	27'-4"	27'-4"	59'-8"	26'-4"	59'-10⅜"	8.439	17.317	8.777	18.061
10' ×	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-8"	7'-7⅝"	30'-0"	30'-0"	60'-0"	29'-0"	66'-1"	10.758	22.078	11.183	22.899
11' ×	12"	11"	11'-10"	3'-8"	6'-2"	3'-1⅛"	5'-2"	8'-7⅝"	32'-8"	32'-8"	65'-4"	31'-8"	72'-3⅜"	13.988	27.672	13.897	28.570
12' ×	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-8"	9'-7⅝"	35'-4"	35'-4"	70'-8"	34'-4"	78'-5⅜"	16.661	34.170	17.103	35.194

* Quantity per wing does not include headwall or that portion of apron or headwall for the length W3.
× See Table "A" for special values of F1, F2, and W4 & W5 for Single 7'x9', 8'x10', 9'x11', 10'x11', 10'x12' and 11'x12' Box Culverts.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL* FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
7'	9'	9"	10"	3759	53.08	55.11	57.04	58.98	60.91
8'	9'	9"	10"	3759	53.93	55.62	57.79	59.98	62.15
	10'	10"	11"	4694	67.40	69.75	71.96	74.19	76.40
9'	9'	9"	10"	3759	53.69	56.18	58.54	60.97	63.38
	10'	10"	11"	4694	67.78	70.26	72.71	75.19	77.64
	11'	11"	12"	5676	84.18	86.84	89.32	91.82	94.30
10'	9'	9"	10"	3759	53.94	56.65	59.30	61.94	64.61
	10'	10"	11"	4694	68.04	70.77	73.47	76.17	78.89
	11'	11"	12"	5675	84.61	87.36	90.08	92.81	95.56
	12'	12"	13"	7152	103.64	106.63	109.59	112.14	114.91
11'	9'	9"	10"	3759	56.19	57.16	60.09	62.97	——
	10'	10"	11"	4694	68.29	71.30	74.23	77.17	——
	11'	11"	12"	5675	84.86	87.88	90.84	93.83	——
	12'	12"	13"	7152	104.11	107.15	110.16	113.17	——
12'	9'	9"	10"	3759	54.44	57.73	60.89	64.06	——
	10'	10"	11"	4694	68.54	71.84	75.03	78.22	——
	11'	11"	12"	5675	85.12	88.42	91.61	94.84	——
	12'	12"	13"	7152	104.88	107.68	110.92	114.19	——

* For reinforcing steel in Headwalls and Aprons, see

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mopcoings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 24,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 BENT: In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length. SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	NO. REQD	LENGTH	X	Y	SF3 & LF3 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	NO. REQD	LENGTH	X	Y	SF4 & LF4 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	NO. REQD	LENGTH	X	Y
H	SHORT LONG																											
9'	Short	#5	12"	28	4'-11"	14'-0"	1'-6"	3'-10"	3'-6"	10'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	55	4'-11"	13'-10"	1'-6"	3'-8"	3'-6"	10'-3"	#5	12"	7	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	31	5'-5"	15'-7"	1'-8"	4'-6"	3'-10"	11'-4"	#6	12"	4	8'-6"	2'-4"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	61	5'-5"	15'-4"	1'-8"	4'-1"	3'-10"	11'-4"	#6	12"	7	8'-6"	2'-4"	6'-3"	#5	12"	8	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	33	6'-1"	17'-2"	1'-9"	4'-10"	4'-6"	12'-5"	#6	12"	8	8'-6"	2'-4"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	66	5'-11"	16'-11"	1'-9"	4'-7"	4'-3"	12'-5"	#6	12"	15	8'-6"	2'-4"	6'-3"	#5	12"	8	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	36	6'-7"	18'-9"	1'-11"	5'-4"	4'-9"	13'-6"	#7	12"	8	9'-6"	2'-7"	7'-0"	#6	12"	8	8'-6"	2'-4"	6'-3"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#5	12"	71	6'-7"	18'-5"	1'-11"	5'-0"	4'-9"	13'-6"	#7	12"	15	9'-6"	2'-7"	7'-0"	#6	12"	16	8'-6"	2'-4"	6'-3"	#4	12"	16	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	WING LOCATION	SF5 & LF5 STRAIGHT: Longitudinal in top of wing footing heel. SIZE	NO. REQD	LENGTH	SF6 & LF6 STRAIGHT: Longitudinal in bottom of wing footing toe. SIZE	NO. REQD	LENGTH	SF7 & LF7 BENT: Footing dowels extending up into front face of wing. SIZE	SPACING	NO. REQD	LENGTH	X	SH1 & LH1 STRAIGHT: Horizontal in back face at wing. SIZE	SPACING	NO. REQD	LENGTH	SH2 & LH2 STRAIGHT: Horizontal in back face of wing. One bar of each length.* SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	LENGTHS VARY MIN.	SH3 & LH3 In back face of wing at top - on slope. SIZE	NO. REQD	LENGTH
H	SHORT LONG																							
9'	Short	#4	2	15'-9"	#4	8	15'-9"	#4	18"	19	4'-0"	3'-6"	#4	12"	6	14'-6"	#4	12"	6	26'-0"	4'-4"	#4	2	14'-10"
	Long	#4	3	20'-2"	#4	12	21'-9"	#4	18"	37	4'-0"	3'-6"	#4	12"	9	19'-3"	#4	12"	6	46'-0"	8'-8"	#4	3	19'-6"
10'	Short	#4	2	17'-1"	#4	8	16'-8"	#4	18"	20	4'-4"	3'-10"	#4	12"	6	16'-8"	#4	12"	7	28'-0"	4'-4"	#4	2	16'-3"
	Long	#4	3	22'-0"	#4	12	23'-10"	#4	18"	40	4'-4"	3'-10"	#4	12"	9	21'-0"	#4	12"	7	56'-0"	8'-8"	#4	3	21'-3"
11'	Short	#4	2	18'-5"	#4	8	18'-0"	#4	18"	22	4'-8"	4'-2"	#4	12"	8	17'-0"	#4	12"	7	28'-4"	4'-4"	#4	2	17'-9"
	Long	#4	3	23'-8"	#4	12	25'-11"	#4	18"	44	4'-8"	4'-2"	#4	12"	12	22'-10"	#4	12"	7	56'-8"	8'-8"	#4	3	23'-0"
12'	Short	#4	2	19'-3"	#4	8	19'-4"	#4	18"	24	5'-0"	4'-6"	#4	12"	8	18'-4"	#4	12"	8	32'-4"	4'-4"	#4	2	19'-6"
	Long	#4	3	25'-6"	#4	12	28'-0"	#4	18"	48	5'-0"	4'-6"	#4	12"	12	24'-7"	#4	12"	8	64'-8"	8'-8"	#4	3	24'-9"

BAR BENDING DIAGRAMS: SF1-SF6, LF1-LF4 (4½" Pin); SF7 & LF7 (3" Pin)

QUANTITY: REINFORCING STEEL PER WING - LBS.	SHORT WING	LONG WING
	630.7	1298.7
	788.4	1558.5
	949.5	1888.1
	1201.2	2374.7

NOTE:- Dimensions are to bar centers.

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

© Except as shown at headwall.

* Lengths without splice. Bars over 28'-0" length may be spliced. (1'-8" lap). Quantities include laps for SH2 & LH2 bars over 28'-0" length.

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES
R-130X-0	R-230X-01	R-330X-01
	R-230X-02	R-330X-02
R-130X-1	R-230X-1	R-330X-1
	R-230X-2	R-330X-2

QUADRUPLES	QUINTUPLES
R-430X-01	R-530X-01
R-430X-02	R-530X-02
R-430X-1	R-530X-1

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 30° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

STANDARD DRAWING NO. W-X304-2

Designed By:- W.C.H. 5-16-63 Checked By:- ____
Drawn By:- W.C.H. 6-3-63 Checked By:- ____
Quantities By:- W.C.H. 1-7-64 Checked By:- ____

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 30° SKEWED ENDS.

"a" bars – STRAIGHT – In Top and Bottom Slabs of Barrel. "a1" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel - (Four of each Length). "b" bars – BENT - See Diagrams below – In Top and Bottom Slabs of Barrel - hooked. Alternate with "a" bars.

D (Depth of Cover)	S (Clear Span)	H (Clear Height)	a Size	a Spacing	a No. Req'd	a Length	a1 Size	a1 Spacing	a1 No. Req'd	a1 Length Max.	a1 Length Min.	b Size	b Spacing	b No. Req'd	b Length	b X
0'-0" TO 5'-0" MAXIMUM	1 @ 4'	2'	#5	13"	108	4'-9"	#5	13"	4	2'-11"	—	#6	13"	108	5'-10"	4'-8"
		3'			108	4'-9"			4	"	—			108	5'-10"	"
		4'			108	4'-9"			4	"	—			108	5'-10"	"
		5'			108	4'-9"			4	"	—			108	5'-10"	"
		6'			108	4'-11"			4	3'-1"	—			108	6'-0"	4'-10"
	1 @ 5'	3'	#6	13"	108	5'-9"	#6	13"	4	3'-11"	—	#6	13"	106	6'-10"	5'-8"
		4'			108	5'-9"			4	"	—			106	6'-10"	"
		5'			108	5'-9"			4	"	—			106	6'-10"	"
		6'			108	5'-11"			4	4'-1"	—			106	7'-0"	5'-10"
		7'			108	6'-0"			4	4'-2"	—			106	7'-1"	5'-11"
	1 @ 6'	3'	#6	12"	114	6'-9"	#6	12"	8	5'-0"	3'-3"	#6	12"	114	7'-10"	6'-8"
		4'			114	6'-9"			8	"	"			114	7'-10"	"
		5'			114	6'-9"			8	"	"			114	7'-10"	"
		6'			114	6'-11"			8	5'-2"	3'-5"			114	8'-0"	6'-10"
		7'			114	7'-0"			8	5'-3"	3'-6"			114	8'-1"	6'-11"
		8'			114	7'-1"			8	5'-4"	3'-7"			114	8'-2"	7'-0"
	1 @ 7'	4'	#6	11"	124	7'-9"	#6	11"	12	6'-2"	3'-0"	#6	11"	122	8'-10"	7'-8"
		5'			124	7'-9"			12	"	"			122	8'-10"	"
		6'			124	7'-11"			12	6'-4"	3'-2"			122	9'-0"	7'-10"
		7'			124	8'-0"			12	6'-5"	3'-3"			122	9'-1"	7'-11"
		8'			124	8'-1"			12	6'-6"	3'-4"			122	9'-2"	8'-0"
		9'			124	8'-3"			12	6'-8"	3'-6"			122	9'-4"	8'-2"
	1 @ 8'	4'	#7	12"	112	8'-9"	#7	12"	12	7'-0"	3'-6"	#6	12"	112	9'-10"	8'-8"
		5'			112	8'-11"			12	7'-2"	3'-8"			112	10'-0"	8'-10"
		6'			112	8'-11"			12	"	"			112	10'-0"	"
		7'			112	9'-0"			12	7'-3"	3'-9"			112	10'-1"	8'-11"
		8'			112	9'-1"			12	7'-4"	3'-10"			112	10'-2"	9'-0"
		9'			112	9'-3"			12	7'-6"	4'-0"			112	10'-4"	9'-2"
		10'			112	9'-5"			16	7'-8"	2'-5"			110	10'-6"	9'-4"
	1 @ 9'	5'	#7	11"	122	9'-11"	#7	11"	16	8'-4"	3'-7"	#6	11"	120	11'-0"	9'-10"
		6'			122	10'-0"			16	8'-5"	3'-8"			120	11'-1"	9'-11"
		7'			122	10'-0"			16	"	"			120	11'-1"	9'-11"
		8'			122	10'-1"			16	8'-6"	3'-9"			120	11'-2"	10'-0"
		9'			120	10'-3"			20	8'-8"	2'-4"			120	11'-4"	10'-2"
		10'			120	10'-5"			20	8'-10"	2'-6"			120	11'-6"	10'-4"
		11'			120	10'-7"			20	9'-0"	2'-8"			120	11'-8"	10'-6"
	1 @ 10'	5'	#7	12"	110	10'-11"	#7	12"	16	9'-2"	3'-11"	#7	12"	110	12'-2"	10'-10"
		6'			110	11'-0"			16	9'-3"	4'-0"			110	12'-3"	10'-11"
		7'			110	11'-0"			16	"	"			110	12'-3"	"
		8'			110	11'-1"			20	9'-4"	2'-4"			110	12'-4"	11'-0"
		9'			110	11'-3"			20	9'-6"	2'-6"			108	12'-6"	11'-2"
		10'			110	11'-5"			20	9'-8"	2'-8"			108	12'-8"	11'-4"
		11'			110	11'-7"			20	9'-10"	2'-10"			108	12'-10"	11'-6"
		12'			110	11'-9"			20	10'-0"	3'-0"			108	13'-0"	11'-8"
	1 @ 11'	6'	#7	11"	118	12'-1"	#7	11"	24	10'-6"	2'-7"	#7	11"	118	13'-4"	12'-0"
		7'			118	12'-1"			24	"	"			118	13'-4"	"
		8'			118	12'-1"			24	"	"			118	13'-4"	"
		9'			118	12'-3"			24	10'-8"	2'-9"			118	13'-6"	12'-2"
		10'			118	12'-5"			24	10'-10"	2'-11"			116	13'-8"	12'-4"
		11'			118	12'-7"			24	11'-0"	3'-1"			116	13'-10"	12'-6"
		12'			118	12'-9"			24	11'-2"	3'-3"			116	14'-0"	12'-8"
	1 @ 12'	6'	#8	12"	108	13'-1"	#8	12"	24	11'-4"	2'-7"	#7	12"	106	14'-4"	13'-0"
		7'			108	13'-1"			24	"	"			106	14'-4"	"
		8'			108	13'-1"			24	"	"			106	14'-4"	"
		9'			108	13'-3"			24	11'-6"	2'-9"			106	14'-6"	13'-2"
		10'			108	13'-5"			24	11'-8"	2'-11"			106	14'-8"	13'-4"
		11'			108	13'-7"			24	11'-10"	3'-1"			106	14'-10"	13'-6"
		12'			106	13'-9"			24	12'-0"	3'-3"			106	15'-0"	13'-8"

"b1" bars (▼) – BENT - See Diagrams below – In Top and Bottom Slabs of Barrel - one end hooked. (Four of each Length) Alternate with "a1" bars. "d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel.

S	H	b1 Size	b1 Spacing	b1 No. Req'd	b1 Length Max.	b1 Length Min.	b1 X Max.	b1 X Min.	d Size	d Spacing	d No. Req'd	d Length
1 @ 4'	2'	#6	13"	4	4'-5"	—	3'-10"	—	#5	10½"	6	2 @ 30'-8" for 60'-0" Length Barrel. (1'-8" Lap)
	3'			4	"	—	"	—			6	
	4'			4	"	—	"	—			6	
	5'			4	"	—	"	—			6	
	6'			8	4'-8"	2'-8"	4'-0"	2'-1"			6	
1 @ 5'	3'	#6	13"	8	5'-5"	3'-6"	4'-10"	2'-11"	#5	10½"	7	
	4'			8	"	"	"	"			7	
	5'			8	"	"	"	"			7	
	6'			8	5'-7"	3'-8"	5'-0"	3'-1"			7	
	7'			8	5'-8"	3'-9"	5'-1"	3'-2"			7	
1 @ 6'	3'	#6	12"	12	6'-5"	2'-11"	5'-10"	2'-4"	#5	10½"	8	
	4'			12	"	"	"	"			8	
	5'			12	"		"	"			8	
	6'			12	6'-7"	3'-1"	6'-0"	2'-6"			8	
	7'			12	6'-8"	3'-2"	6'-1"	2'-7"			8	
	8'			12	6'-9"	3'-3"	6'-2"	2'-8"			8	
1 @ 7'	4'	#6	11"	12	7'-6"	4'-4"	6'-11"	3'-9"	#5	10½"	9	
	5'			12	"	"	"	"			9	
	6'			16	7'-8"	2'-11"	7'-1"	2'-4"			9	
	7'			16	7'-9"	3'-0"	7'-2"	2'-5"			9	
	8'			16	7'-10"	3'-1"	7'-3"	2'-6"			9	
	9'			16	8'-0"	3'-3"	7'-5"	2'-8"			9	
1 @ 8'	4'	#6	12"	16	8'-5"	3'-2"	7'-10"	2'-7"	#5	10"	11	
	5'			16	8'-7"	3'-4"	8'-0"	2'-9"			11	
	6'			16	"	"	"	"			11	
	7'			16	8'-8"	3'-5"	8'-1"	2'-10"			11	
	8'			16	8'-9"	3'-6"	8'-2"	2'-11"			11	
	9'			16	8'-11"	3'-8"	8'-4"	3'-1"			11	
	10'			16	9'-1"	3'-10"	8'-6"	3'-3"			11	
1 @ 9'	5'	#6	11"	20	9'-8"	3'-4"	9'-1"	2'-9"	#5	10"	12	
	6'			20	9'-9"	3'-5"	9'-2"	2'-10"			12	
	7'			20	"	"	"	"			12	
	8'			20	9'-10"	3'-6"	9'-3"	2'-11"			12	
	9'			20	10'-0"	3'-8"	9'-5"	3'-1"			12	
	10'			20	10'-2"	3'-10"	9'-7"	3'-3"			12	
	11'			20	10'-4"	4'-0"	9'-9"	3'-5"			12	
1 @ 10'	5'	#7	12"	20	10'-8"	3'-8"	10'-0"	3'-0"	#5	10"	13	
	6'			20	10'-9"	3'-9"	10'-1"	3'-1"			13	
	7'			20	"	"	"	"			13	
	8'			20	10'-10"	3'-10"	10'-2"	3'-2"			13	
	9'			20	11'-0"	4'-0"	10'-4"	3'-4"			13	
	10'			20	11'-2"	4'-2"	10'-6"	3'-6"			13	
	11'			20	11'-4"	4'-4"	10'-8"	3'-8"			13	
	12'			20	11'-6"	4'-6"	10'-10"	3'-10"			13	
1 @ 11'	6'	#7	11"	24	11'-11"	4'-0"	11'-3"	3'-4"	#5	9½"	15	
	7'			24	"	"	"	"			15	
	8'			24	"	"	"	"			15	
	9'			24	12'-1"	4'-2"	11'-5"	3'-6"			15	
	10'			24	12'-3"	4'-4"	11'-7"	3'-8"			15	
	11'			24	12'-5"	4'-6"	11'-9"	3'-10"			15	
	12'			24	12'-7"	4'-8"	11'-11"	4'-0"			15	
1 @ 12'	6'	#7	12"	24	12'-10"	4'-1"	12'-2"	3'-5"	#5	9½"	16	
	7'			24	"	"	"	"			16	
	8'			24	"	"	"	"			16	
	9'			24	13'-0"	4'-3"	12'-4"	3'-7"			16	
	10'			24	13'-2"	4'-5"	12'-6"	3'-9"			16	
	11'			24	13'-4"	4'-7"	12'-8"	3'-11"			16	
	12'			24	13'-6"	4'-9"	12'-10"	4'-1"			16	

"d1" bars – STRAIGHT – Longitudinal in Sidewalls. "e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. "f" bars – STRAIGHT – Verticals in Sidewalls. "k1" bars (▼) – STRAIGHT – In Bottom of Headwall. "k2" bars – STRAIGHT – In Top of Headwall and Apron (2 Each).

S	H	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length	f Size	f Spacing	f No. Req'd	f Length	k1 Size	k1 No. Req'd	k1 Length	k2 Size	k2 No. Req'd	k2 Length
1 @ 4'	2'	#4	12"	4	2 @ 30'-6" for 60'-0" Length Barrel. (1'-3" Lap)	#4	12"	5	2 @ 31'-8" for 60'-0" Length Barrel. (1'-3" Lap)	#4	12"	120	2'-11"	#5	6	5'-6"	#5	8	6'-8"
	3'			6				5				120	3'-11"		6	"		8	"
	4'			8				5				120	4'-11"		6	"		8	"
	5'			10				5				120	5'-11"		6	"		8	"
	6'			12				5				120	6'-11"		6	5'-8"		8	6'-10"
1 @ 5'	3'	#4	12"	6		#4	12"	6		#4	12"	120	4'-0"	#6	6	6'-8"	#6	8	7'-10"
	4'			8				6				120	5'-0"		6	"		8	"
	5'			10				6				120	6'-0"		6	"		8	"
	6'			12				6				120	7'-0"		6	6'-10"		8	8'-0"
	7'			14				6				120	8'-0"		6	6'-11"		8	8'-1"
1 @ 6'	3'	#4	12"	6		#4	12"	7		#4	12"	120	4'-1"	#6	6	7'-10"	#6	8	9'-0"
	4'			8				7				120	5'-1"		6	"		8	"
	5'			10				7				120	6'-1"		6	"		8	"
	6'			12				7				120	7'-1"		6	8'-0"		8	9'-2"
	7'			14				7				120	8'-1"		6	8'-1"		8	9'-3"
	8'			16				7		#5	12"	120	9'-1"		6	8'-2"		8	9'-4"
1 @ 7'	4'	#4	12"	8		#4	12"	8		#4	12"	120	5'-2"	#6	6	9'-0"	#6	8	10'-2"
	5'			10				8				120	6'-2"		6	"		8	"
	6'			12				8				120	7'-2"		6	9'-2"		8	10'-4"
	7'			14				8				120	8'-2"		6	9'-3"		8	10'-5"
	8'			16				8			10"	144	9'-2"		6	9'-4"		8	10'-6"
	9'			18				8		#5	12"	120	10'-2"		6	9'-6"		8	10'-8"
1 @ 8'	4'	#4	12"	8		#4	12"	9		#4	12"	120	5'-4"	#7	6	10'-1"	#7	8	11'-3"
	5'			10				9				120	6'-4"		6	10'-4"		8	11'-6"
	6'			12				9				120	7'-4"		6	"		8	"
	7'			14				9				120	8'-4"		6	10'-5"		8	11'-7"
	8'			16				9			10"	144	9'-4"		6	10'-6"		8	11'-8"
	9'			18				9		#5	12"	120	10'-4"		6	10'-8"		8	11'-10"
	10'			20				9			11"	132	11'-4"		6	10'-11"		8	12'-0"
1 @ 9'	5'	#4	12"	10		#4	12"	10		#4	12"	120	6'-5"	#7	6	11'-5"	#7	8	12'-7"
	6'			12				10				120	7'-5"		6	11'-7"		8	12'-9"
	7'			14				10				120	8'-5"		6	"		8	"
	8'			16				10			10"	144	9'-5"		6	11'-8"		8	12'-10"
	9'			18				10			12"	120	10'-5"		6	11'-10"		8	13'-0"
	10'			20				10		#5	11"	132	11'-5"		6	12'-1"		8	13'-2"
	11'			22				10			10"	144	12'-5"		6	12'-3"		8	13'-5"
1 @ 10'	5'	#4	12"	10		#4	12"	11		#4	12"	120	6'-6"	#7	6	12'-7"	#7	8	13'-9"
	6'			12				11				120	7'-6"		6	12'-8"		8	13'-10"
	7'			14				11				120	8'-6"		6	"		8	"
	8'			16				11			10"	144	9'-6"		6	12'-10"		8	14'-0"
	9'			18				11			12"	120	10'-6"		6	13'-0"		8	14'-2"
	10'			20				11		#5	11"	132	11'-6"		6	13'-2"		8	14'-4"
	11'			22				11			10"	144	12'-6"		6	13'-5"		8	14'-6"
	12'			24				11		#6	12"	120	13'-6"		6	13'-7"		8	14'-9"
1 @ 11'	6'	#4	12"	12		#4	12"	12		#4	12"	120	7'-7"	#7	6	14'-0"	#7	8	15'-1"
	7'			14				12				120	8'-7"		6	"		8	"
	8'			16				12			10"	144	9'-7"		6	"		8	"
	9'			18				12			12"	120	10'-7"		6	14'-2"		8	15'-4"
	10'			20				12		#5	11"	132	11'-7"		6	14'-4"		8	15'-6"
	11'			22				12			10"	144	12'-7"		6	14'-7"		8	15'-8"
	12'			24				12		#6	12"	120	13'-7"		6	14'-9"		8	15'-11"
1 @ 12'	6'	#4	12"	12		#4	12"	13		#4	12"	120	7'-9"	#8	6	15'-1"	#8	8	16'-3"
	7'			14				13				120	8'-9"		6	"		8	"
	8'			16				13			10"	144	9'-9"		6	"		8	"
	9'			18				13			12"	120	10'-9"		6	15'-4"		8	16'-6"
	10'			20				13		#5	11"	132	11'-9"		6	15'-6"		8	16'-8"
	11'			22				13			10"	144	12'-9"		6	15'-8"		8	16'-10"
	12'			24				13		#6	12"	120	13'-9"		6	15'-11"		8	17'-0"

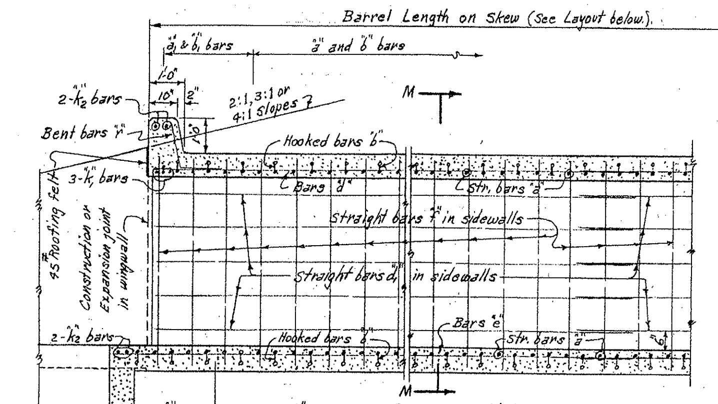
▼ These bars are in the skewed portion of barrel only. The length of "a1" bars and overall length X of "b1" bars vary by 1'-11" for 13" spacing, 1'-9" for 12" spacing and 1'-7" for 11" spacing.

BAR SIZE	PIN DIAM.	K	ADD FOR HOOKS	BENDING DIAGRAMS FOR BARS "b" & "b1"
#6	3"	5"	1'-2"	2 Hooks – "b" bars (K, Pin diam, X)
#7	3½"	5¾"	1'-4"	
#6	3"	5"	0'-7"	1 Hook – "b1" bars (K, Pin diam., X)
#7	3½"	5¾"	0'-8"	

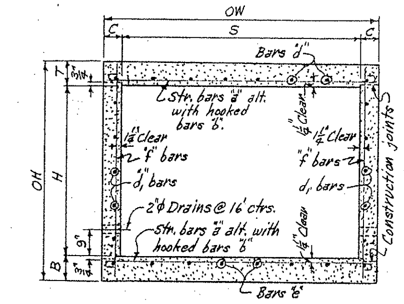
NOTE:- Dimensions are to centers of bars. ("b" and "b1")

DOWEL BARS FOR TWO HEADWALLS

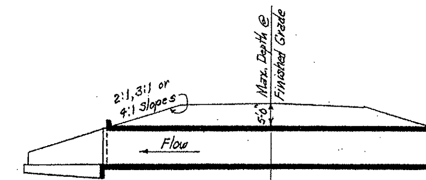
SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in Two Headwalls.
4'	#4	12"±	12	2'-6"	1'-3"	
5'	#4	12"±	16	2'-7"	1'-3½"	
6'	#4	12"±	18	2'-8"	1'-4"	
7'	#4	12"±	20	2'-9"	1'-4½"	
8'	#4	12"±	22	2'-11"	1'-5½"	
9'	#4	12"±	26	3'-0"	1'-6"	
10'	#4	12"±	28	3'-1"	1'-6½"	
11'	#4	12"±	30	3'-2"	1'-7"	
12'	#4	12"±	32	3'-3"	1'-7½"	



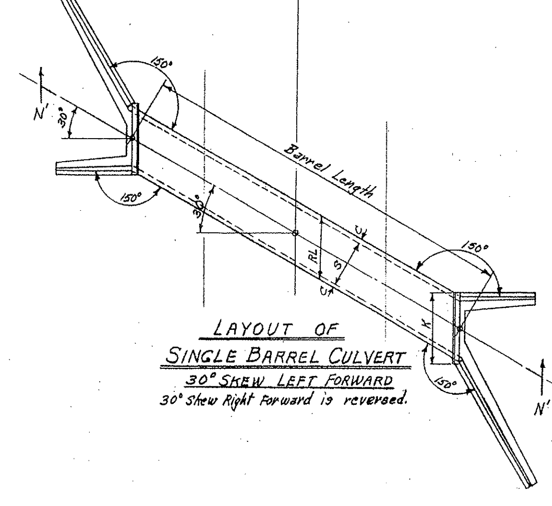
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF SINGLE BARREL CULVERT

30° SKEW LEFT FORWARD

30° Skew Right Forward is reversed.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs

UNIT STRESSES:-

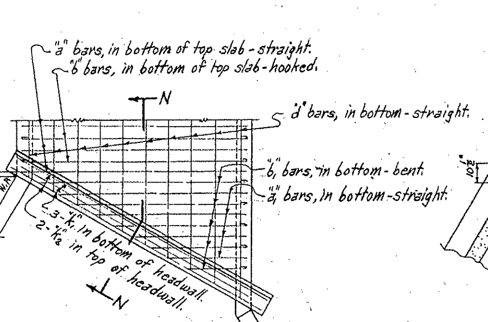
Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

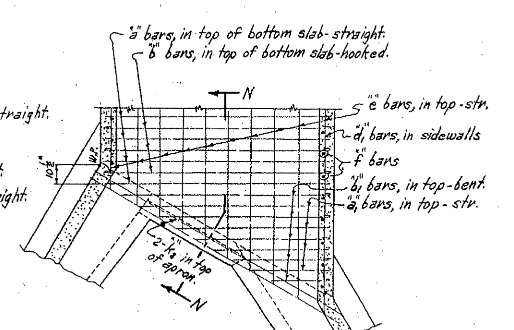
MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALLS K	* CLASS S CONC. PER LIN. FT. OF BARREL Cu.Yd.	REINFORCING STEEL TOTAL FOR 60'-0" LENGTH OF BARREL Lb.	PER LIN. FT. OF BARREL Lb.	ADDITIONAL PER LAP Lb.
5'-0"	1 @ 4'	2'	8	5'-0"	7"	6"	6½"	3'-1½"	5'-9¾"	6'-11½"	0.282	2622	41.99	17.95
		3'	12	5'-0"		6"		4'-1½"	"	"	0.319	2784	44.16	19.62
		4'	16	5'-0"		6"		5'-1½"	"	"	0.356	2946	46.83	21.29
		5'	20	5'-0"		6"		6'-1½"	"	"	0.394	3107	49.50	22.96
		6'	24	5'-2"		7"		7'-1½"	5'-11⅝"	7'-1½"	0.474	3335	52.96	24.63
	1 @ 5'	3'	15	6'-0"	7½"	6"	7"	4'-2½"	6'-11⅝"	8'-1"	0.380	3541	55.55	22.19
		4'	20	6'-0"		6"		5'-2½"	"	"	0.417	3703	58.23	23.86
		5'	25	6'-0"		6"		6'-2½"	"	"	0.454	3865	60.90	25.53
		6'	30	6'-2"		7"		7'-2½"	7'-1½"	8'-3¾"	0.535	4091	64.49	27.20
		7'	35	6'-3"		7½"		8'-2½"	7'-2⅝"	8'-4½"	0.604	4283	67.63	28.87
	1 @ 6'	3'	18	7'-0"	8"	6"	7½"	4'-3½"	8'-1"	9'-2⅞"	0.446	4221	66.29	24.76
		4'	24	7'-0"		6"		5'-3½"	"	"	0.483	4383	68.96	26.43
		5'	30	7'-0"		6"		6'-3½"	"	"	0.520	4545	71.64	28.10
		6'	36	7'-2"		7"		7'-3½"	8'-3¾"	9'-5⅛"	0.602	4772	75.31	29.77
		7'	42	7'-3"		7½"		8'-3½"	8'-4½"	9'-6⅜"	0.671	4966	78.48	31.44
		8'	48	7'-4"		8"		9'-3½"	8'-5⅝"	9'-7½"	0.746	5570	88.47	33.11
	1 @ 7'	4'	28	8'-0"	8½"	6"	8½"	5'-5"	9'-2⅞"	10'-4¾"	0.568	5146	81.32	29.01
		5'	35	8'-0"		6"		6'-5"	"	"	0.605	5307	84.00	30.68
		6'	42	8'-2"		7"		7'-5"	9'-5⅛"	10'-7"	0.688	5558	87.76	32.35
		7'	49	8'-3"		7½"		8'-5"	9'-6¼"	10'-8⅛"	0.757	5755	90.98	34.02
		8'	56	8'-4"		8"		9'-5"	9'-7½"	10'-9⅜"	0.832	6100	96.65	35.69
		9'	63	8'-6"		9"		10'-5"	9'-9¾"	10'-11¾"	0.946	6644	105.59	37.36
	1 @ 8'	4'	32	9'-0"	9½"	6"	9½"	5'-7"	10'-4¾"	11'-6½"	0.676	6114	95.26	33.32
		5'	40	9'-2"		7"		6'-7"	10'-7"	11'-8⅞"	0.754	6357	99.12	34.99
		6'	48	9'-2"		7"		7'-7"	"	"	0.797	6518	101.79	36.66
		7'	56	9'-3"		7½"		8'-7"	10'-8¼"	11'-10"	0.867	6720	105.05	38.33
		8'	64	9'-4"		8"		9'-7"	10'-9⅜"	11'-11¼"	0.942	7070	110.81	40.00
		9'	72	9'-6"		9"		10'-7"	10'-11⅝"	12'-1½"	1.057	7627	119.92	41.67
		10'	80	9'-8"		10"		11'-7"	11'-2"	12'-3¾"	1.184	8073	126.67	43.34
	1 @ 9'	5'	45	10'-2"	10"	7"	10"	6'-8"	11'-8⅞"	12'-10¾"	0.844	7356	114.72	37.56
		6'	54	10'-3"		7½"		7'-8"	11'-10"	13'-0"	0.910	7564	118.04	39.23
		7'	63	10'-3"		7½"		8'-8"	"	"	0.957	7725	120.71	40.90
		8'	72	10'-4"		8"		9'-8"	11'-11¼"	13'-1"	1.033	8081	126.54	42.57
		9'	81	10'-6"		9"		10'-8"	12'-1½"	13'-3¼"	1.148	8625	135.80	44.24
		10'	90	10'-8"		10"		11'-8"	12'-3¾"	13'-5¾"	1.276	9063	142.68	45.91
		11'	99	10'-10"		11"		12'-8"	12'-6⅛"	13'-8"	1.416	9526	150.40	47.58
	1 @ 10'	5'	50	11'-2"	10½"	7"	11"	6'-9½"	12'-10¾"	14'-0½"	0.957	8359	130.64	40.13
		6'	60	11'-3"		7½"		7'-9½"	12'-11⅞"	14'-1¾"	1.024	8567	133.99	41.80
		7'	70	11'-3"		7½"		8'-9½"	"	"	1.071	8729	136.66	43.47
		8'	80	11'-4"		8"		9'-9½"	13'-1"	14'-3"	1.147	9110	142.55	45.14
		9'	90	11'-6"		9"		10'-9½"	13'-3⅜"	14'-5¼"	1.263	9634	151.92	46.81
		10'	100	11'-8"		10"		11'-9½"	13'-5⅝"	14'-7½"	1.391	10,019	158.89	48.48
		11'	110	11'-10"		11"		12'-9½"	13'-8"	14'-9⅞"	1.532	10,547	166.71	50.15
		12'	120	12'-0"		12"		13'-9½"	13'-10⅛"	15'-0⅛"	1.685	11,278	178.67	51.82
	1 @ 11'	6'	66	12'-4"	11"	8"	11½"	7'-10½"	14'-2⅞"	15'-4¾"	1.153	9888	155.16	46.12
		7'	77	12'-4"		8"		8'-10½"	"	"	1.202	10,049	157.83	47.79
		8'	88	12'-4"		8"		9'-10½"	"	"	1.252	10,364	163.06	49.46
		9'	99	12'-6"		9"		10'-10½"	14'-5⅛"	15'-7"	1.368	10,952	172.60	51.13
		10'	110	12'-8"		10"		11'-10½"	14'-7½"	15'-9¼"	1.497	11,349	179.70	52.80
		11'	121	12'-10"		11"		12'-10½"	14'-9⅞"	15'-11⅝"	1.638	11,927	187.67	54.47
		12'	132	13'-0"		12"		13'-10½"	15'-0⅛"	16'-2"	1.792	12,569	199.79	56.14
	1 @ 12'	6'	72	13'-4"	11¾"	8"	12¼"	8'-0"	15'-4¾"	16'-6½"	1.284	11,081	172.20	48.69
		7'	84	13'-4"		8"		9'-0"	"	"	1.333	11,243	174.87	50.36
		8'	96	13'-4"		8"		10'-0"	"	"	1.383	11,561	180.15	52.03
		9'	108	13'-6"		9"		11'-0"	15'-7⅛"	16'-9"	1.500	12,162	189.85	53.70
		10'	120	13'-8"		10"		12'-0"	15'-9⅜"	16'-11¼"	1.630	12,625	197.07	55.37
		11'	132	13'-10"		11"		13'-0"	15'-11⅝"	17'-1½"	1.772	13,113	205.16	57.04
		12'	144	14'-0"		12"		14'-0"	16'-2"	17'-3¾"	1.926	13,795	217.45	58.71

* For remainder of quantities see Std. Wing Drawings listed at left. Total steel quantities listed above include one lap of longitudinal bars.



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT



BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW

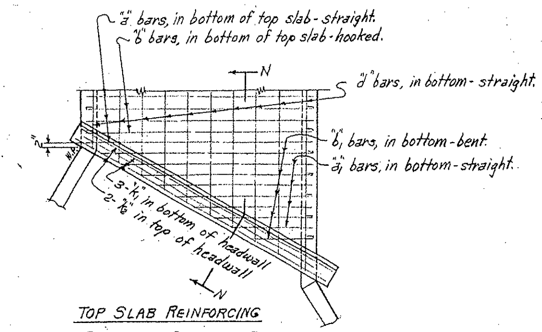
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

SINGLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-130X-0

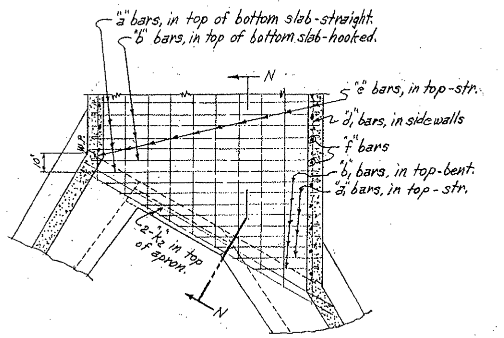
Designed by:- W.C.H. 1-23-63. Checked by:- R.H.S. 5-8-63
Drawn by:- W.C.H. 2-24-64 Checked by:-
Quantities by:- W.C.H. 4-2-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



TOP SLAB REINFORCING

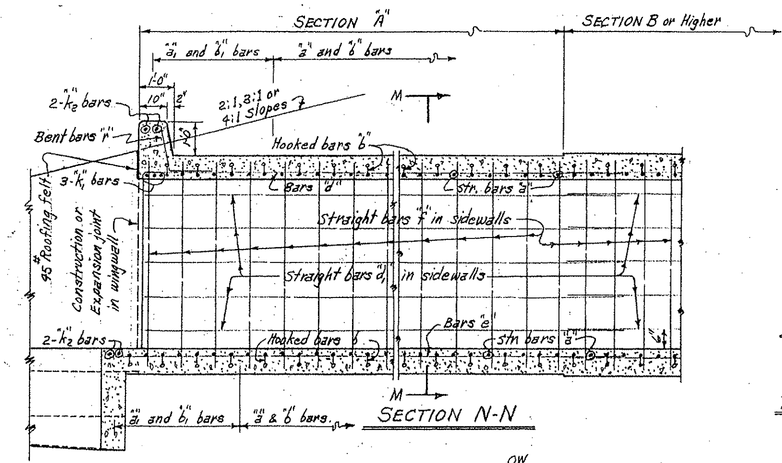
PART PLAN AT END OF CULVERT



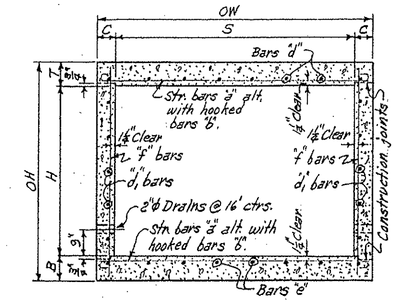
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

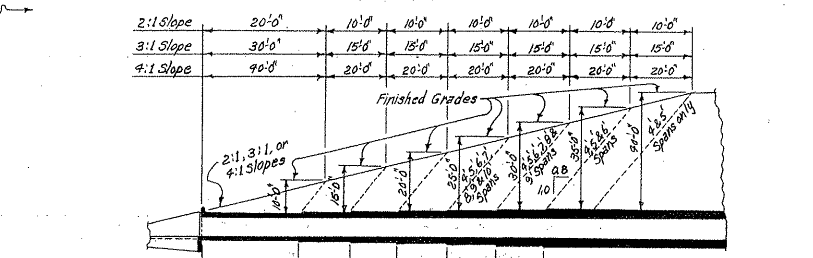
NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-9" min. into SECTION "B".



SECTION N-N



TYPICAL SECTION M-M

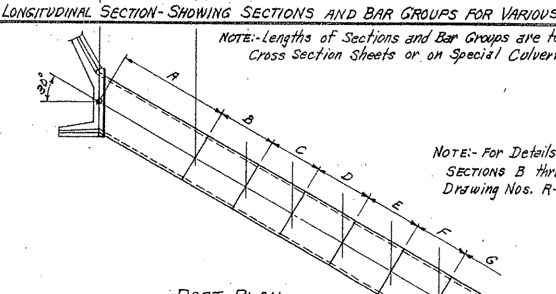


	SECTIONS / Bar Group							
2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	F = 6'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G-Varies
	Bar Group	A	B	C	D	E	F	G

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths below.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-100X-X1 or R-100X-X2.

LENGTH OF SECTIONS ON 30° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B, C, D, E & F	A	B, C, D, E & F	A	B, C, D, E & F
LENGTHS	13'-10¼"	6'-11⅛"	25'-4¾"	12'-8⅜"	36'-11¼"	18'-5¾"

NOTE:- Minimum ℄ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

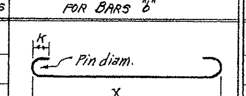
OR ALT.

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

(Column headings above: SECTIONS & BAR GROUPS FOR END SECTIONS — A, B, C, D, E, F.)

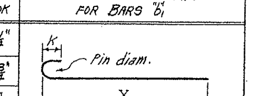
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1"

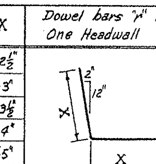


NOTE:- Dimensions are to centers of bars. ("b" and "b1")

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"±	6	2'-5"	1'-2½"
5'	#4	12"±	8	2'-6"	1'-3"
6'	#4	12"±	9	2'-7"	1'-3½"
7'	#4	12"±	10	2'-8"	1'-4"
8'	#4	12"±	11	2'-10"	1'-5"
9'	#4	12"±	13	3'-0"	1'-6"
10'	#4	12"±	14	3'-2"	1'-7"

Dowel bars "r" in One Headwall



BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY.

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 13'-10¼", 3:1 = 25'-4¾", 4:1 = 36'-11¼". D (Depth of Cover): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slabs of Barrel. "a1" bars ◤ — STRAIGHT — In Top and Bottom Slab of Barrel - (Two of each Length.)

S	H	a Size	a Spacing	a No. 2:1	a No. 3:1	a No. 4:1	a Length	a1 Size	a1 Spacing	a1 No. Req'd	a1 Length Max.	a1 Length Min.
1 @ 4'	2'	#4	12"	27	49	73	4'-9"	#4	12"	2	3'-0"	—
	3'			27	49	73	"			2	"	—
	4'			27	49	73	"			2	"	—
	5'			27	49	73	"			2	"	—
	6'			27	49	73	4'-11"			2	3'-2"	—
1 @ 5'	3'	#5	12"	25	49	73	5'-9"	#5	12"	4	4'-0"	2'-3"
	4'			25	49	73	"			4	"	"
	5'			25	49	73	"			4	"	"
	6'			25	49	73	5'-11"			4	4'-2"	2'-5"
	7'			25	49	73	6'-0"			4	4'-3"	2'-6"
1 @ 6'	3'	#5	12"	25	49	71	6'-9"	#5	12"	4	5'-0"	3'-3"
	4'			25	49	71	"			4	"	"
	5'			25	49	71	"			4	"	"
	6'			25	49	71	6'-11"			4	5'-2"	3'-5"
	7'			25	49	71	7'-0"			4	5'-3"	3'-6"
	8'			25	49	71	7'-1"			4	5'-4"	3'-7"
1 @ 7'	4'	#5	12"	25	47	71	7'-9"	#5	12"	6	6'-0"	2'-6"
	5'			25	47	71	"			6	"	"
	6'			25	47	71	7'-11"			6	6'-2"	2'-8"
	7'			25	47	71	8'-0"			6	6'-3"	2'-9"
	8'			25	47	71	8'-1"			6	6'-4"	2'-10"
	9'			25	47	71	8'-3"			6	6'-6"	3'-0"
1 @ 8'	4'	#6	12"	25	47	71	8'-9"	#6	12"	6	7'-0"	3'-6"
	5'			25	47	71	8'-11"			6	7'-2"	3'-8"
	6'			25	47	71	"			6	"	"
	7'			25	47	71	9'-0"			6	7'-3"	3'-9"
	8'			25	47	71	9'-1"			6	7'-4"	3'-10"
	9'			25	47	71	9'-3"			6	7'-6"	4'-0"
	10'			25	47	71	9'-5"			6	7'-8"	4'-2"
1 @ 9'	5'	#6	11"	25	51	75	9'-11"	#6	11"	8	8'-4"	3'-7"
	6'			25	51	75	10'-0"			8	8'-5"	3'-8"
	7'			25	51	75	"			8	"	"
	8'			25	51	75	10'-1"			8	8'-6"	3'-9"
	9'			25	51	75	10'-3"			8	8'-8"	3'-11"
	10'			25	51	75	10'-5"			8	8'-10"	4'-1"
	11'			25	51	75	10'-7"			8	9'-0"	4'-3"
1 @ 10'	5'	#7	12"	23	45	69	10'-11"	#7	12"	10	9'-2"	2'-2"
	6'			23	45	69	11'-0"			10	9'-3"	2'-3"
	7'			23	45	69	"			10	"	"
	8'			23	45	69	11'-1"			10	9'-4"	2'-4"
	9'			23	45	69	11'-3"			10	9'-6"	2'-6"
	10'			23	45	69	11'-5"			10	9'-8"	2'-8"
	11'			23	45	69	11'-7"			10	9'-10"	2'-10"
	12'			23	45	69	11'-9"			10	10'-0"	3'-0"

"b" bars — BENT - See Diagrams at Right — In Top and Bottom Slabs of Barrel - hooked. Alternate with "a" bars. "b1" bars ◤ — In Top and Bottom Slabs of Barrel - one end hooked. (Two of each Length) Alternate with "a1" bars.

S	H	b Size	b Spacing	b No. 2:1	b No. 3:1	b No. 4:1	b Length	b X	b1 Size	b1 Spacing	b1 No. Req'd	b1 Length Max.	b1 Length Min.	b1 X Max.	b1 X Min.
1 @ 4'	2'	#4	12"	25	49	71	5'-7"	4'-8½"	#4	12"	4	4'-3"	2'-6"	3'-10"	2'-1"
	3'			25	49	71	"	"			4	"	"	"	"
	4'			25	49	71	"	"			4	"	"	"	"
	5'			25	49	71	"	"			4	"	"	"	"
	6'			25	49	71	5'-9"	4'-10½"			4	4'-5"	2'-8"	4'-0"	2'-3"
1 @ 5'	3'	#5	12"	25	47	71	6'-8"	5'-8½"	#5	12"	4	5'-4"	3'-7"	4'-10"	3'-1"
	4'			25	47	71	"	"			4	"	"	"	"
	5'			25	47	71	"	"			4	"	"	"	"
	6'			25	47	71	6'-10"	5'-10½"			4	5'-6"	3'-9"	5'-0"	3'-3"
	7'			25	47	71	6'-11"	5'-11½"			4	5'-7"	3'-10"	5'-1"	3'-4"
1 @ 6'	3'	#6	12"	25	47	71	7'-10"	6'-8"	#6	12"	6	6'-5"	2'-11"	5'-10"	2'-4"
	4'			25	47	71	"	"			6	"	"	"	"
	5'			25	47	71	"	"			6	"	"	"	"
	6'			25	47	71	8'-0"	6'-10"			6	6'-7"	3'-1"	6'-0"	2'-6"
	7'			25	47	71	8'-1"	6'-11"			6	6'-8"	3'-2"	6'-1"	2'-7"
	8'			25	47	71	8'-2"	7'-0"			6	6'-9"	3'-3"	6'-2"	2'-8"
1 @ 7'	4'	#6	12"	23	47	69	8'-10"	7'-8"	#6	12"	6	7'-5"	3'-11"	6'-10"	3'-4"
	5'			23	47	69	"	"			6	"	"	"	"
	6'			23	47	69	9'-0"	7'-10"			6	7'-7"	4'-1"	7'-0"	3'-6"
	7'			23	47	69	9'-1"	7'-11"			6	7'-8"	4'-2"	7'-1"	3'-7"
	8'			23	47	69	9'-2"	8'-0"			6	7'-9"	4'-3"	7'-2"	3'-8"
	9'			23	47	69	9'-4"	8'-2"			6	7'-11"	4'-5"	7'-4"	3'-10"
1 @ 8'	4'	#6	12"	23	47	69	9'-10"	8'-8"	#6	12"	8	8'-5"	3'-2"	7'-10"	2'-7"
	5'			23	47	69	10'-0"	8'-10"			8	8'-7"	3'-4"	8'-0"	2'-9"
	6'			23	47	69	"	"			8	"	"	"	"
	7'			23	47	69	10'-1"	8'-11"			8	8'-8"	3'-5"	8'-1"	2'-10"
	8'			23	47	69	10'-2"	9'-0"			8	8'-9"	3'-6"	8'-2"	2'-11"
	9'			23	47	69	10'-4"	9'-2"			8	8'-11"	3'-8"	8'-4"	3'-1"
	10'			23	47	69	10'-6"	9'-4"			8	9'-1"	3'-10"	8'-6"	3'-3"
1 @ 9'	5'	#7	11"	25	49	75	11'-2"	9'-10"	#7	11"	10	9'-9"	3'-5"	9'-1"	2'-9"
	6'			25	49	75	11'-3"	9'-11"			10	9'-10"	3'-6"	9'-2"	2'-10"
	7'			25	49	75	"	"			10	"	"	"	"
	8'			25	49	75	11'-4"	10'-0"			10	9'-11"	3'-7"	9'-3"	2'-11"
	9'			25	49	75	11'-6"	10'-2"			10	10'-1"	3'-9"	9'-5"	3'-1"
	10'			25	49	75	11'-8"	10'-4"			10	10'-3"	3'-11"	9'-7"	3'-3"
	11'			25	49	75	11'-10"	10'-6"			10	10'-5"	4'-1"	9'-9"	3'-5"
1 @ 10'	5'	#7	12"	21	45	69	12'-2"	10'-10"	#7	12"	10	10'-8"	3'-8"	10'-0"	3'-0"
	6'			21	45	69	12'-3"	10'-11"			10	10'-9"	3'-9"	10'-1"	3'-1"
	7'			21	45	69	"	"			10	"	"	"	"
	8'			21	45	69	12'-4"	11'-0"			10	10'-10"	3'-10"	10'-2"	3'-2"
	9'			21	45	67	12'-6"	11'-2"			10	11'-0"	4'-0"	10'-4"	3'-4"
	10'			21	45	67	12'-8"	11'-4"			10	11'-2"	4'-2"	10'-6"	3'-6"
	11'			21	45	67	12'-10"	11'-6"			10	11'-4"	4'-4"	10'-8"	3'-8"
	12'			21	45	67	13'-0"	11'-8"			10	11'-6"	4'-6"	10'-10"	3'-10"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls. "e" bars — Longitudinal in Bottom Slab of Barrel.

S	H	d Size	d Spacing	d No. Req'd	d Length	d1 Size	d1 Spacing	d1 No. Req'd	d1 Length	e Size	e Spacing	e No. Req'd	e Length
1 @ 4'	2'	#4	12"	5	Lengths Vary - Average Length; 2:1 = 15'-6", 3:1 = 27'-1", 4:1 = 38'-8"	#4	12"	4	Lengths Vary - Average Length; 2:1 = 15'-6", 3:1 = 27'-1", 4:1 = 38'-8"	#4	12"	5	Lengths Vary - Average Length; 2:1 = 16'-8", 3:1 = 28'-3", 4:1 = 39'-10"
	3'			5				6				5	
	4'			5				8				5	
	5'			5				10				5	
	6'			5				12				5	
1 @ 5'	3'	#4	12"	6		#4	12"	6		#4	12"	6	
	4'			6				8				6	
	5'			6				10				6	
	6'			6				12				6	
	7'			6				14				6	
1 @ 6'	3'	#4	12"	7		#4	12"	6		#4	12"	7	
	4'			7				8				7	
	5'			7				10				7	
	6'			7				12				7	
	7'			7				14				7	
	8'			7				16				7	
1 @ 7'	4'	#4	12"	8		#4	12"	8		#4	12"	8	
	5'			8				10				8	
	6'			8				12				8	
	7'			8				14				8	
	8'			8				16				8	
	9'			8				18				8	
1 @ 8'	4'	#4	12"	9		#4	12"	8		#4	12"	9	
	5'			9				10				9	
	6'			9				12				9	
	7'			9				14				9	
	8'			9				16				9	
	9'			9				18				9	
	10'			9				20				9	
1 @ 9'	5'	#4	12"	10		#4	12"	10		#4	12"	10	
	6'			10				12				10	
	7'			10				14				10	
	8'			10				16				10	
	9'			10				18				10	
	10'			10				20				10	
	11'			10				22				10	
1 @ 10'	5'	#4	12"	11		#4	12"	10		#4	12"	11	
	6'			11				12				11	
	7'			11				14				11	
	8'			11				16				11	
	9'			11				18				11	
	10'			11				20				11	
	11'			11				22				11	
	12'			11				24				11	

"f" bars — STRAIGHT — Verticals in Sidewalls. "k1" bars ◤ — STRAIGHT — In Bottom of Headwall. "k2" bars ◤ — In Top of Headwall and Apron. (2 Each)

S	H	f Size	f Spacing	f No. 2:1	f No. 3:1	f No. 4:1	f Length	k1 Size	k1 No. Req'd	k1 Length	k2 Size	k2 No. Req'd	k2 Length
1 @ 4'	2'	#4	12"	28	51	74	2'-10"	#5	3	5'-6"	#5	4	6'-8"
	3'			28	51	74	3'-10"		3	"		4	"
	4'			28	51	74	4'-10"		3	"		4	"
	5'			28	51	74	5'-10"		3	"		4	"
	6'			28	51	74	6'-10"		3	5'-8"		4	6'-10"
1 @ 5'	3'	#4	12"	28	51	74	3'-11"	#5	3	6'-8"	#5	4	7'-10"
	4'			28	51	74	4'-11"		3	"		4	"
	5'			28	51	74	5'-11"		3	"		4	"
	6'			28	51	74	6'-11"		3	6'-10"		4	8'-0"
	7'		10"	34	61	89	7'-11"		3	6'-11"		4	8'-1"
1 @ 6'	3'	#4	12"	28	51	74	4'-0"	#5	3	7'-10"	#5	4	9'-0"
	4'			28	51	74	5'-0"		3	"		4	"
	5'			28	51	74	6'-0"		3	"		4	"
	6'			28	51	74	7'-0"		3	8'-0"		4	9'-2"
	7'		10"	34	61	89	8'-0"		3	8'-1"		4	9'-3"
	8'	#5	11"	31	56	81	9'-0"		3	8'-2"		4	9'-4"
1 @ 7'	4'	#4	12"	28	51	74	5'-1"	#6	3	9'-0"	#6	4	10'-2"
	5'			28	51	74	6'-1"		3	"		4	"
	6'			28	51	74	7'-1"		3	9'-2"		4	10'-4"
	7'		11"	31	56	81	8'-1"		3	9'-3"		4	10'-5"
	8'	#5	12"	28	51	74	9'-1"		3	9'-4"		4	10'-6"
	9'		11"	31	56	81	10'-1"		3	9'-6"		4	10'-8"
1 @ 8'	4'	#4	12"	28	51	74	5'-3"	#6	3	10'-1"	#6	4	11'-3"
	5'			28	51	74	6'-3"		3	10'-4"		4	11'-6"
	6'			28	51	74	7'-3"		3	"		4	"
	7'			28	51	74	8'-3"		3	10'-5"		4	11'-7"
	8'	#5	12"	28	51	74	9'-3"		3	10'-6"		4	11'-8"
	9'		11"	31	56	81	10'-3"		3	10'-8"		4	11'-10"
	10'		10"	34	61	89	11'-3"		3	10'-11"		4	12'-0"
1 @ 9'	5'	#4	12"	28	51	74	6'-5"	#6	3	11'-5"	#6	4	12'-7"
	6'			28	51	74	7'-5"		3	11'-7"		4	12'-9"
	7'			28	51	74	8'-5"		3	"		4	"
	8'		12"	28	51	74	9'-5"		3	11'-8"		4	12'-10"
	9'	#5	11"	31	56	81	10'-5"		3	11'-10"		4	13'-0"
	10'		10"	34	61	89	11'-5"		3	12'-1"		4	13'-2"
	11'	#6	12"	28	51	74	12'-5"		3	12'-3"		4	13'-5"
1 @ 10'	5'	#4	12"	28	51	74	6'-7"	#7	3	12'-7"	#7	4	13'-9"
	6'			28	51	74	7'-7"		3	12'-8"		4	13'-10"
	7'		11"	31	56	81	8'-7"		3	"		4	"
	8'	#5	12"	28	51	74	9'-7"		3	12'-10"		4	14'-0"
	9'			28	51	74	10'-7"		3	13'-0"		4	14'-2"
	10'		10"	34	61	89	11'-7"		3	13'-2"		4	14'-4"
	11'	#6	12"	28	51	74	12'-7"		3	13'-5"		4	14'-6"
	12'		11"	31	56	81	13'-7"		3	13'-7"		4	14'-9"

◤ These bars are in the skewed portion of barrel only. The length of "a1" bars and overall length X of "b1" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

Max. Design Depth of Cover (D): SECTION "A" = 10'-0"

Clear Spans S	Clear Height H	Sq.Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	Class S Concrete, Barrel Only 2:1 Cu.Yd.	3:1 Cu.Yd.	4:1 Cu.Yd.	Reinforcing Steel, Barrel, Apron and Headwall 2:1 Lb.	3:1 Lb.	4:1 Lb.
1 @ 4'	2'	8	5'-0"	6½"	6"	6½"	3'-1"	5'-9¼"	6'-11⅛"	3.81	6.98	10.16	453	764	1074
	3'	12	5'-0"		6"		4'-1"	"	"	4.32	7.92	11.53	492	834	1175
	4'	16	5'-0"		6"		5'-1"	"	"	4.84	8.86	12.89	531	904	1276
	5'	20	5'-0"		6"		6'-1"	"	"	5.35	9.80	14.26	571	975	1377
	6'	24	5'-2"		7"		7'-1"	5'-11⅝"	7'-1½"	6.47	11.86	17.25	614	1053	1492
1 @ 5'	3'	15	6'-0"	7"	6"	7"	4'-2"	6'-11⅛"	8'-1"	5.13	9.40	13.67	687	1183	1693
	4'	20	6'-0"		6"		5'-2"	"	"	5.64	10.34	15.03	726	1253	1794
	5'	25	6'-0"		6"		6'-2"	"	"	6.15	11.28	16.40	765	1323	1895
	6'	30	6'-2"		7"		7'-2"	7'-1½"	8'-3¾"	7.29	13.36	19.43	816	1413	2024
	7'	35	6'-3"		7½"		8'-2"	7'-2⅝"	8'-4½"	8.23	15.09	21.94	893	1525	2171
1 @ 6'	3'	18	7'-0"	7½"	6"	7½"	4'-3"	8'-1"	9'-2⅞"	6.03	11.05	16.07	894	1538	2192
	4'	24	7'-0"		6"		5'-3"	"	"	6.54	11.99	17.44	934	1609	2293
	5'	30	7'-0"		6"		6'-3"	"	"	7.05	12.93	18.80	973	1679	2394
	6'	36	7'-2"		7"		7'-3"	8'-3¾"	9'-5⅛"	8.19	15.01	21.83	1027	1773	2529
	7'	42	7'-3"		7½"		8'-3"	8'-4⅛"	9'-6⅜"	9.14	16.76	24.38	1105	1908	2727
	8'	48	7'-4"		8"		9'-3"	8'-5⅝"	9'-7½"	10.18	18.67	27.15	1242	2156	3080
1 @ 7'	4'	28	8'-0"	8"	6"	8½"	5'-4½"	9'-2⅞"	10'-4¾"	7.70	14.12	20.54	1054	1815	2565
	5'	35	8'-0"		6"		6'-4½"	"	"	8.22	15.06	21.90	1094	1885	2666
	6'	42	8'-2"		7"		7'-4½"	9'-5¼"	10'-7"	9.35	17.14	24.93	1147	1979	2800
	7'	49	8'-3"		7½"		8'-4½"	9'-6¼"	10'-8⅜"	10.31	18.89	27.48	1210	2088	2956
	8'	56	8'-4"		8"		9'-4½"	9'-7½"	10'-9⅜"	11.35	20.80	30.25	1282	2263	3234
	9'	63	8'-6"		9"		10'-4½"	9'-9¾"	10'-11¾"	12.93	23.69	34.46	1432	2484	3525
1 @ 8'	4'	32	9'-0"	8½"	6"	9½"	5'-6"	10'-4¾"	11'-6¼"	8.98	16.46	23.94	1293	2219	3141
	5'	40	9'-2"		7"		6'-6"	10'-7"	11'-8⅞"	10.04	18.41	26.78	1362	2329	3294
	6'	48	9'-2"		7"		7'-6"	"	"	10.65	19.53	28.41	1401	2400	3395
	7'	56	9'-3"		7½"		8'-6"	10'-8¼"	11'-10"	11.61	21.28	30.95	1438	2474	3506
	8'	64	9'-4"		8"		9'-6"	10'-9⅜"	11'-11⅛"	12.66	23.21	33.76	1584	2735	3884
	9'	72	9'-6"		9"		10'-6"	10'-11⅝"	12'-1½"	14.24	26.11	37.97	1683	2907	4128
	10'	80	9'-8"		10"		11'-6"	11'-2"	12'-3¾"	15.99	29.31	42.63	1789	3089	4398
1 @ 9'	5'	45	10'-2"	9½"	7"	10½"	6'-8"	11'-8⅞"	12'-10¾"	11.69	21.43	31.18	1674	2940	4221
	6'	54	10'-3"		7½"		7'-8"	11'-10"	13'-0"	12.61	23.11	33.61	1792	3096	4416
	7'	63	10'-3"		7½"		8'-8"	"	"	13.26	24.30	35.35	1831	3166	4517
	8'	72	10'-4"		8"		9'-8"	11'-11¼"	13'-1"	14.31	26.23	38.16	1981	3435	4905
	9'	81	10'-6"		9"		10'-8"	12'-1½"	13'-3¼"	15.91	29.15	42.40	2085	3615	5161
	10'	90	10'-8"		10"		11'-8"	12'-3⅞"	13'-5¾"	17.68	32.41	47.13	2196	3806	5445
	11'	99	10'-10"		11"		12'-8"	12'-6⅛"	13'-8"	19.62	35.96	52.30	2357	4104	5869
1 @ 10'	5'	50	11'-2"	10½"	7"	11½"	6'-10"	12'-10¾"	14'-0⅝"	13.49	24.74	35.98	1980	3417	4898
	6'	60	11'-3"		7½"		7'-10"	12'-11⅞"	14'-1¾"	14.44	26.46	38.49	2047	3522	5042
	7'	70	11'-3"		7½"		8'-10"	"	"	15.07	27.63	40.19	2103	3621	5183
	8'	80	11'-4"		8"		9'-10"	13'-1"	14'-3"	16.14	29.59	43.03	2224	3852	5524
	9'	90	11'-6"		9"		10'-10"	13'-3⅜"	14'-5¼"	17.75	32.53	47.32	2298	3981	5658
	10'	100	11'-8"		10"		11'-10"	13'-5¾"	14'-7½"	19.52	35.78	52.05	2445	4231	6024
	11'	110	11'-10"		11"		12'-10"	13'-8"	14'-9¾"	21.47	39.36	57.25	2609	4534	6455
	12'	120	12'-0"		12"		13'-10"	13'-10½"	15'-0¼"	23.61	43.27	62.94	2758	4790	6817

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.
For Barrels of 4', 5' & 6' Spans, See Drawing No. R-100X-X1.
For Barrels of 7', 8', 9' & 10' Spans, See Drawing No. R-100X-X2.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS

30° SKEW ~ SECTIONS "A" ONLY

4', 5', 6', 7', 8', 9' & 10' SPANS — SINGLES
2:1, 3:1 OR 4:1 SLOPES — OVER 5'-0" COVER

STANDARD DRAWING No. R-130X-1

Designed by:- W.C.H. 9-5-62 Checked by:- R.H.S. 11-8-62
Drawn by:- W.C.H. 1-24-64 Checked by:-
Quantities by:- W.C.H. 4-21-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 30° SKEWED ENDS

D = Depth of Cover: 0'-0" TO 5'-0" MAXIMUM (all rows)

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a1" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel (Four of each Length). "b" bars – BENT – See Diagrams below. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.

S (Clear Span)	H (Clear Height)	a Size	a Spacing	a No. Req'd	a Length	a1 Size	a1 Spacing	a1 No. Req'd	a1 Length Max.	a1 Length Min.	b Size	b Spacing	b No. Req'd	b Length	b X	b Y	b Z
2@4'	2'	#5	12"	112	9'-5"	#5	12"	16	7'-8"	2'-5"	#5	12"	54	10'-6"	0'-3"	2'-2½"	3'-4"
	3'			112	9'-5"			16	"	"			54	10'-6"	"	"	"
	4'			112	9'-5"			16	"	"			54	10'-6"	"	"	"
	5'			112	9'-5"			16	"	"			54	10'-6"	"	"	"
	6'			112	9'-8"			16	7'-11"	2'-8"			54	10'-9"	0'-3"	2'-3½"	3'-5"
2@5'	3'	#6	12"	110	11'-5"	#6	12"	20	9'-8"	2'-8"	#5	12"	53	12'-7"	0'-3½"	2'-7½"	4'-1"
	4'			110	11'-5"			20	"	"			53	12'-7"	"	"	"
	5'			110	11'-5"			20	"	"			53	12'-7"	"	"	"
	6'			110	11'-8"			20	9'-11"	2'-11"			53	12'-10"	"	2'-8½"	4'-2"
	7'			110	11'-10"			20	10'-1"	3'-1"			53	13'-0"	0'-3½"	2'-9½"	4'-2½"
2@6'	3'	#6	11"	118	13'-5"	#6	11"	24	11'-10"	3'-11"	#5	11"	56	14'-7"	0'-4"	3'-0½"	4'-10"
	4'			118	13'-5"			24	"	"			56	14'-7"	"	"	"
	5'			118	13'-5"			24	"	"			56	14'-7"	"	"	"
	6'			118	13'-8"			28	12'-1"	2'-7"			56	14'-10"	"	3'-1½"	4'-11"
	7'			118	13'-10"			28	12'-3"	2'-9"			56	15'-0"	"	3'-2½"	4'-11½"
	8'			118	13'-11"			28	12'-4"	2'-10"			56	15'-1"	0'-4"	"	5'-0"
2@7'	4'	#6	12"	106	15'-5"	#6	12"	28	13'-8"	3'-2"	#6	12"	50	16'-9"	0'-4½"	3'-5"	5'-7"
	5'			106	15'-5"			28	"	"			50	"	"	"	"
	6'			106	15'-8"			28	13'-11"	3'-5"			50	17'-0"	"	3'-6"	5'-8"
	7'			106	15'-10"			28	14'-1"	3'-7"			50	17'-2"	"	3'-7"	5'-8½"
	8'			106	15'-11"			28	14'-2"	3'-8"			50	17'-3"	"	"	5'-9"
	9'			106	16'-2"			28	14'-5"	3'-11"			50	17'-6"	0'-4½"	3'-8"	5'-10"
2@8'	4'	#6	11"	112	17'-5"	#6	11"	36	15'-10"	3'-2"	#6	11"	54	18'-10"	0'-5"	3'-10"	6'-4"
	5'			112	17'-8"			36	16'-1"	3'-5"			54	19'-1"	"	3'-11"	6'-5"
	6'			112	17'-8"			36	"	"			54	19'-1"	"	"	"
	7'			112	17'-10"			36	16'-3"	3'-7"			54	19'-3"	"	4'-0"	6'-5½"
	8'			112	17'-11"			36	16'-4"	3'-8"			54	19'-4"	"	"	6'-6"
	9'			112	18'-2"			36	16'-7"	3'-11"			53	19'-7"	"	4'-1"	6'-7"
	10'			112	18'-5"			36	16'-10"	4'-2"			53	19'-10"	0'-5"	4'-2"	6'-8"

"b1" bars (▼) – BENT – In Bottom of Top Slab - some bent up over Division Wall - one end hooked. (2 of Each Length) Alternate with "a1" and "c" or "c1" bars. "b2" bars – BENT – In Top of Bottom Slab - bent down under Division Wall - hooked. Alternate with "a" and "c" bars.

S	H	b1 Size	b1 Spacing	b1 No. Req'd	b1 Length Max.	b1 Length Min.	b1 L Max.	b1 L Min.	b2 Size	b2 Spacing	b2 No. Req'd	b2 Length	b2 X	b2 Y	b2 Z
2@4'	2'	#5	12"	6	9'-2"	3'-6"	8'-6"	3'-0"	#5	12"	56	10'-6"	0'-2½"	2'-3½"	3'-4"
	3'			6	"	"	"	"			56	10'-6"	"	"	"
	4'			6	"	"	"	"			56	10'-6"	"	"	"
	5'			6	"	"	"	"			56	10'-6"	"	"	"
	6'			6	9'-5"	3'-9"	8'-9"	3'-3"			56	10'-9"	0'-2½"	2'-4½"	3'-5"
2@5'	3'	#5	12"	10	11'-2"	4'-0"	10'-6"	3'-6"	#5	12"	55	12'-6"	0'-3"	2'-8½"	4'-1"
	4'			10	"	"	"	"			55	12'-6"	"	"	"
	5'			10	"	"	"	"			55	12'-6"	"	"	"
	6'			10	11'-5"	4'-3"	10'-9"	3'-9"			55	12'-9"	"	2'-9½"	4'-2"
	7'			10	11'-7"	4'-5"	10'-11"	3'-11"			55	12'-11"	0'-3"	2'-10½"	4'-2½"
2@6'	3'	#5	11"	14	13'-4"	3'-7"	12'-7"	3'-1"	#5	11"	58	14'-7"	0'-4"	3'-0½"	4'-10"
	4'			14	"	"	"	"			58	14'-7"	"	"	"
	5'			14	"	"	"	"			58	14'-7"	"	"	"
	6'			14	13'-7"	3'-10"	12'-10"	3'-4"			58	14'-10"	"	3'-1½"	4'-11"
	7'			14	13'-9"	4'-0"	13'-0"	3'-6"			58	15'-0"	"	3'-2½"	4'-11½"
	8'			14	13'-10"	4'-1"	13'-1"	3'-7"			58	15'-1"	0'-4"	"	5'-0"
2@7'	4'	#6	12"	14	15'-4"	4'-7"	14'-6"	4'-0"	#6	12"	52	16'-9"	0'-4½"	3'-5"	5'-7"
	5'			14	"	"	"	"			52	"	"	"	"
	6'			16	15'-7"	3'-1"	14'-9"	2'-6"			52	17'-0"	"	3'-6"	5'-8"
	7'			16	15'-9"	3'-3"	14'-11"	2'-8"			52	17'-2"	"	3'-7"	5'-8½"
	8'			16	15'-10"	3'-4"	15'-0"	2'-9"			52	17'-3"	"	"	5'-9"
	9'			16	16'-1"	3'-7"	15'-3"	3'-0"			52	17'-6"	0'-4½"	3'-8"	5'-10"
2@8'	4'	#6	11"	18	17'-6"	4'-6"	16'-7"	3'-11"	#6	11"	56	18'-10"	0'-5"	3'-10"	6'-4"
	5'			20	17'-9"	3'-2"	16'-10"	2'-7"			56	19'-1"	"	3'-11"	6'-5"
	6'			20	"	"	"	"			56	"	"	"	"
	7'			20	17'-11"	3'-4"	17'-0"	2'-9"			56	19'-3"	"	4'-0"	6'-5½"
	8'			20	18'-0"	3'-5"	17'-1"	2'-10"			56	19'-4"	"	"	6'-6"
	9'			20	18'-3"	3'-8"	17'-4"	3'-1"			55	19'-7"	"	4'-1"	6'-7"
	10'			20	18'-6"	3'-11"	17'-7"	3'-4"			55	19'-10"	0'-5"	4'-2"	6'-8"

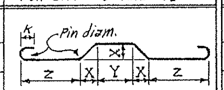
"b3" bars (▼) – BENT – In Top of Bottom Slab - some bent down under Division Wall - one end hooked. (2 of Each Length) Alternate with "a1" and "c" or "c1" bars. "c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Four of each Length.)

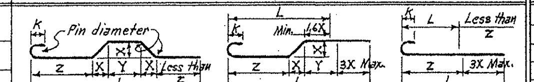
S	H	b3 Size	b3 Spacing	b3 No. Req'd	b3 Length Max.	b3 Length Min.	b3 L Max.	b3 L Min.	c Size	c Spacing	c No. Req'd	c Length	c1 Size	c1 Spacing	c1 No. Req'd	c1 Length Max.	c1 Length Min.
2@4'	2'	#5	12"	6	9'-2"	3'-6"	8'-6"	3'-0"	#5	12"	116	4'-8"	#5	12"	4	3'-7"	—
	3'			6	"	"	"	"			116	4'-8"			4	"	—
	4'			6	"	"	"	"			116	4'-8"			4	"	—
	5'			6	"	"	"	"			116	4'-8"			4	"	—
	6'			6	9'-3"	3'-9"	8'-9"	3'-3"			116	4'-9"			4	3'-9"	—
2@5'	3'	#5	12"	10	11'-2"	4'-0"	10'-6"	3'-6"	#6	12"	114	5'-8"	#6	12"	8	5'-1"	3'-4"
	4'			10	"	"	"	"			114	5'-8"			8	"	"
	5'			10	"	"	"	"			114	5'-8"			8	"	"
	6'			10	11'-5"	4'-3"	10'-9"	3'-9"			114	5'-9"			8	5'-3"	3'-6"
	7'			10	11'-7"	4'-5"	10'-11"	3'-11"			114	5'-10"			8	5'-4"	3'-7"
2@6'	3'	#5	11"	14	13'-4"	3'-7"	12'-7"	3'-1"	#6	11"	126	6'-8"	#6	11"	8	5'-4"	3'-9"
	4'			14	"	"	"	"			126	6'-8"			8	"	"
	5'			14	"	"	"	"			126	6'-8"			8	"	"
	6'			14	13'-7"	3'-10"	12'-10"	3'-4"			126	6'-9"			8	5'-6"	3'-11"
	7'			14	13'-9"	4'-0"	13'-0"	3'-6"			126	6'-10"			8	5'-7"	4'-0"
	8'			14	13'-10"	4'-1"	13'-1"	3'-7"			126	6'-10"			8	5'-8"	4'-1"
2@7'	4'	#6	12"	14	15'-4"	4'-7"	14'-6"	4'-0"	#6	12"	114	7'-8"	#6	12"	12	6'-4"	2'-10"
	5'			14	"	"	"	"			114	7'-8"			12	"	"
	6'			16	15'-7"	3'-1"	14'-9"	2'-6"			114	7'-9"			12	6'-6"	3'-0"
	7'			16	15'-9"	3'-3"	14'-11"	2'-8"			114	7'-10"			12	6'-7"	3'-1"
	8'			16	15'-10"	3'-4"	15'-0"	2'-9"			114	7'-10"			12	6'-8"	3'-2"
	9'			16	16'-1"	3'-7"	15'-3"	3'-0"			114	7'-11"			12	6'-10"	3'-4"
2@8'	4'	#6	11"	18	17'-6"	4'-6"	16'-7"	3'-11"	#6	11"	120	8'-8"	#6	11"	16	8'-4"	3'-7"
	5'			20	17'-9"	3'-2"	16'-10"	2'-7"			120	8'-9"			16	8'-6"	3'-9"
	6'			20	"	"	"	"			120	8'-9"			16	"	"
	7'			20	17'-11"	3'-4"	17'-0"	2'-9"			120	8'-10"			16	8'-7"	3'-10"
	8'			20	18'-0"	3'-5"	17'-1"	2'-10"			120	8'-10"			16	8'-8"	3'-11"
	9'			20	18'-3"	3'-8"	17'-4"	3'-1"			120	8'-11"			16	8'-10"	4'-1"
	10'			20	18'-6"	3'-11"	17'-7"	3'-4"			124	9'-0"			16	7'-5"	2'-8"

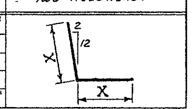
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. "d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Wall. "e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. "f" bars – STRAIGHT – Verticals in Sidewalls and Division Wall. "k1" bars (▼) – STRAIGHT – In Bottom of Headwalls. "k2" bars (▼) – STRAIGHT – In Top of Headwalls and Aprons (2 Each).

Lengths: "d" bars – 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap). "d1" bars – 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap). "e" bars – 2 @ 31'-8" for 60'-0" Length Barrel (1'-3" Lap).

S	H	d Size	d Spacing	d No. Req'd	d1 Size	d1 Spacing	d1 No. Req'd	e Size	e Spacing	e No. Req'd	f Size	f Spacing	f No. Req'd	f Length	k1 Size	k1 No. Req'd	k1 Length	k2 Size	k2 No. Req'd	k2 Length
2@4'	2'	#5	12"	14	#4	12"	8	#4	12"	14	#4	12"	240	2'-10"	#5	6	10'-11"	#5	8	12'-0"
	3'			14			12			14			240	3'-10"		6	"		8	"
	4'			14			16			14			240	4'-10"		6	"		8	"
	5'			14			20			14			240	5'-10"		6	"		8	"
	6'			14			24			14			240	6'-10"		6	11'-2"		8	12'-4"
2@5'	3'	#5	11½"	16	#4	12"	12	#4	12"	16	#4	12"	240	3'-11"	#6	6	13'-2"	#6	8	14'-4"
	4'			16			16			16			240	4'-11"		6	"		8	"
	5'			16			20			16			240	5'-11"		6	"		8	"
	6'			16			24			16			240	6'-11"		6	13'-6"		8	14'-8"
	7'			16			28			16			240	7'-11"		6	13'-8"		8	14'-10"
2@6'	3'	#5	11½"	18	#4	12"	12	#4	12"	18	#4	12"	240	4'-0"	#6	6	15'-6"	#6	8	16'-8"
	4'			18			16			18			240	5'-0"		6	"		8	"
	5'			18			20			18			240	6'-0"		6	"		8	"
	6'			18			24			18			240	7'-0"		6	15'-9"		8	16'-11"
	7'			18			28			18			240	8'-0"		6	16'-0"		8	17'-2"
	8'			18			32			18		10"	288	9'-0"		6	16'-1"		8	17'-3"
2@7'	4'	#5	11½"	20	#4	12"	16	#4	12"	20	#4	12"	240	5'-1"	#6	6	17'-10"	#6	8	19'-0"
	5'			20			20			20			240	6'-1"		6	"		8	"
	6'			20			24			20			240	7'-1"		6	18'-1"		8	19'-3"
	7'			20			28			20			240	8'-1"		6	18'-3"		8	19'-5"
	8'			20			32			20		10"	288	9'-1"		6	18'-5"		8	19'-6"
	9'			20			36			20	#5	12"	240	10'-1"		6	18'-8"		8	19'-10"
2@8'	4'	#5	11½"	23	#4	12"	16	#4	12"	22	#4	12"	240	5'-2"	#6	6	20'-1"	#6	8	21'-3"
	5'			23			20			22			240	6'-2"		6	20'-5"		8	21'-7"
	6'			23			24			22			240	7'-2"		6	"		8	"
	7'			23			28			22			240	8'-2"		6	20'-7"		8	21'-9"
	8'			23			32			22		10"	288	9'-2"		6	20'-8"		8	21'-10"
	9'			23			36			22	#5	12"	240	10'-2"		6	21'-0"		8	22'-2"
	10'			23			40			22		11"	264	11'-2"		6	21'-3"		8	22'-5"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" AND "b2"
#5	2½"	4¼"	0'-11½"	
#6	3"	5"	1'-2"	

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b1" AND "b3"
#5	2½"	4¼"	0'-5¾"	
#6	3"	5"	0'-7"	

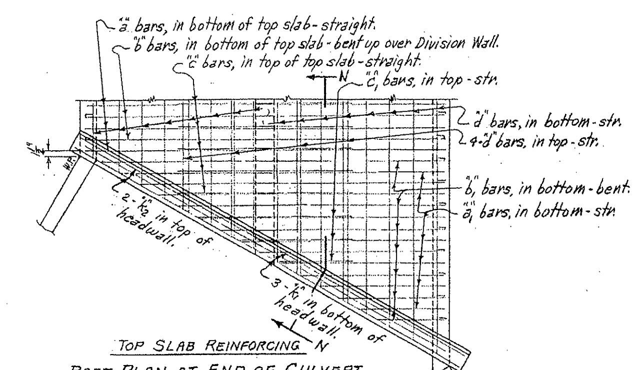
SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X	Dowel bars "r" in Two Headwalls
4'	#4	12"±	24	2'-5"	1'-2½"	
5'	#4	12"±	28	2'-6"	1'-3"	
6'	#4	12"±	32	2'-7"	1'-3½"	
7'	#4	12"±	36	2'-8"	1'-4"	
8'	#4	12"±	42	2'-9"	1'-4½"	

NOTE:- Dimensions are to centers of bars (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

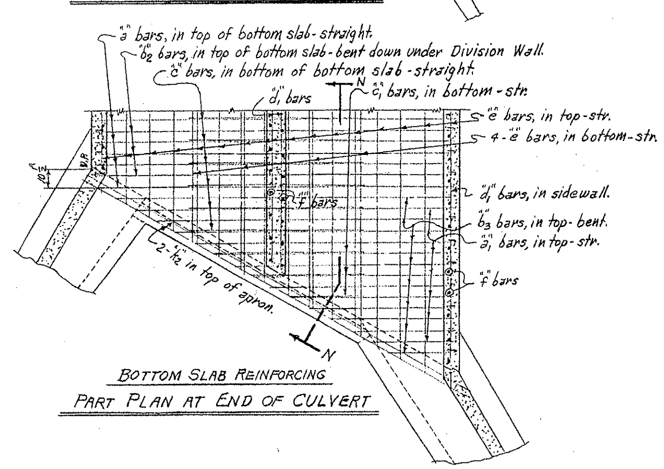
▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b2" bars, use a set of "a" & "c" bars instead.

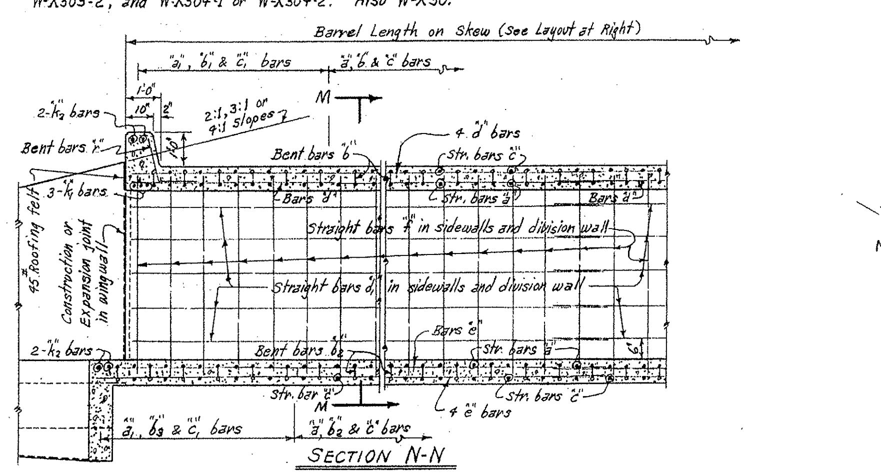
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



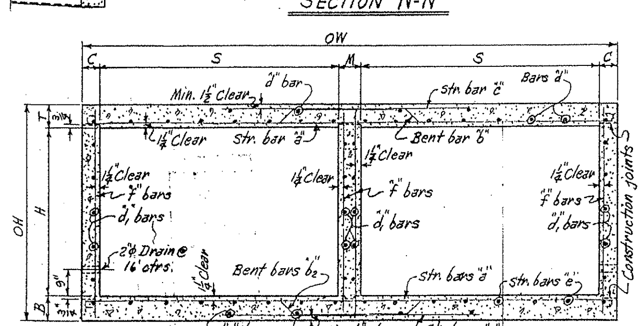
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



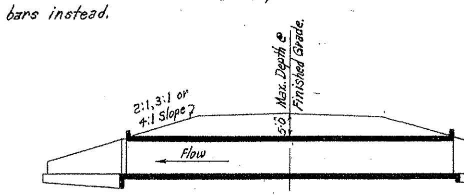
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT



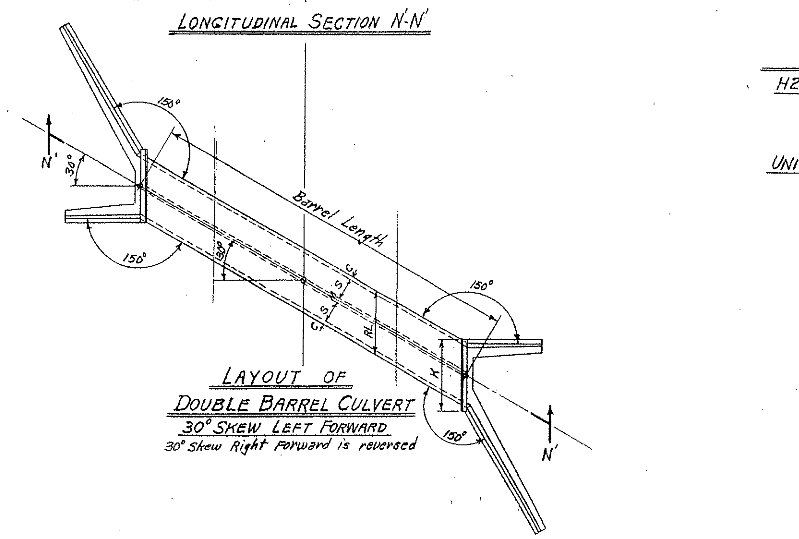
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF DOUBLE BARREL CULVERT
30° SKEW LEFT FORWARD
30° Skew Right Forward is reversed

MAX DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALL	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALLS	* CLASS S CONC. PER LIN. FT. OF BARREL	TOTAL FOR 60'-0" LENGTH OF BARREL (Reinforcing Steel)	PER LIN. FT. OF BARREL (Reinforcing Steel)	ADDITIONAL PER LAP (Reinforcing Steel)
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	LB.	LB.	LB.
5'-0"	2@4'	2'	16	9'-8"	6½"	6"	8"	6"	3'-0½"	11'-2"	12'-3¾"	0.496	5523	88.15	42.71
		3'	24	9'-8"		6"	8"		4'-0½"	"	"	0.558	5846	93.49	46.05
		4'	32	9'-8"		6"	8"		5'-0½"	"	"	0.620	6170	98.84	49.39
		5'	40	9'-8"		6"	8"		6'-0½"	"	"	0.682	6483	104.18	52.73
		6'	48	9'-11"		7"	9"		7'-0½"	11'-5½"	12'-7¼"	0.809	6897	110.74	56.07
	2@5'	3'	30	11'-8"	7"	6"	8"	6½"	4'-1½"	13'-5¾"	14'-7½"	0.671	7818	123.34	51.19
		4'	40	11'-8"		6"	8"		5'-1½"	"	"	0.733	8142	128.68	54.53
		5'	50	11'-8"		6"	8"		6'-1½"	"	"	0.795	8465	134.03	57.87
		6'	60	11'-11"		7"	9"		7'-1½"	13'-9⅛"	14'-11"	0.922	8894	140.89	61.21
		7'	70	12'-1"		7½"	10"		8'-1½"	13'-11⅛"	15'-1¼"	1.044	9291	147.34	64.55
	2@6'	3'	36	13'-8"	7½"	6"	8"	7½"	4'-3"	15'-9¾"	16'-11¼"	0.818	9398	148.50	56.34
		4'	48	13'-8"		6"	8"		5'-3"	"	"	0.880	9721	153.85	59.68
		5'	60	13'-8"		6"	8"		6'-3"	"	"	0.941	10,044	159.19	63.02
		6'	72	13'-11"		7"	9"		7'-3"	16'-0⅞"	17'-2¾"	1.070	10,496	166.20	66.36
		7'	84	14'-1"		7½"	10"		8'-3"	16'-3¾"	17'-5"	1.192	10,903	172.74	69.70
		8'	96	14'-2"		8"	10"		9'-3"	16'-4¼"	17'-6¼"	1.298	11,548	183.36	73.04
	2@7'	4'	56	15'-8"	8"	6"	8"	8"	5'-4"	18'-1⅛"	19'-3"	1.021	11,081	178.15	64.83
		5'	70	15'-8"		6"	8"		6'-4"	"	"	1.082	11,405	183.49	68.17
		6'	84	15'-11"		7"	9"		7'-4"	18'-4½"	19'-6½"	1.212	12,069	190.59	71.51
		7'	98	16'-1"		7½"	10"		8'-4"	18'-6⅞"	19'-8¾"	1.334	12,479	197.19	74.85
		8'	112	16'-2"		8"	10"		9'-4"	18'-8"	19'-9¾"	1.440	13,084	207.89	78.19
		9'	126	16'-5"		9"	11"		10'-4"	18'-11½"	20'-1½"	1.616	14,148	225.25	81.53
	2@8'	4'	64	17'-8"	8½"	6"	8"	8½"	5'-5"	20'-4¾"	21'-6¾"	1.174	13,251	210.37	71.71
		5'	80	17'-11"		7"	9"		6'-5"	20'-8¼"	21'-10"	1.295	13,731	217.63	75.05
		6'	96	17'-11"		7"	9"		7'-5"	"	"	1.366	14,054	222.97	78.39
		7'	112	18'-1"		7½"	10"		8'-5"	20'-10⅝"	22'-0½"	1.489	14,402	229.68	81.73
		8'	128	18'-2"		8"	10"		9'-5"	20'-11¾"	22'-1½"	1.595	15,131	240.47	85.07
		9'	144	18'-5"		9"	11"		10'-5"	21'-3¼"	22'-5"	1.772	16,154	258.08	88.41
		10'	160	18'-8"		10"	12"		11'-5"	21'-6¾"	22'-8½"	1.967	16,999	271.07	91.75

* For quanities in wings see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each add'l 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diam. min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
DOUBLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-230X-01

Designed by:- W.C.H. 1-17-63.
Drawn by:- W.C.H. 2-26-64
Quantities by:- W.C.H. 4-3-64
Checked by:- R.H.S. 5-14-63
Checked by:-
Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 30° SKEWED ENDS.

Depth of Cover (D): 0'-0" TO 5'-0" MAXIMUM

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a₁" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel (Four of each Length.)

S	H	a Size	a Spacing	a No. Req'd	a Length	a₁ Size	a₁ Spacing	a₁ No. Req'd	a₁ Length Max.	a₁ Length Min.
2 @ 9'	5'			110	19'-8"			40	18'-1"	3'-10"
	6'			110	19'-10"			40	18'-3"	4'-0"
	7'			110	19'-10"			40	″	″
	8'	#6	11"	110	19'-11"	#6	11"	44	18'-4"	2'-6"
	9'			110	20'-2"			44	18'-7"	2'-9"
	10'			110	20'-5"			44	18'-10"	3'-0"
	11'			108	20'-7"			44	19'-0"	3'-2"
2 @ 10'	5'			98	21'-8"			40	19'-11"	4'-2"
	6'			98	21'-10"			44	20'-1"	3'-3"
	7'			98	21'-10"			44	″	″
	8'	#7	12"	98	21'-11"	#7	12"	44	20'-2"	3'-4"
	9'			98	22'-2"			44	20'-5"	3'-7"
	10'			98	22'-5"			44	20'-8"	3'-10"
	11'			98	22'-7"			44	20'-10"	4'-0"
	12'			98	22'-9"			44	21'-0"	4'-2"
2 @ 11'	6'			96	23'-11"			48	22'-2"	2'-11"
	7'			96	23'-11"			48	″	″
	8'			96	23'-11"			48	″	″
	9'	#7	12"	96	24'-2"	#7	12"	48	22'-5"	3'-2"
	10'			96	24'-5"			48	22'-8"	3'-5"
	11'			96	24'-7"			48	22'-10"	3'-7"
	12'			96	24'-9"			48	23'-0"	3'-9"
2 @ 12'	6'			102	25'-11"			56	24'-4"	3'-9"
	7'			102	25'-11"			56	″	″
	8'			102	25'-11"			56	″	″
	9'	#7	11"	102	26'-2"	#7	11"	56	24'-7"	4'-0"
	10'			102	26'-5"			60	24'-10"	2'-8"
	11'			102	26'-7"			60	25'-0"	2'-10"
	12'			102	26'-9"			60	25'-2"	3'-0"

"b" bars – BENT - See Diagrams below – In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. "b₁" bars (▼) – In Bottom of Top Slab - some bent up over Division Wall - one end hooked. (2 of Each Length.) Alternate with "a₁" and "c" or "c₁" bars.

S	H	b Size	b Spacing	b No. Req'd	b Length	X	Y	Z	b₁ Size	b₁ Spacing	b₁ No. Req'd	b₁ Length Max.	b₁ Length Min.	L Max.	L Min.
2 @ 9'	5'			52	21'-1"	0'-5½"	4'-4"	7'-2"			22	19'-9"	3'-7"	18'-10"	3'-0"
	6'			52	21'-3"	″	4'-5"	7'-2½"			22	19'-11"	3'-9"	19'-0"	3'-2"
	7'			52	21'-3"	″	″	″			22	″	″	″	″
	8'	#6	11"	52	21'-4"	″	″	7'-3"	#6	11"	22	20'-0"	3'-10"	19'-1"	3'-3"
	9'			52	21'-7"	″	4'-6"	7'-4"			22	20'-3"	4'-1"	19'-4"	3'-6"
	10'			52	21'-10"	″	4'-7"	7'-5"			22	20'-6"	4'-4"	19'-7"	3'-9"
	11'			52	22'-0"	0'-5½"	″	7'-6"			22	20'-8"	4'-6"	19'-9"	3'-11"
2 @ 10'	5'			47	23'-2"	0'-6"	4'-9"	7'-11"			22	21'-9"	3'-10"	20'-9"	3'-3"
	6'			47	23'-4"	″	4'-10"	7'-11½"			22	21'-11"	4'-0"	20'-11"	3'-5"
	7'			47	23'-4"	″	″	″			22	″	″	″	″
	8'	#6	12"	47	23'-5"	″	″	8'-0"	#6	12"	22	22'-0"	4'-1"	21'-0"	3'-6"
	9'			47	23'-8"	″	4'-11"	8'-1"			22	22'-3"	4'-4"	21'-3"	3'-9"
	10'			47	23'-11"	″	5'-0"	8'-2"			22	22'-6"	4'-7"	21'-6"	4'-0"
	11'			46	24'-1"	″	″	8'-3"			22	22'-8"	4'-9"	21'-8"	4'-2"
	12'			46	24'-3"	0'-6"	5'-0"	8'-4"			24	22'-10"	3'-2"	21'-10"	2'-7"
2 @ 11'	6'			46	25'-5"	0'-6½"	5'-3"	8'-9"			24	24'-0"	4'-2"	23'-0"	3'-9"
	7'			46	25'-5"	″	″	″			24	″	″	″	″
	8'			46	25'-5"	″	″	″			24	″	″	″	″
	9'	#6	12"	46	25'-8"	″	5'-4"	8'-10"	#6	12"	24	24'-3"	4'-7"	23'-3"	4'-0"
	10'			45	25'-11"	″	5'-5"	8'-11"			26	24'-6"	3'-1"	23'-6"	2'-6"
	11'			45	26'-1"	″	″	9'-0"			26	24'-8"	3'-3"	23'-8"	2'-8"
	12'			45	26'-3"	0'-6½"	5'-5"	9'-1"			26	24'-10"	3'-5"	23'-10"	2'-10"
2 @ 12'	6'			49	27'-5"	0'-7"	5'-8"	9'-6"			30	26'-1"	3'-6"	25'-1"	2'-11"
	7'			49	27'-5"	″	″	″			30	″	″	″	″
	8'			49	27'-5"	″	″	″			30	″	″	″	″
	9'	#6	11"	48	27'-8"	″	5'-9"	9'-7"	#6	11"	30	26'-4"	3'-9"	25'-4"	3'-2"
	10'			48	27'-11"	″	5'-10"	9'-8"			30	26'-7"	4'-0"	25'-7"	3'-5"
	11'			48	28'-1"	″	″	9'-9"			30	26'-9"	4'-2"	25'-9"	3'-7"
	12'			48	28'-3"	0'-7"	5'-10"	9'-10"			30	26'-11"	4'-4"	25'-11"	3'-9"

"b₂" bars – BENT - See Diagrams below. – In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b₃" bars (▼) – In Top of Bottom Slab - some bent down under Division Wall - one end hooked. (2 of Each Length.) Alternate with "a₁" and "c" or "c₁" bars.

S	H	b₂ Size	b₂ Spacing	b₂ No. Req'd	b₂ Length	X	Y	Z	b₃ Size	b₃ Spacing	b₃ No. Req'd	b₃ Length Max.	b₃ Length Min.	L Max.	L Min.
2 @ 9'	5'			54	21'-1"	0'-5¾"	4'-3½"	7'-2"			22	19'-9"	3'-7"	18'-10"	3'-0"
	6'			54	21'-3"	″	4'-4½"	7'-2½"			22	19'-11"	3'-9"	19'-0"	3'-2"
	7'			54	21'-3"	″	″	″			22	″	″	″	″
	8'	#6	11"	54	21'-4"	″	″	7'-3"	#6	11"	22	20'-0"	3'-10"	19'-1"	3'-3"
	9'			54	21'-7"	″	4'-5½"	7'-4"			22	20'-3"	4'-1"	19'-4"	3'-6"
	10'			54	21'-10"	″	4'-6½"	7'-5"			22	20'-6"	4'-4"	19'-7"	3'-9"
	11'			54	22'-0"	0'-5¾"	″	7'-6"			22	20'-8"	4'-6"	19'-9"	3'-11"
2 @ 10'	5'			49	23'-2"	0'-6½"	4'-8"	7'-11"			22	21'-9"	3'-10"	20'-9"	3'-3"
	6'			49	23'-4"	″	4'-9"	7'-11½"			22	21'-11"	4'-0"	20'-11"	3'-5"
	7'			49	23'-4"	″	″	″			22	″	″	″	″
	8'	#6	12"	49	23'-5"	″	″	8'-0"	#6	12"	22	22'-0"	4'-1"	21'-0"	3'-6"
	9'			49	23'-8"	″	4'-10"	8'-1"			22	22'-3"	4'-4"	21'-3"	3'-9"
	10'			49	23'-11"	″	4'-11"	8'-2"			22	22'-6"	4'-7"	21'-6"	4'-0"
	11'			48	24'-1"	″	″	8'-3"			22	22'-8"	4'-9"	21'-8"	4'-2"
	12'			48	24'-3"	0'-6½"	4'-11"	8'-4"			24	22'-10"	3'-2"	21'-10"	2'-7"
2 @ 11'	6'			48	25'-6"	0'-7½"	5'-1"	8'-9"			24	24'-1"	4'-2"	23'-0"	3'-9"
	7'			48	25'-6"	″	″	″			24	″	″	″	″
	8'			48	25'-6"	″	″	″			24	″	″	″	″
	9'	#6	12"	48	25'-9"	″	5'-2"	8'-10"	#6	12"	24	24'-4"	4'-7"	23'-3"	4'-0"
	10'			47	26'-0"	″	5'-3"	8'-11"			26	24'-7"	3'-1"	23'-6"	2'-6"
	11'			47	26'-2"	″	″	9'-0"			26	24'-9"	3'-3"	23'-8"	2'-8"
	12'			47	26'-4"	0'-7½"	5'-3"	9'-1"			26	24'-11"	3'-5"	23'-10"	2'-10"
2 @ 12'	6'			51	27'-7"	0'-8½"	5'-5"	9'-6"			30	26'-3"	3'-6"	25'-1"	2'-11"
	7'			51	27'-7"	″	″	″			30	″	″	″	″
	8'			51	27'-7"	″	″	″			30	″	″	″	″
	9'	#6	11"	50	27'-10"	″	5'-6"	9'-7"	#6	11"	30	26'-6"	3'-9"	25'-4"	3'-2"
	10'			50	28'-1"	″	5'-7"	9'-8"			30	26'-9"	4'-0"	25'-7"	3'-5"
	11'			50	28'-3"	″	″	9'-9"			30	26'-11"	4'-2"	25'-9"	3'-7"
	12'			50	28'-5"	0'-8½"	5'-7"	9'-10"			30	27'-1"	4'-4"	25'-11"	3'-9"

"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. "c₁" bars (▼) – In Top and Bottom Slab of Barrel. Alt. with "b₁" & "b₃" bars (Four of each Length). "d" bars – Longitudinal in Top Slab of Barrel. "d₁" bars – Longitudinal in Sidewalls and Division Wall. "e" bars – Longitudinal in Bottom Slab of Barrel.

Lengths: "d" bars – 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap). "d₁" bars – 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap). "e" bars – 2 @ 31'-8" for 60'-0" Length Barrel (1'-3" Lap).

S	H	c Size	c Spacing	c No. Req'd	c Length	c₁ Size	c₁ Spacing	c₁ No. Req'd	c₁ Length Max.	c₁ Length Min.	d Size	d Spacing	d No. Req'd	d₁ Size	d₁ Spacing	d₁ No. Req'd	e Size	e Spacing	e No. Req'd
2 @ 9'	5'			122	9'-9"			16	8'-5"	3'-8"			26			20			25
	6'			122	9'-10"			16	8'-6"	3'-9"			26			24			25
	7'			122	9'-10"			16	″	″			26			28			25
	8'	#6	11"	122	9'-10"	#6	11"	16	8'-7"	3'-10"	#5	11½"	26	#4	12"	32	#4	12"	25
	9'			122	9'-11"			16	8'-9"	4'-0"			26			36			25
	10'			122	10'-0"			20	8'-11"	2'-7"			26			40			25
	11'			120	10'-0"			20	9'-0"	2'-8"			26			44			25
2 @ 10'	5'			110	10'-9"			16	9'-3"	4'-0"			28			20			27
	6'			110	10'-10"			16	9'-4"	4'-1"			28			24			27
	7'			110	10'-10"			16	″	″			28			28			27
	8'	#7	12"	110	10'-10"	#7	12"	16	9'-5"	4'-2"	#5	11½"	28	#4	12"	32	#4	12"	27
	9'			110	10'-11"			20	9'-7"	2'-7"			28			36			27
	10'			110	11'-0"			20	9'-9"	2'-9"			28			40			27
	11'			110	11'-0"			20	9'-10"	2'-10"			28			44			27
	12'			110	11'-0"			20	9'-11"	2'-11"			28			48			27
2 @ 11'	6'			108	11'-10"			20	10'-11"	3'-11"			30			24			29
	7'			108	11'-10"			20	″	″			30			28			29
	8'			108	11'-10"			20	″	″			30			32			29
	9'	#7	12"	108	11'-11"	#7	12"	20	11'-1"	4'-1"	#5	11½"	30	#4	12"	36	#4	12"	29
	10'			108	12'-0"			20	11'-3"	4'-3"			30			40			29
	11'			108	12'-0"			24	11'-4"	2'-7"			30			44			29
	12'			108	12'-0"			24	11'-5"	2'-8"			30			48			29
2 @ 12'	6'			118	12'-10"			24	11'-6"	3'-7"			32			24			31
	7'			118	12'-10"			24	″	″			32			28			31
	8'			118	12'-10"			24	″	″			32			32			31
	9'	#7	11"	118	12'-11"	#7	11"	24	11'-8"	3'-9"	#5	11½"	32	#4	12"	36	#4	12"	31
	10'			118	13'-0"			24	11'-10"	3'-11"			32			40			31
	11'			118	13'-0"			24	11'-11"	4'-0"			32			44			31
	12'			118	13'-0"			24	12'-0"	4'-1"			32			48			31

"f" bars – STRAIGHT – Verticals in Sidewalls and Division Wall. "k₁" bars (▼) – STRAIGHT – In Bottom of Headwalls. "k₂" bars (▼) – In Top of Headwalls and Aprons. (2 Each)

S	H	f Size	f Spacing	f No. Req'd	f Length	k₁ Size	k₁ No. Req'd	k₁ Length	k₂ Size	k₂ No. Req'd	k₂ Length
2 @ 9'	5'			240	6'-3"		6	22'-9"		8	23'-10"
	6'	#4	12"	240	7'-3"		6	22'-11"		8	24'-1"
	7'			240	8'-3"		6	″		8	″
	8'		10"	288	9'-3"	#6	6	23'-0"	#6	8	24'-2"
	9'		12"	240	10'-3"		6	23'-3"		8	24'-5"
	10'	#5	11"	264	11'-3"		6	23'-7"		8	24'-9"
	11'		10"	288	12'-3"		6	23'-9"		8	24'-11"
2 @ 10'	5'			240	6'-4"		6	25'-0"		8	26'-2"
	6'	#4	12"	240	7'-4"		6	25'-3"		8	26'-4"
	7'			240	8'-4"		6	″		8	″
	8'		10"	288	9'-4"	#7	6	25'-4"	#7	8	26'-6"
	9'		12"	240	10'-4"		6	25'-7"		8	26'-9"
	10'	#5	11"	264	11'-4"		6	25'-11"		8	27'-1"
	11'		10"	288	12'-4"		6	26'-1"		8	27'-3"
	12'	#6	12"	240	13'-4"		6	26'-3"		8	27'-5"
2 @ 11'	6'		12"	240	7'-6"		6	27'-7"		8	28'-9"
	7'	#4		240	8'-6"		6	″		8	″
	8'		10"	288	9'-6"		6	″		8	″
	9'		12"	240	10'-6"	#7	6	27'-11"	#7	8	29'-1"
	10'	#5	11"	264	11'-6"		6	28'-2"		8	29'-4"
	11'		10"	288	12'-6"		6	28'-5"		8	29'-7"
	12'	#6	12"	240	13'-6"		6	28'-7"		8	29'-9"
2 @ 12'	6'		12"	240	7'-7"		6	29'-11"		8	31'-1"
	7'	#4		240	8'-7"		6	″		8	″
	8'		10"	288	9'-7"		6	″		8	″
	9'		12"	240	10'-7"	#7	6	30'-3"	#7	8	31'-5"
	10'	#5	11"	264	11'-7"		6	30'-6"		8	31'-8"
	11'		10"	288	12'-7"		6	30'-8"		8	31'-10"
	12'	#6	12"	240	13'-7"		6	30'-11"		8	32'-1"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" AND "b₂"
#6	3"	5"	1'-2"	K, Pin diam., Z, X, Y, X, Z

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b₁" AND "b₃"
#6	3"	5"	0'-7"	K, Pin diameter, Z, X, Y, X, Less than Z, L; K, L, Min. 1.6X, Z, X, Y, 3X Max., L; K, L, Less than Z, Z, 3X Max., L

NOTE:- Dimensions are to centers of bars (b, b₁, b₂, & b₃). The X, Y & Z values for "b₁" bars are same as for "b" bars and for "b₃" bars same as for "b₂" bars.

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X	Dowel bars "r" in Two Headwalls
9'	#4	12"±	48	2'-10"	1'-5"	X, 2, 12, X
10'	#4	12"±	52	2'-11"	1'-5½"	
11'	#4	12"±	58	3'-0"	1'-6"	
12'	#4	12"±	62	3'-1"	1'-6½"	

▼ These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length L of "b₁" and "b₃" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b₂" bars, use a set of "a" & "c" bars instead.

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALL	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALLS	CLASS S CONC. PER LIN. FT. OF BARREL	TOTAL FOR 60'-0" LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU. YD.	LB.	LB.	LB.
5'-0"	2 @ 9'	5'	90	19'-11"	9"	7"	9"	9¼"	6'-6¼"	23'-0"	24'-1¾"	1.477	15,086	239.37	82.77
		6'	108	20'-1"		7½"	10"		7'-6¼"	23'-2¼"	24'-4½"	1.594	15,508	246.08	86.11
		7'	126	20'-1"		7½"	10"		8'-6¼"	″	″	1.671	15,831	251.43	89.45
		8'	144	20'-2"		8"	10"		9'-6¼"	23'-3½"	24'-5¼"	1.778	16,507	262.26	92.79
		9'	162	20'-5"		9"	11"		10'-6¼"	23'-6⅜"	24'-8¾"	1.956	17,595	279.95	96.13
		10'	180	20'-8"		10"	12"		11'-6¼"	23'-10⅜"	25'-0¼"	2.152	18,446	292.97	99.47
		11'	198	20'-10"		11"	12"		12'-6¼"	24'-0⅝"	25'-2½"	2.328	18,969	306.86	102.81
	2 @ 10'	5'	100	21'-11"	9½"	7"	9"	10"	6'-7½"	25'-3¾"	26'-5⅝"	1.674	17,744	279.64	87.92
		6'	120	22'-1"		7½"	10"		7'-7½"	25'-6"	26'-7¾"	1.792	18,227	286.50	91.26
		7'	140	22'-1"		7½"	10"		8'-7½"	″	″	1.869	18,551	291.85	94.60
		8'	160	22'-2"		8"	10"		9'-7½"	25'-7⅝"	26'-9"	1.976	19,222	302.77	97.94
		9'	180	22'-5"		9"	11"		10'-7½"	25'-10⅞"	27'-0½"	2.155	20,353	320.74	101.28
		10'	200	22'-8"		10"	12"		11'-7½"	26'-2⅛"	27'-4"	2.352	21,210	333.99	104.62
		11'	220	22'-10"		11"	12"		12'-7½"	26'-4⅜"	27'-6¼"	2.529	21,976	348.01	107.96
		12'	240	23'-0"		12"	12"		13'-7½"	26'-6⅝"	27'-8½"	2.718	23,353	370.23	111.30
	2 @ 11'	6'	132	24'-2"	10"	8"	10"	11"	7'-9"	27'-10⅝"	29'-0¾"	2.048	19,701	309.86	96.41
		7'	154	24'-2"		8"	10"		8'-9"	″	″	2.128	20,025	314.70	99.75
		8'	176	24'-2"		8"	10"		9'-9"	″	″	2.208	20,652	325.12	103.09
		9'	198	24'-5"		9"	11"		10'-9"	28'-2⅜"	29'-4½"	2.388	21,600	343.25	106.43
		10'	220	24'-8"		10"	12"		11'-9"	28'-5⅞"	29'-7¾"	2.586	22,586	356.57	109.77
		11'	242	24'-10"		11"	12"		12'-9"	28'-8⅞"	29'-10"	2.764	23,954	370.67	113.11
		12'	264	25'-0"		12"	12"		13'-9"	28'-10⅞"	30'-0⅛"	2.954	24,823	393.05	116.45
	2 @ 12'	6'	144	26'-2"	10½"	8"	10"	12"	7'-10½"	30'-2⅞"	31'-4½"	2.299	22,498	353.31	101.55
		7'	168	26'-2"		8"	10"		8'-10½"	″	″	2.379	22,822	358.65	104.89
		8'	192	26'-2"		8"	10"		9'-10½"	″	″	2.459	23,452	369.12	108.23
		9'	216	26'-5"		9"	11"		10'-10½"	30'-6"	31'-8"	2.640	24,516	387.52	111.57
		10'	240	26'-8"		10"	12"		11'-10½"	30'-9⅛"	31'-11⅛"	2.840	25,417	401.07	114.91
		11'	264	26'-10"		11"	12"		12'-10½"	30'-11⅝"	32'-1¾"	3.018	26,273	415.31	118.25
		12'	288	27'-0"		12"	12"		13'-10½"	31'-2⅛"	32'-4"	3.208	27,659	437.88	121.59

(Column groups: BARREL DIMENSIONS – S through K; * QUANTITIES – Class S Conc. and REINFORCING STEEL.)

* For quantities in Wings see Standard Wing Drawings listed below. Total steel quantities listed above included one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

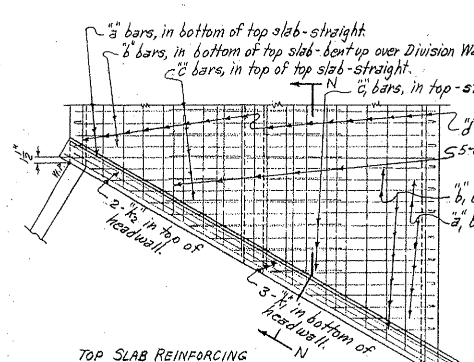
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each add'l 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diam. min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

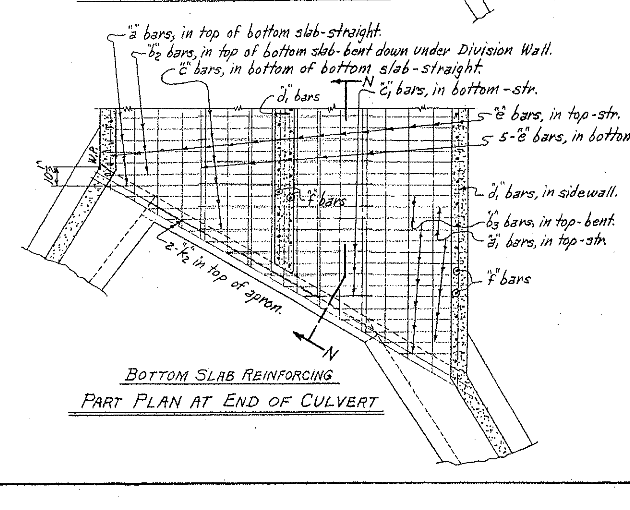
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



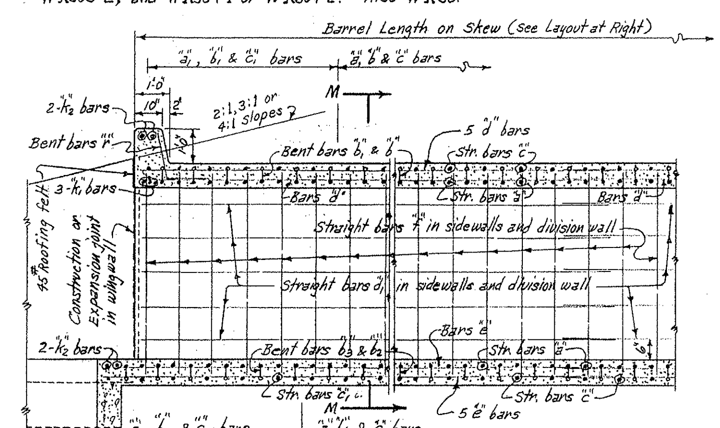
TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

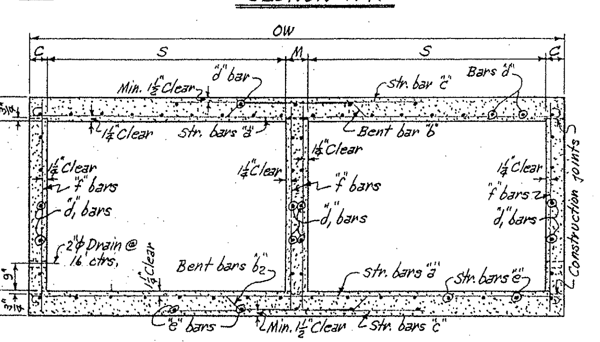


BOTTOM SLAB REINFORCING

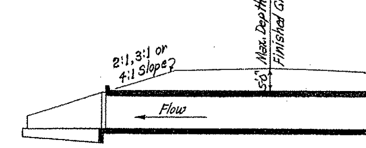
PART PLAN AT END OF CULVERT



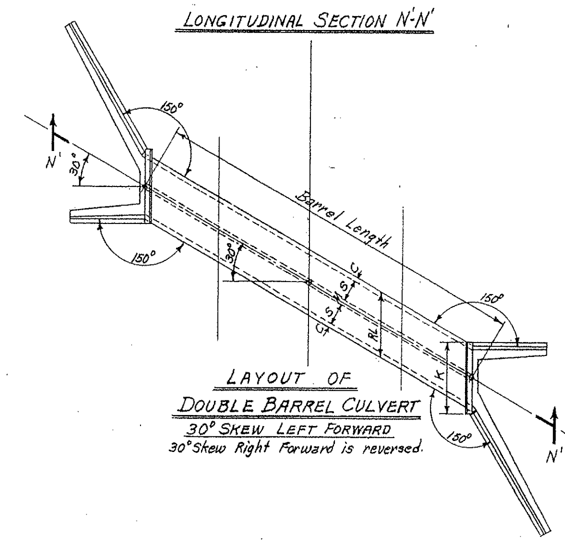
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF DOUBLE BARREL CULVERT

30° SKEW LEFT FORWARD

30° Skew Right Forward is reversed.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW

9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

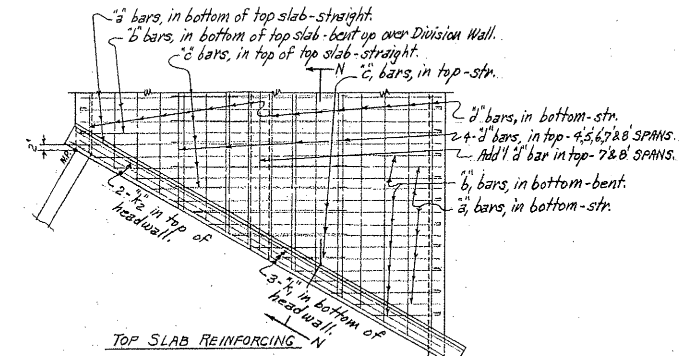
DOUBLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-230X-02

Designed by:- W.C.H. 1-17-63 — Checked by:- R.H.S. 5-14-63
Drawn by:- W.C.H. 3-20-64 — Checked by:-
Quantities by:- W.C.H. 4-7-64 — Checked by:-

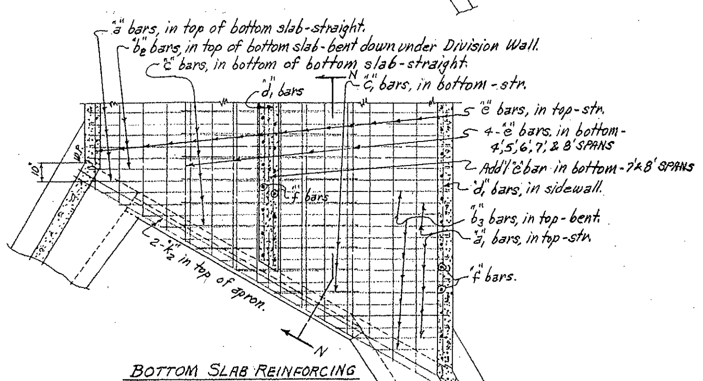
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2., and W-X304-1 or W-X304-2. Also W-X30.



TOP SLAB REINFORCING

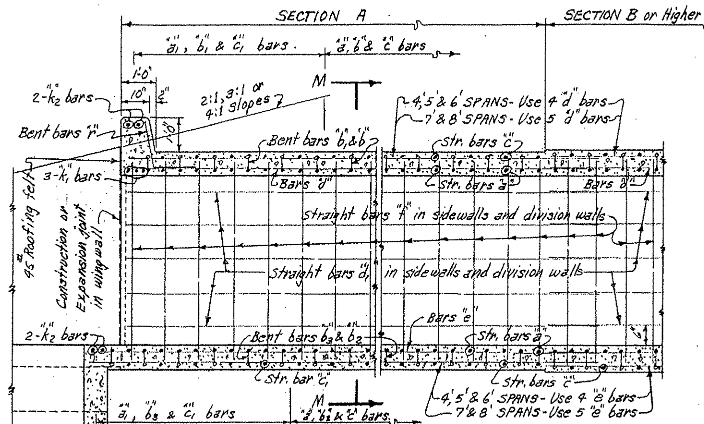
PART PLAN AT END OF CULVERT



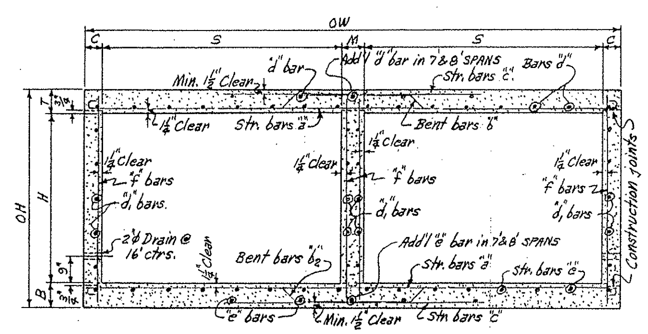
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

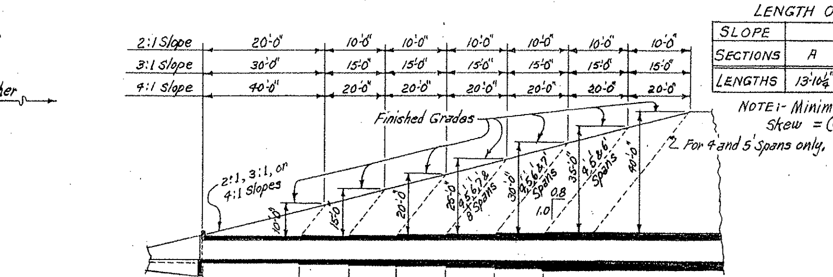
NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-9" min. into SECTION B.



SECTION N-N



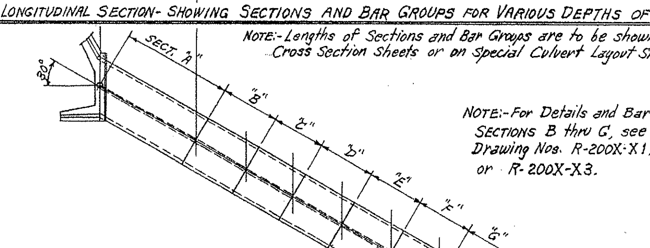
TYPICAL SECTION M-M



2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	F = 6'-0"	MID-SECTION G - Varies	These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths above.
	Bar Group	A	B	C	D	E	F	G	
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G - Varies	
	Bar Group	A	B	C	D	E	F	G	
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G - Varies	
	Bar Group	A	B	C	D	E	F	G	

TYPICAL LONGITUDINAL SECTION- SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-200X-X1, R-200X-X2, or R-200X-X3.

LENGTH OF SECTIONS ON 30° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B,C,D E&F	A	B,C,D E&F	A	B,C,D E&F
LENGTHS	13'-10¼"	6'-11⅛"	25'-4¾"	12'-8⅜"	36'-11¼"	18'-5¾"

NOTE:- Minimum ℄ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS						MID-SECTION AND BAR GROUP
	A	B	C	D	E	F	
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS						MID-SECTION AND BAR GROUP
	A	B	C	D	E	F	
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALL	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* CLASS S CONCRETE BARREL ONLY 2:1	3:1	4:1	REINFORCING STEEL BARREL, APRON AND HEADWALL. 2:1	3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	CU.YD.	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	2 @ 4'	2'	16	9'-8"	6"	6"	8"	6"	3'-0"	11'-2"	12'-3¾"	6.66	12.22	17.77	1063	1803	2580
		3'	24	9'-8"		6"	8"		4'-0"	"	"	7.52	13.79	20.06	1142	1943	2786
		4'	32	9'-8"		6"	8"		5'-0"	"	"	8.38	15.36	22.35	1221	2084	2991
		5'	40	9'-8"		6"	8"		6'-0"	"	"	9.24	16.94	24.64	1300	2224	3197
		6'	48	9'-11"		7"	9"		7'-0"	11'-5½"	12'-7¼"	10.99	20.19	29.29	1393	2391	3438
	2 @ 5'	3'	30	11'-8"	6½"	6"	8"	6½"	4'-1"	13'-5¾"	14'-7¼"	9.05	16.58	24.12	1539	2635	3821
		4'	40	11'-8"		6"	8"		5'-1"	"	"	9.91	18.16	26.41	1618	2776	4027
		5'	50	11'-8"		6"	8"		6'-1"	"	"	10.76	19.73	28.70	1697	2916	4232
		6'	60	11'-11"		7"	9"		7'-1"	13'-9½"	14'-11"	12.52	22.96	33.39	1796	3090	4484
		7'	70	12'-1"		7½"	10"		8'-1"	13'-11½"	15'-1¼"	14.20	26.03	37.86	2053	3552	5157
	2 @ 6'	3'	36	13'-8"	7¼"	6"	8"	7¾"	4'-3"	15'-9⅜"	16'-11½"	11.33	20.77	30.21	1755	3039	4356
		4'	48	13'-8"		6"	8"		5'-3"	"	"	12.19	22.35	32.50	1834	3180	4562
		5'	60	13'-8"		6"	8"		6'-3"	"	"	13.04	23.90	34.76	1913	3320	4767
		6'	72	13'-11"		7"	9"		7'-3"	16'-0⅞"	17'-2¾"	14.82	27.17	39.52	2012	3494	5018
		7'	84	14'-1"		7½"	10"		8'-3"	16'-3⅛"	17'-5"	16.51	30.27	44.03	2273	3965	5702
		8'	96	14'-2"		8"	10"		9'-3"	16'-4⅛"	17'-6¼"	17.98	32.96	47.94	2445	4256	6116
	2 @ 7'	4'	56	15'-8"	8¼"	6"	8"	8¾"	5'-5"	18'-1⅛"	19'-3"	14.81	27.15	39.49	2352	4046	5782
		5'	70	15'-8"		6"	8"		6'-5"	"	"	15.67	28.72	41.78	2430	4186	5987
		6'	84	15'-11"		7"	9"		7'-5"	18'-4½"	19'-6½"	17.47	32.02	46.58	2544	4378	6259
		7'	98	16'-1"		7½"	10"		8'-5"	18'-6⅞"	19'-8¾"	19.17	35.15	51.12	2813	4860	6958
		8'	112	16'-2"		8"	10"		9'-5"	18'-8"	19'-9¾"	20.64	37.84	55.04	2979	5147	7370
		9'	126	16'-5"		9"	11"		10'-5"	18'-11½"	20'-1½"	23.10	42.33	61.57	3175	5505	7872
	2 @ 8'	4'	64	17'-8"	9¼"	6"	8"	9¾"	5'-7"	20'-4¾"	21'-6¾"	17.77	32.58	47.39	2765	4822	6874
		5'	80	17'-11"		7"	9"		6'-7"	20'-8½"	21'-10"	19.48	35.71	51.93	2874	5010	7144
		6'	96	17'-11"		7"	9"		7'-7"	"	"	20.46	37.51	54.56	2953	5151	7350
		7'	112	18'-1"		7½"	10"		8'-7"	20'-10⅝"	22'-0½"	22.18	40.66	59.14	3148	5424	7807
		8'	128	18'-2"		8"	10"		9'-7"	20'-11¾"	22'-1½"	23.65	43.35	63.05	3341	5783	8348
		9	144	18'-5"		9"	11"		10'-7"	21'-3¼"	22'-5"	26.13	47.90	69.66	3595	6116	8824
		10'	160	18'-8"		10"	12"		11'-7"	21'-6⅜"	22'-8½"	28.84	52.87	76.90	3893	6766	9770

(BARREL DIMENSIONS; * QUANTITIES - ONE SECTION "A")

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an additional lap for 4:1 slopes.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A". LENGTH OF SECTION: 4:1 = 36'-11¼"; 3:1 = 25'-4¾"; 2:1 = 13'-10¼". DEPTH OF COVER D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars - STRAIGHT - In Top and Bottom Slab of Barrel. "a1" bars - STRAIGHT - In Top and Bottom Slab of Barrel - (Two of each Length)

S	H	"a" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
2 @ 4'	2'	#4	13"	23	43	65	9'-5"	#4	13"	6	7'-6"	3'-8"
	3'			23	43	65	"			6	"	"
	4'			23	43	65	"			6	"	"
	5'			23	43	65	"			6	"	"
	6'			23	43	65	9'-8"			6	7'-9"	3'-11"
2 @ 5'	3'	#4	11"	25	49	75	11'-5"	#4	11"	10	9'-10"	3'-6"
	4'			25	49	75	"			10	"	"
	5'			25	49	75	"			10	"	"
	6'			25	49	75	11'-8"			10	10'-1"	3'-9"
	7'			25	49	75	11'-10"			10	10'-3"	3'-11"
2 @ 6'	3'	#4	12"	21	45	67	13'-5"	#4	12"	12	11'-8"	2'-11"
	4'			21	45	67	"			12	"	"
	5'			21	45	67	"			12	"	"
	6'			21	45	67	13'-8"			12	11'-11"	3'-2"
	7'			21	45	67	13'-10"			12	12'-1"	3'-4"
	8'			21	45	67	13'-11"			12	12'-2"	3'-5"
2 @ 7'	4'	#4	12"	21	43	67	15'-5"	#4	12"	14	13'-8"	3'-2"
	5'			21	43	67	"			14	"	"
	6'			21	43	67	15'-8"			14	13'-11"	3'-5"
	7'			21	43	67	15'-10"			14	14'-1"	3'-7"
	8'			21	43	67	15'-11"			14	14'-2"	3'-8"
	9'			21	43	67	16'-2"			14	14'-5"	3'-11"
2 @ 8'	4'	#5	13"	17	39	61	17'-5"	#5	13"	14	15'-6"	4'-0"
	5'			17	39	61	17'-8"			14	15'-9"	4'-3"
	6'			17	39	61	"			14	"	"
	7'			17	39	61	17'-10"			16	15'-11"	2'-6"
	8'			17	39	61	17'-11"			16	16'-0"	2'-7"
	9'			17	39	61	18'-2"			16	16'-2"	2'-9"
	10'			17	39	61	18'-5"			16	16'-6"	3'-1"

"b" bars - BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. "b1" bars - In Bottom of Top Slab - some are bent up over Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
2 @ 4'	2'	#4	13"	10	21	31	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	4	9'-0"	3'-1"	8'-5"	2'-8"
	3'			10	21	31	"	"	"	"			4	"	"	"	"
	4'			10	21	31	"	"	"	"			4	"	"	"	"
	5'			10	21	31	"	"	"	"			4	"	"	"	"
	6'			10	21	31	10'-8"	0'-2¾"	2'-2"	3'-6"			4	9'-3"	3'-4"	8'-8"	2'-11"
2 @ 5'	3'	#5	11"	11	23	36	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	6	11'-3"	3'-2"	10'-7"	2'-8"
	4'			11	23	36	"	"	"	"			6	"	"	"	"
	5'			11	23	36	"	"	"	"			6	"	"	"	"
	6'			11	23	36	12'-9"	"	2'-7½"	4'-3"			6	11'-6"	3'-5"	10'-10"	2'-11"
	7'			11	23	36	12'-11"	0'-3"	2'-8½"	4'-3½"			6	11'-8"	3'-7"	11'-0"	3'-1"
2 @ 6'	3'	#5	12"	10	21	33	14'-7"	0'-3¾"	2'-11"	4'-11"	#5	12"	6	13'-3"	4'-3"	12'-6"	3'-9"
	4'			10	21	33	"	"	"	"			6	"	"	"	"
	5'			10	21	33	"	"	"	"			6	"	"	"	"
	6'			10	21	33	14'-10"	"	3'-0"	5'-0"			6	13'-6"	4'-6"	12'-9"	4'-0"
	7'			10	21	33	15'-0"	"	3'-1"	5'-0½"			6	13'-8"	4'-8"	12'-11"	4'-2"
	8'			10	21	33	15'-1"	0'-3¾"	3'-1"	5'-1"			6	13'-9"	4'-9"	12'-0"	4'-3"
2 @ 7'	4'	#6	12"	9	21	32	16'-10"	0'-4¾"	3'-4½"	5'-7"	#6	12"	7	15'-5"	4'-7"	14'-6"	4'-0"
	5'			9	21	32	"	"	"	"			7	"	"	"	"
	6'			9	21	32	17'-1"	"	3'-5½"	5'-8"			8	15'-8"	3'-1"	14'-9"	2'-6"
	7'			9	21	32	17'-3"	"	3'-6½"	5'-8½"			8	15'-10"	3'-3"	14'-11"	2'-8"
	8'			9	21	32	17'-4"	"	3'-6½"	5'-9"			8	15'-11"	3'-4"	15'-0"	2'-9"
	9'			9	21	32	17'-7"	0'-4¾"	3'-7½"	5'-10"			8	16'-2"	3'-7"	15'-3"	3'-0"
2 @ 8'	4'	#6	13"	8	19	29	18'-10"	0'-5¾"	3'-7"	6'-5"	#6	13"	8	17'-4"	3'-7"	16'-5"	3'-0"
	5'			8	19	29	19'-1"	"	3'-8"	6'-6"			8	17'-7"	3'-10"	16'-8"	3'-3"
	6'			8	19	29	"	"	"	"			8	"	"	"	"
	7'			8	18	29	19'-3"	"	3'-9"	6'-6½"			8	17'-9"	4'-0"	16'-10"	3'-5"
	8'			8	18	29	19'-4"	"	3'-9"	6'-7"			8	17'-10"	4'-1"	16'-11"	3'-6"
	9'			8	18	29	19'-7"	"	3'-10"	6'-8"			8	18'-1"	4'-4"	17'-2"	3'-9"
	10'			8	18	29	19'-10"	0'-5¾"	3'-11"	6'-9"			8	18'-4"	4'-7"	17'-5"	4'-0"

"b2" bars - BENT - In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. "b3" bars - In Top of Bottom Slab - some are bent down under Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
2 @ 4'	2'	#4	13"	11	22	32	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	4	9'-0"	3'-1"	8'-5"	2'-8"
	3'			11	22	32	"	"	"	"			4	"	"	"	"
	4'			11	22	32	"	"	"	"			4	"	"	"	"
	5'			11	22	32	"	"	"	"			4	"	"	"	"
	6'			11	22	32	10'-8"	0'-2¾"	2'-2"	3'-6"			4	9'-3"	3'-4"	8'-8"	2'-11"
2 @ 5'	3'	#5	11"	12	24	37	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	6	11'-3"	3'-2"	10'-7"	2'-8"
	4'			12	24	37	"	"	"	"			6	"	"	"	"
	5'			12	24	37	"	"	"	"			6	"	"	"	"
	6'			12	24	37	12'-9"	"	2'-7½"	4'-3"			6	11'-6"	3'-5"	10'-10"	2'-11"
	7'			12	24	37	12'-11"	0'-3"	2'-8½"	4'-3½"			6	11'-8"	3'-7"	11'-0"	3'-1"
2 @ 6'	3'	#5	12"	11	22	34	14'-7"	0'-4½"	2'-10"	4'-11"	#5	12"	6	13'-3"	4'-3"	12'-6"	3'-9"
	4'			11	22	34	"	"	"	"			6	"	"	"	"
	5'			11	22	34	"	"	"	"			6	"	"	"	"
	6'			11	22	34	14'-10"	"	2'-11"	5'-0"			6	13'-6"	4'-6"	12'-9"	4'-0"
	7'			11	22	34	15'-0"	"	3'-0"	5'-0½"			6	13'-8"	4'-8"	12'-11"	4'-2"
	8'			11	22	34	15'-1"	0'-4½"	3'-0"	5'-1"			6	13'-9"	4'-9"	13'-0"	4'-3"
2 @ 7'	4'	#6	12"	10	22	33	16'-10"	0'-5¼"	3'-3½"	5'-7"	#6	12"	7	15'-5"	4'-7"	14'-6"	4'-0"
	5'			10	22	33	"	"	"	"			7	"	"	"	"
	6'			10	22	33	17'-1"	"	3'-4½"	5'-8"			8	15'-8"	3'-1"	14'-9"	2'-6"
	7'			10	22	33	17'-3"	"	3'-5½"	5'-8½"			8	15'-10"	3'-3"	14'-11"	2'-8"
	8'			10	22	33	17'-4"	"	3'-5½"	5'-9"			8	15'-10"	3'-4"	15'-0"	2'-9"
	9'			10	22	33	17'-7"	0'-5¼"	3'-6½"	5'-10"			8	16'-2"	3'-7"	15'-3"	3'-0"
2 @ 8'	4'	#6	13"	9	20	30	18'-11"	0'-6¼"	3'-6"	6'-5"	#6	13"	8	17'-5"	3'-7"	16'-5"	3'-0"
	5'			9	20	30	19'-2"	"	3'-7"	6'-6"			8	17'-8"	3'-10"	16'-8"	3'-3"
	6'			9	20	30	"	"	"	"			8	"	"	"	"
	7'			9	19	30	19'-4"	"	3'-8"	6'-6½"			8	17'-10"	4'-0"	16'-10"	3'-5"
	8'			9	19	30	19'-5"	"	3'-8"	6'-7"			8	17'-11"	4'-1"	16'-11"	3'-6"
	9'			9	19	30	19'-8"	"	3'-9"	6'-8"			8	18'-2"	4'-4"	17'-2"	3'-9"
	10'			9	19	30	19'-11"	0'-6¼"	3'-10"	6'-9"			8	18'-5"	4'-7"	17'-5"	4'-0"

"c" bars - STRAIGHT - In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars - In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length). "d" bars - STRAIGHT - Longitudinal in Top Slab of Barrel.

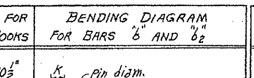
S	H	"c" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	"d" SIZE	SPACING	No. REQ'D	LENGTH
2 @ 4'	2'	#5	13"	25	45	67	4'-8"	#5	13"	2	3'-3"	—	#4	12"	14	Lengths Vary - Ave. Lengths: 2:1 = 15'-6", 3:1 = 27'-1", ⊙4:1 = 38'-8"
	3'			25	45	67	"			2	"	—			14	
	4'			25	45	67	"			2	"	—			14	
	5'			25	45	67	"			2	"	—			14	
	6'			25	45	67	4'-9"			2	3'-6"	—			14	
2 @ 5'	3'	#5	11"	27	51	77	5'-8"	#5	11"	4	5'-5"	3'-10"	#4	12"	16	
	4'			27	51	77	"			4	"	"			16	
	5'			27	51	77	"			4	"	"			16	
	6'			27	51	77	5'-9"			4	5'-7"	4'-0"			16	
	7'			27	51	77	5'-10"			4	5'-8"	4'-1"			16	
2 @ 6'	3'	#6	12"	23	47	69	6'-8"	#6	12"	6	6'-7"	3'-1"	#4	12"	18	
	4'			23	47	69	"			6	"	"			18	
	5'			23	47	69	"			6	"	"			18	
	6'			23	47	69	6'-9"			6	6'-9"	3'-3"			18	
	7'			23	47	69	6'-10"			6	6'-10"	3'-4"			18	
	8'			23	47	69	6'-10"			6	6'-11"	3'-5"			18	
2 @ 7'	4'	#6	12"	25	47	71	7'-8"	#6	12"	6	6'-4"	2'-10"	#4	12"	21	
	5'			25	47	71	"			6	"	"			21	
	6'			25	47	71	7'-9"			6	6'-6"	3'-0"			21	
	7'			25	47	71	7'-10"			6	6'-7"	3'-1"			21	
	8'			25	47	71	7'-10"			6	6'-8"	3'-2"			21	
	9'			25	47	71	7'-11"			6	6'-10"	3'-4"			21	
2 @ 8'	4'	#7	13"	21	43	65	8'-8"	#7	13"	8	8'-0"	3'-3"	#4	12"	23	
	5'			21	43	65	8'-9"			8	8'-2"	3'-5"			23	
	6'			21	43	65	"			8	"	"			23	
	7'			21	43	65	8'-10"			8	8'-3"	3'-6"			23	
	8'			21	43	65	8'-10"			8	8'-4"	3'-7"			23	
	9'			21	43	65	8'-11"			8	8'-6"	3'-9"			23	
	10'			21	43	65	9'-0"			8	8'-8"	3'-11"			23	

"d1" bars - STRAIGHT - Longitudinal in Sidewalls and Division Wall. "e" bars - Longitudinal in Bottom Slab of Barrel. "f" bars - STRAIGHT - Verticals in Sidewalls and Division Wall. "k1" bars - STRAIGHT - In Bottom of Headwall. "k2" bars - In Top of Headwall and Apron. (2 Each)

S	H	"d1" SIZE	SPACING	No. REQ'D	LENGTH	"e" SIZE	SPACING	No. REQ'D	LENGTH	"f" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	No. REQ'D	LENGTH	"k2" SIZE	No. REQ'D	LENGTH
2 @ 4'	2'	#4	12"	8	Lengths Vary - Ave. Lengths: 2:1 = 15'-6", 3:1 = 27'-1", ⊙4:1 = 38'-8"	#4	12"	14	Lengths Vary - Ave. Lengths: 2:1 = 16'-8", 3:1 = 28'-3", ⊙4:1 = 39'-10"	#4	12"	56	102	148	2'-9"	#5	3	10'-11"	#5	4	12'-0"
	3'			12				14				56	102	148	3'-9"		3	"		4	"
	4'			16				14				56	102	148	4'-9"		3	"		4	"
	5'			20				14				56	102	148	5'-9"		3	"		4	"
	6'			24				14				56	102	148	6'-9"		3	11'-2"		4	12'-4"
2 @ 5'	3'	#4	12"	12		#4	12"	16		#4	12"	56	102	148	3'-10"	#5	3	13'-2"	#5	4	14'-4"
	4'			16				16				56	102	148	4'-10"		3	"		4	"
	5'			20				16				56	102	148	5'-10"		3	"		4	"
	6'			24				16				56	102	148	6'-10"		3	13'-6"		4	14'-8"
	7'			28				16		#5	12"	56	102	148	7'-10"		3	13'-8"		4	14'-10"
2 @ 6'	3'	#4	12"	12		#4	12"	18		#4	12"	56	102	148	4'-0"	#5	3	15'-6"	#5	4	16'-8"
	4'			16				18				56	102	148	5'-0"		3	"		4	"
	5'			20				18				56	102	148	6'-0"		3	"		4	"
	6'			24				18				56	102	148	7'-0"		3	15'-9"		4	16'-11"
	7'			28				18		#5	12"	56	102	148	8'-0"		3	16'-0"		4	17'-2"
	8'			32				18			11"	62	112	162	9'-0"		3	16'-1"		4	17'-3"
2 @ 7'	4'	#4	12"	16		#4	12"	21		#4	12"	56	102	148	5'-2"	#6	3	17'-10"	#6	4	19'-0"
	5'			20				21				56	102	148	6'-2"		3	"		4	"
	6'			24				21				56	102	148	7'-2"		3	18'-1"		4	19'-3"
	7'			28				21		#5	12"	56	102	148	8'-2"		3	18'-3"		4	19'-5"
	8'			32				21			11"	62	112	162	9'-2"		3	18'-5"		4	19'-6"
	9'			36				21			10"	68	124	178	10'-2"		3	18'-8"		4	19'-10"
2 @ 8'	4'	#4	12"	16		#4	12"	23		#4	12"	56	102	148	5'-4"	#6	3	20'-1"	#6	4	21'-3"
	5'			20				23				56	102	148	6'-4"		3	20'-5"		4	21'-7"
	6'			24				23				56	102	148	7'-4"		3	"		4	"
	7'			28				23			10"	68	124	178	8'-4"		3	20'-7"		4	21'-9"
	8'			32				23		#5	12"	56	102	148	9'-4"		3	20'-8"		4	21'-10"
	9'			36				23			11"	62	112	162	10'-4"		3	21'-0"		4	22'-2"
	10'			40				23		#6	12"	56	102	148	11'-4"		3	21'-3"		4	22'-5"

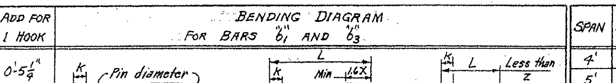
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b2"



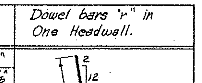
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b1" AND "b3"



SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"±	12	2'-4"	1'-2"
5'	#4	12"±	14	2'-5"	1'-2½"
6'	#4	12"±	16	2'-6"	1'-3"
7'	#4	12"±	18	2'-8"	1'-4"
8'	#4	12"±	21	2'-10"	1'-5"

Dowel bars "r" in One Headwall.



NOTE:- Dimensions are to centers of bars (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

◤ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-11" for 13" spacing, 1'-9" for 12" spacing, and 1'-7" for 11" spacing.

⊙ To Longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" lap).

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

For Barrels of 4',5' & 6' Spans, see Drawing No. R-200X-X1, of 7' Spans Drawing No. R-200X-X3, and of 8' Spans Drawing No. R-200X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW ~ SECTIONS "A" ONLY

4', 5', 6', 7' AND 8' SPANS DOUBLES

2:1, 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

STANDARD DRAWING NO. R-230X-1

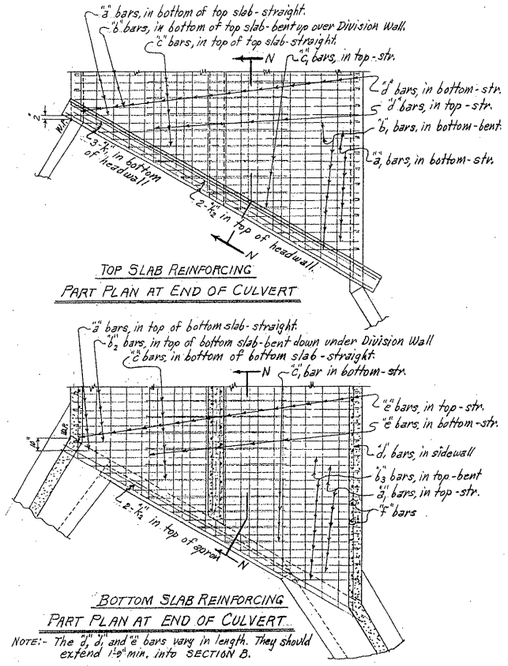
Designed by:- W.C.H. 9-17-62. Checked by:- R.H.S. 11-12-62

Drawn by:- W.C.H. 1-28-64. Checked by:-

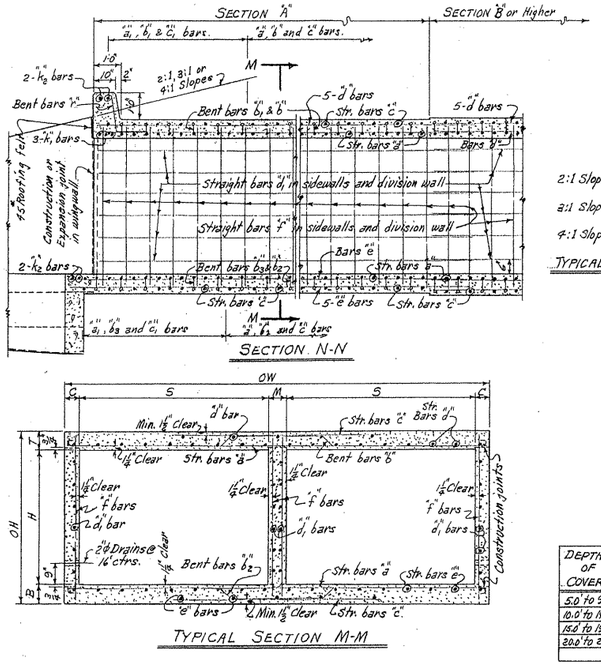
Quantities by:- W.C.H 4-23-64 Checked by:-

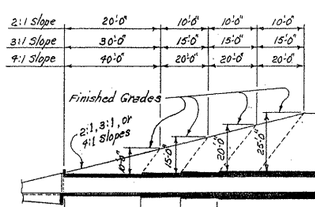
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



NOTE:- The "b₃", "a₁" and "e" bars vary in length. They should extend 1'-6" min. into SECTION B.





2:1 Slope	20'-0"	10'-0"	10'-0"	10'-0"	
3:1 Slope	30'-0"	15'-0"	15'-0"	15'-0"	
4:1 Slope	40'-0"	20'-0"	20'-0"	20'-0"	

LENGTH OF SECTIONS ON 30° SKEW

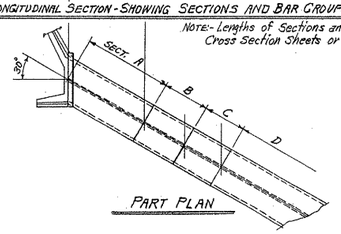
SLOPE	2:1		3:1		4:1	
SECTIONS	A	B & C	A	B & C	A	B & C
LENGTHS	13'-10 1/4"	6'-11 1/8"	25'-4 3/4"	12'-8 3/8"	36'-11 1/2"	18'-5 3/4"

NOTE:- Minimum ℄ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2').

2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	MID-SECTION D-Varies	These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths above.
	Bar Group	A	B	C	D	
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	MID-SECTION D-Varies	
	Bar Group	A	B	C	D	
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	MID-SECTION D-Varies	
	Bar Group	A	B	C	D	

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



NOTE:- For Details and Bar Lists for SECTIONS B, C & D, see Barrel Drawing Nos. R-200X-X2 and R-200X-X3.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	B	C		D

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	2@ C			D

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEAD WALL K	* QUANTITIES - ONE SECTION "A" CLASS S CONCRETE BARREL ONLY 2:1 CU.YD.	3:1 CU.YD.	4:1 CU.YD.	REINFORCING STEEL BARREL, APRON AND HEADWALL 2:1 LB.	3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	2 @ 9'	5'	90	19'-11"	10"	7"	9"	10 3/4"	6'-8 3/8"	23'-0"	24'-3 3/8"	22.58	41.90	60.21	3988	5962	8490
		6'	108	20'-1"		7 1/2"	10"		7'-8 3/8"	23'-6"	24'-4 3/8"	24.23	44.42	64.60	3591	6141	8899
		7'	126	20'-1"		7 1/2"	10"		8'-8 3/8"	"	"	25.30	46.37	67.45	3738	6405	9262
		8'	144	20'-2"		8"	10"		9'-8 3/8"	23'-3 1/2"	24'-5 1/2"	26.79	49.12	71.44	3963	6803	9859
		9'	162	20'-5"		9"	11"		10'-8 3/8"	23'-6 1/2"	24'-9 1/2"	29.27	53.46	78.05	4229	7276	10,522
		10'	180	20'-8"		10"	12"		11'-8 3/8"	23'-10 1/2"	25'-0 1/2"	32.02	58.69	85.36	4462	7776	11,249
		11'	198	20'-10"		11"	12"		12'-8 3/8"	24'-2 1/2"	25'-2 1/2"	34.48	63.21	91.94	4720	8249	11,941
	2 @ 10'	5'	100	21'-11"	10 3/4"	7"	9"	11 1/2"	6'-10 1/2"	25'-3 1/2"	26'-5 1/2"	25.77	47.24	68.70	3796	6986	9321
		6'	120	22'-1"		7 1/2"	10"		7'-10 1/2"	25'-6"	26'-7 1/2"	27.92	50.26	73.10	3851	6668	9583
		7'	140	22'-1"		7 1/2"	10"		8'-10 1/2"	"	"	28.50	52.24	75.98	3999	6934	9960
		8'	160	22'-2"		8"	10"		9'-10 1/2"	25'-7 1/2"	26'-9"	29.98	54.94	79.93	4221	7331	10,596
		9'	180	22'-5"		9"	11"		10'-10 1/2"	25'-10 1/2"	27'-0 1/2"	32.89	59.55	86.62	4489	7808	11,214
		10'	200	22'-8"		10"	12"		11'-10 1/2"	26'-2 1/2"	27'-4"	35.25	64.61	93.97	4790	8342	12,006
		11'	220	22'-10"		11"	12"		12'-10 1/2"	26'-7 1/2"	27'-6 1/2"	37.71	69.13	100.54	5049	8786	12,639
		12'	240	23'-0"		12"	12"		13'-10 1/2"	26'-11 1/2"	27'-9 1/2"	40.36	73.98	107.60	5334	9310	13,363
	2 @ 11'	6'	132	24'-2"	11 3/4"	8"	10"	12 1/2"	8'-10 1/2"	27'-10 1/2"	29'-0 1/2"	31.79	58.16	84.59	4470	8056	11,502
		7'	154	24'-2"		8"	10"		9'-10 1/2"	"	"	32.83	60.19	87.59	4784	8625	11,790
		8'	176	24'-5"		8"	10"		10'-10 1/2"	"	"	33.94	62.25	90.53	5033	8710	12,454
		9'	198	24'-5"		9"	11"		11'-10 1/2"	28'-2 1/2"	29'-4 1/2"	36.98	66.87	97.24	5311	9202	13,141
		10'	220	24'-8"		10"	12"		12'-10 1/2"	28'-5 1/2"	29'-7 1/2"	39.26	71.07	104.68	5635	9769	13,967
		11'	242	24'-10"		11"	12"		13'-10 1/2"	28'-8 1/2"	29'-10"	41.74	74.52	111.29	5902	10,219	14,614
		12'	264	25'-0"		12"	12"		14'-10 1/2"	28'-10 1/2"	30'-0 1/2"	44.39	81.37	118.35	6351	10,993	15,715
	2 @ 12'	6'	144	26'-2"	12 1/4"	8"	10"	13 1/2"	8'-2"	30'-2 1/2"	31'-4 1/2"	35.76	65.55	95.34	5334	9,134	13,120
		7'	168	26'-2"		8"	10"		9'-2"	"	"	36.88	67.60	98.33	5413	9334	13,926
		8'	192	26'-2"		8"	10"		10'-2"	"	"	37.99	69.64	101.28	5700	9854	14,081
		9'	216	26'-5"		9"	11"		11'-2"	30'-6"	31'-8"	40.52	74.28	108.04	5986	10,360	14,783
		10'	240	26'-8"		10"	12"		12'-2"	30'-9 1/2"	31'-11 1/2"	43.34	79.44	115.54	6309	10,924	15,416
		11'	264	26'-10"		11"	12"		13'-2"	30'-11 1/2"	32'-1 1/2"	45.83	84.01	122.19	6579	11,385	16,270
		12'	288	27'-0"		12"	12"		14'-2"	31'-2 1/2"	32'-4"	48.49	88.89	129.28	7035	12,165	17,385

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY.

SECTION & BAR GROUP	LENGTH OF SECTION	DEPTH OF COVER	CLEAR SPAN	CLEAR HEIGHT	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel - (Two of each Length) SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.
SECTION "A" & BAR GROUP "A"	4:1 = 36'-11 1/2"	0'-0" TO 10'-0" MAXIMUM	2 @ 9'	5'	#5	11"	19	43	69	19'-8"	#5	11"	20	18'-1"	3'-10"
				6'			19	43	69	19'-10"			20	18'-3"	4'-0"
				7'			19	43	69	19'-10"			20	18'-3"	"
				8'			19	43	69	19'-11"			22	18'-4"	2'-6"
				9'			19	43	69	20'-2"			22	18'-7"	2'-9"
				10'			19	43	69	20'-5"			22	18'-10"	3'-0"
				11'			19	43	69	20'-7"			22	19'-0"	3'-2"
			2 @ 10'	5'		12"	17	39	63	21'-8"		12"	22	19'-1"	2'-5"
				6'			17	39	63	21'-10"			22	20'-1"	2'-7"
				7'			17	39	63	21'-10"			22	20'-1"	"
				8'			17	39	63	21'-11"			22	20'-2"	2'-8"
				9'			17	39	63	22'-2"			22	20'-5"	2'-11"
				10'			17	39	63	22'-5"			22	20'-8"	3'-2"
				11'			17	39	63	22'-7"			22	20'-10"	3'-4"
				12'			17	39	63	22'-9"			22	21'-0"	3'-6"
			2 @ 11'	6'			15	39	61	23'-11"			24	22'-2"	2'-11"
				7'			15	39	61	23'-11"			24	22'-2"	"
				8'			15	39	61	23'-11"			24	22'-2"	"
				9'			15	39	61	24'-2"			24	22'-5"	3'-2"
				10'			15	39	61	24'-5"			24	22'-8"	3'-5"
				11'			15	39	61	24'-7"			24	22'-10"	3'-7"
				12'			15	39	61	24'-9"			24	23'-0"	3'-9"
			2 @ 12'	6'			15	41	65	25'-11"			28	24'-4"	3'-9"
				7'			15	41	65	25'-11"			28	24'-4"	"
				8'			15	41	65	25'-11"			28	24'-4"	"
				9'			15	41	65	26'-2"			28	24'-7"	4'-0"
				10'			15	41	65	26'-5"			30	24'-10"	2'-8"
				11'			15	41	65	26'-7"			30	25'-0"	2'-10"
				12'			15	41	65	26'-9"			30	25'-2"	3'-0"

SECTION & BAR GROUP	"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Wall - hooked. SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b₁" bars BENT - See Diagrams below. In Bottom of Top Slab - some bent up over Division Wall - one end hooked. Alt. with "b₂" and "c₁" or "c" bars. SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
SECTION "A" & BAR GROUP "A"	#6	11"	9	21	34	21'-2"	0'-6 1/2"	4'-2"	7'-2"	#6	11"	11	19'-10"	3'-7"	18'-10"	3'-0"
			9	21	34	21'-4"	"	4'-3"	7'-2 1/2"			11	20'-0"	3'-9"	19'-0"	3'-2"
			9	21	34	21'-4"	"	4'-3"	7'-2 1/2"			11	20'-0"	"	"	"
			9	21	34	21'-5"	"	"	7'-3"			11	20'-1"	3'-10"	19'-1"	3'-3"
			9	21	34	21'-8"	"	4'-4"	7'-4"			11	20'-4"	4'-1"	19'-4"	3'-6"
			8	21	34	21'-11"	"	4'-5"	7'-5"			11	20'-7"	4'-4"	19'-7"	3'-9"
			8	21	34	22'-1"	0'-6 1/2"	4'-5"	7'-6"			11	20'-9"	4'-6"	19'-9"	3'-11"
	#6	12"	7	19	30	23'-2"	0'-7 1/2"	4'-6 1/2"	7'-11"	#6	12"	11	21'-6"	3'-10"	20'-9"	3'-3"
			7	19	30	23'-4"	"	4'-7 1/2"	7'-11 1/2"			11	22'-0"	4'-0"	20'-11"	3'-5"
			7	19	30	23'-4"	"	"	"			11	22'-0"	"	"	"
			7	19	30	23'-5"	"	"	8'-0"			11	22'-1"	4'-1"	21'-0"	3'-6"
			7	19	30	23'-8"	"	4'-8 1/2"	8'-1"			11	22'-4"	4'-4"	21'-3"	3'-9"
			7	19	30	23'-11"	"	4'-9 1/2"	8'-2"			11	22'-7"	4'-7"	21'-6"	4'-0"
			7	19	30	24'-1"	"	4'-9 1/2"	8'-3"			11	22'-9"	4'-9"	21'-8"	4'-2"
			7	19	30	24'-3"	0'-7 1/2"	4'-9 1/2"	8'-4"			12	22'-11"	3'-1"	21'-10"	2'-7"
			7	18	30	25'-8"	0'-8"	5'-0"	8'-9"			12	24'-2"	4'-5"	23'-0"	3'-9"
			7	18	30	25'-8"	"	"	"			12	24'-2"	"	"	"
			7	18	30	25'-8"	"	"	"			12	24'-2"	"	"	"
			7	18	30	25'-11"	"	5'-1"	8'-10"			12	24'-5"	4'-8"	23'-3"	4'-0"
			7	18	30	26'-2"	"	5'-2"	8'-11"			13	24'-8"	3'-2"	23'-6"	2'-6"
			7	18	30	26'-4"	"	5'-2"	9'-0"			13	24'-10"	3'-4"	23'-8"	2'-8"
			7	18	30	26'-6"	0'-8"	5'-2"	9'-1"			13	25'-1"	3'-6"	23'-10"	2'-10"
	#7	12"	7	19	32	27'-8"	0'-8 3/4"	5'-4 1/2"	9'-6"	#7	12"	15	26'-4"	3'-7"	25'-1"	2'-11"
			7	19	32	27'-8"	"	"	"			15	26'-4"	"	"	"
			7	19	32	27'-8"	"	"	"			15	26'-4"	"	"	"
			7	19	32	27'-11"	"	5'-5 1/2"	9'-7"			15	26'-7"	3'-10"	25'-4"	3'-2"
			7	19	32	28'-2"	"	5'-6 1/2"	9'-8"			15	26'-10"	4'-1"	25'-7"	3'-5"
			7	19	32	28'-4"	"	5'-6 1/2"	9'-9"			15	27'-0"	4'-3"	25'-9"	3'-7"
			7	19	32	28'-6"	0'-8 3/4"	5'-6 1/2"	9'-10"			15	27'-2"	4'-5"	25'-11"	3'-9"

SECTION & BAR GROUP	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b₃" bars BENT - See Diagrams below. In Top of Bottom Slab - some bent down under Division Wall - one end hooked. Alt. with "a₁" and "c" or "c₁" bars. SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
SECTION "A" & BAR GROUP "A"	#6	11"	10	22	35	21'-3"	0'-7 1/2"	4'-0 1/2"	7'-2"	#6	11"	11	19'-10"	3'-7"	18'-10"	3'-0"
			10	22	35	21'-5"	"	4'-1 1/2"	7'-2 1/2"			11	20'-0"	3'-9"	19'-0"	3'-2"
			10	22	35	21'-5"	"	"	7'-2 1/2"			11	20'-0"	"	"	"
			10	22	35	21'-6"	"	"	7'-3"			11	20'-2"	3'-10"	19'-1"	3'-3"
			9	22	35	21'-9"	"	4'-2 1/2"	7'-4"			11	20'-5"	4'-1"	19'-4"	3'-6"
			9	22	35	22'-0"	"	4'-3 1/2"	7'-5"			11	20'-8"	4'-4"	19'-7"	3'-9"
			9	22	35	22'-2"	0'-7 1/2"	4'-3 1/2"	7'-6"			11	20'-10"	4'-6"	19'-9"	3'-11"
	#6	12"	8	20	31	23'-3"	0'-8"	4'-5"	7'-11"	#6	12"	11	21'-10"	3'-10"	20'-9"	3'-3"
			8	20	31	23'-5"	"	4'-6"	7'-11 1/2"			11	22'-0"	4'-0"	20'-11"	3'-5"
			8	20	31	"	"	"	"			11	22'-0"	"	"	"
			8	20	31	23'-6"	"	"	8'-0"			11	22'-1"	4'-1"	21'-0"	3'-6"
			8	20	31	23'-9"	"	4'-7"	8'-1"			11	22'-4"	4'-4"	21'-3"	3'-9"
			8	20	31	24'-0"	"	4'-8"	8'-2"			11	22'-7"	4'-7"	21'-6"	4'-0"
			8	20	31	24'-2"	"	4'-8"	8'-3"			11	22'-9"	4'-9"	21'-8"	4'-2"
			8	20	31	24'-4"	0'-8"	4'-8"	8'-4"			12	22'-11"	3'-1"	21'-10"	2'-7"
			8	19	31	25'-9"	0'-8 3/4"	4'-10 1/2"	8'-9"			12	24'-2"	4'-5"	23'-0"	3'-9"
			8	19	31	"	"	"	"			12	24'-2"	"	"	"
			8	19	31	"	"	"	"			12	24'-2"	"	"	"
			8	19	31	26'-0"	"	4'-11 1/2"	8'-10"			12	24'-6"	4'-8"	23'-3"	4'-0"
			8	19	31	26'-3"	"	5'-0 1/2"	8'-11"			13	24'-9"	3'-2"	23'-6"	2'-6"
			8	19	31	26'-5"	"	5'-0 1/2"	9'-0"			13	24'-11"	3'-4"	23'-8"	2'-8"
			8	19	31	26'-7"	0'-8 3/4"	5'-0 1/2"	9'-1"			13	25'-1"	3'-6"	23'-10"	2'-10"
	#7	12"	8	20	33	27'-9"	0'-9 3/4"	5'-2 1/2"	9'-6"	#7	12"	15	26'-4"	3'-7"	25'-1"	2'-11"
			8	20	33	"	"	"	"			15	26'-4"	"	"	"
			8	20	33	"	"	"	"			15	26'-4"	"	"	"
			8	20	33	28'-0"	"	5'-3 1/2"	9'-7"			15	26'-7"	3'-10"	25'-4"	3'-2"
			8	20	33	28'-3"	"	5'-4 1/2"	9'-8"			15	26'-10"	4'-1"	25'-7"	3'-5"
			8	20	33	28'-5"	"	5'-4 1/2"	9'-9"			15	27'-0"	4'-3"	25'-9"	3'-7"
			8	20	33	28'-7"	0'-9 3/4"	5'-4 1/2"	9'-10"			15	27'-2"	4'-5"	25'-11"	3'-9"

SECTION & BAR GROUP	"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with "b₃" bars. (Two of each Length) SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel. SIZE	SPACING	NO. REQ'D	LENGTH
SECTION "A" & BAR GROUP "A"	#7	11"	25	49	75	9'-9"	#7	11"	8	8'-5"	3'-8"	#4	12"	25	
			25	49	75	9'-10"			8	8'-6"	3'-9"			25	
			25	49	75	"			8	"	"			25	
			25	49	75	9'-11"			8	8'-7"	3'-10"			25	
			25	49	75	10'-0"			8	8'-9"	4'-0"			25	
			25	49	75	"			8	8'-11"	4'-2"			25	
			25	49	75	"			8	9'-0"	4'-3"			25	
			23	45	69	10'-9"			8	9'-2"	3'-11"			27	
			23	45	69	10'-10"			8	9'-4"	4'-1"			27	
			23	45	69	"			8	"	"			27	
			23	45	69	10'-11"			8	9'-5"	4'-2"			27	
			23	45	69	11'-0"			8	9'-7"	4'-4"			27	
			23	45	69	11'-0"			8	9'-9"	4'-6"			27	
			23	45	69	"			8	9'-10"	4'-7"			27	
			23	45	69	"			8	9'-11"	4'-8"			27	
			21	45	67	11'-10"			10	10'-11"	3'-11"			29	
			21	45	67	"			10	"	"			29	
			21	45	67	"			10	"	"			29	
			21	45	67	11'-11"			10	11'-1"	4'-1"			29	
			21	45	67	12'-0"			10	11'-3"	4'-3"			29	
			21	45	67	"			10	11'-4"	4'-4"			29	
			21	45	67	"			10	11'-5"	4'-5"			29	
			23	49	73	12'-10"			12	11'-6"	3'-7"			31	
			23	49	73	"			12	"	"			31	
			23	49	73	"			12	"	"			31	
			23	49	73	12'-11"			12	11'-8"	3'-9"			31	
			23	49	73	13'-0"			12	11'-10"	3'-11"			31	
			23	49	73	"			12	11'-11"	4'-0"			31	
			23	49	73	"			12	12'-0"	4'-1"			31	

SECTION & BAR GROUP	"d₁" bars STRAIGHT Longitudinal in Sidewalls and Division Wall. SIZE	SPACING	NO. REQ'D	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	NO. REQ'D	LENGTH	"f" bars STRAIGHT Verticals in Sidewalls and Division Wall. SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"K" bars STRAIGHT In Bottom of Headwall. SIZE	NO. REQ'D	LENGTH	"K₁" bars STRAIGHT In Top of Headwall and Apron. (2 Each) SIZE	NO. REQ'D	LENGTH
SECTION "A" & BAR GROUP "A"	#4	12"	20		#4	12"	25		#4	12"	56	102	148	6'-5"	3	3	22'-9"	4	4	23'-10"
			24				25				56	102	148	7'-5"	3	3	22'-11"	4	4	24'-1"
			28				25				10"	68	124	176	8'-5"	3	"	4	4	"
			32				25				12"	56	102	148	9'-5"	3	23'-0"	4	4	24'-2"
			36				25				10"	68	124	178	10'-5"	3	23'-2"	4	4	24'-5"
			40				25				12"	56	102	148	11'-5"	3	23'-7"	4	4	24'-9"
			44				25				11"	62	112	162	12'-5"	3	23'-9"	4	4	24'-11"
			20				27				12"	56	102	148	6'-7"	3	25'-5"	4	4	26'-2"
			24				27				56	102	148	7'-7"	3	25'-8"	4	4	26'-4"
			28				27				10"	68	124	178	8'-7"	3	"	4	4	"
			32				27				12"	56	102	148	9'-7"	3	25'-8"	4	4	26'-6"
			36				27				10"	68	124	178	10'-7"	3	25'-7"	4	4	26'-9"
			40				27				12"	56	102	148	11'-7"	3	25'-11"	4	4	27'-1"
			44				27				11"	62	112	162	12'-7"	3	26'-1"	4	4	27'-3"
			48				27				10"	68	124	178	13'-7"	3	26'-3"	4	4	27'-5"
			24				29				12"	56	102	148	7'-9"	3	27'-7"	4	4	28'-9"
			28				29				11"	62	112	162	8'-9"	3	"	4	4	"
			32				29				12"	56	102	148	9'-9"	3	"	4	4	"
			36				29				10"	68	124	178	10'-9"	3	27'-11"	4	4	29'-1"
			40				29				12"	56	102	148	11'-9"	3	28'-2"	4	4	29'-4"
			44				29				11"	62	112	162	12'-9"	3	28'-5"	4	4	29'-7"
			48				29				9"	76	136	196	13'-9"	3	28'-7"	4	4	29'-9"
			24				31				12"	56	102	148	7'-11

3'-3"   3'-3"

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 30° SKEWED ENDS

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel.
"a1" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel (Four of Each Length).
"b" bars – BENT – See Diagrams below – In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

D (Depth of Cover)	S (Clear Span)	H (Clear Height)	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.	"b" Size	"b" Spacing	"b" No. Req'd	"b" Length	"b" X	"b" Y	"b" Z
0'-0" TO 5'-0" MAXIMUM	3 @ 4'	2'	#5	12"	108	14'-1"	#5	12"	24	12'-4"	3'-7"	#5	12"	51	15'-4"	0'-3"	2'-2"	3'-4¼"
		3'			108	14'-1"			24	"	"			51	15'-4"	"	"	"
		4'			108	14'-1"			24	"	"			51	15'-4"	"	"	"
		5'			108	14'-1"			24	"	"			51	15'-4"	"	"	"
		6'			108	14'-5"			24	12'-8"	3'-11"			51	15'-8"	0'-3"	2'-3"	3'-5¼"
	3 @ 5'	3'	#6	12"	104	17'-1"	#6	12"	32	15'-4"	3'-1"	#5	12"	50	18'-5"	0'-3½"	2'-7"	4'-1¼"
		4'			104	17'-1"			32	"	"			50	18'-5"	"	"	"
		5'			104	17'-1"			32	"	"			50	18'-5"	"	"	"
		6'			104	17'-5"			32	15'-8"	3'-5"			50	18'-9"	"	2'-8"	4'-2¼"
		7'			104	17'-8"			32	15'-11"	3'-8"			49	19'-0"	0'-3½"	2'-9"	4'-2¾"
	3 @ 6'	3'	#6	11"	110	20'-1"	#6	11"	44	18'-6"	2'-8"	#5	11"	52	21'-6"	0'-4"	3'-0"	4'-10¼"
		4'			110	20'-1"			44	"	"			52	21'-6"	"	"	"
		5'			110	20'-1"			44	"	"			52	21'-6"	"	"	"
		6'			110	20'-5"			44	18'-10"	3'-0"			52	21'-10"	"	3'-1"	4'-11¼"
		7'			108	20'-8"			44	19'-1"	3'-3"			52	22'-1"	"	3'-2"	4'-11¾"
		8'			108	20'-9"			44	19'-2"	3'-4"			52	22'-2"	0'-4"	3'-2"	5'-0¼"
	3 @ 7'	4'	#6	12"	98	23'-1"	#6	12"	44	21'-4"	3'-10"	#6	12"	46	24'-8"	0'-4½"	3'-5"	5'-7"
		5'			96	23'-1"			44	"	"			46	24'-8"	"	"	"
		6'			96	23'-5"			44	21'-8"	4'-2"			46	25'-0"	"	3'-6"	5'-8"
		7'			96	23'-8"			48	21'-11"	2'-8"			46	25'-3"	"	3'-7"	5'-8½"
		8'			96	23'-9"			48	22'-0"	2'-9"			46	25'-4"	"	"	5'-9"
		9'			96	24'-1"			48	22'-4"	3'-1"			46	25'-8"	0'-4½"	3'-8"	5'-10"
	3 @ 8'	4'	#6	11"	102	26'-1"	#6	11"	56	24'-6"	3'-11"	#6	11"	48	27'-9"	0'-5"	3'-10"	6'-4"
		5'			102	26'-5"			60	24'-10"	2'-8"			48	28'-1"	"	3'-11"	6'-5"
		6'			102	26'-5"			60	"	"			48	28'-1"	"	"	"
		7'			102	26'-8"			60	25'-1"	2'-11"			48	28'-4"	"	4'-0"	6'-5½"
		8'			100	26'-9"			60	25'-2"	3'-0"			48	28'-5"	"	"	6'-6"
		9'			100	27'-1"			60	25'-6"	3'-4"			48	28'-9"	"	4'-1"	6'-7"
		10'			100	27'-5"			60	25'-10"	3'-8"			48	29'-1"	0'-5"	4'-2"	6'-8"

"b1" bars (▼) – BENT – In Bottom of Top Slab - some bent up over Division Walls - one end hooked. (2 of Each Length) Alternate with "a1" and "c" or "c1" bars.
"b2" bars – BENT – In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	"b1" Size	"b1" Spacing	"b1" No. Req'd	"b1" Length Max.	"b1" Length Min.	"b1" L Max.	"b1" L Min.	"b2" Size	"b2" Spacing	"b2" No. Req'd	"b2" Length	"b2" X	"b2" Y	"b2" Z
3 @ 4'	2'	#5	12"	14	14'-0"	3'-2"	13'-2"	2'-8"	#5	12"	53	15'-3"	0'-2½"	2'-3"	3'-4¾"
	3'			14	"	"	"	"			53	15'-3"	"	"	"
	4'			14	"	"	"	"			53	15'-3"	"	"	"
	5'			14	"	"	"	"			53	15'-3"	"	"	"
	6'			14	14'-4"	3'-6"	13'-6"	3'-0"			53	15'-7"	0'-2½"	2'-4"	3'-5¼"
3 @ 5'	3'	#5	12"	16	17'-0"	4'-5"	16'-2"	3'-11"	#5	12"	52	18'-4"	0'-3"	2'-8"	4'-1¼"
	4'			16	"	"	"	"			52	18'-4"	"	"	"
	5'			16	"	"	"	"			52	18'-4"	"	"	"
	6'			18	17'-4"	4'-9"	16'-6"	2'-6"			52	18'-8"	"	2'-9"	4'-2¼"
	7'			18	17'-7"	5'-0"	16'-9"	2'-9"			51	18'-11"	0'-3"	2'-10"	4'-2¾"
3 @ 6'	3'	#5	11"	22	20'-3"	3'-11"	19'-3"	3'-5"	#5	11"	54	21'-5"	0'-3½"	3'-1"	4'-10¼"
	4'			22	"	"	"	"			54	21'-5"	"	"	"
	5'			22	"	"	"	"			54	21'-5"	"	"	"
	6'			22	20'-7"	4'-3"	19'-7"	3'-9"			54	21'-9"	"	3'-2"	4'-11¼"
	7'			22	20'-10"	4'-6"	19'-10"	4'-0"			54	22'-0"	"	3'-3"	4'-11¾"
	8'			24	20'-11"	3'-0"	19'-11"	2'-6"			54	22'-1"	0'-3½"	3'-3"	5'-0¼"
3 @ 7'	4'	#6	12"	24	23'-4"	3'-6"	22'-2"	2'-11"	#6	12"	48	24'-8"	0'-4½"	3'-5½"	5'-7"
	5'			24	"	"	"	"			48	24'-8"	"	"	"
	6'			24	23'-8"	3'-10"	22'-6"	3'-3"			48	25'-0"	"	3'-6½"	5'-8"
	7'			24	23'-11"	4'-1"	22'-9"	3'-6"			48	25'-3"	"	3'-7½"	5'-8½"
	8'			24	24'-0"	4'-2"	22'-10"	3'-7"			48	25'-4"	"	"	5'-9"
	9'			24	24'-4"	4'-6"	23'-2"	3'-11"			48	25'-8"	0'-4½"	3'-8½"	5'-10"
3 @ 8'	4'	#6	11"	30	26'-5"	3'-8"	25'-3"	3'-1"	#6	11"	50	27'-9"	0'-5"	3'-10"	6'-4"
	5'			30	26'-9"	4'-0"	25'-7"	3'-5"			50	28'-1"	"	3'-11"	6'-5"
	6'			30	"	"	"	"			50	28'-1"	"	"	"
	7'			30	27'-0"	4'-3"	25'-10"	3'-8"			50	28'-4"	"	4'-0"	6'-5½"
	8'			30	27'-1"	4'-4"	25'-11"	3'-9"			50	28'-5"	"	"	6'-6"
	9'			30	27'-5"	4'-8"	26'-3"	4'-1"			50	28'-9"	"	4'-1"	6'-7"
	10'			32	27'-9"	3'-5"	26'-7"	2'-10"			50	29'-1"	0'-5"	4'-2"	6'-8"

"b3" bars (▼) – BENT – In Top of Bottom Slab - some bent down under Division Walls - one end hooked. (2 of Each Length) Alternate with "a1" and "c" or "c1" bars.
"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"c1" bars (▼) – STRAIGHT – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Four of each Length)

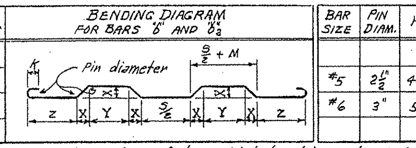
S	H	"b3" Size	"b3" Spacing	"b3" No. Req'd	"b3" Length Max.	"b3" Length Min.	"b3" L Max.	"b3" L Min.	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length	"c1" Size	"c1" Spacing	"c1" No. Req'd	"c1" Length Max.	"c1" Length Min.
3 @ 4'	2'	#5	12"	14	13'-11"	3'-2"	13'-2"	2'-8"	#5	12"	112	9'-4"	#5	12"	16	8'-3"	3'-0"
	3'			14	"	"	"	"			112	9'-4"			16	"	"
	4'			14	"	"	"	"			112	9'-4"			16	"	"
	5'			14	"	"	"	"			112	9'-4"			16	"	"
	6'			14	14'-3"	3'-6"	13'-6"	3'-0"			112	9'-6"			16	8'-6"	3'-3"
3 @ 5'	3'	#5	12"	16	17'-0"	4'-5"	16'-2"	3'-11"	#6	12"	108	11'-4"	#6	12"	20	10'-9"	3'-9"
	4'			16	"	"	"	"			108	11'-4"			20	"	"
	5'			16	"	"	"	"			108	11'-4"			20	"	"
	6'			18	17'-4"	4'-9"	16'-6"	2'-6"			108	11'-6"			20	11'-0"	4'-0"
	7'			18	17'-7"	5'-0"	16'-9"	2'-9"			108	11'-8"			20	11'-2"	4'-2"
3 @ 6'	3'	#5	11"	22	20'-2"	3'-11"	19'-3"	3'-5"	#6	11"	118	13'-4"	#6	11"	28	12'-0"	2'-6"
	4'			22	"	"	"	"			118	13'-4"			28	"	"
	5'			22	"	"	"	"			118	13'-4"			28	"	"
	6'			22	20'-6"	4'-3"	19'-7"	3'-9"			118	13'-6"			28	12'-3"	2'-9"
	7'			22	20'-9"	4'-6"	19'-10"	4'-0"			116	13'-8"			28	12'-5"	2'-11"
	8'			24	20'-10"	3'-0"	19'-11"	2'-6"			116	13'-8"			28	12'-6"	3'-0"
3 @ 7'	4'	#6	12"	24	23'-3"	3'-6"	22'-2"	2'-11"	#6	12"	106	15'-4"	#6	12"	28	14'-0"	3'-6"
	5'			24	"	"	"	"			104	15'-4"			28	"	"
	6'			24	23'-7"	3'-10"	22'-6"	3'-3"			104	15'-6"			28	14'-3"	3'-9"
	7'			24	23'-10"	4'-1"	22'-9"	3'-6"			104	15'-8"			28	14'-5"	3'-11"
	8'			24	23'-11"	4'-2"	22'-10"	3'-7"			104	15'-8"			28	14'-6"	4'-0"
	9'			24	24'-3"	4'-6"	23'-2"	3'-11"			104	15'-10"			32	14'-9"	2'-6"
3 @ 8'	4'	#6	11"	30	26'-5"	3'-8"	25'-3"	3'-1"	#6	11"	110	17'-4"	#6	11"	40	17'-0"	2'-9"
	5'			30	26'-9"	4'-0"	25'-7"	3'-5"			110	17'-6"			40	17'-3"	3'-0"
	6'			30	"	"	"	"			110	17'-6"			40	"	"
	7'			30	27'-0"	4'-3"	25'-10"	3'-8"			110	17'-8"			40	17'-5"	3'-2"
	8'			30	27'-1"	4'-4"	25'-11"	3'-9"			108	17'-8"			40	17'-6"	3'-3"
	9'			30	27'-5"	4'-8"	26'-3"	4'-1"			108	17'-10"			40	17'-9"	3'-6"
	10'			32	27'-9"	3'-5"	26'-7"	2'-10"			110	18'-0"			36	16'-5"	3'-9"

"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. Length: 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap).
"d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls. Length: 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap).
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. Length: 2 @ 31'-9" for 60'-0" Length Barrel (1'-3" Lap).
"f" bars – STRAIGHT – Verticals in Sidewalls and Division Walls.
"k1" bars (▼) – STRAIGHT – In Bottom of Headwalls.
"k2" bars (▼) – STRAIGHT – In Top of Headwalls and Aprons (2 Each).

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d1" Size	"d1" Spacing	"d1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length	"k2" Size	"k2" No. Req'd	"k2" Length
3 @ 4'	2'	#5	12"	22	#4	12"	12	#4	12"	22	#4	12"	360	2'-10"	#5	6	16'-3"	#5	8	17'-5"
	3'			22			18			22			360	3'-10"		6	"		8	"
	4'			22			24			22			360	4'-10"		6	"		8	"
	5'			22			30			22			360	5'-10"		6	"		8	"
	6'			22			36			22			360	6'-10"		6	16'-8"		8	17'-10"
3 @ 5'	3'	#5	11½"	26	#4	12"	18	#4	12"	25	#4	12"	360	3'-11"	#6	6	19'-9"	#6	8	20'-11"
	4'			26			24			25			360	4'-11"		6	"		8	"
	5'			26			30			25			360	5'-11"		6	"		8	"
	6'			26			36			25			360	6'-11"		6	20'-1"		8	21'-3"
	7'			26			42			25			360	7'-11"		6	20'-5"		8	21'-7"
3 @ 6'	3'	#5	11½"	30	#4	12"	18	#4	12"	28	#4	12"	360	4'-0"	#6	6	23'-2"	#6	8	24'-4"
	4'			30			24			28			360	5'-0"		6	"		8	"
	5'			30			30			28			360	6'-0"		6	"		8	"
	6'			30			36			28			360	7'-0"		6	23'-7"		8	24'-9"
	7'			30			42			28			360	8'-0"		6	23'-10"		8	25'-0"
	8'			30			48			28		10"	432	9'-0"		6	24'-0"		8	25'-1"
3 @ 7'	4'	#5	11½"	32	#4	12"	24	#4	12"	31	#4	12"	360	5'-1"	#6	6	26'-8"	#6	8	27'-10"
	5'			32			30			31			360	6'-1"		6	"		8	"
	6'			32			36			31			360	7'-1"		6	27'-1"		8	28'-2"
	7'			32			42			31			360	8'-1"		6	27'-4"		8	28'-6"
	8'			32			48			31		10"	432	9'-1"		6	27'-5"		8	28'-7"
	9'			32			54			31	#5	12"	360	10'-1"		6	27'-10"		8	29'-0"
3 @ 8'	4'	#5	11½"	36	#4	12"	24	#4	12"	35	#4	12"	360	5'-2"	#6	6	30'-1"	#6	8	31'-3"
	5'			36			30			35			360	6'-2"		6	30'-6"		8	31'-8"
	6'			36			36			35			360	7'-2"		6	"		8	"
	7'			36			42			35			360	8'-2"		6	30'-10"		8	31'-11"
	8'			36			48			35		10"	432	9'-2"		6	30'-11"		8	32'-1"
	9'			36			54			35	#5	12"	360	10'-2"		6	31'-3"		8	32'-5"
	10'			36			60			35		11"	396	11'-2"		6	31'-8"		8	32'-10"

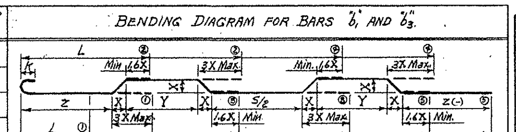
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b1" AND "b3".

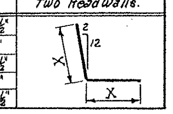


NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars.
①①--⑤⑤ Min. & Max. Lengths of L for bars "b1" & "b3" for each type bend.

DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"	34	2'-5"	1'-2½"
5'	#4	12"	42	2'-6"	1'-3"
6'	#4	12"	48	2'-7"	1'-3½"
7'	#4	12"	56	2'-8"	1'-4"
8'	#4	12"	62	2'-9"	1'-4½"

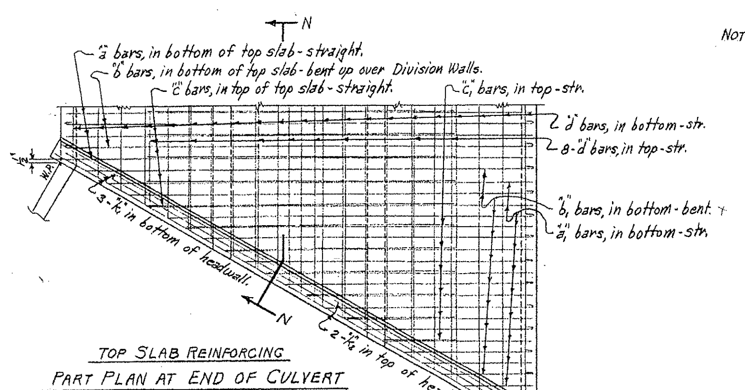
Dowel bars "r" in Two Headwalls.



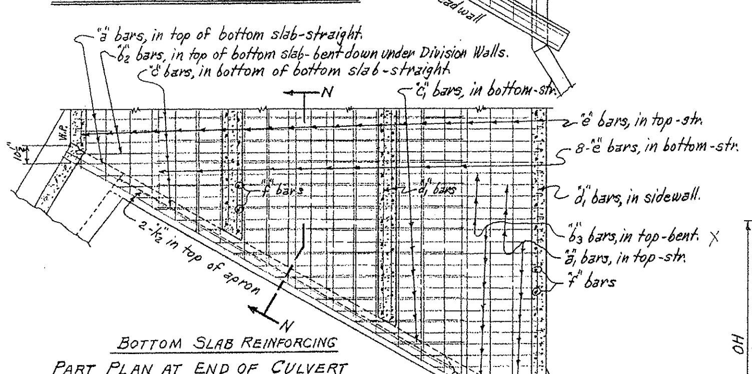
▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

D (Max. Design Depth of Cover)	S (Clear Spans)	H (Clear Height)	A (Sq. Ft. Opening)	OW (Overall Width)	T (Thickness of Top Slab)	C (Thickness of Sidewalls)	M (Thickness of Division Walls)	B (Thickness of Bottom Slab)	OH (Overall Height)	RL (Roadway Length)	K (Length of Headwalls)	* Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel: Total for 60'-0" Length of Barrel (Lb.)	Per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)
5'-0"	3 @ 4'	2'	24	14'-4"	6½"	6"	8"	6"	3'-0½"	16'-6⅝"	17'-8½"	0.726	8689	137.76	66.63
		3'	36	14'-4"		6"	8"		4'-0½"	"	"	0.812	9175	145.78	71.64
		4'	48	14'-4"		6"	8"		5'-0½"	"	"	0.899	9662	153.79	76.15
		5'	60	14'-4"		6"	8"		6'-0½"	"	"	0.985	10,148	161.81	81.66
		6'	72	14'-8"		7"	9"		7'-0½"	16'-11¼"	18'-1"	1.158	10,746	171.56	86.67
	3 @ 5'	3'	45	17'-4"	7"	6"	8"	6½"	4'-1½"	20'-0¼"	21'-2"	0.981	12,375	195.23	81.10
		4'	60	17'-4"		6"	8"		5'-1½"	"	"	1.068	12,870	203.25	86.11
		5'	75	17'-4"		6"	8"		6'-1½"	"	"	1.154	13,365	211.27	91.12
		6'	90	17'-8"		7"	9"		7'-1½"	20'-4⅜"	21'-6¾"	1.329	14,033	221.48	96.13
		7'	105	17'-11"		7½"	10"		8'-1½"	20'-8½"	21'-10"	1.503	14,604	231.27	101.14
	3 @ 6'	3'	54	20'-4"	7½"	6"	8"	7"	4'-2½"	23'-5¾"	24'-7½"	1.169	14,995	236.39	90.56
		4'	72	20'-4"		6"	8"		5'-2½"	"	"	1.256	15,480	244.41	95.57
		5'	90	20'-4"		6"	8"		6'-2½"	"	"	1.342	15,965	252.42	100.58
		6'	108	20'-8"		7"	9"		7'-2½"	23'-10⅜"	25'-0¼"	1.517	16,628	262.84	105.59
		7'	126	20'-11"		7½"	10"		8'-2½"	24'-1⅞"	25'-3¾"	1.692	17,148	272.79	110.60
		8'	144	21'-0"		8"	10"		9'-2½"	24'-3"	25'-4¾"	1.829	18,118	288.48	115.61
	3 @ 7'	4'	84	23'-4"	8"	6"	8"	7¾"	5'-3¾"	26'-11⅜"	28'-1¼"	1.480	17,720	279.99	101.55
		5'	105	23'-4"		6"	8"		6'-3¾"	"	"	1.566	18,090	288.01	106.56
		6'	126	23'-8"		7"	9"		7'-3¾"	27'-4"	28'-5¾"	1.743	18,761	298.53	111.57
		7'	147	23'-11"		7½"	10"		8'-3¾"	27'-7⅜"	28'-9¼"	1.919	19,407	308.55	116.58
		8'	168	24'-0"		8"	10"		9'-3¾"	27'-8½"	28'-10½"	2.056	20,370	324.34	121.59
		9'	189	24'-4"		9"	11"		10'-3¾"	28'-1¼"	29'-3"	2.294	21,982	350.27	126.60
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	8½"	5'-5"	30'-4⅜"	31'-6¾"	1.727	20,858	330.89	111.85
		5'	120	26'-8"		7"	9"		6'-5"	30'-9½"	31'-11¼"	1.893	21,563	341.64	116.86
		6'	144	26'-8"		7"	9"		7'-5"	"	"	1.992	22,049	349.65	121.87
		7'	168	26'-11"		7½"	10"		8'-5"	31'-1"	32'-2¾"	2.168	22,697	359.85	126.88
		8'	192	27'-0"		8"	10"		9'-5"	31'-2½"	32'-4"	2.306	23,538	375.76	131.89
		9'	216	27'-4"		9"	11"		10'-5"	31'-6¾"	32'-8½"	2.545	25,162	402.04	136.90
		10'	240	27'-8"		10"	12"		11'-5"	31'-11⅜"	33'-1¼"	2.810	26,380	421.39	141.91

* For quantities in wings see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.



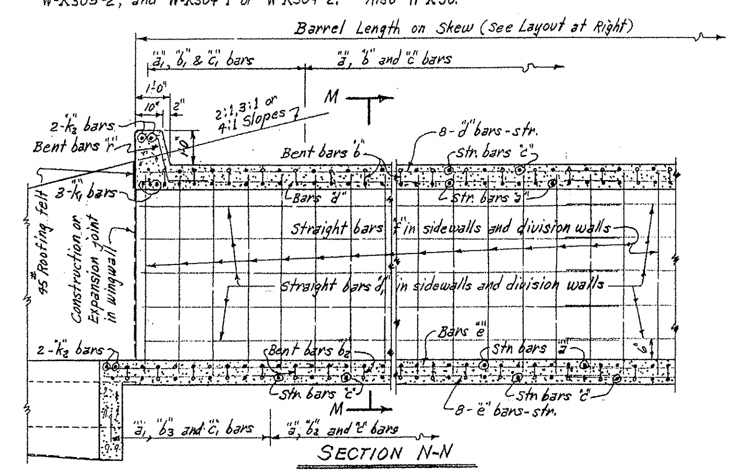
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



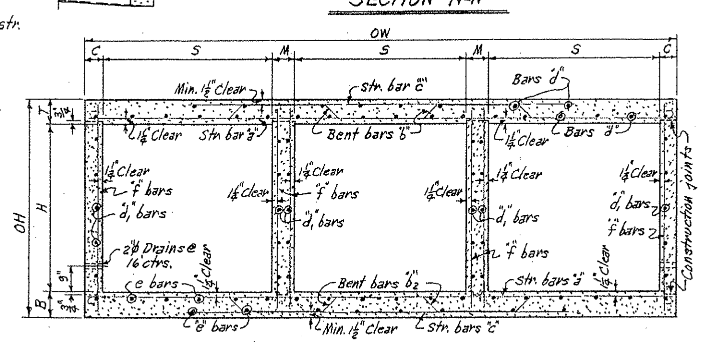
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b1" bars, use a set of "a" & "c" bars instead.

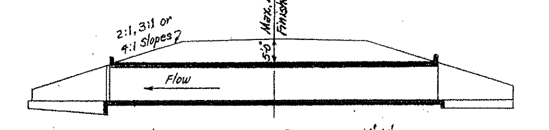
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



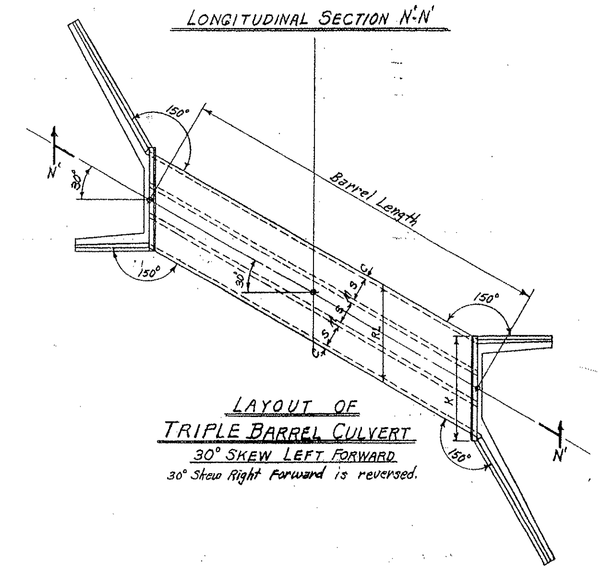
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF
TRIPLE BARREL CULVERT
30° SKEW LEFT FORWARD
30° Skew Right Forward is reversed.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAPS:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-330X-01

Designed by:- W.C.H. 1-22-63. Checked by:- R.H.S. 5-17-63
Drawn by:- W.C.H. 2-27-64. Checked by:-
Quantities by:- W.C.H. 4-8-64. Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 30° SKEWED ENDS

Depth of cover D: 0'-0" TO 5'-0" MAXIMUM

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a₁" bars – STRAIGHT – In Top and Bottom Slab of Barrel (Four of Each Length).

S	H	"a" Size	Spacing	No. Req'd	Length	"a₁" Size	Spacing	No. Req'd	Length Max.	Length Min.
3 @ 9'	5'	#6	11"	98	29'5"	#6	11"	68	27'10"	2'6"
	6'			98	29'8"			68	28'1"	2'9"
	7'			98	29'8"			68	"	"
	8'			98	29'9"			68	28'2"	2'10"
	9'			96	30'1"			68	28'6"	3'2"
	10'			96	30'5"			68	28'10"	3'6"
	11'			96	30'7"			68	29'0"	3'8"
3 @ 10'	5'	#7	12"	86	32'5"	#7	12"	68	30'8"	2'8"
	6'			86	32'8"			68	30'11"	2'11"
	7'			86	32'8"			68	"	"
	8'			86	32'9"			68	31'0"	3'0"
	9'			86	33'1"			68	31'4"	3'4"
	10'			86	33'5"			68	31'8"	3'8"
	11'			86	33'7"			68	31'10"	3'10"
	12'			86	33'9"			68	32'0"	4'0"
3 @ 11'	6'	#7	11"	90	35'9"	#7	11"	84	34'2"	2'6"
	7'			90	35'9"			84	"	"
	8'			90	35'9"			84	"	"
	9'			90	36'1"			84	34'6"	2'10"
	10'			88	36'5"			84	34'10"	3'2"
	11'			88	36'7"			84	35'0"	3'4"
	12'			88	36'9"			84	35'2"	3'6"
3 @ 12'	6'	#7	11"	86	38'9"	#7	11"	88	37'2"	3'11"
	7'			86	38'9"			88	"	"
	8'			86	38'9"			88	"	"
	9'			86	39'1"			92	37'6"	2'8"
	10'			86	39'5"			92	37'10"	3'0"
	11'			84	39'7"			92	38'0"	3'2"
	12'			84	39'9"			92	38'2"	3'4"

"b" bars – BENT - See Diagrams below – In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b₁" bars – In Bottom of Top Slab - some bent up over Division Walls - one end hooked. (2 of Each Length) Alternate with "a₁" and "c" or "c₁" bars.

S	H	"b" Size	Spacing	No. Req'd	Length	X	Y	Z	"b₁" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
3 @ 9'	5'	#6	11"	46	31'2"	0'5½"	4'4"	7'2"	#6	11"	34	29'10"	3'10"	28'7"	3'3"
	6'			46	31'5"	"	4'5"	7'2½"			34	30'1"	4'1"	28'10"	3'6"
	7'			46	31'5"	"	"	"			34	"	"	"	"
	8'			46	31'6"	"	"	7'3"			34	30'2"	4'2"	28'11"	3'7"
	9'			46	31'10"	"	4'6"	7'4"			34	30'6"	4'6"	29'3"	3'11"
	10'			46	32'2"	"	4'7"	7'5"			36	30'10"	3'3"	29'7"	2'8"
	11'			46	32'4"	0'5½"	"	7'6"			36	31'0"	3'5"	29'9"	2'10"
3 @ 10'	5'	#6	11"	41	34'3"	0'6"	4'9"	7'11"	#6	12"	34	32'10"	4'1"	31'6"	3'6"
	6'			41	34'6"	"	4'10"	7'11½"			34	33'1"	4'4"	31'9"	3'9"
	7'			41	34'6"	"	"	"			34	"	"	"	"
	8'			41	34'7"	"	"	8'0"			34	33'2"	4'5"	31'10"	3'10"
	9'			40	34'11"	"	4'11"	8'1"			34	33'6"	4'9"	32'2"	4'2"
	10'			40	35'3"	"	5'0"	8'2"			36	33'10"	3'4"	32'6"	2'9"
	11'			40	35'5"	"	"	8'3"			36	34'0"	3'6"	32'8"	2'11"
	12'			40	35'7"	0'6"	5'0"	8'4"			36	34'2"	3'8"	32'10"	3'1"
3 @ 11'	6'	#6	11"	42	37'8"	0'6½"	5'3"	8'9"	#6	11"	42	36'4"	3'10"	34'11"	3'3"
	7'			42	37'8"	"	"	"			42	"	"	"	"
	8'			42	37'8"	"	"	"			42	"	"	"	"
	9'			42	38'0"	"	5'4"	8'10"			42	36'8"	4'2"	35'3"	3'7"
	10'			42	38'4"	"	5'5"	8'11"			42	37'0"	4'6"	35'7"	3'11"
	11'			42	38'6"	"	"	9'0"			42	37'2"	4'8"	35'9"	4'1"
	12'			42	38'8"	0'6½"	5'5"	9'1"			44	37'4"	3'3"	35'11"	2'8"
3 @ 12'	6'	#6	11"	40	40'9"	0'7"	5'8"	9'6"	#6	11"	46	39'5"	3'8"	37'11"	3'1"
	7'			40	40'9"	"	"	"			46	"	"	"	"
	8'			40	40'9"	"	"	"			46	"	"	"	"
	9'			40	41'1"	"	5'9"	9'7"			46	39'9"	4'0"	38'3"	3'5"
	10'			40	41'5"	"	5'10"	9'8"			46	40'1"	4'4"	38'7"	3'9"
	11'			40	41'7"	"	"	9'9"			46	40'3"	4'6"	38'9"	3'11"
	12'			40	41'9"	0'7"	5'10"	9'10"			46	40'5"	4'8"	38'11"	4'1"

"b₂" bars – BENT - See Diagrams below – In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. "b₃" bars – In Top of Bottom Slab - some bent down under Division Walls - one end hooked. (2 of Each Length) Alternate with "a₁" and "c" or "c₁" bars.

S	H	"b₂" Size	Spacing	No. Req'd	Length	X	Y	Z	"b₃" Size	Spacing	No. Req'd	Length Max.	Length Min.	L Max.	L Min.
3 @ 9'	5'	#6	11"	48	31'2"	0'5½"	4'4"	7'2"	#6	11"	34	29'10"	3'10"	28'7"	3'3"
	6'			48	31'5"	"	4'5"	7'2½"			34	30'1"	4'1"	28'10"	3'6"
	7'			48	31'5"	"	"	"			34	"	"	"	"
	8'			48	31'6"	"	"	7'3"			34	30'2"	4'2"	28'11"	3'7"
	9'			48	31'10"	"	4'6"	7'4"			34	30'6"	4'6"	29'3"	3'11"
	10'			48	32'2"	"	4'7"	7'5"			36	30'10"	3'3"	29'7"	2'8"
	11'			48	32'4"	0'5½"	"	7'6"			36	31'0"	3'5"	29'9"	2'10"
3 @ 10'	5'	#6	12"	43	34'3"	0'6"	4'9"	7'11"	#6	12"	34	32'10"	4'1"	31'6"	3'6"
	6'			43	34'6"	"	4'10"	7'11½"			34	33'1"	4'4"	31'9"	3'9"
	7'			43	34'6"	"	"	"			34	"	"	"	"
	8'			43	34'7"	"	"	8'0"			34	33'2"	4'5"	31'10"	3'10"
	9'			42	34'11"	"	4'11"	8'1"			34	33'6"	4'9"	32'2"	4'2"
	10'			42	35'3"	"	5'0"	8'2"			36	33'10"	3'4"	32'6"	2'9"
	11'			42	35'5"	"	"	8'3"			36	34'0"	3'6"	32'8"	2'11"
	12'			42	35'7"	0'6"	5'0"	8'4"			36	34'2"	3'8"	32'10"	3'1"
3 @ 11'	6'	#6	11"	44	37'8"	0'6½"	5'3"	8'9"	#6	11"	42	36'4"	3'10"	34'11"	3'3"
	7'			44	37'8"	"	"	"			42	"	"	"	"
	8'			44	37'8"	"	"	"			42	"	"	"	"
	9'			44	38'0"	"	5'4"	8'10"			42	36'8"	4'2"	35'3"	3'7"
	10'			44	38'4"	"	5'5"	8'11"			42	37'0"	4'6"	35'7"	3'11"
	11'			44	38'6"	"	"	9'0"			42	37'2"	4'8"	35'9"	4'1"
	12'			44	38'8"	0'6½"	5'5"	9'1"			44	37'4"	3'3"	35'11"	2'8"
3 @ 12'	6'	#6	11"	42	40'9"	0'7"	5'8"	9'6"	#6	11"	46	39'5"	3'8"	37'11"	3'1"
	7'			42	40'9"	"	"	"			46	"	"	"	"
	8'			42	40'9"	"	"	"			46	"	"	"	"
	9'			42	41'1"	"	5'9"	9'7"			46	39'9"	4'0"	38'3"	3'5"
	10'			42	41'5"	"	5'10"	9'8"			46	40'1"	4'4"	38'7"	3'9"
	11'			42	41'7"	"	"	9'9"			46	40'3"	4'6"	38'9"	3'11"
	12'			42	41'9"	0'7"	5'10"	9'10"			46	40'5"	4'8"	38'11"	4'1"

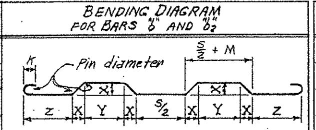
"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. "c₁" bars – In Top and Bottom Slab of Barrel. Alt. with "b₁" & "b₃" bars. (Four of each Length). "d" bars – Longitudinal in Top Slab of Barrel. "d₁" bars – Longitudinal in Sidewalls and Division Walls. "e" bars – Longitudinal in Bottom Slab of Barrel.

S	H	"c" Size	Spacing	No. Req'd	Length	"c₁" Size	Spacing	No. Req'd	Length Max.	Length Min.	"d" Size	Spacing	No. Req'd	Length	"d₁" Size	Spacing	No. Req'd	Length	"e" Size	Spacing	No. Req'd	Length
3 @ 9'	5'	#6	11"	110	19'6"	#6	11"	40	18'2"	3'11"	#5	11½"	41	2 @ 30'8" for 60'-0" Length Barrel (1'8" Lap)	#4	12"	30	2 @ 30'6" for 60'-0" Length Barrel (1'3" Lap)	#4	12"	40	2 @ 31'8" for 60'-0" Length Barrel (1'3" Lap)
	6'			110	19'8"			40	18'4"	4'1"			41				36				40	
	7'			110	19'8"			40	"	"			41				42				40	
	8'			110	19'8"			44	18'5"	2'7"			41				48				40	
	9'			108	19'10"			44	18'8"	2'10"			41				54				40	
	10'			108	20'0"			44	18'11"	3'1"			41				60				40	
	11'			108	20'0"			44	19'0"	3'2"			41				66				40	
3 @ 10'	5'	#7	12"	98	21'6"	#7	11"	44	20'0"	2'6"	#5	11½"	44		#4	12"	30		#4	12"	43	
	6'			98	21'8"			44	20'2"	2'8"			44				36				43	
	7'			98	21'8"			44	"	"			44				42				43	
	8'			98	21'8"			44	20'3"	2'9"			44				48				43	
	9'			98	21'10"			44	20'6"	3'0"			44				54				43	
	10'			98	22'0"			44	20'9"	3'3"			44				60				43	
	11'			98	22'0"			44	20'10"	3'4"			44				66				43	
	12'			98	22'0"			44	20'11"	3'5"			44				72				43	
3 @ 11'	6'	#7	11"	102	23'8"	#7	11"	56	23'5"	2'10"	#5	11½"	48		#4	12"	36		#4	12"	46	
	7'			102	23'8"			56	"	"			48				42				46	
	8'			102	23'8"			56	"	"			48				48				46	
	9'			102	23'10"			56	23'8"	3'1"			48				54				46	
	10'			104	24'0"			52	22'4"	3'4"			48				60				46	
	11'			104	24'0"			52	22'5"	3'5"			48				66				46	
	12'			104	24'0"			52	22'6"	3'6"			48				72				46	
3 @ 12'	6'	#7	11"	102	25'8"	#7	11"	56	24'4"	3'9"	#5	11½"	51		#4	12"	36		#4	12"	49	
	7'			102	25'8"			56	"	"			51				42				49	
	8'			102	25'8"			56	"	"			51				48				49	
	9'			102	25'10"			56	24'7"	4'0"			51				54				49	
	10'			102	26'0"			60	24'10"	2'8"			51				60				49	
	11'			100	26'0"			60	24'11"	2'9"			51				66				49	
	12'			100	26'6"			60	25'0"	2'10"			51				72				49	

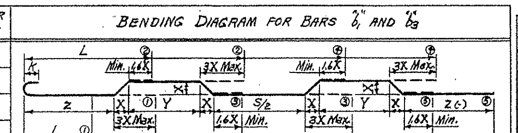
"f" bars – STRAIGHT – Verticals in Sidewalls and Division Walls. "k₁" bars – STRAIGHT – In Bottom of Headwalls. (3 of Each Length per Headwall.) "k₂" bars – In Top of Headwalls and Aprons (2 Each).

S	H	"f" Size	Spacing	No. Req'd	Length	"k₁" Size	No. Req'd	Length Max.	Length Min.	"k₂" Size	No. Req'd	Length
3 @ 9'	5'	#4	12"	360	6'3"	#6	6	34'0"	—	#6	8	35'2"
	6'			360	7'3"		6	34'3"	—		8	35'5"
	7'			360	8'3"		6	"	—		8	"
	8'		10"	432	9'3"		6	34'4"	—		8	35'6"
	9'	#5	12"	360	10'3"		6	34'9"	—		8	35'11"
	10'		11"	396	11'3"		6	35'1"	—		8	36'3"
	11'		10"	432	12'3"		6	35'4"	—		8	36'6"
3 @ 10'	5'	#4	12"	360	6'4"	#7	6	37'5"	—	#7	8	38'7"
	6'			360	7'4"		6	37'9"	—		8	38'11"
	7'			360	8'4"		6	"	—		8	"
	8'		10"	432	9'4"		6	37'10"	—		8	39'0"
	9'	#5	12"	360	10'4"		6	38'2"	—		8	39'4"
	10'		11"	396	11'4"		6	38'7"	—		8	39'9"
	11'		10"	432	12'4"		6	38'9"	—		8	39'11"
	12'	#6	12"	360	13'4"		6	39'0"	—		8	40'2"
3 @ 11'	6'	#4	12"	360	7'5"	⊠ #7	12	29'2"	14'6"	⊠ #7	16	22'5"
	7'			360	8'5"		12	"	"		16	"
	8'		10"	432	9'5"		12	"	"		16	"
	9'		12"	360	10'5"		12	29'4"	14'9"		16	22'7"
	10'	#5	11"	396	11'5"		12	29'7"	14'10"		16	22'10"
	11'		10"	432	12'5"		12	29'9"	14'11"		16	22'11"
	12'	#6	12"	360	13'5"		12	29'10"	15'0"		16	23'0"
3 @ 12'	6'	#4	12"	360	7'6"	⊠ #7	12	31'5"	15'9"	⊠ #7	16	24'2"
	7'			360	8'6"		12	"	"		16	"
	8'		10"	432	9'6"		12	"	"		16	"
	9'		12"	360	10'6"		12	31'7"	15'11"		16	24'4"
	10'	#5	11"	396	11'6"		12	31'11"	16'0"		16	24'7"
	11'		10"	432	12'6"		12	32'0"	16'1"		16	24'8"
	12'	#6	12"	360	13'6"		12	32'2"	16'2"		16	24'9"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS	BENDING DIAGRAM FOR BARS "b" AND "b₂"
#6	3"	5"	1'2"	



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK	BENDING DIAGRAM FOR BARS "b₁" AND "b₃"
#6	3"	5"	0'7"	

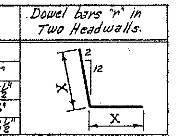


NOTE:- Dimensions are to centers of bars. (b, b₁, b₂ & b₃). The X, Y & Z values for "b₁" bars are same as "b" bars, and for "b₃" bars same as for "b₂" bars.
①①-⑤⑤ Min. & Max. Lengths of L for bars "b₁" & "b₃" for each type bend.

DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#4	12½	70	2'10"	1'5"
10'	#4	12½	76	2'11"	1'5½"
11'	#4	12½	84	3'0"	1'6"
12'	#4	12½	92	3'1"	1'6½"

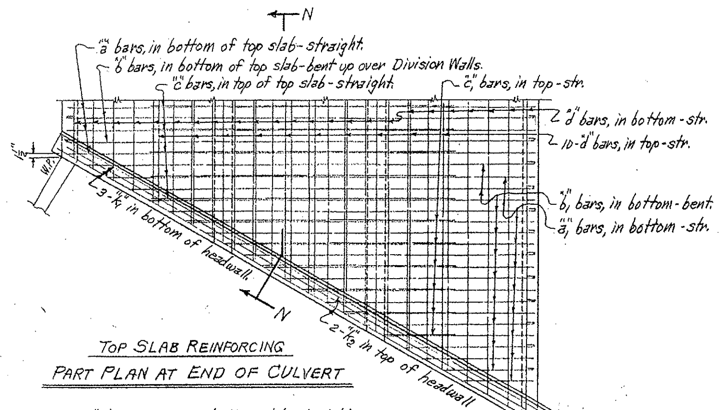
Dowel bars "r" in Two Headwalls.



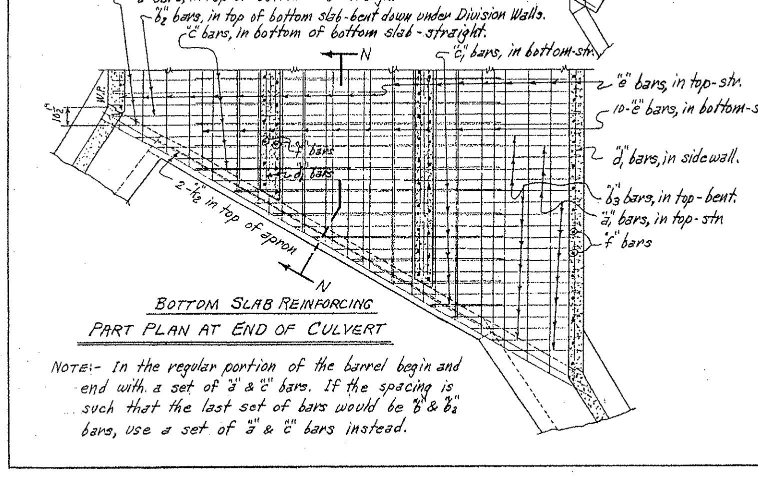
◤ These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length L of "b₁" and "b₃" bars vary by 1'-8" for 12" spacing and 1'-7" for 11" spacing.
⊠ These bars are spliced to make full length bars, "k₁" bars being spliced at alt. division walls and "k₂" bars at center of center span.

D	S	H	A	OW	T	C	M	B	OH	RL	K	Cu.Yd.	LB.	LB.	LB.
Max. Design Depth of Cover	Clear Spans	Clear Height	Sq. Ft. Opening	Overall Width	Thickness of Top Slab	Thickness of Sidewalls	Thickness of Division Walls	Thickness of Bottom Slab	Overall Height	Roadway Length	Length of Headwalls	* Class S Conc. per Lin. Ft. of Barrel	Reinforcing Steel: Total for 60'-0" Length of Barrel	Per Lin. Ft. of Barrel	Additional per Lap
5'-0"	3 @ 9'	5'	135	29'8"	9"	7"	9"	9"	6'6"	34'3⅝"	35'5"	2.142	23,850	377.01	129.72
		6'	162	29'11"		7½"	10"		7'6"	34'6⅝"	35'8⅛"	2.310	24,313	387.21	134.73
		7'	189	29'11"		7½"	10"		8'6"	"	"	2.418	24,797	395.23	139.74
		8'	216	30'0"		8"	10		9'6"	34'7¾"	35'9¼"	2.556	25,791	411.21	144.75
		9'	243	30'4"		9"	11"		10'6"	35'0¼"	36'2¼"	2.796	27,406	437.60	149.76
		10'	270	30'8"		10"	12"		11'6"	35'4⅞"	36'6¾"	3.062	28,684	457.00	154.77
		11'	297	30'10"		11"	12"		12'6"	35'7¼"	36'9"	3.275	29,894	477.29	159.78
	3 @ 10'	5'	150	32'8"	9½"	7"	9"	9½"	6'7"	37'8⅝"	38'10⅝"	2.409	28,172	443.34	137.44
		6'	180	32'11"		7½"	10"		7'7"	38'0⅝"	39'2"	2.578	28,836	453.81	142.45
		7'	210	32'11"		7½"	10"		8'7"	"	"	2.686	29,321	461.83	147.46
		8'	240	33'0"		8"	10"		9'7"	38'1¼"	39'3"	2.824	30,310	477.91	152.47
		9'	270	33'4"		9"	11"		10'7"	38'5⅞"	39'7¾"	3.066	31,876	509.74	157.48
		10'	300	33'8"		10"	12"		11'7"	38'10⅝"	40'0½"	3.332	33,191	524.50	162.49
		11'	330	33'10"		11"	12"		12'7"	39'0¾"	40'2¾"	3.596	34,915	544.94	167.50
		12'	360	34'0"		12"	12"		13'7"	39'3⅛"	40'5"	3.772	36,918	577.67	172.51
	3 @ 11'	6'	198	36'0"	10"	8"	10"	10"	7'8"	41'6⅞"	42'8¾"	2.889	33,264	522.98	151.91
		7'	231	36'0"		8"	10"		8'8"	"	"	3.000	33,749	531.00	156.92
		8'	264	36'0"		8"	10"		9'8"	"	"	3.111	34,687	546.56	161.93
		9'	297	36'4"		9"	11"		10'8"	41'11½"	43'1¼"	3.354	36,403	573.79	166.94
		10'	330	36'8"		10"	12"		11'8"	42'4⅛"	43'6"	3.621	37,485	593.87	171.95
		11'	363	36'10"		11"	12"		12'8"	42'6¾"	43'8⅝"	3.835	38,724	614.47	176.96
		12'	396	37'0"		12"	12"		13'8"	42'8¾"	43'10⅝"	4.062	40,766	647.44	181.97
	3 @ 12'	6'	216	39'0"	10½"	8"	10"	10½"	7'9"	45'0⅜"	46'2¼"	3.194	35,625	560.85	159.63
		7'	252	39'0"		8"	10"		8'9"	"	"	3.306	36,110	568.87	164.64
		8'	288	39'0"		8"	10"		9'9"	"	"	3.417	37,052	584.50	169.65
		9'	324	39'4"		9"	11"		10'9"	45'5"	46'7"	3.660	38,798	611.85	174.66
		10'	360	39'8"		10"	12"		11'9"	45'9⅝"	46'11½"	3.929	40,150	631.98	179.67
		11'	396	39'10"		11"	12"		12'9"	46'0"	47'1¾"	4.144	41,134	652.63	184.68
		12'	432	40'0"		12"	12"		13'9"	46'2¼"	47'4"	4.370	43,166	685.72	189.69

* For quantities in Wings see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.



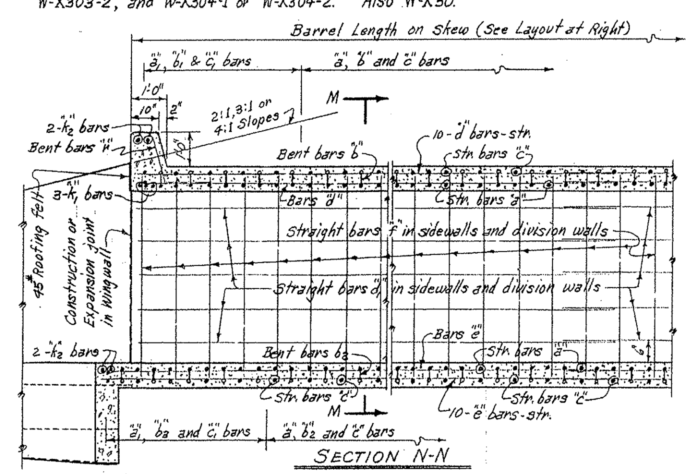
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



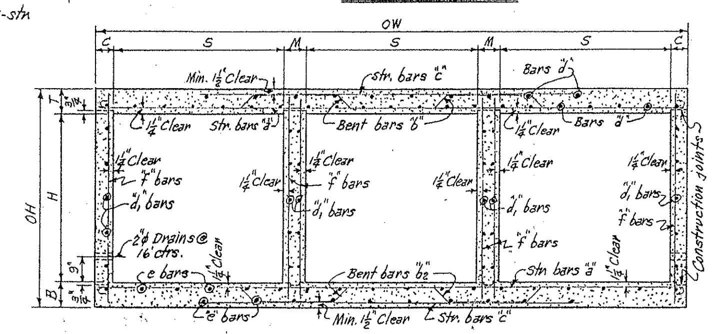
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b₂" bars, use a set of "a" & "c" bars instead.

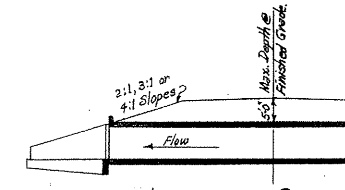
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



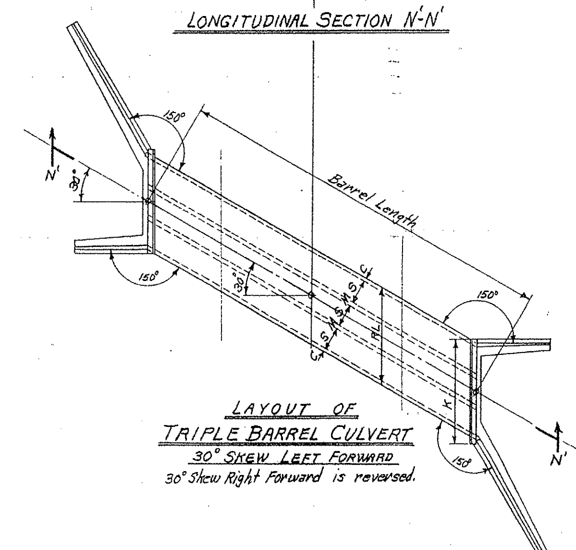
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF
TRIPLE BARREL CULVERT
30° SKEW LEFT FORWARD
30° Skew Right Forward is reversed.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAPS:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

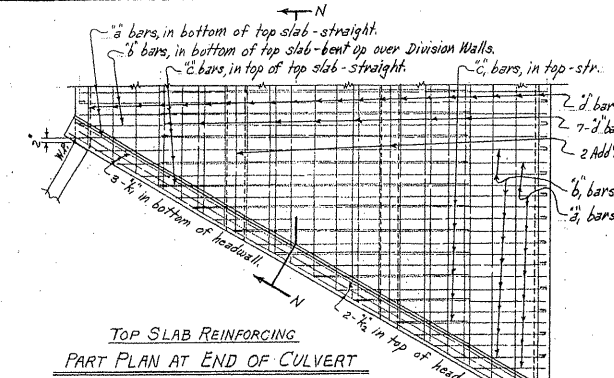
9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-330X-02

Designed by:- W.C.H. 1-22-63. Checked by:- R.H.S. 5-17-63
Drawn by:- W.C.H. 3-24-64. Checked by:-
Quantities by:- W.C.H. 4-9-64. Checked by:-

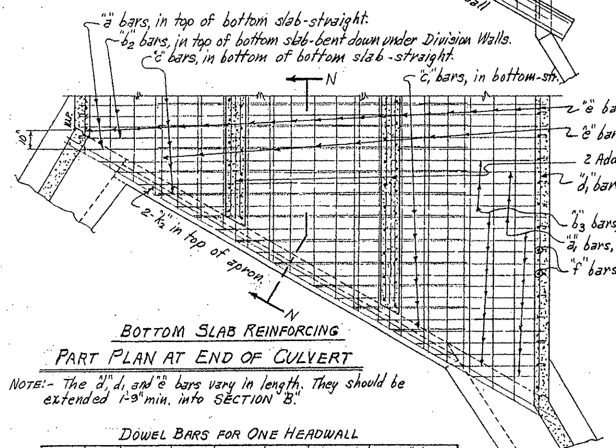
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT



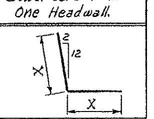
BOTTOM SLAB REINFORCING

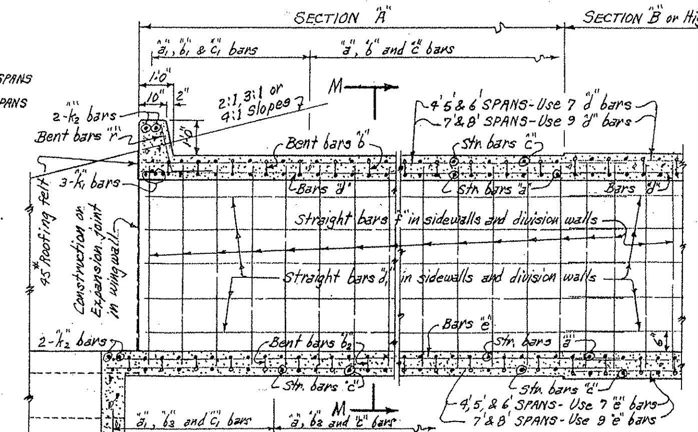
PART PLAN AT END OF CULVERT

NOTE:- The "d", d₁ and "e" bars vary in length. They should be extended 1'-9" min. into SECTION "B".

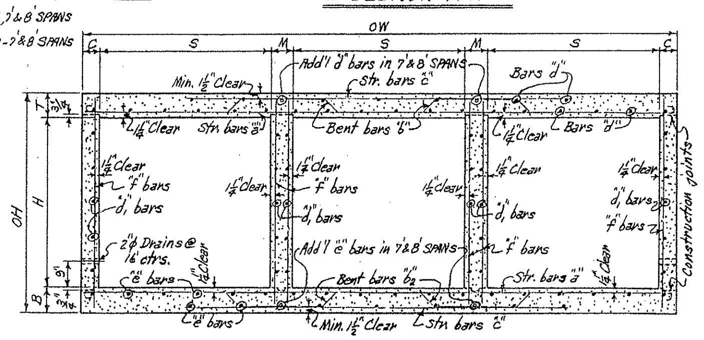
DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"±	17	2'-4"	1'-2"	
5'	#4	12"±	21	2'-5"	1'-2½"	
6'	#4	12"±	24	2'-6"	1'-3"	
7'	#4	12"±	28	2'-8"	1'-4"	
8'	#4	12"±	31	2'-9"	1'-4½"	

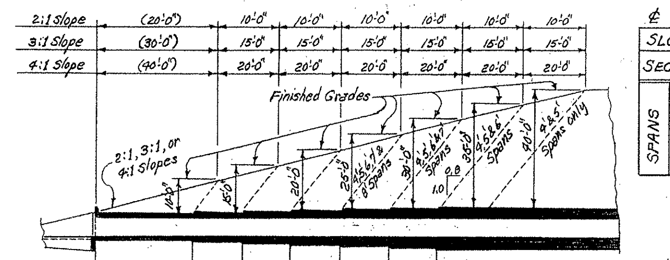




SECTION N-N



TYPICAL SECTION M-M

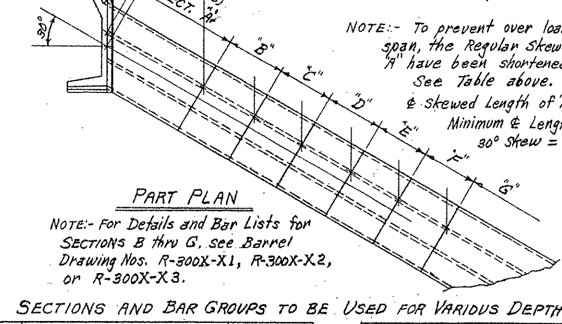


2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	D = 6'-0"	E = 6'-0"	F = 6'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	D = 11'-0"	E = 11'-0"	F = 11'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	D = 16'-0"	E = 16'-0"	F = 16'-0"	MID-SECTION G - Varies
	Bar Group	A	B	C	D	E	F	G

These lengths are perpendicular to ℄ of roadway, near ℄ of Division Wall on Long Side. See Table of Skew Lengths above.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-300X-X1, R-300X-X2, or R-300X-X3.

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ℄ Length of Section "A" have been shortened by one third "S". See Table above.
℄ Skewed Length of "A" = "A" x 1.1547 − ⅓ "S".
Minimum ℄ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

℄ LENGTH OF SECTIONS ON 30° SKEW

SLOPE		2:1		3:1		4:1	
SECTIONS		A	B, C, D, E & F	A	B, C, D, E & F	A	B, C, D, E & F
SPANS	4'	12'-6¼"	6'-11⅛"	24'-0¾"	12'-8⅜"	35'-7½"	18'-5¾"
	5'	12'-2¼"	"	23'-8¾"	"	35'-3½"	"
	6'	11'-10¼"	"	23'-4¾"	"	34'-11½"	"
	7'	11'-6¼"	"	23'-0¾"	"	34'-7½"	"
	8'	11'-2¼"	"	22'-8¾"	"	34'-3½"	"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS: A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 19.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0 to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS: A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 19.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER (D)	CLEAR SPANS (S)	CLEAR HEIGHT (H)	SQ. FT. OPENING (A)	OVERALL WIDTH (OW)	THICKNESS OF TOP SLAB (T)	THICKNESS OF SIDEWALLS (C)	THICKNESS OF DIVISION WALLS (M)	THICKNESS OF BOTTOM SLAB (B)	OVERALL HEIGHT (OH)	ROADWAY LENGTH (RL)	LENGTH OF HEADWALL (K)	CLASS S CONCRETE, BARREL ONLY 2:1 (Cu.Yd.)	3:1 (Cu.Yd.)	4:1 (Cu.Yd.)	REINFORCING STEEL, BARREL, APRON AND HEADWALL 2:1 (Lb.)	3:1 (Lb.)	4:1 (Lb.)
SECTION "A" = 10'-0"	3 @ 4'	2'	24	14'-4"	6"	6"	8"	6"	3'-0"	16'-6⅝"	17'-8½"	8.82	16.94	25.08	1497	2645	3849
		3'	36	14'-4"		6"	8"		4'-0"	"	"	9.89	19.01	28.14	1605	2847	4147
		4'	48	14'-4"		6"	8"		5'-0"	"	"	10.98	21.10	31.24	1714	3048	4446
		5'	60	14'-4"		6"	8"		6'-0"	"	"	12.06	23.17	34.31	1823	3249	4744
		6'	72	14'-8"		7"	9"		7'-0"	16'-11¼"	18'-1"	14.22	27.33	40.47	1953	3484	5089
	3 @ 5'	3'	45	17'-4"	6½"	6"	8"	6½"	4'-1"	20'-0¼"	21'-2"	11.64	22.66	33.70	1976	3554	5232
		4'	60	17'-4"		6"	8"		5'-1"	"	"	12.69	24.70	36.74	2082	3752	5528
		5'	75	17'-4"		6"	8"		6'-1"	"	"	13.75	26.77	39.81	2187	3950	5823
		6'	90	17'-8"		7"	9"		7'-1"	20'-9¾"	21'-6¾"	15.86	30.87	45.91	2317	4211	6150
		7'	105	17'-11"		7½"	10"		8'-1"	20'-8¼"	21'-10"	17.98	35.00	52.06	2666	4869	7120
	3 @ 6'	3'	54	20'-4"	7"	6"	8"	7"	4'-2"	23'-5¾"	24'-7½"	13.49	26.62	39.78	2385	4374	6476
		4'	72	20'-4"		6"	8"		5'-2"	"	"	14.51	28.64	42.79	2487	4569	6768
		5'	90	20'-4"		6"	8"		6'-2"	"	"	15.54	30.67	45.83	2589	4764	7060
		6'	108	20'-8"		7"	9"		7'-2"	23'-10⅜"	25'-0¼"	17.62	34.77	51.95	2720	5005	7373
		7'	126	20'-11"		7½"	10"		8'-2"	24'-1⅞"	25'-3⅞"	19.68	38.84	58.03	3059	5657	8339
		8'	144	21'-0"		8"	10"		9'-2"	24'-3"	25'-4¾"	21.29	42.02	62.79	3259	6062	8929
	3 @ 7'	4'	84	23'-4"	7¾"	6"	8"	8"	5'-3¾"	26'-11⅜"	28'-1¼"	16.91	33.84	50.81	3086	5719	8360
		5'	105	23'-4"		6"	8"		6'-3¾"	"	"	18.04	36.12	54.22	3185	5913	8648
		6'	126	23'-8"		7"	9"		7'-3¾"	27'-4"	28'-5¾"	20.08	40.20	60.35	3320	6165	9017
		7'	147	23'-11"		7½"	10"		8'-3¾"	27'-7⅜"	28'-9¼"	22.11	44.26	66.44	3609	6741	10,002
		8'	168	24'-0"		8"	10"		9'-3¾"	27'-8½"	28'-10½"	23.69	47.42	71.19	3799	7113	10,584
		9'	189	24'-4"		9"	11"		10'-3¾"	28'-1¼"	29'-3"	26.43	52.91	79.43	4062	7588	11,306
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	9"	5'-5½"	30'-4⅞"	31'-6¾"	19.78	40.19	60.63	3595	6749	10,001
		5'	120	26'-8"		7"	9"		6'-5½"	30'-9¼"	31'-11¼"	21.64	43.96	66.32	3736	7008	10,382
		6'	144	26'-8"		7"	9"		7'-5½"	"	"	22.74	46.21	69.71	3834	7198	10,670
		7'	168	26'-11"		7½"	10"		8'-5½"	31'-1"	32'-2¾"	24.72	50.23	75.75	4046	7589	11,244
		8'	192	27'-0"		8"	10"		9'-5½"	31'-2⅛"	32'-4"	26.26	53.35	80.48	4295	8056	11,938
		9'	216	27'-4"		9"	11"		10'-5½"	31'-6¾"	32'-8½"	28.94	58.80	88.71	4546	8565	12,737
		10'	240	27'-8"		10"	12"		11'-5½"	31'-11⅜"	33'-1¼"	31.91	64.82	97.80	5004	9456	14,036

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A". LENGTH OF SECTION: Lengths vary with Clear Span "S" per slope - see Table at upper right. DEPTH OF COVER (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. / ◤"a₁" bars — STRAIGHT — In Top and Bottom Slab of Barrel (Two of each Length)

S	H	"a" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"a₁" Size	Spacing	No. Req'd	Length Max.	Min.
3 @ 4'	2'	#4	12"	19	41	65	14'-1"	#4	12"	12	12'-4"	3'-7"
	3'			19	41	65	"			12	"	"
	4'			19	41	65	"			12	"	"
	5'			19	41	65	"			12	"	"
	6'			19	41	65	14'-5"			12	12'-8"	3'-11"
3 @ 5'	3'	#4	11"	17	43	69	17'-1"	#4	11"	18	15'-6"	2'-10"
	4'			17	43	69	"			18	"	"
	5'			17	43	69	"			18	"	"
	6'			17	43	67	17'-5"			18	15'-10"	3'-2"
	7'			17	43	67	17'-8"			18	16'-1"	3'-5"
3 @ 6'	3'	#4	11"	15	39	65	20'-1"	#4	11"	22	18'-6"	2'-8"
	4'			15	39	65	"			22	"	"
	5'			15	39	65	"			22	"	"
	6'			15	39	65	20'-5"			22	18'-10"	3'-0"
	7'			15	39	65	20'-8"			22	19'-1"	3'-3"
	8'			15	39	65	20'-9"			22	19'-2"	3'-4"
3 @ 7'	4'	#5	12"	11	35	57	23'-1"	#5	12"	22	21'-4"	3'-10"
	5'			11	35	57	"			22	"	"
	6'			11	35	57	23'-5"			22	21'-8"	4'-2"
	7'			11	33	57	23'-8"			24	21'-11"	2'-8"
	8'			11	33	57	23'-9"			24	22'-0"	2'-9"
	9'			11	33	57	24'-1"			24	22'-4"	3'-1"
3 @ 8'	4'	#5	12"	9	31	55	26'-1"	#5	12"	26	24'-4"	3'-4"
	5'			9	31	55	26'-5"			26	24'-8"	3'-8"
	6'			9	31	55	"			26	"	"
	7'			9	31	55	26'-8"			26	24'-11"	3'-11"
	8'			9	31	55	26'-9"			26	25'-0"	4'-0"
	9'			9	31	55	27'-1"			28	25'-4"	2'-7"
	10'			9	31	55	27'-5"			28	25'-8"	2'-11"

"b" bars — BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. / ◤"b₁" bars — In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alternate with "a₁" and "c" or "c₁" bars.

S	H	"b" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b₁" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	L Min.
3 @ 4'	2'	#4	12"	8	20	31	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	7	13'-11"	3'-1"	13'-2"	2'-8"
	3'			8	20	31	"	"	"	"			7	"	"	"	"
	4'			8	20	31	"	"	"	"			7	"	"	"	"
	5'			8	20	31	"	"	"	"			7	"	"	"	"
	6'			8	20	31	15'-7"	0'-2¾"	2'-3½"	3'-5¼"			7	14'-5"	3'-5"	13'-6"	3'-0"
3 @ 5'	3'	#4	11"	8	20	33	18'-4"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	9	17'-1"	4'-0"	16'-3"	3'-7"
	4'			8	20	33	"	"	"	"			9	"	"	"	"
	5'			8	20	33	"	"	"	"			9	"	"	"	"
	6'			8	20	33	18'-8"	"	2'-8½"	4'-2¼"			9	17'-5"	4'-4"	16'-7"	3'-11"
	7'			8	20	33	18'-11"	0'-3¼"	2'-9½"	4'-2¾"			10	17'-8"	3'-0"	16'-10"	2'-7"
3 @ 6'	3'	#5	11"	6	19	32	21'-5"	0'-3½"	3'-1"	4'-10¾"	#5	11"	11	20'-2"	3'-11"	19'-3"	3'-5"
	4'			6	19	32	"	"	"	"			11	"	"	"	"
	5'			6	19	32	"	"	"	"			11	"	"	"	"
	6'			6	19	31	21'-9"	"	3'-2"	4'-11¼"			11	20'-6"	4'-3"	19'-7"	3'-9"
	7'			6	19	31	22'-0"	"	3'-3"	4'-11¾"			11	20'-9"	4'-6"	19'-10"	4'-0"
	8'			6	19	31	22'-1"	0'-3½"	3'-3"	5'-0¼"			12	20'-10"	3'-1"	19'-11"	2'-6"
3 @ 7'	4'	#5	12"	5	16	28	24'-6"	0'-4½"	3'-5½"	5'-7"	#5	12"	12	23'-2"	3'-5"	22'-2"	2'-11"
	5'			5	16	28	"	"	"	"			12	"	"	"	"
	6'			5	16	28	24'-10"	"	3'-6½"	5'-8"			12	23'-6"	3'-9"	22'-6"	3'-3"
	7'			4	16	28	25'-1"	"	3'-7½"	5'-8½"			12	23'-9"	4'-0"	22'-9"	3'-6"
	8'			4	16	28	25'-2"	"	3'-7½"	5'-9"			12	23'-10"	4'-1"	22'-10"	3'-7"
	9'			4	16	28	25'-6"	0'-4½"	3'-8½"	5'-10"			12	24'-2"	4'-5"	23'-2"	3'-11"
3 @ 8'	4'	#6	12"	3	15	26	27'-9"	0'-5"	3'-10"	6'-4"	#6	12"	14	26'-4"	3'-0"	25'-2"	2'-5"
	5'			3	15	26	28'-1"	"	3'-11"	6'-5"			14	26'-8"	3'-4"	25'-6"	2'-9"
	6'			3	15	26	"	"	"	"			14	"	"	"	"
	7'			3	15	26	28'-4"	"	4'-0"	6'-5½"			14	26'-11"	3'-7"	25'-9"	3'-0"
	8'			3	15	26	28'-5"	"	4'-0"	6'-6"			14	27'-0"	3'-8"	25'-10"	3'-1"
	9'			3	15	26	28'-9"	"	4'-1"	6'-7"			14	27'-4"	4'-0"	26'-2"	3'-5"
	10'			3	15	26	29'-1"	0'-5"	4'-2"	6'-8"			14	27'-8"	4'-4"	26'-6"	3'-9"

"b₂" bars — BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. / ◤"b₃" bars — In Top of Bottom Slab - some bent down under Division Walls - one end hooked. Alternate with "a₁" and "c" or "c₁" bars.

S	H	"b₂" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	X	Y	Z	"b₃" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	L Min.
3 @ 4'	2'	#4	12"	9	21	32	15'-3"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	7	13'-11"	3'-1"	13'-2"	2'-8"
	3'			9	21	32	"	"	"	"			7	"	"	"	"
	4'			9	21	32	"	"	"	"			7	"	"	"	"
	5'			9	21	32	"	"	"	"			7	"	"	"	"
	6'			9	21	32	15'-7"	0'-2¾"	2'-3½"	3'-5¼"			7	14'-3"	3'-5"	13'-6"	3'-0"
3 @ 5'	3'	#4	11"	9	21	34	18'-4"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	9	17'-1"	4'-0"	16'-3"	3'-7"
	4'			9	21	34	"	"	"	"			9	"	"	"	"
	5'			9	21	34	"	"	"	"			9	"	"	"	"
	6'			9	21	34	18'-8"	"	2'-8½"	4'-2¼"			9	17'-5"	4'-4"	16'-7"	3'-11"
	7'			9	21	34	18'-11"	0'-3¼"	2'-9½"	4'-2¾"			10	17'-8"	3'-0"	16'-10"	2'-7"
3 @ 6'	3'	#5	11"	7	20	33	21'-5"	0'-3½"	3'-1"	4'-10¾"	#5	11"	11	20'-2"	3'-11"	19'-3"	3'-5"
	4'			7	20	33	"	"	"	"			11	"	"	"	"
	5'			7	20	33	"	"	"	"			11	"	"	"	"
	6'			7	20	32	21'-9"	"	3'-2"	4'-11¼"			11	20'-6"	4'-3"	19'-7"	3'-9"
	7'			7	20	32	22'-0"	"	3'-3"	4'-11¾"			11	20'-9"	4'-6"	19'-10"	4'-0"
	8'			7	20	32	22'-1"	0'-3½"	3'-3"	5'-0¼"			12	20'-10"	3'-1"	19'-11"	2'-6"
3 @ 7'	4'	#5	12"	6	17	29	24'-6"	0'-4½"	3'-5"	5'-7"	#5	12"	12	23'-2"	3'-5"	22'-2"	2'-11"
	5'			6	17	29	"	"	"	"			12	"	"	"	"
	6'			6	17	29	24'-10"	"	3'-6"	5'-8"			12	23'-6"	3'-9"	22'-6"	3'-3"
	7'			5	17	29	25'-1"	"	3'-7"	5'-8½"			12	23'-9"	4'-0"	22'-9"	3'-6"
	8'			5	17	29	25'-2"	"	3'-7"	5'-9"			12	23'-10"	4'-1"	22'-10"	3'-7"
	9'			5	17	29	25'-6"	0'-4½"	3'-8"	5'-10"			12	24'-2"	4'-5"	23'-2"	3'-11"
3 @ 8'	4'	#6	12"	4	16	27	27'-10"	0'-5½"	3'-9"	6'-4"	#6	12"	14	26'-5"	3'-0"	25'-2"	2'-5"
	5'			4	16	27	28'-2"	"	3'-10"	6'-5"			14	26'-9"	3'-4"	25'-6"	2'-9"
	6'			4	16	27	"	"	"	"			14	"	"	"	"
	7'			4	16	27	28'-5"	"	3'-11"	6'-5½"			14	27'-0"	3'-7"	25'-9"	3'-0"
	8'			4	16	27	28'-6"	"	3'-11"	6'-6"			14	27'-1"	3'-8"	25'-10"	3'-1"
	9'			4	16	27	28'-10"	"	4'-0"	6'-7"			14	27'-5"	4'-0"	26'-2"	3'-5"
	10'			4	16	27	29'-2"	0'-5½"	4'-1"	6'-8"			14	27'-9"	4'-4"	26'-6"	3'-9"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. / ◤"c₁" bars — In Top and Bottom Slab of Barrel. Alt. with "b₁" & "b₃" bars. (Two of each Length) / "d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. / "d₁" bars — Longitudinal in Sidewalls and Division Walls. / "e" bars — Longitudinal in Bottom Slab of Barrel. (⊙ Length: Lengths vary with Clear Span "S", skew & slope - see Table for ave. lengths.)

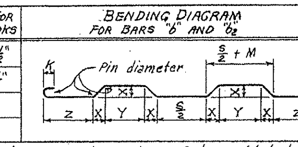
S	H	"c" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"c₁" Size	Spacing	No. Req'd	Length Max.	Min.	"d" Size	Spacing	No. Req'd	"d₁" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd
3 @ 4'	2'	#4	12"	21	43	67	9'-4"	#4	12"	8	8'-3"	3'-0"	#4	12"	22	#4	12"	12	#4	12"	22
	3'			21	43	67	"			8	"	"			22			18			22
	4'			21	43	67	"			8	"	"			22			24			22
	5'			21	43	67	"			8	"	"			22			30			22
	6'			21	43	67	9'-6"			8	8'-6"	3'-3"			22			36			22
3 @ 5'	3'	#5	11"	19	45	71	11'-4"	#5	11"	12	11'-1"	3'-2"	#4	12"	25	#4	12"	18	#4	12"	25
	4'			19	45	71	"			12	"	"			25			24			25
	5'			19	45	71	"			12	"	"			25			30			25
	6'			19	45	69	11'-6"			12	11'-4"	3'-5"			25			36			25
	7'			19	45	69	11'-8"			12	11'-6"	3'-7"			25			42			25
3 @ 6'	3'	#5	11"	19	43	69	13'-4"	#5	11"	12	11'-10"	3'-11"	#4	12"	28	#4	12"	18	#4	12"	28
	4'			19	43	69	"			12	"	"			28			24			28
	5'			19	43	69	"			12	"	"			28			30			28
	6'			19	43	69	13'-6"			14	12'-1"	2'-6"			28			36			28
	7'			19	43	69	13'-8"			14	12'-3"	2'-9"			28			42			28
	8'			19	43	69	13'-8"			14	12'-4"	2'-10"			28			48			28
3 @ 7'	4'	#6	12"	15	39	61	15'-4"	#6	12"	14	14'-0"	3'-6"	#4	12"	33	#4	12"	24	#4	12"	33
	5'			15	39	61	"			14	"	"			33			30			33
	6'			15	39	61	15'-6"			14	14'-3"	3'-9"			33			36			33
	7'			15	37	61	15'-8"			14	14'-5"	3'-11"			33			42			33
	8'			15	37	61	16'-8"			14	14'-6"	4'-0"			33			48			33
	9'			15	37	61	15'-10"			14	14'-9"	4'-3"			33			54			33
3 @ 8'	4'	#6	12"	13	35	59	17'-4"	#6	12"	18	16'-6"	2'-6"	#4	12"	36	#4	12"	24	#4	12"	36
	5'			13	35	59	17'-6"			18	16'-9"	2'-9"			36			30			36
	6'			13	35	59	"			18	"	"			36			36			36
	7'			13	35	59	17'-8"			18	16'-11"	2'-11"			36			42			36
	8'			13	35	59	17'-8"			18	17'-0"	3'-0"			36			48			36
	9'			13	35	59	17'-10"			18	17'-3"	3'-3"			36			54			36
	10'			13	35	59	18'-0"			18	17'-6"	3'-6"			36			60			36

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. / ◤"k₁" bars — STRAIGHT — In Bottom of Headwall / ◤"k₂" bars — In Top of Headwall and Apron. (2 Each)

S	H	"f" Size	Spacing	No. Req'd 2:1	3:1	4:1	Length	"k₁" Size	No. Req'd	Length	"k₂" Size	No. Req'd	Length
3 @ 4'	2'	#4	12"	78	147	216	2'-9"	#5	3	16'-3"	#5	4	17'-5"
	3'			78	147	216	3'-9"		3	"		4	"
	4'			78	147	216	4'-9"		3	"		4	"
	5'			78	147	216	5'-9"		3	"		4	"
	6'			78	147	216	6'-9"		3	16'-8"		4	17'-10"
3 @ 5'	3'	#4	12"	75	144	213	3'-10"	#5	3	19'-9"	#5	4	20'-11"
	4'			75	144	213	4'-10"		3	"		4	"
	5'			75	144	213	5'-10"		3	"		4	"
	6'			75	144	213	6'-10"		3	20'-1"		4	21'-3"
	7'	#5	12"	75	144	213	7'-10"		3	20'-5"		4	21'-7"
3 @ 6'	3'	#4	12"	72	141	210	3'-11"	#5	3	23'-2"	#5	4	24'-4"
	4'			72	141	210	4'-11"		3	"		4	"
	5'			72	141	210	5'-11"		3	"		4	"
	6'			72	141	210	6'-11"		3	23'-7"		4	24'-9"
	7'	#5	12"	72	141	210	7'-11"		3	23'-10"		4	25'-0"
	8'		11"	78	156	231	8'-11"		3	24'-0"		4	25'-1"
3 @ 7'	4'	#4	12"	69	141	207	5'-1"	#6	3	26'-8"	#6	4	27'-10"
	5'			69	141	207	6'-1"		3	"		4	"
	6'			69	141	207	7'-1"		3	27'-1"		4	28'-2"
	7'	#5	12"	69	141	207	8'-1"		3	27'-4"		4	28'-6"
	8'		11"	75	159	228	9'-1"		3	27'-5"		4	28'-7"
	9'		10"	84	168	252	10'-1"		3	27'-10"		4	29'-0"
3 @ 8'	4'	#4	12"	69	138	207	5'-2"	#6	3	30'-1"	#6	4	31'-3"
	5'			69	138	207	6'-2"		3	30'-6"		4	31'-8"
	6'			69	138	207	7'-2"		3	"		4	"
	7'		10"	84	165	246	8'-2"		3	30'-10"		4	31'-11"
	8'	#5	12"	69	138	207	9'-2"		3	30'-11"		4	32'-1"
	9'		11"	75	150	228	10'-2"		3	31'-3"		4	32'-5"
	10'	#6	12"	69	138	207	11'-2"		3	31'-8"		4	32'-10"

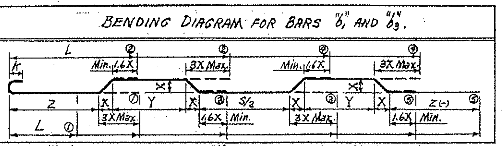
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b₂"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-6¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b₁" AND "b₃".



NOTE:- Dimensions are to centers of bars. (b, b₁, b₂ & b₃). The X, Y & Z values for "b₁" bars are same as "b" bars, and for "b₃" bars same as for "b₂" bars. ①②...④⑤ Min. & Max. lengths L for bars "b₁" & "b₃" for each type bend.

◤ These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length L of "b₁" and "b₃" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

⊙ To Longitudinal bars of 4:1 slopes add one splice for each "d", "d₁" and "e" bars. (1'-3" Lap.)

AVERAGE LENGTHS OF LONG. BARS "d", "d₁" & "e".

SLOPE		2:1 d & d₁	2:1 e	3:1 d & d₁	3:1 e	4:1 d & d₁	4:1 e
SPANS	4'	14'-2"	15'-4"	25'-9"	26'-11"	37'-3"	38'-5"
	5'	13'-10"	15'-0"	25'-5"	26'-7"	36'-11"	38'-1"
	6'	13'-6"	14'-8"	25'-1"	26'-3"	36'-7"	37'-9"
	7'	13'-2"	14'-4"	24'-9"	25'-11"	36'-3"	37'-5"
	8'	12'-10"	14'-0"	24'-5"	25'-7"	35'-11"	37'-1"

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n = 10) 1200 #/□"
Reinforcing Steel 29,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.
For Barrels of 4', 5' & 6' Spans, see Drawing No. R-300X-X1.
For " " 7' Spans, see Drawing No. R-300X-X3.
For " " 8' Spans, see Drawing No. R-300X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

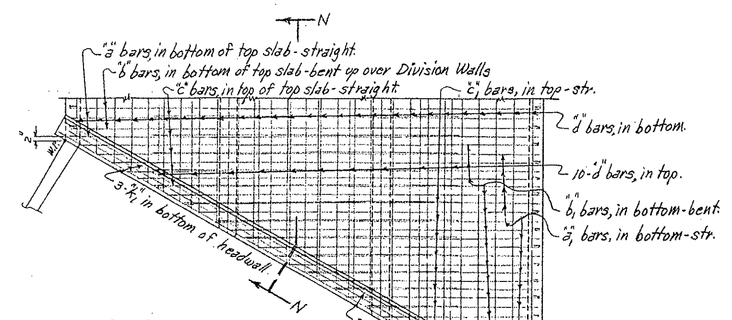
30° SKEW – SECTIONS "A" ONLY

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-330X-1

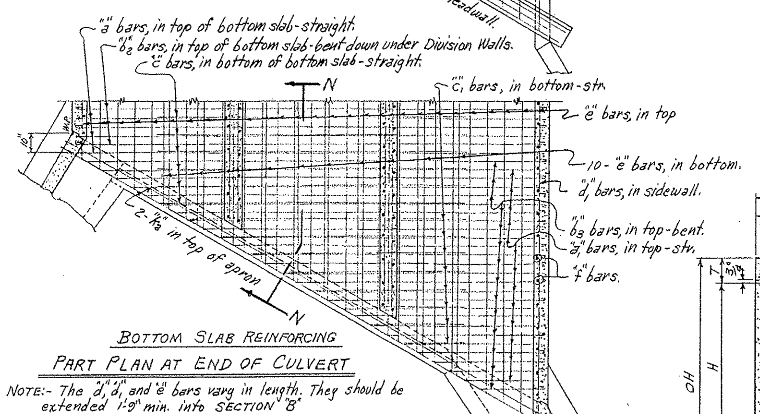
Designed by:- W.C.H. 9-24-62 — Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 2-4-64 — Checked by:-
Quantities by:- W.C.H. 4-30-64 — Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT



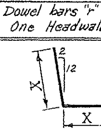
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

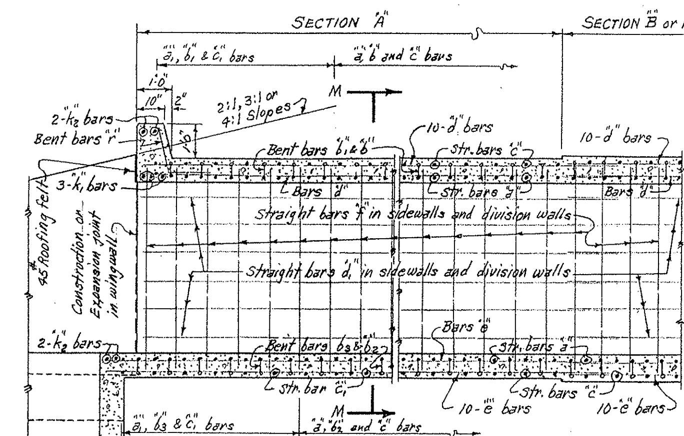
NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" min. into SECTION "B"

DOWEL BARS FOR ONE HEADWALL

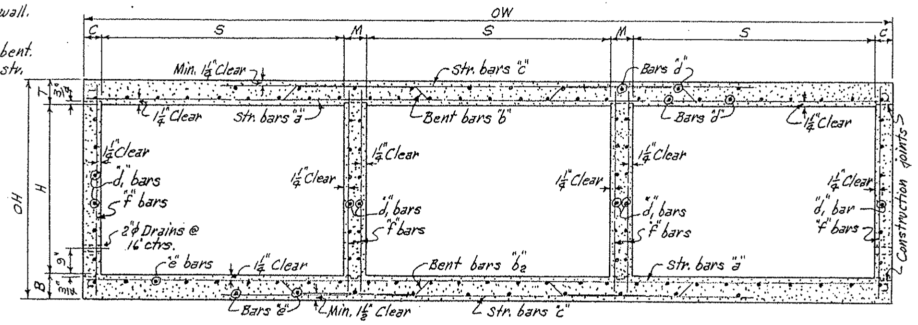
SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
9'	#4	12"±	35	2'-11"	1'-5½"	
10'	#4	12"±	38	3'-0"	1'-6"	
11'	#4	12"±	42	3'-2"	1'-7"	
12'	#4	12"±	46	3'-4"	1'-8"	



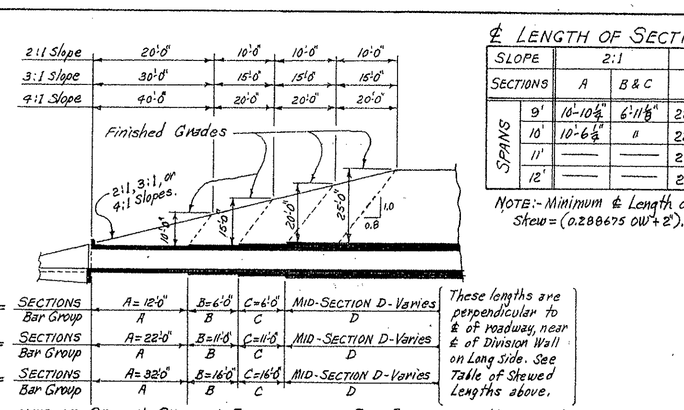
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



SECTION N-N

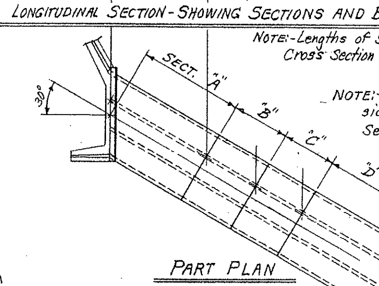


TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ¢ Length of Section "A" have been shortened by ⅓ "S". See Table above.

¢ Skewed Length of "A" = "A" x 1.1547 - ⅓ "S".

NOTE:- For Details and Bar Lists for SECTIONS "B", "C" & "D", see Barrel Drawing Nos. R-300X-X2 and R-300X-X3.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	B	C		D

OR ALT.

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0'	A	2@C			D

¢ LENGTH OF SECTIONS ON 30° SKEW

SLOPE		2:1		3:1		4:1	
SECTIONS		A	B&C	A	B&C	A	B&C
SPANS	9'	10'-10¼"	6'-11⅛"	22'-4¾"	12'-8⅜"	33'-11⅛"	18'-5¾"
	10'	10'-6¼"	"	22'-0¾"	"	33'-7½"	"
	11'	—	—	21'-8¾"	"	33'-3½"	"
	12'	—	—	21'-4¾"	"	32'-11½"	"

NOTE:- Minimum ¢ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

BARREL DIMENSIONS: MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ.FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* QUANTITIES - ONE SECTION "A": CLASS S CONCRETE, BARREL ONLY 2:1	3:1	4:1	REINFORCING STEEL, BARREL, APRON AND HEADWALL 2:1	3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	CU.YD.	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	3 @ 9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	34'-3⅛"	35'-5"	29.25	50.03	75.86	4594	8692	13,069
		6'	162	29'-11"		7½"	10"		7'-7"	34'-6⅜"	35'-8⅞"	26.08	53.82	81.60	4739	8952	13,453
		7'	189	29'-11"		7½"	10"		8'-7"	"	"	27.26	56.24	85.27	4885	9289	13,971
		8'	216	30'-0"		8"	10"		9'-7"	34'-7¾"	35'-9½"	28.74	59.30	89.92	5185	9844	14,787
		9'	243	30'-4"		9"	11"		10'-7"	35'-0½"	36'-2¼"	31.37	64.72	98.14	5288	10,333	15,592
		10'	270	30'-8"		10"	12"		11'-7"	35'-4⅞"	36'-6¾"	34.26	70.68	107.17	5724	11,069	16,503
		11'	297	30'-10"		11"	12"		12'-7"	35'-7¼"	36'-9"	36.58	75.97	114.44	5966	11,630	17,398
	3 @ 10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	37'-8⅝"	38'-10⅞"	26.94	56.50	86.11	5006	9940	14,875
		6'	180	32'-11"		7½"	10"		7'-8½"	38'-0⅛"	39'-2"	28.73	60.25	91.83	5094	10,196	15,206
		7'	210	32'-11"		7½"	10"		8'-8½"	"	"	29.87	62.64	95.96	5254	10,483	15,725
		8'	240	33'-0"		8"	10"		9'-8½"	38'-1¼"	39'-3"	31.32	65.68	100.10	5555	11,075	16,580
		9'	270	33'-4"		9"	11"		10'-8½"	38'-5⅞"	39'-7¾"	33.88	71.04	108.27	5860	11,698	17,335
		10'	300	33'-8"		10"	12"		11'-8½"	38'-10⅛"	40'-0⅛"	36.70	76.95	117.28	6246	12,454	18,445
		11'	330	33'-10"		11"	12"		12'-8½"	39'-0¾"	40'-2¾"	38.95	81.68	124.48	6584	13,016	19,286
		12'	360	34'-0"		12"	12"		13'-8½"	39'-3⅜"	40'-5"	41.34	86.68	132.11	6829	13,674	20,302
	3 @ 11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	41'-6⅞"	42'-8¾"		67.60	103.57		11,284	16,835
		7'	231	36'-0"		8"	10"		8'-10"	"	"		70.01	107.27		11,535	17,217
		8'	264	36'-0"		8"	10"		9'-10"	"	"		72.42	110.96		12,122	18,115
		9'	297	36'-4"		9"	11"		10'-10"	41'-11½"	43'-1⅝"		77.75	119.12		12,756	19,040
		10'	330	36'-8"		10"	12"		11'-10"	42'-4⅛"	43'-6"		83.61	128.11		13,282	20,167
		11'	363	36'-10"		11"	12"		12'-10"	42'-6⅜"	43'-8¼"		88.29	135.26		13,857	21,024
		12'	396	37'-0"		12"	12"		13'-10"	42'-8¾"	43'-10⅝"		93.22	142.82		14,888	22,540
	3 @ 12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	45'-0⅜"	46'-2¼"		74.78	115.19		12,636	19,009
		7'	252	39'-0"		8"	10"		8'-11½"	"	"		77.15	118.85		12,816	19,285
		8'	288	39'-0"		8"	10"		9'-11½"	"	"		79.55	122.54		13,475	20,279
		9'	324	39'-4"		9"	11"		10'-11½"	45'-5"	46'-7"		84.81	130.65		14,091	21,253
		10'	360	39'-8"		10"	12"		11'-11½"	45'-9⅝"	46'-11½"		90.61	139.58		14,672	22,146
		11'	396	39'-10"		11"	12"		12'-11½"	46'-0"	47'-1¾"		95.23	146.70		15,440	23,239
		12'	432	40'-0"		12"	12"		13'-11½"	46'-2⅛"	47'-4"		100.11	154.21		16,366	24,786

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

BAR LIST FOR SECTION A ON 30° SKEW - ONE END ONLY

SECTION "A" & BAR GROUP "A". Lengths vary with Clear Span "S" per Slope, See Table at Upper Right. Depth of Cover D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. / ▼"a1" bars — STRAIGHT — In Top and Bottom Slab of Barrel. (Two of each Length)

S	H	"a" SIZE	SPACING	No. REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
3 @ 9'	5'	#6	12"	7	29	53	29'-5"	#6	12"	30	27'-8"	3'-2"
	6'			7	29	53	29'-8"			30	27'-11"	3'-5"
	7'			7	29	53	"			30	"	"
	8'			7	29	53	29'-9"			30	28'-0"	3'-6"
	9'			5	29	53	30'-1"			30	28'-4"	3'-10"
	10'			5	29	51	30'-5"			30	28'-8"	4'-2"
	11'			5	29	51	30'-7"			32	28'-10"	2'-7"
3 @ 10'	5'	#6	11"	3	29	55	32'-5"	#6	11"	36	30'-10"	3'-11"
	6'			3	29	55	32'-8"			38	31'-1"	2'-7"
	7'			3	29	55	"			38	"	"
	8'			3	29	55	32'-9"			38	31'-2"	2'-8"
	9'			3	29	53	33'-1"			38	31'-6"	3'-0"
	10'			3	29	53	33'-5"			38	31'-10"	3'-4"
	11'			3	29	53	33'-7"			38	32'-0"	3'-6"
	12'			3	29	53	33'-9"			38	32'-2"	3'-8"
3 @ 11'	6'	#6	12"	—	25	47	35'-9"	#6	12"	38	34'-0"	2'-6"
	7'			—	25	47	"			38	"	"
	8'			—	25	47	"			38	"	"
	9'			—	25	47	36'-1"			38	34'-4"	2'-10"
	10'			—	23	47	36'-5"			38	34'-8"	3'-2"
	11'			—	23	47	36'-7"			38	34'-10"	3'-4"
	12'			—	23	47	36'-9"			38	35'-0"	3'-6"
3 @ 12'	6'	#6	11"	—	23	49	38'-9"	#6	11"	44	37'-2"	3'-11"
	7'			—	23	49	"			44	"	"
	8'			—	23	49	"			44	"	"
	9'			—	23	49	39'-1"			46	37'-6"	2'-8"
	10'			—	23	49	39'-5"			46	37'-10"	3'-0"
	11'			—	23	49	39'-7"			46	38'-0"	3'-2"
	12'			—	23	49	39'-9"			46	38'-2"	3'-4"

"b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	SIZE	SPACING	No. REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z
3 @ 9'	5'	#6	12"	2	14	26	31'-2"	0'-5¾"	4'-3½"	7'-2"
	6'			2	14	26	31'-5"	"	4'-4½"	7'-2½"
	7'			2	14	26	"	"	"	"
	8'			2	14	26	31'-6"	"		7'-3"
	9'			2	13	25	31'-10"	"	4'-5½"	7'-4"
	10'			2	13	25	32'-2"	"	4'-6½"	7'-5"
	11'			2	13	25	32'-4"	0'-5¾"	4'-6½"	7'-6"
3 @ 10'	5'	#6	11"	1	14	26	34'-3"	0'-6½"	4'-8"	7'-11"
	6'			1	14	26	34'-6"	"	4'-9"	7'-11½"
	7'			1	14	26	"	"	"	"
	8'			1	14	26	34'-7"	"	"	8'-0"
	9'			1	14	26	34'-11"	"	4'-10"	8'-1"
	10'			1	14	26	35'-3"	"	4'-11"	8'-2"
	11'			1	14	26	35'-5"	"	4'-11"	8'-3"
	12'			1	14	26	35'-7"	0'-6½"	4'-11"	8'-4"
3 @ 11'	6'	#7	12"	—	11	23	37'-10"	0'-7"	5'-2"	8'-9"
	7'			—	11	23	"	"	"	"
	8'			—	11	23	"	"	"	"
	9'			—	11	23	38'-2"	"	5'-3"	8'-10"
	10'			—	11	23	38'-6"	"	5'-4"	8'-11"
	11'			—	11	23	38'-8"	"	5'-4"	9'-0"
	12'			—	11	23	38'-10"	0'-7"	5'-4"	9'-1"
3 @ 12'	6'	#7	11"	—	11	23	40'-11"	0'-7¾"	5'-6½"	9'-6"
	7'			—	11	23	"	"	"	"
	8'			—	11	23	"	"	"	"
	9'			—	11	23	41'-3"	"	5'-7½"	9'-7"
	10'			—	11	23	41'-7"	"	5'-8½"	9'-8"
	11'			—	11	23	41'-9"		5'-8½"	9'-9"
	12'			—	11	23	41'-11"	0'-7¾"	5'-8½"	9'-10"

▼"b1" bars — BENT - See Diagrams below — In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	12"	15	29'-9"	4'-7"	28'-6"	4'-0"
	6'			16	30'-0"	3'-1"	28'-9"	2'-6"
	7'			16	"	"	"	"
	8'			16	30'-1"	3'-2"	28'-10"	2'-7"
	9'			16	30'-5"	3'-6"	29'-2"	2'-11"
	10'			16	30'-9"	3'-10"	29'-6"	3'-3"
	11'			16	30'-11"	4'-0"	29'-8"	3'-5"
3 @ 10'	5'	#6	11"	19	33'-0"	3'-8"	31'-7"	3'-1"
	6'			19	33'-3"	3'-11"	31'-10"	3'-4"
	7'			19	"	"	"	"
	8'			19	33'-4"	4'-0"	31'-11"	3'-5"
	9'			19	33'-8"	4'-4"	32'-3"	3'-9"
	10'			20	34'-0"	3'-1"	32'-7"	2'-6"
	11'			20	34'-2"	3'-3"	32'-9"	2'-8"
	12'			20	34'-4"	3'-5"	32'-11"	2'-10"
3 @ 11'	6'	#7	12"	19	36'-4"	4'-0"	34'-10"	3'-4"
	7'			19	"	"	"	"
	8'			19	"	"	"	"
	9'			19	36'-8"	4'-4"	35'-2"	3'-8"
	10'			19	37'-0"	4'-8"	35'-6"	4'-0"
	11'			19	37'-2"	4'-10"	35'-8"	4'-2"
	12'			20	37'-4"	3'-3"	35'-10"	2'-7"
3 @ 12'	6'	#7	11"	23	39'-7"	3'-9"	37'-11"	3'-1"
	7'			23	"	"	"	"
	8'			23	"	"	"	"
	9'			23	39'-11"	4'-1"	38'-3"	3'-5"
	10'			23	40'-3"	4'-5"	38'-7"	3'-9"
	11'			23	40'-5"	4'-7"	38'-9"	3'-11"
	12'			24	40'-7"	3'-2"	38'-11"	2'-6"

"b2" bars — BENT - See Diagrams below — In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.

S	H	SIZE	SPACING	No. REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z
3 @ 9'	5'	#6	12"	3	15	27	31'-3"	0'-6¼"	4'-2½"	7'-2"
	6'			3	15	27	31'-6"	"	4'-3½"	7'-2½"
	7'			3	15	27	"	"	"	"
	8'			3	15	27	31'-7"	"	"	7'-3"
	9'			3	14	26	31'-11"	"	4'-4½"	7'-4"
	10'			3	14	26	32'-2"	"	4'-5½"	7'-5"
	11'			3	14	26	32'-5"	0'-6¼"	4'-5½"	7'-6"
3 @ 10'	5'	#6	11"	2	15	27	34'-4"	0'-7"	4'-7"	7'-11"
	6'			2	15	27	34'-7"	"	4'-8"	7'-11½"
	7'			2	15	27	"	"	"	"
	8'			2	15	27	34'-8"	"	"	8'-0"
	9'			2	15	27	35'-0"	"	4'-9"	8'-1"
	10'			2	15	27	35'-4"	"	4'-10"	8'-2"
	11'			2	15	27	35'-6"	"	4'-10"	8'-3"
	12'			2	15	27	35'-8"	0'-7"	4'-10"	8'-4"
3 @ 11'	6'	#7	12"	—	12	24	37'-11"	0'-7½"	5'-1"	8'-9"
	7'			—	12	24	"	"	"	"
	8'			—	12	24	"	"	"	"
	9'			—	12	24	38'-3"	"	5'-2"	8'-10"
	10'			—	12	24	38'-7"	"	5'-3"	8'-11"
	11'			—	12	24	38'-9"	"	5'-3"	9'-0"
	12'			—	12	24	38'-11"	0'-7½"	5'-3"	9'-1"
3 @ 12'	6'	#7	11"	—	12	24	41'-0"	0'-8¼"	5'-5½"	9'-6"
	7'			—	12	24	"	"	"	"
	8'			—	12	24	"	"	"	"
	9'			—	12	24	41'-4"	"	5'-6½"	9'-7"
	10'			—	12	24	41'-8"	"	5'-7½"	9'-8"
	11'			—	12	24	41'-10"	"	5'-7½"	9'-9"
	12'			—	12	24	42'-0"	0'-8¼"	5'-7½"	9'-10"

▼"b3" bars — BENT - See Diagrams below — In Top of Bottom Slab - some bent down under Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	12"	15	29'-10"	4'-7"	28'-6"	4'-0"
	6'			16	30'-1"	3'-1"	28'-9"	2'-6"
	7'			16	"	"	"	"
	8'			16	30'-2"	3'-2"	28'-10"	2'-7"
	9'			16	30'-6"	3'-6"	29'-2"	2'-11"
	10'			16	30'-10"	3'-10"	29'-6"	3'-3"
	11'			16	31'-0"	4'-0"	29'-8"	3'-5"
3 @ 10'	5'	#6	11"	19	33'-1"	3'-8"	31'-7"	3'-1"
	6'			19	33'-4"	3'-11"	31'-10"	3'-4"
	7'			19	"	"	"	"
	8'			19	33'-5"	4'-0"	31'-11"	3'-5"
	9'			19	33'-9"	4'-4"	32'-3"	3'-9"
	10'			20	34'-1"	3'-1"	32'-7"	2'-6"
	11'			20	34'-3"	3'-3"	32'-9"	2'-8"
	12'			20	34'-5"	3'-5"	32'-11"	2'-10"
3 @ 11'	6'	#7	12"	19	36'-5"	4'-0"	34'-10"	3'-4"
	7'			19	"	"	"	"
	8'			19	"	"	"	"
	9'			19	36'-9"	4'-4"	35'-2"	3'-8"
	10'			19	37'-1"	4'-8"	35'-6"	4'-0"
	11'			19	37'-3"	4'-10"	35'-8"	4'-2"
	12'			20	37'-5"	3'-3"	35'-10"	2'-7"
3 @ 12'	6'	#7	11"	23	39'-8"	3'-9"	37'-11"	3'-1"
	7'			23	"	"	"	"
	8'			23	"	"	"	"
	9'			23	40'-0"	4'-1"	38'-3"	3'-5"
	10'			23	40'-4"	4'-5"	38'-7"	3'-9"
	11'			23	40'-6"	4'-7"	38'-9"	3'-11"
	12'			24	40'-8"	3'-2"	38'-11"	2'-6"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. / ▼"c1" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" SIZE	SPACING	No. REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
3 @ 9'	5'	#7	12"	11	33	57	19'-6"	#7	12"	20	19'-4"	3'-7"
	6'			11	33	57	19'-8"			20	19'-5"	3'-8"
	7'			11	33	57	"			20	"	"
	8'			11	33	57	"			20	19'-6"	3'-9"
	9'			9	33	57	19'-10"			20	19'-9"	4'-0"
	10'			11	35	57	20'-0"			18	18'-3"	4'-3"
	11'			11	35	57	20'-0"			18	18'-4"	4'-4"
3 @ 10'	5'	#7	11"	9	35	61	21'-6"	#7	11"	24	20'-8"	3'-3"
	6'			9	35	61	21'-8"			24	20'-10"	3'-5"
	7'			9	35	61	"			24	"	"
	8'			9	35	61	"			24	20'-11"	3'-6"
	9'			9	35	59	21'-10"			24	21'-2"	3'-9"
	10'			9	35	59	22'-0"			24	21'-5"	4'-0"
	11'			9	35	59	"			24	21'-6"	4'-1"
	12'			9	35	59	"			24	21'-7"	4'-2"
3 @ 11'	6'	#7	12"	—	31	53	23'-8"	#7	12"	24	22'-9"	3'-6"
	7'			—	31	53	"			24	"	"
	8'			—	31	53	"			24	"	"
	9'			—	31	53	23'-10"			24	23'-0"	3'-9"
	10'			—	29	53	24'-0"			24	23'-3"	4'-0"
	11'			—	29	53	"			24	23'-4"	4'-1"
	12'			—	29	53	"			24	23'-5"	4'-2"
3 @ 12'	6'	#7	11"	—	31	57	25'-8"	#7	11"	28	24'-4"	3'-9"
	7'			—	31	57	"			28	"	"
	8'			—	31	57	"			28	"	"
	9'			—	31	57	25'-10"			28	24'-7"	4'-0"
	10'			—	31	57	26'-0"			28	24'-10"	4'-3"
	11'			—	31	57	"			28	24'-11"	4'-4"
	12'			—	31	57	"			28	25'-0"	4'-5"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. / "d1" bars — Longitudinal in Sidewalls and Division Walls. / "e" bars — Longitudinal in Bottom Slab of Barrel. (LENGTH ①: Lengths vary with Clear Span "S", Skew and Slope - See Table for ave. lengths.)

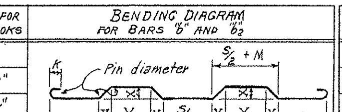
S	H	"d" SIZE	SPACING	No. REQ'D	"d1" SIZE	SPACING	No. REQ'D	"e" SIZE	SPACING	No. REQ'D
3 @ 9'	5'	#4	12"	40	#4	12"	30	#4	12"	40
	6'			40			36			40
	7'			40			42			40
	8'			40			48			40
	9'			40			54			40
	10'			40			60			40
	11'			40			66			40
3 @ 10'	5'	#4	12"	43	#4	12"	30	#4	12"	43
	6'			43			36			43
	7'			43			42			43
	8'			43			48			43
	9'			43			54			43
	10'			43			60			43
	11'			43			66			43
	12'			43			72			43
3 @ 11'	6'	#4	12"	46	#4	12"	36	#4	12"	46
	7'			46			42			46
	8'			46			48			46
	9'			46			54			46
	10'			46			60			46
	11'			46			66			46
	12'			46			72			46
3 @ 12'	6'	#4	12"	49	#4	12"	36	#4	12"	49
	7'			49			42			49
	8'			49			48			49
	9'			49			54			49
	10'			49			60			49
	11'			49			66			49
	12'			49			72			49

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. / ▼"k1" bars — STRAIGHT — In Bottom of Headwall. / ▼"k2" bars — In Top of Headwall and Apron. (2 Each)

S	H	"f" SIZE	SPACING	No. REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	No. REQ'D	LENGTH	"k2" SIZE	No. REQ'D	LENGTH
3 @ 9'	5'	#4	12"	69	135	204	6'-4"	#6	3	34'-0"	#6	4	35'-2"
	6'	#4	12"	69	135	204	7'-4"		3	34'-3"		4	35'-5"
	7'	#4	10"	78	162	246	8'-4"		3	"		4	"
	8'	#5	12"	69	135	204	9'-4"		3	34'-4"		4	35'-6"
	9'	#5	10"	78	162	246	10'-4"		3	34'-9"		4	35'-11"
	10'	#6	12"	69	135	204	11'-4"		3	35'-1"		4	36'-3"
	11'	#6	11"	72	147	222	12'-4"		3	35'-4"		4	36'-6"
3 @ 10'	5'	#4	12"	66	135	204	6'-5"	#6	3	37'-5"	#6	4	38'-7"
	6'	#4	12"	66	135	204	7'-5"		3	37'-9"		4	38'-11"
	7'	#4	10"	78	162	246	8'-5"		3	"		4	"
	8'	#5	12"	63	135	204	9'-5"		3	37'-10"		4	39'-0"
	9'	#5	10"	75	162	246	10'-5"		3	38'-2"		4	39'-4"
	10'	#6	12"	63	135	204	11'-5"		3	38'-7"		4	39'-9"
	11'	#6	11"	72	147	222	12'-5"		3	38'-9"		4	39'-11"
	12'	#6	10"	75	162	246	13'-5"		3	39'-0"		4	40'-2"
3 @ 11'	6'	#4	12"	—	132	201	7'-7"	⊠ #7	3	41'-3"	#7	8	22'-5"
	7'	#4	11"	—	144	219	8'-7"		3	"		8	"
	8'	#5	12"	—	132	201	9'-7"		3	"		8	"
	9'	#5	10"	—	159	240	10'-7"		3	41'-8"		8	22'-7"
	10'	#6	12"	—	132	201	11'-7"		3	42'-1"		8	22'-10"
	11'	#6	11"	—	144	219	12'-7"		3	42'-3"		8	22'-11"
	12'	#6	9"	—	177	267	13'-7"		3	42'-5"		8	23'-0"
3 @ 12'	6'	#4	12"	—	132	198	7'-8"	⊠ #7	3	44'-9"	#7	8	24'-2"
	7'	#4	12"	—	132	198	8'-8"		3	"		8	"
	8'	#5	12"	—	132	198	9'-8"		3	"		8	"
	9'	#5	10"	—	156	240	10'-8"		3	45'-2"		8	24'-4"
	10'	#6	12"	—	132	198	11'-8"		3	45'-6"		8	24'-7"
	11'	#6	11"	—	144	216	12'-8"		3	45'-9"		8	24'-8"
	12'	#6	9"	—	171	267	13'-8"		3	45'-11"		8	24'-9"

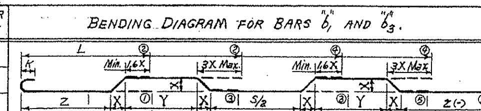
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3"



NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars. ①①-⑤⑤ Min & Max. lengths L for bars "b1" & "b3" for each type bend.

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

① To Longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar, (1'-3" lap).

⊠ These bars may be spliced at alt. division walls (2'-4" lap), three bars of each length. Add 14 Lbs. to steel quantities.

AVERAGE LENGTHS OF LONG. BARS "d", "d1" & "e"

SLOPE		2:1		3:1		4:1	
BARS		d & d1	e	d & d1	e	d & d1	e
SPANS	9'	12'-6"	13'-8"	24'-0"	25'-2"	35'-7"	36'-9"
	10'	12'-2"	13'-4"	23'-8"	24'-10"	35'-3"	36'-5"
	11'	—	—	23'-4"	24'-6"	34'-11"	36'-1"
	12'	—	—	23'-0"	24'-2"	34'-7"	35'-9"

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.

For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW - SECTIONS "A" ONLY

9', 10', 11' AND 12' SPANS TRIPLES

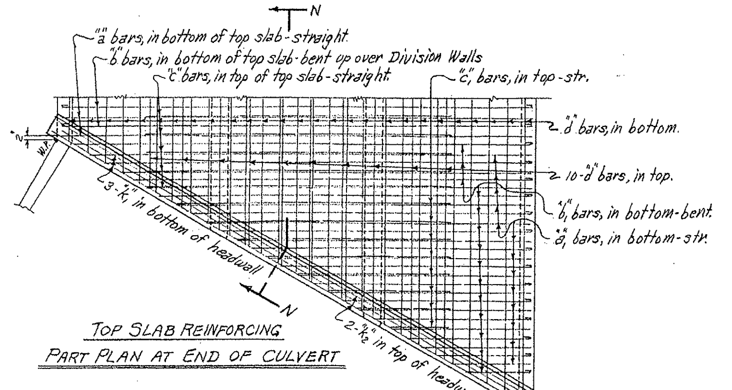
2:1, 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

STANDARD DRAWING No. R-330X-2

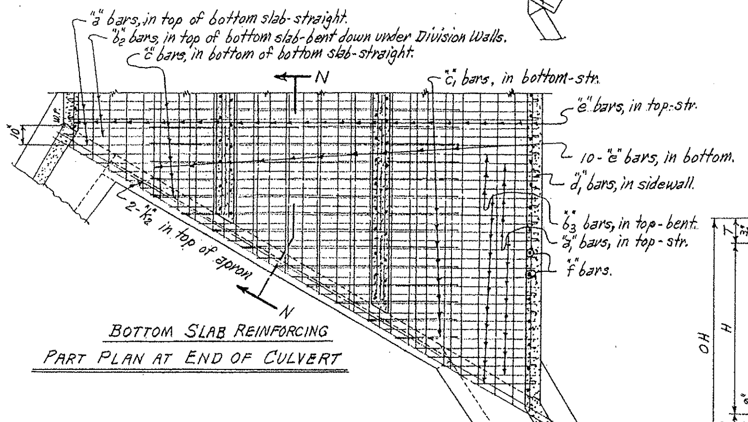
Designed by:- W.C.H. 9-17-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 2-6-64 Checked by:-
Quantities by:- W.C.H. 5-5-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

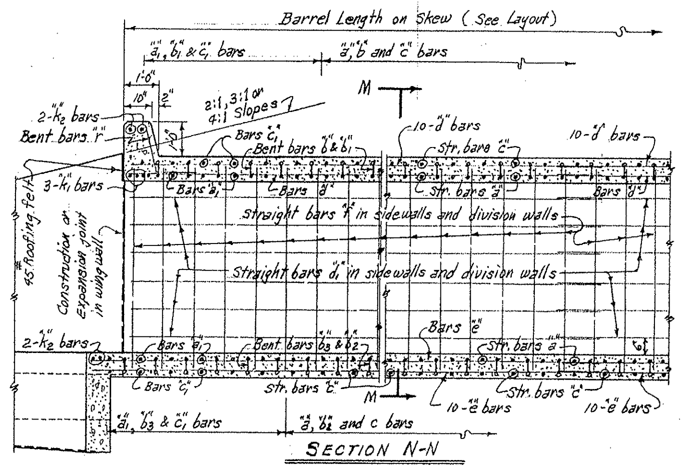
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



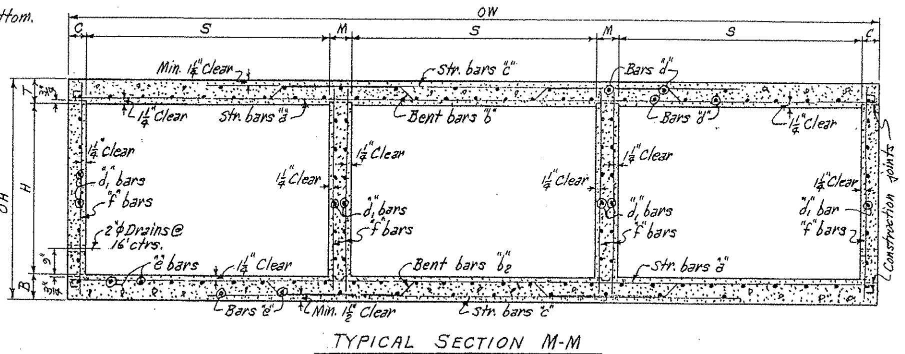
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



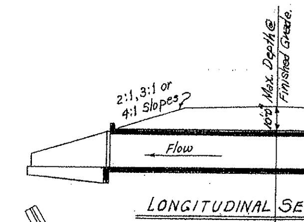
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT



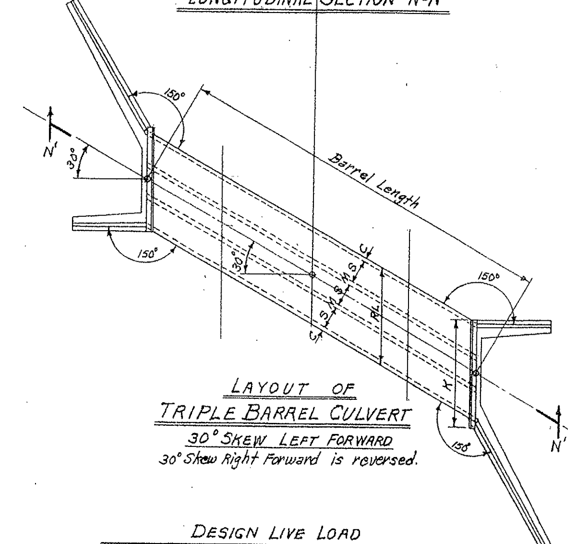
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF
TRIPLE BARREL CULVERT
30° SKEW LEFT FORWARD
30° Skew Right Forward is reversed.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

MAX. DESIGN DEPTH OF COVER	BARREL DIMENSIONS: CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* QUANTITIES: CLASS S CONC. PER LIN. FT. OF BARREL	REINFORCING STEEL: TOTAL FOR 60'-0" LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU. YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	3 @ 9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	34'-3⅛"	35'-5"	2.234	22,721	360.70	91.85
		6'	162	29'-11"		7½"	10"		7'-7"	34'-6⅝"	35'-8½"	2.403	23,384	370.90	96.86
		7'	189	29'-11"		7½"	10"		8'-7"	"	"	2.511	24,270	385.59	101.87
		8'	216	30'-0"		8"	10"		9'-7"	34'-7¾"	35'-9½"	2.648	25,624	408.43	106.88
		9'	243	30'-4"		9"	11"		10'-7"	35'-0⅝"	36'-2⅛"	2.890	27,351	434.31	111.89
		10'	270	30'-8"		10"	12"		11'-7"	35'-4⅞"	36'-6¾"	3.156	29,024	465.54	116.90
		11'	297	30'-10"		11"	12"		12'-7"	35'-7⅞"	36'-9"	3.370	30,577	489.67	121.91
	3 @ 10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	37'-8⅝"	38'-10½"	2.561	26,351	417.70	96.86
		6'	180	32'-11"		7½"	10"		7'-8½"	38'-0⅜"	39'-2"	2.731	27,036	428.10	101.87
		7'	210	32'-11"		7½"	10"		8'-8½"	"	"	2.839	27,926	442.86	106.88
		8'	240	33'-0"		8"	10"		9'-8½"	38'-1¼"	39'-3"	2.977	29,328	465.86	111.89
		9'	270	33'-4"		9"	11"		10'-8½"	38'-5⅝"	39'-7¾"	3.220	30,777	492.09	116.90
		10'	300	33'-8"		10"	12"		11'-8½"	38'-10⅛"	40'-0⅝"	3.488	32,758	522.69	121.91
		11'	330	33'-10"		11"	12"		12'-8½"	39'-0⅜"	40'-2¾"	3.702	34,313	547.98	126.92
		12'	360	34'-0"		12"	12"		13'-8½"	39'-3⅛"	40'-5"	3.929	35,974	576.10	131.93
	3 @ 11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	41'-6⅞"	42'-8¾"	3.111	30,207	474.87	106.88
		7'	231	36'-0"		8"	10"		8'-10"	"	"	3.222	30,899	486.02	111.89
		8'	264	36'-0"		8"	10"		9'-10"	"	"	3.333	32,471	512.47	116.90
		9'	297	36'-4"		9"	11"		10'-10"	41'-11½"	43'-1¼"	3.578	33,138	539.03	121.91
		10'	330	36'-8"		10"	12"		11'-10"	42'-4⅛"	43'-6"	3.848	35,975	570.93	126.92
		11'	363	36'-10"		11"	12"		12'-10"	42'-6⅜"	43'-8¼"	4.063	37,386	595.50	131.93
		12'	396	37'-0"		12"	12"		13'-10"	42'-8⅜"	43'-10½"	4.290	40,185	640.20	136.94
	3 @ 12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	45'-0⅜"	46'-2¼"	3.495	34,575	544.35	111.89
		7'	252	39'-0"		8"	10"		8'-11½"	"	"	3.606	35,060	552.37	116.90
		8'	288	39'-0"		8"	10"		9'-11½"	"	"	3.718	36,850	582.13	121.91
		9'	324	39'-4"		9"	11"		10'-11½"	45'-5"	46'-7"	3.964	38,562	609.07	126.92
		10'	360	39'-8"		10"	12"		11'-11½"	45'-9⅝"	46'-11½"	4.235	40,372	641.44	131.93
		11'	396	39'-10"		11"	12"		12'-11½"	46'-0"	47'-1¾"	4.451	41,961	666.13	136.94
		12'	432	40'-0"		12"	12"		13'-11½"	46'-2¼"	47'-4"	4.679	44,672	711.11	141.95

* For remainder of quantities see Std. Wing Drawings listed below.
The total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAPS:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

BAR LIST FOR BARREL SECTION "A" 60'-0" IN LENGTH - TWO 30° SKEWED ENDS

"a" bars: STRAIGHT - In Top and Bottom slab of Barrel. "a1" bars ▼: STRAIGHT - In Top and Bottom slab of Barrel - (Four of Each Length). "b" bars: BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

D (DEPTH OF COVER)	S (CLEAR SPAN)	H (CLEAR HEIGHT)	a SIZE	a SPACING	a NO. REQ'D	a LENGTH	a1 SIZE	a1 SPACING	a1 NO. REQ'D	a1 LENGTH MAX.	a1 LENGTH MIN.	b SIZE	b SPACING	b NO. REQ'D	b LENGTH	b X	b Y	b Z
5'-0" TO 10'-0" MAXIMUM	3 @ 9'	5'			90	29'-5"			60	27'-8"	3'-2"			42	31'-2"	0'-5¾"	4'-3½"	7'-2"
		6'			90	29'-8"			60	27'-11"	3'-5"			42	31'-5"	"	4'-4½"	7'-2½"
		7'			90	29'-8"			60	"	"			42	"	"	"	"
		8'	#6	12"	90	29'-9"	#6	12"	60	28'-0"	3'-6"	#6	12"	42	31'-6"	"	"	7'-3"
		9'			90	30'-1"			60	28'-4"	3'-10"			42	31'-10"	"	4'-5½"	7'-4"
		10'			88	30'-5"			60	28'-8"	4'-2"			42	32'-2"	"	4'-6½"	7'-5"
		11'			88	30'-7"			64	28'-10"	2'-7"			42	32'-4"	0'-5¾"	4'-6½"	7'-6"
	3 @ 10'	5'			94	32'-5"			72	30'-10"	3'-11"			44	34'-3"	0'-6½"	4'-8"	7'-11"
		6'			94	32'-8"			76	31'-1"	2'-7"			44	34'-6"	"	4'-9"	7'-11½"
		7'			94	32'-8"			76	"	"			44	"	"	"	"
		8'	#6	11"	94	32'-9"	#6	11"	76	31'-2"	2'-8"	#6	11"	44	34'-7"	"	"	8'-0"
		9'			92	33'-1"			76	31'-6"	3'-0"			44	34'-11"	"	4'-10"	8'-1"
		10'			92	33'-5"			76	31'-10"	3'-4"			44	35'-3"	"	4'-11"	8'-2"
		11'			92	33'-7"			76	32'-0"	3'-6"			44	35'-5"	"	"	8'-3"
		12'			92	33'-9"			76	32'-2"	3'-8"			44	35'-7"	0'-6½"	4'-11"	8'-4"
	3 @ 11'	6'			82	35'-9"			76	34'-0"	2'-6"			39	37'-10"	0'-7"	5'-2"	8'-9"
		7'			82	35'-9"			76	"	"			39	"	"	"	"
		8'			82	35'-9"			76	"	"			39	"	"	"	"
		9'	#6	12"	82	36'-1"	#6	12"	76	34'-4"	2'-10"	#7	12"	39	38'-2"	"	5'-3"	8'-10"
		10'			82	36'-5"			76	34'-8"	3'-2"			38	38'-6"	"	5'-4"	8'-11"
		11'			82	36'-7"			76	34'-10"	3'-4"			38	38'-8"	"	"	9'-0"
		12'			82	36'-9"			76	35'-0"	3'-6"			38	38'-10"	0'-7"	5'-4"	9'-1"
	3 @ 12'	6'			86	38'-9"			88	37'-2"	3'-11"			40	40'-11"	0'-7¾"	5'-6½"	9'-6"
		7'			86	38'-9"			88	"	"			40	"	"	"	"
		8'			86	38'-9"			88	"	"			40	"	"	"	"
		9'	#6	11"	86	39'-1"	#6	11"	92	37'-6"	2'-8"	#7	11"	40	41'-3"	"	5'-7½"	9'-7"
		10'			84	39'-5"			92	37'-10"	3'-0"			40	41'-7"	"	5'-8½"	9'-8"
		11'			84	39'-7"			92	38'-0"	3'-2"			40	41'-9"	"	"	9'-9"
		12'			84	39'-9"			92	38'-2"	3'-4"			40	41'-11"	0'-7¾"	5'-8½"	9'-10"

"b1" bars ▼: BENT - In Bottom of Top Slab - some bent up over Division Walls - one end hooked. (2 of Each Length). Alt. with "a1" and "c" or "c1" bars. "b2" bars: BENT - In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

D	S	H	b1 SIZE	b1 SPACING	b1 NO. REQ'D	b1 LENGTH MAX.	b1 LENGTH MIN.	b1 L MAX.	b1 L MIN.	b2 SIZE	b2 SPACING	b2 NO. REQ'D	b2 LENGTH	b2 X	b2 Y	b2 Z
5'-0" TO 10'-0" MAXIMUM	3 @ 9'	5'			30	29'-9"	4'-7"	28'-6"	4'-0"			44	31'-3"	0'-6¼"	4'-2½"	7'-2"
		6'			32	30'-0"	3'-1"	28'-9"	2'-6"			44	31'-6"	"	4'-3⅝"	7'-2½"
		7'			32	"	"	"	"			44	"	"	"	"
		8'	#6	12"	32	30'-1"	3'-2"	28'-10"	2'-7"	#6	12"	44	31'-7"	"	"	7'-3"
		9'			32	30'-5"	3'-6"	29'-2"	2'-11"			44	31'-11"	"	4'-4½"	7'-4"
		10'			32	30'-9"	3'-10"	29'-6"	3'-3"			44	32'-3"	"	4'-5⅝"	7'-5"
		11'			32	30'-11"	4'-0"	29'-8"	3'-5"			44	32'-5"	0'-6¼"	4'-5½"	7'-6"
	3 @ 10'	5'			38	33'-0"	3'-8"	31'-7"	3'-1"			46	34'-4"	0'-7"	4'-7"	7'-11"
		6'			38	33'-3"	3'-11"	31'-10"	3'-4"			46	34'-7"	"	4'-8"	7'-11½"
		7'			38	"	"	"	"			46	"	"	"	"
		8'	#6	11"	38	33'-4"	4'-0"	31'-11"	3'-5"	#6	11"	46	34'-8"	"	"	8'-0"
		9'			38	33'-8"	4'-4"	32'-3"	3'-9"			46	35'-0"	"	4'-9"	8'-1"
		10'			40	34'-0"	3'-1"	32'-7"	2'-6"			46	35'-4"	"	4'-10"	8'-2"
		11'			40	34'-2"	3'-3"	32'-9"	2'-8"			46	35'-6"	"	"	8'-3"
		12'			40	34'-4"	3'-5"	32'-11"	2'-10"			46	35'-8"	0'-7"	4'-10"	8'-4"
	3 @ 11'	6'			38	36'-4"	4'-0"	34'-10"	3'-4"			41	37'-11"	0'-7½"	5'-1"	8'-9"
		7'			38	"	"	"	"			41	"	"	"	"
		8'			38	"	"	"	"			41	"	"	"	"
		9'	#7	12"	38	36'-8"	4'-4"	35'-2"	3'-8"	#7	12"	41	38'-3"	"	5'-2"	8'-10"
		10'			38	37'-0"	4'-8"	35'-6"	4'-0"			40	38'-7"	"	5'-3"	8'-11"
		11'			38	37'-2"	4'-10"	35'-8"	4'-2"			40	38'-9"	"	"	9'-0"
		12'			40	37'-4"	3'-3"	35'-10"	2'-7"			40	38'-11"	0'-7½"	5'-3"	9'-1"
	3 @ 12'	6'			46	39'-7"	3'-9"	37'-11"	3'-1"			42	41'-0"	0'-8¼"	5'-5½"	9'-6"
		7'			46	"	"	"	"			42	"	"	"	"
		8'			46	"	"	"	"			42	"	"	"	"
		9'	#7	11"	46	39'-11"	4'-1"	38'-3"	3'-5"	#7	11"	42	41'-4"	"	5'-6½"	9'-7"
		10'			46	40'-3"	4'-5"	38'-7"	3'-9"			42	41'-8"	"	5'-7½"	9'-8"
		11'			46	40'-5"	4'-7"	38'-9"	3'-11"			42	41'-10"	"	"	9'-9"
		12'			48	40'-7"	3'-2"	38'-11"	2'-6"			42	42'-0"	0'-8¼"	5'-7½"	9'-10"

"b3" bars ▼: BENT - In Top of Bottom Slab - some bent down under Division Walls - one end hooked. (2 of Each Length). Alt. with "a1" and "c" or "c1" bars. "c" bars: STRAIGHT - In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars ▼: STRAIGHT - In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Four of Each Length).

D	S	H	b3 SIZE	b3 SPACING	b3 NO. REQ'D	b3 LENGTH MAX.	b3 LENGTH MIN.	b3 L MAX.	b3 L MIN.	c SIZE	c SPACING	c NO. REQ'D	c LENGTH	c1 SIZE	c1 SPACING	c1 NO. REQ'D	c1 LENGTH MAX.	c1 LENGTH MIN.
5'-0" TO 10'-0" MAXIMUM	3 @ 9'	5'			30	29'-10"	4'-7"	28'-6"	4'-0"			98	19'-6"			40	19'-4"	3'-7"
		6'			32	30'-1"	3'-1"	28'-9"	2'-6"			98	19'-8"			40	19'-5"	3'-8"
		7'			32	"	"	"	"			98	"			40	"	"
		8'	#6	12"	32	30'-2"	3'-2"	28'-10"	2'-7"	#7	12"	98	"	#7	12"	40	19'-6"	3'-9"
		9'			32	30'-6"	3'-6"	29'-2"	2'-11"			98	19'-10"			40	19'-9"	4'-0"
		10'			32	30'-10"	3'-10"	29'-6"	3'-3"			100	20'-0"			36	18'-3"	4'-3"
		11'			32	31'-0"	4'-0"	29'-8"	3'-5"			100	20'-0"			36	18'-4"	4'-4"
	3 @ 10'	5'			38	33'-1"	3'-8"	31'-7"	3'-1"			106	21'-6"			48	20'-8"	3'-3"
		6'			38	33'-4"	3'-11"	31'-10"	3'-4"			106	21'-8"			48	20'-10"	3'-5"
		7'			38	"	"	"	"			106	"			48	"	"
		8'	#6	11"	38	33'-5"	4'-0"	31'-11"	3'-5"	#7	11"	106	"	#7	11"	48	20'-11"	3'-6"
		9'			38	33'-9"	4'-4"	32'-3"	3'-9"			104	21'-10"			48	21'-2"	3'-9"
		10'			40	34'-1"	3'-1"	32'-7"	2'-6"			104	22'-0"			48	21'-5"	4'-0"
		11'			40	34'-3"	3'-3"	32'-9"	2'-8"			104	"			48	21'-6"	4'-1"
		12'			40	34'-5"	3'-5"	32'-11"	2'-10"			104	22'-0"			48	21'-7"	4'-2"
	3 @ 11'	6'			38	36'-5"	4'-0"	34'-10"	3'-4"			94	23'-8"			48	22'-9"	3'-6"
		7'			38	"	"	"	"			94	"			48	"	"
		8'			38	"	"	"	"			94	"			48	"	"
		9'	#7	12"	38	36'-9"	4'-4"	35'-2"	3'-8"	#7	12"	94	23'-10"	#7	12"	48	23'-0"	3'-9"
		10'			38	37'-1"	4'-8"	35'-6"	4'-0"			94	24'-0"			48	23'-3"	4'-0"
		11'			38	37'-3"	4'-10"	35'-8"	4'-2"			94	"			48	23'-4"	4'-1"
		12'			40	37'-5"	3'-3"	35'-10"	2'-7"			94	24'-0"			48	23'-5"	4'-2"
	3 @ 12'	6'			46	39'-8"	3'-9"	37'-11"	3'-1"			102	25'-8"			56	24'-4"	3'-9"
		7'			46	"	"	"	"			102	"			56	"	"
		8'			46	"	"	"	"			102	"			56	"	"
		9'	#7	11"	46	40'-0"	4'-1"	38'-3"	3'-5"	#7	11"	102	25'-10"	#7	11"	56	24'-7"	4'-0"
		10'			46	40'-4"	4'-5"	38'-7"	3'-9"			100	26'-0"			56	24'-10"	4'-3"
		11'			46	40'-6"	4'-7"	38'-9"	3'-11"			100	"			56	24'-11"	4'-4"
		12'			48	40'-8"	3'-2"	38'-11"	2'-6"			100	26'-0"			56	25'-0"	4'-5"

"d" bars: STRAIGHT - Longitudinal in Top Slab of Barrel. "d1" bars: STRAIGHT - Longitudinal in Sidewalls and Division Walls. "e" bars: STRAIGHT - Longitudinal in Bottom Slab of Barrel. "f" bars: STRAIGHT - Verticals in Sidewalls and Division Walls.

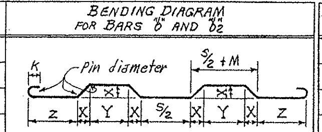
D	S	H	d SIZE	d SPACING	d NO. REQ'D	d LENGTH	d1 SIZE	d1 SPACING	d1 NO. REQ'D	d1 LENGTH	e SIZE	e SPACING	e NO. REQ'D	e LENGTH	f SIZE	f SPACING	f NO. REQ'D	f LENGTH
5'-0" TO 10'-0" MAXIMUM	3 @ 9'	5'	#4	12"	40	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	30	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	40	2 @ 31'-8" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	360	6'-4"
		6'			40				36				40				360	7'-4"
		7'			40				42				40			10"	432	8'-4"
		8'			40				48				40		#5	12"	360	9'-4"
		9'			40				54				40			10"	432	10'-4"
		10'			40				60				40		#6	12"	360	11'-4"
		11'			40				66				40			11"	396	12'-4"
	3 @ 10'	5'			43				30				43		#4	12"	360	6'-5"
		6'			43				36				43				360	7'-5"
		7'			43				42				43			10"	432	8'-5"
		8'			43				48				43		#5	12"	360	9'-5"
		9'			43				54				43			10"	432	10'-5"
		10'			43				60				43		#6	12"	360	11'-5"
		11'			43				66				43			11"	396	12'-5"
		12'			43				72				43			10"	432	13'-5"
	3 @ 11'	6'			46				36				46		#4	12"	360	7'-7"
		7'			46				42				46			11"	396	8'-7"
		8'			46				48				46		#5	12"	360	9'-7"
		9'			46				54				46			10"	432	10'-7"
		10'			46				60				46		#6	12"	360	11'-7"
		11'			46				66				46			11"	396	12'-7"
		12'			46				72				46			9"	480	13'-7"
	3 @ 12'	6'			49				36				49		#4	12"	360	7'-8"
		7'			49				42				49				360	8'-8"
		8'			49				48				49		#5	12"	360	9'-8"
		9'			49				54				49			10"	432	10'-8"
		10'			49				60				49		#6	12"	360	11'-8"
		11'			49				66				49			11"	396	12'-8"
		12'			49				72				49			9"	480	13'-8"

"k1" bars ▼: STRAIGHT - In Bottom of Headwalls (3 of Each Length per Headwall). "k2" bars ▼: STRAIGHT - In Top of Headwalls and Aprons (2 Rows Each).

D	S	H	k1 SIZE	k1 NO. REQ'D	k1 LENGTH MAX.	k1 LENGTH MIN.	k2 SIZE	k2 NO. REQ'D	k2 LENGTH
5'-0" TO 10'-0" MAXIMUM	3 @ 9'	5'		6	34'-0"	—		8	35'-2"
		6'		6	34'-3"	—		8	35'-5"
		7'		6	"	—		8	"
		8'	#6	6	34'-4"	—	#6	8	35'-6"
		9'		6	34'-9"	—		8	35'-11"
		10'		6	35'-1"	—		8	36'-3"
		11'		6	35'-4"	—		8	36'-6"
	3 @ 10'	5'	⊠	12	26'-3"	13'-2"	⌖	16	20'-4"
		6'		12	26'-6"	13'-3"		16	20'-6"
		7'		12	"	"		16	"
		8'	#6	12	26'-6"	13'-4"	#6	16	20'-6"
		9'		12	26'-9"	13'-5"		16	20'-8"
		10'		12	27'-1"	13'-6"		16	20'-10"
		11'		12	27'-2"	13'-7"		16	21'-0"
		12'		12	27'-4"	13'-8"		16	21'-1"
	3 @ 11'	6'	⊠	12	29'-4"	14'-6"	⌖	16	22'-5"
		7'		12	"	"		16	"
		8'		12	"	"		16	"
		9'	#7	12	29'-4"	14'-8"	#7	16	22'-7"
		10'		12	29'-8"	14'-9"		16	22'-10"
		11'		12	29'-9"	14'-10"		16	22'-11"
		12'		12	29'-10"	14'-11"		16	23'-0"
	3 @ 12'	6'	⊠	12	31'-5"	15'-8"	⌖	16	24'-2"
		7'		12	"	"		16	"
		8'		12	"	"		16	"
		9'	#7	12	31'-8"	15'-10"	#7	16	24'-4"
		10'		12	31'-11"	15'-11"		16	24'-7"
		11'		12	32'-1"	16'-0"		16	24'-8"
		12'		12	32'-2"	16'-1"		16	24'-9"

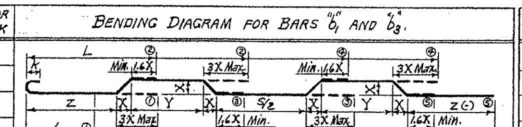
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



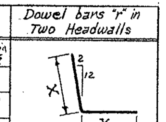
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3".



SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
9'	#4	12½	70	2'-11"	1'-5½"
10'	#4	12½	76	3'-0"	1'-6"
11'	#4	12½	84	3'-2"	1'-7"
12'	#4	12½	92	3'-4"	1'-8"

Dowel bars "r" in Two Headwalls



▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.
⊠ These bars to be spliced at alt. division walls (2'-0" & 2'-4" lap).
⌖ The k2 bars are to be spliced at center of center span.

NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars. ①①-⑤⑤ Min. & Max. lengths "L" for bars "b1" & "b3" for each type bend.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW ~ SECTIONS "A" ONLY

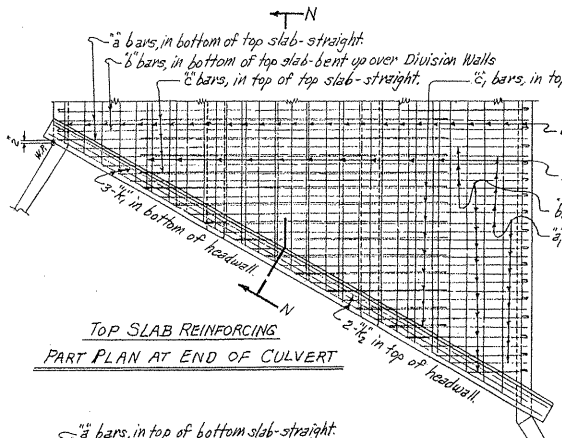
9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — COVER 10'-0" MAX.

STANDARD DRAWING No. R-330X-3

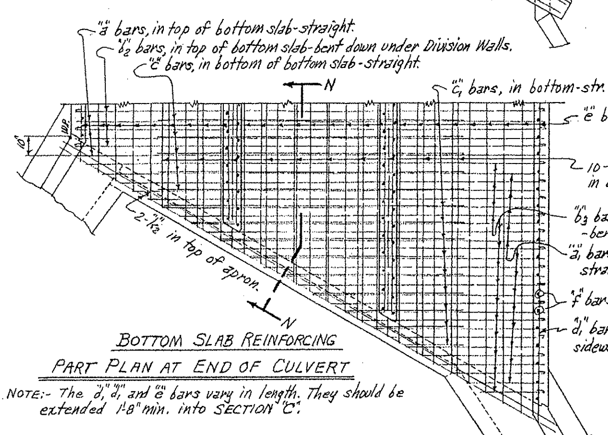
Designed by:- W.C.H. 9-17-62. Checked by:- R.H.S. 11-12-62.
Drawn by:- W.C.H. 9-18-64 Checked by:-
Quantities by:- W.C.H. 9-28-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing Nos W-X302-1 or W-X302-2. Also W-X30.

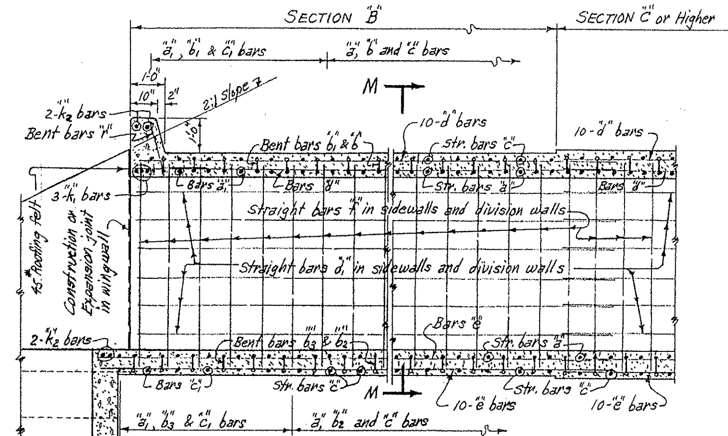


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

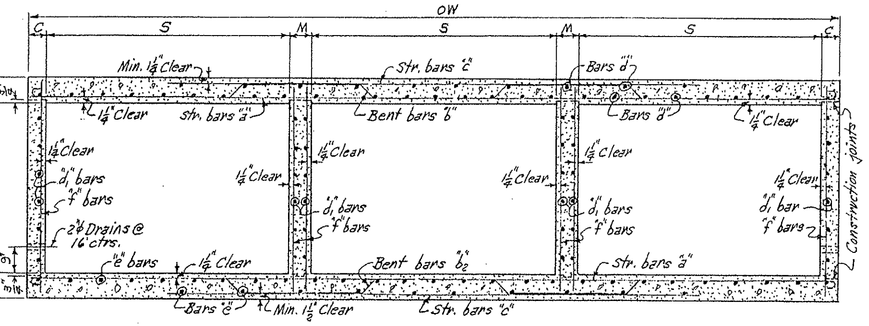


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

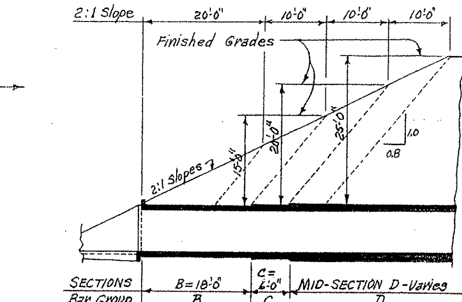
NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-8" min. into SECTION "C".



SECTION N-N



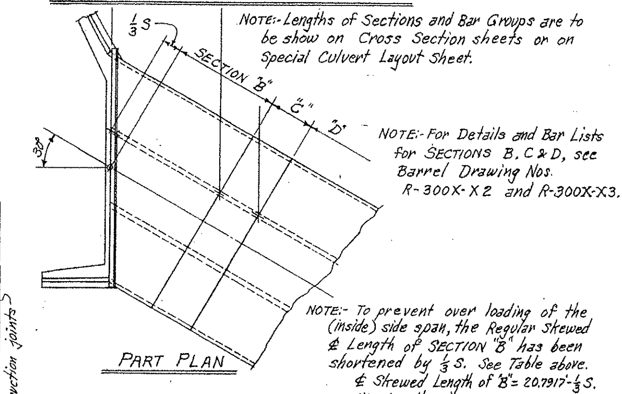
TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

These lengths are perpendicular to ℄ of roadway, near ℄ of Division Wall on Long side. See Table of Skewed Lengths above.

NOTE:- Lengths of Sections and Bar Groups are to be show on Cross Section sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B, C & D, see Barrel Drawing Nos. R-300X-X2 and R-300X-X3.

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ℄ Length of SECTION "B" has been shortened by ⅓ S. See Table above.
℄ Skewed Length of "B" = 20.7917 - ⅓ S.
Min. Length = 0.288675 OW + 2".

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS: B	C		B	C	MID-SECTION AND BAR GROUP
10.0' to 14.5'	B		OR ALT.	B		B
15.0' to 19.5'	B			B		C
20.0' to 25.0'	B	C		B	D	D

℄ L'GTH OF SECT'S ON 30° SKEW

SLOPE		2:1	
SECTIONS		B	C
SPANS	9'	17'-9½"	6'-11"
	10'	17'-5½"	6'-11"
	11'	17'-1½"	6'-11"
	12'	16'-9½"	6'-11"

BARREL DIMENSIONS - SECTION "B" ONLY / * TOTAL QUANTITIES - ONE SECTION "B", & UNIT QUANTITIES

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONCRETE: TOTAL FOR SECTION "B" BARREL ONLY CU. YD.	PER LIN. FT. OF BARREL SECTIONS B CU. YD.	C CU. YD.	D CU. YD.	REINFORCING STEEL: TOTAL FOR SECTION "B" BARREL APRON & HEADWALL LB.	PER LIN. FT. OF BARREL SECTIONS B LB.	C LB.	D LB.	ADDITIONAL PER LAP LB.
SECTION "B" - 15'-0" MAXIMUM	3 @ 9'	5'	135	29'-8"	10¼"	7"	9"	10¾"	6'-9"	34'-3⅛"	35'-5"	43.00	2.417	2.696	2.829	7496	385.72	426.98	455.22	91.85
		6'	162	29'-11"		7½"	10"		7'-9"	34'-6½"	35'-8½"	46.03	2.587	2.818	3.028	7656	396.11	437.70	469.70	96.86
		7'	189	29'-11"		7½"	10"		8'-9"	"	"	47.95	2.695	2.954	3.167	8150	423.25	470.78	500.45	101.87
		8'	216	30'-0"		8"	10"		9'-9"	34'-7¾"	35'-9½"	50.41	2.833	3.096	3.328	8830	460.23	503.36	541.85	106.88
		9'	243	30'-4"		9"	11"		10'-9"	35'-0⅞"	36'-2¼"	54.75	3.077	3.328	3.567	9349	484.78	538.32	585.32	111.89
		10'	270	30'-8"		10"	12"		11'-9"	35'-4⅞"	36'-6¾"	59.53	3.346	3.601	3.846	9905	512.85	586.40	634.23	116.90
		11'	297	30'-10"		11"	12"		12'-9"	35'-7¼"	36'-9"	63.34	3.560	3.738	4.069	10,496	546.89	621.99	675.30	121.91
	3 @ 10'	5'	150	32'-8"	11¼"	7"	9"	11¾"	6'-11"	37'-8⅞"	38'-10½"	49.11	2.813	3.065	3.340	8297	430.73	490.77	528.19	96.86
		6'	180	32'-11"		7½"	10"		7'-11"	38'-0⅞"	39'-2"	52.11	2.985	3.264	3.519	8513	441.21	503.08	539.38	101.87
		7'	210	32'-11"		7½"	10"		8'-11"	"	"	54.00	3.093	3.375	3.658	9013	468.72	530.97	573.68	106.88
		8'	240	33'-0"		8"	10"		9'-11"	38'-1¼"	39'-3"	56.42	3.231	3.517	3.820	9521	499.70	568.96	607.57	111.89
		9'	270	33'-4"		9"	11"		10'-11"	38'-5⅞"	39'-7¾"	60.71	3.477	3.769	4.079	10,026	522.18	605.06	644.43	116.90
		10'	300	33'-8"		10"	12"		11'-11"	38'-10⅞"	40'-0⅞"	65.43	3.748	4.026	4.363	10,658	559.23	640.31	694.10	121.91
		11'	330	33'-10"		11"	12"		12'-11"	39'-0¾"	40'-2¾"	69.20	3.963	4.225	4.568	10,983	590.37	688.98	751.41	126.92
		12'	360	34'-0"		12"	12"		13'-11"	39'-3⅛"	40'-5"	73.17	4.191	4.454	4.782	11,670	628.01	731.61	801.57	131.93
	3 @ 11'	6'	198	36'-0"	12"	8"	10"	12¾"	8'-0¾"	41'-6⅞"	42'-8¾"	58.51	3.417	3.722	4.000	10,328	545.28	585.64	642.61	106.88
		7'	231	36'-0"		8"	10"		9'-0¾"	"	"	60.41	3.528	3.833	4.155	10,810	573.17	613.90	669.46	111.89
		8'	264	36'-0"		8"	10"		10'-0¾"	"	"	62.32	3.629	3.992	4.319	11,452	610.52	652.64	709.38	116.90
		9'	297	36'-4"		9"	11"		11'-0¾"	41'-11½"	43'-1¼"	66.56	3.887	4.230	4.582	11,978	636.03	678.43	735.96	121.91
		10'	330	36'-8"		10"	12"		12'-0¾"	42'-4⅞"	43'-6"	71.22	4.159	4.489	4.850	12,597	679.34	724.85	783.32	126.92
		11'	363	36'-10"		11"	12"		13'-0¾"	42'-1⅜"	43'-8¼"	74.93	4.375	4.709	5.076	13,252	714.21	774.49	833.73	131.93
		12'	396	37'-0"		12"	12"		14'-0¾"	42'-8⅞"	43'-10¼"	78.85	4.604	4.918	5.293	13,959	751.47	817.41	906.31	136.94
	3 @ 12'	6'	216	39'-0"	13"	8"	10"	13½"	8'-2½"	45'-0⅜"	46'-2¼"	64.76	3.856	4.218	4.579	11,473	622.65	677.02	733.92	111.89
		7'	252	39'-0"		8"	10"		9'-2½"	"	"	66.62	3.968	4.329	4.735	11,830	642.57	710.88	769.34	116.90
		8'	288	39'-0"		8"	10"		10'-2½"	"	"	68.49	4.079	4.488	4.900	12,601	638.30	745.16	809.65	121.91
		9'	324	39'-4"		9"	11"		11'-2½"	45'-5"	46'-7"	72.68	4.328	4.728	5.165	13,137	714.12	782.14	842.91	126.92
		10'	360	39'-8"		10"	12"		12'-2½"	45'-9⅝"	46'-11½"	77.28	4.602	4.939	5.435	13,936	757.69	832.09	893.38	131.93
		11'	396	39'-10"		11"	12"		13'-2½"	46'-0"	47'-1¾"	80.93	4.820	5.209	5.663	14,596	792.68	868.67	952.37	136.94
		12'	432	40'-0"		12"	12"		14'-2½"	46'-2¼"	47'-4"	84.79	5.049	5.442	5.904	15,121	830.04	941.08	1003.92	141.95

* For remainder of quantities see Standard Wing and Barrel Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.
For each lap of longitudinal bars for SECTIONS "D", add 6.88# for 11'-0" Spans and 5.01# for 12'-0" Spans to quantity shown above.

BAR LIST FOR BARREL SECTION "B" ON 30° SKEW - ONE END ONLY.

SECTION "B" AND BAR GROUP "B". Lengths vary with Clear Span S, see Table at Upper Right. Depth of Cover D: 10'-0" TO 15'-0" MAXIMUM.

"a" bars - STRAIGHT - In Top and Bottom Slab of Barrel. "a1" bars - STRAIGHT - In Top and Bottom Slab of Barrel (Two of Each Length).

S	H	"a" SIZE	SPACING	No. REQ'D	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
3 @ 9'	5'	#6	11"	21	29'-5"	#6	11"	34	27'-10"	2'-6"
	6'			21	29'-8"			34	28'-1"	2'-9"
	7'			21	29'-8"			34	"	"
	8'			21	29'-9"			34	28'-2"	2'-10"
	9'			21	30'-1"			34	28'-6"	3'-2"
	10'			21	30'-5"			34	28'-10"	3'-6"
	11'			21	30'-7"			34	29'-0"	3'-8"
3 @ 10'	5'	#6	12"	17	32'-5"	#6	13"	32	30'-6"	2'-5"
	6'			17	32'-8"			32	30'-9"	2'-8"
	7'			17	32'-8"			32	"	"
	8'			17	32'-9"			32	30'-10"	2'-9"
	9'			17	33'-1"			32	31'-2"	3'-1"
	10'			17	33'-5"			32	31'-6"	3'-5"
	11'			15	33'-7"			32	31'-8"	3'-7"
	12'			15	33'-9"			32	31'-10"	3'-9"
3 @ 11'	6'	#7	12"	15	35'-9"	#7	12"	38	34'-0"	2'-6"
	7'			15	35'-9"			38	"	"
	8'			15	35'-9"			38	"	"
	9'			15	36'-1"			38	34'-4"	2'-10"
	10'			15	36'-5"			38	34'-8"	3'-2"
	11'			15	36'-7"			38	34'-10"	3'-4"
	12'			15	36'-9"			38	35'-0"	3'-6"
3 @ 12'	6'	#7	12"	13	38'-9"	#7	12"	40	37'-0"	3'-9"
	7'			13	38'-9"			40	"	"
	8'			13	38'-9"			40	"	"
	9'			13	39'-1"			40	37'-4"	4'-1"
	10'			13	39'-5"			42	37'-8"	2'-8"
	11'			13	39'-7"			42	37'-10"	2'-10"
	12'			13	39'-9"			42	38'-0"	3'-0"

"b" bars - BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls-hooked. Alternate with "a" and "c" bars. "b1" bars - In Bottom of Top Slab-some bent up over Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	11"	10	31'-4"	0'-6¾"	4'-1½"	7'-2"	#6	11"	17	30'-0"	3'-9"	28'-7"	3'-2"
	6'			10	31'-7"	"	4'-2½"	7'-2½"			17	30'-3"	4'-0"	28'-10"	3'-5"
	7'			10	31'-7"	"	"	"			17	30'-3"	"	"	"
	8'			10	31'-8"	"	"	7'-3"			17	30'-4"	4'-1"	28'-11"	3'-6"
	9'			10	32'-0"	"	4'-3½"	7'-4"			17	30'-8"	4'-5"	29'-3"	3'-10"
	10'			10	32'-4"	"	4'-4½"	7'-5"			18	31'-0"	3'-2"	29'-7"	2'-7"
	11'			10	32'-6"	0'-6¾"	4'-4½"	7'-6"			18	31'-2"	3'-4"	29'-9"	2'-9"
3 @ 10'	5'	#7	13"	7	34'-7"	0'-7½"	4'-6"	7'-11"	#7	13"	16	33'-0"	4'-0"	31'-5"	3'-4"
	6'			7	34'-10"	"	4'-7"	7'-11½"			16	33'-3"	4'-3"	31'-8"	3'-7"
	7'			7	34'-10"	"	"	"			16	"	"	"	"
	8'			7	34'-11"	"	"	8'-0"			16	33'-4"	4'-4"	31'-9"	3'-8"
	9'			7	35'-3"	"	4'-8"	8'-1"			16	33'-8"	4'-8"	32'-1"	4'-0"
	10'			7	35'-7"	"	4'-9"	8'-2"			16	34'-0"	5'-0"	32'-5"	4'-4"
	11'			7	35'-9"	"	"	8'-3"			17	34'-2"	3'-3"	32'-7"	2'-7"
	12'			7	35'-11"	0'-7½"	4'-9"	8'-4"			17	34'-4"	3'-5"	32'-9"	2'-9"
3 @ 11'	6'	#7	12"	7	38'-1"	0'-8¾"	4'-11½"	8'-9"	#7	12"	19	36'-7"	4'-0"	34'-10"	3'-4"
	7'			7	38'-1"	"	"	"			19	"	"	"	"
	8'			7	38'-1"	"	"	"			19	"	"	"	"
	9'			7	38'-5"	"	5'-0½"	8'-10"			19	36'-11"	4'-4"	35'-2"	3'-8"
	10'			6	38'-9"	"	5'-1½"	8'-11"			19	37'-3"	4'-8"	35'-6"	4'-0"
	11'			6	38'-11"	"	"	9'-0"			19	37'-5"	4'-10"	35'-8"	4'-2"
	12'			6	39'-1"	0'-8¾"	5'-1½"	9'-1"			20	37'-7"	3'-3"	35'-10"	2'-7"
3 @ 12'	6'	#7	12"	5	41'-2"	0'-9¼"	5'-3½"	9'-6"	#7	12"	21	39'-8"	3'-6"	37'-10"	2'-10"
	7'			5	41'-2"	"	"	"			21	"	"	"	"
	8'			5	41'-2"	"	"	"			21	"	"	"	"
	9'			5	41'-6"	"	5'-4½"	9'-7"			21	40'-0"	3'-10"	38'-2"	3'-2"
	10'			5	41'-10"	"	5'-5½"	9'-8"			21	40'-4"	4'-2"	38'-6"	3'-6"
	11'			5	42'-0"	"	"	9'-9"			21	40'-6"	4'-4"	38'-8"	3'-8"
	12'			5	42'-2"	0'-9¼"	5'-5½"	9'-10"			21	40'-8"	4'-6"	38'-10"	3'-10"

"b2" bars - BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls-hooked. Alternate with "a" and "c" bars. "b3" bars - In Top of Bottom Slab-some bent down under Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 9'	5'	#6	11"	11	31'-5"	0'-7¼"	4'-0½"	7'-2"	#6	11"	17	30'-1"	3'-9"	28'-7"	3'-2"
	6'			11	31'-8"	"	4'-1½"	7'-2½"			17	30'-4"	4'-0"	28'-10"	3'-5"
	7'			11	31'-8"	"	"	"			17	30'-4"	"	"	"
	8'			11	31'-9"	"	"	7'-3"			17	30'-5"	4'-1"	28'-11"	3'-6"
	9'			11	32'-1"	"	4'-2½"	7'-4"			17	30'-9"	4'-5"	29'-3"	3'-10"
	10'			11	32'-5"	"	4'-3½"	7'-5"			18	31'-1"	3'-2"	29'-7"	2'-7"
	11'			11	32'-7"	0'-7¼"	4'-3½"	7'-6"			18	31'-3"	3'-4"	29'-9"	2'-9"
3 @ 10'	5'	#7	13"	8	34'-8"	0'-8"	4'-5"	7'-11"	#7	13"	16	33'-1"	4'-0"	31'-5"	3'-4"
	6'			8	34'-11"	"	4'-6"	7'-11½"			16	33'-4"	4'-3"	31'-8"	3'-7"
	7'			8	34'-11"	"	"	"			16	"	"	"	"
	8'			8	35'-0"	"	"	8'-0"			16	33'-5"	4'-4"	31'-9"	3'-8"
	9'			8	35'-4"	"	4'-7"	8'-1"			16	33'-9"	4'-8"	32'-1"	4'-0"
	10'			8	35'-8"	"	4'-8"	8'-2"			16	34'-1"	5'-0"	32'-5"	4'-4"
	11'			8	35'-10"	"	"	8'-3"			17	34'-3"	3'-3"	32'-7"	2'-7"
	12'			8	36'-0"	0'-8"	4'-8"	8'-4"			17	34'-5"	3'-5"	32'-9"	2'-9"
3 @ 11'	6'	#7	12"	8	38'-2"	0'-9"	4'-10"	8'-9"	#7	12"	19	36'-8"	4'-0"	34'-10"	3'-4"
	7'			8	38'-2"	"	"	"			19	"	"	"	"
	8'			8	38'-2"	"	"	"			19	"	"	"	"
	9'			8	38'-6"	"	4'-11"	8'-10"			19	37'-0"	4'-4"	35'-2"	3'-8"
	10'			7	38'-10"	"	5'-0"	8'-11"			19	37'-4"	4'-8"	35'-6"	4'-0"
	11'			7	39'-0"	"	"	9'-0"			19	37'-6"	4'-10"	35'-8"	4'-2"
	12'			7	39'-2"	0'-9"	5'-0"	9'-1"			20	37'-8"	3'-3"	35'-10"	2'-7"
3 @ 12'	6'	#7	12"	6	41'-3"	0'-9¾"	5'-2½"	9'-6"	#7	12"	21	39'-9"	3'-6"	37'-10"	2'-10"
	7'			6	41'-3"	"	"	"			21	"	"	"	"
	8'			6	41'-3"	"	"	"			21	"	"	"	"
	9'			6	41'-7"	"	5'-3½"	9'-7"			21	40'-1"	3'-10"	38'-2"	3'-2"
	10'			6	41'-11"	"	5'-4½"	9'-8"			21	40'-5"	4'-2"	38'-6"	3'-6"
	11'			6	42'-1"	"	"	9'-9"			21	40'-7"	4'-4"	38'-8"	3'-8"
	12'			6	42'-3"	0'-9¾"	5'-4½"	9'-10"			21	40'-9"	4'-6"	38'-10"	3'-10"

"c" bars - STRAIGHT - In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars - In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of Each Length). "d" bars - STRAIGHT - Longitudinal in Top Slab of Barrel. "d1" bars - Longitudinal in Sidewalls and Division Walls. "e" bars - Longitudinal in Bottom Slab of Barrel.

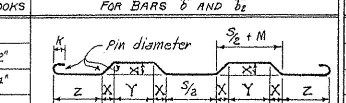
S	H	"c" SIZE	SPACING	No. REQ'D	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	"d" SIZE	SPACING	No. REQ'D	LENGTH	"d1" SIZE	SPACING	No. REQ'D	LENGTH	"e" SIZE	SPACING	No. REQ'D	LENGTH
3 @ 9'	5'	#7	11"	27	19'-6"	#7	11"	20	18'-2"	3'-11"	#4	12"	40	19'-5" Ave.	#4	12"	30	19'-5" Ave.	#4	12"	40	20'-7" Ave.
	6'			27	19'-8"			20	18'-4"	4'-1"			40				36				40	
	7'			27	19'-8"			20	"	"			40				42				40	
	8'			27	19'-8"			20	18'-5"	4'-2"			40				48				40	
	9'			27	19'-10"			22	18'-8"	2'-10"			40				54				40	
	10'			27	20'-0"			22	18'-11"	3'-1"			40				60				40	
	11'			27	20'-0"			22	19'-0"	3'-2"			40				66				40	
3 @ 10'	5'	#8	13"	23	21'-6"	#8	13"	20	19'-5"	2'-7"	#4	12"	43	19'-1" Ave.	#4	12"	30	19'-1" Ave.	#4	12"	43	20'-3" Ave.
	6'			23	21'-8"			20	19'-8"	2'-9"			43				36				43	
	7'			23	21'-8"			20	"	"			43				42				43	
	8'			23	21'-8"			20	19'-8"	2'-10"			43				48				43	
	9'			23	21'-10"			20	19'-11"	3'-1"			43				54				43	
	10'			23	22'-0"			20	20'-2"	3'-4"			43				60				43	
	11'			21	22'-0"			20	20'-3"	3'-5"			43				66				43	
	12'			21	22'-0"			20	20'-4"	3'-6"			43				72				43	
3 @ 11'	6'	#8	12"	21	23'-8"	#8	12"	24	22'-9"	3'-6"	#4	12"	46	18'-9" Ave.	#4	12"	36	18'-9" Ave.	#4	12"	46	19'-11" Ave.
	7'			21	23'-8"			24	"	"			46				42				46	
	8'			21	23'-8"			24	"	"			46				48				46	
	9'			21	23'-10"			24	23'-0"	3'-9"			46				54				46	
	10'			21	24'-0"			24	23'-3"	4'-0"			46				60				46	
	11'			21	24'-0"			24	23'-4"	4'-1"			46				66				46	
	12'			21	24'-0"			24	23'-5"	4'-2"			46				72				46	
3 @ 12'	6'	#9	12"	19	25'-8"	#9	12"	28	25'-3"	2'-6"	#4	12"	49	18'-5" Ave.	#4	12"	36	18'-5" Ave.	#4	12"	49	19'-7" Ave.
	7'			19	25'-8"			28	"	"			49				42				49	
	8'			19	25'-8"			28	"	"			49				48				49	
	9'			19	25'-10"			28	25'-6"	2'-9"			49				54				49	
	10'			19	26'-0"			28	25'-9"	3'-0"			49				60				49	
	11'			19	26'-0"			28	25'-10"	3'-1"			49				66				49	
	12'			19	26'-0"			28	25'-11"	3'-2"			49				72				49	

"f" bars - STRAIGHT - Verticals in Sidewalls and Division Walls. "k1" bars - STRAIGHT - In Bottom of Headwall (3 of Each Length per Headwall). "k2" bars - In Top of Headwalls and Aprons (2 Rows Each).

S	H	"f" SIZE	SPACING	No. REQ'D	LENGTH	"k1" SIZE	No. REQ'D	LENGTH MAX.	LENGTH MIN.	"k2" SIZE	No. REQ'D	LENGTH
3 @ 9'	5'	#4	12"	108	6'-6"	#6	3	34'-0"	—	#6	4	35'-2"
	6'			108	7'-6"		3	34'-3"	—		4	35'-5"
	7'	#5	12"	108	8'-6"		3	"	—		4	"
	8'		12"	108	9'-6"		3	34'-4"	—		4	35'-6"
	9'	#6	11"	120	10'-6"		3	34'-9"	—		4	35'-11"
	10'		10"	132	11'-6"		3	35'-1"	—		4	36'-3"
	11'	#7	12"	108	12'-6"		3	35'-4"	—		4	36'-6"
3 @ 10'	5'	#4	12"	108	6'-8"	#6	6	26'-3"	13'-2"	#6	8	20'-4"
	6'			108	7'-8"		6	26'-6"	13'-3"		8	20'-6"
	7'	#5	12"	108	8'-8"		6	"	"		8	"
	8'		9"	138	9'-8"		6	26'-6"	13'-4"		8	20'-6"
	9'		12"	108	10'-8"		6	26'-9"	13'-5"		8	20'-8"
	10'	#6	10"	126	11'-8"		6	27'-1"	13'-6"		8	20'-10"
	11'		9"	138	12'-8"		6	27'-2"	13'-7"		8	21'-0"
	12'		8"	156	13'-8"		6	27'-4"	13'-8"		8	21'-1"
3 @ 11'	6'	#4	12"	102	7'-10"	#7	6	29'-1"	14'-6"	#7	8	22'-5"
	7'	#5	12"	102	8'-10"		6	"	"		8	"
	8'		12"	102	9'-10"		6	"	"		8	"
	9'	#6	11"	114	10'-10"		6	29'-4"	14'-8"		8	22'-7"
	10'		9"	138	11'-10"		6	29'-8"	14'-9"		8	22'-10"
	11'	#7	11"	114	12'-10"		6	29'-9"	14'-10"		8	22'-11"
	12'		10"	126	13'-10"		6	29'-10"	14'-11"		8	23'-0"
3 @ 12'	6'	#4	12"	102	7'-11"	#7	6	31'-5"	15'-8"	#7	8	24'-2"
	7'		9"	138	8'-11"		6	"	"		8	"
	8'		12"	108	9'-11"		6	"	"		8	"
	9'	#6	11"	114	10'-11"		6	31'-8"	15'-10"		8	24'-9"
	10'		9"	138	11'-11"		6	31'-11"	15'-11"		8	24'-7"
	11'	#7	11"	114	12'-11"		6	32'-1"	16'-0"		8	24'-8"
	12'		10"	120	13'-11"		6	32'-2"	16'-1"		8	24'-9"

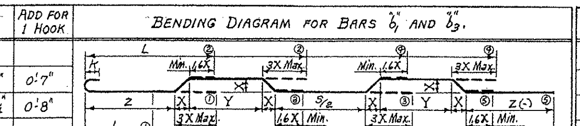
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



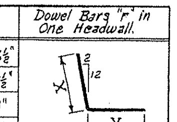
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3".



SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#4	12"±	35	3'-1"	1'-6½"
10'	#4	12"±	38	3'-3"	1'-7½"
11'	#4	12"±	42	3'-4"	1'-8"
12'	#4	12"±	46	3'-6"	1'-9"

Dowel Bars "r" in One Headwall.



◤ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-1" for 13" spacing, 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊠ These bars to be spliced at alternate division walls. (Lap 2'-8" & 3'-0").
⊕ Splice "k2" bars at center of center span.

NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars. ①②...⑤⑥ Min. & Max. lengths "L" for bars "b1" & "b3" for each type bend.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2. Also W-X30.

For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2. Also W-X30.

For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW - SECTIONS "B" ONLY

9', 10', 11', AND 12' SPANS
TRIPLES

ONLY 2:1 SLOPES
OVER 10'-0" COVER

STANDARD DRAWING No. R-3302-1

Designed by:- W.C.H. 9-17-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 9-22-64 Checked by:-
Quantities by:- W.C.H. 9-28-64 Checked by:-

Fed. Road No.	State	Fed. Aid Project	Fiscal Year	Sheet No.	Total Sheets
6	ARK.				
Job No.					

Bar List for Barrel Section 60'-0" in Length - Two 30° Skewed Ends

"a" bars – Straight – In top and bottom slab of barrel. "a1" bars – Straight – In top and bottom slab of barrel – (Four of each length). "b" bars – Bent – See diagrams below – In bottom of top slab, bent up over Division Walls – hooked. Alternate with "a" and "c" bars. "b1" bars – In bottom of top slab – some bent up over Division Walls – one end hooked (2 of each length). Alternate with "a1" and "c" or "c1" bars. "b2" bars – Bent – See diagrams below – In top of bottom slab bent down under Division Walls – hooked. Alternate with "a" and "c" bars. "b3" bars – In top of bottom slab – some bent down under Division Walls – one end hooked (2 of each length). Alternate with "a1" and "c" or "c1" bars. "c" bars – Straight – In top and bottom slab of barrel. Alternate with "b" and "b2" bars. "c1" bars – In top and bottom slab of barrel. Alt. with "b1" & "b3" bars (Four of each length). "d" bars – Straight – Longitudinal in top slab of barrel. "d1" bars – Longitudinal in sidewalls and Division Walls. "e" bars – Longitudinal in bottom slab of barrel. "f" bars – Straight – Verticals in sidewalls and Division Walls. "k1" bars – Straight – In bottom of headwalls. "k2" bars – In top of headwalls and aprons (2 each) ⊠.

D	S	H	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.	"b" Size	"b" Spacing	"b" No. Req'd	"b" Length	"b" X	"b" Y	"b" Z
0'-0" to 5'-0" Maximum	4 @ 4'	2'	#5	12"	102	18'-9"	#5	12"	36	17'-0"	3'-0"	#5	12"	49	20'-2"	0'-3"	2'-2"	3'-4¾"
		3'			102	18'-9"			36	"	"			49	20'-2"	"	"	"
		4'			102	18'-9"			36	"	"			49	20'-2"	"	"	"
		5'			102	18'-9"			36	"	"			49	20'-2"	"	"	"
		6'			102	19'-2"			36	17'-5"	3'-5"			48	20'-7"	0'-3"	2'-3"	3'-5¼"
	4 @ 5'	3'	#6	12"	98	22'-9"	#6	12"	44	21'-0"	3'-6"	#5	12"	46	24'-3"	0'-3½"	2'-7"	4'-1¼"
		4'			98	22'-9"			44	"	"			46	24'-3"	"	"	"
		5'			98	22'-9"			44	"	"			46	24'-3"	"	"	"
		6'			98	23'-2"			44	21'-5"	3'-11"			46	24'-8"	"	2'-8"	4'-2¼"
		7'			96	23'-6"			48	21'-9"	2'-6"			46	25'-0"	0'-3½"	2'-9"	4'-2¾"
	4 @ 6'	3'	#6	11"	100	26'-9"	#6	11"	60	25'-2"	3'-0"	#5	11"	48	28'-4"	0'-4"	3'-0"	4'-10¾"
		4'			100	26'-9"			60	"	"			48	28'-4"	"	"	"
		5'			100	26'-9"			60	"	"			48	28'-4"	"	"	"
		6'			100	27'-2"			60	25'-7"	3'-5"			48	28'-9"	"	3'-1"	4'-11¼"
		7'			100	27'-6"			60	25'-11"	3'-9"			47	29'-1"	"	3'-2"	4'-11¾"
		8'			100	27'-7"			60	26'-0"	3'-10"			47	29'-2"	0'-4"	3'-2"	5'-0¼"
	4 @ 7'	4'	#6	12"	88	30'-9"	#6	12"	64	29'-0"	2'-9"	#6	12"	42	32'-8"	0'-4½"	3'-5"	5'-7"
		5'			88	30'-9"			64	"	"			42	32'-8"	"	3'-5"	5'-7"
		6'			88	31'-2"			64	29'-5"	3'-2"			41	33'-1"	"	3'-6"	5'-8"
		7'			88	31'-6"			64	29'-9"	3'-6"			41	33'-5"	"	3'-7"	5'-8½"
		8'			88	31'-7"			64	29'-10"	3'-7"			41	33'-6"	"	3'-7"	5'-9"
		9'			86	32'-0"			64	30'-3"	4'-0"			41	33'-11"	0'-4½"	3'-8"	5'-10"
	4 @ 8'	4'	#6	11"	90	34'-9"	#6	11"	80	33'-2"	3'-1"	#6	11"	43	36'-9"	0'-5"	3'-10"	6'-4"
		5'			90	35'-2"			80	33'-7"	3'-6"			43	37'-2"	"	3'-11"	6'-5"
		6'			90	35'-2"			80	"	"			43	37'-2"	"	"	6'-5"
		7'			90	35'-6"			80	33'-11"	3'-10"			43	37'-6"	"	4'-0"	6'-5½"
		8'			90	35'-7"			80	34'-0"	3'-11"			42	37'-7"	"	"	6'-6"
		9'			90	36'-0"			84	34'-5"	2'-9"			42	38'-0"	"	4'-1"	6'-7"
		10'			88	36'-5"			84	34'-10"	3'-2"			42	38'-5"	0'-5"	4'-2"	6'-8"

S	H	"b1" Size	"b1" Spacing	"b1" No. Req'd	"b1" Length Max.	"b1" Length Min.	"b1" L Max.	"b1" L Min.	"b2" Size	"b2" Spacing	"b2" No. Req'd	"b2" Length	"b2" X	"b2" Y	"b2" Z
4 @ 4'	2'	#5	12"	18	18'-10"	4'-4"	17'-10"	3'-10"	#5	12"	51	20'-1"	0'-2½"	2'-3"	3'-4¾"
	3'			18	"	"	"	"			51	20'-1"	"	"	"
	4'			18	"	"	"	"			51	20'-1"	"	"	"
	5'			18	"	"	"	"			51	20'-1"	"	"	"
	6'			20	19'-3"	3'-0"	18'-3"	2'-6"			50	20'-6"	0'-2½"	2'-4"	3'-5¼"
4 @ 5'	3'	#5	12"	24	22'-11"	3'-1"	21'-10"	2'-7"	#5	12"	48	24'-2"	0'-3"	2'-8"	4'-1¼"
	4'			24	"	"	"	"			48	24'-2"	"	"	"
	5'			24	"	"	"	"			48	24'-2"	"	"	"
	6'			24	23'-4"	3'-6"	22'-3"	3'-0"			48	24'-7"	"	2'-9"	4'-2¼"
	7'			24	23'-8"	3'-10"	22'-7"	3'-4"			48	24'-11"	0'-3"	2'-10"	4'-2¾"
4 @ 6'	3'	#5	11"	30	27'-1"	4'-3"	25'-11"	3'-9"	#5	11"	50	28'-3"	0'-3½"	3'-1"	4'-10¾"
	4'			30	"	"	"	"			50	28'-3"	"	"	"
	5'			30	"	"	"	"			50	28'-3"	"	"	"
	6'			32	27'-6"	3'-1"	26'-4"	2'-7"			50	28'-8"	"	3'-2"	4'-11¼"
	7'			32	27'-10"	3'-5"	26'-8"	2'-11"			49	29'-0"	"	3'-3"	4'-11¾"
	8'			32	27'-11"	3'-6"	26'-9"	3'-0"			49	29'-1"	0'-3½"	3'-3"	5'-0¼"
4 @ 7'	4'	#6	12"	32	30'-3"	4'-2"	29'-10"	3'-7"	#6	12"	44	32'-7"	0'-4½"	3'-5⅝"	5'-7"
	5'			32	"	"	"	"			44	32'-7"	"	"	5'-7"
	6'			32	30'-8"	4'-7"	30'-3"	4'-0"			43	33'-0"	"	3'-6⅝"	5'-8"
	7'			34	31'-0"	3'-2"	30'-7"	2'-7"			43	33'-4"	"	3'-7⅛"	5'-8½"
	8'			34	31'-1"	3'-3"	30'-8"	2'-8"			43	33'-5"	"	"	5'-9"
	9'			34	31'-6"	3'-8"	31'-1"	3'-1"			43	33'-10"	0'-4½"	3'-8½"	5'-10"
4 @ 8'	4'	#6	11"	40	35'-5"	4'-5"	33'-11"	3'-10"	#6	11"	45	36'-9"	0'-5"	3'-10"	6'-4"
	5'			42	35'-10"	3'-3"	34'-4"	2'-8"			45	37'-2"	"	3'-11"	6'-5"
	6'			42	"	"	"	"			45	37'-2"	"	"	6'-5"
	7'			42	36'-2"	3'-7"	34'-8"	3'-0"			45	37'-6"	"	4'-0"	6'-5½"
	8'			42	36'-3"	3'-8"	34'-9"	3'-1"			44	37'-7"	"	"	6'-6"
	9'			42	36'-8"	4'-1"	35'-2"	3'-6"			44	38'-0"	"	4'-1"	6'-7"
	10'			42	37'-1"	4'-6"	35'-7"	3'-11"			44	38'-5"	0'-5"	4'-2"	6'-8"

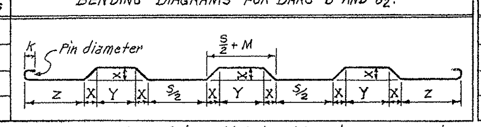
S	H	"b3" Size	"b3" Spacing	"b3" No. Req'd	"b3" Length Max.	"b3" Length Min.	"b3" L Max.	"b3" L Min.	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length	"c1" Size	"c1" Spacing	"c1" No. Req'd	"c1" Length Max.	"c1" Length Min.
4 @ 4'	2'	#5	12"	18	18'-9"	4'-4"	17'-10"	3'-10"	#5	12"	106	14'-0"	#5	12"	28	12'-11"	2'-5"
	3'			18	"	"	"	"			106	14'-0"			28	"	"
	4'			18	"	"	"	"			106	14'-0"			28	"	"
	5'			18	"	"	"	"			106	14'-0"			28	"	"
	6'			20	19'-2"	3'-0"	18'-3"	2'-6"			106	14'-3"			28	13'-3"	2'-9"
4 @ 5'	3'	#5	12"	24	22'-10"	3'-1"	21'-10"	2'-7"	#6	12"	102	17'-0"	#6	12"	36	16'-5"	2'-5"
	4'			24	"	"	"	"			102	17'-0"			36	"	"
	5'			24	"	"	"	"			102	17'-0"			36	"	"
	6'			24	23'-3"	3'-6"	22'-3"	3'-0"			102	17'-3"			36	16'-9"	2'-9"
	7'			24	23'-7"	3'-10"	22'-7"	3'-4"			100	17'-6"			36	17'-0"	3'-0"
4 @ 6'	3'	#5	11"	30	27'-0"	4'-3"	25'-11"	3'-9"	#6	11"	108	20'-0"	#6	11"	44	18'-6"	2'-8"
	4'			30	"	"	"	"			108	20'-0"			44	"	"
	5'			30	"	"	"	"			108	20'-0"			44	"	"
	6'			32	27'-5"	3'-1"	26'-4"	2'-7"			108	20'-3"			44	18'-10"	3'-0"
	7'			32	27'-9"	3'-5"	26'-8"	2'-11"			108	20'-6"			44	19'-1"	3'-3"
	8'			32	27'-10"	3'-6"	26'-9"	3'-0"			108	20'-6"			44	19'-2"	3'-4"
4 @ 7'	4'	#6	12"	32	30'-2"	4'-2"	29'-10"	3'-7"	#6	12"	96	23'-0"	#6	12"	44	21'-8"	4'-2"
	5'			32	"	"	"	"			96	23'-0"			44	"	"
	6'			32	30'-7"	4'-7"	30'-3"	4'-0"			96	23'-3"			48	22'-0"	2'-9"
	7'			34	30'-11"	3'-2"	30'-7"	2'-7"			96	23'-6"			48	22'-3"	3'-0"
	8'			34	31'-0"	3'-3"	30'-8"	2'-8"			96	23'-6"			48	22'-4"	3'-1"
	9'			34	31'-5"	3'-8"	31'-1"	3'-1"			94	23'-9"			48	22'-8"	3'-5"
4 @ 8'	4'	#6	11"	40	35'-5"	4'-5"	33'-11"	3'-10"	#6	11"	98	26'-0"	#6	11"	60	25'-6"	3'-4"
	5'			42	35'-10"	3'-3"	34'-4"	2'-8"			98	26'-3"			60	25'-10"	3'-8"
	6'			42	"	"	"	"			98	26'-3"			60	"	"
	7'			42	36'-2"	3'-7"	34'-8"	3'-0"			98	26'-6"			60	26'-1"	3'-11"
	8'			42	36'-3"	3'-8"	34'-9"	3'-1"			98	26'-6"			60	26'-2"	4'-0"
	9'			42	36'-8"	4'-1"	35'-2"	3'-6"			98	26'-9"			64	26'-6"	2'-9"
	10'			42	37'-1"	4'-6"	35'-7"	3'-11"			96	27'-0"			64	26'-10"	3'-1"

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d" Length	"d1" Size	"d1" Spacing	"d1" No. Req'd	"d1" Length	"e" Size	"e" Spacing	"e" No. Req'd	"e" Length	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length	"k2" Size	"k2" No. Req'd	"k2" Length
4 @ 4'	2'	#5	12"	30	2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap)	#4	12"	16	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	30	2 @ 31'-8" for 60'-0" Length Barrel (1'-3" Lap)	#4	12"	480	2'-10"	#5	6	21'-8"	#5	8	22'-10"
	3'			30				24				30				480	3'-10"		6	"		8	"
	4'			30				32				30				480	4'-10"		6	"		8	"
	5'			30				40				30				480	5'-10"		6	"		8	"
	6'			30				48				30				480	6'-10"		6	22'-2"		8	23'-4"
4 @ 5'	3'	#5	11½"	34		#4	12"	24		#4	12"	34		#4	12"	480	3'-11"	#6	6	26'-3"	#6	8	27'-5"
	4'			34				32				34				480	4'-11"		6	"		8	"
	5'			34				40				34				480	5'-11"		6	"		8	"
	6'			34				48				34				480	6'-11"		6	26'-9"		8	27'-11"
	7'			34				56				34				480	7'-11"		6	27'-2"		8	28'-4"
4 @ 6'	3'	#5	11½"	38		#4	12"	24		#4	12"	38		#4	12"	480	4'-0"	#6	6	30'-11"	#6	8	32'-1"
	4'			38				32				38				480	5'-0"		6	"		8	"
	5'			38				40				38				480	6'-0"		6	"		8	"
	6'			38				48				38				480	7'-0"		6	31'-4"		8	32'-6"
	7'			38				56				38				480	8'-0"		6	31'-9"		8	32'-11"
	8'			38				64				38			10"	576	9'-0"		6	31'-10"		8	33'-0"
4 @ 7'	4'	#5	11½"	44		#4	12"	32		#4	12"	42		#4	12"	480	5'-1"	#6	6	35'-6"	#6	8	36'-8"
	5'			44				40				42				480	6'-1"		6	"		8	"
	6'			44				48				42				480	7'-1"		6	36'-0"		8	37'-2"
	7'			44				56				42				480	8'-1"		6	36'-5"		8	37'-6"
	8'			44				64				42			10"	576	9'-1"		6	36'-6"		8	37'-8"
	9'			44				72				42		#5	12"	480	10'-1"		6	36'-11"		8	38'-1"
4 @ 8'	4'	#5	11½"	48		#4	12"	32		#4	12"	46		#4	12"	480	5'-2"	⊠ #6	12	21'-1"	⊠ #6	16	21'-8"
	5'			48				40				46				480	6'-2"		12	21'-4"		16	21'-11"
	6'			48				48				46				480	7'-2"		12	"		16	"
	7'			48				56				46				480	8'-2"		12	21'-6"		16	22'-1"
	8'			48				64				46			10"	576	9'-2"		12	21'-7"		16	22'-2"
	9'			48				72				46		#5	12"	480	10'-2"		12	21'-10"		16	22'-5"
	10'			48				80				46			11"	528	11'-2"		12	22'-1"		16	22'-8"

◤ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" and "b2" bars, use a set of "a" and "c" bars instead.
⊠ These bars are to be spliced at center Division Wall.

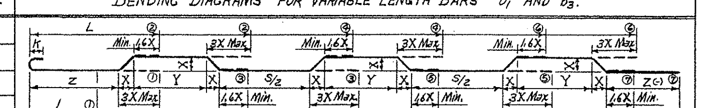
Bending Diagrams for Bars "b" and "b2".

Bar Size	Pin Diam.	K	Add for 2 Hooks
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"



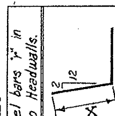
Bending Diagrams for Variable Length Bars "b1" and "b3".

Bar Size	Pin Diam.	K	Add for 1 Hook
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"



Note:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values of "b1" bars are same as for "b" bars, and for "b3" bars same as for "b2" bars.
①①--⑦⑦ Min. & Max. lengths L for bars "b1" & "b3" for each type bend.

Dowel Bars for Two Headwalls

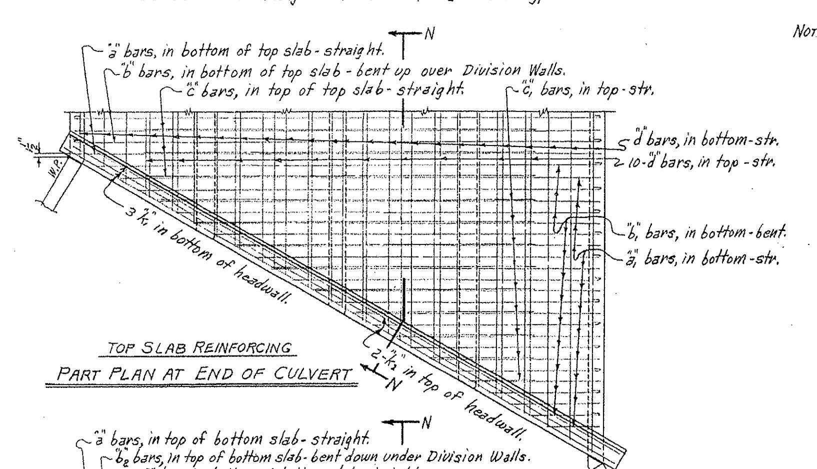


Span	Size	Spacing	No. Req'd	Length	X
4'	#4	12¼"	46	2'-5"	1'-2½"
5'	#4	12¼"	56	2'-6"	1'-3"
6'	#4	12¼"	64	2'-7"	1'-3½"
7'	#4	12¼"	74	2'-8"	1'-4"
8'	#4	12¼"	82	2'-9"	1'-4½"

Barrel Dimensions / * Quantities

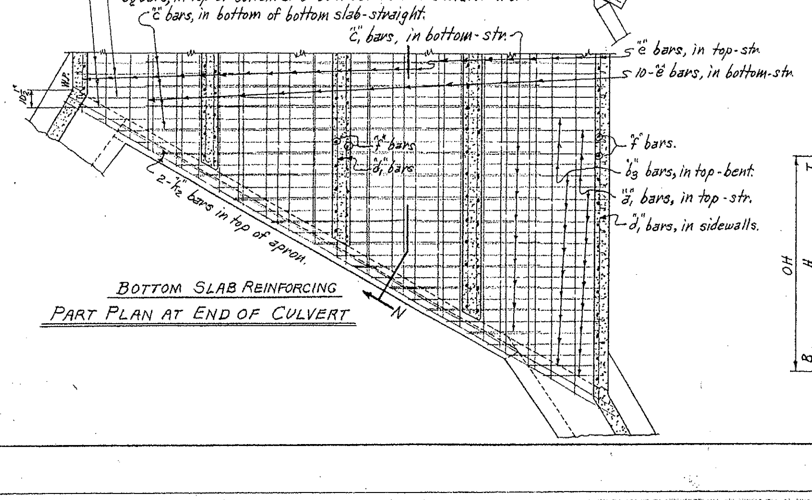
Max. Design Depth of Cover (D)	Clear Spans (S)	Clear Height (H)	Sq. Ft. Opening (A)	Overall Width (OW)	Thickness of Top Slab (T)	Thickness of Sidewalls (C)	Thickness of Division Wall (M)	Thickness of Bottom Slab (B)	Overall Height (OH)	Roadway Length (RL)	Length of Headwalls (K)	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel: Total for 60'-0" Length of Barrel (Lb.)	Per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)
5'-0"	4 @ 4'	2'	32	19'-0"	6½"	6"	8"	6"	3'-0½"	21'-11¼"	23'-1"	0.955	11,824	187.46	90.56
		3'	48	19'-0"		6"	8"		4'-0½"	"	"	1.066	12,471	198.14	97.24
		4'	64	19'-0"		6"	8"		5'-0½"	"	"	1.177	13,118	208.83	103.92
		5'	80	19'-0"		6"	8"		6'-0½"	"	"	1.289	13,764	219.52	110.60
		6'	96	19'-5"		7"	9"		7'-0½"	22'-5"	23'-7"	1.508	14,586	232.47	117.28
	4 @ 5'	3'	60	23'-0"	7"	6"	8"	6½"	4'-1½"	26'-6¾"	27'-8½"	1.292	16,802	265.05	107.53
		4'	80	23'-0"		6"	8"		5'-1½"	"	"	1.403	17,449	275.73	114.21
		5'	100	23'-0"		6"	8"		6'-1½"	"	"	1.514	18,095	286.42	120.89
		6'	120	23'-5"		7"	9"		7'-1½"	27'-0½"	28'-2¼"	1.735	18,959	299.98	127.57
		7'	140	23'-9"		7½"	10"		8'-1½"	27'-5¼"	28'-7"	1.962	19,679	313.12	134.25
	4 @ 6'	3'	72	27'-0"	7½"	6"	8"	7"	4'-2½"	31'-2⅛"	32'-4"	1.542	20,175	320.01	117.83
		4'	96	27'-0"		6"	8"		5'-2½"	"	"	1.653	20,822	330.70	124.51
		5'	120	27'-0"		6"	8"		6'-2½"	"	"	1.764	21,469	341.39	131.19
		6'	144	27'-5"		7"	9"		7'-2½"	31'-7⅞"	32'-9¾"	1.986	22,370	355.21	137.87
		7'	168	27'-9"		7½"	10"		8'-2½"	32'-0½"	33'-2¼"	2.214	23,158	368.57	144.55
		8'	192	27'-10"		8"	10"		9'-2½"	32'-1¾"	33'-3½"	2.381	24,422	389.34	151.23
	4 @ 7'	4'	112	31'-0"	8"	6"	8"	7¾"	5'-3¾"	35'-9½"	36'-11⅛"	1.951	24,047	381.96	138.28
		5'	140	31'-0"		6"	8"		6'-3¾"	"	"	2.063	24,693	392.65	144.96
		6'	168	31'-5"		7"	9"		7'-3¾"	36'-3⅜"	37'-5¼"	2.286	25,513	406.59	151.64
		7'	196	31'-9"		7½"	10"		8'-3¾"	36'-8"	37'-9¾"	2.516	26,390	420.03	158.32
		8'	224	31'-10"		8"	10"		9'-3¾"	36'-9⅛"	37'-11"	2.683	27,666	440.93	165.00
		9'	252	32'-3"		9"	11"		10'-3¾"	37'-2⅞"	38'-4¾"	2.984	29,637	475.41	171.68
	4 @ 8'	4'	128	35'-0"	8½"	6"	8"	8½"	5'-5"	40'-5"	41'-6¾"	2.281	28,281	449.30	148.57
		5'	160	35'-5"		7"	9"		6'-5"	40'-10¾"	42'-0½"	2.491	29,239	463.53	155.25
		6'	192	35'-5"		7"	9"		7'-5"	"	"	2.618	29,886	474.22	161.93
		7'	224	35'-9"		7½"	10"		8'-5"	41'-3⅜"	42'-5¼"	2.848	30,770	482.91	168.61
		8'	256	35'-10"		8"	10"		9'-5"	41'-4½"	42'-6⅜"	3.016	31,945	508.95	175.29
		9'	288	36'-3"		9"	11"		10'-5"	41'-10¼"	43'-0⅛"	3.319	34,157	543.89	181.97
		10'	320	36'-8"		10"	12"		11'-5"	42'-4⅛"	43'-6"	3.652	35,922	569.59	188.65

* For quantities in wings, see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.



Top Slab Reinforcing

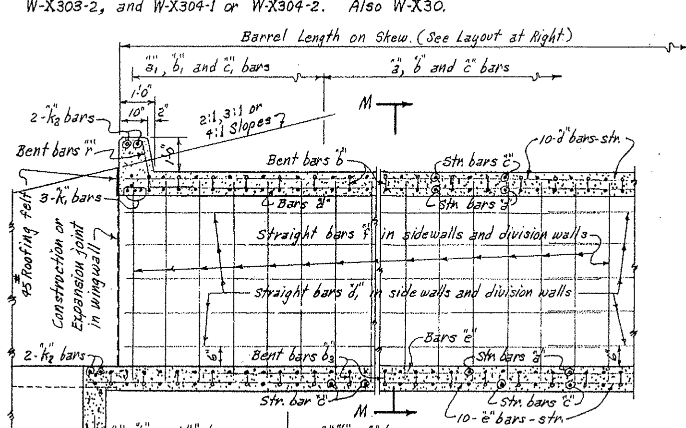
Part Plan at End of Culvert



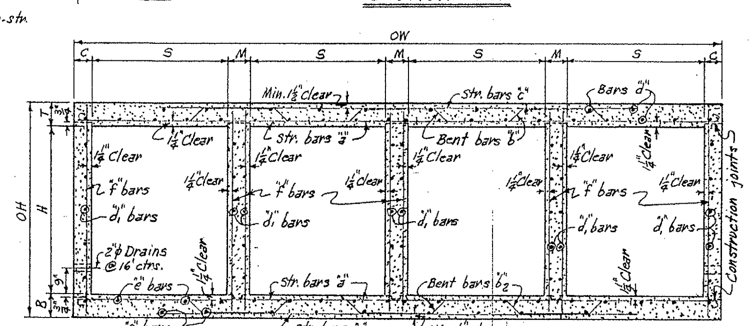
Bottom Slab Reinforcing

Part Plan at End of Culvert

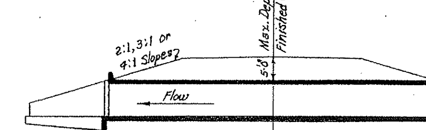
Note:- For Details of Standard Wings and bar lists, see Drawing No W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.



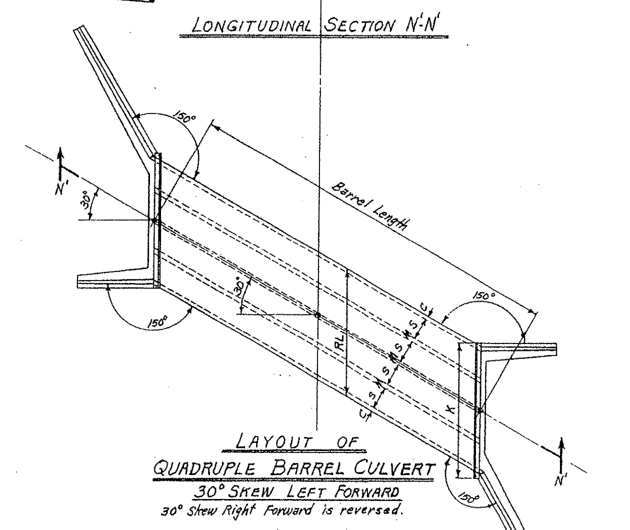
Section N-N



Typical Section M-M



Longitudinal Section N'-N'



Layout of Quadruple Barrel Culvert

30° Skew Left Forward

30° Skew Right Forward is reversed.

General Notes

Concrete:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.
Reinforcing Steel:- Reinforcing to be deformed bars of intermediate or hard grade.
Bar Lap:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters minimum.
Construction Joints:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
Specifications:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

Design Live Load

H20-S16 Loading A.A.S.H.O. 1961
and
Special Military Loading
Two 24,000 Lb. Axles @ 4'-0" ctrs.

Unit Stresses:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

Note:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

Class S Concrete

Designed by:- W.C.H. 1-23-63 Checked by:- R.H.S. 5-21-63
Drawn by:- W.C.H. 3-3-64 Checked by:-
Quantities by:- W.C.H. 4-10-64 Checked by:-

Arkansas State Highway Commission

Details of Standard Barrel Sections for Reinforced Concrete Box Culverts

30° Skew

4', 5', 6', 7' and 8' Spans Quadruples — 2:1, 3:1 or 4:1 Slopes Under 5'-0" Cover

Standard Drawing No. R-430X-01

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 30° SKEWED ENDS

"a" bars: STRAIGHT – In Top and Bottom Slab of Barrel. "a1" bars (skewed portion): STRAIGHT – In Top and Bottom Slab of Barrel (Eight of Each Length). "b" bars: BENT – See Diagrams below – In Bottom of Top Slab bent up over Division Walls – hooked. Alternate with "a" and "c" bars.

D	S	H	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.	"b" Size	"b" Spacing	"b" No. Req'd	"b" Length	X	Y	Z
0'-0" TO 5'-0" MAXIMUM	4 @ 9'	5'	⊠		216	20'-7"			88	19'-0"	3'-2"	⊠		104	21'-8"	0'-5½"	4'-4"	7'-2"
		6'			216	20'-9"			88	19'-2"	3'-4"			104	21'-10"	"	4'-5"	7'-2½"
		7'			216	20'-9"			88	"	"			104	21'-10"	"	"	"
		8'	#6	11"	216	20'-10"	#6	11" ±	88	19'-3"	3'-5"	#6	11"	104	21'-10"	"	"	7'-3"
		9'			216	21'-0"			88	19'-5"	3'-7"			104	22'-1"	"	4'-6"	7'-4"
		10'			216	21'-3"			88	19'-8"	3'-10"			104	22'-3"	"	4'-7"	7'-5"
		11'			216	21'-4"			88	19'-9"	3'-11"			104	22'-4"	0'-5½"	"	7'-6"
	4 @ 10'	5'			196	22'-9"			88	21'-0"	3'-6"			92	23'-8"	0'-6"	4'-9"	7'-11"
		6'	⊠		196	22'-11"			88	21'-2"	3'-8"	⊠		92	23'-10"	"	4'-10"	7'-11½"
		7'			196	22'-11"			88	"	"			92	23'-10"	"	"	"
		8'			196	23'-0"			88	21'-3"	3'-9"			92	23'-11"	"	"	8'-0"
		9'	#7	12"	196	23'-2"	#7	12" ±	88	21'-5"	3'-11"	#6	12"	92	24'-1"	"	4'-11"	8'-1"
		10'			196	23'-5"			88	21'-8"	4'-2"			92	24'-3"	"	5'-0"	8'-2"
		11'			196	23'-6"			88	21'-9"	4'-3"			92	24'-4"	"	"	8'-3"
		12'			196	23'-7"			88	21'-10"	4'-4"			92	24'-5"	0'-6"	5'-0"	8'-4"
	4 @ 11'	6'			208	25'-0"			112	23'-5"	2'-10"			98	25'-11"	0'-6½"	5'-3"	8'-9"
		7'	⊠		208	25'-0"			112	"	"	⊠		98	25'-11"	"	"	"
		8'			208	25'-0"			112	"	"			98	25'-11"	"	"	"
		9'	#7	11"	208	25'-2"	#7	11" ±	112	23'-7"	3'-0"	#6	11"	98	26'-2"	"	5'-4"	8'-10"
		10'			208	25'-5"			112	23'-10"	3'-3"			98	26'-4"	"	5'-5"	8'-11"
		11'			208	25'-6"			112	23'-11"	3'-4"			98	26'-5"	"	"	9'-0"
		12'			208	25'-7"			112	24'-0"	3'-5"			98	26'-6"	0'-6½"	5'-5"	9'-1"
	4 @ 12'	6'			200	27'-0"			120	25'-5"	3'-3"	⊠		96	28'-0"	0'-7"	5'-8"	9'-6"
		7'	⊠		200	27'-0"			120	"	"			96	28'-0"	"	"	"
		8'			200	27'-0"			120	"	"			96	28'-0"	"	"	"
		9'	#7	11"	200	27'-2"	#7	11" ±	120	25'-7"	3'-5"	#6	11"	96	28'-3"	"	5'-9"	9'-7"
		10'			200	27'-5"			120	25'-10"	3'-8"			96	28'-5"	"	5'-10"	9'-8"
		11'			200	27'-6"			120	25'-11"	3'-9"			96	28'-6"	"	"	9'-9"
		12'			200	27'-7"			120	26'-0"	3'-10"			96	28'-7"	0'-7"	5'-10"	9'-10"

"b1" & "b4" bars (skewed portion): BENT – In Bottom of Top Slab – some bent up over Division Walls (2 of Each Length). "b1" hooked one end. "b4" bars spliced to "b" bars. Alternate with "a1" and "c" or "c1" bars. "b2" bars: BENT – In Top of Bottom Slab bent down under Division Walls – hooked. Alternate with "a" and "c" bars.

D	S	H	"b1"&"b4" Size	Spacing	No. Req'd "b1"	No. Req'd "b4"	"b1" Max.	"b1" Min.	"b4" Max.	"b4" Min.	L Max.	L Min.	"b2" Size	"b2" Spacing	"b2" No. Req'd	"b2" Length	X	Y	Z
0'-0" TO 5'-0" MAXIMUM	4 @ 9'	5'			22	22	20'-10"	4'-6"	20'-3"	3'-11"	19'-9"	3'-11"	⊠		108	21'-8"	0'-5½"	4'-4"	7'-2"
		6'			24	24	21'-0"	3'-1"	20'-5"	2'-6"	19'-11"	2'-6"			108	21'-10"	"	4'-5"	7'-2½"
		7'			24	24	"	"	"	"	"	"			108	21'-10"	"	"	"
		8'	#6	11" ±	24	24	21'-1"	3'-2"	20'-6"	2'-7"	20'-0"	2'-7"	#6	11"	108	21'-10"	"	"	7'-3"
		9'			24	24	21'-3"	3'-4"	20'-8"	2'-9"	20'-2"	2'-9"			108	22'-1"	"	4'-6"	7'-4"
		10'			24	24	21'-6"	3'-7"	20'-11"	3'-0"	20'-5"	3'-0"			108	22'-3"	"	4'-7"	7'-5"
		11'			24	24	21'-7"	3'-8"	21'-0"	3'-1"	20'-6"	3'-1"			108	22'-4"	0'-5½"	"	7'-6"
	4 @ 10'	5'			22	22	22'-10"	4'-9"	22'-3"	4'-2"	21'-8"	4'-2"			96	23'-8"	0'-6"	4'-9"	7'-11"
		6'			24	24	23'-0"	3'-2"	22'-5"	2'-7"	21'-10"	2'-7"	⊠		96	23'-10"	"	4'-10"	7'-11½"
		7'			24	24	"	"	"	"	"	"			96	23'-10"	"	"	"
		8'			24	24	23'-1"	3'-3"	22'-6"	2'-8"	21'-11"	2'-8"			96	23'-11"	"	"	8'-0"
		9'	#6	12" ±	24	24	23'-3"	3'-5"	22'-8"	2'-10"	22'-1"	2'-10"	#6	12"	96	24'-1"	"	4'-11"	8'-1"
		10'			24	24	23'-6"	3'-8"	22'-11"	3'-1"	22'-4"	3'-1"			96	24'-3"	"	5'-0"	8'-2"
		11'			24	24	23'-7"	3'-9"	23'-0"	3'-2"	22'-5"	3'-2"			96	24'-4"	"	"	8'-3"
		12'			24	24	23'-8"	3'-10"	23'-1"	3'-3"	22'-6"	3'-3"			96	24'-5"	0'-6"	5'-0"	8'-4"
	4 @ 11'	6'			28	28	25'-2"	4'-0"	24'-7"	3'-5"	24'-0"	3'-5"			102	26'-0"	0'-7"	5'-2"	8'-9"
		7'			28	28	"	"	"	"	"	"	⊠		102	26'-0"	"	"	"
		8'			28	28	"	"	"	"	"	"			102	26'-0"	"	"	"
		9'	#6	11" ±	28	28	25'-4"	4'-2"	24'-9"	3'-7"	24'-2"	3'-7"	#6	11"	102	26'-3"	"	5'-3"	8'-10"
		10'			28	28	25'-7"	4'-5"	25'-0"	3'-10"	24'-5"	3'-10"			102	26'-5"	"	5'-4"	8'-11"
		11'			28	28	25'-8"	4'-6"	25'-1"	3'-11"	24'-6"	3'-11"			102	26'-6"	"	"	9'-0"
		12'			28	28	25'-9"	4'-7"	25'-2"	4'-0"	24'-7"	4'-0"			102	26'-7"	0'-7"	5'-4"	9'-1"
	4 @ 12'	6'			30	30	27'-3"	4'-5"	26'-8"	3'-10"	26'-0"	3'-10"			100	28'-1"	0'-8"	5'-6"	9'-6"
		7'			30	30	"	"	"	"	"	"	⊠		100	28'-1"	"	"	"
		8'			30	30	"	"	"	"	"	"			100	28'-1"	"	"	"
		9'	#6	11" ±	30	30	27'-5"	4'-7"	26'-10"	4'-0"	26'-2"	4'-0"	#6	11"	100	28'-4"	"	5'-7"	9'-7"
		10'			32	32	27'-8"	3'-3"	27'-1"	2'-8"	26'-5"	2'-8"			100	28'-6"	"	5'-8"	9'-8"
		11'			32	32	27'-9"	3'-4"	27'-2"	2'-9"	26'-6"	2'-9"			100	28'-7"	"	"	9'-9"
		12'			32	32	27'-10"	3'-5"	27'-3"	2'-10"	26'-7"	2'-10"			100	28'-8"	0'-8"	5'-8"	9'-10"

"b3" & "b5" bars (skewed portion): BENT – In Top of Bottom Slab – some bent down under Division Walls (2 of Each Length). "b3" hooked one end. "b5" bars spliced to "b2" bars. Alternate with "a1" and "c" or "c1" bars. "c" bars: STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.

D	S	H	"b3"&"b5" Size	Spacing	No. Req'd "b3"	No. Req'd "b5"	"b3" Max.	"b3" Min.	"b5" Max.	"b5" Min.	L Max.	L Min.	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length
0'-0" TO 5'-0" MAXIMUM	4 @ 9'	5'			22	22	20'-10"	4'-6"	20'-3"	3'-11"	19'-9"	3'-11"			102	29'-3"
		6'			24	24	21'-0"	3'-1"	20'-5"	2'-6"	19'-11"	2'-6"			102	29'-6"
		7'			24	24	"	"	"	"	"	"			102	29'-6"
		8'	#6	11" ±	24	24	21'-1"	3'-2"	20'-6"	2'-7"	20'-0"	2'-7"	#6	11"	102	29'-6"
		9'			24	24	21'-3"	3'-4"	20'-8"	2'-9"	20'-2"	2'-9"			102	29'-9"
		10'			24	24	21'-6"	3'-7"	20'-11"	3'-0"	20'-5"	3'-0"			102	30'-0"
		11'			24	24	21'-7"	3'-8"	21'-0"	3'-1"	20'-6"	3'-1"			102	30'-0"
	4 @ 10'	5'			22	22	22'-10"	4'-9"	22'-3"	4'-2"	21'-8"	4'-2"			90	32'-3"
		6'			24	24	23'-0"	3'-2"	22'-5"	2'-7"	21'-10"	2'-7"			90	32'-6"
		7'			24	24	"	"	"	"	"	"			90	32'-6"
		8'			24	24	23'-1"	3'-3"	22'-6"	2'-8"	21'-11"	2'-8"	#7	12"	90	32'-6"
		9'	#6	12" ±	24	24	23'-3"	3'-5"	22'-8"	2'-10"	22'-1"	2'-10"			90	32'-9"
		10'			24	24	23'-6"	3'-8"	22'-11"	3'-1"	22'-4"	3'-1"			90	33'-0"
		11'			24	24	23'-7"	3'-9"	23'-0"	3'-2"	22'-5"	3'-2"			90	33'-0"
		12'			24	24	23'-8"	3'-10"	23'-1"	3'-3"	22'-6"	3'-3"			90	33'-0"
	4 @ 11'	6'			28	28	25'-3"	4'-0"	24'-8"	3'-5"	24'-0"	3'-5"			90	35'-6"
		7'			28	28	"	"	"	"	"	"			90	35'-6"
		8'			28	28	"	"	"	"	"	"			90	35'-6"
		9'	#6	11" ±	28	28	25'-5"	4'-2"	24'-10"	3'-7"	24'-2"	3'-7"	#7	11"	90	35'-9"
		10'			28	28	25'-8"	4'-5"	25'-1"	3'-10"	24'-5"	3'-10"			90	36'-0"
		11'			28	28	25'-9"	4'-6"	25'-2"	3'-11"	24'-6"	3'-11"			90	36'-0"
		12'			28	28	25'-10"	4'-7"	25'-3"	4'-0"	24'-7"	4'-0"			90	36'-0"
	4 @ 12'	6'			30	30	27'-4"	4'-5"	26'-9"	3'-10"	26'-0"	3'-10"			90	38'-6"
		7'			30	30	"	"	"	"	"	"			90	38'-6"
		8'			30	30	"	"	"	"	"	"			90	38'-6"
		9'	#6	11" ±	30	30	27'-6"	4'-7"	26'-11"	4'-0"	26'-2"	4'-0"	#7	11"	90	38'-9"
		10'			32	32	27'-9"	3'-3"	27'-2"	2'-8"	26'-5"	2'-8"			90	39'-0"
		11'			32	32	27'-10"	3'-4"	27'-3"	2'-9"	26'-6"	2'-9"			90	39'-0"
		12'			32	32	27'-11"	3'-5"	27'-4"	2'-10"	26'-7"	2'-10"			90	39'-0"

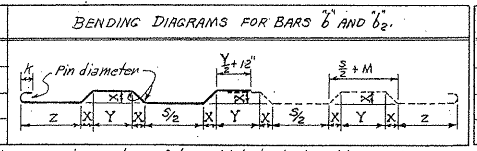
"c1" bars (skewed portion): STRAIGHT – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars (Four of Each Length). "d" bars: STRAIGHT – Longitudinal in Top Slab of Barrel. "d1" bars: Longitudinal in Sidewalls and Division Walls. "e" bars: Longitudinal in Bottom Slab of Barrel. "f" bars: STRAIGHT – Verticals in Sidewalls and Division Walls. "k1" bars (skewed portion): STRAIGHT – In Bottom of Headwalls. "k2" bars (skewed portion): In Top of Headwalls and Aprons (2 Each).

"d" bars length: 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap). "d1" bars length: 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap). "e" bars length: 2 @ 31'-8" for 60'-0" Length Barrel (1'-3" Lap).

D	S	H	"c1" Size	"c1" Spacing	"c1" No. Req'd	"c1" Max.	"c1" Min.	"d" Size	"d" Spacing	"d" No. Req'd	"d1" Size	"d1" Spacing	"d1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length	"k2" Size	"k2" No. Req'd	"k2" Length
0'-0" TO 5'-0" MAXIMUM	4 @ 9'	5'			72	27'-11"	2'-7"			55			40			53	#4	12"	480	6'-3"	⊠	12	23'-8"	⊠	16	24'-3"
		6'			72	28'-2"	2'-10"			55			48			53			480	7'-3"		12	23'-10"		16	24'-5"
		7'			72	"	"			55			56			53			480	8'-3"		12	"		16	"
		8'	#6	11"	72	28'-3"	2'-11"	#5	11½"	55	#4	12"	64	#4	12"	53		10"	576	9'-3"	#6	12	23'-11"	#6	16	24'-6"
		9'			72	28'-7"	3'-3"			55			72			53	#5	12"	480	10'-3"		12	24'-2"		16	24'-9"
		10'			72	28'-11"	3'-7"			55			80			53		11"	528	11'-3"		12	24'-5"		16	25'-0"
		11'			72	29'-0"	3'-8"			55			88			53		10"	576	12'-3"		12	24'-6"		16	25'-1"
	4 @ 10'	5'			68	30'-9"	2'-9"			59			40			57	#4	12"	480	6'-4"		12	26'-2"		16	26'-9"
		6'			68	31'-0"	3'-0"			59			48			57			480	7'-4"	⊠	12	26'-4"	⊠	16	26'-11"
		7'			68	"	"			59			56			57			480	8'-4"		12	"		16	"
		8'	#7	12"	68	31'-1"	3'-1"	#5	11½"	59	#4	12"	64	#4	12"	57		10"	576	9'-4"	#7	12	26'-5"	#7	16	27'-0"
		9'			68	31'-5"	3'-5"			59			72			57	#5	12"	480	10'-4"		12	26'-7"		16	27'-2"
		10'			68	31'-9"	3'-9"			59			80			57		11"	528	11'-4"		12	26'-10"		16	27'-5"
		11'			68	31'-10"	3'-10"			59			88			57		10"	576	12'-4"		12	26'-11"		16	27'-6"
		12'			68	31'-11"	3'-11"			59			96			57	#6	12"	480	13'-4"		12	27'-1"		16	27'-8"
	4 @ 11'	6'			84	35'-3"	3'-7"			63			48			61	#4	12"	480	7'-5"		12	28'-8"		16	29'-3"
		7'			84	"	"			63			56			61			480	8'-5"	⊠	12	"	⊠	16	"
		8'			84	"	"			63			64			61		10"	576	9'-5"		12	"		16	"
		9'	#7	11"	84	35'-7"	3'-11"	#5	11½"	63	#4	12"	72	#4	12"	61	#5	12"	480	10'-5"	#7	12	28'-11"	#7	16	29'-6"
		10'			88	35'-11"	2'-8"			63			80			61		11"	528	11'-5"		12	29'-2"		16	29'-9"
		11'			88	36'-0"	2'-9"			63			88			61		10"	576	12'-5"		12	29'-3"		16	29'-10"
		12'			88	36'-1"	2'-10"			63			96			61	#6	12"	480	13'-5"		12	29'-4"		16	29'-11"
	4 @ 12'	6'			88	37'-2"	3'-11"			67			48			65	#4	12"	480	7'-7"		12	31'-0"		16	31'-7"
		7'			88	"	"			67			56			65			480	8'-7"	⊠	12	"	⊠	16	"
		8'			88	"	"			67			64			65		10"	576	9'-7"		12	"		16	"
		9'	#7	11"	92	37'-6"	2'-8"	#5	11½"	67	#4	12"	72	#4	12"	65	#5	12"	480	10'-7"	#7	12	31'-3"	#7	16	31'-10"
		10'			92	37'-10"	3'-0"			67			80			65		11"	528	11'-7"		12	31'-6"		16	32'-1"
		11'			92	37'-11"	3'-1"			67			88			65		10"	576	12'-7"		12	31'-7"		16	32'-2"
		12'			92	38'-0"	3'-2"			67			96			65	#6	12"	480	13'-7"		12	31'-8"		16	32'-3"

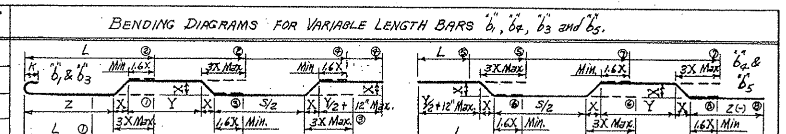
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b2".



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"

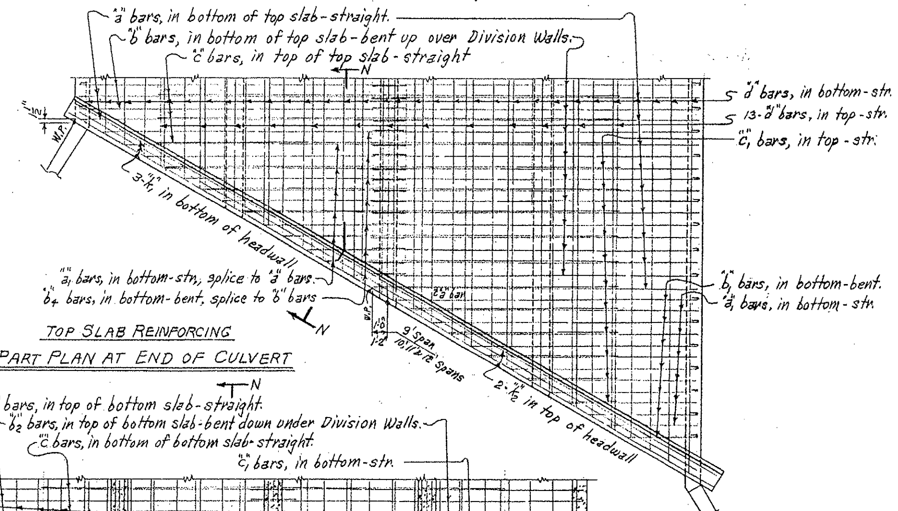
BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b1", "b4", "b3" and "b5".



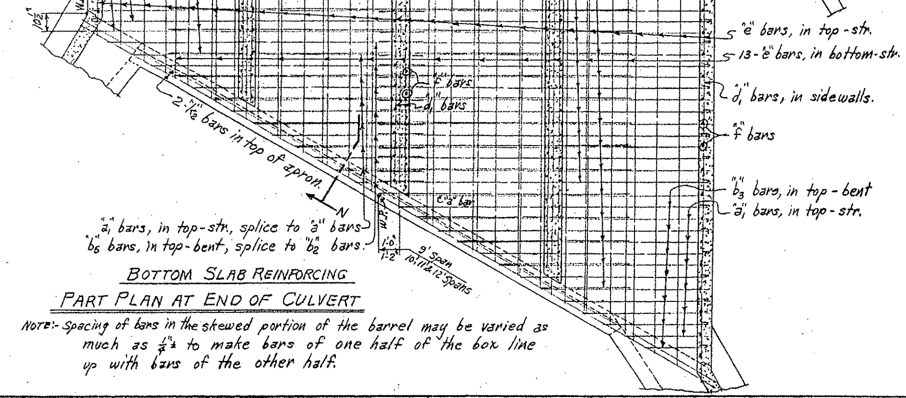
NOTE:- Dimensions are to centers of bars (b, b1, b2, b3, b4 & b5). The X, Y & Z values of "b1" & "b4" bars are same as for "b" bars, and for "b3" & "b5" bars same as for "b2" bars.
①⑦ ⑤⑧ Min. & Max. lengths L for bars "b1", "b3", "b4" & "b5" for each type bend.

▼ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length L of "b1", "b4", "b3" & "b5" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" and "b2" bars, use a set of "a" and "c" bars instead.
⊠ The "a", "b", "b2", "k1" and "k2" bars are to be spliced at middle division wall to make full length bars. Lap #6 bars 2'-0" min. and #7 bars 2'-4" min.
Some "b" bars are to be spliced to "b4" bars and some "b2" bars spliced to "b5" bars to make full length bars.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2 and W-X304-1 or W-X304-2. Also W-X30.

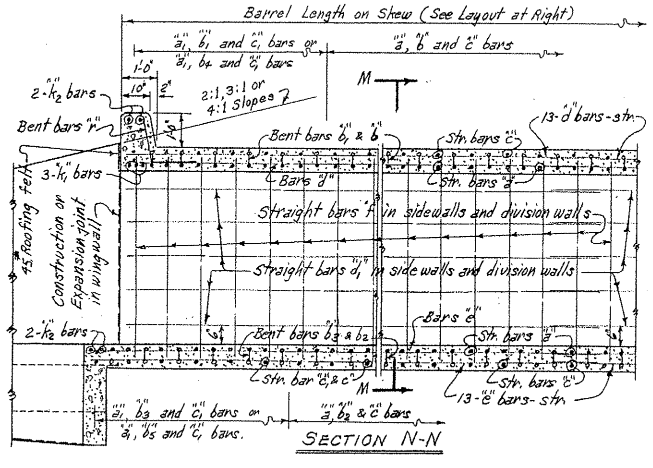


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

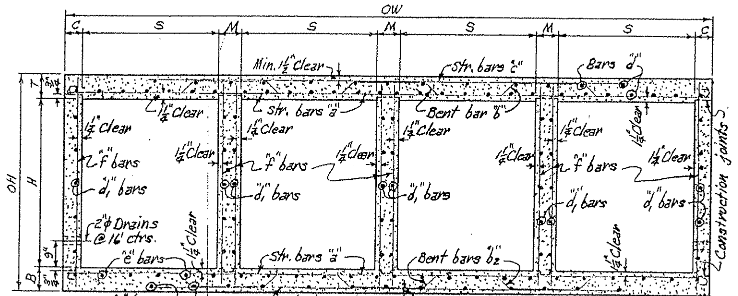


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

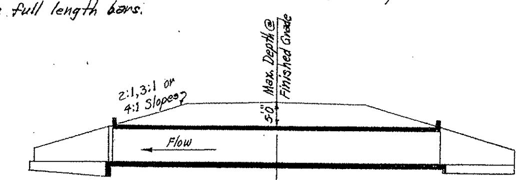
NOTE:- Spacing of bars in the skewed portion of the barrel may be varied as much as ¼"± to make bars of one half of the box line up with bars of the other half.



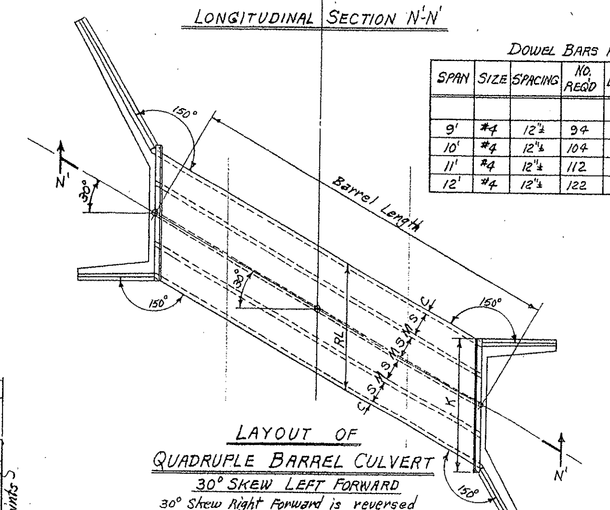
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF
QUADRUPLE BARREL CULVERT
30° SKEW LEFT FORWARD
30° Skew Right Forward is reversed

REVISIONS:- Bars b3 & b4 in Bending Diagram. 6-17-66 W.C.H.

D	S	H	A	OW	T	C	M	B	OH	RL	K	Cu. Yd.	Total LB.	Per Lin. Ft. LB.	Additional Per Lap LB.
MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALLS	* CLASS S CONC. PER LIN. FT. OF BARREL	* REINFORCING STEEL – TOTAL FOR 60'-0" LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
5'-0"	4 @ 9'	5'	180	39'-5"	9"	7"	9"	9"	6'-6"	45'-6⅝"	46'-8"	2.823	33,390	525.66	173.26
		6'	216	39'-9"		7½"	10"		7'-6"	45'-10¾"	47'-0¾"	3.042	34,297	539.35	179.94
		7'	252	39'-9"		7½"	10"		8'-6"	"	"	3.181	34,943	550.04	186.62
		8'	288	39'-10"		8"	10"		9'-6"	46'-0"	47'-1¾"	3.349	36,246	571.16	193.30
		9'	324	40'-3"		9"	11"		10'-6"	46'-5¾"	47'-7¾"	3.653	38,309	606.26	199.98
		10'	360	40'-8"		10"	12"		11'-6"	46'-11½"	48'-1¼"	3.988	40,087	632.03	206.66
		11'	396	40'-10"		11"	12"		12'-6"	47'-1¾"	48'-3¾"	4.238	41,666	658.72	213.34
	4 @ 10'	5'	200	43'-5"	9½"	7"	9"	9½"	6'-7"	50'-1⅜"	51'-3⅞"	3.179	39,611	620.21	183.56
		6'	240	43'-9"		7½"	10"		7'-7"	50'-6¼"	51'-8"	3.399	40,552	634.28	190.24
		7'	280	43'-9"		7½"	10"		8'-7"	"	"	3.538	41,199	644.97	196.92
		8'	320	43'-10"		8"	10"		9'-7"	50'-7⅜"	51'-9⅛"	3.706	42,544	666.82	203.60
		9'	360	44'-3"		9"	11"		10'-7"	51'-1⅛"	52'-3"	4.012	44,721	701.92	210.28
		10'	400	44'-8"		10"	12"		11'-7"	51'-7"	52'-8¾"	4.348	46,451	728.27	216.96
		11'	440	44'-10"		11"	12"		12'-7"	51'-9¼"	52'-11"	4.598	48,045	755.12	223.64
		12'	480	45'-0"		12"	12"		13'-7"	51'-11⅛"	53'-1⅛"	4.861	50,680	798.37	230.32
	4 @ 11'	6'	264	47'-10"	10"	8"	10"	10½"	7'-8½"	55'-2¾"	56'-4⅝"	3.878	46,532	729.59	200.53
		7'	308	47'-10"		8"	10"		8'-8½"	"	"	4.020	47,179	740.28	207.21
		8'	352	47'-10"		8"	10"		9'-8½"	"	"	4.162	48,430	761.03	213.89
		9'	396	48'-3"		9"	11"		10'-8½"	55'-8⅝"	56'-10⅝"	4.470	50,679	797.14	220.57
		10'	440	48'-8"		10"	12"		11'-8½"	56'-2⅜"	57'-4¼"	4.808	52,372	823.93	227.25
		11'	484	48'-10"		11"	12"		12'-8½"	56'-4⅝"	57'-6½"	5.059	54,025	850.97	233.93
		12'	528	49'-0"		12"	12"		13'-8½"	56'-7"	57'-8¾"	5.323	56,734	894.99	240.61
	4 @ 12'	6'	288	51'-10"	10½"	8"	10"	11½"	7'-10"	59'-10⅝"	61'-0"	4.371	49,859	782.20	210.82
		7'	336	51'-10"		8"	10"		8'-10"	"	"	4.513	50,505	792.88	217.50
		8'	384	51'-10"		8"	10"		9'-10"	"	"	4.655	51,767	813.82	224.18
		9'	432	52'-3"		9"	11"		10'-10"	60'-4"	61'-5¾"	4.965	54,114	850.25	230.86
		10'	480	52'-8"		10"	12"		11'-10"	60'-9¾"	61'-11¾"	5.305	55,913	877.16	237.54
		11'	528	52'-10"		11"	12"		12'-10"	61'-0⅝"	62'-2"	5.557	57,507	904.35	244.22
		12'	576	53'-0"		12"	12"		13'-10"	61'-2¾"	62'-4¼"	5.821	60,182	948.21	250.90

* For quantities in Wings see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.

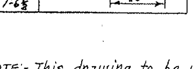
GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters minimum.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
9'	#4	12"±	94	2'-10"	1'-5"
10'	#4	12"±	104	2'-11"	1'-5½"
11'	#4	12"±	112	3'-0"	1'-6"
12'	#4	12"±	122	3'-1"	1'-6½"

Dowel bars "r" in Two Headwalls



DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW

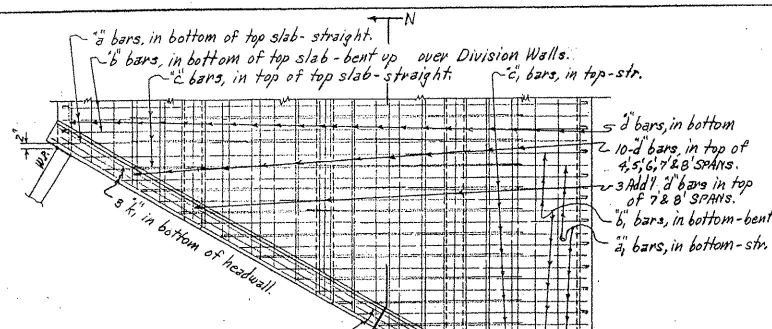
9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUADRUPLES — UNDER 5'-0" COVER

STANDARD DRAWING NO. R-430X-02

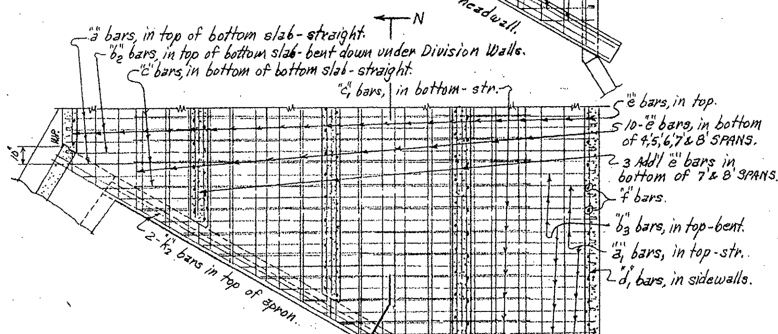
Designed by:- W.C.H. 1-23-63 — Checked by:- R.H.S. 5-21-63
Drawn by:- W.C.H. 3-26-64 — Checked by:-
Quantities by:- W.C.H. 4-13-64 — Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing No W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

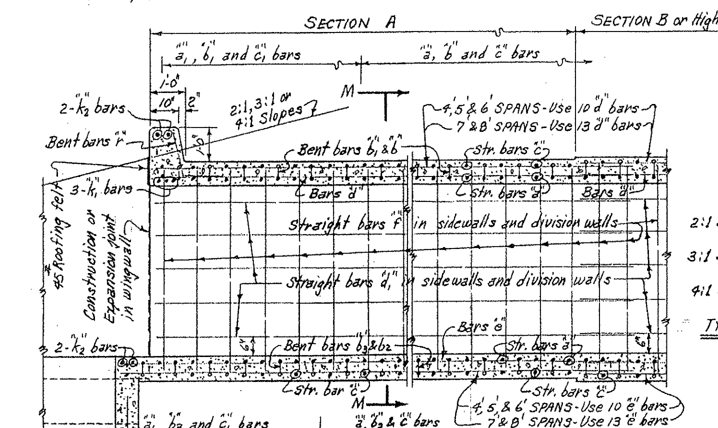


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

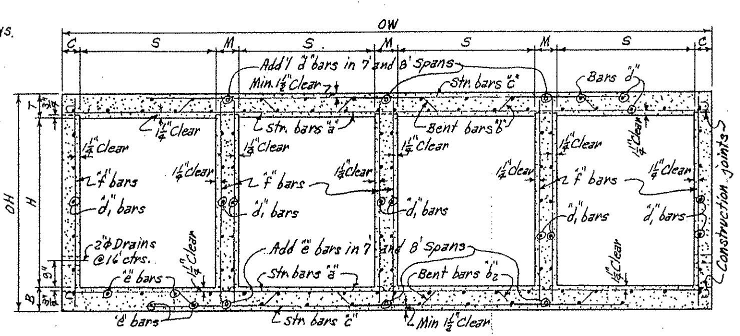


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

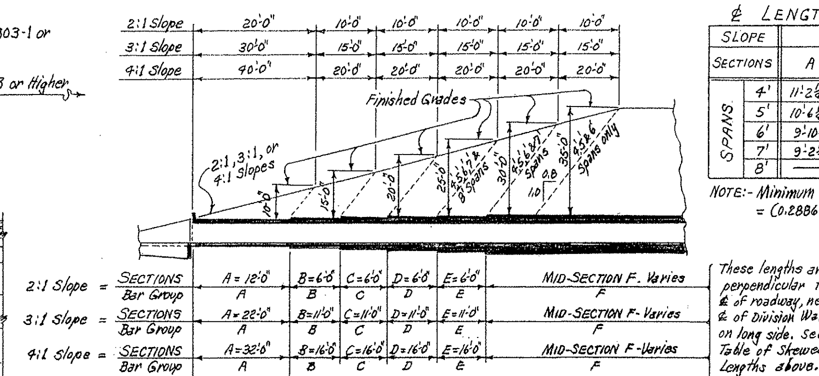
NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" min. into SECTION B.



SECTION N-N

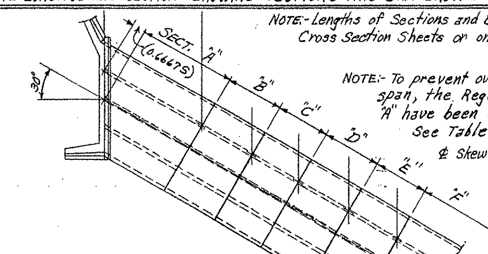


TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER.

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ¢ Length of Section "A" have been shortened by two thirds "S". See Table above.

¢ Skewed Length of "A" = "A" x 1.1547 − ⅔ "S".

NOTE:-
For Details and Bar Lists for SECTIONS B thru F, see Barrel Drawing Nos. R-400X-X1 & R-400X-X2.

¢ LENGTHS OF SECTIONS ON 30° SKEW

SLOPE		2:1		3:1		4:1	
SECTIONS		A	B, C, D & E	A	B, C, D & E	A	B, C, D & E
SPANS	4'	11'-2¼"	6'-11⅛"	22'-8¾"	12'-8⅜"	34'-3½"	18'-5¾"
	5'	10'-6¼"	"	22'-0¾"	"	33'-7½"	"
	6'	9'-10¼"	"	21'-4¾"	"	32'-11½"	"
	7'	9'-2¼"	"	20'-8¾"	"	32'-3½"	"
	8'	—	—	20'-0¾"	"	31'-7½"	"

NOTE:- Minimum ¢ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	B	C			D
25.0' to 29.5'	A	B	C	D		E
30.0' to 35.0'	A	B	C	D	E	F

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	2@C				D
25.0' to 29.5'	A	B	2@D			E
30.0' to 35.0'	A	2@C		2@E		F

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER (D): SECTION "A" = 10'-0"

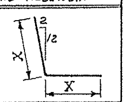
CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONCRETE BARREL ONLY 2:1 Cu.Yd.	3:1 Cu.Yd.	4:1 Cu.Yd.	REINFORCING STEEL BARREL, APRON AND HEADWALL 2:1 Lb.	3:1 Lb.	4:1 Lb.
4@4'	2'	32	19'-0"	6"	6"	8"	6"	3'-0"	21'-11¼"	23'-1"	10.36	21.05	31.75	1851	3428	5040
	3'	48	19'-0"		6"	8"		4'-0"	"	"	11.60	23.57	35.56	1981	3681	5420
	4'	64	19'-0"		6"	8"		5'-0"	"	"	12.84	26.09	39.37	2111	3935	5801
	5'	80	19'-0"		6"	8"		6'-0"	"	"	14.09	28.62	43.17	2241	4188	6181
	6'	96	19'-5"		7"	9"		7'-0"	22'-5"	23'-7"	16.54	33.59	50.68	2401	4489	6625
4@5'	3'	60	23'-0"	6½"	6"	8"	6½"	4'-1"	26'-6¾"	27'-8½"	13.21	27.71	42.23	2385	4542	6795
	4'	80	23'-0"		6"	8"		5'-1"	"	"	14.38	30.16	45.97	2506	4787	7166
	5'	100	23'-0"		6"	8"		6'-1"	"	"	15.55	32.61	49.70	2627	5031	7538
	6'	120	23'-5"		7"	9"		7'-1"	27'-0½"	28'-2⅛"	17.87	37.48	57.13	2859	5474	8128
	7'	140	23'-9"		7½"	10"		8'-1"	27'-5⅝"	28'-7"	20.25	42.47	64.73	3129	6122	9213
4@6'	3'	72	27'-0"	7"	6"	8"	7¼"	4'-2¼"	31'-2⅝"	32'-4"	14.99	32.54	50.13	2895	5776	8793
	4'	96	27'-0"		6"	8"		5'-2¼"	"	"	16.08	34.92	53.79	3010	6014	9161
	5'	120	27'-0"		6"	8"		6'-2¼"	"	"	17.18	37.29	57.45	3115	6252	9529
	6'	144	27'-5"		7"	9"		7'-2¼"	31'-7⅝"	32'-9¾"	19.36	42.04	64.76	3288	6564	9879
	7'	168	27'-9"		7½"	10"		8'-2¼"	32'-0½"	33'-2¼"	21.61	46.92	72.28	3675	7371	11,110
	8'	192	27'-10"		8"	10"		9'-2¼"	32'-1¾"	33'-3½"	23.26	50.49	77.78	3903	7835	11,817
4@7'	4'	112	31'-0"	7¾"	6"	8"	8¼"	5'-4"	35'-9⅝"	36'-11⅝"	18.15	40.94	63.78	3776	7512	11,408
	5'	140	31'-0"		6"	8"		6'-4"	"	"	19.17	43.24	67.36	3885	7744	11,769
	6'	168	31'-5"		7"	9"		7'-4"	36'-3⅜"	37'-5¼"	21.23	47.91	74.63	4001	7997	12,304
	7'	196	31'-9"		7½"	10"		8'-4"	36'-8"	37'-9¾"	23.34	52.65	82.02	4383	8755	13,447
	8'	224	31'-10"		8"	10"		9'-4"	36'-9⅝"	37'-11"	24.88	56.13	87.45	4559	9169	14,105
	9'	252	32'-3"		9"	11"		10'-4"	37'-2⅞"	38'-4¾"	27.65	62.37	97.17	4898	9788	14,875
4@8'	4'	128	35'-0"	8½"	6"	8"	9¼"	5'-5¾"	40'-5"	41'-6¾"	X	47.39	74.70	X	8545	12,993
	5'	160	35'-5"		7"	9"		6'-5¾"	40'-10¾"	42'-0½"	X	51.62	81.37	X	8680	13,474
	6'	192	35'-5"		7"	9"		7'-5¾"	"	"	X	54.17	85.39	X	8903	13,830
	7'	224	35'-9"		7½"	10"		8'-5¾"	41'-3⅜"	42'-5¼"	X	58.80	92.69	X	9388	14,565
	8'	256	35'-10"		8"	10"		9'-5¾"	41'-4½"	42'-6⅞"	X	62.17	98.01	X	10,008	15,454
	9'	288	36'-3"		9"	11"		10'-5¾"	41'-10⅛"	43'-0½"	X	68.27	107.62	X	10,554	16,287
	10'	320	36'-8"		10"	12"		11'-5¾"	42'-4⅛"	43'-6"	X	74.97	118.18	X	11,653	17,998

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	23	2'-4"	1'-2"
5'	#4	12"±	28	2'-5"	1'-2½"
6'	#4	12"±	32	2'-6"	1'-3"
7'	#4	12"±	37	2'-8"	1'-4"
8'	#4	12"±	41	2'-10"	1'-5"

Dowel bars "r" in One Headwall.



BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A". Length of Section: Lengths vary with Clear Span "S" per slope, see Table at upper right. Depth of Cover D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars: STRAIGHT, In Top and Bottom Slab of Barrel. "a1" bars: STRAIGHT, In Top and Bottom Slab of Barrel - (Two of each Length).

S	H	"a" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.
4@4'	2'	#4	12"	13	37	59	18'-9"	#4	12"	18	17'-0"	3'-0"
	3'			13	37	59	"			18	"	"
	4'			13	37	59	"			18	"	"
	5'			13	37	59	"			18	"	"
	6'			13	37	59	19'-2"			18	17'-5"	3'-5"
4@5'	3'	#4	11"	11	35	61	22'-9"	#4	11"	24	21'-2"	3'-9"
	4'			11	35	61	"			24	"	"
	5'			11	35	61	"			24	"	"
	6'			9	35	61	23'-2"			26	21'-7"	2'-7"
	7'			9	35	61	23'-6"			26	21'-11"	2'-11"
4@6'	3'	#5	13"	5	27	49	26'-9"	#5	13"	24	24'-11"	4'-3"
	4'			5	27	49	"			24	"	"
	5'			5	27	49	"			24	"	"
	6'			5	27	47	27'-2"			26	25'-4"	2'-10"
	7'			5	27	47	27'-6"			26	25'-8"	3'-2"
	8'			5	27	47	27'-7"			26	25'-9"	3'-3"
4@7'	4'	#5	11"	3	27	53	30'-9"	#5	11"	34	29'-2"	3'-10"
	5'			3	27	53	"			34	"	"
	6'			3	27	53	31'-2"			36	29'-7"	2'-8"
	7'			3	27	53	31'-6"			36	29'-11"	3'-0"
	8'			3	27	53	31'-7"			36	30'-0"	3'-1"
	9'			3	27	51	32'-0"			36	30'-5"	3'-6"
4@8'	4'	#5	13"	—	21	41	34'-9"	#5	13"	34	32'-11"	2'-11"
	5'			—	19	41	35'-2"			34	33'-4"	3'-4"
	6'			—	19	41	"			34	"	"
	7'			—	19	41	35'-6"			34	33'-8"	3'-8"
	8'			—	19	41	35'-7"			34	33'-9"	3'-9"
	9'			—	19	41	36'-0"			34	34'-2"	4'-2"
	10'			—	19	41	36'-5"			36	34'-7"	2'-9"

"b" bars: BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b1" bars: In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
4@4'	2'	#4	12"	6	17	29	20'-1"	0'-2¾	2'-2½	3'-4¾	#4	12"	9	18'-9"	4'-3"	17'-10"	3'-10"
	3'			6	17	29	"	"	"	"			9	"	"	"	"
	4'			6	17	29	"	"	"	"			9	"	"	"	"
	5'			6	17	29	"	"	"	"			9	"	"	"	"
	6'			6	17	29	20'-6"	0'-2¾	2'-3½	3'-5⅞			10	19'-2"	2'-11"	18'-3"	2'-6"
4@5'	3'	#4	11"	4	17	29	24'-2"	0'-3¾	2'-7½	4'-1¼	#4	11"	13	22'-11"	3'-2"	21'-11"	2'-9"
	4'			4	17	29	"	"	"	"			13	"	"	"	"
	5'			4	17	29	"	"	"	"			13	"	"	"	"
	6'			4	17	29	24'-7"	"	2'-8½	4'-2¼			13	23'-4"	3'-7"	22'-4"	3'-2"
	7'			4	16	29	24'-11"	0'-3¼	2'-9¼	4'-2¾			13	23'-8"	3'-11"	22'-8"	3'-6"
4@6'	3'	#5	13"	2	12	23	28'-4"	0'-3½	3'-1"	4'-10¾	#5	13"	13	25'-11"	3'-10"	25'-10"	3'-4"
	4'			2	12	23	"	"	"	"			13	"	"	"	"
	5'			2	12	23	"	"	"	"			13	"	"	"	"
	6'			2	12	23	28'-8"	"	3'-2"	4'-11¾			13	26'-4"	4'-3"	26'-3"	3'-9"
	7'			2	12	23	29'-0"	"	3'-3"	4'-11¾			13	26'-8"	4'-7"	26'-7"	4'-1"
	8'			2	12	23	29'-1"	0'-3⅛	3'-3"	5'-0½			13	26'-9"	4'-8"	26'-8"	4'-2"
4@7'	4'	#5	11"	0	13	25	32'-5"	0'-4⅛	3'-5½	5'-7"	#5	11"	18	31'-2"	3'-6"	29'-11"	3'-0"
	5'			0	13	25	"	"	"	"			18	"	"	"	"
	6'			0	12	25	32'-10"	"	3'-6½	5'-8"			18	31'-7"	3'-11"	30'-4"	3'-5"
	7'			0	12	25	33'-2"	"	3'-7½	5'-8½			18	31'-11"	4'-3"	30'-8"	3'-9"
	8'			0	12	25	33'-3"	"	3'-7½	5'-9"			18	32'-0"	4'-4"	30'-9"	3'-10"
	9'			0	12	25	33'-8"	0'-4¼	3'-8½	5'-10"			19	32'-5"	3'-2"	31'-1"	2'-8"
4@8'	4'	#6	13"	—	9	20	36'-9"	0'-5"	3'-10"	6'-4"	#6	13"	17	35'-4"	4'-5"	33'-10"	3'-10"
	5'			—	9	20	37'-2"	"	3'-11"	6'-5"			17	35'-9"	4'-10"	34'-3"	4'-3"
	6'			—	9	20	"	"	"	"			17	"	"	"	"
	7'			—	9	20	37'-6"	"	4'-0"	6'-5½			18	36'-1"	3'-4"	34'-7"	2'-8½
	8'			—	9	19	37'-7"	"	4'-0"	6'-6"			18	36'-2"	3'-5"	34'-8"	2'-9½
	9'			—	9	19	38'-0"	"	4'-1"	6'-7"			18	36'-7"	3'-10"	35'-1"	3'-2½
	10'			—	9	19	38'-5"	0'-5"	4'-2"	6'-8"			18	37'-0"	4'-3"	35'-6"	3'-2½

"b2" bars: BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. "b3" bars: In Top of Bottom Slab - some bent down under Division Walls - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
4@4'	2'	#4	12"	7	18	30	20'-1"	0'-2¾	2'-2½	3'-4¾	#4	12"	9	18'-9"	4'-3"	17'-10"	3'-10"
	3'			7	18	30	"	"	"	"			9	"	"	"	"
	4'			7	18	30	"	"	"	"			9	"	"	"	"
	5'			7	18	30	"	"	"	"			9	"	"	"	"
	6'			7	18	30	20'-6"	0'-2¾	2'-3½	3'-5⅝			10	19'-2"	2'-11"	18'-3"	2'-6"
4@5'	3'	#4	11"	5	18	30	24'-2"	0'-3¾	2'-7½	4'-1¼	#4	11"	13	22'-11"	3'-2"	21'-11"	2'-9"
	4'			5	18	30	"	"	"	"			13	"	"	"	"
	5'			5	18	30	"	"	"	"			13	"	"	"	"
	6'			5	18	30	24'-7"	"	2'-8½	4'-2¼			13	23'-4"	3'-7"	22'-4"	3'-2"
	7'			5	17	30	24'-11"	0'-3⅛	2'-9⅛	4'-2¾			13	23'-8"	3'-11"	22'-8"	3'-6"
4@6'	3'	#5	13"	3	13	24	28'-4"	0'-3⅜	3'-0½	4'-10½	#5	13"	13	26'-0"	3'-10"	25'-10"	3'-4"
	4'			3	13	24	"	"	"	"			13	"	"	"	"
	5'			3	13	24	"	"	"	"			13	"	"	"	"
	6'			3	13	24	28'-9"	"	3'-1½	4'-11⅛			13	26'-5"	4'-3"	26'-3"	3'-9"
	7'			3	13	24	29'-1"	"	3'-2½	4'-11¾			13	26'-9"	4'-7"	26'-7"	4'-1"
	8'			3	13	24	29'-2"	0'-3⅜	3'-2½	5'-0¼			13	26'-10"	4'-8"	26'-8"	4'-2"
4@7'	4'	#5	11"	1	14	26	32'-6"	0'-4⅛	3'-4½	5'-7"	#5	11"	18	31'-3"	3'-6"	29'-11"	3'-0"
	5'			1	14	26	"	"	"	"			18	"	"	"	"
	6'			1	13	26	32'-11"	"	3'-5½	5'-8"			18	31'-8"	3'-11"	30'-4"	3'-5"
	7'			1	13	26	33'-3"	"	3'-6½	5'-8½			18	32'-0"	4'-3"	30'-8"	3'-9"
	8'			1	13	26	33'-4"	"	3'-6½	5'-9"			18	32'-1"	4'-4"	30'-9"	3'-10"
	9'			1	13	26	33'-9"	0'-4⅜	3'-7½	5'-10"			19	32'-6"	3'-2"	31'-1"	2'-8"
4@8'	4'	#6	13"	—	10	21	36'-11"	0'-5¾	3'-8½	6'-4"	#6	13"	17	35'-6"	4'-5"	33'-10"	3'-10"
	5'			—	10	21	37'-4"	"	3'-9½	6'-5"			17	35'-9"	4'-10"	34'-3"	4'-3"
	6'			—	10	21	"	"	"	"			17	"	"	"	"
	7'			—	10	21	37'-8"	"	3'-10½	6'-5½			18	36'-3"	3'-4"	34'-7"	2'-8½
	8'			—	10	20	37'-9"	"	3'-10½	6'-6"			18	36'-4"	3'-5"	34'-8"	2'-9½
	9'			—	10	20	38'-2"	"	3'-11½	6'-7"			18	36'-9"	3'-10"	35'-1"	3'-2½
	10'			—	10	20	38'-7"	0'-5⅝	4'-0½	6'-8"			18	37'-2"	4'-3"	35'-6"	3'-7½

"c" bars: STRAIGHT, In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars: In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length). "d" bars: Longitudinal in Top Slab of Barrel. "d1" bars: Longitudinal in Sidewalls and Division Walls. "e" bars: Longitudinal in Bottom Slab of Barrel. ⊙ LENGTH of "d", "d1" and "e" bars: Lengths vary with Clear Span "S", skew and slope, see Table for ave. Lengths.

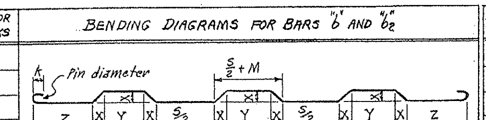
S	H	"c" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	MIN.	"d" SIZE	SPACING	NO. REQ'D	"d1" SIZE	SPACING	NO. REQ'D	"e" SIZE	SPACING	NO. REQ'D
4@4'	2'	#4	12"	15	39	61	14'-0"	#4	12"	14	12'-11"	2'-5"	#4	12"	30	#4	12"	16	#4	12"	30
	3'			15	39	61	"			14	"	"			30			24			30
	4'			15	39	61	"			14	"	"			30			32			30
	5'			15	39	61	"			14	"	"			30			40			30
	6'			15	39	61	14'-3"			14	13'-3"	2'-9"			30			48			30
4@5'	3'	#5	11"	13	37	63	17'-0"	#5	11"	20	16'-9"	2'-6"	#4	12"	34	#4	12"	24	#4	12"	34
	4'			13	37	63	"			20	"	"			34			32			34
	5'			13	37	63	"			20	"	"			34			40			34
	6'			11	37	63	17'-3"			20	17'-1"	2'-10"			34			48			34
	7'			11	37	63	17'-6"			20	17'-4"	3'-1"			34			56			34
4@6'	3'	#6	13"	7	29	51	20'-0"	#6	13"	20	19'-8"	2'-10"	#4	12"	38	#4	12"	24	#4	12"	38
	4'			7	29	51	"			20	"	"			38			32			38
	5'			7	29	51	"			20	"	"			38			40			38
	6'			7	29	49	20'-3"			20	20'-0"	3'-2"			38			48			38
	7'			7	29	49	20'-6"			20	20'-3"	3'-5"			38			56			38
	8'			7	29	49	20'-6"			20	20'-4"	3'-6"			38			64			38
4@7'	4'	#6	11"	7	31	57	23'-6"	#6	11"	26	22'-2"	3'-2"	#4	12"	45	#4	12"	32	#4	12"	45
	5'			7	31	57	"			26	"	"			45			40			45
	6'			7	31	57	23'-3"			26	22'-6"	3'-6"			45			48			45
	7'			7	31	57	23'-6"			26	22'-9"	3'-9"			45			56			45
	8'			7	31	57	23'-6"			26	22'-10"	3'-10"			45			64			45
	9'			7	31	55	23'-9"			26	23'-2"	4'-2"			45			72			45
4@8'	4'	#7	13"	—	25	45	26'-0"	#7	13"	26	25'-1"	2'-7"	#4	12"	49	#4	12"	32	#4	12"	49
	5'			—	23	45	26'-3"			26	25'-5"	2'-11"			49			40			49
	6'			—	23	45	"			26	"	"			49			48			49
	7'			—	23	45	26'-6"			26	25'-8"	3'-2"			49			56			49
	8'			—	23	45	26'-6"			26	25'-9"	3'-3"			49			64			49
	9'			—	23	45	26'-9"			26	26'-1"	3'-7"			49			72			49
	10'			—	23	45	27'-0"			26	26'-5"	3'-11"			49			80			49

"f" bars: STRAIGHT, Verticals in Sidewalls and Division Walls. "k1" bars: STRAIGHT, In Bottom of Headwall. "k2" bars: In Top of Headwall and Apron (2 Each).

S	H	"f" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	NO. REQ'D	LENGTH	"k2" SIZE	NO. REQ'D	LENGTH
4@4'	2'	#4	12"	92	184	272	2'-9"	#5	3	21'-8"	#5	4	22'-10"
	3'			92	184	272	3'-9"		3	"		4	"
	4'			92	184	272	4'-9"		3	"		4	"
	5'			92	184	272	5'-9"		3	"		4	"
	6'			92	184	272	6'-9"		3	22'-2"		4	23'-4"
4@5'	3'	#4	12"	84	176	264	3'-10"	#5	3	26'-3"	#5	4	27'-5"
	4'			84	176	264	4'-10"		3	"		4	"
	5'			84	176	264	5'-10"		3	"		4	"
	6'			84	176	264	6'-10"		3	26'-9"		4	27'-11"
	7'	#5	12"	84	176	264	7'-10"		3	27'-2"		4	28'-4"
4@6'	3'	#4	12"	80	172	264	3'-11"	#5	3	30'-11"	#5	4	32'-1"
	4'			80	172	264	4'-11"		3	"		4	"
	5'			80	172	264	5'-11"		3	"		4	"
	6'			80	172	264	6'-11"		3	31'-4"		4	32'-6"
	7'	#5	12"	80	172	264	7'-11"		3	31'-9"		4	32'-11"
	8'		11"	88	188	288	8'-11"		3	31'-11"		4	33'-0"
4@7'	4'	#4	12"	76	168	260	5'-1"	#6	3	35'-6"	#6	4	36'-8"
	5'			76	168	260	6'-1"		3	"		4	"
	6'			76	168	260	7'-1"		3	36'-0"		4	37'-2"
	7'	#5	12"	76	168	260	8'-1"		3	36'-5"		4	37'-6"
	8'		11"	84	184	284	9'-1"		3	36'-6"		4	37'-8"
	9'		10"	92	200	308	10'-1"		3	36'-11"		4	38'-1"
4@8'	4'	#4	12"	—	160	256	5'-3"	#6	6	21'-1"	#6	8	21'-8"
	5'			—	160	256	6'-3"		6	21'-4"		8	21'-11"
	6'			—	160	256	7'-3"		6	"		8	"
	7'		10"	—	192	304	8'-3"		6	21'-6"		8	22'-1"
	8'	#5	12"	—	160	256	9'-3"		6	21'-7"		8	22'-2"
	9'		11"	—	176	280	10'-3"		6	21'-10"		8	22'-5"
	10'	#6	12"	—	160	256	11'-3"		6	22'-1"		8	22'-8"

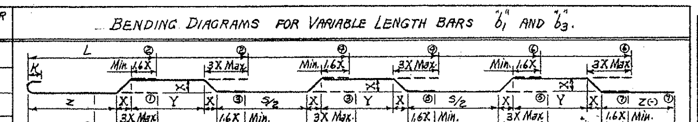
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4½"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4½"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b1" AND "b3".



NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values of "b1" bars are same as for "b" bars, and for "b3" bars same as for "b2" bars. ①①-⑦⑦ Min. & Max. lengths L for bars "b1" & "b3" for each type bend.

AVERAGE LENGTHS OF LONG. BARS "d", "d1" & "e"

SLOPE		2:1 d&d1	2:1 e	3:1 d&d1	3:1 e	4:1 d&d1	4:1 e
SPANS	4'	12'-10"	14'-0"	24'-5"	25'-7"	35'-11"	37'-1"
	5'	12'-2"	13'-4"	23'-9"	24'-11"	35'-3"	36'-5"
	6'	11'-6"	12'-8"	23'-1"	24'-3"	34'-7"	35'-9"
	7'	10'-10"	12'-0"	22'-5"	23'-7"	33'-11"	35'-1"
	8'	—	—	21'-9"	22'-11"	33'-3"	34'-5"

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-10½" for 13" spacing, 1'-9" for 12" spacing, and 1'-7" for 11" spacing.
⊙ To longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" Lap).
⊠ These bars to be spliced at center division wall. (2'-0" Lap).

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.
For Barrels of 4', 5' & 6' Spans, see Drawing No. R-400X-X1.
For Barrels of 7' & 8' Spans, see Drawing No. R-400X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
30° SKEW - SECTIONS "A" ONLY
4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUADRUPLES — OVER 5'-0" COVER
STANDARD DRAWING NO. R-430X-1

Designed by:- W.C.H. 10-2-62 Checked by:- R.H.S. 11-16-62
Drawn by:- W.C.H. 2-10-64 Checked by:-
Quantities by:- W.C.H. 5-8-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 30° SKEWED ENDS

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH	"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel (Four of Each Length). SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'	#5	12"	96	23'-5"	#5	12"	48	21'-8"	2'-5"
		3'			96	23'-5"			48	"	"
		4'			96	23'-5"			48	"	"
		5'			96	23'-5"			48	"	"
		6'			96	23'-11"			48	22'-2"	2'-11"
	5 @ 5	3'			90	28'-5"			56	26'-8"	3'-11"
		4'			90	28'-5"			56	"	"
		5'	#6	12"	90	28'-5"	#6	12"	56	"	"
		6'			90	28'-11"			60	27'-2"	2'-8"
		7'			90	29'-4"			60	27'-2"	3'-1"
	5 @ 6	3'			86	33'-5"			74	31'-10"	3'-4"
		4'			86	33'-5"			76	"	"
		5'	#6	11"	86	33'-5"	#6	11"	76	"	"
		6'			84	33'-11"			76	32'-4"	3'-10"
		7'			84	34'-4"			80	32'-9"	2'-8"
		8'			84	34'-5"			80	32'-10"	2'-9"
	5 @ 7	4'			80	38'-5"			80	36'-8"	3'-5"
		5'			80	38'-5"			80	"	"
		6'	#6	12"	78	38'-11"	#6	12"	80	37'-2"	3'-11"
		7'			78	39'-4"			84	37'-7"	2'-7"
		8'			78	39'-5"			84	37'-8"	2'-8"
		9'			78	39'-11"			84	38'-2"	3'-2"

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls-hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b₁" bars In Bottom of Top Slab-some bent up over Division Walls-one end hooked. (2 of Each Length.) Alternate with "a₁" and "c" or "c₁" bars. SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'	#5	12"	46	25'-0"	0'-3"	2'-2"	3'-6½"	#5	12"	24	23'-8"	3'-9"
		3'			46	25'-0"	"	"	"			24	"	"
		4'			46	25'-0"	"	"	"			24	"	"
		5'			46	25'-0"	"	"	"			24	"	"
		6'			46	25'-6"	0'-3"	2'-8"	3'-5½"			24	24'-2"	4'-3"
	5 @ 5	3'			43	30'-2"	0'-8⅝"	2'-7"	4'-1½"			30	28'-10"	3'-6"
		4'			43	30'-2"	"	"	"			30	"	"
		5'	#5	12"	43	30'-2"	"	"	"	#5	12"	30	"	"
		6'			43	30'-8"	"	2'-8"	4'-2½"			30	29'-4"	4'-0"
		7'			43	31'-1"	0'-3⅜"	2'-9"	4'-2⅜"			30	29'-9"	4'-5"
	5 @ 6	3'			40	35'-3"	0'-4"	3'-0"	4'-10⅝"			40	34'-0"	3'-0"
		4'			40	35'-3"	"	"	"			40	"	"
		5'	#5	11"	40	35'-3"	"	"	"	#5	11"	40	"	"
		6'			40	36'-3"	"	3'-2"	4'-10⅜"			40	34'-11"	3'-11"
		7'			40	36'-3"	0'-4"	3'-2"	5'-0⅛"			40	35'-0"	4'-0"
	5 @ 7	4'			37	40'-7"	0'-4½"	3'-5"	5'-1⅞"			42	39'-2"	3'-1"
		5'			37	40'-7"	"	"	"			42	"	"
		6'	#6	12"	37	41'-1"	"	3'-6"	5'-1⅝"	#6	12"	42	39'-8"	3'-7"
		7'			37	41'-6"	"	3'-7"	5'-2⅛"			42	40'-1"	4'-0"
		8'			37	41'-7"	"	"	5'-2⅜"			42	40'-2"	4'-1"
		9'			36	42'-1"	0'-4⅝"	3'-8"	5'-3⅛"			42	40'-8"	4'-7"

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls-hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b₃" bars In Top of Bottom Slab-some bent down under Division Walls-one end hooked. (2 of Each Length.) Alternate with "b₂" and "c" or "c₁" bars. SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'	#5	12"	48	26'-0"	0'-2⅝"	2'-3"	3'-6⅝"	#5	12"	24	23'-6"	3'-9"
		3'			48	26'-10"	"	"	"			24	"	"
		4'			48	26'-10"	"	"	"			24	"	"
		5'			48	26'-10"	"	"	"			24	"	"
		6'			48	25'-6"	0'-2½"	2'-4"	3'-5½"			24	24'-2"	4'-3"
	5 @ 5	3'			45	30'-0"	0'-3"	2'-8"	4'-1½"			30	28'-8"	3'-6"
		4'			45	30'-0"	"	"	"			30	"	"
		5'	#5	12"	45	30'-0"	"	"	"	#5	12"	30	"	"
		6'			45	30'-6"	"	2'-9"	4'-2⅜"			30	29'-2"	4'-0"
		7'			45	30'-11"	0'-3"	2'-10"	4'-2⅜"			30	29'-7"	4'-5"
	5 @ 6	3'			42	35'-2"	0'-3⅝"	3'-1"	4'-10⅝"			40	33'-10"	3'-0"
		4'			42	35'-2"	"	"	"			40	"	"
		5'	#5	11"	42	35'-2"	"	"	"	#5	11"	40	"	"
		6'			42	35'-8"	"	3'-2"	4'-11⅛"			40	34'-6"	3'-6"
		7'			42	36'-1"	"	3'-3"	4'-11⅜"			40	34'-9"	3'-11"
		8'			42	36'-2"	0'-3⅝"	3'-3"	5'-0⅜"			40	35'-0"	4'-0"
	5 @ 7	4'			39	40'-6"	0'-4⅝"	3'-5½"	5'-1"			42	39'-1"	3'-1"
		5'			39	40'-6"	"	3'-5½"	5'-1"			42	"	"
		6'	#6	12"	39	41'-0"	"	3'-6½"	5'-1⅜"	#6	12"	42	39'-7"	3'-7"
		7'			39	41'-5"	"	3'-7"	5'-2⅛"			42	40'-0"	4'-0"
		8'			39	41'-6"	"	3'-7½"	5'-2⅜"			42	40'-1"	4'-1"
		9'			38	42'-0"	0'-4⅝"	3'-8½"	5'-3"			42	40'-7"	4'-7"

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. SIZE	SPACING	No. REQ'D	LENGTH	"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with "b" & "b₂" bars. (Four of each Length) SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'	#5	12"	100	18'-8"	#5	12"	36	17'-7"	3'-7"
		3'			100	18'-8"			36	"	"
		4'			100	18'-8"			36	"	"
		5'			100	18'-8"			36	"	"
		6'			100	19'-0"			36	18'-0"	4'-0"
	5 @ 5	3'			94	22'-8"			48	22'-1"	2'-10"
		4'			94	22'-8"			48	"	"
		5'	#6	12"	94	22'-8"	#6	12"	48	"	"
		6'			94	23'-0"			48	22'-6"	3'-3"
		7'			94	23'-4"			48	22'-10"	3'-7"
	5 @ 6	3'			94	26'-8"			60	25'-9"	3'-2"
		4'			94	26'-8"			60	"	"
		5'	#6	11"	94	26'-8"	#6	11"	60	"	"
		6'			92	27'-0"			60	25'-9"	3'-7"
		7'			92	27'-4"			60	26'-1"	3'-11"
		8'			92	27'-4"			60	26'-2"	4'-0"
	5 @ 7	4'			88	30'-8"			68	29'-6"	3'-1"
		5'			88	30'-8"			68	"	"
		6'	#6	12"	86	31'-0"	#6	12"	68	29'-9"	3'-6"
		7'			86	31'-4"			68	30'-2"	3'-10"
		8'			86	31'-4"			68	30'-7"	2'-9"
		9'			86	31'-8"			68	30'-7"	2'-9"

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel SIZE	SPACING	No. REQ'D	LENGTH	"d₁" bars STRAIGHT Longitudinal in Sidewalls and Division Walls SIZE	SPACING	No. REQ'D	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'			38				20				38	
		3'			38				30				38	
		4'			38				40				38	
		5'			38				50				38	
		6'			38				60				38	
	5 @ 5	3'			44				30				48	
		4'			44				40				48	
		5'			44				50				48	
		6'			44				60				48	
		7'			44				70				48	
	5 @ 6	3'			49				30				48	
		4'			49				40				48	
		5'			49				50				48	
		6'			49				60				48	
		7'			49				70				48	
		8'			49				80				48	
	5 @ 7	4'			54				40				53	
		5'			54				50				53	
		6'			54				60				53	
		7'			54				70				53	
		8'			54				80				53	
		9'			54				90				53	

DEPTH OF COVER D	SIZE S	CLEAR HEIGHT H	"f" bars STRAIGHT Verticals in Sidewalls and Division Walls. SIZE	SPACING	No. REQ'D	LENGTH	"k₁" bars STRAIGHT In Bottom of Headwalls SIZE	No. REQ'D	LENGTH	"k₂" bars STRAIGHT In Top of Headwalls and Aprons (2 Each) SIZE	No. REQ'D	LENGTH
5'-0" TO 5'-0" MAXIMUM	5 @ 4	2'	#4	12"	600	2'-10"	#5	6	27'-1"	#5	8	28'-2"
		3'			600	3'-10"		6	"		8	"
		4'			600	4'-10"		6	"		8	"
		5'			600	5'-10"		6	"		8	"
		6'			600	6'-10"		6	27'-7"		8	28'-9"
	5 @ 5	3'			600	3'-11"		6	32'-10"		8	34'-0"
		4'			600	4'-11"		6	"		8	"
		5'	#4	12"	600	5'-11"	#6	6	"	#6	8	"
		6'			600	6'-11"		6	33'-5"		8	34'-7"
		7'			600	7'-11"		6	33'-11"		8	35'-0"
	5 @ 6	3'			600	4'-0"		6	38'-7"		16	20'-1"
		4'			600	5'-0"		6	"	⊕	16	"
		5'			600	6'-0"		6	"		16	"
		6'			600	7'-0"		6	39'-2"		16	21'-2"
		7'			600	8'-0"		6	39'-8"		16	21'-6"
		8'			720	9'-0"		6	39'-9"		16	21'-6"
	5 @ 7	4'			600	5'-1"	⊕	12	23'-8"	⊕	16	23'-10"
		5'			600	6'-1"		12	"		16	"
		6'			600	7'-1"	⊕	12	23'-6"	#6	16	24'-1"
		7'			600	8'-1"		12	23'-9"		16	24'-4"
		8'			720	9'-1"		12	23'-10"		16	24'-5"
		9'			720	10'-1"	#5	12	24'-1"		16	24'-8"

2@ 30'-8" for 60'-0" Length Barrel (1'-8" Lap)

2@ 31'-8" for 60'-0" Length Barrel (1'-8" Lap)

2@ 30'-6" for 60'-0" Length Barrel (1'-8" Lap)

2@ 31'-8" for 60'-0" Length Barrel (1'-8" Lap)

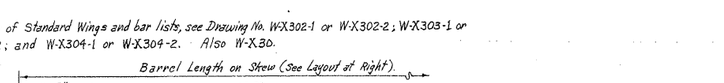
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#5	2½"	4⅝"	0'-11⅝"
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b₂"

NOTE:- Dimensions are to centers of bars (b, b₁, b₂ & b₃). The X, Y & Z values of b₁ bars are same as for "b" bars, and for b₃ bars same as for b₂ bars. ①-⑨ Min. & Max. lengths L for bars b₁ & b₃ for each type bend.

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#5	2½"	4⅝"	0'-5⅜"
#6	3"	5"	0'-7"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS b₁ AND b₃.



These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length L of b₁ and b₃ bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be b & b₂ bars, use a set of "a" and "c" bars instead.

⊕ These bars are to be spliced at center of mid-span.

BARREL DIMENSIONS: MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALLS K
5'-0"	5 @ 4	2'	40	23'-8"	6½"	6"	8"	6"	3'-0½"	27'-4"	28'-5⅝"
		3'	60	23'-8"		6"	8"		3'-6"	"	"
		4'	80	23'-8"		6"	8"		5'-0½"	"	"
		5'	100	23'-8"		6"	8"		6'-0½"	"	"
		6'	120	24'-2"		7"	9"		7'-0½"	27'-10⅝"	29'-0⅝"
	5 @ 5	3'	75	28'-8"		6"	8"		4'-1½"	33'-1⅝"	34'-3"
		4'	100	28'-8"		6"	8"		5'-1½"	"	"
		5'	125	28'-8"	7"	6"	8"	6½"	6'-1½"	"	"
		6'	150	29'-2"		7"	9"		7'-1½"	33'-8⅝"	34'-10"
		7'	175	29'-7"		7½"	10"		8'-1½"	34'-2"	35'-3⅝"
	5 @ 6	3'	90	33'-8"		6"	8"		4'-2½"	38'-10⅝"	40'-0⅝"
		4'	120	33'-8"		6"	8"		5'-2½"	"	"
		5'	150	33'-8"	7½"	6"	8"	7"	6'-2½"	"	"
		6'	180	34'-2"		7"	9"		7'-2½"	39'-5⅝"	40'-7½"
		7'	210	34'-7"		7½"	10"		8'-2½"	39'-11⅝"	41'-1"
		8'	240	34'-8"		8"	10"		9'-2½"	40'-0⅝"	41'-2⅝"
	5 @ 7	4'	140	38'-8"		6"	8"		5'-3⅜"	44'-7⅝"	45'-9⅝"
		5'	175	38'-8"		6"	8"		6'-3⅜"	"	"
		6'	210	39'-2"	8"	7"	9"	7¾"	7'-3⅜"	45'-2⅝"	46'-4⅝"
		7'	245	39'-7"		7½"	10"		8'-3⅜"	45'-8⅝"	46'-10⅝"
		8'	280	39'-8"		8"	10"		9'-3⅜"	45'-9⅝"	46'-11⅝"
		9'	315	40'-2"		9"	11"		10'-3⅜"	46'-4⅝"	47'-6⅝"

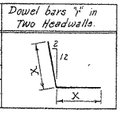
QUANTITIES: CLASS S CONC. PER LIN. FT. OF BARREL	REINFORCING STEEL: TOTAL FOR 60'-0" LENGTH OF BARREL	REINFORCING STEEL: PER LIN. FT. OF BARREL	REINFORCING STEEL: INDIVIDUAL PER LAP.
CU.YD.	LB.	LB.	LB.
1.185	19,865	237.07	11.49
1.321	15,673	250.93	12.84
1.456	16,981	263.79	13.19
1.592	17,290	277.15	13.54
1.858	18,344	293.29	14.83
1.602	21,240	337.03	13.94
1.738	22,093	350.39	14.53
1.873	22,857	363.75	15.14
2.141	23,957	380.65	16.49
2.421	25,217	397.14	17.84
1.914	24,904	406.95	15.31
2.050	25,712	420.31	15.66
2.186	26,520	433.67	16.01
2.455	27,498	450.90	17.34
2.786	28,529	467.67	18.71
2.934	30,104	493.51	19.06
2.923	30,496	481.72	17.53
2.559	31,254	495.08	17.88
2.830	32,073	512.44	18.23
3.112	33,296	529.31	19.58
3.311	34,504	545.30	20.93
3.675	37,356	598.35	21.28

* For quantities in Wings, see Standard Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"	56	2'-5"	1'-2⅝"
5'	#4	12"	68	2'-6"	1'-3"
6'	#4	12"	80	2'-7"	1'-3⅝"
7'	#4	12"	92	2'-8"	1'-4"

Dowel bars "y" in Two Headwalls.



GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

HS20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200 #/□"

Reinforcing steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS

FOR

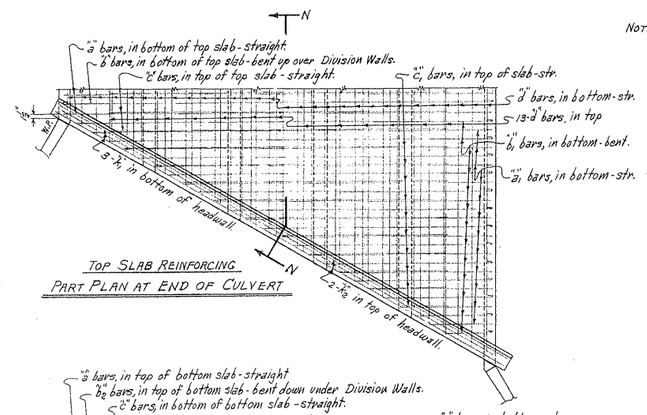
REINFORCED CONCRETE BOX CULVERTS

30° SKEW

4', 5', 6' AND 7' SPANS — 2:1, 3:1 OR 4:1 SLOPES

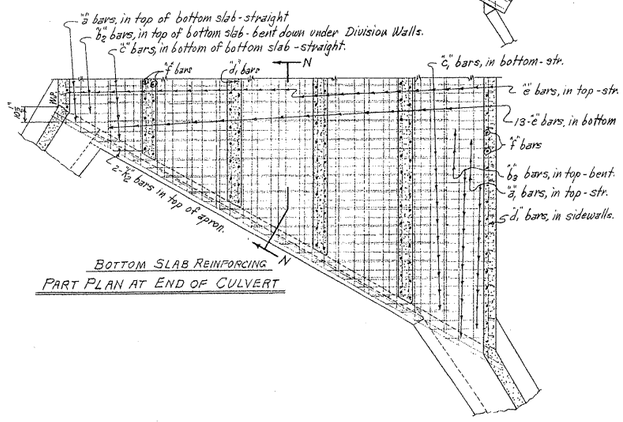
QUINTUPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-530X-01



TOP SLAB REINFORCING

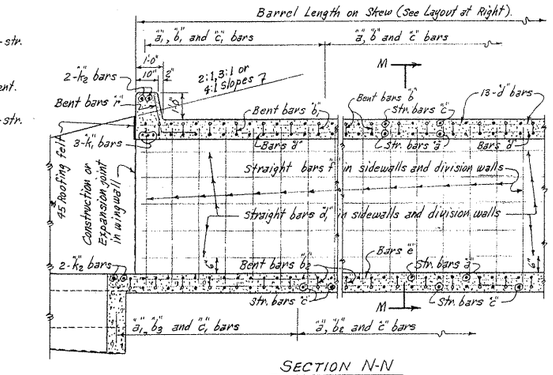
PART PLAN AT END OF CULVERT



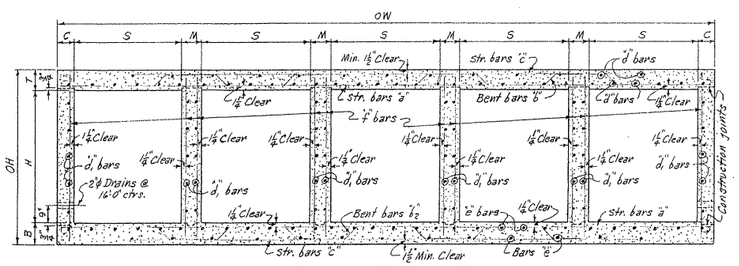
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

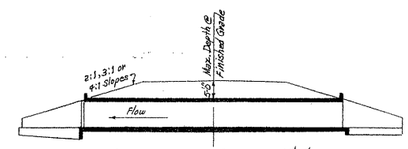
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2; and W-X304-1 or W-X304-2. Also W-X30.



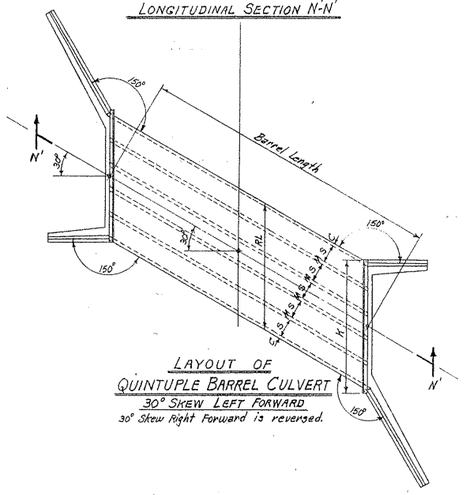
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N-N'



LAYOUT OF QUINTUPLE BARREL CULVERT

30° SKEW LEFT FORWARD

30° Skew Right Forward is reversed.

Designed by:- W.C.H. 1-23-63. Checked by:- R.H.S. 5-29-63.
Drawn by:- W.C.H. 3-5-69. Checked by:- Checked by:-
Quantities by:- W.C.H. 4-19-68

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 30° SKEWED ENDS

D (Depth of Cover) = 0'-0" TO 5'-0" MAXIMUM for all rows. S = Clear Span, H = Clear Height.

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a1" bars – STRAIGHT – In Top and Bottom Slab of Barrel (Eight of Each Length). "b" bars – BENT – See Diagrams below – In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.	"b" Size	"b" Spacing	"b" No. Req'd	"b" Length	X	Y	Z
5 @ 8'	4'	⊠ #6	11"	212	22'-9"	#6	11"±	96	21'-2"	3'-9"	⊠ #6	11"	102	23'-10"	0'-5"	3'-10"	6'-4"
	5'			212	23'-0"			96	21'-5"	4'-0"			102	24'-1"	"	3'-11"	6'-5"
	6'			212	23'-0"			96	"	"			102	24'-1"	"	"	"
	7'			212	23'-4"			104	21'-9"	2'-9"			100	24'-4"	"	4'-0"	6'-5½"
	8'			212	23'-4"			104	"	"			100	24'-4"	"	"	6'-6"
	9'			212	23'-6"			104	21'-11"	2'-11"			100	24'-7"	"	4'-1"	6'-7"
	10'			212	23'-9"			104	22'-2"	3'-2"			100	24'-10"	0'-5"	4'-2"	6'-8"
5 @ 9'	5'	⊠ #6	11"	204	25'-6"	#6	11"±	112	23'-11"	3'-4"	⊠ #6	11"	98	26'-8"	0'-5½"	4'-4"	7'-2"
	6'			204	25'-8"			112	24'-1"	3'-6"			98	26'-11"	"	4'-5"	7'-2½"
	7'			204	25'-8"			112	"	"			98	26'-11"	"	"	7'-2½"
	8'			204	25'-9"			112	24'-2"	3'-7"			98	26'-11"	"	"	7'-3"
	9'			204	26'-0"			112	24'-5"	3'-10"			98	27'-2"	"	4'-6"	7'-4"
	10'			204	26'-3"			112	24'-8"	4'-1"			96	27'-5"	"	4'-7"	7'-5"
	11'			204	26'-4"			112	24'-9"	4'-2"			96	27'-6"	0'-5½"	"	7'-6"
5 @ 10'	5'	⊠ #7	12"	184	28'-2"	#7	12"±	112	26'-5"	3'-8"	⊠ #6	12"	86	29'-3"	0'-6"	4'-9"	7'-11"
	6'			184	28'-4"			112	26'-7"	3'-10"			86	29'-6"	"	4'-10"	7'-11½"
	7'			184	28'-4"			112	"	"			86	29'-6"	"	"	"
	8'			184	28'-5"			112	26'-8"	3'-11"			86	29'-6"	"	"	8'-0"
	9'			180	28'-8"			112	26'-11"	4'-2"			86	29'-9"	"	4'-11"	8'-1"
	10'			180	28'-11"			120	27'-2"	2'-8"			86	30'-0"	"	5'-0"	8'-2"
	11'			180	29'-0"			120	27'-3"	2'-9"			86	30'-1"	"	"	8'-3"
	12'			180	29'-1"			120	27'-4"	2'-10"			86	30'-2"	0'-6"	5'-0"	8'-4"

"b1" & "b4" bars – BENT – In Bottom of Top Slab - some bent up over Division Walls (2 of Each Length). "b1" hooked one end. "b4" bars spliced to "b" bars. Alternate with "a1" and "c" or "c1" bars. "b2" bars – BENT – In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	Size	Spacing	No. Req'd "b1"	No. Req'd "b4"	"b1" Max.	"b1" Min.	"b4" Max.	"b4" Min.	L Max.	L Min.	"b2" Size	"b2" Spacing	"b2" No. Req'd	"b2" Length	X	Y	Z
5 @ 8'	4'	#6	11"±	26	26	23'-1"	3'-6"	22'-6"	2'-11"	21'-11"	2'-11"	⊠ #6	11"	106	23'-10"	0'-5"	3'-10"	6'-4"
	5'			26	26	23'-4"	3'-9"	22'-9"	3'-2"	22'-2"	3'-2"			106	24'-1"	"	3'-11"	6'-5"
	6'			26	26	"	"	"	"	"	"			106	24'-1"	"	"	"
	7'			26	26	23'-8"	4'-1"	23'-1"	3'-6"	22'-6"	3'-6"			104	24'-4"	"	4'-0"	6'-5½"
	8'			26	26	"	"	"	"	"	"			104	24'-4"	"	"	6'-6"
	9'			26	26	23'-10"	4'-3"	23'-3"	3'-8"	22'-8"	3'-8"			104	24'-7"	"	4'-1"	6'-7"
	10'			26	26	24'-1"	4'-6"	23'-6"	3'-11"	22'-11"	3'-11"			104	24'-10"	0'-5"	4'-2"	6'-8"
5 @ 9'	5'	#6	11"±	30	30	25'-11"	3'-1"	25'-4"	2'-6"	24'-8"	2'-6"	⊠ #6	11"	102	26'-8"	0'-5½"	4'-4"	7'-2"
	6'			30	30	26'-1"	3'-3"	25'-6"	2'-8"	24'-10"	2'-8"			102	26'-11"	"	4'-5"	7'-2½"
	7'			30	30	"	"	"	"	"	"			102	26'-11"	"	"	"
	8'			30	30	26'-2"	3'-4"	25'-7"	2'-9"	24'-11"	2'-9"			102	26'-11"	"	"	7'-3"
	9'			30	30	26'-5"	3'-7"	25'-10"	3'-0"	25'-2"	3'-0"			102	27'-2"	"	4'-6"	7'-4"
	10'			30	30	26'-8"	3'-10"	26'-1"	3'-3"	25'-5"	3'-3"			100	27'-5"	"	4'-7"	7'-5"
	11'			30	30	26'-9"	3'-11"	26'-2"	3'-4"	25'-6"	3'-4"			100	27'-6"	0'-5½"	"	7'-6"
5 @ 10'	5'	#6	12"±	30	30	28'-5"	3'-2"	27'-10"	2'-7"	27'-1"	2'-7"	⊠ #6	12"	90	29'-3"	0'-6"	4'-9"	7'-11"
	6'			30	30	28'-7"	3'-4"	28'-0"	2'-9"	27'-3"	2'-9"			90	29'-6"	"	4'-10"	7'-11½"
	7'			30	30	"	"	"	"	"	"			90	29'-6"	"	"	"
	8'			30	30	28'-8"	3'-5"	28'-1"	2'-10"	27'-4"	2'-10"			90	29'-6"	"	"	8'-0"
	9'			30	30	28'-11"	3'-8"	28'-4"	3'-1"	27'-7"	3'-1"			90	29'-9"	"	4'-11"	8'-1"
	10'			30	30	29'-2"	3'-11"	28'-7"	3'-4"	27'-10"	3'-4"			90	30'-0"	"	5'-0"	8'-2"
	11'			30	30	29'-3"	4'-0"	28'-8"	3'-5"	27'-11"	3'-5"			90	30'-1"	"	"	8'-3"
	12'			30	30	29'-4"	4'-1"	28'-9"	3'-6"	28'-0"	3'-6"			90	30'-2"	0'-6"	5'-0"	8'-4"

"b3" & "b5" bars – BENT – In Top of Bottom Slab - some bent down under Division Walls (2 of Each Length). "b3" hooked one end. "b5" bars spliced to "b2" bars. Alternate with "a1" and "c" or "c1" bars. "c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars (Four of each Length).

S	H	Size	Spacing	No. Req'd "b3"	No. Req'd "b5"	"b3" Max.	"b3" Min.	"b5" Max.	"b5" Min.	L Max.	L Min.	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length	"c1" Size	"c1" Spacing	"c1" No. Req'd	"c1" Length Max.	"c1" Length Min.
5 @ 8'	4'	#6	11"±	26	26	23'-1"	3'-6"	22'-6"	2'-11"	21'-11"	2'-11"	#6	11"	92	34'-8"	#6	11"±	84	34'-4"	2'-8"
	5'			26	26	23'-4"	3'-9"	22'-9"	3'-2"	22'-2"	3'-2"			92	35'-0"			84	34'-9"	3'-1"
	6'			26	26	"	"	"	"	"	"			92	35'-0"			84	"	"
	7'			26	26	23'-8"	4'-1"	23'-1"	3'-6"	22'-6"	3'-6"			92	35'-4"			84	35'-1"	3'-5"
	8'			26	26	"	"	"	"	"	"			92	35'-4"			84	35'-2"	3'-6"
	9'			26	26	23'-10"	4'-3"	23'-3"	3'-8"	22'-8"	3'-8"			92	35'-8"			84	35'-6"	3'-10"
	10'			26	26	24'-1"	4'-6"	23'-6"	3'-11"	22'-11"	3'-11"			96	36'-0"			84	34'-5"	2'-9"
5 @ 9'	5'	#6	11"±	30	30	25'-11"	3'-1"	25'-4"	2'-6"	24'-8"	2'-6"	#6	11"	90	39'-0"	#6	11"±	92	37'-8"	2'-10"
	6'			30	30	26'-1"	3'-3"	25'-6"	2'-8"	24'-10"	2'-8"			90	39'-4"			92	38'-0"	3'-2"
	7'			30	30	"	"	"	"	"	"			90	39'-4"			92	38'-0"	"
	8'			30	30	26'-2"	3'-4"	25'-7"	2'-9"	24'-11"	2'-9"			90	39'-4"			92	38'-1"	3'-3"
	9'			30	30	26'-5"	3'-7"	25'-10"	3'-0"	25'-2"	3'-0"			90	39'-8"			92	38'-6"	3'-8"
	10'			30	30	26'-8"	3'-10"	26'-1"	3'-3"	25'-5"	3'-3"			90	40'-0"			92	38'-11"	4'-1"
	11'			30	30	26'-9"	3'-11"	26'-2"	3'-4"	25'-6"	3'-4"			90	40'-0"			92	39'-0"	4'-2"
5 @ 10'	5'	#6	12"±	30	30	28'-5"	3'-2"	27'-10"	2'-7"	27'-1"	2'-7"	⊠ #7	12"	200	22'-8"	#7 (8 Ea. Lgth.)	12"±	88	21'-2"	3'-8"
	6'			30	30	28'-7"	3'-4"	28'-0"	2'-9"	27'-3"	2'-9"			200	22'-10"			88	21'-4"	3'-10"
	7'			30	30	"	"	"	"	"	"			200	22'-10"			88	"	"
	8'			30	30	28'-8"	3'-5"	28'-1"	2'-10"	27'-4"	2'-10"			200	22'-10"			88	21'-5"	3'-11"
	9'			30	30	28'-11"	3'-8"	28'-4"	3'-1"	27'-7"	3'-1"			196	23'-0"			88	21'-8"	4'-2"
	10'			30	30	29'-2"	3'-11"	28'-7"	3'-4"	27'-10"	3'-4"			196	23'-2"			96	21'-11"	2'-8"
	11'			30	30	29'-3"	4'-0"	28'-8"	3'-5"	27'-11"	3'-5"			196	23'-2"			96	22'-0"	2'-9"
	12'			30	30	29'-4"	4'-1"	28'-9"	3'-6"	28'-0"	3'-6"			196	23'-2"			96	22'-1"	2'-10"

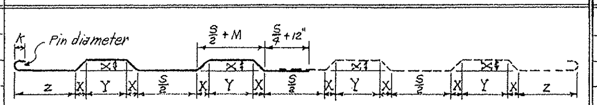
"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. "d1" bars – STRAIGHT – Longitudinal in Sidewalls and Division Walls. "e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. "f" bars – STRAIGHT – Verticals in Sidewalls and Division Walls. "k1" bars – STRAIGHT – In Bottom of Headwalls (3 of Each Length per Headwall). "k2" bars – In Top of Headwalls and Aprons (2 Each).

"d" Length: 60'-0" Length Barrel (1'-8" Lap); 2 @ 30'-8" for 60'-0" Length Barrel. "d1" Length: 60'-0" Length Barrel (1'-3" Lap); 2 @ 30'-6" for 60'-0" Length Barrel. "e" Length: 60'-0" Length Barrel (1'-3" Lap); 2 @ 31'-8" for 60'-0" Length Barrel.

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d1" Size	"d1" Spacing	"d1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length Max.	"k1" Length Min.	"k2" Size	"k2" No. Req'd	"k2" Length
5 @ 8'	4'	#5	11½"	60	#4	12"	40	#4	12"	58	#4	12"	600	5'-2"	⊗ #6	12	31'-2"	21'-0"	⊠ #6	16	26'-8"
	5'			60			50			58			600	6'-2"		12	31'-6"	21'-3"		16	27'-0"
	6'			60			60			58			600	7'-2"		12	"	"		16	"
	7'			60			70			58			600	8'-2"		12	31'-9"	21'-6"		16	27'-3"
	8'			60			80			58		10"	720	9'-2"		12	"	21'-7"		16	"
	9'			60			90			58	#5	12"	600	10'-2"		12	32'-2"	21'-9"		16	27'-7"
	10'			60			100			58		11"	660	11'-2"		12	32'-6"	22'-0"		16	27'-10"
5 @ 9'	5'	#5	11½"	69	#4	12"	50	#4	12"	67	#4	12"	600	6'-3"	⊗ #6	12	34'-10"	23'-8"	⊠ #6	16	29'-10"
	6'			69			60			67			600	7'-3"		12	35'-2"	23'-10"		16	30'-1"
	7'			69			70			67			600	8'-3"		12	"	"		16	30'-1"
	8'			69			80			67		10"	720	9'-3"		12	35'-3"	23'-11"		16	30'-2"
	9'			69			90			67	#5	12"	600	10'-3"		12	35'-6"	24'-3"		16	30'-5"
	10'			69			100			67		11"	660	11'-3"		12	35'-10"	24'-5"		16	30'-9"
	11'			69			110			67		10"	720	12'-3"		12	36'-0"	24'-6"		16	30'-10"
5 @ 10'	5'	#5	11½"	74	#4	12"	50	#4	12"	72	#4	12"	600	6'-4"	⊗ #7	12	38'-6"	26'-2"	⊠ #7	16	32'-11"
	6'			74			60			72			600	7'-4"		12	38'-10"	26'-4"		16	33'-2"
	7'			74			70			72			600	8'-4"		12	"	"		16	"
	8'			74			80			72		10"	720	9'-4"		12	"	26'-5"		16	"
	9'			74			90			72	#5	12"	600	10'-4"		12	39'-3"	26'-7"		16	33'-6"
	10'			74			100			72		11"	660	11'-4"		12	39'-7"	26'-10"		16	33'-9"
	11'			74			110			72		10"	720	12'-4"		12	39'-8"	26'-11"		16	33'-11"
	12'			74			120			72	#6	12"	600	13'-4"		12	39'-9"	27'-0"		16	34'-0"

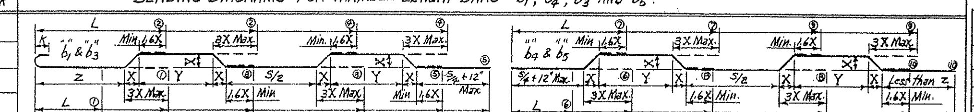
BENDING DIAGRAMS FOR BARS "b" AND "b2"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"



BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b1", "b4", "b3" AND "b5".

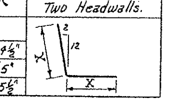
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	1'-2"



DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
8'	#4	12"±	104	2'-9"	1'-4½"
9'	#4	12"±	116	2'-10"	1'-5"
10'	#4	12"±	128	2'-11"	1'-5½"

Dowel bars "r" in Two Headwalls.



NOTE:- Dimensions are to centers of bars (b, b1, b2, b3, b4 & b5). The X, Y & Z values of "b1" & b4 bars are same as for "b" bars and for "b3" & "b5" bars same as for b2 bars. ①②--⑨⑩ Min. & Max. lengths L for bars "b1", "b4", "b3" & "b5" for each type bend.

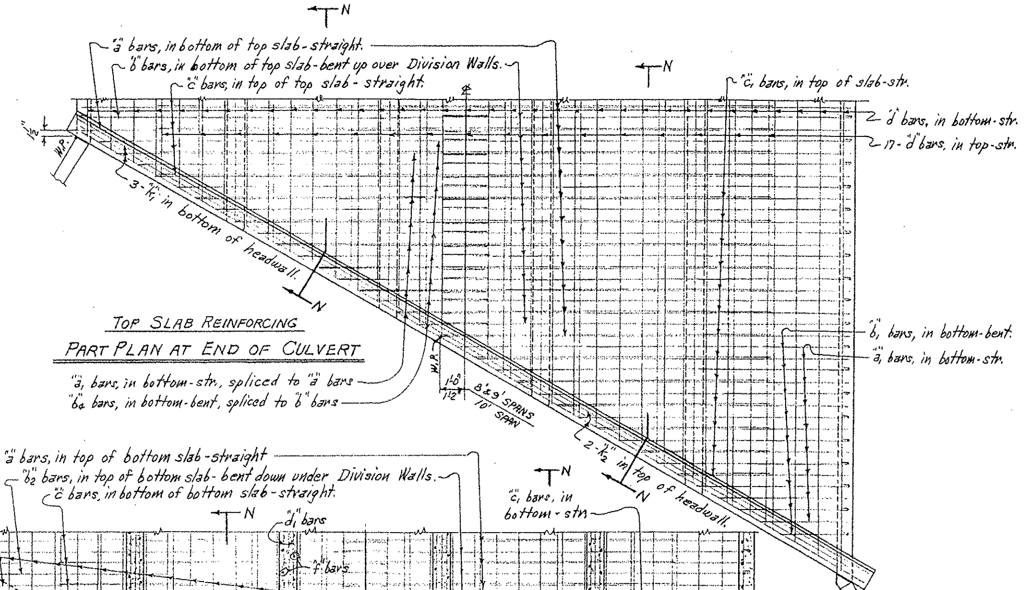
BARREL DIMENSIONS / * QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel Total for 60'-0" Length of Barrel (LB.)	Per Lin. Ft. of Barrel (LB.)	Additional per Lap (LB.)
5'-0"	5 @ 8'	4'	160	43'-8"	8½"	6"	8"	8½"	5'-5"	50'-5⅛"	51'-7"	2.834	36,936	581.48	186.13
		5'	200	44'-2"		7"	9"		6'-5"	51'-0"	52'-1¾"	3.089	38,089	599.21	194.49
		6'	240	44'-2"		7"	9"		7'-5"	51'-0"	52'-1¾"	3.243	38,898	612.57	202.83
		7'	280	44'-7"		7½"	10"		8'-5"	51'-5¾"	52'-7½"	3.528	39,976	630.84	211.18
		8'	320	44'-8"		8"	10"		9'-5"	51'-7"	52'-8¾"	3.726	41,530	656.45	219.53
		9'	360	45'-2"		9"	11"		10'-5"	52'-1⅞"	53'-3¾"	4.092	44,174	699.51	227.88
		10'	400	45'-8"		10"	12"		11'-5"	52'-8⅜"	53'-10¾"	4.495	46,278	731.58	236.23
	5 @ 9'	5'	225	49'-2"	9"	7"	9"	9"	6'-6"	56'-9¼"	57'-11¼"	3.503	42,002	661.59	217.64
		6'	270	49'-7"		7½"	10"		7'-6"	57'-3"	58'-5"	3.778	43,096	678.77	225.99
		7'	315	49'-7"		7½"	10"		8'-6"	57'-3"	58'-5"	3.943	43,904	692.13	234.34
		8'	360	49'-8"		8"	10"		9'-6"	57'-4¼"	58'-6"	4.142	45,584	718.40	242.69
		9'	405	50'-2"		9"	11"		10'-6"	57'-11⅛"	59'-1"	4.509	48,250	762.21	251.04
		10'	450	50'-8"		10"	12"		11'-6"	58'-6"	59'-8"	4.914	50,176	794.35	259.39
		11'	495	50'-10"		11"	12"		12'-6"	58'-8¾"	59'-10½"	5.201	52,133	827.44	267.74
	5 @ 10'	5'	250	54'-2"	9½"	7"	9"	9½"	6'-7"	62'-6⅜"	63'-8⅜"	3.948	50,537	792.33	230.51
		6'	300	54'-7"		7½"	10"		7'-7"	63'-0⅜"	64'-2¼"	4.219	51,655	809.92	238.86
		7'	350	54'-7"		7½"	10"		8'-7"	63'-0⅜"	64'-2¼"	4.389	52,463	823.28	247.21
		8'	400	54'-8"		8"	10"		9'-7"	63'-1½"	64'-3¼"	4.588	54,101	849.79	255.56
		9'	450	55'-2"		9"	11"		10'-7"	63'-8⅜"	64'-10¼"	4.957	56,457	894.34	263.91
		10'	500	55'-8"		10"	12"		11'-7"	64'-3⅜"	65'-5¼"	5.363	58,674	927.10	272.26
		11'	550	55'-10"		11"	12"		12'-7"	64'-5⅜"	65'-7½"	5.651	60,695	960.38	280.61
		12'	600	56'-6"		12"	12"		13'-7"	64'-8"	65'-9¾"	5.951	63,925	1014.14	288.96

* For quantities in wings, see Std. Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

(Flag symbol) These bars are in the skewed portion of barrel only. The lengths of "a1" and "c1" bars and overall length L of "b1" & "b4" and "b3" & "b5" bars vary by 1'-9" for 12" spacing and 1'-7" for 11" spacing.

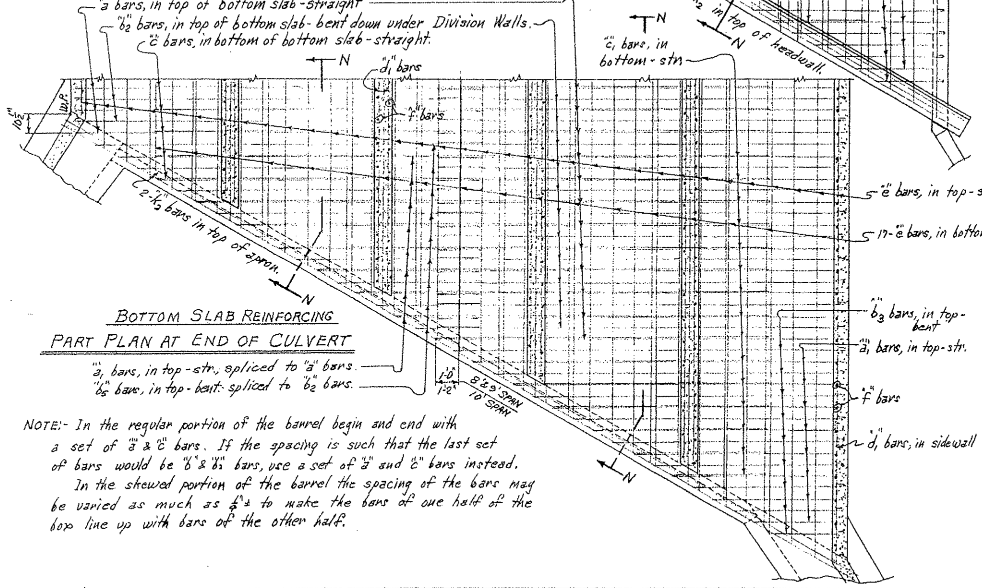
⊠ These bars are to be spliced at center of center span to make full length bar. Some "b" bars are to be spliced to "b4" bars and some "b2" bars to "b5" to make full length bars. Lap #6 bars 2'-0" and #7 bars 2'-4". Some "a" bars are to be spliced to "a1" bars, and in 10'-0" SPANS some "c" bars are spliced to "c1" bars. ⊗ "k2" bars are to be spliced at alternate center Division Walls.



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

"a1" bars, in bottom - str., spliced to "a" bars
"b4" bars, in bottom - bent, spliced to "b" bars



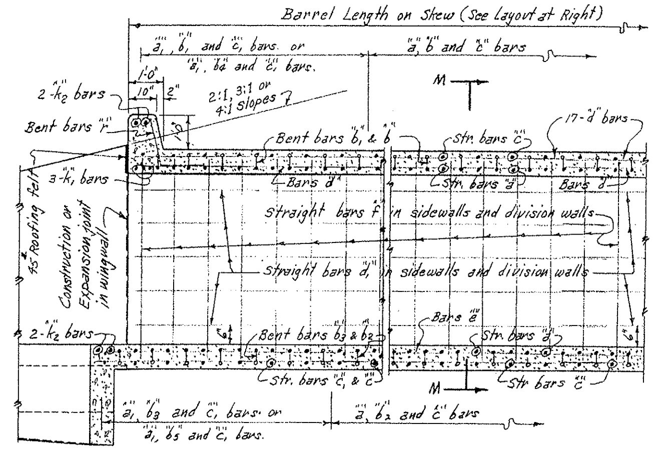
BOTTOM SLAB REINFORCING

PART PLAN AT END OF CULVERT

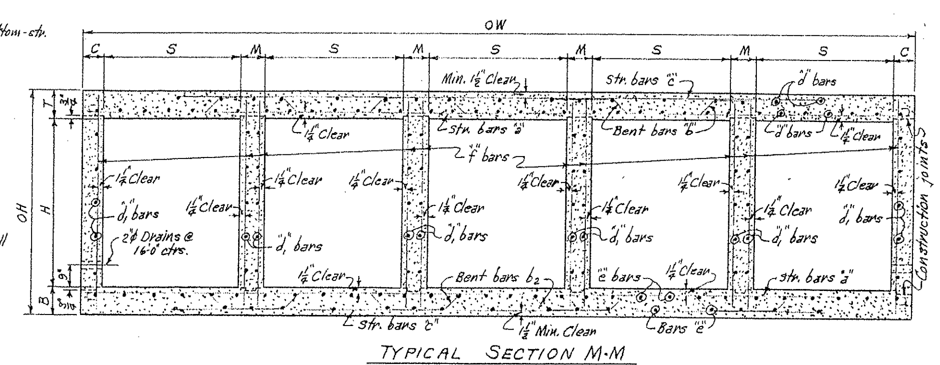
"a1" bars, in top - str., spliced to "a" bars.
"b5" bars, in top - bent - spliced to "b2" bars.

NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b2" bars, use a set of "a" and "c" bars instead. In the skewed portion of the barrel the spacing of the bars may be varied as much as ¼"± to make the bars of one half of the box line up with bars of the other half.

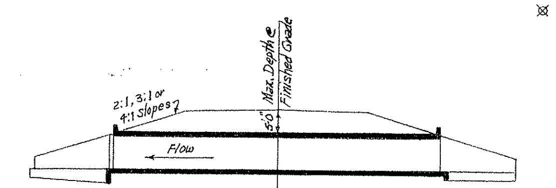
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2 and W-X304-1 or W-X304-2. Also W-X30.



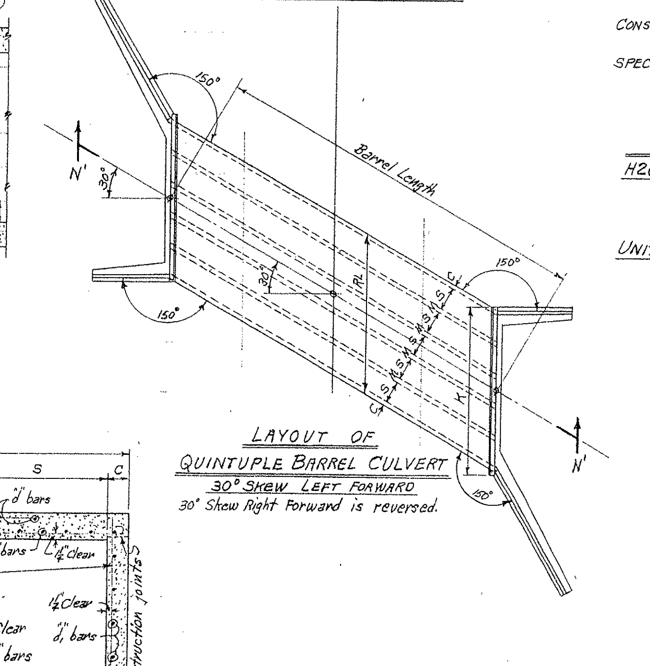
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF QUINTUPLE BARREL CULVERT

30° SKEW LEFT FORWARD

30° Skew Right Forward is reversed.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-6". Lap longitudinal bars 30 diameters min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

CLASS S CONCRETE

Designed by:- W.C.H. 1-23-63. Checked by:- R.H.S. 5-24-63.
Drawn by:- W.C.H. 3-30-64. Checked by:-
Quantities by:- W.C.H. 4-15-64. Checked by:-

REVISIONS:- Bars b3 & b4 in Bending Diagram. 6-17-66 W.C.H.

ARKANSAS STATE HIGHWAY COMMISSION

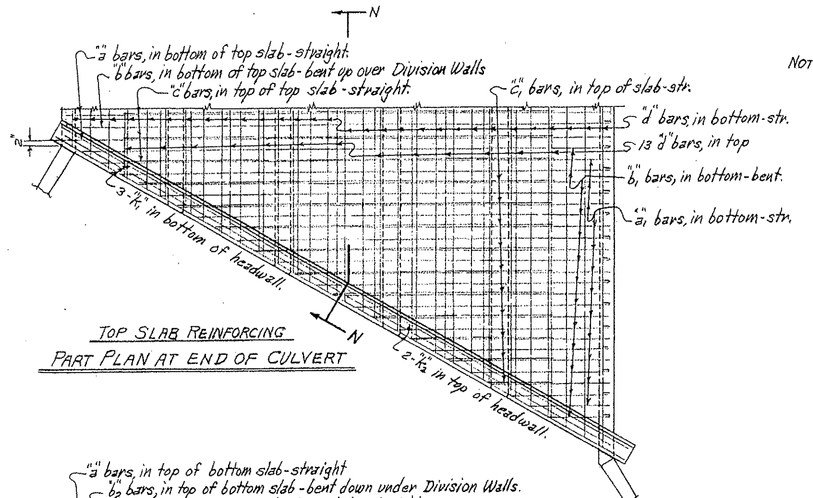
DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW

8', 9' AND 10' SPANS — QUINTUPLES
2:1, 3:1 OR 4:1 SLOPES — UNDER 5'-0" COVER

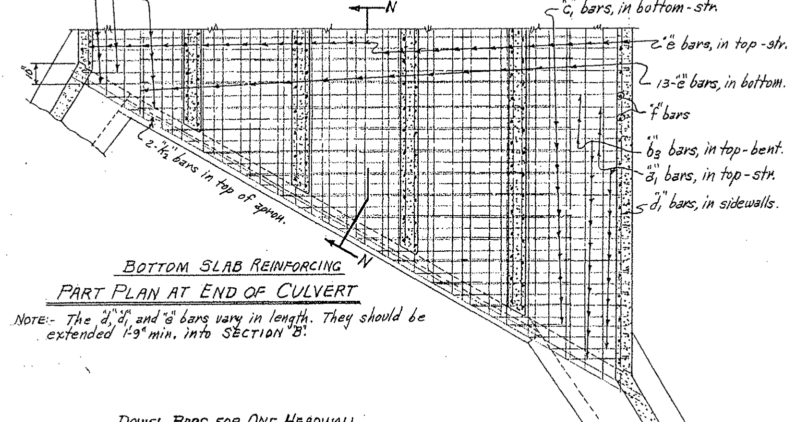
STANDARD DRAWING NO. R-530X-02

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

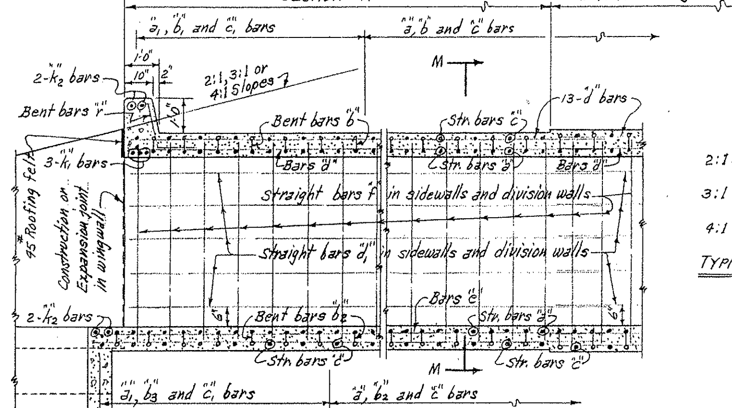


BOTTOM SLAB REINFORCING

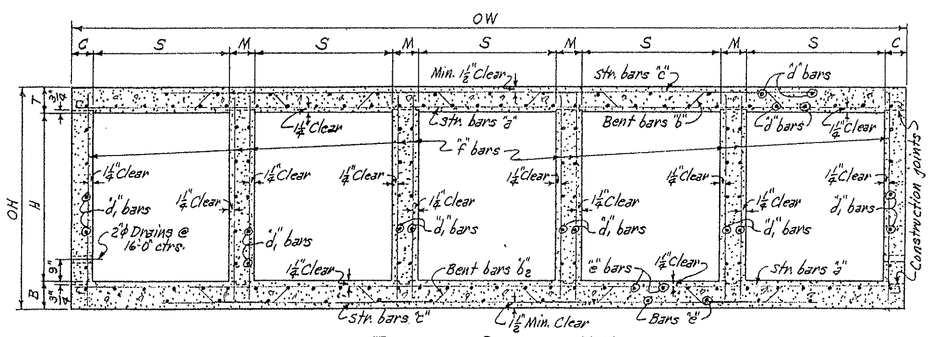
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-9" min. into SECTION "B".

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X302-1 or W-X302-2; W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

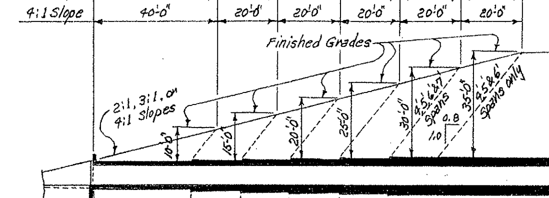


SECTION N-N



TYPICAL SECTION M-M

2:1 Slope	20'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
3:1 Slope	30'-0"	15'-0"	15'-0"	15'-0"	15'-0"	15'-0"
4:1 Slope	40'-0"	20'-0"	20'-0"	20'-0"	20'-0"	20'-0"

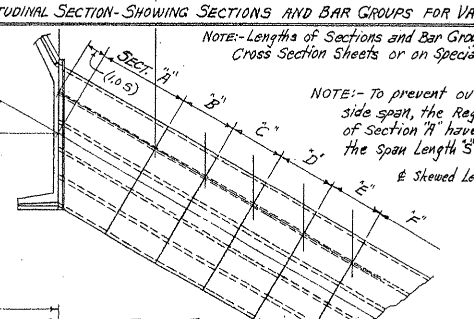


2:1 Slope =	SECTIONS / Bar Group	A=12'-0" / A	B=6'-0" / B	C=6'-0" / C	D=6'-0" / D	E=6'-0" / E	MID-SECTION F, Varies / F
3:1 Slope =	SECTIONS / Bar Group	A=22'-0" / A	B=11'-0" / B	C=11'-0" / C	D=11'-0" / D	E=11'-0" / E	MID-SECTION F, Varies / F
4:1 Slope =	SECTIONS / Bar Group	A=32'-0" / A	B=16'-0" / B	C=16'-0" / C	D=16'-0" / D	E=16'-0" / E	MID-SECTION F, Varies / F

These lengths are perpendicular to ℄ of roadway near ℄ of Division Wall on Long Side. See Table of Skewed Lengths above.

TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.

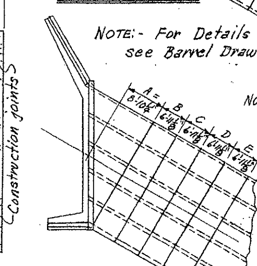


NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ℄ Length of Section "A" have been shortened by the Span Length "S". See Table above.

℄ Skewed Length of "A" = "A" × 1.1547 - "S".

PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B thru F, see Barrel Drawing Nos. R-500X-X1 & ________



NOTE:- Minimum ℄ Length of SECTION "A" on 30° Skew = (0.288675 OW + 2").

PART PLAN
5'-0" SPANS
2:1 SLOPE

℄ LENGTHS OF SECTIONS ON 30° SKEW

SLOPE		2:1		3:1		4:1	
SECTIONS		A	B, C, D & E	A	B, C, D & E	A	B, C, D & E
SPAN	4'	9'-10¼"	6'-11⅛"	21'-4¾"	12'-8⅜"	32'-11½"	18'-5¾"
	5'	8'-10¼"	"	20'-4¾"	"	31'-11½"	"
	6'	———	———	19'-4¾"	"	30'-11½"	"
	7'	———	———	18'-4¾"	"	29'-11½"	"

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	CLASS S CONCRETE, BARREL ONLY 2:1	3:1	4:1	REINFORCING STEEL, BARREL, APRON AND HEADWALL 2:1	3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU. YD.	CU. YD.	CU. YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	5 @ 4'	2'	40	23'-8"	6"	6"	8"	6"	3'-0"	27'-4"	28'-5¾"	11.31	24.56	37.84	2060	4055	6111
		3'	60	23'-8"		6"	8"		4'-0"	"	"	12.65	27.47	42.32	2204	4353	6574
		4'	80	23'-8"		6"	8"		5'-0"	"	"	13.99	30.38	46.80	2491	4650	7037
		5'	100	23'-8"		6"	8"		6'-0"	"	"	15.33	33.29	51.28	2634	4948	7500
		6'	120	24'-2"		7"	9"		7'-0"	27'-10⅞"	29'-0¾"	17.94	38.96	60.02	2670	5302	8040
	5 @ 5'	3'	75	28'-8"	6½"	6"	8"	6½"	4'-1"	33'-1¼"	34'-3"	13.79	31.78	49.79	2643	5424	8250
		4'	100	28'-8"		6"	8"		5'-1"	"	"	14.99	34.53	51.11	2773	5708	8697
		5'	125	28'-8"		6"	8"		6'-1"	"	"	16.19	37.30	58.45	2908	5993	9143
		6'	150	29'-2"		7"	9"		7'-1"	33'-8¼"	34'-10"	18.56	42.75	66.98	3072	6255	9639
		7'	175	29'-7"		7½"	10"		8'-1"	34'-2"	35'-3¾"	21.03	48.44	75.90	3506	7203	11,110
	5 @ 6'	3'	90	33'-8"	7"	6"	8"	7¼"	4'-2¼"	38'-10½"	40'-0¼"		36.62	58.95		6723	10,552
		4'	120	33'-8"		6"	8"		5'-2¼"	"	"		39.26	62.66		6997	10,988
		5'	150	33'-8"		6"	8"		6'-2¼"	"	"		41.89	66.87		7272	11,425
		6'	180	34'-2"		7"	9"		7'-2¼"	39'-5½"	40'-7¼"		47.11	75.20		7199	11,549
		7'	210	34'-7"		7½"	10"		8'-2¼"	39'-11⅝"	41'-1"		52.54	83.87		8588	13,460
		8'	240	34'-8"		8"	10"		9'-2¼"	40'-0⅜"	41'-2¼"		56.38	90.00		9138	14,136
	5 @ 7'	4'	140	38'-8"	7¾"	6"	8"	8¼"	5'-4"	44'-7¾"	45'-9¾"		45.12	73.49		8418	13,285
		5'	175	38'-8"		6"	8"		6'-4"	"	"		47.61	77.53		8679	13,705
		6'	210	39'-2"		7"	9"		7'-4"	45'-2¾"	46'-4¾"		52.61	85.68		9048	14,272
		7'	245	39'-7"		7½"	10"		8'-4"	45'-8¼"	46'-10¼"		57.82	94.16		9312	15,148
		8'	280	39'-8"		8"	10"		9'-4"	45'-9⅝"	46'-11½"		61.48	100.12		9756	15,986
		9'	315	40'-2"		9"	11"		10'-4"	46'-4⅝"	47'-6½"		68.17	111.02		10,984	17,370

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	B	C			D
25.0' to 29.5'	A	B	C	D		E
30.0' to 35.0'	A	B	C	D	E	F

OR ALT.

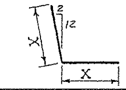
DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	2@C				D
25.0' to 29.5'	A	B	2@D			E
30.0' to 35.0'	A	2@C		2@E		F

AVERAGE LENGTHS OF LONG. BARS "d", "d1" & "e"

SLOPE		2:1		3:1		4:1	
BARS		d & d1	e	d & d1	e	d & d1	e
SPANS	4'	11'-6"	12'-8"	23'-1"	24'-3"	34'-7"	35'-9"
	5'	10'-6"	11'-8"	22'-1"	23'-3"	33'-7"	34'-9"
	6'	———	———	21'-1"	22'-3"	32'-7"	33'-9"
	7'	———	———	20'-1"	21'-3"	31'-7"	32'-9"

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"±	28	2'-4"	1'-2"	
5'	#4	12"±	34	2'-5"	1'-2½"	
6'	#4	12"±	40	2'-6"	1'-3"	
7'	#4	12"±	46	2'-8"	1'-4"	



BAR LIST FOR SECTION "A" ON 30° SKEW - ONE END ONLY

SECTION & BAR GROUP: SECTION "A" AND BAR GROUP "A". LENGTH OF SECTION: Lengths vary with Clear Span "S" per Slope, see Table upper right. DEPTH OF COVER (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars - STRAIGHT - In Top and Bottom Slab of Barrel. "a1" bars (▼) - STRAIGHT - In Top and Bottom Slab of Barrel. (Two of each Length.)

CLEAR SPAN S	CLEAR HEIGHT H	"a" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.
5 @ 4'	2'	#4	12"	7	31	53	23'-5"	#4	12"	22	21'-8"	4'-2"
	3'			7	31	53	"			22	"	"
	4'			7	31	53	"			22	"	"
	5'			7	31	53	"			22	"	"
	6'			7	31	53	23'-11"			24	22'-2"	2'-11"
5 @ 5'	3'	#4	11"	3	29	53	28'-5"	#4	11"	32	26'-10"	3'-1"
	4'			3	29	53	"			32	"	"
	5'			3	29	53	"			32	"	"
	6'			3	27	53	28'-11"			32	27'-4"	3'-7"
	7'			3	27	53	29'-4"			32	27'-9"	4'-0"
5 @ 6'	3'	#5	13"	—	19	41	33'-5"	#5	13"	32	31'-7"	3'-5"
	4'			—	19	41	"			32	"	"
	5'			—	19	41	"			32	"	"
	6'			—	19	41	33'-11"			32	32'-1"	3'-11"
	7'			—	19	41	34'-4"			34	32'-6"	2'-6"
	8'			—	19	41	34'-5"			34	32'-7"	2'-7"
5 @ 7'	4'	#5	11"	—	17	43	38'-5"	#5	11"	44	36'-10"	3'-7"
	5'			—	17	43	"			44	"	"
	6'			—	17	43	38'-11"			46	37'-4"	2'-6"
	7'			—	17	43	39'-4"			46	37'-9"	2'-11"
	8'			—	17	43	39'-5"			46	37'-10"	3'-0"
	9'			—	17	41	39'-11"			46	38'-4"	3'-6"

"b" bars - BENT - See Diagrams below - In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. "b1" bars (▼) - In Bottom of Top Slab - some bent up over Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
5 @ 4'	2'	#4	12"	3	14	26	24'-11"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	12	23'-7"	3'-8"	22'-6"	3'-3"
	3'			3	14	26	"	"	"	"			12	"	"	"	"
	4'			3	14	26	"	"	"	"			12	"	"	"	"
	5'			3	14	26	"	"	"	"			12	"	"	"	"
	6'			3	14	26	25'-5"	0'-2¾"	2'-3½"	3'-5¼"			12	24'-1"	4'-2"	23'-0"	3'-9"
5 @ 5'	3'	#4	11"	1	13	26	30'-0"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	16	28'-10"	4'-3"	27'-7"	3'-10"
	4'			1	13	26	"	"	"	"			16	"	"	"	"
	5'			1	13	26	"	"	"	"			16	"	"	"	"
	6'			1	13	25	30'-6"	"	2'-8½"	4'-2¼"			17	29'-4"	3'-2"	28'-1"	2'-9"
	7'			1	13	25	30'-11"	0'-3¼"	2'-9½"	4'-2¾"			17	29'-9"	3'-7"	28'-6"	3'-2"
5 @ 6'	3'	#5	13"	—	9	20	35'-2"	0'-3½"	3'-1"	4'-10¼"	#5	13"	17	33'-9"	3'-0"	32'-6"	2'-6"
	4'			—	9	20	"	"	"	"			17	"	"	"	"
	5'			—	9	20	"	"	"	"			17	"	"	"	"
	6'			—	9	20	35'-8"	"	3'-2"	4'-11¼"			17	34'-3"	3'-6"	33'-0"	3'-0"
	7'			—	9	20	36'-1"	"	3'-3"	4'-11¾"			17	34'-8"	3'-11"	33'-5"	3'-5"
	8'			—	9	20	36'-2"	0'-3½"	3'-3"	5'-0¼"			17	34'-9"	4'-0"	33'-6"	3'-6"
5 @ 7'	4'	#5	11"	—	8	20	40'-4"	0'-4¼"	3'-5½"	5'-7"	#5	11"	23	39'-1"	3'-3"	37'-7"	2'-9"
	5'			—	8	20	"	"	"	"			23	"	"	"	"
	6'			—	8	20	40'-10"	"	3'-6½"	5'-8"			23	39'-7"	3'-9"	38'-1"	3'-3"
	7'			—	7	20	41'-3"	"	3'-7½"	5'-8½"			23	40'-0"	4'-2"	38'-6"	3'-8"
	8'			—	7	20	41'-4"	"	3'-7½"	5'-9"			23	40'-1"	4'-3"	38'-7"	3'-9"
	9'			—	7	20	41'-10"	0'-4¼"	3'-8½"	5'-10"			24	40'-7"	3'-2"	39'-1"	2'-8"

"b2" bars - BENT - See Diagrams below - In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. "b3" bars (▼) - In Top of Bottom Slab - some bent down under Division Walls - one end hooked. Alt. with "a1" and "c1" or "c" bars.

S	H	"b2" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	L MAX.	MIN.
5 @ 4'	2'	#4	12"	4	15	27	24'-11"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	12	23'-7"	3'-8"	22'-6"	3'-3"
	3'			4	15	27	"	"	"	"			12	"	"	"	"
	4'			4	15	27	"	"	"	"			12	"	"	"	"
	5'			4	15	27	"	"	"	"			12	"	"	"	"
	6'			4	15	27	25'-5"	0'-2¾"	2'-3½"	3'-5¼"			12	24'-1"	4'-2"	23'-0"	3'-9"
5 @ 5'	3'	#4	11"	2	14	27	30'-0"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	16	28'-10"	4'-3"	27'-7"	3'-10"
	4'			2	14	27	"	"	"	"			16	"	"	"	"
	5'			2	14	27	"	"	"	"			16	"	"	"	"
	6'			2	14	26	30'-6"	"	2'-8½"	4'-2¼"			17	29'-4"	3'-2"	28'-1"	2'-9"
	7'			2	14	26	30'-11"	0'-3¼"	2'-9½"	4'-2¾"			17	29'-9"	3'-7"	28'-6"	3'-2"
5 @ 6'	3'	#5	13"	—	10	21	35'-2"	0'-3¾"	3'-0½"	4'-10¼"	#5	13"	17	33'-10"	3'-0"	32'-6"	2'-6"
	4'			—	10	21	"	"	"	"			17	"	"	"	"
	5'			—	10	21	"	"	"	"			17	"	"	"	"
	6'			—	10	21	35'-8"	"	3'-1½"	4'-11¼"			17	34'-4"	3'-6"	33'-0"	3'-0"
	7'			—	10	21	36'-1"	"	3'-2½"	4'-11¾"			17	34'-9"	3'-11"	33'-5"	3'-5"
	8'			—	10	21	36'-2"	0'-3¾"	3'-2½"	5'-0¼"			17	34'-10"	4'-0"	33'-6"	3'-6"
5 @ 7'	4'	#5	11"	—	9	21	40'-5"	0'-4¾"	3'-4½"	5'-7"	#5	11"	23	39'-3"	3'-3"	37'-7"	2'-9"
	5'			—	9	21	"	"	"	"			23	"	"	"	"
	6'			—	9	21	40'-11"	"	3'-5½"	5'-8"			23	39'-9"	3'-9"	38'-1"	3'-3"
	7'			—	8	21	41'-4"	"	3'-6½"	5'-8½"			23	40'-2"	4'-2"	38'-6"	3'-8"
	8'			—	8	21	41'-5"	"	3'-6½"	5'-9"			23	40'-3"	4'-3"	38'-7"	3'-9"
	9'			—	8	21	41'-11"	0'-4¾"	3'-7½"	5'-10"			24	40'-9"	3'-2"	39'-1"	2'-8"

"c" bars - STRAIGHT - In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) - In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length.) "d" bars - STRAIGHT - Longitudinal in Top Slab of Barrel. "d1" bars - Longitudinal in Sidewalls and Division Walls. "e" bars - Longitudinal in Bottom Slab of Barrel. Lengths (①) of "d", "d1" and "e" bars: Lengths vary with Clear Span "S", skew & slope, see Table.

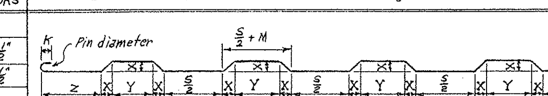
S	H	"c" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	MIN.	"d" SIZE	SPACING	No. REQ'D	"d1" SIZE	SPACING	No. REQ'D	"e" SIZE	SPACING	No. REQ'D
5 @ 4'	2'	#4	12"	9	33	55	18'-8"	#4	12"	18	15'-10"	3'-7"	#4	12"	38	#4	12"	20	#4	12"	38
	3'			9	33	55	"			18	"	"			38			30			38
	4'			9	33	55	"			18	"	"			38			40			38
	5'			9	33	55	"			18	"	"			38			50			38
	6'			9	33	55	19'-0"			18	16'-3"	4'-0"			38			60			38
5 @ 5'	3'	#5	11"	5	31	55	22'-8"	#5	11"	26	22'-5"	3'-5"	#4	12"	43	#4	12"	30	#4	12"	43
	4'			5	31	55	"			26	"	"			43			40			43
	5'			5	31	55	"			26	"	"			43			50			43
	6'			5	29	55	23'-0"			26	22'-10"	3'-10"			43			60			43
	7'			5	29	55	23'-4"			28	23'-2"	2'-7"			43			70			43
5 @ 6'	3'	#6	13"	—	21	43	26'-8"	#6	13"	26	26'-4"	3'-10"	#4	12"	48	#4	12"	30	#4	12"	48
	4'			—	21	43	"			26	"	"			48			40			48
	5'			—	21	43	"			26	"	"			48			50			48
	6'			—	21	43	27'-0"			26	26'-9"	4'-3"			48			60			48
	7'			—	21	43	27'-4"			28	27'-2"	2'-9"			48			70			48
	8'			—	21	43	27'-4"			28	27'-3"	2'-10"			48			80			48
5 @ 7'	4'	#6	11"	—	21	47	30'-8"	#6	11"	36	29'-10"	2'-11"	#4	12"	53	#4	12"	40	#4	12"	53
	5'			—	21	47	"			36	"	"			53			50			53
	6'			—	21	47	31'-0"			36	30'-3"	3'-4"			53			60			53
	7'			—	21	47	31'-4"			36	30'-7"	3'-8"			53			70			53
	8'			—	21	47	31'-4"			36	30'-8"	3'-9"			53			80			53
	9'			—	21	45	31'-8"			38	31'-1"	2'-7"			53			90			53

"f" bars - STRAIGHT - Verticals in Sidewalls and Division Walls. "k1" bars (▼) - STRAIGHT - In Bottom of Headwall. "k2" bars (▼) - In Top of Headwall and Apron 2 Each.

S	H	"f" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	No. REQ'D	LENGTH	"k2" SIZE	No. REQ'D	LENGTH
5 @ 4'	2'	#4	12"*	100	215	335	2'-9"	#5	3	27'-1"	#5	4	28'-2"
	3'			100	215	335	3'-9"		3	"		4	"
	4'			100	215	335	4'-9"		3	"		4	"
	5'			100	215	335	5'-9"		3	"		4	"
	6'			100	215	335	6'-9"		3	27'-8"		4	28'-9"
5 @ 5'	3'	#4	12"	90	205	320	3'-10"	#5	3	32'-10"	#5	4	34'-0"
	4'			90	205	320	4'-10"		3	"		4	"
	5'			90	205	320	5'-10"		3	"		4	"
	6'			90	205	320	6'-10"		3	33'-5"		4	34'-7"
	7'	#5	12"	90	205	320	7'-10"		3	33'-11"		4	35'-0"
5 @ 6'	3'	#4	12"	—	200	315	3'-11"	#5	3	38'-7"	⊠ #5	8	20'-11"
	4'			—	200	315	4'-11"		3	"		8	"
	5'			—	200	315	5'-11"		3	"		8	"
	6'			—	200	315	6'-11"		3	39'-2"		8	21'-2"
	7'	#5	12"	—	200	315	7'-11"		3	39'-8"		8	21'-5"
	8'		11"	—	220	325	8'-11"		3	39'-9"		8	21'-6"
5 @ 7'	4'	#4	12"	—	190	300	5'-1"	⊠ #6	6	23'-3"	⊠ #6	8	23'-10"
	5'			—	190	300	6'-1"		6	"		8	"
	6'			—	190	300	7'-1"		6	23'-6"		8	24'-1"
	7'	#5	12"	—	190	300	8'-1"		6	23'-9"		8	24'-4"
	8'		11"	—	200	330	9'-1"		6	23'-10"		8	24'-5"
	9'		10"	—	220	360	10'-1"		6	24'-1"		8	24'-8"

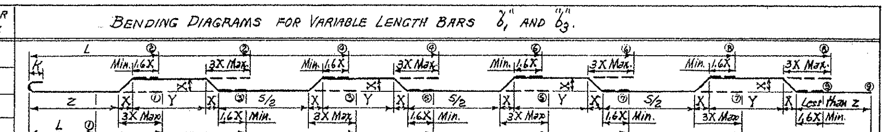
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"

BENDING DIAGRAMS FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b1" AND "b3".



NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values of "b1" bars are same as for "b" bars, and for "b3" bars same as for "b2" bars. ①①-⑨⑨ Min. & Max. lengths L for bars "b1" & "b3" for each type bend.

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length L of "b1" and "b3" bars vary by 1'-10½" for 13" spacing, 1'-9" for 12" spacing and 1'-7" for 11" spacing.

① To longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" Lap).

⊠ These bars to be spliced at center of middle span (2'-0" lap).

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers:-

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

* Total steel quantities listed above include one lap of Longitudinal bars, plus an add'l lap for 4:1 slopes.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X302-1 or W-X302-2, W-X303-1 or W-X303-2, and W-X304-1 or W-X304-2. Also W-X30.

For Barrels of 4', 5' & 6' Spans, see Drawing No. R-500X-X1.

For Barrels of 7' Spans, see Drawing No. ________

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

30° SKEW - SECTIONS "A" ONLY

4', 5', 6' AND 7' SPANS QUINTUPLES

2:1, 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

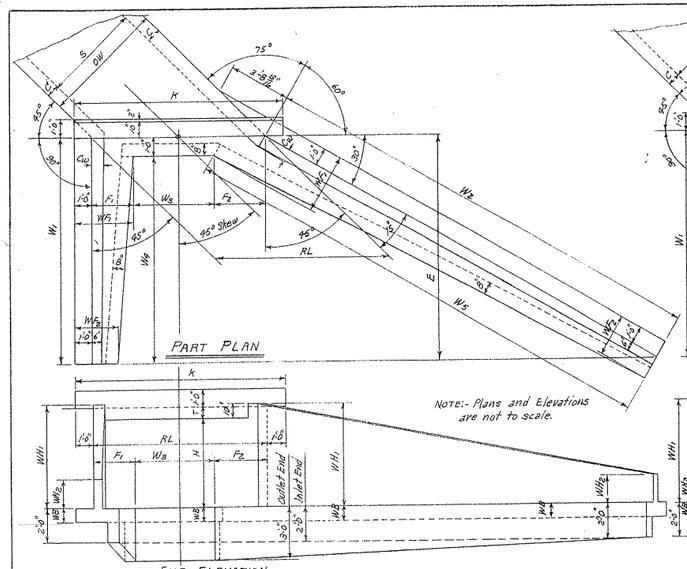
STANDARD DRAWING NO. R-530X-1

Designed by:- W.C.H. 10-3-62. Checked by:- R.H.S. 11-14-62

Drawn by:- W.C.H. 2-12-64. Checked by:-

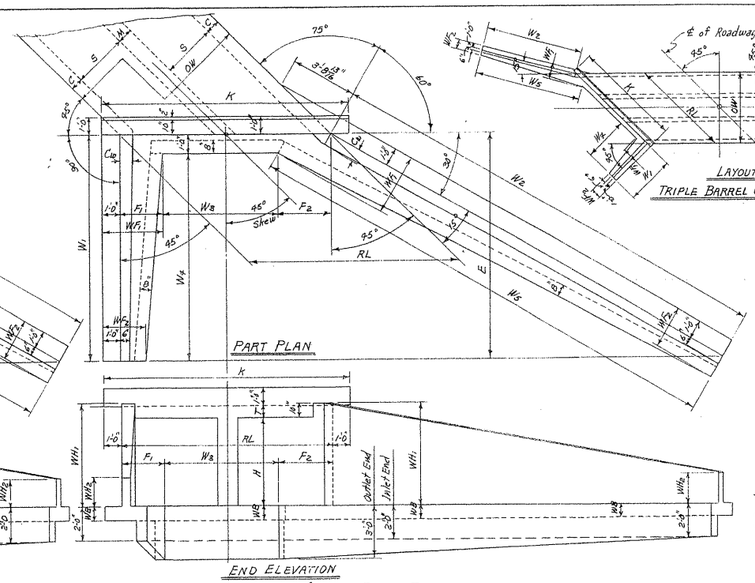
Quantities by:- W.C.H. 5-11-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



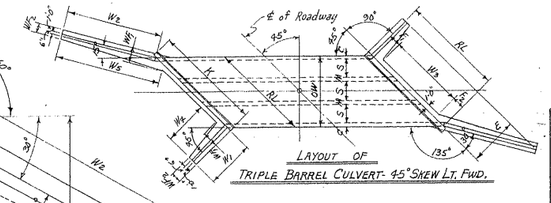
SINGLE BARREL CULVERT-45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Layout below.

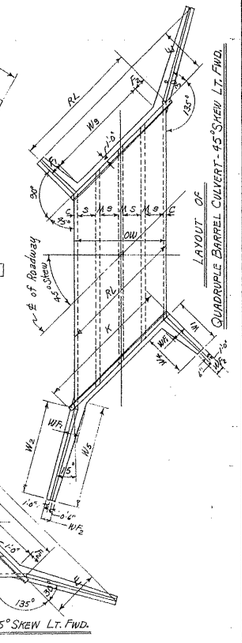


DOUBLE BARREL CULVERT-45° SKEW RIGHT FORWARD

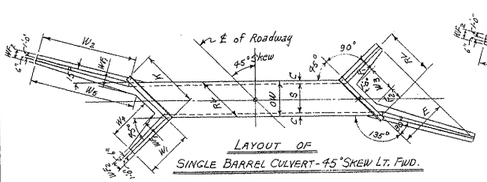
Details of Culvert with 45° Skew Left Forward is reversed, see Layout below.



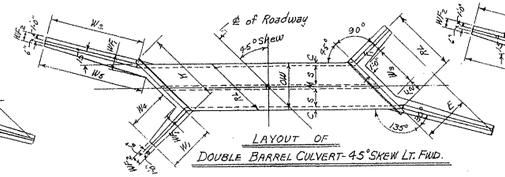
LAYOUT OF TRIPLE BARREL CULVERT-45° SKEW LT. FWD.



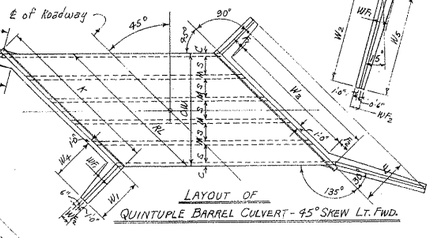
LAYOUT OF QUADRUPLE BARREL CULVERT-45° SKEW LT. FWD.



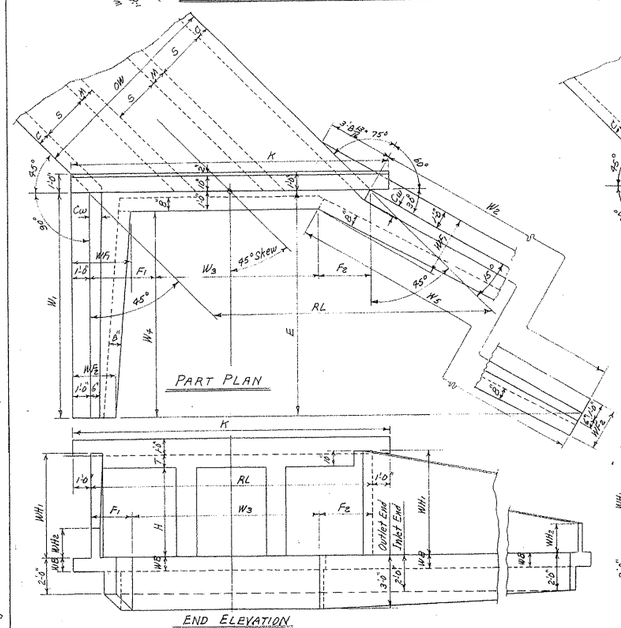
LAYOUT OF SINGLE BARREL CULVERT-45° SKEW LT. FWD.



LAYOUT OF DOUBLE BARREL CULVERT-45° SKEW LT. FWD.

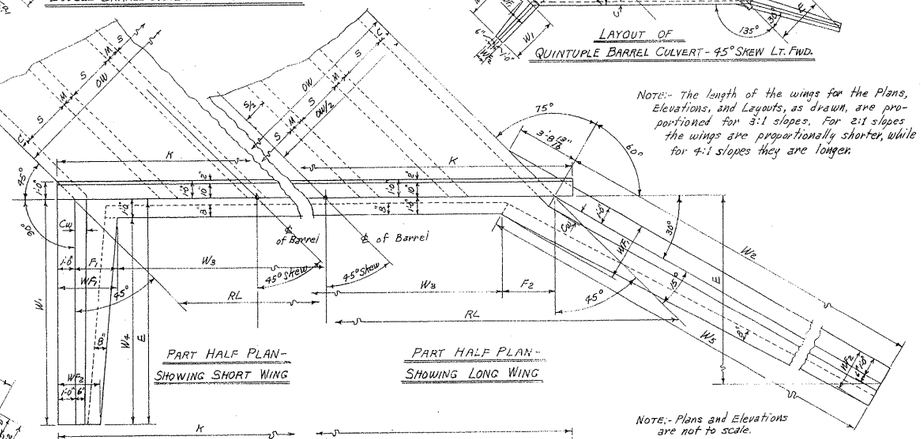


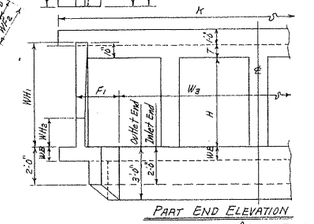
LAYOUT OF QUINTUPLE BARREL CULVERT-45° SKEW LT. FWD.



TRIPLE BARREL CULVERT-45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Layout at top center of sheet.

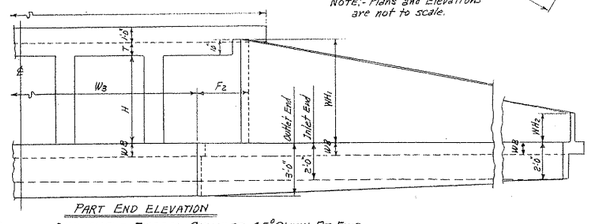




PART END ELEVATION

QUADRUPLE BARREL CULVERT-45° SKEW RT. FWD.

Details of Culvert with 45° Skew Left Forward is reversed, see Layout at above center.



PART END ELEVATION

QUINTUPLE BARREL CULVERT-45° SKEW RT. FWD.

Details of Culvert with 45° Skew Left Forward is reversed, see Layout above.

USE WITH DRAWING No.	CLEAR SPAN S	CLEAR HEIGHT H	SUM OF FILLETS F_1+F_2	ROADWAY LENGTH RL = OW x 1.41421				HEADWALL LENGTH K = RL+(2'-0")				APRON DIMENSION W_3 = RL-(F_1+F_2)			
				SINGLE BARREL CULVERT				DOUBLE BARREL CULVERT				TRIPLE BARREL CULVERT			
				OW	RL	K	W_3	OW	RL	K	W_3	OW	RL	K	W_3
W-X452-1, W-X453-1 OR W-X454-1. (FOR H=8'-0" OR LESS)	4'	2'	2'-3 1/8"	5'-0"	7'-0 7/8"	9'-0 7/8"	4'-9 7/8"	9'-8"	13'-8"	15'-8"	11'-4 7/8"	14'-4"	20'-3 1/8"	22'-3 1/8"	18'-8"
		3'	3'-3 1/8"	5'-0"	"	"	3'-9 7/8"	9'-8"	"	"	10'-4 7/8"	14'-4"	"	"	17'-0"
		4'	4'-3 1/8"	5'-0"	"	"	2'-9 7/8"	9'-8"	"	"	9'-4 7/8"	14'-4"	"	"	16'-0"
		5'	5'-3 1/8"	5'-0"	7'-0 7/8"	9'-0 7/8"	1'-9 7/8"	9'-8"	13'-8"	15'-8"	8'-4 7/8"	14'-4"	20'-3 1/8"	22'-3 1/8"	15'-0"
		6'	6'-3 1/8"	5'-0"	7'-3 5/8"	9'-3 5/8"	1'-0 5/8"	9'-11"	14'-0 1/8"	16'-0 1/8"	7'-0 1/8"	14'-8"	20'-8 7/8"	22'-8"	14'-5 3/8"
	5'	3'	3'-3 1/8"	6'-0"	8'-5 3/8"	10'-5 3/8"	5'-2 3/8"	11'-8"	16'-6"	18'-6"	13'-2 3/8"	17'-4"	24'-6 1/8"	26'-6 1/8"	21'-3"
		4'	4'-3 1/8"	6'-0"	"	"	4'-2 3/8"	11'-8"	"	"	12'-2 3/8"	17'-4"	"	"	20'-3"
		5'	5'-3 1/8"	6'-0"	8'-5 7/8"	10'-5 7/8"	3'-2 7/8"	11'-8"	16'-6"	18'-6"	11'-2 7/8"	17'-4"	24'-6 1/8"	26'-6 1/8"	19'-3"
		6'	6'-3 1/8"	6'-2"	8'-8 3/8"	10'-8 3/8"	2'-5 3/8"	11'-11"	16'-10 1/8"	18'-10 1/8"	10'-7"	17'-8"	24'-10 1/8"	27'-0"	18'-8 3/8"
		7'	7'-3 1/8"	6'-3"	8'-10 1/8"	10'-10 1/8"	1'-0 1/8"	12'-1"	17'-1"	19'-1"	9'-3 1/8"	17'-11"	25'-4"	27'-4"	17'-4 1/8"
	6'	3'	3'-3 1/8"	7'-0"	9'-10 3/8"	11'-10 3/8"	6'-7 3/8"	13'-8"	19'-3 3/8"	21'-9"	16'-0 3/8"	20'-4"	28'-9 1/8"	30'-9"	25'-3 3/8"
		4'	4'-3 1/8"	7'-0"	"	"	5'-7 3/8"	13'-8"	"	"	15'-0 3/8"	20'-4"	"	"	24'-3 3/8"
		5'	5'-3 1/8"	7'-0"	9'-10 3/8"	11'-10 3/8"	4'-7 3/8"	13'-8"	19'-3 3/8"	21'-9"	14'-0 3/8"	20'-4"	28'-9 1/8"	30'-9"	23'-3 3/8"
		6'	6'-3 1/8"	7'-2"	10'-1 7/8"	12'-1 7/8"	3'-10 7/8"	13'-11"	19'-8 7/8"	21'-8 7/8"	13'-5"	20'-8"	29'-2 7/8"	31'-2 7/8"	22'-11 1/8"
		7'	7'-3 1/8"	7'-3"	10'-3"	12'-3"	2'-5 7/8"	14'-1"	19'-11"	21'-11"	12'-1 7/8"	20'-11"	29'-7"	31'-7"	21'-9 7/8"
		8'	8'-3 1/8"	7'-4"	10'-4 7/8"	12'-4 7/8"	1'-1 7/8"	14'-2"	20'-0 7/8"	22'-0 7/8"	10'-9 7/8"	21'-0"	29'-8 7/8"	31'-8"	20'-5"
	7'	4'	4'-3 1/8"	8'-0"	11'-3 3/8"	13'-3 3/8"	7'-0 1/8"	15'-8"	22'-1 7/8"	24'-1 7/8"	17'-10 1/8"	23'-4"	33'-0"	35'-0"	28'-8 3/8"
		5'	5'-3 1/8"	8'-0"	11'-3 3/8"	13'-3 3/8"	6'-0 1/8"	15'-9"	22'-1 7/8"	24'-1 7/8"	16'-10 1/8"	23'-4"	33'-0"	35'-0"	27'-8 3/8"
		6'	6'-3 1/8"	8'-2"	11'-6 5/8"	13'-6 5/8"	5'-3 3/8"	15'-11"	22'-6 5/8"	24'-6"	16'-2 3/8"	23'-8"	33'-5 5/8"	35'-5 5/8"	27'-2 1/8"
		7'	7'-3 1/8"	8'-3"	11'-8"	13'-8"	4'-3 1/8"	16'-1"	22'-9"	24'-9"	14'-11 3/8"	23'-11"	33'-9 3/8"	35'-11 1/8"	26'-0 3/8"
		8'	8'-3 1/8"	8'-4"	11'-9 3/8"	13'-9 3/8"	2'-6 3/8"	16'-2"	22'-10 3/8"	24'-10 3/8"	13'-7"	24'-0"	33'-11 1/8"	35'-11 1/8"	24'-8"
	8'	4'	4'-3 1/8"	9'-0"	12'-0 3/8"	14'-0 3/8"	8'-5 1/8"	17'-8"	24'-11 1/8"	26'-11 1/8"	20'-9 1/8"	26'-9"	37'-2 7/8"	39'-3"	32'-11 3/8"
		5'	5'-3 1/8"	9'-2"	12'-11 1/8"	14'-11 1/8"	7'-8 3/8"	17'-11"	25'-1"	27'-1"	20'-0 3/8"	26'-8"	37'-9 1/8"	39'-9 1/8"	32'-1 5/8"
		6'	6'-3 1/8"	9'-2"	12'-11 1/8"	14'-11 1/8"	6'-8 3/8"	17'-11"	25'-1"	27'-1"	19'-0 3/8"	26'-8"	37'-9 1/8"	39'-9 1/8"	31'-5 1/8"
		7'	7'-3 1/8"	9'-3"	13'-1"	15'-1"	5'-3 3/8"	18'-1"	25'-4 1/8"	27'-1"	17'-9 3/8"	26'-11"	38'-0 1/8"	40'-0 1/8"	30'-8 3/8"
		8'	8'-3 1/8"	9'-4"	13'-2 1/8"	15'-2 1/8"	3'-11 1/8"	18'-2"	25'-8 1/8"	27'-8 1/8"	16'-5"	27'-0"	38'-2 1/8"	40'-2 1/8"	28'-11"
	9'	5'	5'-3 1/8"	10'-2"	14'-3 1/8"	16'-3 1/8"	9'-7 3/8"	19'-11"	28'-2"	30'-2"	22'-10 3/8"	28'-8"	41'-1 1/8"	43'-1 1/8"	36'-8 3/8"
		6'	6'-3 1/8"	10'-3"	14'-6"	16'-6"	8'-2 3/8"	20'-1"	28'-4 1/8"	30'-4 1/8"	22'-1 5/8"	28'-11"	42'-3 3/8"	44'-3 3/8"	36'-0"
		7'	7'-3 1/8"	10'-3"	14'-6"	16'-6"	6'-8 3/8"	20'-1"	28'-4 1/8"	30'-4 1/8"	20'-7 1/8"	29'-11"	42'-3 3/8"	44'-3 3/8"	34'-1 5/8"
		8'	8'-3 1/8"	10'-4"	14'-7 3/8"	16'-7 3/8"	5'-5 3/8"	20'-2"	28'-6 1/8"	30'-6 1/8"	19'-3"	30'-0"	42'-5 3/8"	44'-5"	33'-2"
	10'	5'	5'-3 1/8"	11'-2"	15'-9 3/8"	17'-9 3/8"	10'-6 1/8"	21'-11"	31'-0"	33'-0"	25'-8 3/8"	32'-8"	46'-2 3/8"	48'-2 3/8"	40'-11"
		6'	6'-3 1/8"	11'-3"	15'-11"	17'-11"	9'-7 3/8"	22'-1"	31'-2 3/8"	33'-2 3/8"	24'-11 1/8"	32'-11"	46'-6 3/8"	48'-6 3/8"	39'-5 3/8"
		7'	7'-3 1/8"	11'-3"	15'-11"	17'-11"	8'-1 3/8"	22'-1"	31'-2 3/8"	33'-2 3/8"	23'-5 1/8"	32'-11"	46'-6 3/8"	48'-6 3/8"	38'-0 3/8"
		8'	8'-3 1/8"	11'-4"	16'-0 3/8"	18'-0 3/8"	6'-9 3/8"	22'-2"	31'-4 3/8"	33'-4 3/8"	22'-1"	33'-0"	46'-8"	48'-8"	37'-1 3/8"
	11'	6'	6'-3 1/8"	12'-0"	17'-0 1/8"	19'-0 1/8"	11'-2 7/8"	24'-2"	34'-2 7/8"	36'-2"	27'-11"	36'-0"	50'-11"	52'-11"	44'-7 3/8"
		7'	7'-3 1/8"	12'-0"	"	"	9'-8 1/8"	24'-2"	"	"	26'-5"	36'-0"	"	"	43'-1 3/8"
		8'	8'-3 1/8"	12'-0"	"	"	8'-2 1/8"	24'-2"	"	"	24'-11"	36'-0"	"	"	41'-7 3/8"
	12'	6'	6'-3 1/8"	13'-1"	18'-10 1/8"	20'-10 1/8"	12'-7 7/8"	26'-2"	37'-0 7/8"	39'-0"	30'-8 3/8"	39'-0"	55'-1 7/8"	57'-1 7/8"	48'-10 3/8"
		7'	7'-3 1/8"	13'-1"	"	"	11'-1 7/8"	26'-2"	"	"	29'-2 3/8"	39'-0"	"	"	47'-4 3/8"
		8'	8'-3 1/8"	13'-1"	"	"	9'-7 7/8"	26'-2"	"	"	27'-8 3/8"	39'-0"	"	"	45'-10 3/8"
W-X452-2, W-X453-2 OR W-X454-2 (FOR H=9'-0" & OVER.)	7'	9'	10'-9 3/8"	8'-6"	12'-0 1/8"	14'-0 1/8"	1'-3"	16'-5"	23'-2 5/8"	25'-2 5/8"	12'-5 3/8"	24'-4"	34'-5"	36'-5"	23'-7 3/8"
	8'	9'	10'-9 3/8"	9'-6"	13'-5 3/8"	15'-5 3/8"	2'-8"	18'-5"	26'-0 5/8"	28'-0 5/8"	15'-3 1/8"	27'-9"	38'-7 7/8"	40'-8"	27'-10 3/8"
		10'	12'-3 3/8"	9'-8"	13'-8"	15'-8"	1'-9 3/8"	18'-8"	26'-9 3/8"	28'-9 3/8"	14'-1 5/8"	27'-8"	39'-1 1/8"	41'-1 1/8"	26'-10 3/8"
	9'	9'	10'-9 3/8"	10'-6"	14'-10 1/8"	16'-10 1/8"	4'-1"	20'-5"	28'-10 1/8"	30'-10 1/8"	18'-1 5/8"	30'-9"	42'-10 3/8"	44'-10 3/8"	32'-1 1/8"
		10'	12'-3 3/8"	10'-8"	15'-1"	17'-1"	2'-9 3/8"	20'-8"	29'-2 3/8"	31'-2 3/8"	16'-11 5/8"	30'-8"	43'-1 3/8"	45'-1 3/8"	30'-8"
		11'	13'-3 3/8"	10'-10"	15'-3 3/8"	17'-3 3/8"	1'-6 3/8"	20'-10"	29'-5 5/8"	31'-5 5/8"	15'-8 3/8"	30'-10"	43'-3 3/8"	45'-3 3/8"	29'-10"
	10'	9'	10'-9 3/8"	11'-6"	16'-3 5/8"	18'-3 5/8"	5'-6"	22'-5"	31'-8 3/8"	33'-8 3/8"	20'-11 1/8"	33'-9"	47'-1 7/8"	49'-1 7/8"	35'-1 3/8"
		10'	12'-3 3/8"	11'-8"	16'-6"	18'-6"	4'-2 3/8"	22'-8"	32'-0 3/8"	34'-0 3/8"	19'-9 1/8"	33'-8"	47'-7 7/8"	49'-7 7/8"	35'-4 1/8"
		11'	13'-9 3/8"	11'-10"	16'-8 7/8"	18'-8 7/8"	2'-11 5/8"	22'-10"	32'-2 3/8"	34'-2 3/8"	18'-6 3/8"	33'-10"	47'-10 1/8"	49'-10 1/8"	34'-1"
		12'	15'-3 3/8"	12'-0"	16'-11 7/8"	18'-11 7/8"	1'-8 3/8"	23'-0"	32'-4 1/8"	34'-4 1/8"	17'-3"	34'-0"	48'-1"	50'-1"	32'-9 3/8"
	11'	9'	10'-9 3/8"	12'-6"	17'-10 1/8"	19'-10 1/8"	6'-10 5/8"	24'-5"	34'-6 1/8"	36'-6 1/8"	28'-9 1/8"	36'-9"	51'-4 5/8"	53'-4 5/8"	40'-11 5/8"
		10'	12'-3 3/8"	12'-8"	17'-11"	19'-11"	5'-7 3/8"	24'-8"	34'-10 1/8"	36'-10 1/8"	22'-7 5/8"	36'-8"	51'-10 1/8"	53'-10 1/8"	39'-7"
		11'	13'-9 3/8"	12'-10"	18'-1 3/8"	20'-1 3/8"	4'-4 5/8"	24'-10"	35'-1 3/8"	37'-1 3/8"	21'-4 1/8"	36'-10"	52'-1 1/8"	54'-1"	38'-3 1/8"
		12'	15'-3 3/8"	13'-0"	18'-2 5/8"	20'-2 5/8"	3'-1 3/8"	25'-0"	35'-2 5/8"	37'-2 5/8"	20'-1"	37'-0"	52'-3 5/8"	54'-3 5/8"	37'-0 3/8"
	12'	9'	10'-9 3/8"	13'-6"	19'-1 7/8"	21'-1"	8'-3 7/8"	26'-5"	37'-1 7/8"	39'-1 7/8"	26'-7"	39'-9"	55'-7 7/8"	57'-7 7/8"	44'-10 3/8"
		10'	12'-3 3/8"	13'-8"	19'-3 3/8"	21'-3"	7'-0 3/8"	26'-8"	37'-10 3/8"	39'-10 3/8"	25'-5 5/8"	39'-8"	56'-1 1/8"	58'-1 1/8"	43'-10"
		11'	13'-9 3/8"	13'-10"	19'-6 3/8"	21'-6 3/8"	5'-10 3/8"	26'-10"	37'-11 3/8"	39'-11 3/8"	24'-2 5/8"	39'-10"	56'-4"	58'-4"	42'-6 3/8"
		12'	15'-3 3/8"	14'-0"	19'-9 3/8"	21'-9 3/8"	4'-6 3/8"	27'-0"	38'-2 5/8"	40'-2 5/8"	22'-11"	40'-0"	56'-6 7/8"	58'-6 7/8"	41'-3 5/8"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawings for 45° Skews for each slope as listed below.

2:1 Slopes	3:1 Slopes	4:1 Slopes
W-X452-1 or W-X452-2	W-X453-1 or W-X453-2	W-X454-1 or W-X454-2.

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 45° SKEW

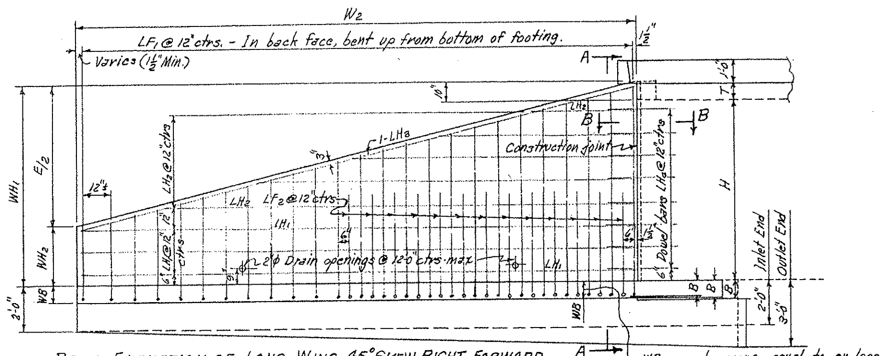
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1, 3:1 & 4:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER H= 2', 3', 4', 5', 6', 7', 8', 9', 10', 11' & 12'

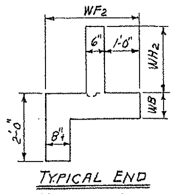
STANDARD DRAWING No. W-X45

Designed by:- W.C.H. 5-16-63 Checked by:-
Drawn by:- W.C.H. 6-15-63 Checked by:- J.E.M. 6-23-63
Quantities by:- Checked by:-

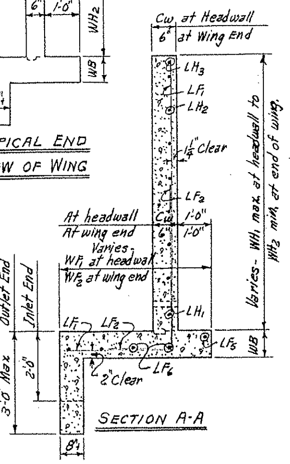
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



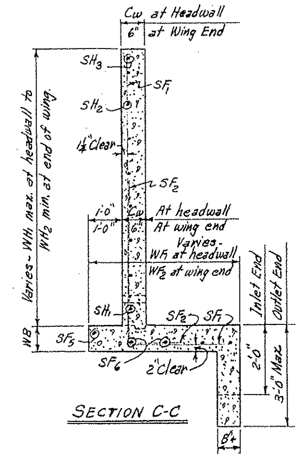
REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



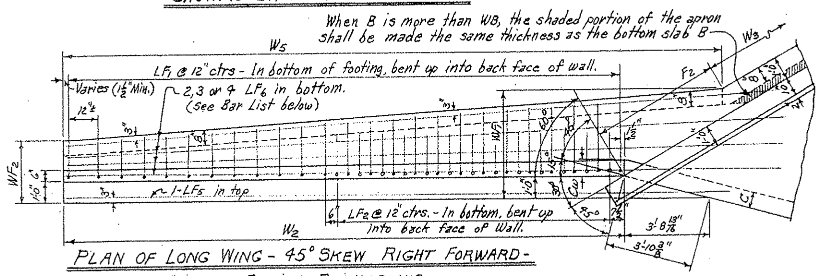
TYPICAL END VIEW OF WING



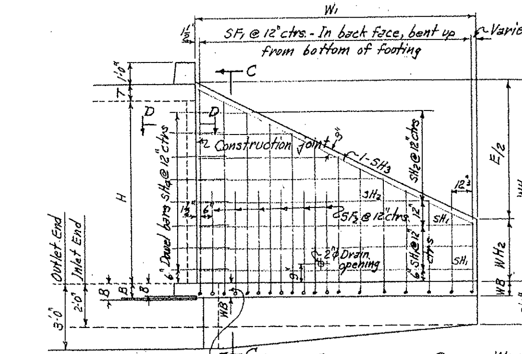
SECTION A-A



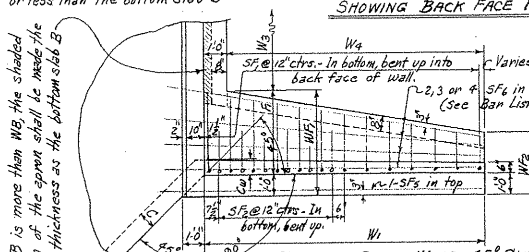
SECTION C-C



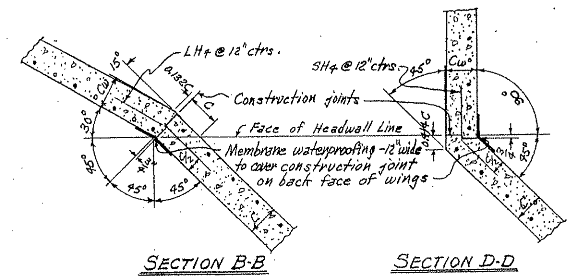
PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



REAR ELEVATION OF SHORT WING - 45° SKEW RT. FWD. SHOWING BACK FACE REINFORCING



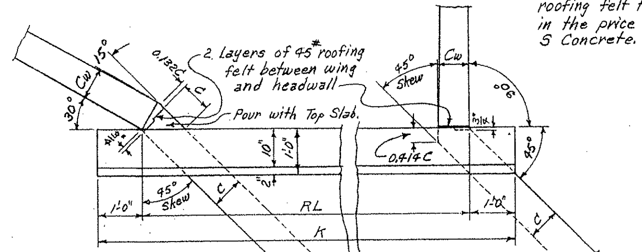
PLAN OF SHORT WING - 45° SKEW RT. FWD. SHOWING FOOTING REINFORCING



SECTION B-B SECTION D-D

SECTIONS THRU CONSTRUCTION JOINTS

NOTE:- Payment for membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



DETAILS AT TOP OF WINGS - 45° SKEW RIGHT FORWARD

REGULAR WING DIMENSIONS - 2:1 SLOPES

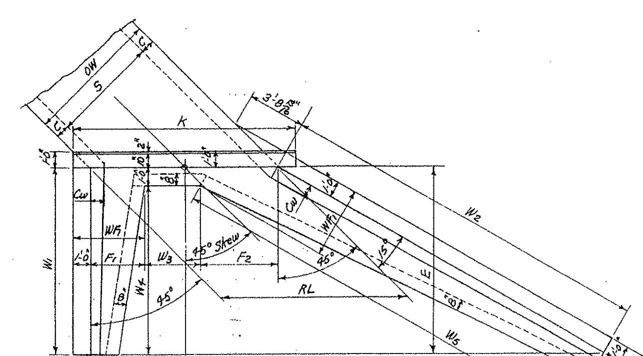
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSIONS SHORT WING	INSIDE FOOTING DIMENSIONS LONG WING	* QUANTITY PER WING CLASS S CONCRETE INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-4"	0'-11¾"	4'-4"	4'-4"	8'-8"	3'-4"	8'-11¾"	0.495	1.077	0.553	1.193
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1⅛"	1'-8"	1'-7¾"	5'-8"	5'-8"	11'-4"	4'-8"	12'-2¾"	0.748	1.619	0.821	1.775
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	2'-0"	2'-3¾"	7'-0"	7'-0"	14'-0"	6'-0"	15'-5½"	1.046	2.254	1.136	2.449
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11¼"	8'-4"	8'-4"	16'-8"	7'-4"	18'-8½"	1.391	2.983	1.498	3.219
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11¼"	8'-4"	8'-4"	16'-8"	7'-4"	18'-8½"	1.446	3.110	1.553	3.345
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	9'-8"	9'-8"	19'-4"	8'-8"	21'-11½"	1.934	4.132	2.057	4.408
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	9'-8"	9'-8"	19'-4"	8'-8"	21'-11½"	1.972	4.218	2.095	4.494
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	9'-8"	9'-8"	19'-4"	8'-8"	21'-11½"	2.009	4.305	2.133	4.581
7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7¼"	11'-0"	11'-0"	22'-0"	10'-0"	25'-5¾"	2.536	5.411	2.676	5.731
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7¼"	11'-0"	11'-0"	22'-0"	10'-0"	25'-5¾"	2.586	5.523	2.726	5.843
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7¼"	12'-4"	12'-4"	24'-8"	11'-4"	29'-0¼"	3.245	6.914	3.403	7.277

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

QUANTITIES

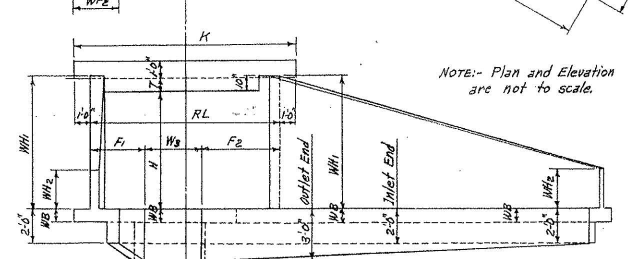
CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊕ REINFORCING STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS) SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	101	4.59	5.94	7.30	8.66	10.01
	3'	6"	7"	152	6.10	7.45	8.80	10.16	11.52
	4'	6"	7"	233	7.88	9.23	10.59	11.95	13.31
	5'	6"	7"	322	9.95	11.30	12.66	14.01	15.37
	6'	7"	8"	523	13.29	14.67	16.07	17.47	18.86
5'	3'	6"	7"	152	6.40	8.04	9.69	11.33	12.98
	4'	6"	7"	233	8.18	9.82	11.47	13.12	14.77
	5'	6"	7"	322	10.25	11.89	13.54	15.19	16.83
	6'	7"	8"	523	13.59	15.27	16.96	18.65	20.34
	7'	7½"	8½"	1025	17.22	18.93	20.66	22.38	24.10
6'	3'	6"	7"	152	6.69	8.65	10.57	12.52	14.45
	4'	6"	7"	233	8.48	10.43	12.35	14.31	16.23
	5'	6"	7"	322	10.54	12.50	14.42	16.37	18.30
	6'	7"	8"	523	13.87	15.88	17.85	19.84	21.82
	7'	7½"	8½"	1025	17.52	19.54	21.55	23.57	25.59
	8'	8"	9"	1287	21.81	23.85	25.86	27.89	29.92
7'	4'	6"	7"	233	8.78	11.06	13.28	15.56	17.76
	5'	6"	7"	322	10.85	13.12	15.35	17.62	19.83
	6'	7"	8"	523	14.20	16.49	18.75	21.04	23.30
	7'	7½"	8½"	1025	17.83	20.15	22.45	24.77	27.07
	8'	8"	9"	1287	22.13	24.46	26.77	29.10	31.42
8'	4'	6"	7"	233	9.10	11.69	14.23	16.83	19.32
	5'	7"	7"	322	11.57	14.19	16.76	19.38	21.90
	6'	7"	8"	523	14.51	17.13	19.69	22.31	24.83
	7'	7½"	8½"	1025	18.14	20.78	23.38	26.02	28.56
	8'	8"	9"	1287	22.44	25.08	27.67	30.32	32.91
9'	5'	7"	7"	322	11.89	14.84	17.71	20.55	23.44
	6'	7½"	8"	523	15.10	18.07	20.96	23.83	26.74
	7'	7½"	8½"	1025	18.45	21.43	24.32	27.19	30.11
	8'	8"	9"	1287	22.74	25.71	28.61	31.48	34.40
10'	5'	7"	7"	322	12.22	15.48	18.67	21.79	25.00
	6'	7½"	8"	523	15.42	18.71	21.92	25.07	28.30
	7'	7½"	8½"	1025	18.77	22.07	25.28	28.43	31.66
	8'	8"	9"	1287	23.06	26.36	29.57	32.73	35.96
11'	6'	8"	8"	523	16.00	19.65	23.17	26.66	——
	7'	8"	8½"	1025	19.42	23.08	26.60	30.09	——
	8'	8"	9"	1287	23.36	27.02	30.54	34.04	——
12'	6'	8"	8"	523	16.32	20.33	24.16	28.01	——
	7'	8"	8½"	1025	19.75	23.75	27.58	31.43	——
	8'	8"	9"	1287	23.68	27.69	31.52	35.38	——

⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.



PART PLAN

NOTE:- Plan and Elevation are not to scale.



END ELEVATION

SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X45.
For values of RL, K and W3 for each box, see above std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF1 & LF1 — BENT — In bottom of footing, bent up into back face of wing. One bar of each length. SF2 & LF2 — BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars.

H	SHORT OR LONG	SF1 & LF1 SIZE	SPACING	NO. REQ'D	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 SIZE	SPACING	NO. REQ'D	LENGTH	X	Y
2'	Short	#3	12"	5	1'-6"	3'-11"	0'-8"	1'-1"	0'-11"	2'-11"	—	—	—	—	—	—
	Long	#3	12"	9	1'-7"	3'-11"	0'-8"	1'-0"	1'-0"	3'-0"	—	—	—	—	—	—
3'	Short	#3	12"	6	2'-2"	5'-3"	0'-10"	1'-5"	1'-5"	3'-11"	—	—	—	—	—	—
	Long	#3	12"	12	2'-0"	5'-3"	0'-10"	1'-4"	1'-3"	4'-0"	—	—	—	—	—	—
4'	Short	#3	12"	8	2'-3"	6'-7"	0'-11"	1'-9"	1'-5"	4'-11"	—	—	—	—	—	—
	Long	#3	12"	15	2'-4"	6'-6"	0'-11"	1'-7"	1'-6"	5'-0"	—	—	—	—	—	—
5'	Short	#3	12"	9	2'-10"	7'-11"	1'-0"	2'-1"	1'-11"	5'-11"	#3	12"	2	3'-6"	1'-1"	2'-6"
	Long	#3	12"	17	2'-11"	7'-10"	1'-0"	1'-11"	2'-0"	6'-0"	#3	12"	5	3'-6"	1'-1"	2'-6"
6'	Short	#4	12"	10	3'-7"	9'-4"	1'-2"	2'-5"	2'-6"	7'-0"	#3	12"	2	4'-6"	1'-4"	3'-3"
	Long	#4	12"	20	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	5	4'-6"	1'-4"	3'-3"
7'	Short	#4	12"	12	3'-8"	10'-10"	1'-3"	2'-11"	2'-6"	8'-0"	#4	12"	4	5'-6"	1'-7"	4'-0"
	Long	#4	12"	23	3'-9"	10'-8"	1'-3"	2'-8"	2'-7"	8'-1"	#4	12"	9	5'-6"	1'-7"	4'-0"
8'	Short	#4	12"	13	4'-5"	12'-5"	1'-5"	3'-5"	3'-1"	9'-1"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#4	12"	25	4'-6"	12'-2"	1'-5"	3'-1"	3'-2"	9'-2"	#4	12"	13	6'-6"	1'-10"	4'-9"

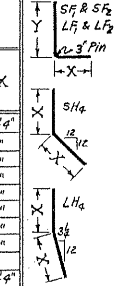
SF5 & LF5 — STRAIGHT — Longitudinal in top of wing footing heel. SF6 & LF6 — STRAIGHT — Longitudinal in bottom of wing footing toe. SH1 & LH1 — STRAIGHT — Horizontal in back face of wing. SH2 & LH2 — STRAIGHT — Horizontal in back face of wing. One bar of each length.

H	SHORT OR LONG	SF5 & LF5 SIZE	NO. REQ'D	LENGTH	SF6 & LF6 SIZE	NO. REQ'D	LENGTH	SH1 & LH1 SIZE	SPACING	NO. REQ'D	LENGTH	SH2 & LH2 SIZE	SPACING	NO. REQ'D	LENGTHS VARY MAX.	LENGTHS VARY MIN.
2'	Short	#3	1	6'-2"	#3	2	6'-6"	#3	12"	1	4'-1"	#3	12"	1	—	2'-2"
	Long	#3	1	13'-2"	#3	2	11'-2"	#3	12"	1	8'-4"	#3	12"	1	—	4'-4"
3'	Short	#3	1	7'-6"	#3	2	7'-4"	#3	12"	1	5'-5"	#3	12"	2	4'-2"	2'-2"
	Long	#3	1	15'-10"	#3	2	14'-6"	#3	12"	1	11'-0"	#3	12"	2	8'-4"	4'-4"
4'	Short	#3	1	8'-10"	#3	3	8'-8"	#3	12"	1	6'-9"	#3	12"	3	6'-2"	2'-2"
	Long	#3	1	18'-6"	#3	3	17'-10"	#3	12"	1	13'-8"	#3	12"	3	12'-4"	4'-4"
5'	Short	#3	1	10'-2"	#3	3	10'-0"	#3	12"	2	8'-1"	#3	12"	3	6'-2"	2'-2"
	Long	#3	1	21'-2"	#3	3	21'-2"	#3	12"	2	16'-4"	#3	12"	3	12'-4"	4'-4"
6'	Short	#3	1	11'-6"	#3	3	11'-4"	#3	12"	2	9'-5"	#3	12"	4	8'-2"	2'-2"
	Long	#3	1	23'-10"	#3	3	24'-6"	#3	12"	2	19'-0"	#3	12"	4	16'-4"	4'-4"
7'	Short	#4	1	12'-10"	#4	4	12'-8"	#4	12"	2	10'-9"	#4	12"	5	10'-2"	2'-2"
	Long	#4	1	26'-6"	#4	4	28'-0"	#4	12"	2	21'-8"	#4	12"	5	20'-4"	4'-4"
8'	Short	#4	1	14'-2"	#4	4	14'-0"	#4	12"	3	12'-1"	#4	12"	5	10'-2"	2'-2"
	Long	#4	1	29'-2"	#4	4	31'-6"	#4	12"	3	24'-4"	#4	12"	5	20'-4"	4'-4"

SH3 & LH3 — STRAIGHT — In back face of wing at top - on slope. SH4 & LH4 — BENT — Dowels thru construction joint at headwall.

H	SHORT OR LONG	SH3 & LH3 SIZE	NO. REQ'D	LENGTH	SH4 & LH4 SIZE	SPACING	NO. REQ'D	LENGTH	X	QUANTITY REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
2'	Short	#3	1	4'-6"	#3	12"	2	2'-8"	1'-4"	18.0	32.7
	Long	#3	1	8'-8"	#3	12"	2	"	"		
3'	Short	#3	1	6'-0"	#3	12"	3	"	"	26.4	49.4
	Long	#3	1	11'-5"	#3	12"	3	"	"		
4'	Short	#3	1	7'-6"	#3	12"	4	"	"	40.5	75.9
	Long	#3	1	14'-3"	#3	12"	4	"	"		
5'	Short	#3	1	9'-0"	#3	12"	5	"	"	55.1	105.8
	Long	#3	1	16'-11"	#3	12"	5	"	"		
6'	Short	#3	1	10'-6"	#3	12"	6	"		88.5	172.9
	Long	#3	1	19'-8"	#3	12"	6	2'-8"	1'-4"		
7'	Short	#4	1	12'-0"	#4	12"	7	3'-6"	1'-9"	179.8	337.8
	Long	#4	1	22'-5"	#4	12"	7	"	"		
8'	Short	#4	1	13'-6"	#4	12"	8	"	"	218.5	424.7
	Long	#4	1	25'-2"	#4	12"	8	3'-6"	1'-9"		

BAR BENDING DIAGRAM



NOTE:- Dimensions are to bar centers.

NOTE:- Bars for Short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

GENERAL NOTES:-
CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.
UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 45° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 2:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

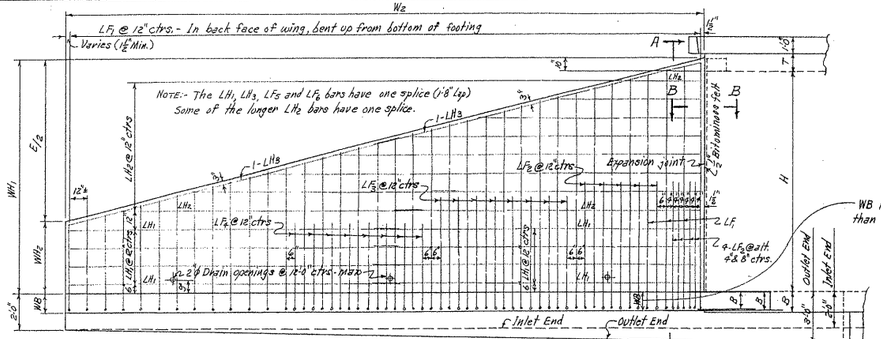
STANDARD DRAWING No. W-X452-1

Designed By:- W.C.H. 5-13-63 Checked By:- JEM 7-14-64
Drawn By:- W.C.H. 6-2-64 Checked By:- JEM 7-14-64
Quantities By:-

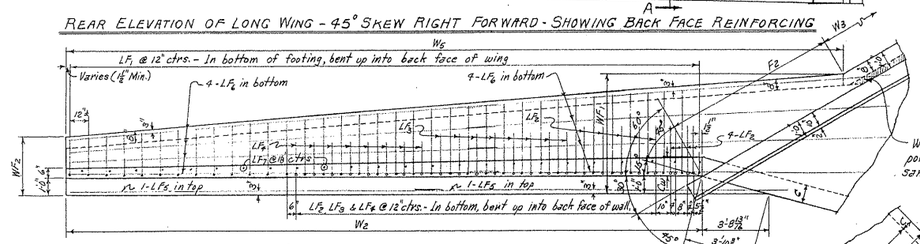
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

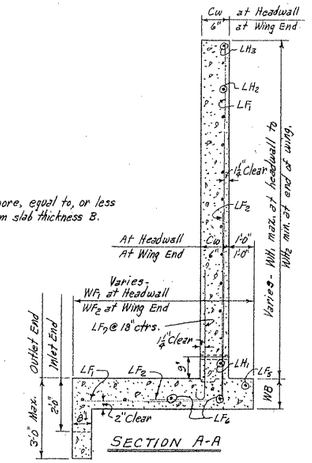
SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		



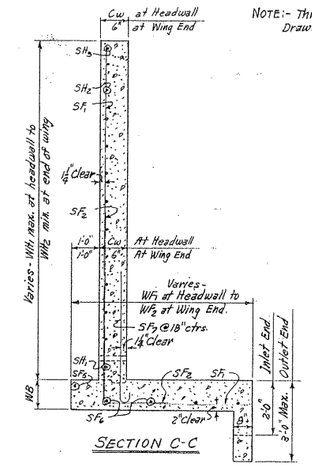
REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



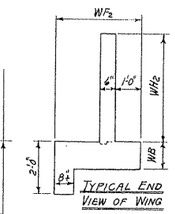
PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



SECTION A-A



SECTION C-C



TYPICAL END VIEW OF WING

REGULAR WING DIMENSIONS - 2:1 SLOPES

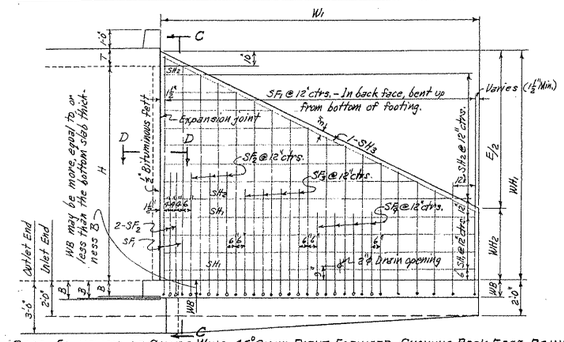
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HEADWALL	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WINGWALL HEIGHTS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	FOOTING DIMENSION PARALLEL WITH HEADWALL	PERPENDICULAR DIST. FROM HEAD TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSIONS		* QUANTITY PER WING CLASS S CONCRETE INLET END		OUTLET END	
								SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
9'	10"	9"	9'-10"	3'-10"	5'-2"	2'-10⅛"	4'-2"	6'-7⅛"	13'-8"	13'-8"	27'-4"	12'-8"	32'-6⅝"	9.222	8.981	9.396	9.388
10'	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-8"	7'-7⅛"	15'-0"	15'-0"	30'-0"	14'-0"	36'-1"	5.384	11.933	5.576	11.831
11'	12"	11"	11'-10"	3'-8"	6'-2"	3'-1⅛"	5'-2"	8'-7⅛"	16'-4"	16'-4"	32'-8"	15'-4"	39'-7⅛"	6.750	14.326	6.959	14.821
12'	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-8"	9'-7⅛"	17'-8"	17'-8"	35'-4"	16'-8"	43'-1⅜"	8.336	17.676	8.562	18.215

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

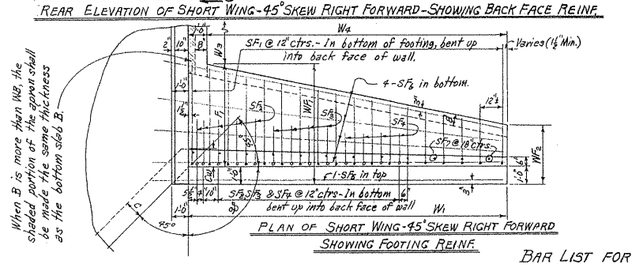
QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊕ REINFORCING STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	1949	28.10	30.97	32.83	35.21	37.58
8'	9'	9"	10"	1949	28.41	31.09	33.75	36.42	39.09
	10'	10"	11"	2459	35.56	38.26	40.98	43.70	46.42
9'	9'	9"	10"	1949	28.72	31.72	34.66	37.62	40.59
	10'	10"	11"	2459	35.85	38.88	41.89	44.91	47.94
	11'	11"	12"	2935	44.24	47.30	50.34	53.38	56.44
10'	9'	9"	10"	1949	29.04	32.34	35.60	38.83	42.10
	10'	10"	11"	2459	36.17	39.51	42.81	46.13	49.46
	11'	11"	12"	2935	44.56	47.92	51.27	54.61	57.97
	12'	12"	13"	3702	54.31	57.70	61.08	64.46	67.85
11'	9'	9"	10"	1949	29.34	33.01	36.57	40.09	———
	10'	10"	11"	2459	36.47	40.17	43.75	47.35	———
	11'	11"	12"	2935	44.86	48.56	52.19	55.85	———
	12'	12"	13"	3702	54.62	58.33	62.02	65.70	———
12'	9'	9"	10"	1949	29.66	33.68	37.55	41.43	———
	10'	10"	11"	2459	36.79	40.84	44.73	48.64	———
	11'	11"	12"	2935	45.18	49.23	53.12	57.09	———
	12'	12"	13"	3702	54.94	58.98	62.95	66.96	———

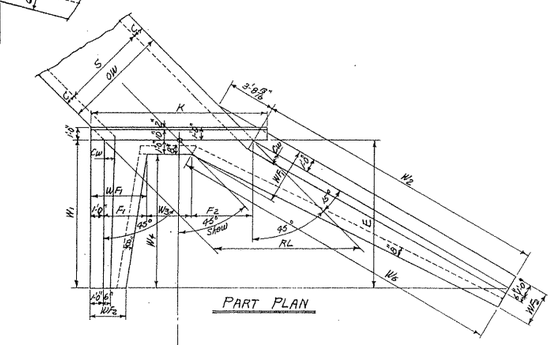
⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed at top of sheet.



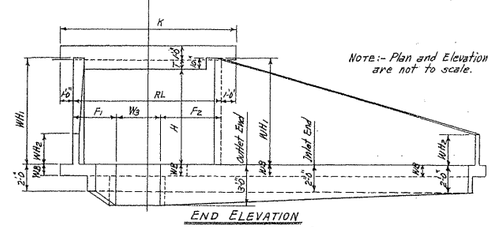
REAR ELEVATION OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.



PLAN OF SHORT WING - 45° SKEW RIGHT FORWARD SHOWING FOOTING REINF.



PART PLAN



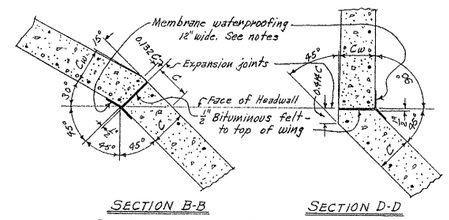
Note:- Plan and Elevation are not to scale.

END ELEVATION

SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

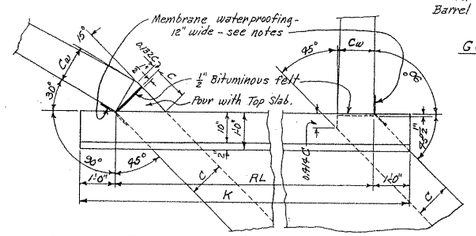
Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS



SECTION B-B SECTION D-D

SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WING9 - 45° SKEW RIGHT FORWARD

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple span Culverts, see std. Drawing No. W-X45.
For values of RL, K and W5 for each box, see above Std. also.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three mappings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.

Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

CLEAR HEIGHT	WING LOCATION	SF1 & LF1 BENT: In bottom of footing, bent up into back face of wing. One bar of each length. SIZE	SPACING	No. READ	LENGTHS VARY MIN.	MAX.	X MIN.	MAX.	Y MIN.	MAX.
H	SHORT OR LONG									
9'	Short	#5	12"	14	5'-11"	13'-11"	1'-6"	3'-10"	3'-8"	10'-5"
	Long	#5	12"	28	4'-11"	13'-8"	1'-6"	3'-6"	3'-6"	10'-3"
10'	Short	#5	12"	16	5'-8"	15'-6"	1'-8"	4'-9"	3'-9"	11'-3"
	Long	#5	12"	31	5'-5"	15'-2"	1'-8"	3'-11"	3'-10"	11'-0"
11'	Short	#5	12"	17	6'-0"	17'-0"	1'-9"	4'-9"	4'-1"	12'-1"
	Long	#5	12"	33	6'-11"	16'-8"	1'-9"	4'-3"	4'-5"	12'-5"
12'	Short	#5	12"	18	6'-9"	18'-7"	1'-11"	5'-3"	4'-11"	13'-5"
	Long	#5	12"	36	6'-7"	18'-2"	1'-11"	4'-9"	4'-9"	13'-2"

CLEAR HEIGHT	WING LOCATION	SF2 & LF2 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	⊕ SPACING	No. READ	LENGTH	X	Y
9'	Short	#5	12"	3	7'-6"	2'-1"	5'-6"
	Long	#5	12"	5	7'-6"	2'-1"	5'-6"
10'	Short	#6	12"	3	8'-6"	2'-4"	6'-3"
	Long	#6	12"	5	8'-6"	2'-4"	6'-3"
11'	Short	#6	12"	5	8'-6"	2'-4"	6'-3"
	Long	#6	12"	9	8'-6"	2'-4"	6'-3"
12'	Short	#7	12"	5	9'-6"	2'-7"	7'-0"
	Long	#7	12"	9	9'-6"	2'-7"	7'-0"

CLEAR HEIGHT	WING LOCATION	SF3 & LF3 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	No. READ	LENGTH	X	Y
9'	Short	#5	12"	2	7'-6"	2'-1"	5'-6"
	Long	#5	12"	4	7'-6"	2'-1"	5'-6"
10'	Short	#5	12"	2	7'-6"	2'-1"	5'-6"
	Long	#5	12"	4	7'-6"	2'-1"	5'-6"
11'	Short	#5	12"	2	7'-6"	2'-1"	5'-6"
	Long	#5	12"	4	7'-6"	2'-1"	5'-6"
12'	Short	#6	12"	4	8'-6"	2'-4"	6'-3"
	Long	#6	12"	8	8'-6"	2'-4"	6'-3"

CLEAR HEIGHT	WING LOCATION	SF4 & LF4 BENT: In bottom of footing, bent up into back face of wing. Alt. with F1 bars. SIZE	SPACING	No. READ	LENGTH	X	Y
9'	Short	—	—	—	—	—	—
	Long	—	—	—	—	—	—
10'	Short	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#4	12"	8	6'-6"	1'-10"	4'-9"
11'	Short	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#4	12"	8	6'-6"	1'-10"	4'-9"
12'	Short	#4	12"	4	6'-6"	1'-10"	4'-9"
	Long	#4	12"	8	6'-6"	1'-10"	4'-9"

CLEAR HEIGHT	WING LOCATION	SF5 & LF5 STRAIGHT: Longitudinal in top of wing footing heel. SIZE	No. READ	LENGTH	SF6 & LF6 STRAIGHT: Longitudinal in bottom of wing footing toe. SIZE	No. READ	LENGTH
9'	Short	#4	1	15'-6"	#4	4	15'-6"
	Long	#4	2	16'-9"	#4	8	18'-5"
10'	Short	#4	1	16'-10"	#4	4	16'-8"
	Long	#4	2	18'-1"	#4	8	20'-6"
11'	Short	#4	1	18'-2"	#4	4	18'-0"
	Long	#4	2	19'-5"	#4	8	22'-0"
12'	Short	#4	1	19'-6"	#4	4	19'-4"
	Long	#4	2	20'-9"	#4	8	23'-9"

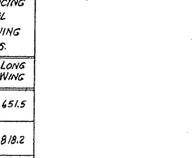
CLEAR HEIGHT	WING LOCATION	SF7 & LF7 BENT: Footing dowels extending up into front face of wing. SIZE	SPACING	No. READ	LENGTH	X
9'	Short	#4	18"	10	4'-6"	3'-6"
	Long	#4	18"	19	4'-10"	3'-6"
10'	Short	#4	18"	11	4'-9"	3'-10"
	Long	#4	18"	21	4'-9"	3'-10"
11'	Short	#4	18"	11	4'-8"	4'-2"
	Long	#4	18"	23	4'-8"	4'-2"
12'	Short	#4	18"	12	5'-0"	4'-6"
	Long	#4	18"	24	5'-0"	4'-6"

CLEAR HEIGHT	WING LOCATION	SH1 & LH1 STRAIGHT: Horizontal in back face of wing. SIZE	SPACING	No. READ	LENGTH
9'	Short	#4	12"	3	12'-9"
	Long	#4	12"	6	19'-4"
10'	Short	#4	12"	3	14'-8"
	Long	#4	12"	6	15'-8"
11'	Short	#4	12"	4	16'-0"
	Long	#4	12"	8	17'-0"
12'	Short	#4	12"	4	17'-9"
	Long	#4	12"	8	18'-9"

CLEAR HEIGHT	WING LOCATION	SH2 & LH2 STRAIGHT: Horizontal in back face of wing. One bar of each length. SIZE	SPACING	No. READ	LENGTHS VARY MAX.	MIN.
9'	Short	#4	12"	6	12'-2"	2'-2"
	Long	#4	12"	6	24'-4"	4'-4"
10'	Short	#4	12"	7	14'-2"	2'-2"
	Long	#4	12"	7	*28'-4"	4'-4"
11'	Short	#4	12"	7	14'-2"	2'-2"
	Long	#4	12"	7	*28'-4"	4'-4"
12'	Short	#4	12"	8	16'-2"	2'-2"
	Long	#4	12"	8	*32'-4"	4'-4"

CLEAR HEIGHT	WING LOCATION	SH3 & LH3 STRAIGHT: In back face of wing at top - on slope. SIZE	No. READ	LENGTH
9'	Short	#4	1	15'-0"
	Long	#4	2	14'-10"
10'	Short	#4	1	16'-6"
	Long	#4	2	16'-3"
11'	Short	#4	1	17'-11"
	Long	#4	2	17'-7"
12'	Short	#4	1	19'-5"
	Long	#4	2	19'-0"

BAR BENDING DIAGRAMS



NOTE:- Dimensions are to bar centers.

QUANTITY: REINFORCING STEEL PER WING LBS.	SHORT WING	LONG WING
	323.1	651.5
	411.4	818.2
	488.2	979.5
	616.4	1239.7

* Lengths without splice. Bars over 28'0" length may be spliced. (1'-8" lap)
Quantities include laps for LH2 bars over 28'0" length.

NOTE:- Bars for short wing to be marked with prefix letter S, while those for long wing shall be marked with letter L.

⊕ Except as shown at headwall.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

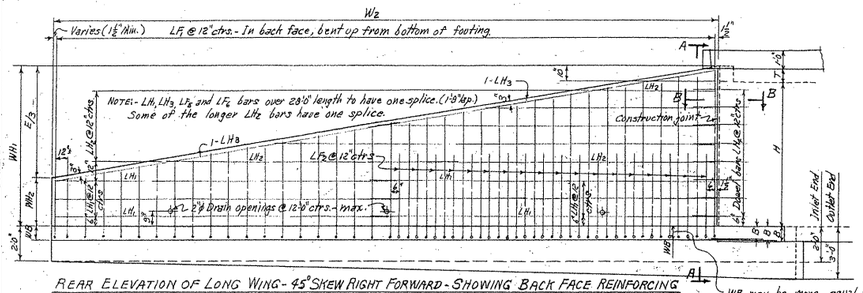
7', 8', 9', 10', 11 & 12' SPANS — 2:1 SLOPES

SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES. — ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

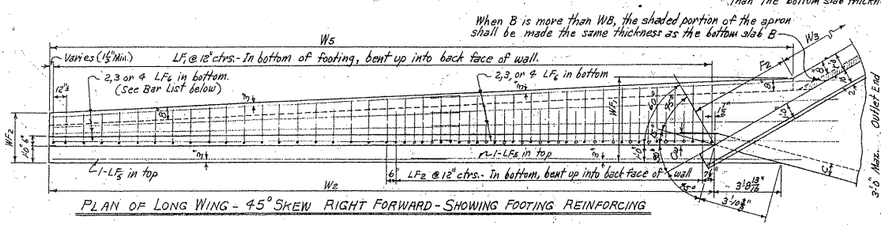
STANDARD DRAWING NO. W-X452-2

Designed By:- W.C.H.	5-16-63	Checked By:-	7-15-64
Drawn By:- W.C.H.	6-4-64	Checked By:- J.E.M.	7-14-64
Quantities By:- W.C.H.	6-30-64	Checked By:- J.E.M.	

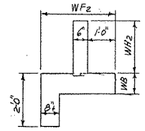
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



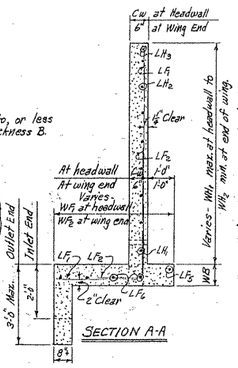
REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



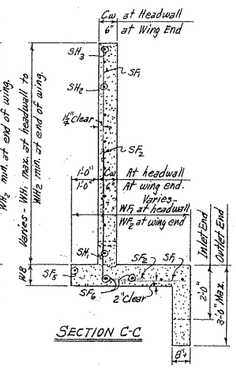
PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



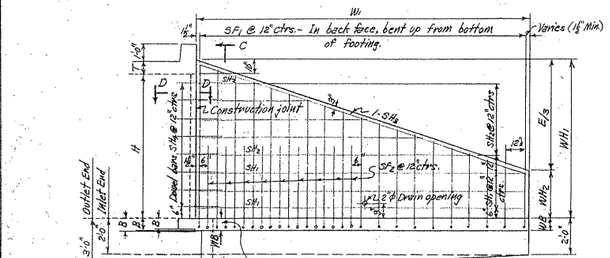
TYPICAL END VIEW OF WING



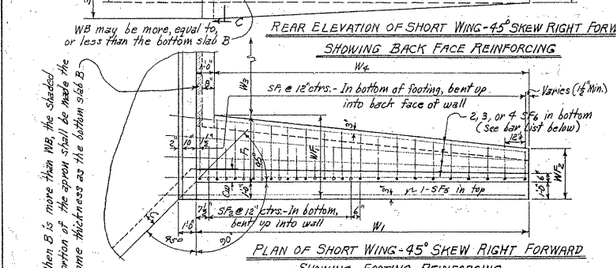
SECTION A-A



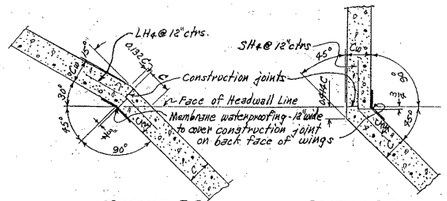
SECTION C-C



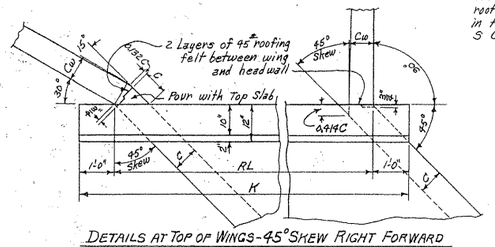
REAR ELEVATION OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



PLAN OF SHORT WING - 45° SKEW RIGHT FORWARD SHOWING FOOTING REINFORCING



SECTIONS THRU CONSTRUCTION JOINTS



DETAILS AT TOP OF WINGS - 45° SKEW RIGHT FORWARD

NOTE:- Payment for the membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.

REGULAR WING DIMENSIONS - 3:1 SLOPES

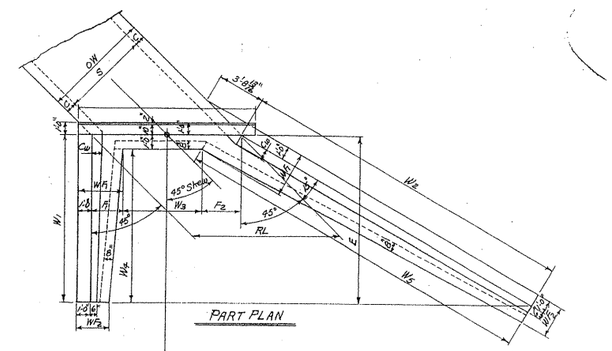
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT TOP & C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL		PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS		INSIDE FOOTING DIMENSION		* QUANTITY PER WING — CLASS S CONCRETE — INLET END		OUTLET END	
										SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING	SHORT WING	LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
2'	7"	6"	2'-10"	0'-8"	2'-9"	2'-10"	1'-4"	0'-11⅝"	6'-6"	6'-6"	13'-0"	5'-6"	13'-3⅜"	0.793	1.572	0.827	1.791
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-11½"	1'-8"	1'-7⅝"	8'-6"	8'-6"	17'-0"	7'-6"	17'-10⅜"	1.180	2.369	1.229	2.590
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	2'-0"	2'-3⅝"	10'-6"	10'-6"	21'-0"	9'-6"	22'-5½"	1.567	3.295	1.700	3.577
5'	7"	6"	5'-10"	1'-8"	3'-9"	2'-4½"	2'-4"	2'-11⅝"	12'-6"	12'-6"	25'-0"	11'-6"	27'-0½"	2.082	4.367	2.241	4.705
		7"	5'-10"	1'-8"	3'-9"	2'-4½"	2'-4"	2'-11⅝"	12'-6"	12'-6"	25'-0"	11'-6"	27'-0½"	2.166	4.551	2.325	4.889
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅝"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7½"	2.894	6.055	3.078	6.450
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅝"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7½"	2.952	6.180	3.135	6.575
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7⅝"	14'-6"	14'-6"	29'-0"	13'-6"	31'-7½"	3.009	6.305	3.192	6.700
7'	8½"	7½"	7'-10"	2'-4"	4'-0"	2'-7½"	3'-2"	4'-2⅝"	16'-6"	16'-6"	33'-0"	15'-6"	36'-5⅜"	3.794	7.930	9.003	8.385
		8"	7'-10"	2'-4"	4'-0"	2'-7½"	3'-2"	4'-2⅝"	16'-6"	16'-6"	33'-0"	15'-6"	36'-5⅜"	3.870	8.093	9.078	8.598
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7½"	18'-6"	18'-6"	37'-0"	17'-6"	41'-4⅝"	4.855	10.136	5.088	10.651

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W5.

QUANTITIES

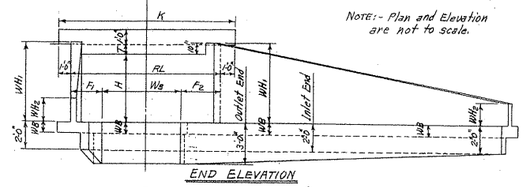
CLEAR SPAN S	CLEAR HEIGHT H	THICKNESS OF WING AT HEADWALL Cw	THICKNESS OF WING FOOTING WB	REINFORCING STEEL ⊕ FOR 4 WINGS LB.	CLASS S CONCRETE - 4 WINGS — HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS: SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
					CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
4'	2'	6"	7"	142	6.15	7.50	8.86	10.22	11.58
	3'	6"	7"	214	8.44	9.79	11.14	12.50	13.86
	4'	6"	7"	328	11.13	12.48	13.84	15.20	16.56
	5'	6"	7"	463	14.25	15.60	16.96	18.32	19.68
	6'	7"	8"	763	19.23	20.62	22.02	23.41	24.81
5'	3'	6"	7"	214	8.74	10.38	12.03	13.67	15.32
	4'	6"	7"	328	11.48	13.07	14.72	16.37	18.02
	5'	6"	7"	463	14.55	16.19	17.84	19.49	21.14
	6'	7"	8"	763	19.53	21.21	22.90	24.59	26.28
	7'	7½"	8½"	1475	24.98	26.69	28.41	30.14	31.86
6'	3'	6"	7"	214	9.03	10.99	12.91	14.86	16.79
	4'	6"	7"	328	11.73	13.69	15.60	17.56	19.48
	5'	6"	7"	463	14.85	16.80	18.72	20.68	22.60
	6'	7"	8"	763	19.83	21.82	23.79	25.78	27.76
	7'	7½"	8½"	1475	25.28	27.30	29.31	31.33	33.35
	8'	8"	9"	1872	31.70	33.74	35.75	37.79	39.81
7'	4'	6"	7"	328	12.04	14.21	16.54	18.81	21.02
	5'	6"	7"	463	15.15	17.93	19.65	21.93	24.13
	6'	7"	8"	763	20.14	22.44	24.69	26.99	29.24
	7'	7½"	8½"	1475	25.59	27.91	30.21	32.58	34.83
	8'	8"	9"	1872	32.02	34.36	36.66	38.99	41.31
8'	4'	6"	7"	328	12.35	14.95	17.49	20.08	22.57
	5'	7"	7"	463	16.06	18.67	21.24	23.86	26.37
	6'	7"	8"	763	20.95	23.07	25.64	28.24	30.77
	7'	7½"	8½"	1475	25.90	28.54	31.13	33.78	36.32
	8'	8"	9"	1872	32.33	34.97	37.56	40.21	42.80
9'	5'	7"	7"	463	16.32	19.32	22.18	25.02	27.91
	6'	7½"	8"	763	21.16	24.18	27.02	29.89	32.81
	7'	7½"	8½"	1475	26.21	29.18	32.08	34.94	37.86
	8'	8"	9"	1872	32.43	35.61	38.51	41.37	44.29
10'	5'	7"	7"	463	16.69	19.96	23.14	26.27	29.47
	6'	7½"	8"	763	21.48	24.77	27.99	31.18	34.36
	7'	7½"	8½"	1475	26.53	29.82	33.07	36.19	39.42
	8'	8"	9"	1872	32.95	36.25	39.46	42.62	45.86
11'	6'	8"	8"	763	22.18	25.83	29.35	32.84	——
	7'	8"	8½"	1475	27.33	30.99	34.51	38.01	——
	8'	8"	9"	1872	33.86	36.91	40.43	43.93	——
12'	6'	8"	8"	763	22.50	26.51	30.33	34.19	——
	7'	8"	8½"	1475	27.66	31.66	35.49	39.36	——
	8'	8"	9"	1872	33.58	37.58	41.41	45.27	——

⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.



PART PLAN

NOTE:- Plan and Elevation are not to scale.



END ELEVATION

SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple-Span Culverts, see Std. Drawing No. W-X45.
For values of RL, K and W3 for each box, see above Std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three applications of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

NOTE:- Payment for the membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

BAR LIST FOR ONE SHORT AND ONE LONG WING — 2 EACH REQUIRED

CLEAR HEIGHT H	WING LOCATION: SHORT OR LONG	SF1 & LF1 BENT — In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length. SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars SIZE	SPACING	NO. REQD	LENGTH	X	Y
2'	Short	#3	12"	7	1'-7"	3'-11"	0'-8"	1'-0"	1'-0"	3'-0"	—	—	—	—	—	—
	Long	#3	12"	14	1'-5"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—
3'	Short	#3	12"	9	2'-1"	5'-3"	0'-10"	1'-4"	1'-4"	4'-10"	—	—	—	—	—	—
	Long	#3	12"	18	1'-11"	5'-3"	0'-10"	1'-4"	1'-2"	4'-10"	—	—	—	—	—	—
4'	Short	#3	12"	11	2'-6"	6'-7"	0'-11"	1'-8"	1'-8"	5'-6"	—	—	—	—	—	—
	Long	#3	12"	22	2'-4"	6'-6"	0'-11"	1'-7"	1'-6"	5'-6"	—	—	—	—	—	—
5'	Short	#3	12"	13	2'-11"	7'-11"	1'-0"	2'-0"	2'-0"	6'-10"	#3	12"	3	3'-6"	1'-1"	2'-6"
	Long	#3	12"	26	2'-9"	7'-10"	1'-0"	1'-11"	1'-10"	6'-10"	#3	12"	6	3'-4"	1'-1"	2'-6"
6'	Short	#4	12"	15	3'-6"	9'-4"	1'-2"	2'-4"	2'-5"	7'-11"	#3	12"	3	4'-6"	1'-4"	3'-3"
	Long	#4	12"	30	3'-4"	9'-3"	1'-2"	2'-3"	2'-3"	7'-11"	#3	12"	6	4'-4"	1'-4"	3'-3"
7'	Short	#4	12"	17	3'-11"	10'-10"	1'-3"	2'-10"	2'-9"	8'-11"	#4	12"	6	5'-4"	1'-7"	4'-0"
	Long	#4	12"	34	3'-9"	10'-9"	1'-3"	2'-8"	2'-7"	8'-11"	#4	12"	12	5'-4"	1'-7"	4'-0"
8'	Short	#4	12"	19	4'-6"	12'-5"	1'-5"	3'-4"	3'-2"	9'-10"	#4	12"	9	6'-4"	1'-10"	4'-9"
	Long	#4	12"	38	4'-4"	12'-3"	1'-5"	3'-2"	3'-0"	9'-2"	#4	12"	18	6'-6"	1'-10"	4'-9"

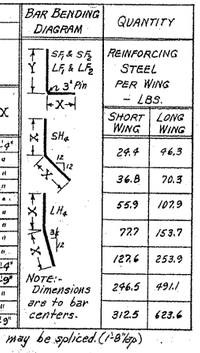
CLEAR HEIGHT H	WING LOCATION: SHORT OR LONG	SF3 & LF3 STRAIGHT — Longitudinal in top of wing footing heel. SIZE	NO. REQD	LENGTH	SF4 & LF4 STRAIGHT — Longitudinal in bottom of wing footing toe. SIZE	NO. REQD	LENGTH	SH1 & LH1 STRAIGHT — Horizontal in back face of wing. SIZE	SPACING	NO. REQD	LENGTH	SH2 & LH2 STRAIGHT — Horizontal in back face of wing. One bar of each length.* SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	MIN.
2'	Short	#3	1	8'-9"	#3	2	8'-0"	#3	12"	1	6'-3"	#3	12"	1	—	3'-9"
	Long	#3	1	17'-6"	#3	2	15'-6"	#3	12"	1	12'-9"	#3	12"	1	—	6'-6"
3'	Short	#3	1	10'-9"	#3	2	10'-0"	#3	12"	1	8'-3"	#3	12"	2	6'-9"	3'-9"
	Long	#3	1	21'-6"	#3	2	20'-0"	#3	12"	1	16'-9"	#3	12"	2	13'-6"	6'-6"
4'	Short	#3	1	12'-9"	#3	3	12'-0"	#3	12"	1	10'-9"	#3	12"	3	9'-9"	3'-9"
	Long	#3	1	25'-6"	#3	3	24'-0"	#3	12"	1	20'-9"	#3	12"	3	16'-6"	6'-6"
5'	Short	#3	1	14'-6"	#3	3	14'-0"	#3	12"	2	12'-9"	#3	12"	3	9'-9"	3'-9"
	Long	#3	1	29'-6"	#3	6	28'-0"	#3	12"	2	24'-9"	#3	12"	3	19'-6"	6'-6"
6'	Short	#3	1	16'-9"	#3	3	16'-0"	#3	12"	2	16'-9"	#3	12"	4	12'-9"	3'-9"
	Long	#3	1	33'-6"	#3	6	32'-0"	#3	12"	4	28'-6"	#3	12"	4	22'-6"	6'-6"
7'	Short	#3	2	17'-8"	#4	4	18'-0"	#4	12"	2	16'-9"	#4	12"	5	15'-9"	3'-9"
	Long	#3	2	35'-4"	#4	8	36'-0"	#4	12"	4	27'-3"	#4	12"	5	30'-6"	6'-6"
8'	Short	#3	2	19'-8"	#4	4	20'-0"	#4	12"	3	19'-9"	#4	12"	5	18'-9"	3'-9"
	Long	#3	2	39'-4"	#4	8	40'-0"	#4	12"	6	31'-6"	#4	12"	5	36'-6"	6'-6"

CLEAR HEIGHT H	WING LOCATION: SHORT OR LONG	SH3 & LH3 STRAIGHT — In back face of wing at top - on slope SIZE	NO. REQD	LENGTH	SH4 & LH4 BENT — Dowels thru construction joint at headwall. SIZE	SPACING	NO. REQD	LENGTH	X
2'	Short	#3	1	6'-7"	#3	12"	2	2'-8"	1'-9"
	Long	#3	1	12'-11"	#3	12"	2	"	"
3'	Short	#3	1	8'-8"	#3	12"	3	"	"
	Long	#3	1	16'-11"	#3	12"	3	"	"
4'	Short	#3	1	10'-9"	#3	12"	4	"	"
	Long	#3	1	20'-9"	#3	12"	4	"	"
5'	Short	#3	1	12'-11"	#3	12"	5	"	"
	Long	#3	1	25'-0"	#3	12"	5	"	"
6'	Short	#3	1	15'-0"	#3	12"	6	"	"
	Long	#3	1	29'-6"	#3	12"	6	2'-8"	1'-9"
7'	Short	#4	1	17'-11"	#4	12"	7	3'-6"	1'-9"
	Long	#4	2	17'-2"	#4	12"	7	"	"
8'	Short	#4	1	19'-9"	#4	12"	8	"	"
	Long	#4	2	19'-6"	#4	12"	8	3'-6"	1'-9"

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

* Length without splice. Bars over 28'0" length may be spliced. (1'-8" lap)

BAR BENDING DIAGRAM



QUANTITY — REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
29.4	46.3
36.8	70.3
55.9	102.9
77.7	153.7
127.6	253.9
246.5	491.1
312.5	623.6

REVISIONS:- Membrane Added. 5-10-66 W.C.H.

Designed By:- W.C.H. 5-13-63 Checked By:- J.E.M. 7-21-64
Drawn By:- W.C.H. 6-5-64 Checked By:- J.E.M. 7-21-64
Quantities By:- W.C.H. 7-2-64 Checked By:- J.E.M. 7-21-64

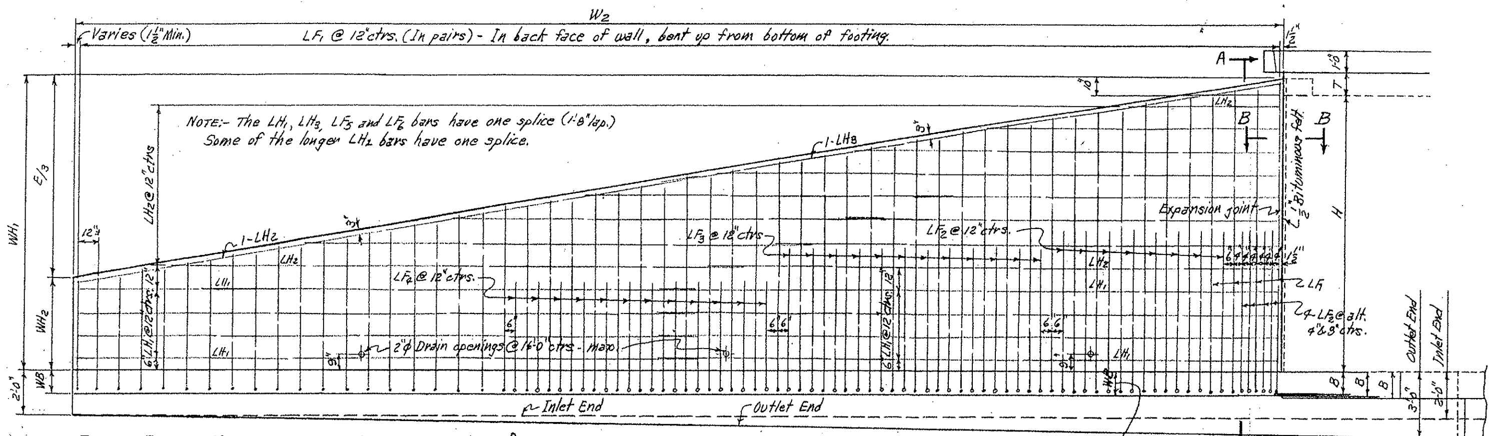
CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION
DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

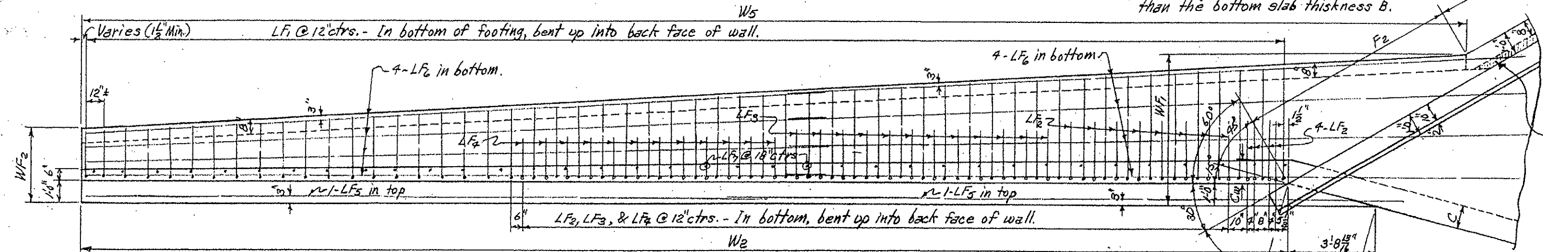
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 3:1 SLOPES
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES — ALL DEPTHS OF COVER FOR H = 8'-0" OR LESS

STANDARD DRAWING No. W-X453-1

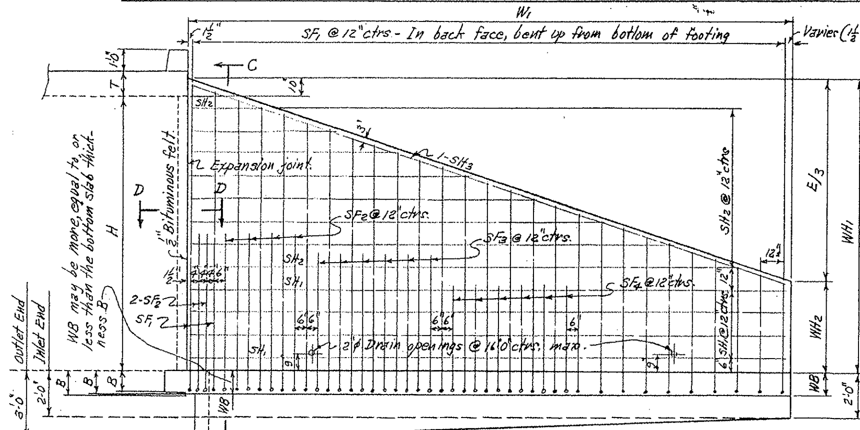
FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



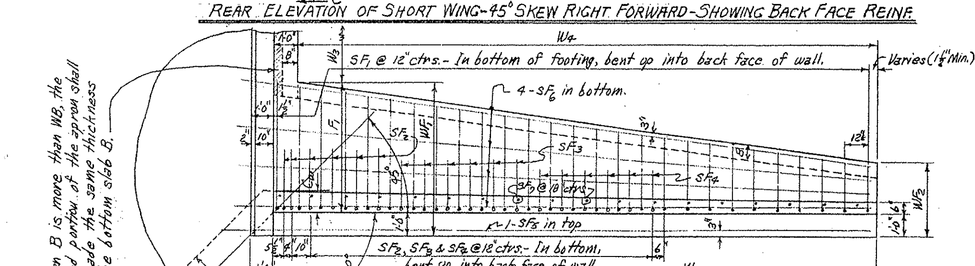
PART REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING



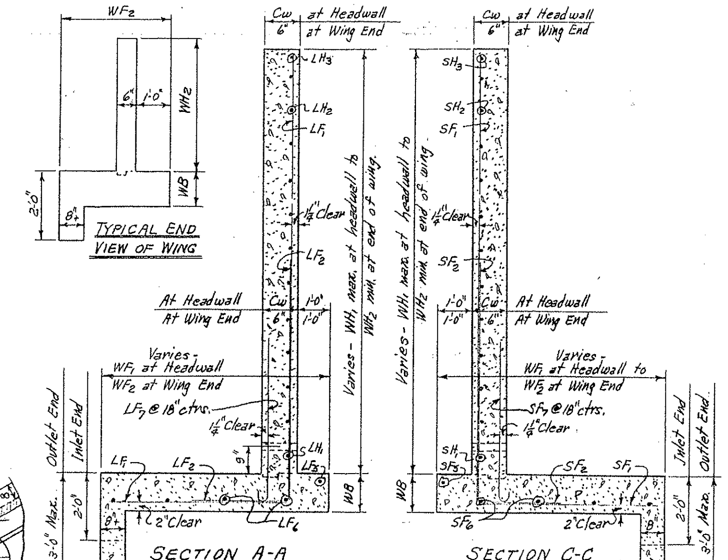
PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING

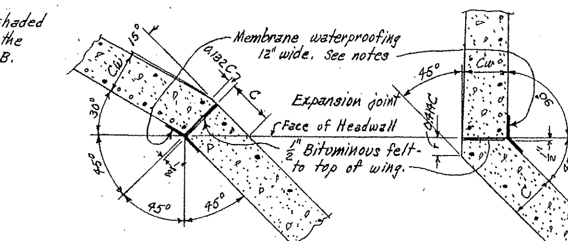


REAR ELEVATION OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.

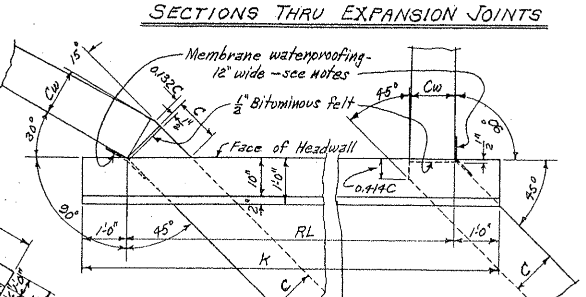


PLAN OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINF.

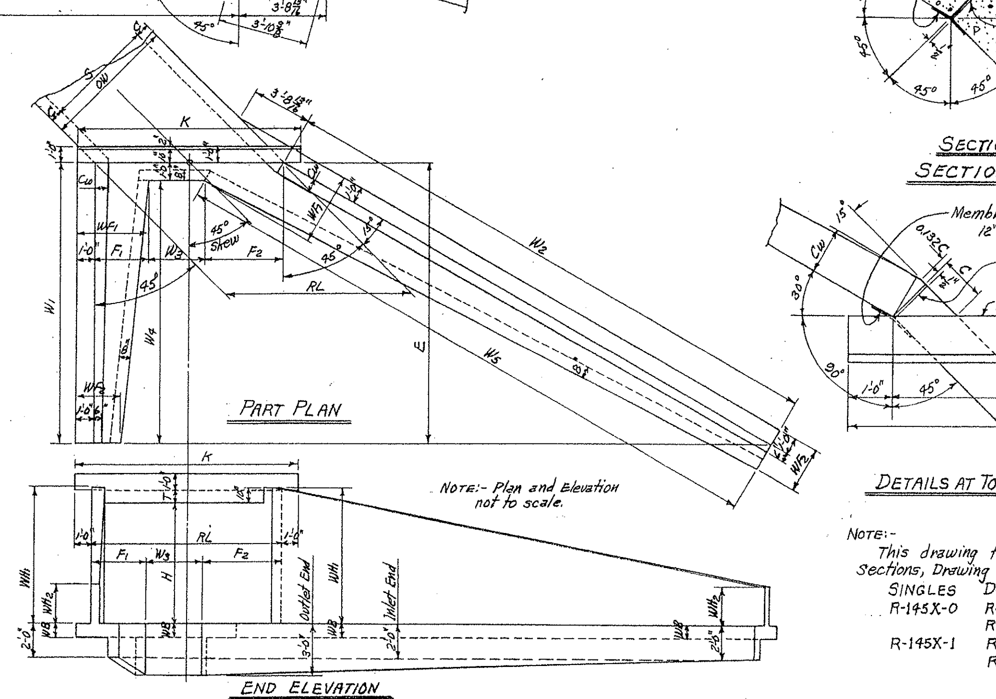




SECTIONS THRU EXPANSION JOINTS



DETAILS AT TOP OF WINGS - 45° SKEW RIGHT FORWARD



SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS

REGULAR WING DIMENSIONS - 3:1 SLOPES

CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL-C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSIONS SHORT WING	INSIDE FOOTING DIMENSIONS LONG WING	* QUANTITY PER WING CLASS S CONCRETE INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	CU.YD.	CU.YD.	CU.YD.	CU.YD.
9'	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-2"	6'-7¼"	20'-6"	20'-6"	41'-0"	19'-6"	46'-2½"	6.316	13.172	6.574	13.747
10'	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-8"	7'-7¼"	22'-6"	22'-6"	45'-0"	21'-6"	51'-1"	8.056	16.786	8.339	17.422
11'	12"	11"	11'-10"	3'-8"	6'-2"	3'-1½"	5'-2"	8'-7¼"	24'-6"	24'-6"	49'-0"	23'-6"	55'-11½"	10.101	21.031	10.409	21.728
12'	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-8"	9'-7¼"	26'-6"	26'-6"	53'-0"	25'-6"	60'-9¾"	12.476	25.961	12.810	26.717

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_3.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	REINFORCING STEEL - FOR 4 WINGS ⊕	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS) SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU.YD.	CU.YD.	CU.YD.	CU.YD.	CU.YD.
7'	9'	9"	10"	2831	40.92	43.30	45.66	48.03	50.40
8'	9'	9"	10"	2831	41.23	43.91	46.57	49.25	51.91
	10'	10"	11"	3546	51.85	54.58	57.29	60.02	62.73
9'	9'	9"	10"	2831	41.55	44.54	47.48	50.44	53.42
	10'	10"	11"	3546	52.17	55.20	58.21	61.22	64.25
	11'	11"	12"	4282	64.65	67.71	70.75	73.80	76.85
10'	9'	9"	10"	2831	41.86	45.18	48.92	51.65	54.92
	10'	10"	11"	3546	52.48	55.79	59.13	62.44	65.77
	11'	11"	12"	4282	64.97	68.33	71.68	75.03	78.39
	12'	12"	13"	5395	79.49	82.88	86.26	89.63	93.03
11'	9'	9"	10"	2831	42.16	45.84	49.39	52.92	——
	10'	10"	11"	3546	52.79	56.48	60.06	63.67	——
	11'	11"	12"	4282	65.28	68.97	72.61	76.26	——
	12'	12"	13"	5395	79.79	83.51	87.19	90.88	——
12'	9'	9"	10"	2831	42.48	46.51	50.37	54.25	——
	10'	10"	11"	3546	53.10	57.15	61.04	64.95	——
	11'	11"	12"	4282	65.59	69.64	73.54	77.50	——
	12'	12"	13"	5395	80.11	84.16	88.13	92.13	——

⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed at left below.

NOTE:-
This drawing to be used in conjunction with standard Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X45.
For values of RL, K and W_3 for each box, see above Std. also.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.
Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF1 & LF1 – BENT – In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length.
SF2 & LF2, SF3 & LF3, SF4 & LF4 – BENT – In bottom of footing, bent up into back face of wing. Alt. with F1 bars.

H	SHORT OR LONG	SF1&LF1 SIZE	SPACING	NO. REQ'D	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2&LF2 SIZE	⊙ SPACING	NO. REQ'D	LENGTH	X	Y	SF3&LF3 SIZE	SPACING	NO. REQ'D	LENGTH	X	Y	SF4&LF4 SIZE	SPACING	NO. REQ'D	LENGTH	X	Y
9'	Short	#5	12"	21	5'-0"	14'-0"	1'-6"	3'-10"	3'-7"	10'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	42	4'-10"	13'-9"	1'-6"	3'-7"	3'-5"	10'-3"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	12	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#5	12"	23	5'-7"	15'-7"	1'-8"	4'-4"	4'-0"	11'-4"	#6	12"	3	8'-6"	2'-4"	6'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	46	5'-5"	15'-4"	1'-8"	4'-1"	3'-10"	11'-4"	#6	12"	6	8'-6"	2'-4"	6'-3"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	12	6'-6"	1'-10"	4'-9"
11'	Short	#5	12"	25	6'-1"	17'-2"	1'-9"	4'-10"	4'-5"	12'-5"	#6	12"	6	8'-6"	2'-4"	6'-3"	#5	12"	3	7'-6"	2'-1"	5'-6"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	50	5'-11"	16'-10"	1'-9"	4'-6"	4'-3"	12'-5"	#6	12"	12	8'-6"	2'-4"	6'-3"	#5	12"	6	7'-6"	2'-1"	5'-6"	#4	12"	12	6'-6"	1'-10"	4'-9"
12'	Short	#5	12"	27	6'-8"	18'-9"	1'-11"	5'-4"	4'-10"	13'-6"	#7	12"	6	9'-6"	2'-7"	7'-0"	#6	12"	6	8'-6"	2'-4"	6'-3"	#4	12"	6	6'-6"	1'-10"	4'-9"
	Long	#5	12"	54	6'-6"	18'-4"	1'-11"	4'-11"	4'-8"	13'-6"	#7	12"	12	9'-6"	2'-7"	7'-0"	#6	12"	12	8'-6"	2'-4"	6'-3"	#4	12"	12	6'-6"	1'-10"	4'-9"

SF5 & LF5 – STRAIGHT – Longitudinal in top of wing footing heel. SF6 & LF6 – STRAIGHT – Longitudinal in bottom of wing footing toe. SF7 & LF7 – BENT – Footing dowels extending up into front face of wing. SH1 & LH1 – STRAIGHT – Horizontal in back face of wing. SH2 & LH2 – STRAIGHT – Horizontal in back face of wing. One bar of each length.* SH3 & LH3 – STRAIGHT – In back face of wing at top-on slope.

H	SHORT OR LONG	SF5&LF5 SIZE	NO. REQ'D	LENGTH	SF6&LF6 SIZE	NO. REQ'D	LENGTH	SF7&LF7 SIZE	SPACING	NO. REQ'D	LENGTH	X	SH1&LH1 SIZE	SPACING	NO. REQ'D	LENGTH	SH2&LH2 SIZE	SPACING	NO. REQ'D	LENGTHS VARY MAX.	LENGTHS VARY MIN.	SH3&LH3 SIZE	NO. REQ'D	LENGTH	QUANTITY REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
9'	Short	#4	1	22'-4"	#4	4	22'-0"	#4	18"	14	4'-0"	3'-6"	#4	12"	3	20'-3"	#4	12"	6	18'-3"	3'-3"	#4	1	21'-4"	466.6	949.0
	Long	#4	2	23'-8"	#4	8	25'-2"	#4	18"	28	4'-0"	3'-6"	#4	12"	6	21'-2"	#4	12"	6	*36'-6"	6'-6"	#4	2	21'-6"		
10'	Short	#4	1	24'-4"	#4	4	24'-0"	#4	18"	16	4'-4"	3'-10"	#4	12"	3	22'-3"	#4	12"	7	21'-3"	3'-3"	#4	1	23'-5"	586.0	1187.0
	Long	#4	2	25'-8"	#4	8	27'-7"	#4	18"	31	4'-4"	3'-10"	#4	12"	6	23'-2"	#4	12"	7	*42'-6"	6'-6"	#4	2	23'-6"		
11'	Short	#4	1	26'-4"	#4	4	26'-0"	#4	18"	17	4'-8"	4'-2"	#4	12"	4	24'-3"	#4	12"	7	21'-3"	3'-3"	#4	1	25'-7"	708.5	1432.6
	Long	#4	2	27'-8"	#4	8	30'-1"	#4	18"	33	4'-8"	4'-2"	#4	12"	8	25'-2"	#4	12"	7	*42'-6"	6'-6"	#4	2	25'-7"		
12'	Short	#4	1	28'-4"	#4	4	28'-0"	#4	18"	18	5'-0"	4'-6"	#4	12"	4	26'-3"	#4	12"	8	24'-3"	3'-3"	#4	1	27'-8"	893.0	1804.7
	Long	#4	2	29'-8"	#4	8	32'-6"	#4	18"	36	5'-0"	4'-6"	#4	12"	8	27'-2"	#4	12"	8	*48'-6"	6'-6"	#4	2	27'-7"		

BAR BENDING DIAGRAMS: SF1-SF4, LF1-LF4 (Y, X, 4½" Pin); SF7 & LF7 (X, 3" Pin).
NOTE:- Dimensions are to bar centers.

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".
⊙ Except as shown at headwall.
* Lengths without splice. Bars over 28'-0" length may be spliced (1'-8" lap). Quantities include laps for LH_2 bars over 28'-0" length.

Designed By:- W.C.H. 5-16-63 Checked By:-
Drawn By:- W.C.H. 6-8-64 Checked By:- J.E.M. 7-20-64
Quantities By:- W.C.H. 7-7-64 Checked By:- J.E.M. 7-21-64

CLASS S CONCRETE

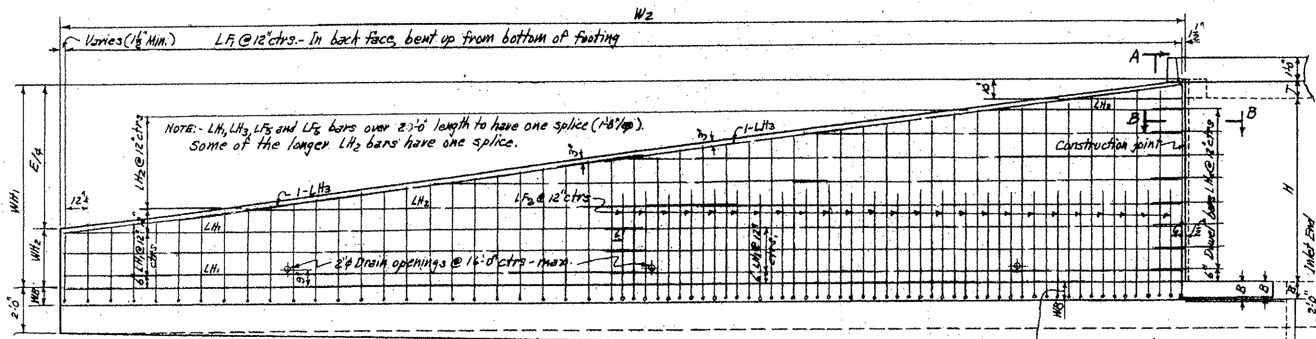
ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS FOR REINFORCED CONCRETE BOX CULVERTS 45° SKEW

7', 8', 9', 10', 11' & 12' SPANS
SINGLES, DOUBLES, TRIPLES, QUADRUPLES & QUINTUPLES.
3:1 SLOPES
ALL DEPTHS OF COVER FOR H = 9'-0" & OVER

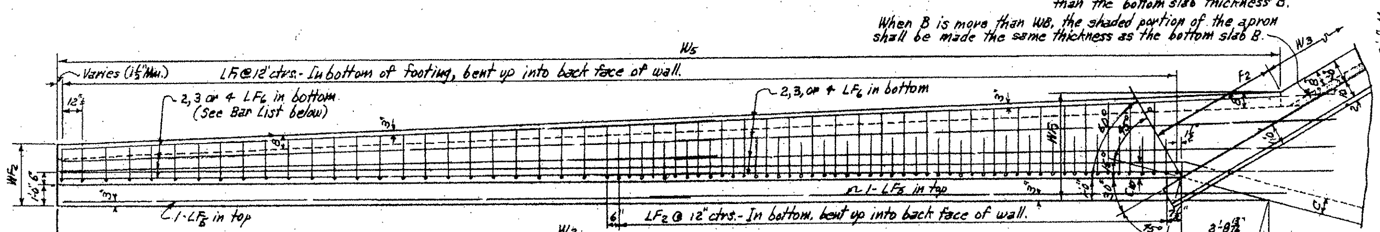
STANDARD DRAWING No. W-X453-2

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

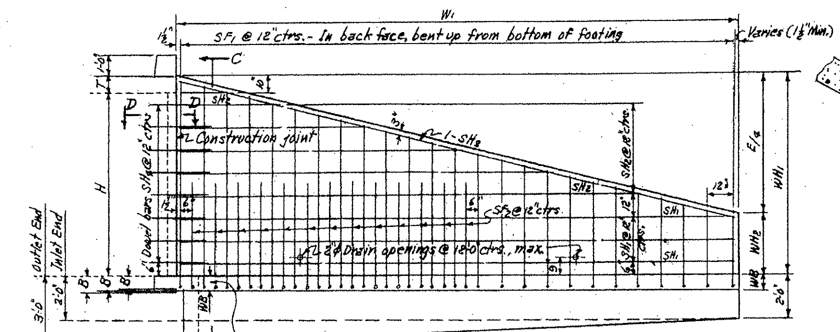


REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING

WB may be more, equal to, or less than the bottom slab thickness B.
When B is more than WB, the shaded portion of the apron shall be made the same thickness as the bottom slab B.



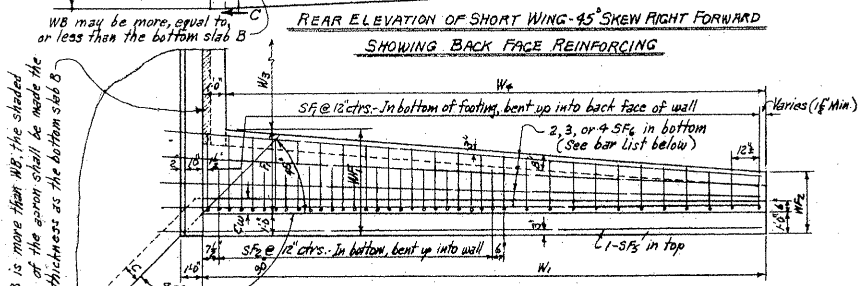
PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



WB may be more, equal to, or less than the bottom slab B

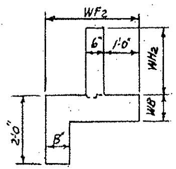
REAR ELEVATION OF SHORT WING - 45° SKEW RIGHT FORWARD

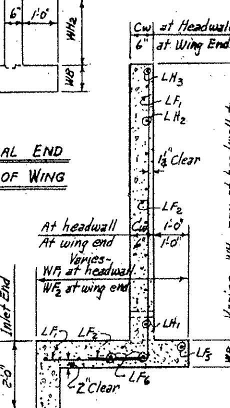
SHOWING BACK FACE REINFORCING



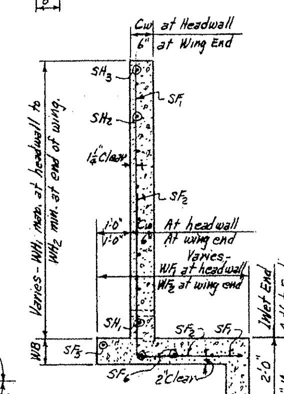
PLAN OF SHORT WING - 45° SKEW RIGHT FORWARD

SHOWING FOOTING REINFORCING

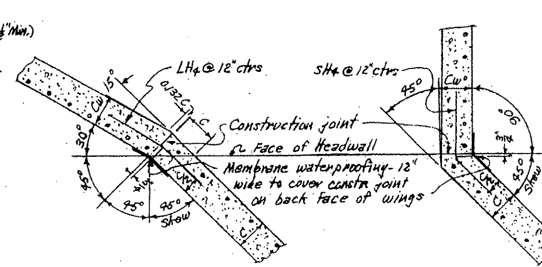




SECTION A-A



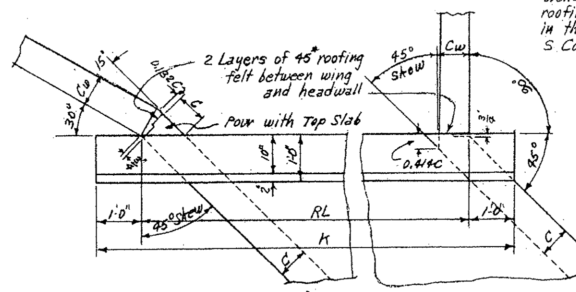
SECTION C-C



SECTION B-B SECTION D-D

SECTIONS THRU CONSTRUCTION JOINTS

NOTE:- Payment for the membrane waterproofing and roofing felt to be included in the price bid for Class S Concrete.



DETAILS AT TOP OF WINGS - 45° SKEW RIGHT FORWARD

REGULAR WING DIMENSIONS - 4:1 SLOPES

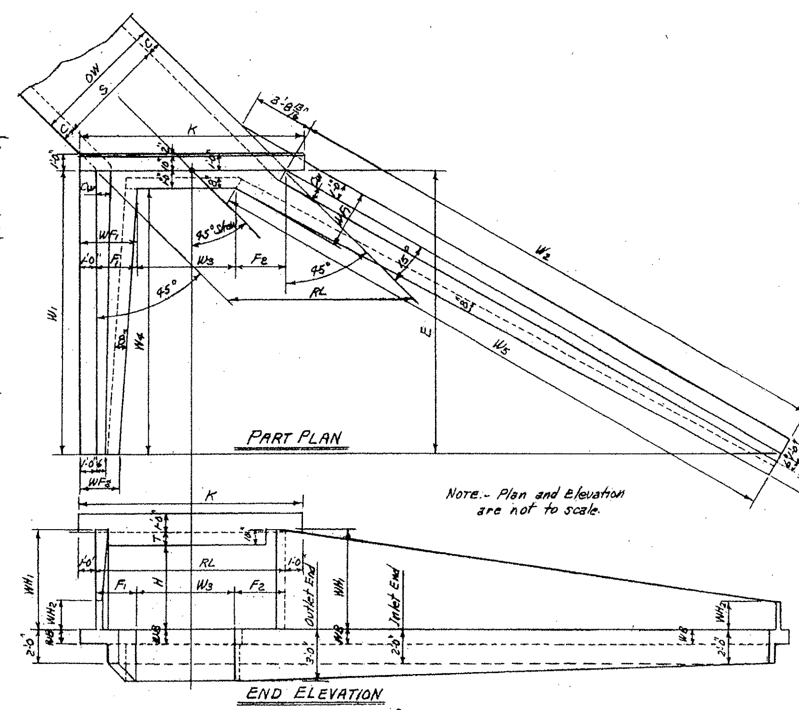
CLEAR HEIGHT OF BOX	THICKNESS OF WING FOOTING	THICKNESS OF WING AT HDWL = C	WINGWALL HEIGHTS AT HEADWALL	WINGWALL HEIGHTS AT END OF WING	WIDTHS OF WING FOOTINGS AT HEADWALL	WIDTHS OF WING FOOTINGS AT END OF WING	FOOTING DIMENSION PARALLEL WITH HEADWALL SHORT WING	FOOTING DIMENSION PARALLEL WITH HEADWALL LONG WING	PERPENDICULAR DIST. FROM HDWL TO END OF WING	LENGTHS OF WINGWALLS SHORT WING	LENGTHS OF WINGWALLS LONG WING	INSIDE FOOTING DIMENSION SHORT WING	INSIDE FOOTING DIMENSION LONG WING	* QUANTITY PER WING, CLASS S CONCRETE, INLET END SHORT WING	INLET END LONG WING	OUTLET END SHORT WING	OUTLET END LONG WING
H	WB	Cw	WH1	WH2	WF1	WF2	F1	F2	E	W1	W2	W4	W5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
2'	7"	6"	2'-10"	0'-8"	2'-4"	2'-0"	1'-4"	0'-11¼"	8'-8"	8'-8"	17'-4"	7'-8"	17'-7¾"	0.990	2.067	1.101	2.289
3'	7"	6"	3'-10"	1'-0"	2'-8"	2'-1½"	1'-8"	1'-7¼"	11'-4"	11'-4"	22'-8"	10'-4"	23'-6¾"	1.493	3.109	1.636	3.405
4'	7"	6"	4'-10"	1'-4"	3'-0"	2'-3"	2'-0"	2'-3½"	14'-0"	14'-0"	28'-0"	13'-0"	29'-5½"	2.087	4.336	2.264	4.705
5'	7"	6"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11¼"	16'-8"	16'-8"	33'-4"	15'-8"	35'-4½"	2.774	5.751	2.984	6.192
		7"	5'-10"	1'-8"	3'-4"	2'-4½"	2'-4"	2'-11¼"	16'-8"	16'-8"	33'-4"	15'-8"	35'-4½"	2.887	5.992	3.097	6.433
6'	8"	7"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3½"	3.855	7.977	4.098	8.492
		7½"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3½"	3.932	8.141	4.175	8.655
		8"	6'-10"	2'-0"	3'-8"	2'-6"	2'-8"	3'-7¼"	19'-4"	19'-4"	38'-8"	18'-4"	41'-3½"	4.009	8.306	4.252	8.820
7'	8½"	7½"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7¼"	22'-0"	22'-0"	44'-0"	21'-0"	47'-5¾"	5.063	10.449	5.329	11.040
		8"	7'-10"	2'-4"	4'-2"	2'-7½"	3'-2"	4'-7¼"	22'-0"	22'-0"	44'-0"	21'-0"	47'-5¾"	5.154	10.662	5.430	11.253
8'	9"	8"	8'-10"	2'-8"	4'-8"	2'-9"	3'-8"	5'-7¼"	24'-8"	24'-8"	49'-4"	23'-8"	53'-8½"	6.465	13.358	6.775	14.025

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W3.

QUANTITIES

CLEAR SPAN	CLEAR HEIGHT	THICKNESS OF WING AT HEADWALL	THICKNESS OF WING FOOTING	⊕ REINFORCING STEEL - FOR 4 WINGS	CLASS S CONCRETE - 4 WINGS (HEADWALLS, WINGWALLS, FOOTINGS, TOEWALLS AND APRONS) SINGLE BARREL CULVERT	DOUBLE BARREL CULVERT	TRIPLE BARREL CULVERT	QUADRUPLE BARREL CULVERT	QUINTUPLE BARREL CULVERT
S	H	Cw	WB	LB.	CU. YD.	CU. YD.	CU. YD.	CU. YD.	CU. YD.
4'	2'	6"	7"	180	7.72	9.07	10.43	11.79	13.14
	3'	6"	7"	275	10.78	12.13	13.48	14.84	16.20
	4'	6"	7"	429	14.39	15.74	17.10	18.45	19.81
	5'	6"	7"	604	18.56	19.91	21.27	22.62	23.98
	6'	7"	8"	995	25.18	26.57	27.96	29.36	30.75
5'	3'	6"	7"	275	11.08	12.72	14.36	16.01	17.66
	4'	6"	7"	429	14.69	16.33	17.98	19.63	21.27
	5'	6"	7"	604	18.86	20.50	22.15	23.80	25.44
	6'	7"	8"	995	25.98	27.16	28.85	30.54	32.23
	7'	7½"	8½"	1928	32.74	34.45	36.17	37.90	39.62
6'	3'	6"	7"	275	11.37	13.33	15.25	17.20	19.13
	4'	6"	7"	429	14.98	16.94	18.86	20.82	22.74
	5'	6"	7"	604	19.15	21.11	23.03	24.98	26.91
	6'	7"	8"	995	25.78	27.77	29.74	31.73	33.71
	7'	7½"	8½"	1928	33.04	35.06	37.07	39.09	41.10
	8'	8"	9"	2444	41.60	43.63	45.65	47.68	49.70
7'	4'	6"	7"	429	15.29	17.56	19.79	22.06	24.27
	5'	6"	7"	604	19.46	21.73	23.96	26.23	28.44
	6'	7"	8"	995	26.09	28.38	30.64	32.93	35.19
	7'	7½"	8½"	1928	33.35	35.67	37.97	40.29	42.59
	8'	8"	9"	2444	41.91	44.24	46.55	48.88	51.20
8'	4'	6"	7"	429	15.60	18.20	20.74	23.34	25.83
	5'	7"	7"	604	20.53	23.15	25.71	28.33	30.85
	6'	7"	8"	995	26.40	29.02	31.58	34.20	36.72
	7'	7½"	8½"	1928	33.66	36.30	38.89	41.54	44.08
	8'	8"	9"	2444	42.22	44.86	47.46	50.10	52.69
9'	5'	7"	7"	604	20.85	23.79	26.66	29.50	32.39
	6'	7½"	8"	995	27.22	30.19	33.09	35.95	38.87
	7'	7½"	8½"	1928	33.97	36.94	39.84	42.70	45.62
	8'	8"	9"	2444	42.53	45.50	48.40	51.27	54.18
10'	5'	7"	7"	604	21.17	24.44	27.62	30.74	33.95
	6'	7½"	8"	995	27.54	30.84	34.05	37.20	40.43
	7'	7½"	8½"	1928	34.29	37.58	40.80	43.95	47.18
	8'	8"	9"	2444	42.85	46.14	49.36	52.51	55.74
11'	6'	8"	8"	995	28.35	32.01	35.53	39.02	—
	7'	8"	8½"	1928	35.25	38.90	42.42	45.92	—
	8'	8"	9"	2444	43.15	46.80	50.32	53.82	—
12'	6'	8"	8"	995	28.68	32.69	36.51	40.37	—
	7'	8"	8½"	1928	35.57	39.58	43.40	47.26	—
	8'	8"	9"	2444	43.47	47.47	51.30	55.16	—

⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed below.



SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X45.
For values of RL, K and W3 for each box, see above std. also.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the construction joints in wings.

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF1 & LF1 — BENT — In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length.
SF2 & LF2 — BENT — In bottom of footing, bent up into back face of wing. Alt. with F1 bars.

H	SHORT OR LONG	SF1 & LF1 SIZE	SPACING	NO. REQD	LENGTHS VARY MIN.	LENGTHS VARY MAX.	X MIN.	X MAX.	Y MIN.	Y MAX.	SF2 & LF2 SIZE	SPACING	NO. REQD	LENGTH	X	Y
2'	Short	#3	12"	9	1'-7"	8'-11"	0'-8"	1'-0"	1'-0"	3'-0"	—	—	—	—	—	—
	Long	#3	12"	18	1'-5"	3'-11"	0'-8"	1'-0"	0'-10"	3'-0"	—	—	—	—	—	—
3'	Short	#3	12"	12	2'-0"	5'-3"	0'-10"	1'-4"	1'-3"	4'-0"	—	—	—	—	—	—
	Long	#3	12"	23	2'-0"	5'-3"	0'-10"	1'-4"	1'-3"	4'-0"	—	—	—	—	—	—
4'	Short	#3	12"	15	2'-4"	6'-7"	0'-11"	1'-8"	1'-6"	5'-0"	—	—	—	—	—	—
	Long	#3	12"	29	2'-4"	6'-6"	0'-11"	1'-7"	1'-6"	5'-0"	—	—	—	—	—	—
5'	Short	#3	12"	17	2'-11"	7'-11"	1'-0"	2'-0"	2'-0"	6'-0"	#3	12"	5	3'-6"	1'-1"	2'-6"
	Long	#3	12"	34	2'-9"	7'-10"	1'-0"	1'-11"	1'-10"	6'-0"	#3	12"	8	3'-6"	1'-1"	2'-6"
6'	Short	#4	12"	20	3'-5"	9'-4"	1'-2"	2'-4"	2'-4"	7'-1"	#3	12"	5	4'-6"	1'-4"	3'-3"
	Long	#4	12"	39	3'-5"	9'-3"	1'-2"	2'-3"	2'-4"	7'-1"	#3	12"	8	4'-6"	1'-4"	3'-3"
7'	Short	#4	12"	23	3'-9"	10'-10"	1'-3"	2'-10"	2'-7"	8'-1"	#4	12"	9	5'-6"	1'-7"	4'-0"
	Long	#4	12"	45	3'-9"	10'-8"	1'-3"	2'-8"	2'-7"	8'-1"	#4	12"	16	5'-6"	1'-7"	4'-0"
8'	Short	#4	12"	25	4'-6"	12'-5"	1'-5"	3'-4"	3'-2"	9'-2"	#4	12"	13	6'-6"	1'-10"	4'-9"
	Long	#4	12"	50	4'-4"	12'-3"	1'-5"	3'-2"	3'-0"	9'-2"	#4	12"	24	6'-6"	1'-10"	4'-9"

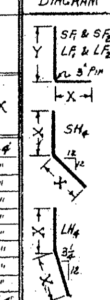
SF5 & LF5 — STRAIGHT — Longitudinal in top of wing footing heel.
SF6 & LF6 — STRAIGHT — Longitudinal in bottom of wing footing toe.
SH1 & LH1 — STRAIGHT — Horizontal in back face of wing.
SH2 & LH2 — STRAIGHT — Horizontal in back face of wing. One bar of each length. *

H	SHORT OR LONG	SF5 & LF5 SIZE	NO. REQD	LENGTH	SF6 & LF6 SIZE	NO. REQD	LENGTH	SH1 & LH1 SIZE	SPACING	NO. REQD	LENGTH	SH2 & LH2 SIZE	SPACING	NO. REQD	LENGTHS VARY MAX.	LENGTHS VARY MIN.
2'	Short	#3	1	10'-6"	#3	2	10'-4"	#3	12"	1	8'-4"	#3	12"	1	—	4'-4"
	Long	#3	1	21'-8"	#3	2	19'-6"	#3	12"	1	17'-0"	#3	12"	1	—	8'-8"
3'	Short	#3	1	13'-2"	#3	2	13'-0"	#3	18"	1	11'-0"	#3	12"	2	8'-4"	4'-4"
	Long	#3	1	27'-0"	#3	2	25'-6"	#3	12"	1	22'-4"	#3	12"	2	16'-8"	8'-8"
4'	Short	#3	1	15'-10"	#3	3	15'-8"	#3	12"	1	13'-8"	#3	12"	3	12'-4"	4'-4"
	Long	#3	2	17'-0"	#3	6	16'-7"	#3	12"	1	27'-8"	#3	12"	3	24'-8"	8'-8"
5'	Short	#3	1	18'-6"	#3	3	18'-4"	#3	12"	2	16'-4"	#3	12"	3	12'-4"	4'-4"
	Long	#3	2	19'-8"	#3	6	19'-7"	#3	12"	4	17'-4"	#3	12"	3	24'-8"	8'-8"
6'	Short	#3	1	21'-2"	#3	3	21'-0"	#3	12"	2	19'-0"	#3	12"	4	16'-4"	4'-4"
	Long	#3	2	22'-2"	#3	6	22'-7"	#3	12"	4	20'-0"	#3	12"	4	32'-8"*	8'-8"
7'	Short	#4	1	23'-10"	#4	4	23'-8"	#4	12"	2	21'-8"	#4	12"	5	20'-4"	4'-4"
	Long	#4	2	25'-0"	#4	8	25'-8"	#4	12"	4	22'-8"	#4	12"	5	40'-8"*	8'-8"
8'	Short	#4	1	26'-6"	#4	4	26'-4"	#4	12"	3	24'-4"	#4	12"	5	20'-4"	4'-4"
	Long	#4	2	27'-8"	#4	8	28'-9"	#4	12"	6	25'-4"	#4	12"	5	40'-8"*	8'-8"

SH3 & LH3 — In back face of wing at top - on slope.
SH4 & LH4 — BENT — Dowels thru construction joint at headwall.

H	SHORT OR LONG	SH3 & LH3 SIZE	NO. REQD	LENGTH	SH4 & LH4 SIZE	SPACING	NO. REQD	LENGTH	X	QUANTITY - REINFORCING STEEL PER WING - LBS. SHORT WING	LONG WING
2'	Short	#3	1	8'-8"	#3	12"	2	2'-8"	1'-4"	31.1	59.0
	Long	#3	1	17'-2"	#3	12"	2	"	"		
3'	Short	#3	1	11'-5"	#3	12"	3	"	"	47.3	90.1
	Long	#3	1	22'-7"	#3	12"	3	"	"		
4'	Short	#3	1	14'-2"	#3	12"	4	"	"	72.6	142.1
	Long	#3	1	27'-11"	#3	12"	4	"	"		
5'	Short	#3	1	16'-11"	#3	12"	5	"	"	101.9	200.2
	Long	#3	2	17'-6"	#3	12"	5	"	"		
6'	Short	#3	1	19'-8"	#3	12"	6	"	"	168.5	329.1
	Long	#3	2	20'-2"	#3	12"	6	2'-8"	1'-4"		
7'	Short	#4	1	22'-5"	#4	12"	7	3'-6"	1'-9"	325.7	638.3
	Long	#4	2	23'-0"	#4	12"	7	"	"		
8'	Short	#4	1	25'-1"	#4	12"	8	"	"	411.2	810.9
	Long	#4	2	25'-8"	#4	12"	8	3'-6"	1'-9"		

BAR BENDING DIAGRAM



NOTE:- Dimensions are to bar centers.

NOTE:- Bars for short wing shall be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

* Length without splice. Bars over 28'-0" length may be spliced (1'-8" lap)

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwall, footings and sidewalls shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.-

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS

FOR

REINFORCED CONCRETE BOX CULVERTS

45° SKEW

4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES

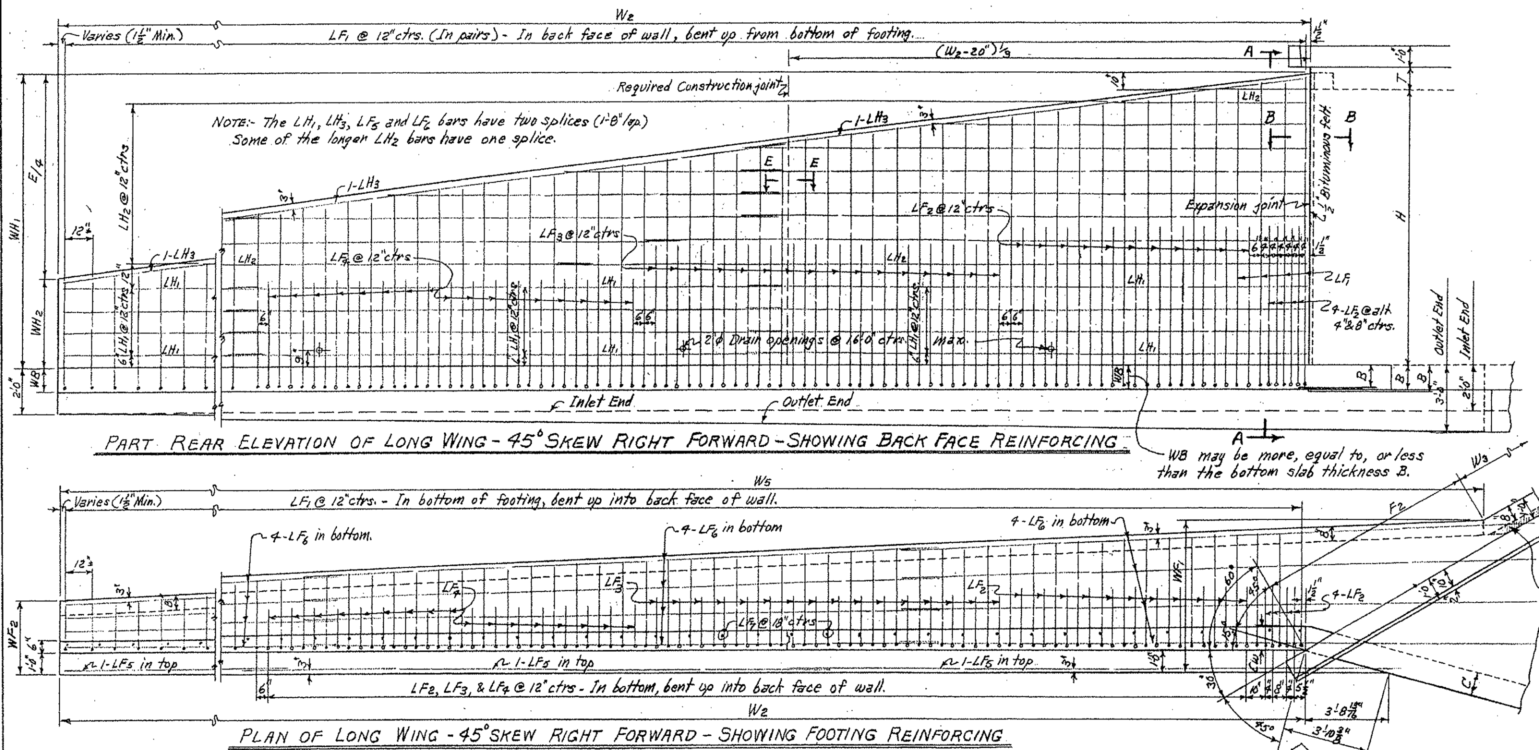
SINGLES, DOUBLES, TRIPLES, — ALL DEPTHS OF COVER

QUADRUPLES & QUINTUPLES — FOR H = 8'-0" OR LESS

STANDARD DRAWING NO. W-X454-1

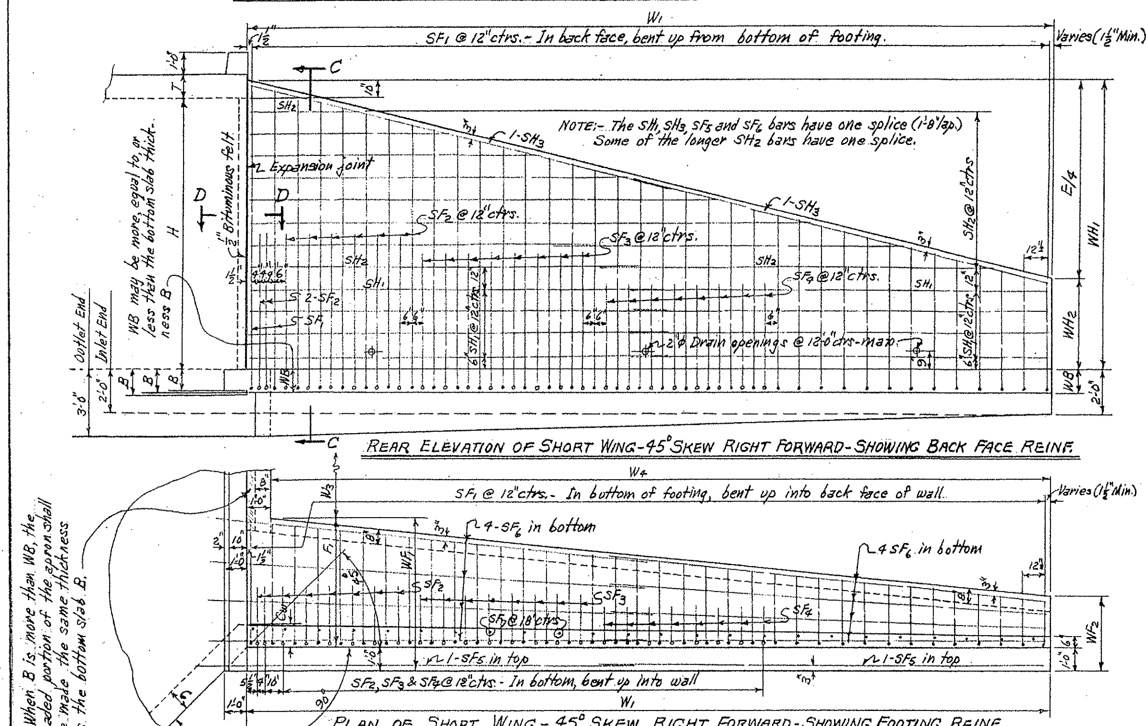
COPY MADE FROM PRINTS 1-4-71 H.G.T.
(ORIGINAL DAMAGED)
REVISIONS:- Membrane Added. 5-10-66 W.C.H.

Designed By: W.C.H. 5-13-63 Checked By: JEM 7-20-64
Drawn By: W.C.H. 6-10-64 Checked By: JEM 7-20-64
Quantities By: W.C.H. 7-2-64 Checked By: JEM



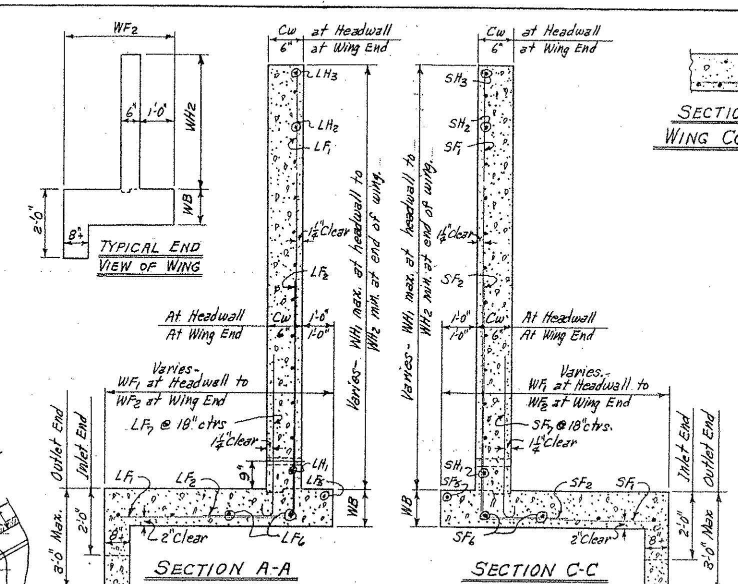
PART REAR ELEVATION OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINFORCING

PLAN OF LONG WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINFORCING



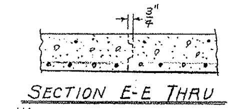
REAR ELEVATION OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING BACK FACE REINF.

PLAN OF SHORT WING - 45° SKEW RIGHT FORWARD - SHOWING FOOTING REINF.

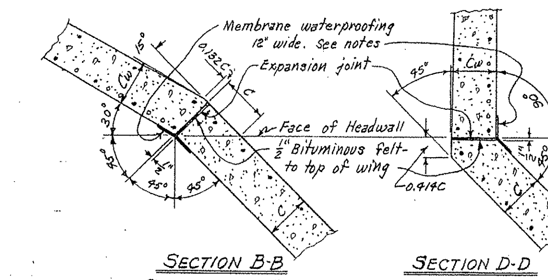


SECTION A-A

SECTION C-C



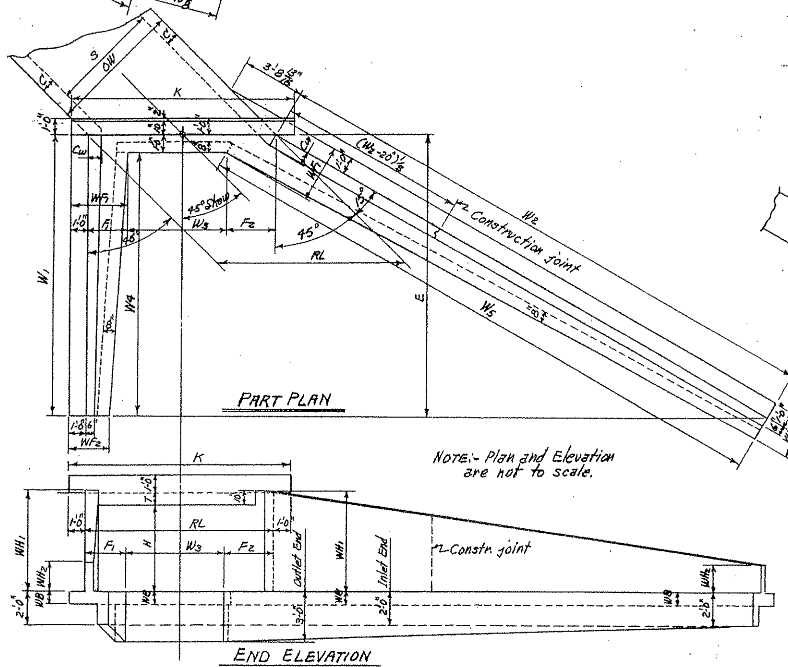
SECTION E-E THRU WING CONSTRUCTION JOINT



SECTION B-B

SECTION D-D

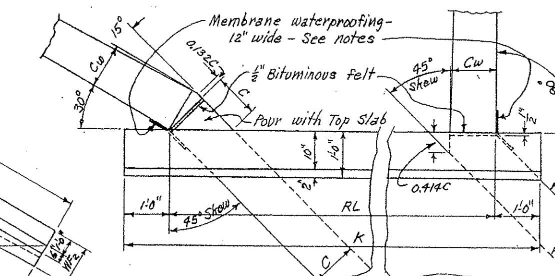
SECTIONS THRU EXPANSION JOINTS



SINGLE BARREL CULVERT - 45° SKEW RIGHT FORWARD

Details of Culvert with 45° Skew Left Forward is reversed, see Drawing No. W-X45.

TYPICAL WING DETAILS



DETAILS AT TOP OF WINGS - 45° SKEW RIGHT FORWARD

NOTE:-
This drawing to be used in conjunction with Standard Barrel Sections, Drawing Nos.

SINGLES	DOUBLES	TRIPLES	QUADRUPLES	QUINTUPLES
R-145X-0	R-245X-01	R-345X-01	R-445X-01	R-545X-01
	R-245X-02	R-345X-02	R-445X-02	R-545X-02
R-145X-1	R-245X-1	R-345X-1	R-445X-1	
	R-245X-2	R-345X-2		

NOTE:-
For remainder of General Plans and Elevations of Single, Double, Triple, Quadruple and Quintuple Span Culverts, see Std. Drawing No. W-X45.
For values of RL, K and W_3 for each box, see above Std. also.

REGULAR WING DIMENSIONS - 4:1 SLOPES

Clear Height of Box	Thickness of Wing Footing	Thickness of Wing at Hdwl = C	Wingwall Heights: At Headwall	Wingwall Heights: At End of Wing	Widths of Wing Footings: At Headwall	Widths of Wing Footings: At End of Wing	Footing Dimension Parallel with Headwall: Short Wing	Footing Dimension Parallel with Headwall: Long Wing	Perpendicular Dist. from Hdwl. to End of Wing	Lengths of Wingwalls: Short Wing	Lengths of Wingwalls: Long Wing	Inside Footing Dimensions: Short Wing	Inside Footing Dimensions: Long Wing	* Quantity per Wing, Class S Concrete, Inlet End: Short Wing	Inlet End: Long Wing	Outlet End: Short Wing	Outlet End: Long Wing
H	WB	Cw	WH_1	WH_2	WF_1	WF_2	F_1	F_2	E	W_1	W_2	W_4	W_5	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
9'	10"	9"	9'-10"	3'-0"	5'-2"	2'-10½"	4'-2"	6'-7¼"	27'-4"	27'-4"	54'-8"	26'-4"	59'-10½"	8.411	17.363	8.753	18.107
10'	11"	10"	10'-10"	3'-4"	5'-8"	3'-0"	4'-8"	7'-7¼"	30'-0"	30'-0"	60'-0"	29'-0"	66'-1"	10.728	22.133	11.104	22.954
11'	12"	11"	11'-10"	3'-8"	6'-2"	3'-1½"	5'-2"	8'-7¼"	32'-8"	32'-8"	65'-4"	31'-8"	72'-3½"	13.453	27.737	13.861	28.635
12'	13"	12"	12'-10"	4'-0"	6'-8"	3'-3"	5'-8"	9'-7¼"	35'-4"	35'-4"	70'-8"	34'-4"	78'-5¾"	16.618	34.246	17.060	35.220

* Quantity per wing does not include headwall or that portion of apron or toewall for the length W_3.

QUANTITIES

Clear Span	Clear Height	Thickness of Wing at Headwall	Thickness of Wing Footing	Reinforcing Steel - for 4 Wings ⊕	Class S Concrete - 4 Wings (Headwalls, Wingwalls, Footings, Toewalls and Aprons): Single Barrel Culvert	Double Barrel Culvert	Triple Barrel Culvert	Quadruple Barrel Culvert	Quintuple Barrel Culvert
S	H	Cw	WB	LB.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.	Cu.Yd.
7'	9'	9"	10"	3761	53.74	56.12	58.48	60.86	63.22
8'	9'	9"	10"	3761	54.06	56.73	59.40	62.07	64.73
	10'	10"	11"	4695	68.17	70.89	73.60	76.33	79.04
9'	9'	9"	10"	3761	54.37	57.37	60.31	63.27	66.24
	10'	10"	11"	4695	60.48	71.51	74.52	77.54	80.56
	11'	11"	12"	5677	85.07	88.13	91.17	94.21	97.27
10'	9'	9"	10"	3761	54.69	58.01	61.25	64.48	67.75
	10'	10"	11"	4695	68.80	72.14	75.44	78.76	82.09
	11'	11"	12"	5677	85.39	88.75	92.10	95.44	98.80
	12'	12"	13"	7154	104.67	108.06	111.44	114.81	118.21
11'	9'	9"	10"	3761	54.99	58.66	62.21	65.74	—
	10'	10"	11"	4695	69.10	72.80	76.38	79.98	—
	11'	11"	12"	5677	85.69	89.39	93.02	96.68	—
	12'	12"	13"	7154	104.97	108.69	112.37	116.06	—
12'	9'	9"	10"	3761	55.31	59.33	63.19	67.07	—
	10'	10"	11"	4695	69.42	73.47	77.36	81.27	—
	11'	11"	12"	5677	86.01	90.06	93.95	97.92	—
	12'	12"	13"	7154	105.29	109.34	113.31	117.31	—

⊕ For reinforcing steel in Headwalls and Aprons, see Drawing Nos. of Barrel Sections listed at left below.

GENERAL NOTES:-

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾ chamfers.

REINFORCING STEEL:- Reinforcing steel to be deformed bars of intermediate or hard grade.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, footings and sidewalls shall be only where shown on plans.

MEMBRANE:- A membrane waterproofing 12" wide, consisting of three moppings of waterproofing asphalt and two alternate layers of treated cotton fabric shall be applied to the back face of wing to cover the expansion joints.
Payment for the membrane waterproofing and bituminous felt shall be included in unit price bid for Class S Concrete.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

BAR LIST FOR ONE SHORT AND ONE LONG WING - 2 EACH REQUIRED

SF1 & LF1 — Bent — In bottom of footing, bent up into back face of wing. One bar (or two bars) of each length.

H	Wing	Size	Spacing	No. Req'd	Lengths Vary Min.	Lengths Vary Max.	X Min.	X Max.	Y Min.	Y Max.
9'	Short	#5	12"	28	4'-11"	14'-0"	1'-6"	3'-10"	3'-6"	10'-3"
	Long	#5	12"	55	4'-11"	13'-10"	1'-6"	3'-8"	3'-6"	10'-3"
10'	Short	#5	12"	31	5'-5"	15'-7"	1'-8"	4'-4"	3'-10"	11'-4"
	Long	#5	12"	61	5'-5"	15'-4"	1'-8"	4'-1"	3'-10"	11'-4"
11'	Short	#5	12"	33	6'-1"	17'-2"	1'-9"	4'-10"	4'-5"	12'-5"
	Long	#5	12"	66	5'-11"	16'-11"	1'-9"	4'-7"	4'-3"	12'-5"
12'	Short	#5	12"	36	6'-7"	18'-9"	1'-11"	5'-4"	4'-9"	13'-6"
	Long	#5	12"	71	6'-7"	18'-5"	1'-11"	5'-0"	4'-9"	13'-6"

Bent bars — SF2 & LF2, SF3 & LF3, SF4 & LF4: In bottom of footing, bent up into back face of wing. Alt. with F_1 bars.

H	Wing	SF2 & LF2 Size	Spacing ⊙	No. Req'd	Length	X	Y	SF3 & LF3 Size	Spacing	No. Req'd	Length	X	Y	SF4 & LF4 Size	Spacing	No. Req'd	Length	X	Y
9'	Short	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
	Long	#5	12"	7	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"	—	—	—	—	—	—
10'	Short	#6	12"	4	8'-6"	2'-4"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#6	12"	7	8'-6"	2'-4"	6'-3"	#5	12"	8	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"
11'	Short	#6	12"	8	8'-6"	2'-4"	6'-3"	#5	12"	4	7'-6"	2'-1"	5'-6"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#6	12"	15	8'-6"	2'-4"	6'-3"	#5	12"	8	7'-6"	2'-1"	5'-6"	#4	12"	16	6'-6"	1'-10"	4'-9"
12'	Short	#7	12"	8	9'-6"	2'-7"	7'-0"	#6	12"	8	8'-6"	2'-4"	6'-3"	#4	12"	8	6'-6"	1'-10"	4'-9"
	Long	#7	12"	15	9'-6"	2'-7"	7'-0"	#6	12"	16	8'-6"	2'-4"	6'-3"	#4	12"	16	6'-6"	1'-10"	4'-9"

SF5 & LF5 (Straight) — Longitudinal in top of wing footing heel. SF6 & LF6 (Straight) — Longitudinal in bottom of wing footing toe. SF7 & LF7 (Bent) — Footing dowels extending up into front face of wing.

H	Wing	SF5 & LF5 Size	No. Req'd	Length	SF6 & LF6 Size	No. Req'd	Length	SF7 & LF7 Size	Spacing	No. Req'd	Length	X
9'	Short	#4	2	15'-5"	#4	8	15'-4"	#4	18"	19	4'-0"	3'-6"
	Long	#4	3	20'-10"	#4	12	21'-9"	#4	18"	37	4'-0"	3'-6"
10'	Short	#4	2	16'-9"	#4	8	16'-8"	#4	18"	20	4'-4"	3'-10"
	Long	#4	3	22'-8"	#4	12	23'-10"	#4	18"	40	4'-4"	3'-10"
11'	Short	#4	2	18'-1"	#4	8	18'-0"	#4	18"	22	4'-8"	4'-2"
	Long	#4	3	24'-4"	#4	12	25'-11"	#4	18"	44	4'-8"	4'-2"
12'	Short	#4	2	19'-5"	#4	8	19'-4"	#4	18"	24	5'-0"	4'-6"
	Long	#4	3	26'-2"	#4	12	28'-0"	#4	18"	48	5'-0"	4'-6"

SH1 & LH1 (Straight) — Horizontal in back face of wing. SH2 & LH2 (Straight) — Horizontal in back face of wing, one bar of each length.* SH3 & LH3 — In back face of wing at top - on slope.

H	Wing	SH1 & LH1 Size	Spacing	No. Req'd	Length	SH2 & LH2 Size	Spacing	No. Req'd	Lengths Vary Max.	Lengths Vary Min.	SH3 & LH3 Size	No. Req'd	Length
9'	Short	#4	12"	6	14'-4"	#4	12"	6	24'-4"	4'-4"	#4	2	14'-10"
	Long	#4	12"	9	19'-3"	#4	12"	6	*48'-8"	8'-8"	#4	3	19'-6"
10'	Short	#4	12"	6	15'-8"	#4	12"	7	*28'-4"	4'-4"	#4	2	16'-3"
	Long	#4	12"	9	21'-0"	#4	12"	7	*56'-8"	8'-8"	#4	3	21'-3"
11'	Short	#4	12"	8	17'-0"	#4	12"	7	*28'-4"	4'-4"	#4	2	17'-7"
	Long	#4	12"	12	22'-10"	#4	12"	7	*56'-8"	8'-8"	#4	3	23'-0"
12'	Short	#4	12"	8	18'-4"	#4	12"	8	*32'-4"	4'-4"	#4	2	19'-0"
	Long	#4	12"	12	24'-7"	#4	12"	8	*64'-8"	8'-8"	#4	3	24'-9"

Bar Bending Diagrams: SF_1 - SF_4, LF_1 - LF_4 (Y, X, 4½" Pin); SF_7 & LF_7 (X, 3" Pin).
NOTE:- Dimensions are to bar centers.

H	Quantity - Reinforcing Steel per Wing - Lbs.: Short Wing	Long Wing
9'	630.3	1250.0
10'	787.9	1559.8
11'	949.0	1889.5
12'	1200.8	2376.1

NOTE:- Bars for short wing to be marked with prefix letter "S", while those for long wing shall be marked with letter "L".

⊙ Except as shown at headwall.

* Lengths without splice. Bars over 28'-0" length may be spliced, (1'-8" lap) Quantities include laps for SH_2 & LH_2 bars over 28'-0" length.

Designed By:- W.C.H. 5-16-63 Checked By:-
Drawn By:- W.C.H. 6-11-64 Checked By:- J.E.M. 7-14-64
Quantities By:- W.C.H. 7-7-64 Checked By:- J.E.M. 7-13-64

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD WINGS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

7', 8', 9', 10', 11' & 12' SPANS — 4:1 SLOPES
SINGLES, DOUBLES, TRIPLES, — ALL DEPTHS OF COVER
QUADRUPLES & QUINTUPLES — FOR H = 9'-0" & OVER

STANDARD DRAWING NO. W-X454-2

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 45° SKEWED ENDS.

"a" bars: STRAIGHT – In Top and Bottom Slabs of Barrel. "a₁" bars: STRAIGHT – In Top and Bottom Slab of Barrel- (Four of each Length). "b" bars: BENT – See Diagrams below – In Top and Bottom Slabs of Barrel- hooked. Alternate with "a" bars. "b₁" bars: BENT – See Diagrams below – In Top and Bottom Slabs of Barrel- one end hooked. (Four of each Length) Alternate with "a₁" bars.

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" SIZE	"a" SPACING	"a" NO. REQ'D	"a" LENGTH	"a₁" SIZE	"a₁" SPACING	"a₁" NO. REQ'D	"a₁" LENGTH MAX.	"a₁" LENGTH MIN.	"b" SIZE	"b" SPACING	"b" NO. REQ'D	"b" LENGTH	"b" X
0'-0" TO 5'-0" MAXIMUM	1 @ 4'	2'	#5	13"	104	4'-9"	#5	13"	8	3'-8"	2'-7"	#6	13"	104	5'-10"	4'-8"
		3'			104	4'-9"			8	"	"			104	5'-10"	"
		4'			104	4'-9"			8	"	"			104	5'-10"	"
		5'			104	4'-9"			8	"	"			104	5'-10"	"
		6'			104	4'-11"			8	3'-10"	2'-9"			104	6'-0"	4'-10"
	1 @ 5'	3'	#6	13"	102	5'-9"	#6	13"	12	4'-8"	2'-6"	#6	13"	102	6'-10"	5'-8"
		4'			102	5'-9"			12	"	"			102	6'-10"	"
		5'			102	5'-9"			12	"	"			102	6'-10"	"
		6'			102	5'-11"			12	4'-10"	2'-8"			102	7'-0"	5'-10"
		7'			102	6'-0"			12	4'-11"	2'-9"			102	7'-1"	5'-11"
	1 @ 6'	3'	#6	12"	110	6'-9"	#6	12"	16	5'-9"	2'-9"	#6	12"	108	7'-10"	6'-8"
		4'			110	6'-9"			16	"	"			108	7'-10"	"
		5'			110	6'-9"			16	"	"			108	7'-10"	"
		6'			108	6'-11"			16	5'-11"	2'-11"			108	8'-0"	6'-10"
		7'			108	7'-0"			16	6'-0"	3'-0"			108	8'-1"	6'-11"
		8'			108	7'-1"			16	6'-1"	3'-1"			108	8'-2"	7'-0"
	1 @ 7'	4'	#6	11"	116	7'-9"	#6	11"	24	6'-10"	2'-3"	#6	11"	116	8'-10"	7'-8"
		5'			116	7'-9"			24	"	"			116	8'-10"	"
		6'			116	7'-11"			24	7'-0"	2'-5"			116	9'-0"	7'-10"
		7'			116	8'-0"			24	7'-1"	2'-6"			116	9'-1"	7'-11"
		8'			116	8'-1"			24	7'-2"	2'-7"			114	9'-2"	8'-0"
		9'			116	8'-3"			24	7'-4"	2'-9"			114	9'-4"	8'-2"
	1 @ 8'	4'	#7	12"	106	8'-9"	#7	12"	24	7'-9"	2'-9"	#6	12"	104	9'-10"	8'-8"
		5'			104	8'-11"			24	7'-11"	2'-11"			104	10'-0"	8'-10"
		6'			104	8'-11"			24	"	"			104	10'-0"	"
		7'			104	9'-0"			24	8'-0"	3'-0"			104	10'-1"	8'-11"
		8'			104	9'-1"			24	8'-1"	3'-1"			104	10'-2"	9'-0"
		9'			104	9'-3"			24	8'-3"	3'-3"			104	10'-4"	9'-2"
		10'			104	9'-5"			28	8'-5"	2'-5"			102	10'-6"	9'-4"
	1 @ 9'	5'	#7	11"	112	9'-11"	#7	11"	32	9'-0"	2'-7"	#6	11"	110	11'-0"	9'-10"
		6'			112	10'-0"			32	9'-1"	2'-8"			110	11'-1"	9'-11"
		7'			112	10'-0"			32	"	"			110	11'-1"	9'-11"
		8'			112	10'-1"			32	9'-2"	2'-9"			110	11'-2"	10'-0"
		9'			112	10'-3"			32	9'-4"	2'-11"			110	11'-4"	10'-2"
		10'			110	10'-5"			32	9'-6"	3'-1"			110	11'-6"	10'-4"
		11'			110	10'-7"			32	9'-8"	3'-3"			110	11'-8"	10'-6"
	1 @ 10'	5'	#7	12"	100	10'-11"	#7	12"	32	9'-11"	2'-11"	#7	12"	100	12'-2"	10'-10"
		6'			100	11'-0"			32	10'-0"	3'-0"			100	12'-3"	10'-11"
		7'			100	11'-0"			32	"	"			100	12'-3"	"
		8'			100	11'-1"			32	10'-1"	3'-1"			100	12'-4"	11'-0"
		9'			100	11'-3"			32	10'-3"	3'-3"			100	12'-6"	11'-2"
		10'			100	11'-5"			36	10'-5"	2'-5"			98	12'-8"	11'-4"
		11'			100	11'-7"			36	10'-7"	2'-7"			98	12'-10"	11'-6"
		12'			100	11'-9"			36	10'-9"	2'-9"			98	13'-0"	11'-8"
	1 @ 11'	6'	#7	11"	108	12'-1"	#7	11"	40	11'-2"	2'-11"	#7	11"	106	13'-4"	12'-0"
		7'			106	12'-1"			40	"	"			106	13'-4"	"
		8'			106	12'-1"			40	"	"			106	13'-4"	"
		9'			106	12'-3"			40	11'-4"	3'-1"			106	13'-6"	12'-2"
		10'			106	12'-5"			44	11'-6"	2'-4"			106	13'-8"	12'-4"
		11'			106	12'-7"			44	11'-8"	2'-6"			106	13'-10"	12'-6"
		12'			106	12'-9"			44	11'-10"	2'-8"			104	14'-0"	12'-8"
	1 @ 12'	6'	#8	12"	96	13'-1"	#8	12"	40	12'-1"	3'-1"	#7	12"	96	14'-4"	13'-0"
		7'			96	13'-1"			40	"	"			96	14'-4"	"
		8'			96	13'-1"			40	"	"			96	14'-4"	"
		9'			96	13'-3"			40	12'-3"	3'-1"			96	14'-6"	13'-2"
		10'			96	13'-5"			44	12'-5"	2'-5"			94	14'-8"	13'-4"
		11'			96	13'-7"			44	12'-7"	2'-7"			94	14'-10"	13'-6"
		12'			96	13'-9"			44	12'-9"	2'-9"			94	15'-0"	13'-8"

"d" bars: STRAIGHT – Longitudinal in Top Slab of Barrel. "d₁" bars: STRAIGHT – Longitudinal in Sidewalls.

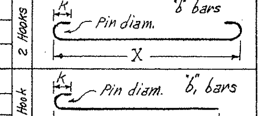
S	H	"b₁" SIZE	"b₁" SPACING	"b₁" NO. REQ'D	"b₁" LENGTH MAX.	"b₁" LENGTH MIN.	"b₁" X MAX.	"b₁" X MIN.	"d" SIZE	"d" SPACING	"d" NO. REQ'D	"d" LENGTH	"d₁" SIZE	"d₁" SPACING	"d₁" NO. REQ'D	"d₁" LENGTH
1 @ 4'	2'	#6	13"	8	4'-9"	3'-8"	4'-2"	3'-1"	#5	10½"	6	2 @ 30'-8", for 60'-0" Length Barrel. (1'-8" Lap)	#4	12"	4	2 @ 30'-6", for 60'-0" Length Barrel. (1'-3" Lap)
	3'			8	"	"	"	"			6				6	
	4'			8	"	"	"	"			6				8	
	5'			8	"	"	"	"			6				10	
	6'			8	4'-11"	3'-10"	4'-4"	3'-3"			6				12	
1 @ 5'	3'	#6	13"	12	5'-9"	3'-7"	5'-2"	3'-0"	#5	10½"	7		#4	12"	6	
	4'			12	"	"	"	"			7				8	
	5'			12	"	"	"	"			7				10	
	6'			12	5'-11"	3'-9"	5'-4"	3'-2"			7				12	
	7'			12	6'-0"	3'-10"	5'-5"	3'-3"			7				14	
1 @ 6'	3'	#6	12"	16	6'-9"	3'-9"	6'-2"	3'-2"	#5	10½"	8		#4	12"	6	
	4'			16	"	"	"	"			8				8	
	5'			16	"	"	"	"			8				10	
	6'			20	6'-11"	2'-11"	6'-4"	2'-4"			8				12	
	7'			20	7'-0"	3'-0"	6'-5"	2'-5"			8				14	
	8'			20	7'-1"	3'-1"	6'-6"	2'-6"			8				16	
1 @ 7'	4'	#6	11"	24	7'-10"	3'-3"	7'-3"	2'-8"	#5	10½"	9		#4	12"	8	
	5'			24	"	"	"	"			9				10	
	6'			24	8'-0"	3'-5"	7'-5"	2'-10"			9				12	
	7'			24	8'-1"	3'-6"	7'-6"	2'-11"			9				14	
	8'			24	8'-2"	3'-7"	7'-7"	3'-0"			9				16	
	9'			24	8'-4"	3'-9"	7'-9"	3'-2"			9				18	
1 @ 8'	4'	#6	12"	24	8'-9"	3'-9"	8'-2"	3'-2"	#5	10"	11		#4	12"	8	
	5'			28	8'-11"	2'-11"	8'-4"	2'-4"			11				10	
	6'			28	"	"	"	"			11				12	
	7'			28	9'-0"	3'-0"	8'-5"	2'-5"			11				14	
	8'			28	9'-1"	3'-1"	8'-6"	2'-6"			11				16	
	9'			28	9'-3"	3'-3"	8'-8"	2'-8"			11				18	
	10'			28	9'-5"	3'-5"	8'-10"	2'-10"			11				20	
1 @ 9'	5'	#6	11"	32	10'-0"	3'-7"	9'-5"	3'-0"	#5	10"	12		#4	12"	10	
	6'			32	10'-1"	3'-8"	9'-6"	3'-1"			12				12	
	7'			32	"	"	"	"			12				14	
	8'			32	10'-2"	3'-9"	9'-7"	3'-2"			12				16	
	9'			36	10'-4"	3'-0"	9'-9"	2'-5"			12				18	
	10'			36	10'-6"	3'-2"	9'-11"	2'-7"			12				20	
	11'			36	10'-8"	3'-4"	10'-1"	2'-9"			12				22	
1 @ 10'	5'	#7	12"	36	11'-0"	3'-0"	10'-4"	2'-4"	#5	10"	13		#4	12"	10	
	6'			36	11'-1"	3'-1"	10'-5"	2'-5"			13				12	
	7'			36	"	"	"	"			13				14	
	8'			36	11'-2"	3'-2"	10'-6"	2'-6"			13				16	
	9'			36	11'-4"	3'-4"	10'-8"	2'-8"			13				18	
	10'			36	11'-6"	3'-6"	10'-10"	2'-10"			13				20	
	11'			36	11'-8"	3'-8"	11'-0"	3'-0"			13				22	
	12'			36	11'-10"	3'-10"	11'-2"	3'-2"			13				24	
1 @ 11'	6'	#7	11"	44	12'-3"	4'-1"	11'-7"	2'-5"	#5	9½"	15		#4	12"	12	
	7'			44	"	"	"	"			15				14	
	8'			44	"	"	"	"			15				16	
	9'			44	12'-5"	4'-3"	11'-9"	2'-7"			15				18	
	10'			44	12'-7"	4'-5"	11'-11"	2'-9"			15				20	
	11'			44	12'-9"	4'-7"	12'-1"	2'-11"			15				22	
	12'			44	12'-11"	4'-9"	12'-3"	3'-1"			15				24	
1 @ 12'	6'	#7	12"	44	13'-2"	3'-2"	12'-6"	2'-6"	#5	9½"	16		#4	12"	12	
	7'			44	"	"	"	"			16				14	
	8'			44	"	"	"	"			16				16	
	9'			44	13'-4"	3'-4"	12'-8"	2'-8"			16				18	
	10'			44	13'-6"	3'-6"	12'-10"	2'-10"			16				20	
	11'			44	13'-8"	3'-8"	13'-0"	3'-0"			16				22	
	12'			44	13'-10"	3'-10"	13'-2"	3'-2"			16				24	

"e" bars: STRAIGHT – Longitudinal in Bottom Slab of Barrel. "f" bars: STRAIGHT – Verticals in Sidewalls. "k₁" bars: STRAIGHT – In Bottom of Headwall. "k₂" bars: STRAIGHT – In Top of Headwall and Apron. (2 Each)

S	H	"e" SIZE	"e" SPACING	"e" NO. REQ'D	"e" LENGTH	"f" SIZE	"f" SPACING	"f" NO. REQ'D	"f" LENGTH	"k₁" SIZE	"k₁" NO. REQ'D	"k₁" LENGTH	"k₂" SIZE	"k₂" NO. REQ'D	"k₂" LENGTH
1 @ 4'	2'	#4	12"	5	2 @ 31'-10", for 60'-0" Length Barrel. (1'-3" Lap)	#4	12"	120	2'-11"	#5	6	6'-9"	#5	8	8'-10"
	3'			5				120	3'-11"		6	"		8	
	4'			5				120	4'-11"		6	"		8	"
	5'			5				120	5'-11"		6	"		8	"
	6'			5				120	6'-11"		6	6'-11"		8	9'-0"
1 @ 5'	3'	#4	12"	6		#4	12"	120	4'-0"	#6	6	8'-1"	#6	8	10'-3"
	4'			6				120	5'-0"		6	"		8	"
	5'			6				120	6'-0"		6	"		8	"
	6'			6				120	7'-0"		6	8'-4"		8	10'-5"
	7'			6				120	8'-0"		6	8'-5"		8	10'-7"
1 @ 6'	3'	#4	12"	7		#4	12"	120	4'-1"	#6	6	9'-6"	#6	8	11'-7"
	4'			7				120	5'-1"		6	"		8	"
	5'			7				120	6'-1"		6	"		8	"
	6'			7				120	7'-1"		6	9'-9"		8	11'-10"
	7'			7				120	8'-1"		6	9'-10"		8	12'-0"
	8'			7		#5	12"	120	9'-1"		6	10'-0"		8	12'-1"
1 @ 7'	4'	#4	12"	8		#4	12"	120	5'-2"	#7	6	10'-11"	#7	8	13'-0"
	5'			8				120	6'-2"		6	"		8	"
	6'			8				120	7'-2"		6	11'-2"		8	13'-3"
	7'			8				120	8'-2"		6	11'-3"		8	13'-5"
	8'			8			10"	144	9'-2"		6	11'-4"		8	13'-6"
	9'			8		#5	12"	120	10'-2"		6	11'-7"		8	13'-9"
1 @ 8'	4'	#4	12"	9		#4	12"	120	5'-4"	#7	6	12'-4"	#7	8	14'-5"
	5'			9				120	6'-4"		6	12'-7"		8	14'-8"
	6'			9				120	7'-4"		6	"		8	"
	7'			9				120	8'-4"		6	12'-8"		8	14'-10"
	8'			9			10"	144	9'-4"		6	12'-10"		8	14'-11"
	9'			9		#5	12"	120	10'-4"		6	13'-0"		8	15'-2"
	10'			9			11"	132	11'-4"		6	13'-3"		8	15'-5"
1 @ 9'	5'	#4	12"	10		#4	12"	120	6'-5"	#8	6	14'-0"	#8	8	16'-1"
	6'			10				120	7'-5"		6	14'-1"		8	16'-3"
	7'			10				120	8'-5"		6	"		8	"
	8'			10			10"	144	9'-5"		6	14'-2"		8	16'-4"
	9'			10		#5	12"	120	10'-5"		6	14'-5"		8	16'-7"
	10'			10			11"	132	11'-5"		6	14'-8"		8	16'-10"
	11'			10			10"	144	12'-5"		6	14'-11"		8	17'-0"
1 @ 10'	5'	#4	12"	11		#4	12"	120	6'-6"	#8	6	15'-5"	#8	8	17'-6"
	6'			11				120	7'-6"		6	15'-6"		8	17'-8"
	7'			11				120	8'-6"		6	"		8	"
	8'			11			10"	144	9'-6"		6	15'-7"		8	17'-9"
	9'			11		#5	12"	120	10'-6"		6	15'-10"		8	18'-0"
	10'			11			11"	132	11'-6"		6	16'-1"		8	18'-3"
	11'			11			10"	144	12'-6"		6	16'-4"		8	18'-5"
	12'			11		#6	12"	120	13'-6"		6	16'-7"		8	18'-8"
1 @ 11'	6'	#4	12"	12		#4	12"	120	7'-7"	#9	6	17'-0"	#9	8	19'-2"
	7'			12				120	8'-7"		6	"		8	"
	8'			12			10"	144	9'-7"		6	"		8	"
	9'			12		#5	12"	120	10'-7"		6	17'-3"		8	19'-5"
	10'			12			11"	132	11'-7"		6	17'-6"		8	19'-8"
	11'			12			10"	144	12'-7"		6	17'-9"		8	19'-10"
	12'			12		#6	12"	120	13'-7"		6	18'-0"		8	20'-1"
1 @ 12'	6'	#4	12"	13		#4	12"	120	7'-9"	#9	6	18'-5"	#9	8	20'-7"
	7'			13				120	8'-9"		6	"		8	"
	8'			13			10"	144	9'-9"		6	"		8	"
	9'			13		#5	12"	120	10'-9"		6	18'-8"		8	20'-10"
	10'			13			11"	132	11'-9"		6	18'-11"		8	21'-1"
	11'			13			10"	144	12'-9"		6	19'-2"		8	21'-3"
	12'			13		#6	12"	120	13'-9"		6	19'-5"		8	21'-6"

These bars are in the skewed portion of barrel only. The length of "a₁" bars and overall length X of "b₁" bars vary by 1'-1" for 13" spacing, 1'-0" for 12" spacing and 0'-11" for 11" spacing.

BAR SIZE	PIN DIAM	K	ADD FOR HOOKS		BENDING DIAGRAMS FOR BARS "b" & "b₁"
#6	3"	5"	1'-2"	2 Hooks	"b" bars
#7	3½"	5¾"	1'-4"		
#6	3"	5"	0'-7"	1 Hook	"b₁" bars
#7	3½"	5¾"	0'-8"		

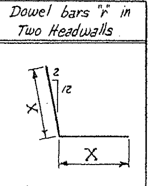


NOTE:- Dimensions are to centers of bars. ("b" and "b₁")

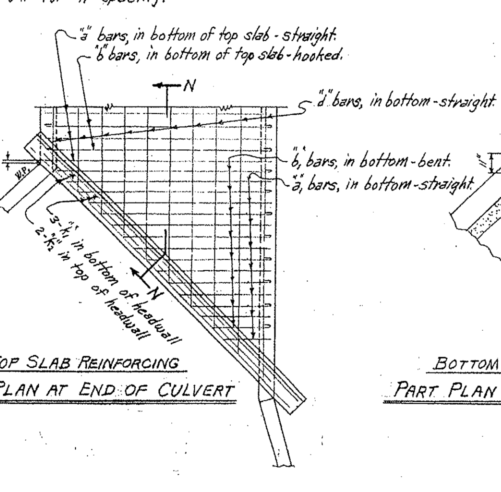
DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12"±	16	2'-6"	1'-3"
5'	#4	12"±	18	2'-7"	1'-3½"
6'	#4	12"±	22	2'-8"	1'-4"
7'	#4	12"±	24	2'-9"	1'-4½"
8'	#4	12"±	28	2'-11"	1'-5½"
9'	#4	12"±	30	3'-0"	1'-6"
10'	#4	12"±	34	3'-1"	1'-6½"
11'	#4	12"±	36	3'-2"	1'-7"
12'	#4	12"±	40	3'-3"	1'-7½"

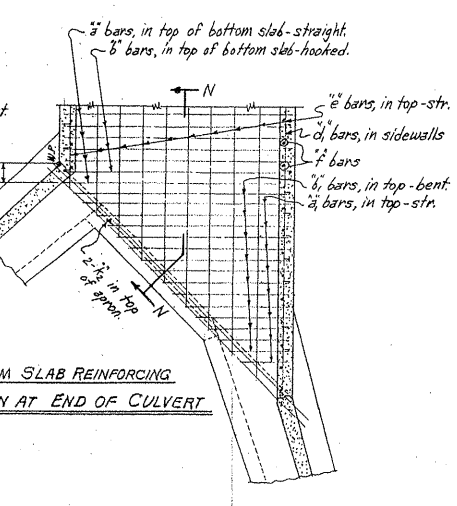
Dowel bars "r" in Two Headwalls



Designed by:- W.C.H. 1-23-63. Checked by:- R.H.S. 5-8-63
Drawn by:- W.C.H. 7-10-64 Checked by:-
Quantities by:- W.C.H. 9-30-64 Checked by:-

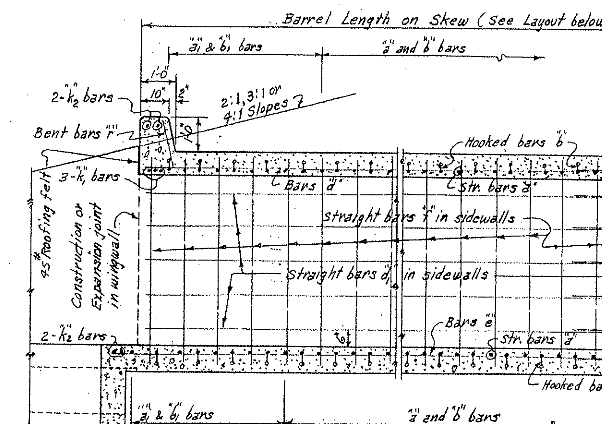


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

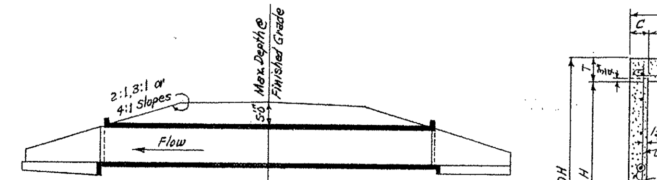


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

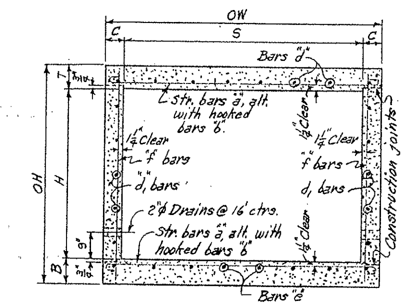
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.



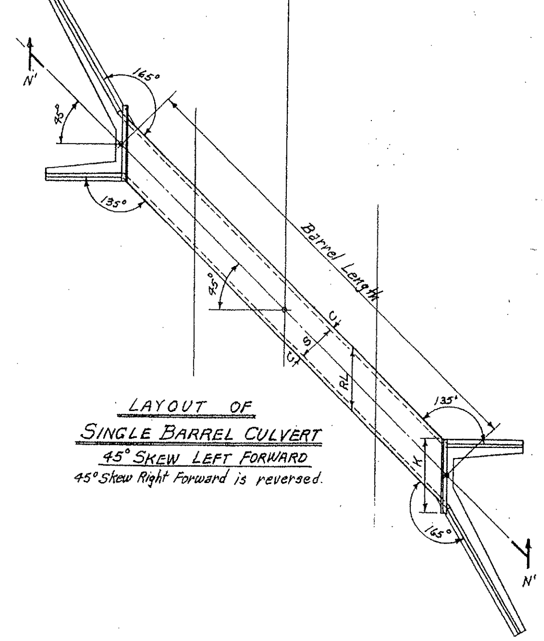
SECTION N-N



LONGITUDINAL SECTION N-N'



TYPICAL SECTION M-M



LAYOUT OF
SINGLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	* CLASS S CONC. PER LIN. FT. OF BARREL CU.YD.	REINFORCING STEEL TOTAL FOR 60'-0" LENGTH OF BARREL LB.	PER LIN. FT. OF BARREL LB.	ADDITIONAL PER LAP LB.
5'-0"	1 @ 4'	2'	8	5'-0"	7"	6"	6½"	3'-1½"	7'-0⅞"	9'-0⅞"	0.282	2635	41.49	17.95
		3'	12	5'-0"		6"		4'-1½"	"	"	0.319	2797	44.16	19.62
		4'	16	5'-0"		6"		5'-1½"	"	"	0.356	2958	46.83	21.29
		5'	20	5'-0"		6"		6'-1½"	"	"	0.394	3120	49.50	22.96
		6'	24	5'-2"		7"		7'-1½"	7'-3⅝"	9'-3⅝"	0.474	3336	52.96	24.63
	1 @ 5'	3'	15	6'-0"	7½"	6"	7"	4'-2½"	8'-5⅞"	10'-5⅞"	0.380	3572	55.55	22.19
		4'	20	6'-0"		6"		5'-2½"	"	"	0.417	3733	58.23	23.86
		5'	25	6'-0"		6"		6'-2½"	"	"	0.454	3895	60.90	25.53
		6'	30	6'-2"		7"		7'-2½"	8'-8⅜"	10'-8⅜"	0.535	4115	64.49	27.20
		7'	35	6'-3"		7½"		8'-2½"	8'-10⅝"	10'-10⅝"	0.604	4308	67.63	28.87
	1 @ 6'	3'	18	7'-0"	8"	6"	7½"	4'-3½"	9'-10¾"	11'-10¾"	0.446	4260	66.29	24.76
		4'	24	7'-0"		6"		5'-3½"	"	"	0.483	4421	68.96	26.43
		5'	30	7'-0"		6"		6'-3½"	"	"	0.520	4583	71.64	28.10
		6'	36	7'-2"		7"		7'-3½"	10'-1⅛"	12'-1⅛"	0.602	4813	75.31	29.77
		7'	42	7'-3"		7½"		8'-3½"	10'-3"	12'-3"	0.671	5008	78.98	31.44
		8'	48	7'-4"		8"		9'-3½"	10'-4½"	12'-4½"	0.746	5610	88.47	33.11
	1 @ 7'	4'	28	8'-0"	8½"	6"	8½"	5'-5"	11'-3¾"	13'-3¾"	0.568	5303	81.32	29.01
		5'	35	8'-0"		6"		6'-5"	"	"	0.605	5464	84.00	30.68
		6'	42	8'-2"		7"		7'-5"	11'-6⅝"	13'-6½"	0.688	5700	87.76	32.35
		7'	49	8'-3"		7½"		8'-5"	11'-8"	13'-8"	0.757	5901	90.98	34.02
		8'	56	8'-4"		8"		9'-5"	11'-9⅜"	13'-9½"	0.832	6219	96.65	35.69
		9'	63	8'-6"		9"		10'-5"	12'-0¼"	14'-0¼"	0.946	6976	105.59	37.36
	1 @ 8'	4'	32	9'-0"	9½"	6"	9½"	5'-7"	12'-8¾"	14'-8¾"	0.676	6196	95.26	33.32
		5'	40	9'-2"		7"		6'-7"	12'-11⅝"	14'-11½"	0.754	6423	99.12	34.99
		6'	48	9'-2"		7"		7'-7"	"	"	0.797	6584	101.79	36.66
		7'	56	9'-3"		7½"		8'-7"	13'-1"	15'-1"	0.867	6788	105.05	38.33
		8'	64	9'-4"		8"		9'-7"	13'-2½"	15'-2½"	0.942	7141	110.81	40.00
		9'	72	9'-6"		9"		10'-7"	13'-5¼"	15'-5¼"	1.057	7701	119.92	41.67
		10'	80	9'-8"		10"		11'-7"	13'-8"	15'-8"	1.184	8121	126.67	43.34
	1 @ 9'	5'	45	10'-2"	10"	7"	10"	6'-8"	14'-4½"	16'-4½"	0.844	7535	114.72	37.56
		6'	54	10'-3"		7½"		7'-8"	14'-6"	16'-6"	0.910	7745	118.04	39.23
		7'	63	10'-3"		7½"		8'-8"	"	"	0.957	7906	120.71	40.90
		8'	72	10'-4"		8"		9'-8"	14'-7⅜"	16'-7¼"	1.033	8264	126.54	42.57
		9'	81	10'-6"		9"		10'-8"	14'-10¼"	16'-10½"	1.148	8856	135.80	44.24
		10'	90	10'-8"		10"		11'-8"	15'-1"	17'-1"	1.276	9248	142.68	45.91
		11'	99	10'-10"		11"		12'-8"	15'-3⅞"	17'-3¾"	1.416	9717	150.40	47.58
	1 @ 10'	5'	50	11'-2"	10½"	7"	11"	6'-9½"	15'-9½"	17'-9½"	0.957	8572	130.64	40.13
		6'	60	11'-3"		7½"		7'-9½"	15'-11"	17'-11"	1.024	8784	133.99	41.80
		7'	70	11'-3"		7½"		8'-9½"	"	"	1.071	8946	136.66	43.47
		8'	80	11'-4"		8"		9'-9½"	16'-0⅜"	18'-0¼"	1.147	9308	142.55	45.14
		9'	90	11'-6"		9"		10'-9½"	16'-3⅛"	18'-3¼"	1.263	9891	151.92	46.81
		10'	100	11'-8"		10"		11'-9½"	16'-6"	18'-6"	1.391	10,310	158.89	48.48
		11'	110	11'-10"		11"		12'-9½"	16'-8⅞"	18'-8¾"	1.532	10,785	166.71	50.15
		12'	120	12'-0"		12"		13'-9½"	16'-11⅝"	18'-11¾"	1.685	11,524	178.67	51.82
	1 @ 11'	6'	66	12'-4"	11"	8"	11½"	7'-10½"	17'-5¾"	19'-5¾"	1.153	10,378	155.16	46.12
		7'	77	12'-4"		8"		8'-10½"	"	"	1.202	10,539	157.83	47.79
		8'	88	12'-4"		8"		9'-10½"	"	"	1.252	10,855	163.06	49.46
		9'	99	12'-6"		9"		10'-10½"	17'-8⅝"	19'-8¼"	1.368	11,493	172.60	51.13
		10'	110	12'-8"		10"		11'-10½"	17'-11"	19'-11"	1.497	11,886	179.70	52.80
		11'	121	12'-10"		11"		12'-10½"	18'-1¾"	20'-1¾"	1.638	12,374	187.67	54.47
		12'	132	13'-0"		12"		13'-10½"	18'-4⅝"	20'-4½"	1.792	13,071	199.79	56.14
	1 @ 12'	6'	72	13'-4"	11¾"	8"	12¼"	8'-0"	18'-10⅞"	20'-10¾"	1.284	11,420	172.20	48.69
		7'	84	13'-4"		8"		9'-0"	"	"	1.333	11,581	174.87	50.36
		8'	96	13'-4"		8"		10'-0"	"	"	1.383	11,899	180.15	52.03
		9'	108	13'-6"		9"		11'-0"	19'-1⅝"	21'-1"	1.500	12,500	189.85	53.70
		10'	120	13'-8"		10"		12'-0"	19'-3⅞"	21'-4"	1.630	12,948	197.07	55.37
		11'	132	13'-10"		11"		13'-0"	19'-6¾"	21'-6¾"	1.772	13,446	205.16	57.04
		12'	144	14'-0"		12"		14'-0"	19'-9⅝"	21'-9½"	1.926	14,212	217.45	58.71

* For remainder of quantities see Std. Wing Drawings listed at left. Total steel quantities listed above include one lap of longitudinal bars.

CLASS S CONCRETE

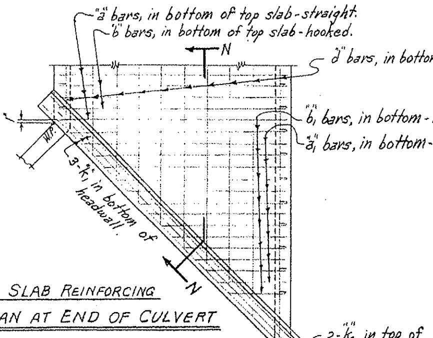
ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS 45° SKEW

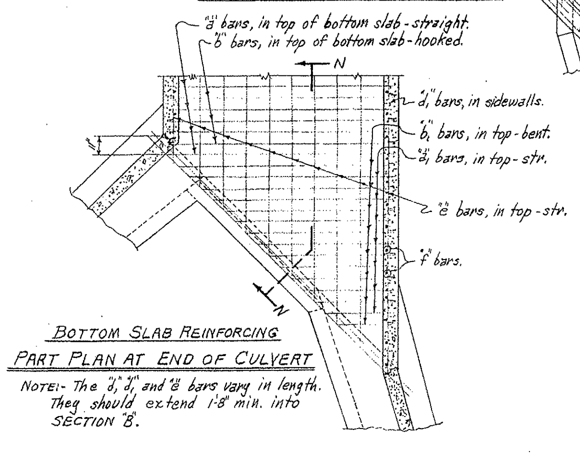
4', 5', 6', 7', 8', 9', 10', 11' & 12' SPANS SINGLES
2:1, 3:1 OR 4:1 SLOPES UNDER 5'-0" COVER

STANDARD DRAWING NO. R-145X-0

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

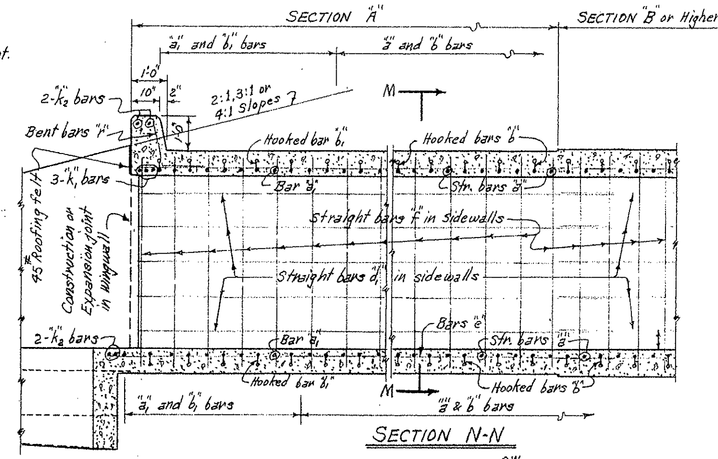


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

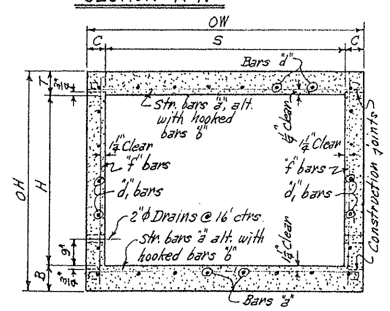


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

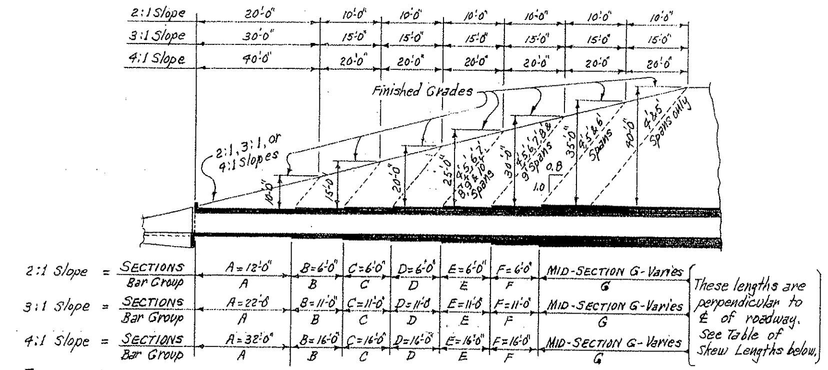
NOTE:- The "d," "d1" and "e" bars vary in length. They should extend 1'-8" min. into SECTION "B".



SECTION N-N

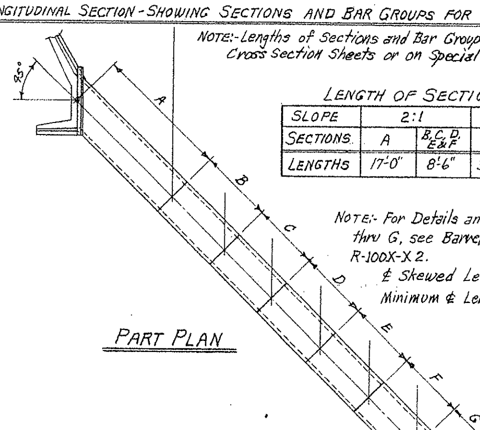


TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 45° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B,C,D, E&F	A	B,C,D, E&F	A	B,C,D, E&F
LENGTHS	17'-0"	8'-6"	31'-1½"	15'-6¾"	45'-3"	22'-7½"

NOTE:- For Details and Bar Lists for SECTIONS B thru G, see Barrel Drawing Nos. R-100X-X1 or R-100X-X2.
℄ Skewed Length of A = 1.41421 x A.
Minimum ℄ Length on Skew = (0.5 OW + 1").

BAR LIST FOR SECTION "A" ON 45° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A". LENGTH OF SECTION: 2:1 = 17'-0", 3:1 = 31'-1½", 4:1 = 45'-3". DEPTH OF COVER (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars – STRAIGHT – In Top and Bottom Slabs of Barrel. ▼"a1" bars – STRAIGHT – In Top and Bottom Slab of Barrel - (Two of each Length)

Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd 2:1	"a" No. Req'd 3:1	"a" No. Req'd 4:1	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.
1 @ 4'	2'	#4	12"	31	59	87	4'-9"	#4	12"	4	3'-9"	2'-9"
	3'			31	59	87	"			4	"	"
	4'			31	59	87	"			4	"	"
	5'			31	59	87	"			4	"	"
	6'			31	59	87	4'-11"			4	3'-11"	2'-11"
1 @ 5'	3'	#5	12"	29	59	87	5'-9"	#5	12"	6	4'-9"	2'-9"
	4'			29	59	87	"			6	"	"
	5'			29	59	87	"			6	"	"
	6'			29	57	87	5'-11"			6	4'-11"	2'-11"
	7'			29	57	87	6'-0"			6	5'-0"	3'-0"
1 @ 6'	3'	#5	12"	29	57	85	6'-9"	#5	12"	8	5'-9"	2'-9"
	4'			29	57	85	"			8	"	"
	5'			29	57	85	"			8	"	"
	6'			29	57	85	6'-11"			8	5'-11"	2'-11"
	7'			29	57	85	7'-0"			8	6'-0"	3'-0"
	8'			29	57	85	7'-1"			8	6'-1"	3'-1"
1 @ 7'	4'	#5	12"	27	57	85	7'-9"	#5	12"	10	6'-9"	2'-9"
	5'			27	57	85	"			10	"	"
	6'			27	55	85	7'-11"			10	6'-11"	2'-11"
	7'			27	55	85	8'-0"			10	7'-0"	3'-0"
	8'			27	55	85	8'-1"			10	7'-1"	3'-1"
	9'			27	55	83	8'-3"			10	7'-3"	3'-3"
1 @ 8'	4'	#6	12"	27	55	83	8'-9"	#6	12"	12	7'-9"	2'-9"
	5'			27	55	83	8'-11"			12	7'-11"	2'-11"
	6'			27	55	83	"			12	"	"
	7'			27	55	83	9'-0"			12	8'-0"	3'-0"
	8'			27	55	83	9'-1"			12	8'-1"	3'-1"
	9'			27	55	83	9'-3"			12	8'-3"	3'-3"
	10'			27	55	83	9'-5"			14	8'-5"	2'-5"
1 @ 9'	5'	#6	11"	27	59	89	9'-11"	#6	11"	16	9'-0"	2'-7"
	6'			27	59	89	10'-0"			16	9'-1"	2'-8"
	7'			27	59	89	"			16	"	"
	8'			27	59	89	10'-1"			16	9'-2"	2'-9"
	9'			27	59	89	10'-3"			16	9'-4"	2'-11"
	10'			27	59	89	10'-5"			16	9'-6"	3'-1"
	11'			27	57	89	10'-7"			16	9'-8"	3'-3"
1 @ 10'	5'	#7	12"	25	53	82	10'-11"	#7	12"	16	9'-11"	2'-11"
	6'			25	53	82	11'-0"			16	10'-0"	3'-0"
	7'			25	53	82	"			16	"	"
	8'			25	53	82	11'-1"			16	10'-1"	3'-1"
	9'			25	53	82	11'-3"			16	10'-3"	3'-3"
	10'			25	53	82	11'-5"			18	10'-5"	2'-5"
	11'			23	53	82	11'-7"			18	10'-7"	2'-7"
	12'			23	53	82	11'-9"			18	10'-9"	2'-9"

"b" bars – BENT - See Diagrams at Right – In Top and Bottom Slabs of Barrel - hooked. Alternate with "a" bars. ▼"b1" bars – In Top and Bottom Slabs of Barrel - one end hooked. (Two of each Length) Alternate with "a1" bars.

Clear Span S	Clear Height H	"b" Size	"b" Spacing	"b" No. Req'd 2:1	"b" No. Req'd 3:1	"b" No. Req'd 4:1	"b" Length	"b" X	"b1" Size	"b1" Spacing	"b1" No. Req'd	"b1" Length Max.	"b1" Length Min.	"b1" X Max.	"b1" X Min.
1 @ 4'	2'	#4	12"	29	59	87	5'-7"	4'-8½"	#4	12"	6	4'-7"	2'-7"	4'-2"	2'-2"
	3'			29	59	87	"	"			6	"		"	
	4'			29	59	87	"	"			6	"		"	
	5'			29	59	87	"	"			6	"			
	6'			29	57	87	5'-9"	4'-10½"			6	4'-9"	2'-9"	4'-4"	2'-4"
1 @ 5'	3'	#5	12"	29	57	85	6'-8"	5'-8½"	#5	12"	8	5'-8"	2'-8"	5'-2"	2'-2"
	4'			29	57	85	"	"			8	"	"	"	"
	5'			29	57	85	"	"			8	"	"	"	
	6'			29	57	85	6'-10"	5'-10½"			8	5'-10"	2'-10"	5'-4"	2'-4"
	7'			29	57	85	6'-11"	5'-11½"			8	5'-11"	2'-11"	5'-5"	2'-5"
1 @ 6'	3'	#6	12"	27	57	85	7'-10"	6'-8"	#6	12"	10	6'-9"	2'-9"	6'-2"	2'-2"
	4'			27	57	85	"	"			10	"	"	"	"
	5'			27	57	85	"	"			10	"	"	"	"
	6'			27	55	85	8'-0"	6'-10"			10	6'-11"	2'-11"	6'-4"	2'-4"
	7'			27	55	85	8'-1"	6'-11"			10	7'-0"	3'-0"	6'-5"	2'-5"
	8'			27	55	85	8'-2"	7'-0"			10	7'-1"	3'-1"	6'-6"	2'-6"
1 @ 7'	4'	#6	12"	27	55	83	8'-10"	7'-8"	#6	12"	12	7'-9"	2'-9"	7'-2"	2'-2"
	5'			27	55	83	"	"			12	"	"	"	"
	6'			27	55	83	9'-0"	7'-10"			12	7'-11"	2'-11"	7'-4"	2'-4"
	7'			27	55	83	9'-1"	7'-11"			12	8'-0"	3'-0"	7'-5"	2'-5"
	8'			27	55	83	9'-2"	8'-0"			12	8'-1"	3'-1"	7'-6"	2'-6"
	9'			27	55	83	9'-4"	8'-2"			12	8'-3"	3'-3"	7'-8"	2'-8"
1 @ 8'	4'	#6	12"	27	55	83	9'-10"	8'-8"	#6	12"	14	8'-9"	2'-9"	8'-2"	2'-2"
	5'			27	53	83	10'-0"	8'-10"			14	8'-10"	2'-10"	8'-3"	2'-3"
	6'			27	53	83	"	"			14	"	"	"	"
	7'			27	53	83	10'-1"	8'-11"			14	8'-11"	2'-11"	8'-4"	2'-4"
	8'			27	53	83	10'-2"	9'-0"			14	9'-0"	3'-0"	8'-5"	2'-5"
	9'			27	53	81	10'-4"	9'-2"			14	9'-2"	3'-2"	8'-7"	2'-7"
	10'			27	53	81	10'-6"	9'-4"			14	9'-4"	3'-4"	8'-9"	2'-9"
1 @ 9'	5'	#7	11"	27	57	89	11'-2"	9'-10"	#7	11"	16	10'-1"	3'-8"	9'-5"	3'-0"
	6'			27	57	89	11'-3"	9'-11"			16	10'-2"	3'-9"	9'-6"	3'-1"
	7'			27	57	89	"	"			16	"	"	"	"
	8'			27	57	89	11'-4"	10'-0"			16	10'-3"	3'-10"	9'-7"	3'-2"
	9'			27	57	89	11'-6"	10'-2"			18	10'-5"	3'-1"	9'-9"	2'-5"
	10'			27	57	87	11'-8"	10'-4"			18	10'-7"	3'-3"	9'-11"	2'-7"
	11'			27	57	87	11'-10"	10'-6"			18	10'-9"	3'-5"	10'-1"	2'-9"
1 @ 10'	5'	#7	12"	23	51	81	12'-2"	10'-10"	#7	12"	18	11'-0"	3'-0"	10'-4"	2'-4"
	6'			23	51	81	12'-3"	10'-11"			18	11'-1"	3'-1"	10'-5"	2'-5"
	7'			23	51	81	"	"			18	"	"	"	"
	8'			23	51	81	12'-4"	11'-0"			18	11'-2"	3'-2"	10'-6"	2'-6"
	9'			23	51	79	12'-6"	11'-2"			18	11'-4"	3'-4"	10'-8"	2'-8"
	10'			23	51	79	12'-8"	11'-4"			18	11'-6"	3'-6"	10'-10"	2'-10"
	11'			23	51	79	12'-10"	11'-6"			18	11'-8"	3'-8"	11'-0"	3'-0"
	12'			23	51	79	13'-0"	11'-8"			18	11'-10"	3'-10"	11'-2"	3'-2"

"d" bars – STRAIGHT – Longitudinal in Top Slab of Barrel. Length: Lengths Vary - Average Length; 2:1 = 16'-7", 3:1 = 32'-9", ⊙4:1 = 46'-10".
"d1" bars – STRAIGHT – Longitudinal in Sidewalls. Length: Lengths Vary - Average Length; 2:1 = 18'-7", 3:1 = 32'-9", ⊙4:1 = 46'-10".
"e" bars – STRAIGHT – Longitudinal in Bottom Slab of Barrel. Length: Lengths Vary - Average Length: 2:1 = 19'-11", 3:1 = 34'-1", ⊙4:1 = 48'-2".

Clear Span S	Clear Height H	"d" Size	"d" Spacing	"d" No. Req'd	"d1" Size	"d1" Spacing	"d1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd
1 @ 4'	2'	#4	12"	5	#4	12"	4	#4	12"	5
	3'			5			6			5
	4'			5			8			5
	5'			5			10			5
	6'			5			12			5
1 @ 5'	3'	#4	12"	6	#4	12"	6	#4	12"	6
	4'			6			8			6
	5'			6			10			6
	6'			6			12			6
	7'			6			14			6
1 @ 6'	3'	#4	12"	7	#4	12"	6	#4	12"	7
	4'			7			8			7
	5'			7			10			7
	6'			7			12			7
	7'			7			14			7
	8'			7			16			7
1 @ 7'	4'	#4	12"	8	#4	12"	8	#4	12"	8
	5'			8			10			8
	6'			8			12			8
	7'			8			14			8
	8'			8			16			8
	9'			8			18			8
1 @ 8'	4'	#4	12"	9	#4	12"	8	#4	12"	9
	5'			9			10			9
	6'			9			12			9
	7'			9			14			9
	8'			9			16			9
	9'			9			18			9
	10'			9			20			9
1 @ 9'	5'	#4	12"	10	#4	12"	10	#4	12"	10
	6'			10			12			10
	7'			10			14			10
	8'			10			16			10
	9'			10			18			10
	10'			10			20			10
	11'			10			22			10
1 @ 10'	5'	#4	12"	11	#4	12"	10	#4	12"	11
	6'			11			12			11
	7'			11			14			11
	8'			11			16			11
	9'			11			18			11
	10'			11			20			11
	11'			11			22			11
	12'			11			24			11

"f" bars – STRAIGHT – Verticals in Sidewalls. ▼"k1" bars – STRAIGHT – In Bottom of Headwall. ▼"k2" bars – STRAIGHT – In Top of Headwall and Apron. (2 Each).

Clear Span S	Clear Height H	"f" Size	"f" Spacing	"f" No. Req'd 2:1	"f" No. Req'd 3:1	"f" No. Req'd 4:1	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length	"k2" Size	"k2" No. Req'd	"k2" Length
1 @ 4'	2'	#4	12"	35	63	91	2'-10"	#5	3	6'-9"	#5	4	8'-10"
	3'			35	63	91	3'-10"		3	"		4	"
	4'			35	63	91	4'-10"		3	"		4	"
	5'			35	63	91	5'-10"		3	"		4	"
	6'			35	63	91	6'-10"		3	6'-11"		4	9'-0"
1 @ 5'	3'	#4	12"	35	63	91	3'-11"	#6	3	8'-1"	#6	4	10'-3"
	4'			35	63	91	4'-11"		3	"		4	"
	5'			35	63	91	5'-11"		3	"		4	"
	6'			35	63	91	6'-11"		3	8'-4"		4	10'-5"
	7'		10"	41	75	109	7'-11"		3	8'-5"		4	10'-7"
1 @ 6'	3'	#4	12"	35	63	91	4'-0"	#6	3	9'-6"	#6	4	11'-7"
	4'			35	63	91	5'-0"		3	"		4	"
	5'			35	63	91	6'-0"		3	"		4	"
	6'			35	63	91	7'-0"		3	9'-9"		4	11'-10"
	7'		10"	41	75	109	8'-0"		3	9'-10"		4	12'-0"
	8'	#5	11"	38	69	99	9'-0"		3	10'-0"		4	12'-1"
1 @ 7'	4'	#4	12"	35	63	91	5'-1"	#7	3	10'-11"	#7	4	13'-0"
	5'			35	63	91	6'-1"		3	"		4	"
	6'			35	63	91	7'-1"		3	11'-2"		4	13'-3"
	7'		11"	38	69	99	8'-1"		3	11'-3"		4	13'-5"
	8'	#5	12"	35	63	91	9'-1"		3	11'-4"		4	13'-6"
	9'		11"	38	69	99	10'-1"		3	11'-7"		4	13'-9"
1 @ 8'	4'	#4	12"	35	63	91	5'-3"	#7	3	12'-4"	#7	4	14'-5"
	5'			35	63	91	6'-3"		3	12'-7"		4	14'-8"
	6'			35	63	91	7'-3"		3	"		4	"
	7'			35	63	91	8'-3"		3	12'-8"		4	14'-10"
	8'	#5	12"	35	63	91	9'-3"		3	12'-10"		4	14'-11"
	9'		11"	38	69	99	10'-3"		3	13'-0"		4	15'-2"
	10'		10"	41	75	109	11'-3"		3	13'-3"		4	15'-5"
1 @ 9'	5'	#4	12"	35	63	91	6'-5"	#8	3	14'-0"	#8	4	16'-1"
	6'			35	63	91	7'-5"		3	14'-1"		4	16'-3"
	7'			35	63	91	8'-5"		3	"		4	"
	8'	#5	12"	35	63	91	9'-5"		3	14'-2"		4	16'-4"
	9'		11"	38	69	99	10'-5"		3	14'-5"		4	16'-7"
	10'		10"	41	75	109	11'-5"		3	14'-8"		4	16'-10"
	11'	#6	12"	35	63	91	12'-5"		3	14'-11"		4	17'-0"
1 @ 10'	5'	#4	12"	35	63	91	6'-7"	#8	3	15'-5"	#8	4	17'-6"
	6'			35	63	91	7'-7"		3	15'-6"		4	17'-8"
	7'		11"	38	69	99	8'-7"		3	"		4	"
	8'	#5	12"	35	63	91	9'-7"		3	15'-7"		4	17'-9"
	9'			35	63	91	10'-7"		3	15'-10"		4	18'-0"
	10'		10"	41	75	109	11'-7"		3	16'-1"		4	18'-3"
	11'	#6	12"	35	63	91	12'-7"		3	16'-4"		4	18'-5"
	12'		11"	38	69	99	13'-7"		3	16'-7"		4	18'-8"

▼ These bars are in the skewed portion of barrel only. The length of "a1" bars and overall length "X" of "b1" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

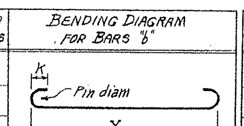
(Columns A–F: SECTIONS & BAR GROUPS FOR END SECTIONS)

OR ALT.

DEPTHS OF COVER	A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

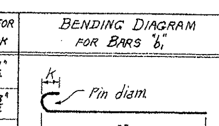
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1"

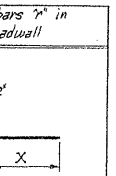


NOTE:- Dimensions are to centers of bars. ("b" and "b1")

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
4'	#4	12"±	8	2'-5"	1'-2½"
5'	#4	12"±	9	2'-6"	1'-3"
6'	#4	12"±	11	2'-7"	1'-3½"
7'	#4	12"±	12	2'-8"	1'-4"
8'	#4	12"±	14	2'-10"	1'-5"
9'	#4	12"±	15	3'-0"	1'-6"
10'	#4	12"±	17	3'-2"	1'-7"

Dowel bars "r" in One Headwall



To longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" lap).

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

SECTION "A" = 10'-0" (MAX. DESIGN DEPTH OF COVER, D)

S	H	A	OW	T	C	B	OH	RL	K	Class S Concrete Barrel Only 2:1 Cu.Yd.	3:1 Cu.Yd.	4:1 Cu.Yd.	Reinforcing Steel Barrel, Apron and Headwall 2:1 Lb.	3:1 Lb.	4:1 Lb.
1 @ 4'	2'	8	5'-0"	6½"	6"	6½"	3'-1"	7'-0⅞"	9'-0⅞"	4.67	8.56	12.44	555	931	1321
	3'	12	5'-0"		6"		4'-1"	"	"	5.30	9.71	14.12	593	1017	1446
	4'	16	5'-0"		6"		5'-1"	"	"	5.93	10.86	15.79	641	1103	1571
	5'	20	5'-0"		6"		6'-1"	"	"	6.56	12.01	17.47	690	1189	1696
	6'	24	5'-2"		7"		7'-1"	7'-3⅜"	9'-3⅜"	7.94	14.54	21.13	747	1282	1843
1 @ 5'	3'	15	6'-0"	7"	6"	7"	4'-2"	8'-5⅞"	10'-5⅞"	6.29	11.52	16.74	867	1485	2106
	4'	20	6'-0"		6"		5'-2"	"	"	6.92	12.67	18.42	915	1571	2216
	5'	25	6'-0"		6"		6'-2"	"	"	7.55	13.82	20.09	964	1657	2341
	6'	30	6'-2"		7"		7'-2"	8'-8⅝"	10'-8⅝"	8.94	16.37	23.80	1026	1755	2515
	7'	35	6'-3"		7½"		8'-2"	8'-10⅛"	10'-10⅛"	10.10	18.49	26.88	1114	1917	2753
1 @ 6'	3'	18	7'-0"	7½"	6"	7½"	4'-3"	9'-10¾"	11'-10¾"	7.40	13.54	19.68	1108	1922	2729
	4'	24	7'-0"		6"		5'-3"	"	"	8.02	14.69	21.36	1156	2008	2854
	5'	30	7'-0"		6"		6'-3"	"	"	8.65	15.84	23.03	1205	2094	2979
	6'	36	7'-2"		7"		7'-3"	10'-1⅛"	12'-1⅛"	10.05	18.39	26.74	1271	2187	3146
	7'	42	7'-3"		7½"		8'-3"	10'-3"	12'-3"	11.22	20.54	29.86	1361	2352	3389
	8'	48	7'-4"		8"		9'-3"	10'-4½"	12'-4½"	12.50	22.88	33.26	1532	2657	3836
1 @ 7'	4'	28	8'-0"	8"	6"	8½"	5'-4½"	11'-3¾"	13'-3¾"	9.45	17.30	25.13	1339	2275	3214
	5'	35	8'-0"		6"		6'-4½"	"	"	10.08	18.46	26.83	1387	2361	3339
	6'	42	8'-2"		7"		7'-4½"	11'-6⅝"	13'-6½"	11.48	21.01	30.54	1455	2463	3508
	7'	49	8'-3"		7½"		8'-4½"	11'-8"	13'-8"	12.65	23.16	33.67	1530	2597	3698
	8'	56	8'-4"		8"		9'-4½"	11'-9⅜"	13'-9½"	13.92	25.49	37.06	1623	2812	4044
	9'	63	8'-6"		9"		10'-4½"	12'-0¼"	14'-0¼"	15.86	29.04	42.22	1803	3094	4391
1 @ 8'	4'	32	9'-0"	8½"	6"	9½"	5'-6"	12'-8¾"	14'-8¾"	11.02	20.17	29.32	1643	2769	3915
	5'	40	9'-2"		7"		6'-6"	12'-11⅝"	14'-11½"	12.33	22.57	32.81	1711	2859	4088
	6'	48	9'-2"		7"		7'-6"	"	"	13.07	23.94	34.80	1759	2945	4213
	7'	56	9'-3"		7½"		8'-6"	13'-1"	15'-1"	14.25	26.08	37.92	1820	3049	4364
	8'	64	9'-4"		8"		9'-6"	13'-2½"	15'-2½"	15.54	28.45	41.36	2001	3372	4830
	9'	72	9'-6"		9"		10'-6"	13'-5¾"	15'-5¾"	17.48	32.00	46.52	2117	3582	5095
	10'	80	9'-8"		10"		11'-6"	13'-8"	15'-8"	19.62	35.92	52.22	2249	3814	5440
1 @ 9'	5'	45	10'-2"	9½"	7"	10½"	6'-8"	14'-4½"	16'-4½"	14.35	26.27	38.19	2228	3793	5398
	6'	54	10'-3"		7½"		7'-8"	14'-6"	16'-6"	15.47	28.32	41.18	2291	3903	5556
	7'	63	10'-3"		7½"		8'-8"	"	"	16.27	29.79	43.30	2339	3989	5681
	8'	72	10'-4"		8"		9'-8"	14'-7⅜"	16'-7¼"	17.56	32.15	46.74	2525	4321	6160
	9'	81	10'-6"		9"		10'-8"	14'-10¼"	16'-10¼"	19.52	35.73	51.95	2662	4556	6496
	10'	90	10'-8"		10"		11'-8"	15'-1"	17'-1"	21.69	39.72	57.74	2809	4809	6808
	11'	99	10'-10"		11"		12'-8"	15'-3⅝"	17'-3¾"	24.07	44.07	64.07	3012	5134	7321
1 @ 10'	5'	50	11'-2"	10½"	7"	11½"	6'-10"	15'-9½"	17'-9½"	16.56	30.32	44.07	2505	4252	6096
	6'	60	11'-3"		7½"		7'-10"	15'-11"	17'-11"	17.71	32.43	47.15	2569	4363	6257
	7'	70	11'-3"		7½"		8'-10"	"	"	18.50	33.86	49.23	2635	4484	6428
	8'	80	11'-4"		8"		9'-10"	16'-0⅜"	18'-0¼"	19.81	36.26	52.72	2807	4787	6869
	9'	90	11'-6"		9"		10'-10"	16'-3⅜"	18'-3¼"	21.78	39.87	57.97	2901	4998	7048
	10'	100	11'-8"		10"		11'-10"	16'-6"	18'-6"	23.95	43.86	63.76	3077	5264	7506
	11'	110	11'-10"		11"		12'-10"	16'-8⅞"	18'-8¾"	26.35	48.24	70.14	3253	5647	8098
	12'	120	12'-0"		12"		13'-10"	16'-11⅝"	18'-11¾"	28.97	53.04	77.11	3424	5957	8480

(BARREL DIMENSIONS: S = Clear Spans, H = Clear Height, A = Sq. Ft. Opening, OW = Overall Width, T = Thickness of Top Slab, C = Thickness of Sidewalls, B = Thickness of Bottom Slab, OH = Overall Height, RL = Roadway Length, K = Length of Headwall. * QUANTITIES - ONE SECTION "A".)

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.
For Barrels of 4', 5' & 6' Spans, See Drawing No. R-100X-X1.
For Barrels of 7', 8', 9' & 10' Spans, See Drawing No. R-100X-X2.

CLASS S CONCRETE

Designed by:- W.C.H. 9-5-62. Checked by:- R.H.S. 11-8-62
Drawn by:- W.C.H. 8-10-64. Checked by:-
Quantities by:- W.C.H. 10-22-64. Checked by:-

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

45° SKEW SECTIONS "A" ONLY
4', 5', 6', 7', 8', 9' & 10' SPANS 2:1, 3:1 OR 4:1 SLOPES
SINGLES OVER 5'-0" COVER
STANDARD DRAWING NO. R-145X-1

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	SH.
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 45° SKEWED ENDS

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH	"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel (Four of each Length) SIZE	SPACING	No. REQD	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	2@4	2'	#5	12"	104	9'-5"	#5	12"	28	8'-5"	2'-5"
		3'			104	9'-5"			28	"	"
		4'			104	9'-5"			28	"	"
		5'			104	9'-5"			28	"	"
		6'			104	9'-8"			28	8'-11"	2'-8"
	2@5	3'	#6	12"	100	11'-5"	#6	12"	36	10'-5"	2'-5"
		4'			100	11'-5"			36	"	"
		5'			100	11'-5"			36	"	"
		6'			100	11'-8"			36	10'-8"	2'-8"
		7'			100	11'-10"			36	10'-10"	2'-10"
	2@6	3'	#6	11"	106	13'-5"	#6	11"	48	12'-6"	2'-5"
		4'			106	13'-5"			48	"	"
		5'			106	13'-5"			48	"	"
		6'			106	13'-5"			48	"	"
		7'			104	13'-8"			48	12'-9"	2'-8"
		8'			104	13'-10"			48	12'-11"	2'-10"
		9'			104	13'-11"			48	13'-0"	2'-11"
	2@7	4'	#6	12"	92	15'-5"	#6	12"	52	14'-5"	2'-5"
		5'			92	15'-5"			52	"	"
		6'			92	15'-8"			52	14'-8"	2'-8"
		7'			92	15'-10"			52	14'-10"	2'-10"
		8'			92	15'-11"			52	14'-11"	2'-11"
		9'			92	16'-2"			52	15'-2"	3'-2"
	2@8	4'	#6	11"	96	17'-5"	#6	11"	64	16'-5"	2'-5"
		5'			96	17'-8"			64	16'-8"	3'-0"
		6'			96	17'-8"			64	"	"
		7'			96	17'-10"			64	16'-11"	3'-2"
		8'			96	17'-11"			64	17'-0"	2'-9"
		9'			94	18'-2"			68	17'-3"	2'-7"
		10'			94	18'-5"			68	17'-6"	2'-10"

DEPTH OF COVER D	CLEAR SPAN S	"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z	"b₁" bars In Bottom of Top Slab - same bent up over Division Wall - one end hooked. (2 of Each Length). Alternate with "a₁" and "c₁" or "c₂" bars. SIZE	SPACING	No. REQD	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	2@4	#5	12"	50	10'-6"	0'-3"	2'-2½"	3'-9"	#5	12"	14	9'-6"	3'-4"
				50	10'-6"	"	"	"			14	"	"
				50	10'-6"	"	"	"			14	"	"
				50	10'-6"	"	"	"			14	"	"
				50	10'-9"	0'-3"	2'-3½"	3'-5"			14	9'-9"	3'-7"
	2@5	#6	12"	48	12'-7"	0'-3½"	2'-5½"	4'-1"	#6	12"	18	11'-6"	3'-4"
				48	12'-7"	"	"	"			18	"	"
				48	12'-7"	"	"	"			18	"	"
				48	12'-10"	"	2'-5½"	4'-2"			18	11'-9"	3'-7"
				48	13'-0"	0'-3½"	2'-9½"	4'-5½"			18	11'-11"	3'-9"
	2@6	#6	11"	50	14'-7"	0'-4"	3'-0½"	4'-10"	#6	11"	24	13'-8"	3'-4"
				50	14'-7"	"	"	"			24	"	"
				50	14'-7"	"	"	"			24	"	"
				50	14'-10"	"	3'-1½"	4'-11"			24	13'-11"	3'-7"
				50	15'-0"	"	3'-2½"	4'-11½"			26	14'-1"	2'-10"
				50	15'-1"	0'-4"	"	5'-0"			26	14'-2"	2'-11"
	2@7	#6	12"	44	16'-9"	0'-4½"	3'-5"	5'-7"	#6	12"	26	15'-8"	3'-5"
				44	"	"	"	"			26	"	"
				44	17'-0"	"	3'-6"	5'-8"			26	15'-11"	3'-8"
				44	17'-2"	"	3'-7"	5'-8½"			26	16'-1"	3'-10"
				44	17'-3"	"	"	5'-9"			28	16'-2"	2'-11"
				43	17'-6"	0'-4½"	3'-8"	5'-10"			28	16'-5"	3'-2"
	2@8	#6	11"	46	18'-10"	0'-5"	3'-10"	6'-4"	#6	11"	32	17'-10"	3'-9"
				46	19'-1"	"	3'-11"	6'-5"			34	18'-1"	3'-1"
				46	19'-1"	"	"	"			34	"	"
				45	19'-3"	"	4'-0"	6'-5½"			34	18'-3"	3'-3"
				45	19'-4"	"	4'-1"	6'-6"			34	18'-4"	3'-4"
				45	19'-7"	"	4'-2"	6'-6½"			34	18'-7"	3'-7"
				45	19'-10"	0'-5"	4'-2"	6'-8"			34	18'-10"	3'-10"

DEPTH OF COVER D	CLEAR SPAN S	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab - bent down under Division Wall - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z	"b₃" bars In Top of Bottom Slab - same bent down under Division Wall - one end hooked. (2 of Each Length). Alternate with "a₁" and "c₁" or "c₂" bars. SIZE	SPACING	No. REQD	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	2@4	#5	12"	52	10'-6"	0'-2½"	2'-3½"	3'-5"	#5	12"	14	9'-6"	3'-4"
				52	10'-6"	"	"	"			14	"	"
				52	10'-6"	"	"	"			14	"	"
				52	10'-6"	"	"	"			14	"	"
				52	10'-9"	0'-2½"	2'-3½"	3'-5"			14	9'-9"	3'-7"
	2@5	#6	12"	50	12'-6"	0'-3"	2'-5½"	4'-1"	#6	12"	18	11'-6"	3'-4"
				50	12'-6"	"	"	"			18	"	"
				50	12'-6"	"	"	"			18	"	"
				50	12'-9"	"	2'-5½"	4'-2"			18	11'-9"	3'-7"
				50	12'-11"	0'-3"	2'-10½"	4'-5½"			18	11'-11"	3'-9"
	2@6	#6	11"	52	14'-7"	0'-4"	3'-0½"	4'-10"	#6	11"	24	13'-8"	3'-4"
				52	14'-7"	"	"	"			24	"	"
				52	14'-7"	"	"	"			24	"	"
				52	14'-10"	"	3'-1½"	4'-11"			24	13'-11"	3'-7"
				52	15'-0"	"	3'-2½"	4'-11½"			26	14'-1"	2'-10"
				52	15'-1"	0'-4"	"	5'-0"			26	14'-2"	2'-11"
	2@7	#6	12"	46	16'-9"	0'-4½"	3'-5"	5'-7"	#6	12"	26	15'-8"	3'-5"
				46	"	"	"	"			26	"	"
				46	17'-0"	"	3'-6"	5'-8"			26	15'-11"	3'-8"
				46	17'-2"	"	3'-7"	5'-8½"			26	16'-1"	3'-10"
				46	17'-3"	"	"	5'-9"			28	16'-2"	2'-11"
				45	17'-6"	0'-4½"	3'-8"	5'-10"			28	16'-5"	3'-2"
	2@8	#6	11"	48	18'-10"	0'-5"	3'-10"	6'-4"	#6	11"	32	17'-10"	3'-9"
				48	19'-1"	"	3'-11"	6'-5"			34	18'-1"	3'-1"
				48	"	"	"	"			34	"	"
				47	19'-3"	"	4'-0"	6'-5½"			34	18'-3"	3'-3"
				47	19'-4"	"	"	6'-6"			34	18'-4"	3'-4"
				47	19'-7"	"	4'-1"	6'-7"			34	18'-7"	3'-7"
				47	19'-10"	0'-5"	4'-2"	6'-8"			34	18'-10"	3'-10"

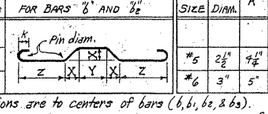
DEPTH OF COVER D	CLEAR SPAN S	"c" bars STRAIGHT In Top and Bottom Slab of Barrel Alternate with "b" and "b₂" bars. SIZE	SPACING	No. REQD	LENGTH	"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel Alt. with "b", "b₂" bars. (Four of each Length.) SIZE	SPACING	No. REQD	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	2@4	#5	12"	112	4'-8"	#5	12"	8	4'-1"	3'-1"
				112	4'-8"			8	"	"
				112	4'-8"			8	"	"
				112	4'-8"			8	"	"
				112	4'-9"			8	3'-3"	2'-3"
	2@5	#6	12"	112	5'-8"	#6	12"	12	4'-7"	2'-7"
				112	5'-8"			12	"	"
				112	5'-8"			12	"	"
				112	5'-9"			12	4'-9"	2'-9"
				112	5'-10"			12	4'-10"	2'-10"
	2@6	#6	11"	118	6'-8"	#6	11"	16	6'-5"	2'-9"
				118	6'-8"			16	"	"
				118	6'-8"			16	6'-6"	2'-10"
				118	6'-9"			16	6'-8"	3'-0"
				118	6'-10"			16	6'-9"	3'-1"
	2@7	#6	12"	108	7'-8"	#6	12"	20	6'-7"	2'-7"
				108	7'-8"			20	"	"
				108	7'-9"			20	6'-9"	2'-9"
				108	7'-10"			20	6'-10"	2'-10"
				108	7'-10"			20	6'-11"	3'-1"
				108	7'-11"			20	7'-1"	3'-3"
	2@8	#6	11"	112	8'-8"	#6	11"	28	6'-6"	3'-2"
				112	8'-9"			28	6'-8"	3'-4"
				112	8'-9"			28	"	"
				116	8'-10"			28	7'-10"	2'-9"
				116	8'-10"			28	7'-11"	2'-10"
				114	8'-11"			28	8'-1"	2'-12"
				114	9'-0"			28	8'-3"	2'-9"

DEPTH OF COVER D	CLEAR SPAN S	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel SIZE	SPACING	No. REQD	LENGTH	"d₁" bars STRAIGHT Longitudinal in Sidewalls and Division Wall. SIZE	SPACING	No. REQD	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH
0'-0" TO 5'-0" MAXIMUM	2@4	#5	12"	14		#4	12"	8		#4	12"	14	
				14				12				14	
				14				16				14	
				14				20				14	
				14				24				14	
	2@5	#5	12"	16		#4	12"	16		#4	12"	16	
				16				20				16	
				16				24				16	
				16				28				16	
	2@6	#5	11½"	18		#4	12"	12		#4	12"	18	
				18				16				18	
				18				20				18	
				18				24				18	
				18				32				18	
	2@7	#5	11½"	20		#4	12"	14		#4	12"	20	
				20				20				20	
				20				24				20	
				20				28				20	
				20				32				20	
				20				36				20	
	2@8	#5	11½"	23		#4	12"	16		#4	12"	22	
				23				20				22	
				23				24				22	
				23				28				22	
				23				32				22	
				23				36				22	
				23				40				22	

DEPTH OF COVER D	CLEAR SPAN S	"f" bars STRAIGHT Verticals in Sidewalls and Division Wall. SIZE	SPACING	No. REQD	LENGTH	"k₁" bars STRAIGHT In Bottom of Headwalls SIZE	No. REQD	LENGTH	"k₂" bars STRAIGHT In Top of Headwalls and Aprons (2 Each) SIZE	No. REQD	LENGTH
0'-0" TO 5'-0" MAXIMUM	2@4	#4	12"	240	2'-10"	#5	6	13'-3"	#5	8	15'-5"
				240	3'-10"		6	"		8	"
				240	4'-10"		6	"		8	"
				240	5'-10"		6	"		8	"
				240	6'-10"		6	13'-7"		8	15'-9"
	2@5	#4	12"	240	3'-11"	#6	6	16'-1"	#6	8	18'-3"
				240	4'-11"		6	"		8	"
				240	5'-11"		6	16'-5"		8	18'-7"
				240	6'-11"		6	16'-8"		8	18'-10"
	2@6	#4	12"	240	4'-5"	#6	6	18'-11"	#6	8	21'-1"
				240	5'-10"		6	"		8	"
				240	7'-0"		6	19'-3"		8	21'-5"
				240	8'-0"		6	19'-6"		8	21'-8"
				288	9'-0"		6	19'-7"		8	21'-9"
	2@7	#4	12"	240	5'-4"	#7	6	21'-5"	#7	8	23'-10"
				240	6'-7"		6	"		8	"
				240	7'-11"		6	22'-1"		8	24'-3"
				240	8'-11"		6	22'-4"		8	24'-6"
				288	9'-7"		6	22'-5"		8	24'-7"
				240	10'-7"		6	22'-10"		8	24'-11"
	2@8	#4	12"	240	5'-2"		6	24'-7"		8	26'-8"
				240	6'-2"		6	24'-10"		8	27'-1"
				240	7'-2"		6	"		8	"
				240	8'-2"	#7	6	25'-2"	#7	8	27'-4"
				240	9'-2"		6	25'-3"		8	27'-5"
				240	10'-2"		6	25'-6"		8	27'-9"
				264	11'-2"		6	26'-0"		8	28'-1"

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#5	2⅝"	4⅛"	0'-11⅛"
#6	3"	5"	1'-2"

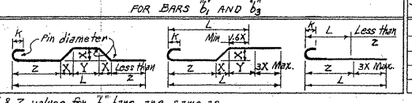
BENDING DIAGRAM FOR BARS "b" AND "b₂"



NOTE:- Dimensions are to centers of bars (b, b₁, b₂, & b₃). The X, Y & Z values for "b₁" bars are same as for "b" bars and for "b₃" bars same as for "b₂" bars.

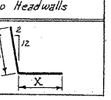
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#5	2⅝"	4⅛"	0'-5⅜"
#6	3"	5"	0'-7"

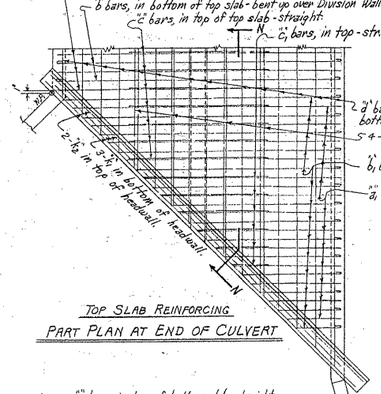
BENDING DIAGRAM FOR BARS "b₁" AND "b₃"



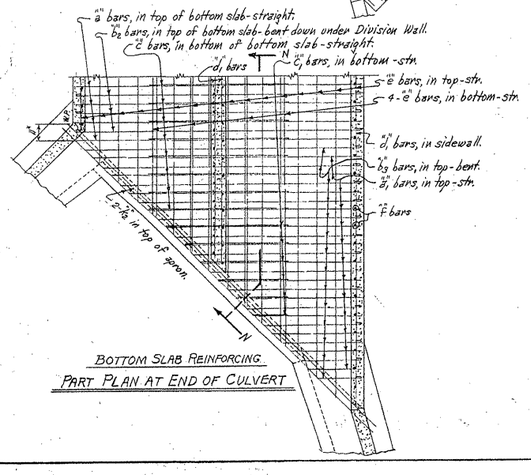
SPAN	SIZE	SPACING	No. REQD	LENGTH	X
4'	#4	12"	28	2'-5"	1'-8½"
5'	#4	12"	34	2'-6"	1'-8"
6'	#4	12"	40	2'-7"	1'-3½"
7'	#4	12"	46	2'-8"	1'-0"
8'	#4	12"	52	2'-9"	1'-6½"

Dowel bars "m" in Two Headwalls



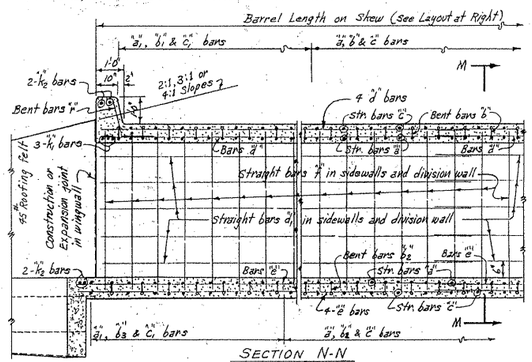


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

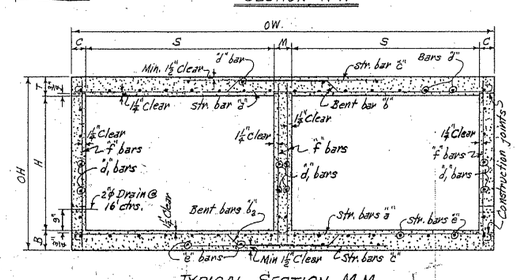


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

Designed by:- W.C.H. 1-17-63. Checked by:- R.H.S. 5-14-63
Drawn by:- W.C.H. 7-14-63. Checked by:-
Quantities by:- W.C.H. 10-1-63. Checked by:-



SECTION N-N

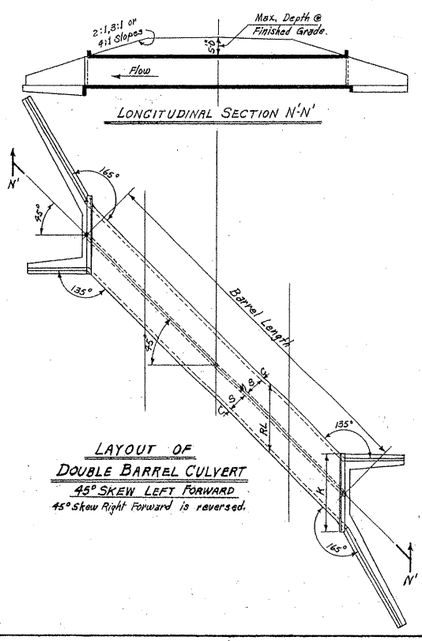


TYPICAL SECTION M-M

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length "L" of "b₁" and "b₃" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.

In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" & "b₂" bars, use a set of "a" & "c" bars instead.



LAYOUT OF
DOUBLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY RL	LENGTH OF HEADWALL K	* QUANTITIES REINFORCING STEEL CLASS S CONC. PER LIN. FT. OF BARREL CU.YD.	TOTAL OF LENGTH OF BARREL LB.	PER LIN. FT. OF BARREL LB.	ADDITIONAL PER LAP LB.
5'-0"	2@4	2'	16	9'-8"	6½"	6"	8"	6"	3'-0½"	13'-8"	15'-8"	0.496	5.587	88.15	42.71
		3'	24	9'-8"		6"	8"		4'-0½"	"	"	0.558	5.910	93.99	46.05
		4'	32	9'-8"		6"	8"		5'-0½"	"	"	0.620	6.234	98.84	49.39
		5'	40	9'-8"		6"	8"		6'-0½"	"	"	0.682	6.557	104.18	52.73
		6'	48	9'-11"		7"	9"		7'-0½"	14'-0½"	14'-0½"	0.809	6.965	110.74	56.07
	2@5	3'	30	11'-8"	7"	6"	8"	6½"	4'-1½"	16'-6"	18'-6"	0.671	7.882	123.34	51.19
		4'	40	11'-8"		6"	8"		5'-1½"	"	"	0.733	8.205	128.69	54.58
		5'	50	11'-8"		6"	8"		6'-1½"	"	"	0.795	8.529	134.03	57.87
		6'	60	11'-11"		7"	9"		7'-1½"	16'-10½"	18'-10½"	0.922	8.962	140.83	61.21
		7'	70	12'-1"		7½"	10"		8'-1½"	17'-1"	19'-1"	1.044	9.363	147.34	64.55
	2@6	3'	36	13'-8"	7½"	6"	8"	7½"	4'-3"	19'-3⅜"	21'-9"	0.818	9.983	148.50	56.34
		4'	48	13'-8"		6"	8"		5'-3"	"	"	0.880	9.806	153.85	59.68
		5'	60	13'-8"		6"	8"		6'-3"	"	"	0.941	10.129	159.19	63.02
		6'	72	13'-11"		7"	9"		7'-3"	19'-8⅜"	21'-8⅜"	1.070	10.532	166.20	66.36
		7'	84	14'-2"		7½"	10"		8'-3"	19'-11"	21'-11"	1.192	10.956	172.74	69.70
		8'	96	14'-2"		8"	10"		9'-3"	20'-0⅜"	22'-0⅜"	1.298	11.316	183.36	73.04
	2@7	4'	56	15'-8"	8"	6"	8"	8"	5'-4"	22'-1⅞"	24'-1⅞"	1.021	11.514	178.15	69.83
		5'	70	15'-8"		6"	8"		6'-4"	"	"	1.082	11.837	183.49	68.17
		6'	84	15'-11"		7"	9"		7'-4"	22'-6⅞"	24'-6"	1.212	12.297	190.59	71.51
		7'	98	16'-1"		7½"	10"		8'-4"	22'-9"	24'-9"	1.334	12.716	197.13	74.85
		8'	112	16'-2"		8"	10"		9'-4"	22'-10⅞"	24'-10⅞"	1.490	13.389	207.89	78.19
		9'	126	16'-5"		9"	11"		10'-4"	23'-2⅞"	25'-2⅞"	1.616	14.414	225.25	81.53
	2@8	4'	64	17'-8"	8½"	6"	8"	8½"	5'-5"	24'-11⅞"	26'-11⅞"	1.174	13.555	210.37	71.71
		5'	80	17'-11"		7"	9"		6'-5"	25'-4"	27'-4"	1.295	14.047	217.63	75.05
		6'	96	17'-11"		7"	9"		7'-5"	"	"	1.366	14.371	222.97	78.39
		7'	112	18'-1"		7½"	10"		8'-5"	25'-6⅞"	27'-5"	1.489	14.956	229.68	81.73
		8'	128	18'-2"		8"	10"		9'-5"	25'-8⅞"	27'-10⅞"	1.586	15.494	240.47	85.07
		9'	144	18'-5"		9"	11"		10'-5"	26'-0⅞"	28'-0⅞"	1.772	16.932	258.08	88.41
		10'	160	18'-8"		10"	12"		11'-5"	26'-3⅞"	28'-3⅞"	1.967	17.276	271.07	91.75

* For quantities in wings see Standard Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAP:- In computing the quantities of steel from the tables add one lap for each add'l 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diam. min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
DOUBLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-245X-01

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 45° SKEWED ENDS.

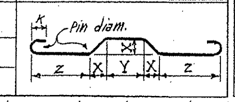
Depth of Cover D	Clear Span S	Clear Height H	"a" bars (Straight) – In Top and Bottom Slab of Barrel: Size	Spacing	No. Reqd	Length	▼"a1" bars (Straight) – In Top and Bottom slab of Barrel- (Four of each Length): Size	Spacing	No. Reqd	Length Max.	Length Min.
0'-0" TO 5'-0" MAXIMUM	2 @ 9'	5'	#6	11"	92	19'-8"	#6	11"	76	18'-9"	2'-3"
		6'			92	19'-10"			76	18'-11"	2'-5"
		7'			92	19'-10"			76	"	"
		8'			92	19'-11"			76	19'-0"	2'-6"
		9'			90	20'-2"			76	19'-3"	2'-9"
		10'			90	20'-5"			76	19'-6"	3'-0"
		11'			90	20'-7"			76	19'-8"	3'-2"
	2 @ 10'	5'	#7	12"	80	21'-8"	#7	12"	76	20'-8"	2'-8"
		6'			80	21'-10"			76	20'-10"	2'-10"
		7'			80	21'-10"			76	"	"
		8'			80	21'-11"			76	20'-11"	2'-11"
		9'			80	22'-2"			76	21'-2"	3'-2"
		10'			78	22'-5"			80	21'-5"	2'-5"
		11'			78	22'-7"			80	21'-7"	2'-7"
		12'			78	22'-9"			80	21'-9"	2'-9"
	2 @ 11'	6'	#7	12"	76	23'-11"	#7	12"	84	22'-11"	2'-11"
		7'			76	23'-11"			84	"	"
		8'			76	23'-11"			84	"	"
		9'			76	24'-2"			84	23'-2"	3'-2"
		10'			74	24'-5"			88	23'-5"	2'-5"
		11'			74	24'-7"			88	23'-7"	2'-7"
		12'			74	24'-9"			88	23'-9"	2'-9"
	2 @ 12'	6'	#7	11"	78	25'-11"	#7	11"	100	25'-0"	3'-0"
		7'			78	25'-11"			100	"	"
		8'			78	25'-11"			100	"	"
		9'			78	26'-2"			104	25'-3"	2'-4"
		10'			76	26'-5"			104	25'-6"	2'-7"
		11'			76	26'-7"			104	25'-8"	2'-9"
		12'			76	26'-9"			104	25'-10"	2'-11"

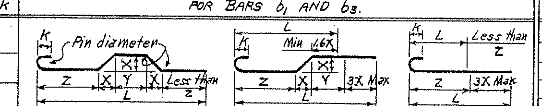
S	H	"b" bars (Bent - See Diagrams below) – In Bottom of Top Slab bent up over Division Wall - hooked. Alternate with "a" and "c" bars.: Size	Spacing	No. Reqd	Length	X	Y	Z	▼"b1" bars – In Bottom of Top Slab- some bent up over Division Wall- one end hooked. (2 of Each Length.) Alternate with "a1" and "c" or "c1" bars.: Size	Spacing	No. Reqd	Length Max.	Length Min.	L Max.	L Min.
2 @ 9'	5'	#6	11"	43	21'-1"	0'-5½"	4'-4"	7'-2"	#6	11"	38	20'-1"	3'-3"	19'-2"	2'-8"
	6'			43	21'-3"	"	4'-5"	7'-2½"			38	20'-3"	3'-5"	19'-4"	2'-10"
	7'			43	21'-3"	"	"	"			38	"	"	"	"
	8'			43	21'-4"	"	"	7'-3"			38	20'-4"	3'-6"	19'-5"	2'-11"
	9'			43	21'-7"	"	4'-6"	7'-4"			38	20'-7"	3'-9"	19'-8"	3'-2"
	10'			43	21'-10"	"	4'-7"	7'-5"			40	20'-10"	3'-1"	19'-11"	2'-6"
	11'			42	22'-0"	0'-5½"	"	7'-6"			40	21'-0"	3'-3"	20'-1"	2'-8"
2 @ 10'	5'	#6	12"	38	23'-2"	0'-6"	4'-9"	7'-11"	#6	12"	38	22'-1"	3'-8"	21'-1"	3'-1"
	6'			38	23'-4"	"	4'-10"	7'-11½"			38	22'-3"	3'-10"	21'-3"	3'-3"
	7'			38	23'-4"	"	"	"			38	"	"	"	"
	8'			38	23'-5"	"	"	8'-0"			40	22'-4"	2'-11"	21'-4"	2'-4"
	9'			37	23'-8"	"	4'-11"	8'-1"			40	22'-7"	3'-2"	21'-7"	2'-7"
	10'			37	23'-11"	"	5'-0"	8'-2"			40	22'-10"	3'-5"	21'-10"	2'-10"
	11'			37	24'-1"	"	"	8'-3"			40	23'-0"	3'-7"	22'-0"	3'-0"
	12'			37	24'-3"	0'-6"	5'-0"	8'-4"			40	23'-2"	3'-9"	22'-2"	3'-2"
2 @ 11'	6'	#6	12"	35	25'-5"	0'-6½"	5'-3"	8'-9"	#6	12"	44	24'-4"	2'-11"	23'-4"	2'-4"
	7'			35	25'-5"	"	"	"			44	"	"	"	"
	8'			35	25'-5"	"	"	"			44	"	"	"	"
	9'			35	25'-8"	"	5'-4"	8'-10"			44	24'-7"	3'-2"	23'-7"	2'-7"
	10'			35	25'-11"	"	5'-5"	8'-11"			44	24'-10"	3'-5"	23'-10"	2'-10"
	11'			35	26'-1"	"	"	9'-0"			44	25'-0"	3'-7"	24'-0"	3'-0"
	12'			35	26'-3"	0'-6½"	5'-5"	9'-1"			44	25'-2"	3'-9"	24'-2"	3'-2"
2 @ 12'	6'	#6	11"	36	27'-5"	0'-7"	5'-8"	9'-6"	#6	11"	52	26'-5"	3'-1"	25'-5"	2'-6"
	7'			36	27'-5"	"	"	"			52	"	"	"	"
	8'			36	27'-5"	"	"	"			52	"	"	"	"
	9'			36	27'-8"	"	5'-9"	9'-7"			52	26'-8"	3'-4"	25'-8"	2'-9"
	10'			36	27'-11"	"	5'-10"	9'-8"			52	26'-11"	3'-7"	25'-11"	3'-0"
	11'			36	28'-1"	"	"	9'-9"			52	27'-1"	3'-9"	26'-1"	3'-2"
	12'			36	28'-3"	0'-7"	5'-10"	9'-10"			54	27'-3"	3'-0"	26'-3"	2'-5"

S	H	"b2" bars (Bent - See Diagrams below) – In Top of Bottom Slab bent down under Division Wall - hooked. Alternate with "a" and "c" bars.: Size	Spacing	No. Reqd	Length	X	Y	Z	▼"b3" bars – In Top of Bottom Slab-some bent down under Division Wall-one end hooked. (2 of Each Length.) Alternate with "a1" and "c" or "c1" bars.: Size	Spacing	No. Reqd	Length Max.	Length Min.	L Max.	L Min.
2 @ 9'	5'	#6	11"	45	21'-1"	0'-5¾"	4'-3½"	7'-2"	#6	11"	38	20'-1"	3'-3"	19'-2"	2'-8"
	6'			45	21'-3"	"	4'-4½"	7'-2½"			38	20'-3"	3'-5"	19'-4"	2'-10"
	7'			45	21'-3"	"	"	"			38	"	"	"	"
	8'			45	21'-4"	"	"	7'-3"			38	20'-4"	3'-6"	19'-5"	2'-11"
	9'			45	21'-7"	"	4'-5½"	7'-4"			38	20'-7"	3'-9"	19'-8"	3'-2"
	10'			45	21'-10"	"	4'-6½"	7'-5"			40	20'-10"	3'-1"	19'-11"	2'-6"
	11'			44	22'-0"	0'-5¾"	"	7'-6"			40	21'-0"	3'-3"	20'-1"	2'-8"
2 @ 10'	5'	#6	12"	40	23'-2"	0'-6½"	4'-8"	7'-11"	#6	12"	38	22'-1"	3'-8"	21'-1"	3'-1"
	6'			40	23'-4"	"	4'-9"	7'-11½"			38	22'-3"	3'-10"	21'-3"	3'-3"
	7'			40	23'-4"	"	"	"			38	"	"	"	"
	8'			40	23'-5"	"	"	8'-0"			40	22'-4"	2'-11"	21'-11"	2'-4"
	9'			39	23'-8"	"	4'-10"	8'-1"			40	22'-7"	3'-2"	21'-7"	2'-7"
	10'			39	23'-11"	"	4'-11"	8'-2"			40	22'-10"	3'-5"	21'-10"	2'-10"
	11'			39	24'-1"	"	"	8'-3"			40	23'-0"	3'-7"	22'-0"	3'-0"
	12'			39	24'-3"	0'-6½"	4'-11"	8'-4"			40	23'-2"	3'-9"	22'-2"	3'-2"
2 @ 11'	6'	#6	12"	37	25'-6"	0'-7½"	5'-1"	8'-9"	#6	12"	44	24'-5"	2'-11"	23'-4"	2'-4"
	7'			37	25'-6"	"	"	"			44	"	"	"	"
	8'			37	25'-6"	"	"	"			44	"	"	"	"
	9'			37	25'-9"	"	5'-2"	8'-10"			44	24'-8"	3'-2"	23'-7"	2'-7"
	10'			37	26'-0"	"	5'-3"	8'-11"			44	24'-11"	3'-5"	23'-10"	2'-10"
	11'			37	26'-2"	"	"	9'-0"			44	25'-1"	3'-7"	24'-0"	3'-0"
	12'			37	26'-4"	0'-7½"	5'-3"	9'-1"			44	25'-3"	3'-9"	24'-2"	3'-2"
2 @ 12'	6'	#6	11"	38	27'-7"	0'-8½"	5'-5"	9'-6"	#6	11"	52	26'-7"	3'-1"	25'-5"	2'-6"
	7'			38	27'-7"	"	"	"			52	"	"	"	"
	8'			38	27'-7"	"	"	"			52	"	"	"	"
	9'			38	27'-10"	"	5'-6"	9'-7"			52	26'-10"	3'-4"	25'-8"	2'-9"
	10'			38	28'-1"	"	5'-7"	9'-8"			52	27'-1"	3'-7"	25'-11"	3'-0"
	11'			38	28'-3"	"	"	9'-9"			52	27'-3"	3'-9"	26'-1"	3'-2"
	12'			38	28'-5"	0'-8½"	5'-7"	9'-10"			54	27'-5"	3'-0"	26'-3"	2'-5"

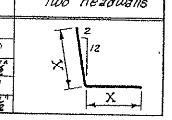
S	H	"c" bars (Straight) – In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.: Size	Spacing	No. Reqd	Length	▼"c1" bars – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Four of each Length): Size	Spacing	No. Reqd	Length Max.	Length Min.	"d" bars – Longitudinal in Top Slab of Barrel: Size	Spacing	No. Reqd	Length	"d1" bars – Longitudinal in Sidewalls and Division Wall: Size	Spacing	No. Reqd	Length	"e" bars – Longitudinal in Bottom Slab of Barrel: Size	Spacing	No. Reqd	Length
2 @ 9'	5'	#6	11"	112	9'-9"	#6	11"	32	9'-3"	2'-10"	#5	11½"	26	2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap).	#4	12"	20	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap).	#4	12"	25	2 @ 31'-10" for 60'-0" Length Barrel (1'-3" Lap).
	6'			112	9'-10"			32	9'-4"	2'-11"			26				24				25	
	7'			112	9'-10"			32	"	"			26				28				25	
	8'			112	9'-10"			32	9'-5"	3'-0"			26				32				25	
	9'			112	9'-11"			32	9'-7"	3'-2"			26				36				25	
	10'			112	10'-0"			36	9'-9"	2'-5"			26				40				25	
	11'			112	10'-0"			36	9'-10"	2'-6"			26				44				25	
2 @ 10'	5'	#7	12"	100	10'-9"	#7	12"	36	10'-3"	2'-3"	#5	11½"	28		#4	12"	20		#4	12"	27	
	6'			100	10'-10"			36	10'-4"	2'-4"			28				24				27	
	7'			100	10'-10"			36	"	"			28				28				27	
	8'			100	10'-10"			36	10'-5"	2'-5"			28				32				27	
	9'			100	10'-11"			36	10'-7"	2'-7"			28				36				27	
	10'			98	11'-0"			36	10'-9"	2'-9"			28				40				27	
	11'			98	11'-0"			36	10'-10"	2'-10"			28				44				27	
	12'			98	11'-0"			36	10'-11"	2'-11"			28				48				27	
2 @ 11'	6'	#7	12"	100	11'-10"	#7	12"	36	10'-11"	2'-11"	#5	11½"	30		#4	12"	24		#4	12"	29	
	7'			100	11'-10"			36	"	"			30				28				29	
	8'			100	11'-10"			36	"	"			30				32				29	
	9'			100	11'-11"			36	11'-1"	3'-1"			30				36				29	
	10'			98	12'-0"			36	11'-3"	3'-3"			30				40				29	
	11'			98	12'-0"			40	11'-4"	2'-4"			30				44				29	
	12'			98	12'-0"			40	11'-5"	2'-5"			30				48				29	
2 @ 12'	6'	#7	11"	106	12'-10"	#7	11"	44	12'-1"	2'-11"	#5	11½"	32		#4	12"	24		#4	12"	31	
	7'			106	12'-10"			44	"	"			32				28				31	
	8'			106	12'-10"			44	"	"			32				32				31	
	9'			106	12'-11"			44	12'-3"	3'-1"			32				36				31	
	10'			104	13'-0"			48	12'-5"	2'-4"			32				40				31	
	11'			104	13'-0"			48	12'-6"	2'-5"			32				44				31	
	12'			104	13'-0"			48	12'-7"	2'-6"			32				48				31	

S	H	"f" bars (Straight) – Verticals in Sidewalls and Division Wall: Size	Spacing	No. Reqd	Length	▼"k1" bars (Straight) – In Bottom of Headwalls: Size	No. Reqd	Length	▼"k2" bars – In Top of Headwalls and Aprons. (2 Each): Size	No. Reqd	Length
2 @ 9'	5'	#4	12"	240	6'-3"	#8	6	27'-9"	#8	8	29'-11"
	6'		12"	240	7'-3"		6	28'-0"		8	30'-1"
	7'			240	8'-3"		6	"		8	"
	8'		10"	288	9'-3"		6	28'-1"		8	30'-3"
	9'	#5	12"	240	10'-3"		6	28'-6"		8	30'-7"
	10'		11"	264	11'-3"		6	28'-10"		8	30'-11"
	11'		10"	288	12'-3"		6	29'-1"		8	31'-2"
2 @ 10'	5'	#4	12"	240	6'-4"	#8	6	30'-7"	#8	8	32'-9"
	6'		12"	240	7'-4"		6	30'-10"		8	32'-11"
	7'			240	8'-4"		6	"		8	"
	8'		10"	288	9'-4"		6	30'-11"		8	33'-1"
	9'	#5	12"	240	10'-4"		6	31'-3"		8	33'-5"
	10'		11"	264	11'-4"		6	31'-8"		8	33'-9"
	11'		10"	288	12'-4"		6	31'-11"		8	34'-0"
	12'	#6	12"	240	13'-4"		6	32'-1"		8	34'-3"
2 @ 11'	6'	#4	12"	240	7'-6"	#9	6	33'-9"	#9	8	35'-11"
	7'			240	8'-6"		6	"		8	"
	8'		10"	288	9'-6"		6	"		8	"
	9'	#5	12"	240	10'-6"		6	34'-1"		8	36'-3"
	10'		11"	264	11'-6"		6	34'-6"		8	36'-7"
	11'		10"	288	12'-6"		6	34'-8"		8	36'-10"
	12'	#6	12"	240	13'-6"		6	34'-11"		8	37'-1"
2 @ 12'	6'	#4	12"	240	7'-7"	#9	6	36'-7"	#9	8	38'-9"
	7'			240	8'-7"		6	"		8	"
	8'		10"	288	9'-7"		6	"		8	"
	9'	#5	12"	240	10'-7"		6	36'-11"		8	39'-1"
	10'		11"	264	11'-7"		6	37'-4"		8	39'-5"
	11'		10"	288	12'-7"		6	37'-6"		8	39'-8"
	12'	#6	12"	240	13'-7"		6	37'-9"		8	39'-11"

Bar Size	Pin Diam.	K	Add for 2 Hooks	Bending Diagram for Bars "b" and "b2"
#6	3"	5"	1'-2"	

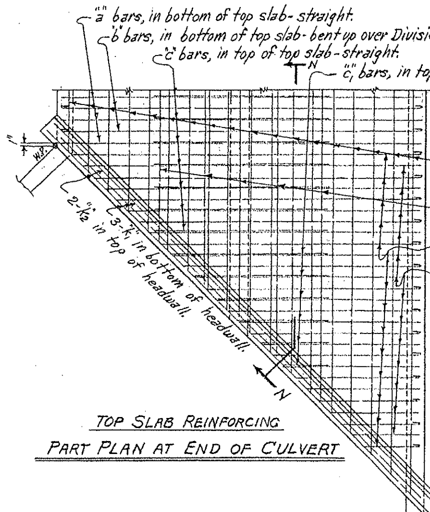
Bar Size	Pin Diam.	K	Add for 1 Hook	Bending Diagram for Bars "b1" and "b3"
#6	3"	5"	0'-7"	

NOTE:- Dimensions are to centers of bars (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as "b" bars and for "b3" bars same as for "b2" bars.

Span	Size	Spacing	No. Reqd	Length	X	Dowel bars "r" in Two Headwalls
9'	#4	12"±	58	2'-10"	1'-5"	
10'	#4	12"±	64	2'-11"	1'-5½"	
11'	#4	12"±	70	3'-0"	1'-6"	
12'	#4	12"±	76	3'-1"	1'-6½"	

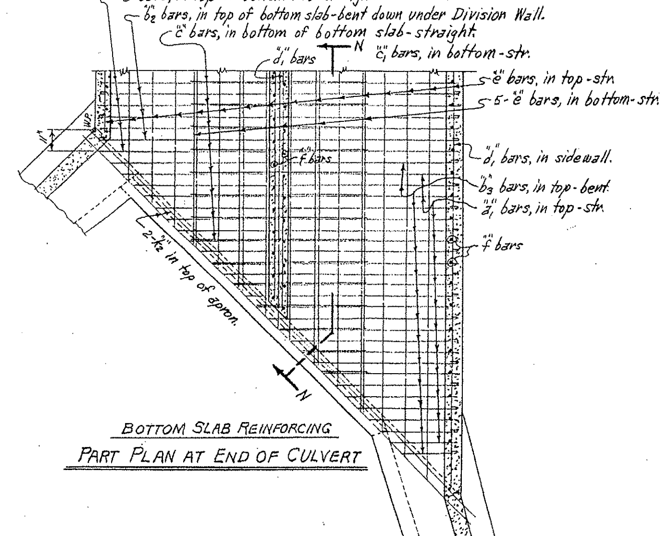
▼ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" & "b2" bars, use a set of "a" & "c" bars instead.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.



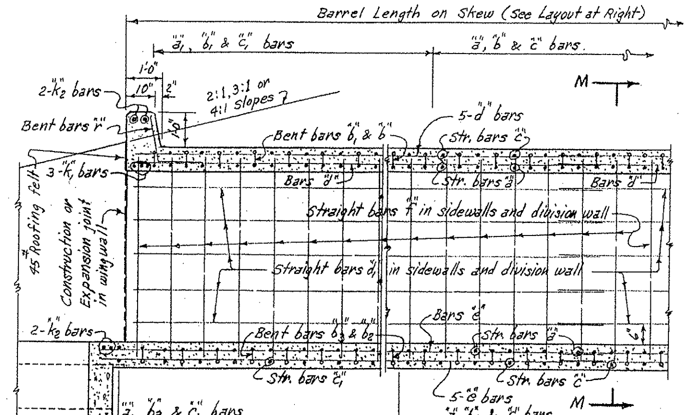
TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT

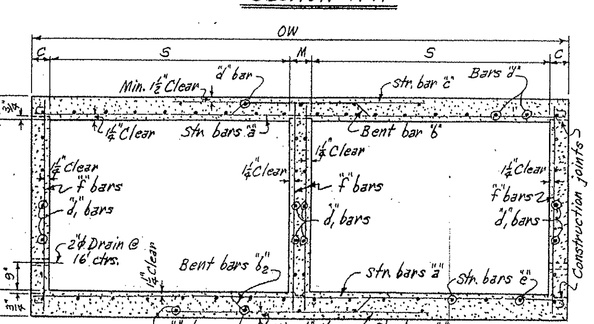


BOTTOM SLAB REINFORCING

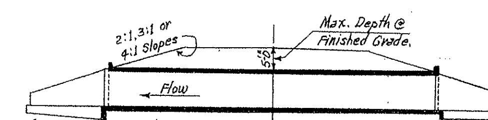
PART PLAN AT END OF CULVERT



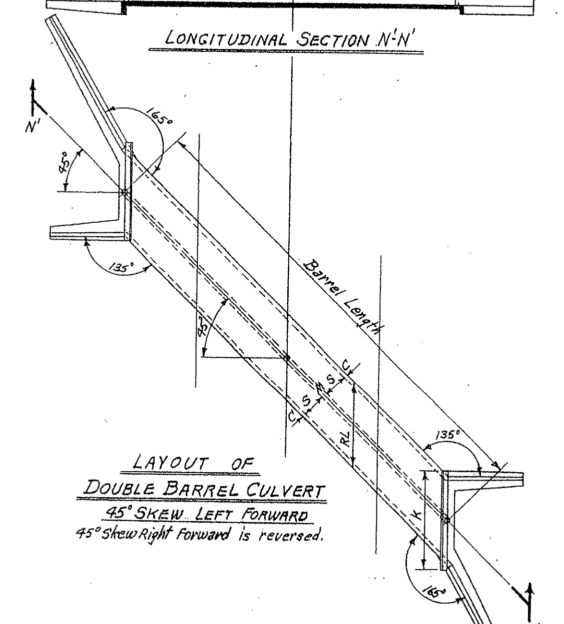
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N-N'



LAYOUT OF DOUBLE BARREL CULVERT

45° SKEW LEFT FORWARD

45° Skew Right Forward is reversed.

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Wall M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwalls K	* Class S Conc. per Lin. Ft. of Barrel (Cu. Yd.)	Reinforcing Steel: Total for 60'-0" Length of Barrel (Lb.)	Per Lin. Ft. of Barrel (Lb.)	Additional per Lap (Lb.)
5'-0"	2 @ 9'	5'	90	19'-11"	9"	7"	9"	9¼"	6'-6¼"	28'-2"	30'-2"	1.477	15,689	239.37	82.77
		6'	108	20'-1"		7½"	10"		7'-6¼"	28'-4⅛"	30'-4¾"	1.594	16,134	246.08	86.11
		7'	126	20'-1"		7½"	10"		8'-6¼"	"	"	1.671	16,457	251.43	89.45
		8'	144	20'-2"		8"	10"		9'-6¼"	28'-6¼"	30'-6¼"	1.778	17,128	262.26	92.79
		9'	162	20'-5"		9"	11"		10'-6¼"	28'-10½"	30'-10½"	1.956	18,177	279.95	96.13
		10'	180	20'-8"		10"	12"		11'-6¼"	29'-2¾"	31'-2¾"	2.152	19,064	292.97	99.47
		11'	198	20'-10"		11"	12"		12'-6¼"	29'-5½"	31'-5½"	2.328	20,480	306.86	102.81
	2 @ 10'	5'	100	21'-11"	9½"	7"	9"	10"	6'-7½"	31'-0"	33'-0"	1.674	18,280	279.64	87.92
		6'	120	22'-1"		7½"	10"		7'-7½"	31'-2⅜"	33'-2⅜"	1.792	18,726	286.50	91.26
		7'	140	22'-1"		7½"	10"		8'-7½"	"	"	1.869	19,099	291.85	94.60
		8'	160	22'-2"		8"	10"		9'-7½"	31'-4⅝"	33'-4⅝"	1.976	19,748	302.77	97.94
		9'	180	22'-5"		9"	11"		10'-7½"	31'-8¾"	33'-8½"	2.155	20,811	320.74	101.28
		10'	200	22'-8"		10"	12"		11'-7½"	32'-0⅝"	34'-0⅜"	2.352	21,573	333.99	104.62
		11'	220	22'-10"		11"	12"		12'-7½"	32'-3½"	34'-3½"	2.529	22,201	348.01	107.96
		12'	240	23'-0"		12"	12"		13'-7½"	32'-6⅝"	34'-6⅝"	2.718	23,800	370.23	111.30
	2 @ 11'	6'	132	24'-2"	10"	8"	10"	11"	7'-9"	34'-2⅜"	36'-2"	2.048	20,556	309.36	96.91
		7'	154	24'-2"		8"	10"		8'-9"	"	"	2.128	20,880	314.70	99.75
		8'	176	24'-2"		8"	10"		9'-9"	"	"	2.208	21,507	325.12	103.09
		9'	198	24'-5"		9"	11"		10'-9"	34'-6⅜"	36'-6⅜"	2.388	22,559	343.25	106.43
		10'	220	24'-8"		10"	12"		11'-9"	34'-10⅜"	36'-10½"	2.596	23,419	356.57	109.77
		11'	242	24'-10"		11"	12"		12'-9"	35'-1⅜"	37'-1½"	2.764	24,301	370.67	113.11
		12'	264	25'-0"		12"	12"		13'-9"	35'-4¼"	37'-4¼"	2.954	25,689	393.05	116.45
	2 @ 12'	6'	144	26'-2"	10½"	8"	10"	12"	7'-10½"	37'-0⅝"	39'-0"	2.299	23,332	353.31	101.55
		7'	168	26'-2"		8"	10"		8'-10½"	"	"	2.379	23,655	358.65	104.89
		8'	192	26'-2"		8"	10"		9'-10½"	"	"	2.459	24,286	369.12	108.23
		9'	216	26'-5"		9"	11"		10'-10½"	37'-4¼"	39'-4¼"	2.640	25,980	387.52	111.57
		10'	240	26'-8"		10"	12"		11'-10½"	37'-8½"	39'-8½"	2.840	26,252	401.07	114.91
		11'	264	26'-10"		11"	12"		12'-10½"	37'-11⅜"	39'-11½"	3.018	27,200	415.31	118.25
		12'	288	27'-0"		12"	12"		13'-10½"	38'-2¼"	40'-2¼"	3.208	28,597	437.88	121.59

* For quantities in wings see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each add'l 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diam. min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

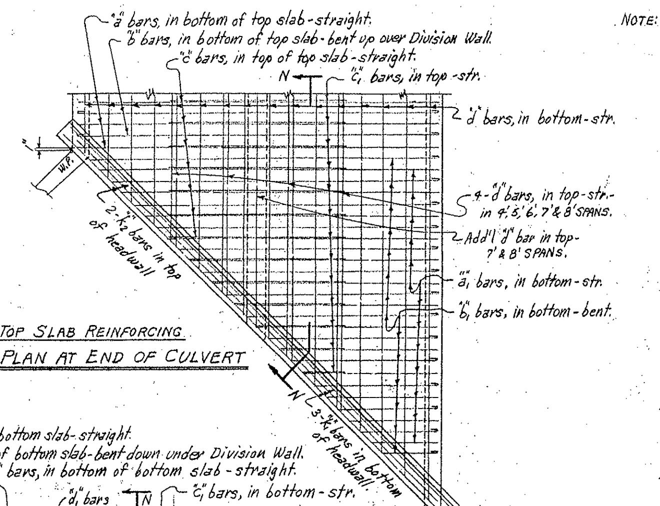
45° SKEW

9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
DOUBLES — UNDER 5'-0" COVER

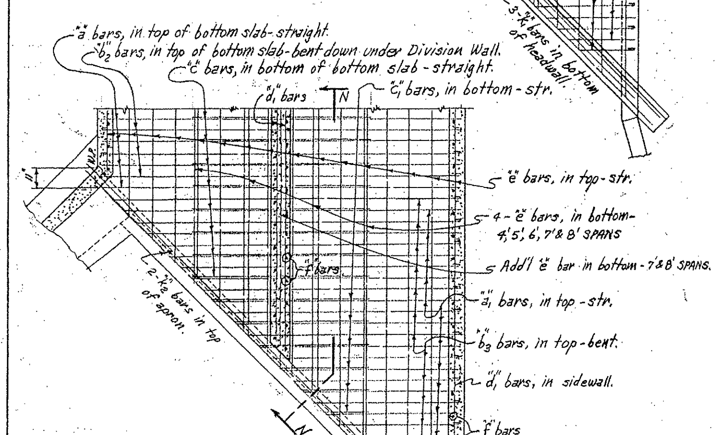
STANDARD DRAWING NO. R-245X-02

Designed by:- W.C.H. 1-17-63. Checked by:- R.H.S. 5-14-63
Drawn by:- W.C.H. 7-15-64. Checked by:-
Quantities by:- W.C.H. 10-5-64. Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



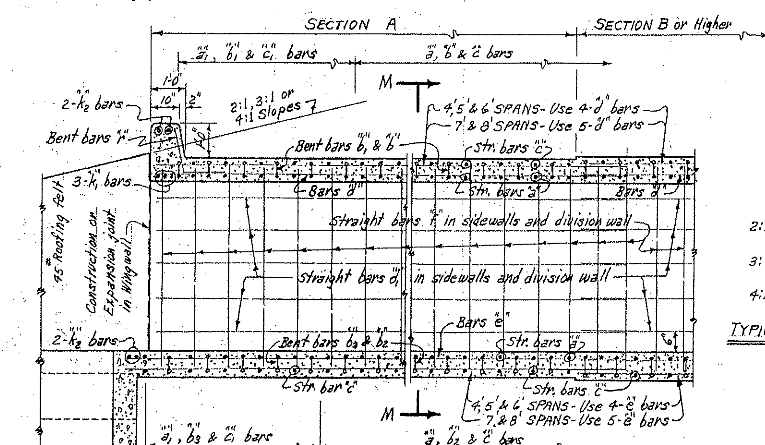
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



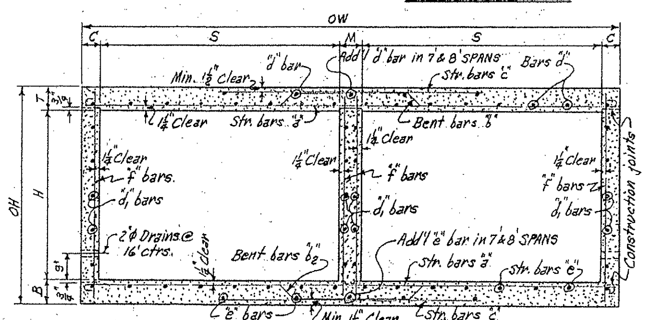
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-8" min. into SECTION B.

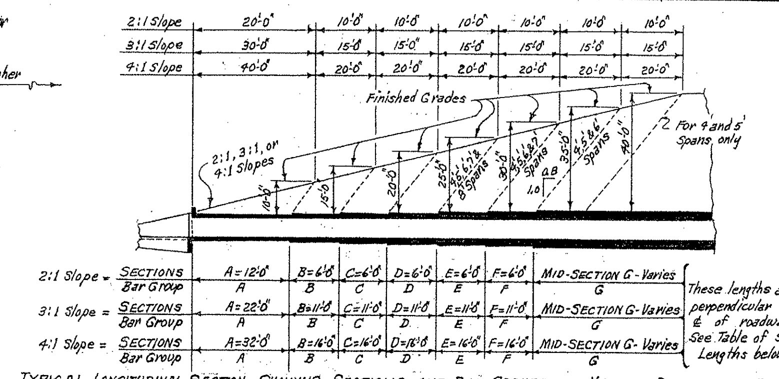
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.



SECTION N-N

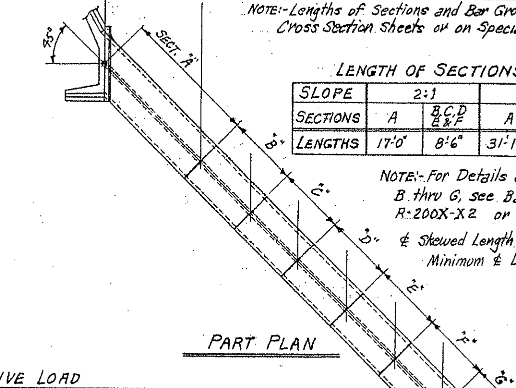


TYPICAL SECTION M-M



TYPICAL LONGITUDINAL SECTION- SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

LENGTH OF SECTIONS ON 45° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B,C,D E&F	A	B,C,D E&F	A	B,C,D E&F
LENGTHS	17'-0"	8'-6"	31'-1½"	15'-6¾"	45'-3"	22'-7½"

NOTE:- For Details and Bar Lists for SECTION B thru G, see Barrel Drawing Nos. R-200X-X1, R-200X-X2 or R-200X-X3.

℄ Skewed Length of A = 1.41421 A.
Minimum ℄ Length on skew = (0.5 OW + 1')

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

MAX. DESIGN DEPTH OF COVER	BARREL DIMENSIONS											* QUANTITIES - ONE SECTION "A"					
	CLEAR SPANS	CLEAR HEIGHT	SQ.FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALL	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	CLASS S CONCRETE BARREL ONLY 2:1	3:1	4:1	REINFORCING STEEL BARREL, APRON AND HEADWALL. 2:1	3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	CU.YD.	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"	2@4'	2'	16	9'-8"	6"	6"	8"	6"	3'-0"	13'-8"	15'-8"	8.18	14.97	21.77	1288	2203	3147
		3'	24	9'-8"		6"	8"		4'-0"	"	"	9.23	16.90	24.57	1384	2374	3397
		4'	32	9'-8"		6"	8"		5'-0"	"	"	10.28	18.83	27.38	1479	2545	3647
		5'	40	9'-8"		6"	8"		6'-0"	"	"	11.34	20.76	30.18	1575	2716	3897
		6'	48	9'-11"		7"	9"		7'-0"	14'-0½"	16'-0½"	13.48	24.68	35.88	1689	2916	4187
	2@5'	3'	30	11'-8"	6½"	6"	8"	6½"	4'-1"	16'-6"	18'-6"	11.10	20.33	29.55	1935	3292	4712
		4'	40	11'-8"		6"	8"		5'-1"	"	"	12.16	22.25	32.35	2030	3463	4962
		5'	50	11'-8"		6"	8"		6'-1"	"	"	13.21	24.18	35.16	2126	3634	5212
		6'	60	11'-11"		7"	9"		7'-1"	16'-10¼"	18'-10¼"	15.37	28.14	40.91	2229	3855	5528
		7'	70	12'-1"		7½"	10"		8'-1"	17'-1"	19'-1"	17.42	31.90	46.38	2547	4408	6339
	2@6'	3'	36	13'-8"	7¼"	6"	8"	7¾"	4'-3"	19'-3⅞"	21'-4"	13.91	25.46	37.01	2216	3777	5378
		4'	48	13'-8"		6"	8"		5'-3"	"	"	14.96	27.39	39.82	2312	3948	5628
		5'	60	13'-8"		6"	8"		6'-3"	"	"	16.00	29.29	42.58	2407	4119	5878
		6'	72	13'-11"		7"	9"		7'-3"	19'-8⅛"	21'-8¼"	18.19	33.30	48.42	2494	4337	6192
		7'	84	14'-1"		7½"	10"		8'-3"	19'-11"	21'-11"	20.26	37.10	53.94	2821	4899	7033
		8'	96	14'-2"		8"	10"		9'-3"	20'-0⅝"	22'-0½"	22.07	40.40	58.73	3017	5232	7536
	2@7'	4'	56	15'-8"	8¼"	6"	8"	8¾"	5'-5"	22'-1⅞"	24'-1¾"	18.17	33.27	48.37	2952	5018	7123
		5'	70	15'-8"		6"	8"		6'-5"	"	"	19.23	35.20	51.18	3048	5184	7373
		6'	84	15'-11"		7"	9"		7'-5"	22'-6⅝"	24'-6"	21.44	39.25	57.06	3125	5409	7696
		7'	98	16'-1"		7½"	10"		8'-5"	22'-9"	24'-9"	23.53	43.08	62.63	3467	5957	8555
		8'	112	16'-2"		8"	10"		9'-5"	22'-10⅝"	24'-10¼"	25.33	46.38	67.42	3666	6296	9066
		9'	126	16'-5"		9"	11"		10'-5"	23'-2⅝"	25'-2½"	28.34	51.88	75.43	3914	6748	9632
	2@8'	4'	64	17'-8"	9¼"	6"	8"	9¾"	5'-7"	24'-11⅝"	26'-11¾"	21.81	39.93	58.06	3415	5871	8461
		5'	80	17'-11"		7"	9"		6'-7"	25'-4"	27'-4"	23.90	43.76	63.62	3585	6237	8845
		6'	96	17'-11"		7"	9"		7'-7"	"	"	25.11	45.97	66.83	3680	6408	9095
		7'	112	18'-1"		7½"	10"		8'-7"	25'-6⅞"	27'-7"	27.22	49.89	72.44	3882	6667	9505
		8'	128	18'-2"		8"	10"		9'-7"	25'-8¼"	27'-8¼"	29.02	53.13	77.24	4154	7149	10,215
		9'	144	18'-5"		9"	11"		10'-7"	26'-0½"	28'-0½"	32.06	58.70	85.34	4401	7557	10,819
		10'	160	18'-8"		10"	12"		11'-7"	26'-4¾"	28'-4¾"	35.39	64.80	94.21	4847	8368	11,973

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	B	C				D
25.0' to 29.5'	A	B	C	D			E
30.0' to 34.5'	A	B	C	D	E		F
35.0' to 40.0'	A	B	C	D	E	F	G

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	F	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A						A
10.0' to 14.5'	A						B
15.0' to 19.5'	A	B					C
20.0' to 24.5'	A	2@C					D
25.0' to 29.5'	A	B	2@D				E
30.0' to 34.5'	A	2@C		2@E			F
35.0' to 40.0'	A	B	2@D		2@F		G

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.
* Total steel quantities listed above include one lap of longitudinal bars, plus an additional lap for 4:1 slopes.

BAR LIST FOR SECTION "A" ON 45° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A" — LENGTH OF SECTION: 2:1 = 17'-0", 3:1 = 31'-1½", 4:1 = 45'-3" — DEPTH OF COVER (D): 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars (▼) — STRAIGHT — In Top and Bottom Slab of Barrel- (Two of each Length)

S	H	"a" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"a1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.
2@4'	2'	#4	13"	25	51	77	9'-5"	#4	13"	12	8'-4"	2'-11"
	3'			25	51	77	"			12	"	"
	4'			25	51	77	"			12	"	"
	5'			25	51	77	"			12	"	"
	6'			25	51	77	9'-8"			12	8'-7"	3'-2"
2@5'	3'	#4	11"	27	57	87	11'-5"	#4	11"	18	10'-6"	3'-2"
	4'			27	57	87	"			18	"	"
	5'			27	57	87	"			18	"	"
	6'			25	57	87	11'-8"			20	10'-9"	2'-6"
	7'			25	57	87	11'-10"			20	10'-11"	2'-8"
2@6'	3'	#4	12"	23	51	79	13'-5"	#4	12"	22	12'-5"	2'-5"
	4'			23	51	79	"			22	"	"
	5'			23	51	79	"			22	"	"
	6'			21	51	79	13'-8"			22	12'-8"	2'-8"
	7'			21	49	79	13'-10"			22	12'-10"	2'-10"
	8'			21	49	79	13'-11"			22	12'-11"	2'-11"
2@7'	4'	#4	12"	21	49	77	15'-5"	#4	12"	26	14'-5"	2'-5"
	5'			21	49	77	"			26	"	"
	6'			19	49	77	15'-8"			26	14'-8"	2'-8"
	7'			19	47	77	15'-10"			26	14'-10"	2'-10"
	8'			19	47	77	15'-11"			26	14'-11"	2'-11"
	9'			19	47	75	16'-2"			26	15'-2"	3'-2"
2@8'	4'	#5	13"	17	43	69	17'-5"	#5	13"	26	16'-4"	3'-4"
	5'			17	43	69	17'-8"			28	16'-7"	2'-6"
	6'			17	43	69	"			28	"	"
	7'			17	43	69	17'-10"			28	16'-9"	2'-8"
	8'			17	43	69	17'-11"			28	16'-10"	2'-9"
	9'			17	43	69	18'-2"			28	17'-1"	3'-0"
	10'			17	43	69	18'-5"			28	17'-4"	3'-3"

"b" bars — BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Wall-hooked. Alternate with "a" and "c" bars. "b1" bars (▼) — In Bottom of Top Slab- some bent up over Division Wall - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
2@4'	2'	#4	13"	11	24	37	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	7	9'-5"	2'-9"	8'-10"	2'-4"
	3'			11	24	37	"	"	"	"			7	"	"	"	"
	4'			11	24	37	"	"	"	"			7	"	"	"	"
	5'			11	24	37	"	"	"	"			7	"	"	"	"
	6'			11	24	37	10'-8"	0'-2¾"	2'-2"	3'-6"			7	9'-8"	3'-0"	9'-1"	2'-7"
2@5'	3'	#5	11"	12	27	43	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	10	11'-7"	3'-2"	10'-11"	2'-8"
	4'			12	27	43	"	"	"	"			10	"	"	"	"
	5'			12	27	43	"	"	"	"			10	"	"	"	"
	6'			12	27	43	12'-9"	"	2'-7½"	4'-3"			10	11'-10"	3'-5"	11'-2"	2'-11"
	7'			12	27	43	12'-11"	0'-3"	2'-8½"	4'-3½"			10	12'-0"	3'-7"	11'-4"	3'-1"
2@6'	3'	#5	12"	10	24	38	14'-7"	0'-3¾"	2'-11"	4'-11"	#5	12"	11	13'-7"	3'-4"	12'-10"	2'-10"
	4'			10	24	38	"	"	"	"			11	"	"	"	"
	5'			10	24	38	"	"	"	"			11	"	"	"	"
	6'			10	24	38	14'-10"	"	3'-0"	5'-0"			11	13'-10"	3'-7"	13'-1"	3'-1"
	7'			10	24	38	15'-0"	"	3'-1"	5'-0½"			11	14'-0"	3'-9"	13'-3"	3'-3"
	8'			10	24	38	15'-1"	0'-3¾"	3'-1"	5'-1"			11	14'-1"	3'-10"	13'-4"	3'-4"
2@7'	4'	#6	12"	9	23	37	16'-10"	0'-4¾"	3'-4½"	5'-7"	#6	12"	13	15'-9"	3'-5"	14'-10"	2'-10"
	5'			9	23	37	"	"	"	"			13	"	"	"	"
	6'			9	23	37	17'-1"	"	3'-5½"	5'-8"			13	16'-0"	3'-8"	15'-1"	3'-1"
	7'			9	23	37	17'-3"	"	3'-6½"	5'-8½"			13	16'-2"	3'-10"	15'-3"	3'-3"
	8'			9	23	37	17'-4"	"	"	5'-9"			13	16'-3"	3'-11"	15'-4"	3'-4"
	9'			9	23	37	17'-7"	0'-4¾"	3'-7½"	5'-10"			14	16'-6"	3'-2"	15'-7"	2'-7"
2@8'	4'	#6	13"	7	20	34	18'-10"	0'-5¾"	3'-7"	6'-5"	#6	13"	14	17'-9"	3'-4"	16'-10"	2'-9"
	5'			7	20	33	19'-1"	"	3'-8"	6'-6"			14	18'-0"	3'-7"	17'-1"	3'-0"
	6'			7	20	33	"	"	"	"			14	"	"	"	"
	7'			7	20	33	19'-3"	"	3'-9"	6'-6½"			14	18'-2"	3'-9"	17'-3"	3'-2"
	8'			7	20	33	19'-4"	"	"	6'-7"			14	18'-3"	3'-10"	17'-4"	3'-3"
	9'			7	20	33	19'-7"	"	3'-10"	6'-8"			15	18'-6"	3'-0"	17'-7"	2'-5"
	10'			7	20	33	19'-10"	0'-5¾"	3'-11"	6'-9"			15	18'-9"	3'-3"	17'-10"	2'-8"

"b2" bars — BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Wall-hooked. Alternate with "a" and "c" bars. "b3" bars (▼) — In Top of Bottom Slab- some bent down under Division Wall- one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	X	Y	Z	"b3" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
2@4'	2'	#4	13"	12	25	38	10'-5"	0'-2¾"	2'-1"	3'-5"	#4	13"	7	9'-5"	2'-9"	8'-10"	2'-4"
	3'			12	25	38	"	"	"	"			7	"	"	"	"
	4'			12	25	38	"	"	"	"			7	"	"	"	"
	5'			12	25	38	"	"	"	"			7	"	"	"	"
	6'			12	25	38	10'-8"	0'-2¾"	2'-2"	3'-6"			7	9'-8"	3'-0"	9'-1"	2'-7"
2@5'	3'	#5	11"	13	28	44	12'-6"	0'-3"	2'-6½"	4'-2"	#5	11"	10	11'-7"	3'-2"	10'-11"	2'-8"
	4'			13	28	44	"	"	"	"			10	"	"	"	"
	5'			13	28	44	"	"	"	"			10	"	"	"	"
	6'			13	28	44	12'-9"	"	2'-7½"	4'-3"			10	11'-10"	3'-5"	11'-2"	2'-11"
	7'			13	28	44	12'-11"	0'-3"	2'-8½"	4'-3½"			10	12'-0"	3'-7"	11'-4"	3'-1"
2@6'	3'	#5	12"	11	25	39	14'-7"	0'-4¼"	2'-10"	4'-11"	#5	12"	11	13'-7"	3'-4"	12'-10"	2'-10"
	4'			11	25	39	"	"	"	"			11	"	"	"	"
	5'			11	25	39	"	"	"	"			11	"	"	"	"
	6'			11	25	39	14'-10"	"	2'-11"	5'-0"			11	13'-10"	3'-7"	13'-1"	3'-1"
	7'			11	25	39	15'-0"	"	3'-0"	5'-0½"			11	14'-0"	3'-9"	13'-3"	3'-3"
	8'			11	25	39	15'-1"	0'-4¼"	3'-0"	5'-1"			11	14'-1"	3'-10"	13'-4"	3'-4"
2@7'	4'	#6	12"	10	24	38	16'-10"	0'-5¼"	3'-3½"	5'-7"	#6	12"	13	15'-9"	3'-5"	14'-10"	2'-10"
	5'			10	24	38	"	"	"	"			13	"	"	"	"
	6'			10	24	38	17'-1"	"	3'-4½"	5'-8"			13	16'-0"	3'-8"	15'-1"	3'-1"
	7'			10	24	38	17'-3"	"	3'-5½"	5'-8½"			13	16'-2"	3'-10"	15'-3"	3'-3"
	8'			10	24	38	17'-4"	"	"	5'-9"			13	16'-3"	3'-11"	15'-4"	3'-4"
	9'			10	24	38	17'-7"	0'-5¼"	3'-6½"	5'-10"			14	16'-6"	3'-2"	15'-7"	2'-7"
2@8'	4'	#6	13"	8	21	35	18'-11"	0'-6¼"	3'-6"	6'-5"	#6	13"	14	17'-10"	3'-4"	16'-10"	2'-9"
	5'			8	21	34	19'-2"	"	3'-7"	6'-6"			14	18'-1"	3'-7"	17'-1"	3'-0"
	6'			8	21	34	"	"	"	"			14	"	"	"	"
	7'			8	21	34	19'-4"	"	3'-8"	6'-6½"			14	18'-3"	3'-9"	17'-3"	3'-2"
	8'			8	21	34	19'-5"	"	"	6'-7"			14	18'-4"	3'-10"	17'-4"	3'-3"
	9'			8	21	34	19'-8"	"	3'-9"	6'-8"			15	18'-7"	3'-0"	17'-7"	2'-5"
	10'			8	21	34	19'-11"	0'-6¼"	3'-10"	6'-9"			15	18'-10"	3'-3"	17'-10"	2'-8"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars (▼) — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length). "d" bars — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Wall. "e" bars — Longitudinal in Bottom Slab of Barrel.

S	H	"c" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"c1" SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	"d" SIZE	SPACING	NO. REQ'D	"d1" SIZE	SPACING	NO. REQ'D	"e" SIZE	SPACING	NO. REQ'D
2@4'	2'	#5	13"	29	55	81	4'-8"	#5	13"	4	3'-10"	2'-9"	#4	12"	14	#4	12"	8	#4	12"	14
	3'			29	55	81	"			4	"	"			14			12			14
	4'			29	55	81	"			4	"	"			14			16			14
	5'			29	55	81	"			4	"	"			14			20			14
	6'			29	55	81	4'-9"			4	4'-0"	2'-11"			14			24			14
2@5'	3'	#5	11"	33	63	93	5'-8"	#5	11"	6	4'-11"	3'-1"	#4	12"	16	#4	12"	12	#4	12"	16
	4'			33	63	93	"			6	"	"			16			16			16
	5'			33	63	93	"			6	"	"			16			20			16
	6'			31	63	93	5'-9"			8	5'-1"	2'-4"			16			24			16
	7'			31	63	93	5'-10"			8	5'-2"	2'-5"			16			28			16
2@6'	3'	#6	12"	29	57	85	6'-8"	#6	12"	8	6'-1"	3'-1"	#4	12"	18	#4	12"	12	#4	12"	18
	4'			29	57	85	"			8	"	"			18			16			18
	5'			29	57	85	"			8	"	"			18			20			18
	6'			27	57	85	6'-9"			8	6'-3"	3'-3"			18			24			18
	7'			27	57	85	6'-10"			10	6'-4"	2'-4"			18			28			18
	8'			27	57	85	6'-10"			10	6'-5"	2'-5"			18			32			18
2@7'	4'	#6	12"	29	57	85	7'-8"	#6	12"	8	6'-7"	2'-7"	#4	12"	21	#4	12"	16	#4	12"	21
	5'			29	57	85	"			8	"	"			21			20			21
	6'			27	57	85	7'-9"			8	6'-9"	2'-9"			21			24			21
	7'			27	55	85	7'-10"			8	6'-10"	2'-10"			21			28			21
	8'			27	55	85	7'-10"			8	6'-11"	2'-11"			21			32			21
	9'			27	55	83	7'-11"			8	7'-1"	3'-1"			21			36			21
2@8'	4'	#7	13"	25	51	77	8'-8"	#7	13"	8	7'-8"	3'-4"	#4	12"	23	#4	12"	16	#4	12"	23
	5'			25	51	77	8'-9"			10	7'-10"	2'-5"			23			20			23
	6'			25	51	77	"			10	"	"			23			24			23
	7'			25	51	77	8'-10"			10	7'-11"	2'-6"			23			28			23
	8'			25	51	77	8'-10"			10	8'-0"	2'-7"			23			32			23
	9'			25	51	77	8'-11"			10	8'-2"	2'-9"			23			36			23
	10'			25	51	77	9'-0"			10	8'-4"	2'-11"			23			40			23

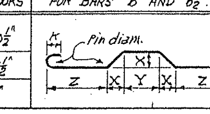
"d" bars LENGTH: Lengths Vary - Ave. Lengths: 2:1 = 18'-7", 3:1 = 32'-9", ⊙4:1 = 46'-10"
"d1" bars LENGTH: Lengths Vary - Ave. Lengths: 2:1 = 18'-7", 3:1 = 32'-9", ⊙4:1 = 46'-10"
"e" bars LENGTH: Lengths Vary - Ave. Lengths: 2:1 = 19'-11", 3:1 = 34'-1", ⊙4:1 = 48'-2"

"f" bars — STRAIGHT — Verticals in Sidewalls and Division Wall. "k1" bars (▼) — STRAIGHT — In Bottom of Headwall. "k2" bars (▼) — In Top of Headwall and Apron. (2 Each)

S	H	"f" SIZE	SPACING	NUMBER REQ'D 2:1	3:1	4:1	LENGTH	"k1" SIZE	NO. REQ'D	LENGTH	"k2" SIZE	NO. REQ'D	LENGTH
2@4'	2'	#4	12"	69	125	182	2'-9"	#5	3	13'-3"	#5	4	15'-5"
	3'			69	125	182	3'-9"		3	"		4	"
	4'			69	125	182	4'-9"		3	"		4	"
	5'			69	125	182	5'-9"		3	"		4	"
	6'			69	125	182	6'-9"		3	13'-7"		4	15'-9"
2@5'	3'	#4	12"	69	125	182	3'-10"	#6	3	16'-1"	#6	4	18'-3"
	4'			69	125	182	4'-10"		3	"		4	"
	5'			69	125	182	5'-10"		3	"		4	"
	6'			69	125	182	6'-10"		3	16'-5"		4	18'-7"
	7'	#5	12"	69	125	182	7'-10"		3	16'-8"		4	18'-10"
2@6'	3'	#4	12"	69	125	182	4'-0"	#6	3	18'-11"	#6	4	21'-1"
	4'			69	125	182	5'-0"		3	"		4	"
	5'			69	125	182	6'-0"		3	"		4	"
	6'			69	125	182	7'-0"		3	19'-3"		4	21'-5"
	7'	#5	12"	69	125	182	8'-0"		3	19'-6"		4	21'-8"
	8'		11"	76	136	200	9'-0"		3	19'-7"		4	21'-9"
2@7'	4'	#4	12"	69	125	182	5'-2"	#7	3	21'-9"	#7	4	23'-10"
	5'			69	125	182	6'-2"		3	"		4	"
	6'			69	125	182	7'-2"		3	22'-1"		4	24'-3"
	7'	#5	12"	69	125	182	8'-2"		3	22'-4"		4	24'-6"
	8'		11"	76	136	200	9'-2"		3	22'-5"		4	24'-7"
	9'		10"	83	151	218	10'-2"		3	22'-10"		4	24'-11"
2@8'	4'	#4	12"	69	125	182	5'-4"	#7	3	24'-7"	#7	4	26'-8"
	5'			69	125	182	6'-4"		3	24'-11"		4	27'-1"
	6'			69	125	182	7'-4"		3	"		4	"
	7'		10"	83	151	218	8'-4"		3	25'-2"		4	27'-4"
	8'	#5	12"	69	125	182	9'-4"		3	25'-3"		4	27'-5"
	9'		11"	76	136	200	10'-4"		3	25'-8"		4	27'-9"
	10'	#6	12"	69	125	182	11'-4"		3	26'-0"		4	28'-1"

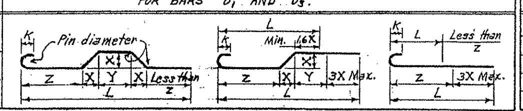
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b2".



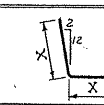
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b1" AND "b3".



SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
4'	#4	12½"	14	2'-4"	1'-2"
5'	#4	12½"	17	2'-5"	1'-2½"
6'	#4	12½"	20	2'-6"	1'-3"
7'	#4	12½"	23	2'-8"	1'-4"
8'	#4	12½"	26	2'-10"	1'-5"

Dowel bars "r" in One Headwall.



NOTE:- Dimensions are to centers of bars (b, b1, b2, & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

▼ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-1" for 13" spacing, 1'-0" for 12" spacing, and 0'-11" for 11" spacing.
⊙ To longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" min. lap).

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.
For Barrels of 4', 5' & 6' Spans, see Drawing No. R-200X-X1, of 7' Spans Drawing No. R-200X-X3, and of 8' Spans Drawing No. R-200X-X2.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW — SECTIONS "A" ONLY

4', 5', 6', 7' AND 8' SPANS — DOUBLES
2:1, 3:1 OR 4:1 SLOPES OVER 5'-0" COVER

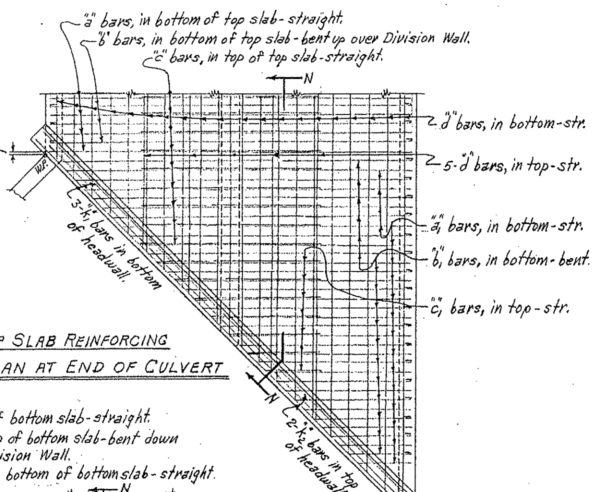
STANDARD DRAWING NO. R-245X-1

Designed by:- W.C.H. 9-17-62. Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 8-12-64. Checked by:-
Quantities by:- W.C.H. 10-27-64. Checked by:-

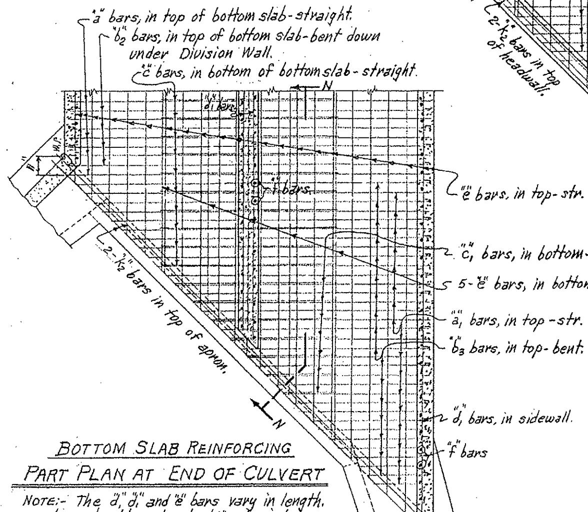
TJL [redacted]

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing Nos. W-X452-1 or W-X452-2; W-453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

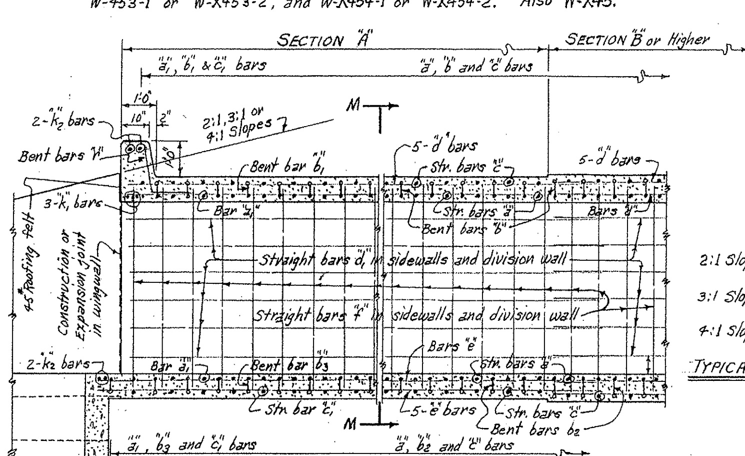


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

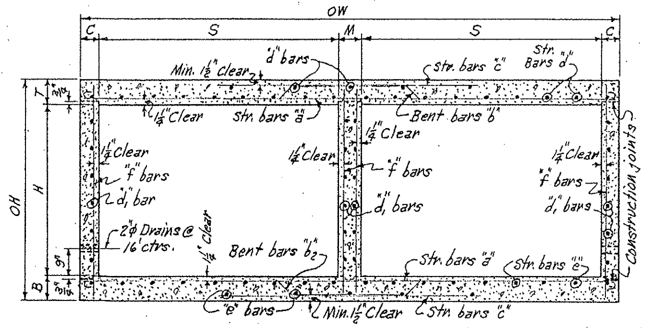


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should extend 1'-8" min. into SECTION "B".

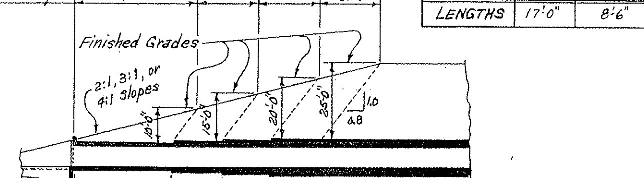


SECTION N-N



TYPICAL SECTION M-M

2:1 Slope	20'-0"	10'-0"	10'-0"	10'-0"
3:1 Slope	30'-0"	15'-0"	15'-0"	15'-0"
4:1 Slope	40'-0"	20'-0"	20'-0"	20'-0"

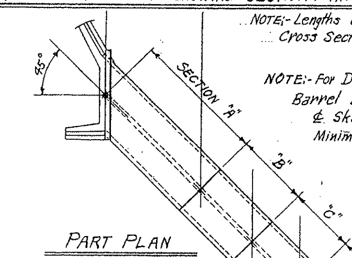


2:1 Slope =	SECTIONS	A = 12'-0"	B = 6'-0"	C = 6'-0"	MID-SECTION D - Varies
	Bar Group	A	B	C	D
3:1 Slope =	SECTIONS	A = 22'-0"	B = 11'-0"	C = 11'-0"	MID-SECTION D - Varies
	Bar Group	A	B	C	D
4:1 Slope =	SECTIONS	A = 32'-0"	B = 16'-0"	C = 16'-0"	MID-SECTION D - Varies
	Bar Group	A	B	C	D

These lengths are perpendicular to ℄ of roadway. See Table of Skew Lengths above.

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- For Details and Bar Lists for SECTIONS B, C & D, see Barrel Drawing Nos. R-200X-X2 and R-200X-X3.
℄ Skewed Length of A = 1.41421 × A.
Minimum ℄ Length on Skew = (0.5 OW + 1").

℄ LENGTH OF SECTIONS ON 45° SKEW

SLOPE	2:1		3:1		4:1	
SECTIONS	A	B & C	A	B & C	A	B & C
LENGTHS	17'-0"	8'-6"	31'-1½"	15'-6¾"	45'-3"	22'-7½"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS: A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0 to 25.0	A	B	C		D

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS: A	B	C		MID-SECTION AND BAR GROUP
5.0' to 9.5'	A				A
10.0' to 14.5'	A				B
15.0' to 19.5'	A	B			C
20.0' to 25.0	A	2@C			D

BARREL DIMENSIONS / * QUANTITIES - ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	Class S Concrete, Barrel Only 2:1 CU.YD.	3:1 CU.YD.	4:1 CU.YD.	Reinforcing Steel, Barrel, Apron and Headwall 2:1 LB.	3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	2 @ 9'	5'	90	19'-11"	10"	7"	9"	10¾"	6'-8¾"	28'-2"	30'-2"	27.71	50.73	73.76	4470	7570	10,752
		6'	108	20'-1"		7½"	10"		7'-8¾"	28'-4⅞"	30'-4¾"	29.73	54.44	79.14	4664	7860	11,138
		7'	126	20'-1"		7½"	10"		8'-8¾"	"	"	31.04	56.83	82.63	4833	8173	11,590
		8'	144	20'-2"		8"	10"		9'-8¾"	28'-6¼"	30'-6¼"	32.88	60.20	87.51	4992	8609	12,249
		9'	162	20'-5"		9"	11"		10'-8¾"	28'-10¼"	30'-10¼"	35.92	65.77	95.61	5306	9177	13,061
		10'	180	20'-8"		10"	12"		11'-8¾"	29'-2¾"	31'-2¾"	39.29	71.93	104.57	5708	9865	14,051
		11'	198	20'-10"		11"	12"		12'-8¾"	29'-5½"	31'-5½"	42.31	77.47	112.63	6015	10,421	14,820
	2 @ 10'	5'	100	21'-11"	10¾"	7"	9"	11½"	6'-10¼"	31'-0"	33'-0"	31.62	57.89	84.17	4803	8,295	11,686
		6'	120	22'-1"		7½"	10"		7'-10¼"	31'-2¾"	33'-2¾"	33.64	61.60	89.55	4934	8522	12,008
		7'	140	22'-1"		7½"	10"		8'-10¼"	"	"	34.97	64.02	93.08	5104	8838	12,464
		8'	160	22'-2"		8"	10"		9'-10¼"	31'-4⅛"	33'-4⅛"	36.79	67.35	97.92	5204	9050	13,005
		9'	180	22'-5"		9"	11"		10'-10¼"	31'-8⅜"	33'-8⅜"	39.87	72.99	106.11	5731	9831	14,035
		10'	200	22'-8"		10"	12"		11'-10¼"	32'-0⅝"	34'-0⅝"	43.25	79.18	115.12	6133	10,521	14,921
		11'	220	22'-10"		11"	12"		12'-10¼"	32'-3½"	34'-3½"	46.27	84.72	123.17	6431	11,068	15,680
		12'	240	23'-0"		12"	12"		13'-10¼"	32'-6⅜"	34'-6¼"	49.52	90.67	131.81	6693	11,552	16,332
	2 @ 11'	6'	132	24'-2"	11¾"	8"	10"	12½"	8'-0¼"	34'-2⅜"	36'-2"	38.93	71.28	103.62	6013	10,168	14,436
		7'	154	24'-2"		8"	10"		9'-0¼"	"	"	40.29	73.77	107.24	6144	10,402	14,780
		8'	176	24'-2"		8"	10"		10'-0¼"	"	"	41.67	76.29	110.91	6457	10,853	15,366
		9'	198	24'-5"		9"	11"		11'-0¼"	34'-6⅜"	36'-6⅛"	44.76	81.95	119.14	6801	11,574	16,456
		10'	220	24'-8"		10"	12"		12'-0¼"	34'-10⅝"	36'-10½"	48.18	88.21	128.24	7219	12,285	17,364
		11'	242	24'-10"		11"	12"		13'-0¼"	35'-1⅜"	37'-1½"	51.22	93.78	136.34	7524	12,825	18,139
		12'	264	25'-0"		12"	12"		14'-0¼"	35'-4¼"	37'-4¼"	54.47	99.72	144.98	7958	13,802	19,552
	2 @ 12'	6'	144	26'-2"	12½"	8"	10"	13½"	8'-2"	37'-0⅛"	39'-0"	43.88	80.33	116.79	6870	11,667	16,474
		7'	168	26'-2"		8"	10"		9'-2"	"	"	45.25	82.85	120.46	6966	11,840	16,724
		8'	192	26'-2"		8"	10"		10'-2"	"	"	46.61	85.34	124.08	7318	12,477	17,651
		9'	216	26'-5"		9"	11"		11'-2"	37'-4½"	39'-4¼"	49.73	91.04	132.36	7658	13,083	18,388
		10'	240	26'-8"		10"	12"		12'-2"	37'-8½"	39'-8½"	53.18	97.36	141.54	7962	13,695	19,430
		11'	264	26'-10"		11"	12"		13'-2"	37'-11⅜"	39'-11½"	56.24	102.96	149.69	8317	14,286	20,259
		12'	288	27'-0"		12"	12"		14'-2"	38'-2¼"	40'-2¼"	59.50	108.94	158.38	8896	15,233	21,647

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes and one add'l lap for half of bars for 3:1 slopes

BAR LIST FOR SECTION "A" ON 45° SKEW - ONE END ONLY.

Section & Bar Group: SECTION "A" & BAR GROUP "A". Length of Section: 2:1 = 17'-0"; 3:1 = 31'-1½"; 4:1 = 45'-3". Depth of Cover D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars — Straight, in top and bottom slab of barrel. "a1" bars — Straight, in top and bottom slab of barrel (two of each length). "b" bars — Bent (see diagrams below), in bottom of top slab bent up over Division Wall, hooked; alternate with "a" and "c" bars.

S	H	"a" Size	Spacing	No. 2:1	3:1	4:1	Length	"a1" Size	Spacing	No. Req'd	Length Max.	Min.	"b" Size	Spacing	No. 2:1	3:1	4:1	Length	X	Y	Z
2@9'	5'	#5	11"	17	47	79	19'-8"	#5	11"	36	18'-9"	3'-2"	#6	11"	8	23	38	21'-2"	0'-6½"	4'-2"	7'-2"
	6'			17	47	79	19'-10"			36	18'-11"	3'-4"			8	23	38	21'-4"	"	4'-3"	7'-2½"
	7'			17	47	79	19'-10"			36	18'-11"	"			8	23	38	21'-4"	"	"	7'-2½"
	8'			17	47	79	19'-11"			38	19'-0"	2'-6"			7	23	38	21'-5"	"	"	7'-3"
	9'			17	47	79	20'-2"			38	19'-3"	2'-9"			7	23	38	21'-8"	"	4'-4"	7'-4"
	10'			17	47	79	20'-5"			38	19'-6"	3'-0"			7	23	38	21'-11"	"	4'-5"	7'-5"
	11'			17	47	79	20'-7"			38	19'-8"	3'-2"			7	23	38	22'-1"	0'-6½"	4'-5"	7'-6"
2@10'	5'	#5	12"	13	43	71	21'-8"	#5	12"	38	20'-8"	2'-8"	#6	12"	6	20	34	23'-2"	0'-7¾"	4'-6½"	7'-11"
	6'			13	43	71	21'-10"			38	20'-10"	2'-10"			6	20	34	23'-4"	"	4'-7½"	7'-11½"
	7'			13	43	71	21'-10"			38	20'-10"	"			6	20	34	23'-4"	"	"	"
	8'			13	41	71	21'-11"			38	20'-11"	2'-11"			6	20	34	23'-5"	"	"	8'-0"
	9'			13	41	71	22'-2"			38	21'-2"	3'-2"			6	20	34	23'-8"	"	4'-8½"	8'-1"
	10'			13	41	69	22'-5"			40	21'-5"	2'-5"			6	20	34	23'-11"	"	4'-9½"	8'-2"
	11'			13	41	69	22'-7"			40	21'-7"	2'-7"			6	20	34	24'-1"	"	4'-9½"	8'-3"
	12'			13	41	69	22'-9"			40	21'-9"	2'-9"			5	20	34	24'-3"	0'-7¾"	4'-9½"	8'-4"
2@11'	6'	#5	12"	11	39	69	23'-11"	#5	12"	42	22'-11"	2'-11"	#7	12"	5	19	33	25'-8"	0'-8"	5'-0"	8'-9"
	7'			11	39	69	23'-11"			42	22'-11"	"			5	19	33	25'-8"	"	"	"
	8'			11	39	69	23'-11"			42	22'-11"	"			5	19	33	25'-8"	"	"	"
	9'			11	39	69	24'-2"			42	23'-2"	3'-2"			5	19	33	25'-11"	"	5'-1"	8'-10"
	10'			11	39	67	24'-5"			44	23'-5"	2'-5"			5	19	33	26'-2"	"	5'-2"	8'-11"
	11'			11	39	67	24'-7"			44	23'-7"	2'-7"			5	19	33	26'-4"	"	5'-2"	9'-0"
	12'			11	39	67	24'-9"			44	23'-9"	2'-9"			4	19	33	26'-6"	0'-8"	5'-2"	9'-1"
2@12'	6'	#5	11"	11	41	73	25'-11"	#5	11"	50	25'-0"	3'-0"	#7	11"	4	20	35	27'-8"	0'-8¾"	5'-4½"	9'-6"
	7'			11	41	73	25'-11"			50	25'-0"	"			4	20	35	27'-8"	"	"	"
	8'			11	41	73	25'-11"			50	25'-0"	"			4	20	35	27'-8"	"	"	"
	9'			11	41	71	26'-2"			50	25'-3"	3'-3"			4	20	35	27'-11"	"	5'-5½"	9'-7"
	10'			9	41	71	26'-5"			52	25'-6"	2'-7"			4	19	35	28'-2"	"	5'-6½"	9'-8"
	11'			9	41	71	26'-7"			52	25'-8"	2'-9"			4	19	35	28'-4"	"	5'-6½"	9'-9"
	12'			9	41	71	26'-9"			52	25'-10"	2'-11"			4	19	35	28'-6"	0'-8¾"	5'-6½"	9'-10"

"b1" bars — Bent, in bottom of top slab-some bent up over Division Wall-one end hooked; alt. with "a1" and "c" or "c1" bars. "b2" bars — Bent, in top of bottom slab bent down under Division Wall-hooked; alternate with "a" and "c" bars.

S	H	"b1" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	Min.	"b2" Size	Spacing	No. 2:1	3:1	4:1	Length	X	Y	Z
2@9'	5'	#6	11"	19	20'-2"	3'-3"	19'-2"	2'-8"	#6	11"	9	24	39	21'-3"	0'-7¾"	4'-0½"	7'-2"
	6'			19	20'-4"	3'-5"	19'-4"	2'-10"			9	24	39	21'-5"	"	4'-1½"	7'-2½"
	7'			19	20'-4"	"	"	"			9	24	39	21'-5"	"	"	7'-2½"
	8'			19	20'-5"	3'-6"	19'-5"	2'-11"			8	24	39	21'-6"	"	"	7'-3"
	9'			19	20'-8"	3'-9"	19'-8"	3'-2"			8	24	39	21'-9"	"	4'-2½"	7'-4"
	10'			20	20'-11"	3'-1"	19'-11"	2'-6"			8	24	39	22'-0"	"	4'-3½"	7'-5"
	11'			20	21'-1"	3'-3"	20'-1"	2'-8"			8	24	39	22'-2"	0'-7¾"	4'-3½"	7'-6"
2@10'	5'	#6	12"	19	22'-2"	3'-8"	21'-1"	3'-1"	#6	12"	7	21	35	23'-3"	0'-8"	4'-5"	7'-11"
	6'			19	22'-4"	3'-10"	21'-3"	3'-3"			7	21	35	23'-5"	"	4'-6"	7'-11½"
	7'			19	22'-4"	"	"	"			7	21	35	"	"	"	"
	8'			19	22'-5"	3'-11"	21'-4"	3'-4"			7	21	35	23'-6"	"	"	8'-0"
	9'			20	22'-8"	3'-2"	21'-7"	2'-7"			7	21	35	23'-9"	"	4'-7"	8'-1"
	10'			20	22'-11"	3'-5"	21'-10"	2'-10"			7	21	35	24'-0"	"	4'-8"	8'-2"
	11'			20	23'-1"	3'-7"	22'-0"	3'-0"			7	21	35	24'-2"	"	4'-8"	8'-3"
	12'			20	23'-3"	3'-9"	22'-2"	3'-2"			6	21	35	24'-4"	0'-8"	4'-8"	8'-4"
2@11'	6'	#7	12"	21	24'-6"	4'-0"	23'-4"	3'-4"	#7	12"	6	20	34	25'-9"	0'-8¾"	4'-10½"	8'-9"
	7'			21	24'-6"	"	"	"			6	20	34	"	"	"	"
	8'			21	24'-6"	"	"	"			6	20	34	"	"	"	"
	9'			22	24'-9"	3'-3"	23'-7"	2'-7"			6	20	34	26'-0"	"	4'-11½"	8'-10"
	10'			22	25'-0"	3'-6"	23'-10"	2'-10"			6	20	34	26'-3"	"	5'-0½"	8'-11"
	11'			22	25'-2"	3'-8"	24'-0"	3'-0"			6	20	34	26'-5"	"	5'-0½"	9'-0"
	12'			22	25'-4"	3'-10"	24'-2"	3'-2"			5	20	34	26'-7"	0'-8¾"	5'-0½"	9'-1"
2@12'	6'	#7	11"	26	26'-8"	3'-2"	25'-5"	2'-6"	#7	11"	5	21	36	27'-9"	0'-9¾"	5'-2½"	9'-6"
	7'			26	26'-8"	"	"	"			5	21	36	"	"	"	"
	8'			26	26'-8"	"	"	"			5	21	36	"	"	"	"
	9'			26	26'-11"	3'-5"	25'-8"	2'-9"			5	21	36	28'-0"	"	5'-3½"	9'-7"
	10'			26	27'-2"	3'-8"	25'-11"	3'-0"			5	20	36	28'-3"	"	5'-4½"	9'-8"
	11'			26	27'-4"	3'-10"	26'-1"	3'-2"			5	20	36	28'-5"	"	5'-4½"	9'-9"
	12'			26	27'-6"	4'-0"	26'-3"	3'-4"			5	20	36	28'-7"	0'-9¾"	5'-4½"	9'-10"

"b3" bars — Bent, in top of bottom slab-some bent down under Division Wall-one end hooked; alt. with "a1" and "c" or "c1" bars. "c" bars — Straight, in top and bottom slab of barrel; alternate with "b" and "b2" bars. "c1" bars — Straight, in top and bottom slab of barrel; alt. with "b1" & "b3" bars (two of each length).

S	H	"b3" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	Min.	"c" Size	Spacing	No. 2:1	3:1	4:1	Length	"c1" Size	Spacing	No. Req'd	Length Max.	Min.
2@9'	5'	#6	11"	19	20'-3"	3'-3"	19'-2"	2'-8"	#7	11"	27	57	89	9'-9"	#7	11"	14	9'-3"	2'-10"
	6'			19	20'-5"	3'-5"	19'-4"	2'-10"			27	57	89	9'-10"			14	9'-4"	2'-11"
	7'			19	"	"	"	"			27	57	89	"			14	"	"
	8'			19	20'-6"	3'-6"	19'-5"	2'-11"			27	57	89	"			14	9'-5"	3'-0"
	9'			19	20'-9"	3'-9"	19'-8"	3'-2"			27	57	89	9'-11"			14	9'-7"	3'-2"
	10'			20	21'-0"	3'-1"	19'-11"	2'-6"			27	57	89	10'-0"			14	9'-9"	3'-4"
	11'			20	21'-2"	3'-3"	20'-1"	2'-8"			27	57	89	"			16	9'-10"	2'-6"
2@10'	5'	#6	12"	19	22'-2"	3'-8"	21'-1"	3'-1"	#8	12"	23	53	81	10'-9"	#8	12"	16	10'-3"	3'-3"
	6'			19	22'-4"	3'-10"	21'-3"	3'-3"			23	53	81	10'-10"			16	10'-4"	3'-4"
	7'			19	"	"	"	"			23	53	81	"			16	"	"
	8'			19	22'-5"	3'-11"	21'-4"	3'-4"			23	51	81	"			18	10'-5"	2'-5"
	9'			20	22'-8"	3'-2"	21'-7"	2'-7"			23	51	81	10'-11"			18	10'-7"	2'-7"
	10'			20	22'-11"	3'-5"	21'-10"	2'-10"			23	51	79	11'-0"			18	10'-9"	2'-9"
	11'			20	23'-1"	3'-7"	22'-0"	3'-0"			23	51	79	"			18	10'-10"	2'-10"
	12'			20	23'-3"	3'-9"	22'-2"	3'-2"			23	51	79	"			18	10'-11"	2'-11"
2@11'	6'	#7	12"	21	24'-7"	4'-0"	23'-4"	3'-4"	#8	12"	23	51	81	11'-10"	#8	12"	18	10'-11"	2'-11"
	7'			21	"	"	"	"			23	51	81	"			18	"	"
	8'			21	"	"	"	"			23	51	81	"			18	"	"
	9'			22	24'-10"	3'-3"	23'-7"	2'-7"			23	51	81	11'-11"			18	11'-1"	3'-1"
	10'			22	25'-1"	3'-6"	23'-10"	2'-10"			23	51	79	12'-0"			18	11'-3"	3'-3"
	11'			22	25'-3"	3'-8"	24'-0"	3'-0"			23	51	79	"			18	11'-4"	3'-4"
	12'			22	25'-5"	3'-10"	24'-2"	3'-2"			23	51	79	"			20	11'-5"	2'-5"
2@12'	6'	#7	11"	26	26'-9"	3'-2"	25'-5"	2'-6"	#8	11"	25	55	87	12'-10"	#8	11"	22	12'-1"	2'-11"
	7'			26	"	"	"	"			25	55	87	"			22	"	"
	8'			26	"	"	"	"			25	55	87	"			22	"	"
	9'			26	27'-0"	3'-5"	25'-8"	2'-9"			25	55	85	12'-11"			22	12'-3"	3'-1"
	10'			26	27'-3"	3'-8"	25'-11"	3'-0"			23	55	85	13'-0"			22	12'-5"	3'-3"
	11'			26	27'-5"	3'-10"	26'-1"	3'-2"			23	55	85	"			22	12'-6"	3'-4"
	12'			26	27'-7"	4'-0"	26'-3"	3'-4"			23	55	85	"			24	12'-7"	2'-6"

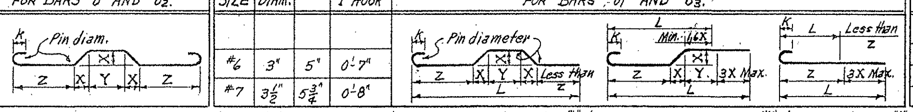
"d" bars — Straight, longitudinal in top slab of barrel. "d1" bars — Straight, longitudinal in sidewalls and division wall. "e" bars — Straight, longitudinal in bottom slab of barrel. "f" bars — Straight, verticals in sidewalls and division wall. "k1" bars — Straight, in bottom of headwall. "k2" bars — Straight, in top of headwall and apron (2 each).

⊙ Lengths of "d", "d1" and "e" bars vary - Ave. lengths: "d" bars: 2:1 = 18'-7", ⊙3:1 = 32'-9", ⊙4:1 = 46'-10"; "d1" bars: 2:1 = 18'-7", ⊙3:1 = 32'-9", ⊙4:1 = 46'-10"; "e" bars: 2:1 = 19'-11", ⊙3:1 = 34'-1", ⊙4:1 = 48'-2".

S	H	"d" Size	Spacing	No. Req'd	"d1" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd	"f" Size	Spacing	No. 2:1	3:1	4:1	Length	"k1" Size	No. Req'd	Length	"k2" Size	No. Req'd	Length
2@9'	5'	#4	12"	25	#4	12"	20	#4	12"	25	#4	12"	69	125	182	6'-5"	#8	3	27'-9"	#8	4	29'-10"
	6'			25			24			25			69	125	182	7'-5"		3	28'-0"		4	30'-1"
	7'			25			28			25		10"	82	150	218	8'-5"		3	"		4	"
	8'			25			32			25	#5	12"	69	125	182	9'-5"		3	28'-1"		4	30'-2"
	9'			25			36			25		10"	82	150	218	10'-5"		3	28'-6"		4	30'-7"
	10'			25			40			25	#6	12"	69	125	182	11'-5"		3	28'-10"		4	30'-11"
	11'			25			44			25		11"	75	137	198	12'-5"		3	29'-1"		4	31'-2"
2@10'	5'	#4	12"	27	#4	12"	20	#4	12"	27	#4	12"	69	125	182	6'-7"	#8	3	30'-7"	#8	4	32'-8"
	6'			27			24			27			69	125	182	7'-7"		3	30'-10"		4	32'-11"
	7'			27			28			27		10"	82	150	218	8'-7"		3	"		4	"
	8'			27			32			27	#5	12"	69	125	182	9'-7"		3	30'-11"		4	33'-0"
	9'			27			36			27		10"	82	150	218	10'-7"		3	31'-4"		4	33'-5"
	10'			27			40			27	#6	12"	69	125	182	11'-7"		3	31'-8"		4	33'-9"
	11'			27			44			27		11"	75	137	198	12'-7"		3	31'-11"		4	34'-0"
	12'			27			48			27		10"	82	150	218	13'-7"		3	32'-1"		4	34'-2"
2@11'	6'	#4	12"	29	#4	12"	24	#4	12"	29	#4	12"	69	125	182	7'-9"	#9	3	33'-9"	#9	4	35'-10"
	7'			29			28			29		11"	75	137	198	8'-9"		3	"		4	"
	8'			29			32			29	#5	12"	69	125	182	9'-9"		3	"		4	"
	9'			29			36			29		10"	82	150	218	10'-9"		3	34'-1"		4	36'-2"
	10'			29			40			29	#6	12"	69	125	182	11'-9"		3	34'-6"		4	36'-7"
	11'			29			44			29		11"	75	136	198	12'-9"		3	34'-8"		4	36'-10"
	12'			29			48			29		9"	91	166	242	13'-9"		3	34'-11"		4	37'-0"
2@12'	6'	#4	12"	31	#4	12"	24	#4	12"	31	#4	12"	69	125	182	7'-11"	#9	3	36'-7"	#9	4	38'-8"
	7'			31			28			31			69	125	182	8'-11"		3	"		4	"
	8'			31			32			31	#5	12"	69	125	182	9'-11"		3	"		4	"
	9'			31			36			31		10"	82	150	218	10'-11"		3	36'-11"		4	39'-0"
	10'			31			40			31	#6	12"	69	125	182	11'-11"		3	37'-4"		4	39'-5"
	11'			31			44			31		11"	75	136	198	12'-11"		3	37'-7"		4	39'-8"
	12'			31			48			31		9"	92	166	242	13'-11"		3	37'-9"		4	39'-10"

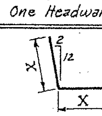
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"



SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#4	12"±	29	3'-1"	1'-6½"
10'	#4	12"±	32	3'-2"	1'-7"
11'	#4	12"±	35	3'-4"	1'-8"
12'	#4	12"±	38	3'-6"	1'-9"

Dowel bars "r" in One Headwall.



NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as for "b" bars and for "b3" bars same as for "b2" bars.

◤ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊙ To Longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bars and for 3:1 slopes add one splice for for one-half of bars. (1'-3" Lap)

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division wall and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45
For Barrels of 10' and 12' Spans, see Drawing No. R-200X-X2.
For " " 9' and 11' Spans, " " No. R-200X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW — SECTIONS "A" ONLY

9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES
DOUBLES — OVER 5'-0" COVER

STANDARD DRAWING No. R-245X-2

Designed by:- W.C.H. 1-29-63 — Checked by:- R.H.S. 5-29-63
Drawn by:- W.C.H. 6-29-62 — Checked by:- 7-20-62
Quantities by:- W.C.H. 8-25-64, 10-30-64 — Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 45° SKEWED ENDS

"a" bars: Straight. In Top and Bottom Slab of Barrel.
"a1" bars (▼): Straight. In Top and Bottom Slab of Barrel - (Four of Each Length)

Depth of Cover D	Clear Span S	Clear Height H	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Req'd	"a1" Length Max.	"a1" Length Min.
0'-0" to 5'-0" Maximum	3 @ 4'	2'	#5	12"	96	14'-1"	#5	12"	44	16'-1"	3'-1"
		3'			96	14'-1"			44	"	"
		4'			96	14'-1"			44	"	"
		5'			96	14'-1"			44	"	"
		6'			94	14'-5"			48	16'-5"	2'-5"
	3 @ 5'	3'	#6	12"	90	17'-1"	#6	12"	56	16'-1"	3'-1"
		4'			90	17'-1"			56	"	"
		5'			90	17'-1"			56	"	"
		6'			88	17'-5"			60	16'-5"	2'-5"
		7'			88	17'-8"			60	16'-8"	2'-8"
	3 @ 6'	3'	#6	11"	90	20'-1"	#6	11"	76	19'-2"	2'-8"
		4'			90	20'-1"			76	"	"
		5'			90	20'-1"			76	"	"
		6'			90	20'-5"			76	19'-6"	3'-0"
		7'			90	20'-8"			80	19'-9"	2'-4"
		8'			90	20'-9"			80	19'-10"	2'-5"
	3 @ 7'	4'	#6	12"	78	23'-1"	#6	12"	80	22'-1"	3'-1"
		5'			78	23'-1"			80	"	"
		6'			76	23'-5"			84	22'-5"	2'-5"
		7'			76	23'-8"			84	22'-8"	2'-8"
		8'			76	23'-9"			84	22'-9"	2'-9"
		9'			76	24'-1"			84	23'-1"	3'-1"
	3 @ 8'	4'	#6	11"	78	26'-1"	#6	11"	100	25'-2"	3'-2"
		5'			76	26'-5"			104	25'-6"	2'-7"
		6'			76	26'-5"			104	"	"
		7'			76	26'-8"			104	25'-9"	2'-10"
		8'			76	26'-9"			104	25'-10"	2'-11"
		9'			76	27'-1"			104	26'-2"	3'-3"
		10'			74	27'-5"			104	26'-6"	3'-7"

"b" bars: Bent - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.
"b1" bars (▼): Bent - See Diagrams below. In Bottom of Top Slab - some bent up over Division Walls - one end hooked (2 of Each Length). Alternate with "a1" and "c" or "c1" bars.

S	H	"b" Size	"b" Spacing	"b" No. Req'd	"b" Length	X	Y	Z	"b1" Size	"b1" Spacing	"b1" No. Req'd	"b1" Length Max.	"b1" Length Min.	L Max.	L Min.
3 @ 4'	2'	#5	12"	45	15'-4"	0'-3"	2'-2"	3'-4¾"	#5	12"	24	14'-7"	3'-0"	13'-6"	2'-6"
	3'			45	15'-4"	"	"	"			24	"	"	"	"
	4'			45	15'-4"	"	"	"			24	"	"	"	"
	5'			45	15'-4"	"	"	"			24	"	"	"	"
	6'			45	15'-8"	0'-3"	2'-3"	3'-5¼"			24	14'-8"	3'-4"	13'-10"	2'-10"
3 @ 5'	3'	#5	12"	42	18'-5"	0'-3½"	2'-7"	4'-1¾"	#5	12"	30	17'-5"	3'-0"	16'-6"	2'-6"
	4'			42	18'-5"	"	"	"			30	"	"	"	"
	5'			42	18'-5"	"	"	"			30	"	"	"	"
	6'			42	18'-9"	"	2'-8"	4'-2¼"			30	17'-9"	3'-4"	16'-10"	2'-10"
	7'			42	19'-0"	0'-3½"	2'-9"	4'-2¾"			30	18'-0"	3'-7"	17'-1"	3'-1"
3 @ 6'	3'	#5	11"	43	21'-6"	0'-4"	3'-0"	4'-10¾"	#5	11"	38	20'-7"	3'-7"	19'-7"	3'-1"
	4'			43	21'-6"	"	"	"			38	"	"	"	"
	5'			43	21'-6"	"	"	"			38	"	"	"	"
	6'			42	21'-10"	"	3'-1"	4'-11¼"			40	20'-11"	3'-0"	19'-11"	2'-6"
	7'			42	22'-1"	"	3'-2"	4'-11¾"			40	21'-2"	3'-3"	20'-2"	2'-9"
	8'			42	22'-2"	0'-4"	3'-2"	5'-0¼"			40	21'-3"	3'-4"	20'-3"	2'-10"
3 @ 7'	4'	#6	12"	36	24'-8"	0'-4½"	3'-5"	5'-7"	#6	12"	42	23'-8"	3'-1"	22'-6"	2'-6"
	5'			36	24'-8"	"	"	"			42	"	"	"	"
	6'			36	25'-0"	"	3'-6"	5'-8"			42	24'-0"	3'-5"	22'-10"	2'-10"
	7'			36	25'-3"	"	3'-7"	5'-8½"			42	24'-3"	3'-8"	23'-1"	3'-1"
	8'			36	25'-4"	"	"	5'-9"			42	24'-4"	3'-9"	23'-2"	3'-2"
	9'			35	25'-8"	0'-4½"	3'-8"	5'-10"			44	24'-8"	3'-1"	23'-6"	2'-6"
3 @ 8'	4'	#6	11"	36	27'-9"	0'-5"	3'-10"	6'-4"	#6	11"	52	26'-9"	3'-3"	25'-7"	2'-8"
	5'			36	28'-1"	"	3'-11"	6'-5"			52	27'-1"	3'-7"	25'-11"	3'-0"
	6'			36	28'-1"	"	"	"			52	"	"	"	"
	7'			36	28'-4"	"	4'-0"	6'-5½"			52	27'-4"	2'-11"	26'-2"	2'-4"
	8'			36	28'-5"	"	"	6'-6"			52	27'-5"	3'-0"	26'-3"	2'-5"
	9'			35	28'-9"	"	4'-1"	6'-7"			52	27'-9"	3'-4"	26'-7"	2'-9"
	10'			35	29'-1"	0'-5"	4'-2"	6'-8"			52	28'-1"	3'-8"	26'-11"	3'-1"

"b2" bars: Bent - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.
"b3" bars (▼): Bent - See Diagrams below. In Top of Bottom Slab - some bent down under Division Walls - one end hooked (2 of Each Length). Alternate with "a1" and "c" or "c1" bars.

S	H	"b2" Size	"b2" Spacing	"b2" No. Req'd	"b2" Length	X	Y	Z	"b3" Size	"b3" Spacing	"b3" No. Req'd	"b3" Length Max.	"b3" Length Min.	L Max.	L Min.
3 @ 4'	2'	#5	12"	47	15'-3"	0'-2½"	2'-3"	3'-4½"	#5	12"	24	14'-3"	3'-0"	13'-6"	2'-6"
	3'			47	15'-3"	"	"	"			24	"	"	"	"
	4'			47	15'-3"	"	"	"			24	"	"	"	"
	5'			47	15'-3"	"	"	"			24	"	"	"	"
	6'			47	15'-7"	0'-2½"	2'-4"	3'-5½"			24	14'-7"	3'-4"	13'-10"	2'-10"
3 @ 5'	3'	#5	12"	44	18'-4"	0'-3"	2'-8"	4'-1¼"	#5	12"	30	17'-4"	3'-0"	16'-6"	2'-6"
	4'			44	18'-4"	"	"	"			30	"	"	"	"
	5'			44	18'-4"	"	"	"			30	"	"	"	"
	6'			44	18'-8"	"	2'-9"	4'-2¼"			30	17'-8"	3'-4"	16'-10"	2'-10"
	7'			44	18'-11"	0'-3"	2'-10"	4'-2¾"			30	17'-11"	3'-7"	17'-1"	3'-1"
3 @ 6'	3'	#5	11"	45	21'-5"	0'-3½"	3'-1"	4'-10¼"	#5	11"	38	20'-6"	3'-7"	19'-7"	3'-1"
	4'			45	21'-5"	"	"	"			38	"	"	"	"
	5'			45	21'-5"	"	"	"			38	"	"	"	"
	6'			44	21'-9"	"	3'-2"	4'-11¼"			40	20'-10"	3'-0"	19'-11"	2'-6"
	7'			44	22'-0"	"	3'-3"	4'-11¾"			40	21'-1"	3'-3"	20'-2"	2'-9"
	8'			44	22'-1"	0'-3½"	3'-3"	5'-0¼"			40	21'-2"	3'-4"	20'-3"	2'-10"
3 @ 7'	4'	#6	12"	38	24'-8"	0'-4½"	3'-5½"	5'-7"	#6	12"	42	23'-7"	3'-1"	22'-6"	2'-6"
	5'			38	24'-8"	"	"	"			42	"	"	"	"
	6'			38	25'-0"	"	3'-6½"	5'-8"			42	23'-11"	3'-5"	22'-10"	2'-10"
	7'			38	25'-3"	"	3'-7½"	5'-8½"			42	24'-2"	3'-8"	23'-1"	3'-1"
	8'			38	25'-4"	"	"	5'-9"			42	24'-3"	3'-9"	23'-2"	3'-2"
	9'			37	25'-8"	0'-4½"	3'-8½"	5'-10"			44	24'-7"	3'-1"	23'-6"	2'-6"
3 @ 8'	4'	#6	11"	38	27'-9"	0'-5"	3'-10"	6'-4"	#6	11"	52	26'-9"	3'-3"	25'-7"	2'-8"
	5'			38	28'-1"	"	3'-11"	6'-5"			52	27'-1"	3'-7"	25'-11"	3'-0"
	6'			38	28'-1"	"	"	"			52	"	"	"	"
	7'			38	28'-4"	"	4'-0"	6'-5½"			52	27'-4"	2'-11"	26'-2"	2'-4"
	8'			38	28'-5"	"	"	6'-6"			52	27'-5"	3'-0"	26'-3"	2'-5"
	9'			37	28'-9"	"	4'-1"	6'-7"			52	27'-9"	3'-4"	26'-7"	2'-9"
	10'			37	29'-1"	0'-5"	4'-2"	6'-8"			52	28'-1"	3'-8"	26'-11"	3'-1"

Straight bars:
"c" bars: In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars.
"c1" bars (▼): In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Four of each Length)
"d" bars: Longitudinal in Top Slab of Barrel. Length: 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap).
"d1" bars: Longitudinal in Sidewalls and Division Walls. Length: 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap).
"e" bars: Longitudinal in Bottom Slab of Barrel. Length: 2 @ 31'-10" for 60'-0" Length Barrel (1'-3" Lap).

S	H	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length	"c1" Size	"c1" Spacing	"c1" No. Req'd	"c1" Length Max.	"c1" Length Min.	"d" Size	"d" Spacing	"d" No. Req'd	"d1" Size	"d1" Spacing	"d1" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd
3 @ 4'	2'	#5	12"	104	9'-4"	#5	12	28	8'-9"	2'-9"	#5	12"	22	#4	12"	12	#4	12"	22
	3'			104	9'-4"			28	"	"			22			18			22
	4'			104	9'-4"			28	"	"			22			24			22
	5'			104	9'-4"			28	"	"			22			30			22
	6'			102	9'-6"			28	9'-6"	3'-0"			22			36			22
3 @ 5'	3'	#6	12"	102	11'-4"	#6	12"	36	10'-3"	2'-3"	#5	11½"	26	#4	12"	18	#4	12"	25
	4'			102	11'-4"			36	"	"			26			24			25
	5'			102	11'-4"			36	"	"			26			30			25
	6'			100	11'-6"			36	10'-6"	2'-6"			26			36			25
	7'			100	11'-8"			36	10'-8"	2'-8"			26			42			25
3 @ 6'	3'	#6	11"	102	13'-4"	#6	11"	48	13'-1"	3'-0"	#5	11½"	30	#4	12"	18	#4	12"	28
	4'			102	13'-4"			48	"	"			30			24			28
	5'			102	13'-4"			48	"	"			30			30			28
	6'			102	13'-6"			52	13'-4"	2'-4"			30			36			28
	7'			102	13'-8"			52	13'-6"	2'-6"			30			42			28
	8'			102	13'-8"			52	13'-7"	2'-7"			30			48			28
3 @ 7'	4'	#6	12"	94	15'-4"	#6	12	52	14'-3"	2'-3"	#5	11½"	32	#4	12"	24	#4	12"	31
	5'			94	15'-4"			52	"	"			32			30			31
	6'			94	15'-6"			52	14'-6"	2'-6"			32			36			31
	7'			94	15'-8"			52	14'-8"	2'-8"			32			42			31
	8'			94	15'-8"			52	14'-9"	2'-9"			32			48			31
	9'			94	15'-10"			52	15'-0"	3'-0"			32			54			31
3 @ 8'	4'	#6	11"	94	17'-4"	#6	11"	68	17'-2"	2'-6"	#5	11½"	36	#4	12"	24	#4	12"	35
	5'			92	17'-6"			68	17'-5"	2'-9"			36			30			35
	6'			92	17'-6"			68	"	"			36			36			35
	7'			96	17'-8"			64	16'-8"	2'-11"			36			42			35
	8'			96	17'-8"			64	16'-9"	3'-0"			36			48			35
	9'			96	17'-10"			68	17'-0"	2'-4"			36			54			35
	10'			94	18'-0"			68	17'-3"	2'-7"			36			60			35

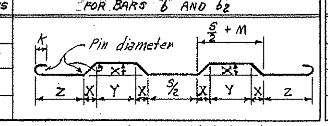
"f" bars: Straight. Verticals in Sidewalls and Division Walls.
"k1" bars (▼): Straight. In Bottom of Headwalls. (3 of Each Length per Headwall)
"k2" bars (▼): Straight. In Top of Headwalls and Aprons. (2 Each) ⊠

S	H	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k1" Size	"k1" No. Req'd	"k1" Length Max.	"k1" Length Min.	"k2" Size	"k2" No. Req'd	"k2" Length
3 @ 4'	2'	#4	12"	360	2'-10"	#5	6	19'-10"	—	#5	8	22'-0"
	3'			360	3'-10"		6	"	—		8	"
	4'			360	4'-10"		6	"	—		8	"
	5'			360	5'-10"		6	"	—		8	"
	6'			360	6'-10"		6	20'-4"	—		8	22'-6"
3 @ 5'	3'	#4	12"	360	3'-11"	#6	6	24'-1"	—	#6	8	26'-3"
	4'			360	4'-11"		6	"	—		8	"
	5'			360	5'-11"		6	"	—		8	"
	6'			360	6'-11"		6	24'-7"	—		8	26'-9"
	7'			360	7'-11"		6	24'-11"	—		8	27'-1"
3 @ 6'	3'	#4	12"	360	4'-0"	#6	6	28'-4"	—	#6	8	30'-6"
	4'			360	5'-0"		6	"	—		8	"
	5'			360	6'-0"		6	"	—		8	"
	6'			360	7'-0"		6	28'-10"	—		8	30'-11"
	7'			360	8'-0"		6	29'-2"	—		8	31'-4"
	8'		10"	432	9'-0"		6	29'-4"	—		8	31'-5"
3 @ 7'	4'	#4	12"	360	5'-1"	⊠ #7	12	22'-10"	12'-1"	⊠ #7	16	18'-7"
	5'			360	6'-1"		12	"	"		16	"
	6'			360	7'-1"		12	23'-2"	12'-3"		16	18'-9"
	7'			360	8'-1"		12	23'-5"	12'-4"		16	18'-11"
	8'		10"	432	9'-1"		12	23'-6"	12'-5"		16	19'-0"
	9'	#5	12"	360	10'-1"		12	23'-9"	12'-7"		16	19'-3"
3 @ 8'	4'	#4	12"	360	5'-2"	⊠ #7	12	25'-8"	13'-6"	⊠ #7	16	20'-8"
	5'			360	6'-2"		12	26'-0"	13'-8"		16	20'-11"
	6'			360	7'-2"		12	"	"		16	"
	7'			360	8'-2"		12	26'-2"	13'-10"		16	21'-1"
	8'		10"	432	9'-2"		12	26'-4"	13'-10"		16	21'-2"
	9'	#5	12"	360	10'-2"		12	26'-7"	14'-0"		16	21'-5"
	10'		11"	396	11'-2"		12	26'-11"	14'-2"		16	21'-7"

▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊠ These bars are spliced to make full length bars, "k1" bars being spliced at alt. division walls and "k2" bars at center of center span.

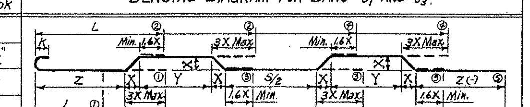
Bar Size	Pin Diam.	K	Add for 2 Hooks
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b2"



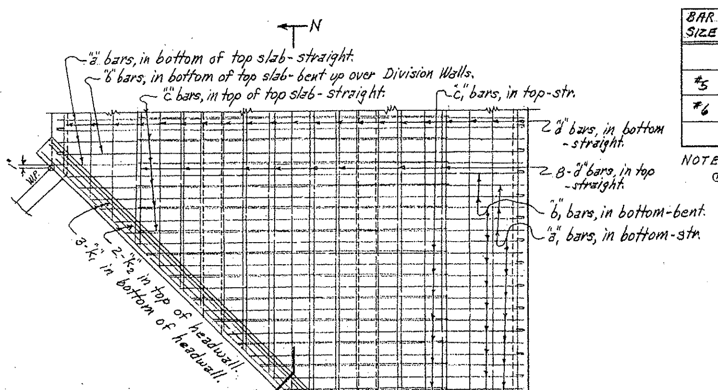
Bar Size	Pin Diam.	K	Add for 1 Hook
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b1" AND "b3"

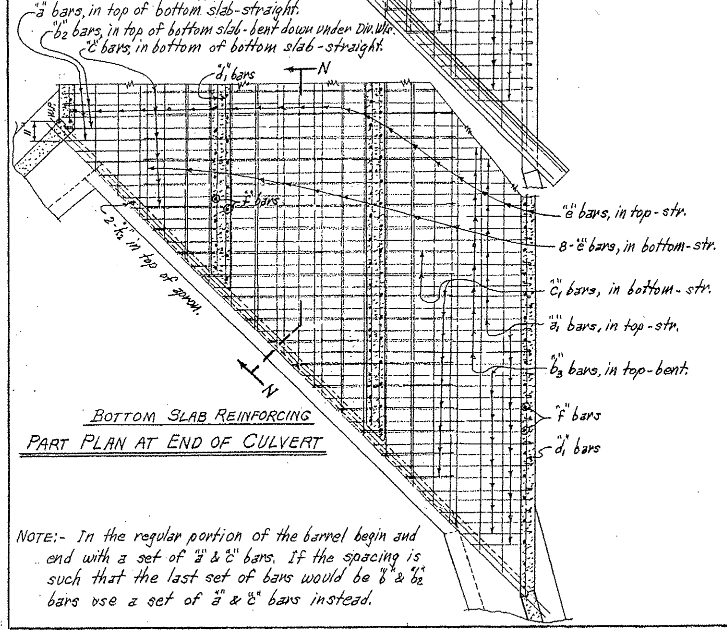


NOTE:- Dimensions are to centers of bars. (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars.
①②---⑤⑤ Min. & Max. Lengths of "L" for bars "b1" & "b3" for each type bend.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X345-1 or W-X453-2; and W-X454-1 or W-X454-2. Also W-X45.

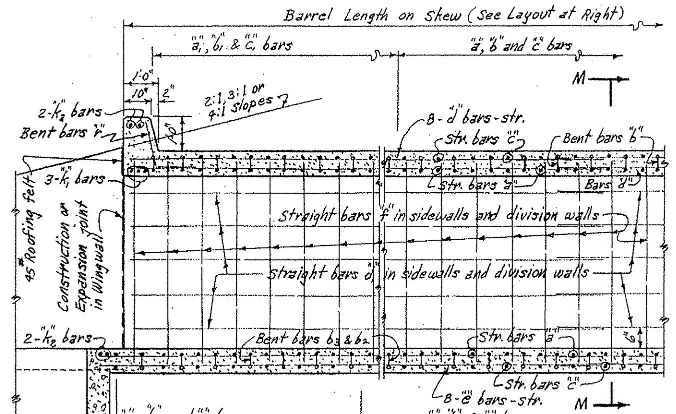


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

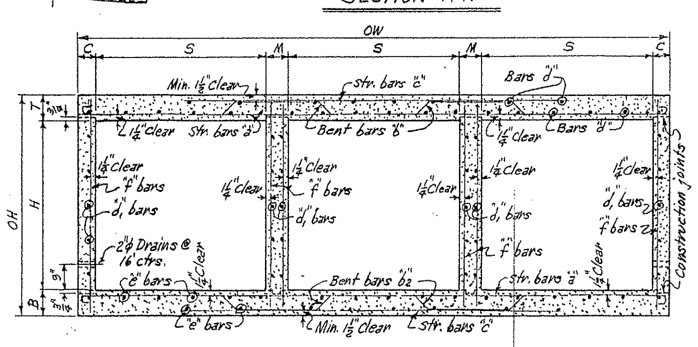


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

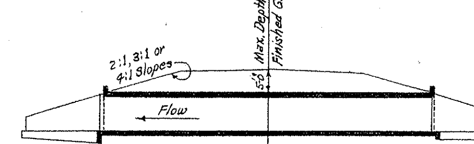
NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b2" bars use a set of "a" & "c" bars instead.



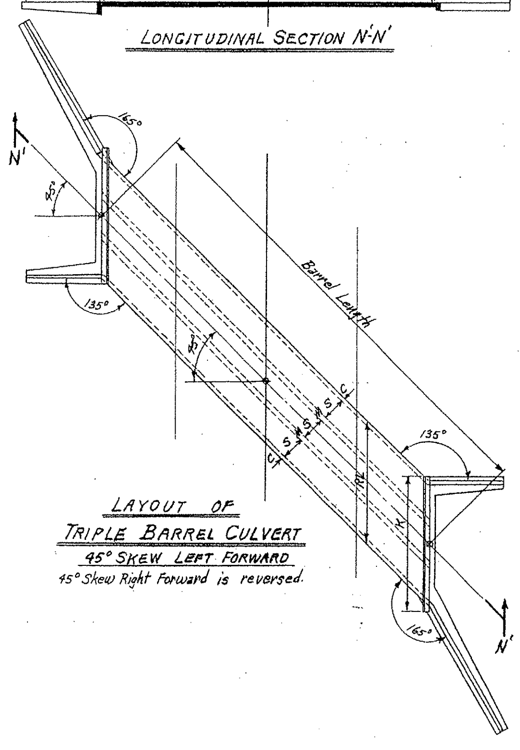
SECTION N-N



TYPICAL SECTION M-M



LONGITUDINAL SECTION N'-N'



LAYOUT OF TRIPLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

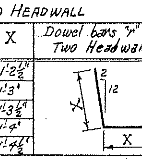
Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwall K	* Class S Conc. per Lin. Ft. of Barrel Cu. Yd.	Reinforcing Steel Total for 60'-0" Length of Barrel Lb.	Per Lin. Ft. of Barrel Lb.	Additional per Lap Lb.
5'-0"	3 @ 4'	2'	24	14'-4"	6½"	6"	8"	6"	3'-0½"	20'-3¾"	22'-3¼"	0.726	8,819	137.76	66.63
		3'	36	14'-4"		6"	8"		4'-0½"	"	"	0.812	9,304	145.78	71.64
		4'	48	14'-4"		6"	8"		5'-0½"	"	"	0.899	9,789	153.79	76.15
		5'	60	14'-4"		6"	8"		6'-0½"	"	"	0.985	10,274	161.81	81.66
		6'	72	14'-8"		7"	9"		7'-0½"	20'-8⅞"	22'-9"	1.158	10,906	171.56	86.67
	3 @ 5'	3'	45	17'-4"	7"	6"	8"	6½"	4'-1½"	24'-6⅞"	26'-6¾"	0.981	12,493	195.23	81.10
		4'	60	17'-4"		6"	8"		5'-1½"	"	"	1.068	12,978	203.25	86.11
		5'	75	17'-4"		6"	8"		6'-1½"	"	"	1.154	13,463	211.27	91.12
		6'	90	17'-8"		7"	9"		7'-1½"	24'-11⅞"	27'-0"	1.329	14,099	221.48	96.13
		7'	105	17'-11"		7½"	10"		8'-1½"	25'-4"	27'-4"	1.503	14,669	231.27	101.14
	3 @ 6'	3'	54	20'-4"	7½"	6"	8"	7"	4'-2½"	28'-9⅛"	30'-9"	1.169	15,035	236.39	90.56
		4'	72	20'-4"		6"	8"		5'-2½"	"	"	1.256	15,520	244.41	95.57
		5'	90	20'-4"		6"	8"		6'-2½"	"	"	1.342	16,005	252.42	100.58
		6'	108	20'-8"		7"	9"		7'-2½"	29'-2¾"	31'-2¾"	1.517	16,667	262.84	105.59
		7'	126	20'-11"		7½"	10"		8'-2½"	29'-7"	31'-7"	1.692	17,318	272.79	110.60
		8'	144	21'-0"		8"	10"		9'-2½"	29'-8⅜"	31'-8½"	1.829	18,274	288.48	115.61
	3 @ 7'	4'	84	23'-4"	8"	6"	8"	7¾"	5'-3¾"	33'-0"	35'-0"	1.480	18,175	279.99	101.55
		5'	105	23'-4"		6"	8"		6'-3¾"	"	"	1.566	18,660	288.01	106.56
		6'	126	23'-8"		7"	9"		7'-3¾"	33'-5⅝"	35'-5½"	1.743	19,302	298.53	111.57
		7'	147	23'-11"		7½"	10"		8'-3¾"	33'-9⅞"	35'-10"	1.919	19,953	308.55	116.58
		8'	168	24'-0"		8"	10"		9'-3¾"	33'-11⅛"	35'-11⅛"	2.056	20,926	324.34	121.59
		9'	189	24'-4"		9"	11"		10'-3¾"	34'-5"	36'-5"	2.294	22,493	350.27	126.60
	3 @ 8'	4'	96	26'-4"	8½"	6"	8"	8½"	5'-5"	37'-2⅝"	39'-3"	1.727	21,371	330.89	111.85
		5'	120	26'-8"		7"	9"		6'-5"	37'-8½"	39'-8½"	1.893	21,981	341.64	116.86
		6'	144	26'-8"		7"	9"		7'-5"	"	"	1.992	22,466	349.65	121.87
		7'	168	26'-11"		7½"	10"		8'-5"	38'-0¾"	40'-0¾"	2.168	23,135	359.85	126.88
		8'	192	27'-0"		8"	10"		9'-5"	38'-2¼"	40'-2¼"	2.306	24,047	375.76	131.89
		9'	216	27'-4"		9"	11"		10'-5"	38'-7⅞"	40'-8"	2.545	25,632	402.04	136.90
		10'	240	27'-8"		10"	12"		11'-5"	39'-1½"	41'-1½"	2.810	26,774	421.39	141.91

* For quantities in wings see Standard Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAPS:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DOWEL BARS FOR TWO HEADWALL

Span	Size	Spacing	No. Reqd	Length	X	Dowel bars "r" in Two Headwalls.
4'	#4	12"±	42	2'-5"	1'-2½"	
5'	#4	12"±	50	2'-6"	1'-3"	
6'	#4	12"±	58	2'-7"	1'-3½"	
7'	#4	12"±	68	2'-8"	1'-4"	
8'	#4	12"±	76	2'-9"	1'-4½"	

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
TRIPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-345X-01

Designed by:- W.C.H. 1-22-63. Checked by:- R.H.S. 5-17-63
Drawn by:- W.C.H. 7-20-64. Checked by:-
Quantities by:- W.C.H. 10-6-64. Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 45° SKEWED ENDS

D	S	H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH	"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel (Four of Each Length) SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#6	11"	70	29'-5"	#6	11"	116	28'-6"	2'-10"
		6'			70	29'-8"			116	28'-9"	3'-1"
		7'			70	29'-8"			116	"	"
		8'			70	29'-9"			116	28'-10"	3'-2"
		9'			68	30'-1"			120	29'-2"	2'-7"
		10'			68	30'-5"			120	29'-6"	2'-11"
		11'			68	30'-7"			120	29'-8"	3'-1"
	10' @ 3	5'	#7	11"	58	32'-5"	#7	12"	120	31'-5"	2'-5"
		6'			58	32'-8"			120	31'-8"	2'-8"
		7'			58	32'-8"			120	"	"
		8'			58	32'-9"			120	31'-9"	2'-9"
		9'			58	32'-11"			120	32'-1"	2'-11"
		10'			58	33'-1"			120	32'-3"	2'-7"
		11'			56	33'-5"			124	32'-5"	2'-5"
		12'			56	33'-7"			124	32'-7"	2'-7"
	11' @ 3	6'	#7	11"	56	35'-9"	#7	12"	144	34'-10"	2'-9"
		7'			56	35'-9"			144	"	"
		8'			56	35'-9"			144	"	"
		9'			56	36'-1"			144	35'-12"	3'-1"
		10'			56	36'-5"			144	35'-12"	2'-6"
		11'			54	36'-7"			148	35'-8"	2'-8"
		12'			54	36'-9"			148	35'-10"	2'-10"
	12' @ 3	6'	#7	11"	50	38'-9"	#7	11"	156	37'-10"	3'-0"
		7'			50	38'-9"			156	"	"
		8'			50	38'-9"			156	"	"
		9'			48	39'-5"			160	38'-2"	2'-5"
		10'			48	39'-5"			160	38'-6"	2'-9"
		11'			48	39'-7"			160	38'-8"	2'-11"
		12'			48	39'-9"			160	38'-10"	3'-1"

D	S	H	"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b₁" bars BENT - See Diagrams below. In Bottom of Top Slab - some bent up over Division Walls - one end hooked. (2 of Each Length) Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	L Max.	L Min.	L Max.	L Min.
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#6	11"	33	31'-12"	0'-5 5/8"	4'-4"	7'-2"	#6	11"	60	30'-2"	2'-11"	28'-11"	2'-4"	
		6'			32	31'-5"	"	4'-5"	7'-2 5/8"			60	30'-5"	3'-2"	29'-2"	2'-7"	
		7'			32	31'-5"	"	"	"			60	"	"	"	"	
		8'			32	31'-6"	"	"	7'-3"			60	30'-6"	3'-3"	29'-3"	2'-8"	
		9'			32	31'-10"	"	4'-6"	7'-4"			60	30'-10"	3'-7"	29'-7"	3'-0"	
		10'			32	32'-2"	"	4'-7"	7'-5"			62	31'-2"	3'-0"	29'-11"	2'-5"	
		11'			32	32'-4"	0'-5 5/8"	"	7'-6"			62	31'-4"	3'-2"	30'-1"	2'-7"	
	10' @ 3	5'	#6	12"	27	34'-3"	0'-6"	4'-9"	7'-11"	#6	12"	60	33'-2"	3'-5"	31'-10"	2'-10"	
		6'			27	34'-6"	"	4'-10"	7'-11 5/8"			60	33'-5"	3'-8"	32'-1"	3'-1"	
		7'			27	34'-6"	"	"	"			60	"	"	"	"	
		8'			27	34'-7"	"	"	8'-0"			60	33'-6"	3'-9"	32'-2"	3'-2"	
		9'			26	34'-11"	"	4'-11"	8'-1"			62	33'-10"	3'-11"	32'-6"	2'-6"	
		10'			26	35'-3"	"	5'-0"	8'-2"			62	34'-2"	3'-5"	32'-10"	2'-10"	
		11'			26	35'-5"	"	"	8'-3"			62	34'-4"	3'-7"	33'-0"	3'-0"	
		12'			26	35'-7"	0'-6"	5'-0"	8'-4"			62	34'-6"	3'-9"	33'-2"	3'-2"	
	11' @ 3	6'	#7	11"	26	37'-8"	0'-6 5/8"	5'-3"	8'-9"	#7	12"	72	36'-8"	3'-9"	35'-3"	3'-2"	
		7'			26	37'-8"	"	"	"			72	"	"	"	"	
		8'			26	37'-8"	"	"	"			72	"	"	"	"	
		9'			25	38'-0"	"	5'-4"	8'-10"			74	37'-0"	3'-2"	35'-7"	2'-7"	
		10'			25	38'-4"	"	5'-5"	8'-11"			74	37'-4"	3'-6"	35'-11"	2'-11"	
		11'			25	38'-6"	"	"	9'-0"			74	37'-6"	3'-8"	36'-1"	3'-1"	
		12'			25	38'-8"	0'-6 5/8"	5'-5"	9'-1"			74	37'-8"	3'-10"	36'-3"	3'-3"	
	12' @ 3	6'	#7	11"	22	40'-9"	0'-7"	5'-8"	9'-6"	#7	11"	80	39'-9"	3'-1"	38'-3"	2'-6"	
		7'			22	40'-9"	"	"	"			80	"	"	"	"	
		8'			22	40'-9"	"	"	"			80	"	"	"	"	
		9'			22	41'-1"	"	5'-9"	9'-7"			80	40'-1"	3'-5"	38'-7"	2'-10"	
		10'			22	41'-5"	"	5'-10"	9'-8"			80	40'-5"	3'-9"	38'-11"	3'-12"	
		11'			22	41'-7"	"	"	9'-9"			82	40'-7"	3'-10"	39'-1"	2'-5"	
		12'			22	41'-9"	0'-7"	5'-10"	9'-10"			82	40'-9"	3'-12"	39'-3"	2'-7"	

D	S	H	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b₃" bars BENT - See Diagrams below. In Top of Bottom Slab - some bent down under Division Walls - one end hooked. (2 of Each Length) Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	L Max.	L Min.	L Max.	L Min.
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#6	11"	35	31'-12"	0'-5 5/8"	4'-4"	7'-2"	#6	11"	60	30'-2"	2'-11"	28'-11"	2'-4"	
		6'			34	31'-5"	"	4'-5"	7'-2 5/8"			60	30'-5"	3'-2"	29'-2"	2'-7"	
		7'			34	31'-5"	"	"	"			60	"	"	"	"	
		8'			34	31'-6"	"	"	7'-3"			60	30'-6"	3'-3"	29'-3"	2'-8"	
		9'			34	31'-10"	"	4'-6"	7'-4"			60	30'-10"	3'-7"	29'-7"	3'-0"	
		10'			34	32'-2"	"	4'-7"	7'-5"			62	31'-2"	3'-0"	29'-11"	2'-5"	
		11'			34	32'-4"	0'-5 5/8"	"	7'-6"			62	31'-4"	3'-2"	30'-1"	2'-7"	
	10' @ 3	5'	#6	12"	29	34'-3"	0'-6"	4'-9"	7'-11"	#6	12"	60	33'-2"	3'-5"	31'-10"	2'-10"	
		6'			29	34'-6"	"	4'-10"	7'-11 5/8"			60	33'-5"	3'-8"	32'-1"	3'-1"	
		7'			29	34'-6"	"	"	"			60	"	"	"	"	
		8'			29	34'-7"	"	"	8'-0"			60	33'-6"	3'-9"	32'-2"	3'-2"	
		9'			28	34'-11"	"	4'-11"	8'-1"			62	33'-10"	3'-11"	32'-6"	2'-6"	
		10'			28	35'-3"	"	5'-0"	8'-2"			62	34'-2"	3'-5"	32'-10"	2'-10"	
		11'			28	35'-5"	"	"	8'-3"			62	34'-4"	3'-7"	33'-0"	3'-0"	
		12'			28	35'-7"	0'-6"	5'-0"	8'-4"			62	34'-6"	3'-9"	33'-2"	3'-2"	
	11' @ 3	6'	#7	12"	28	37'-8"	0'-6 5/8"	5'-3"	8'-9"	#7	12"	72	36'-8"	3'-9"	35'-3"	3'-2"	
		7'			28	37'-8"	"	"	"			72	"	"	"	"	
		8'			28	37'-8"	"	"	"			72	"	"	"	"	
		9'			27	38'-0"	"	5'-4"	8'-10"	#7	11"	74	37'-0"	3'-2"	35'-7"	2'-7"	
		10'			27	38'-4"	"	5'-5"	8'-11"			74	37'-4"	3'-6"	35'-11"	2'-11"	
		11'			27	38'-6"	"	"	9'-0"			74	37'-6"	3'-8"	36'-1"	3'-1"	
		12'			27	38'-8"	0'-6 5/8"	5'-5"	9'-1"			74	37'-8"	3'-10"	36'-3"	3'-3"	
	12' @ 3	6'	#7	11"	24	40'-9"	0'-7"	5'-8"	9'-6"	#7	11"	80	39'-9"	3'-1"	38'-3"	2'-6"	
		7'			24	40'-9"	"	"	"			80	"	"	"	"	
		8'			24	40'-9"	"	"	"			80	"	"	"	"	
		9'			24	41'-1"	"	5'-9"	9'-7"			80	40'-1"	3'-5"	38'-7"	2'-10"	
		10'			24	41'-5"	"	5'-10"	9'-8"			80	40'-5"	3'-9"	38'-11"	3'-12"	
		11'			24	41'-7"	"	"	9'-9"			82	40'-7"	3'-10"	39'-1"	2'-5"	
		12'			24	41'-9"	0'-7"	5'-10"	9'-10"			82	40'-9"	3'-12"	39'-3"	2'-7"	

D	S	H	"c" bars STRAIGHT In Top and Bottom Slab of Barrel, Alternate with "b" and "b₂" bars. SIZE	SPACING	No. REQ'D	LENGTH	"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel, Alt. with "b₁" & "b₃" bars. (Four of each Length) SIZE	SPACING	No. REQ'D	LENGTH Max.	LENGTH Min.
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#6	11"	90	19'-6"	#6	11"	76	19'-0"	2'-6"
		6'			90	19'-8"			76	19'-2"	2'-8"
		7'			90	19'-8"			76	19'-2"	2'-8"
		8'			90	19'-9"			76	19'-3"	2'-9"
		9'			88	19'-10"			76	19'-6"	3'-0"
		10'			88	20'-0"			80	19'-9"	2'-11"
		11'			88	20'-0"			80	19'-10"	2'-5"
	10' @ 3	5'	#7	12"	78	21'-6"	#7	11"	74	21'-0"	3'-0"
		6'			78	21'-8"			74	21'-2"	3'-2"
		7'			78	21'-8"			74	21'-2"	3'-2"
		8'			78	21'-8"			76	21'-3"	3'-3"
		9'			78	21'-10"			80	21'-6"	2'-6"
		10'			76	22'-0"			80	21'-9"	2'-9"
		11'			76	22'-0"			80	21'-10"	2'-10"
		12'			76	22'-0"			80	21'-11"	2'-11"
	11' @ 3	6'	#7	12"	80	23'-8"	#7	11"	92	23'-4"	3'-2"
		7'			80	23'-8"			92	"	"
		8'			80	23'-8"			92	"	"
		9'			80	23'-10"			96	23'-7"	2'-6"
		10'			80	24'-0"			96	23'-8"	2'-9"
		11'			82	24'-0"			92	23'-6"	2'-10"
		12'			82	24'-0"			92	23'-7"	2'-11"
	12' @ 3	6'	#7	11"	78	25'-6"	#7	11"	100	24'-11"	2'-11"
		7'			78	25'-8"			100	"	"
		8'			78	25'-8"			100	"	"
		9'			78	25'-10"			100	25'-4"	3'-2"
		10'			76	26'-0"			104	25'-6"	2'-6"
		11'			76	26'-0"			104	25'-6"	2'-7"
		12'			76	26'-0"			104	25'-7"	2'-8"

D	S	H	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH	"d₁" bars STRAIGHT Longitudinal in Headwalls and Division Walls. SIZE	SPACING	No. REQ'D	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#5	11 1/2"	91		#4	12"	30		#4	12"	90	
		6'			91				36				90	
		7'			91				42				90	
		8'			91				48				90	
		9'			91				54				90	
		10'			91				60				90	
		11'			91				66				90	
	10' @ 3	5'	#5	11 1/2"	44		#4	12"	30		#4	12"	43	
		6'			44				36				43	
		7'			44				42				43	
		8'			44				48				43	
		9'			44				54				43	
		10'			44				60				43	
		11'			44				66				43	
		12'			44				72				43	
	11' @ 3	6'	#5	11 1/2"	48		#4	12"	36		#4	12"	46	
		7'			48				42				46	
		8'			48				48				46	
		9'			48				54				46	
		10'			48				60				46	
		11'			48				66				46	
		12'			48				72				46	
	12' @ 3	6'	#5	11 1/2"	51		#4	12"	36		#4	12"	49	
		7'			51				42				49	
		8'			51				48				49	
		9'			51				54				49	
		10'			51				60				49	
		11'			51				66				49	
		12'			51				72				49	

D	S	H	"F" bars STRAIGHT Verticals in Sidewalls and Division Walls. SIZE	SPACING	No. REQ'D	LENGTH	"k" bars STRAIGHT In Bottom of Headwalls (3 of Each Length per Headwall) SIZE	No. REQ'D	LENGTH Max.	LENGTH Min.	"k₂" bars STRAIGHT In Top of Headwalls and Aprons (2 Rows Each) SIZE	No. REQ'D	LENGTH
0'-0" TO 5'-0" MAXIMUM	9' @ 3	5'	#4	12"	360	6'-3"	⊠	12	29'-5"	14'-10"	⊠	16	23'-2"
		6'			360	7'-3"		12	29'-8"	14'-11"		16	23'-5"
		7'			360	8'-3"		12	"	"		16	"
		8'			432	9'-3"	⊠	12	29'-9"	15'-0"	⊠	16	23'-5"
		9'			360	10'-3"		12	30'-1"	15'-1"		16	23'-8"
		10'			396	11'-3"		12	30'-5"	15'-2"		16	23'-11"
		11'			432	12'-3"		12	30'-7"	15'-3"		16	24'-0"
	10' @ 3	5'	#4	12"	360	6'-9"	⊠	12	32'-2"	16'-3"		16	25'-4"
		6'			360	7'-9"	⊠	12	32'-5"	16'-5"	⊠	16	25'-6"
		7'			360	8'-9"		12	"	"		16	"
		8'			432	9'-9"	⊠	12	32'-6"	16'-5"	⊠	16	25'-7"
		9'			360	10'-9"		12	32'-10"	16'-7"		16	25'-9"
		10'			396	11'-9"		12	33'-2"	16'-9"		16	26'-0"
		11'			432	12'-9"		12	33'-4"	16'-9"		16	26'-2"
		12'			360	13'-9"		12	33'-6"	16'-10"		16	26'-3"
	11' @ 3	6'	#4	12"	360	7'-5"		12	35'-7"	17'-11"		16	27'-10"
		7'			360	8'-5"	⊠	12	"	"	⊠	16	"
		8'			432	9'-5"		12	"	"		16	"
		9'			360	10'-5"		12	35'-11"	18'-1"		16	28'-1"
		10'			396	11'-5"		12	36'-3"	18'-2"		16	28'-4"
		11'			432	12'-5"		12	36'-5"	18'-3"		16	28'-5"
		12'			360	13'-5"		12	36'-7"	18'-4"		16	28'-7"
	12' @ 3	6'	#4	12"	360	7'-6"		12	38'-6"	19'-5"		16	29'-7"
		7'			360	8'-6"	⊠	12	"	"	⊠	16	"
		8'			432	9'-6"		12	"	"		16	"
		9'			360	10'-6"		12	38'-8"	19'-7"		16	30'-2"
		10'			396	11'-6"		12	39'-0"	19'-8"		16	30'-5"
		11'			432	12'-6"		12	39'-2"	19'-9"		16	30'-7"
		12'			360	13'-6"		12	39'-4"	19'-10"		16	30'-8"

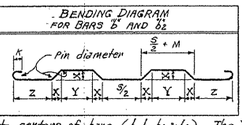
BARREL DIMENSIONS / * QUANTITIES

D	S	MAX. DESIGN DEPTH OF COVER	CLEAR SPANS H	CLEAR HEIGHT A	SQ. FT. OPENING OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY RL	LENGTH OF HEADWALLS K	* CLASS S CONC. PER LIN. FT. OF BARREL CU.YD.	REINFORCING STEEL TOTAL FOR 60'-0" LENGTH OF BARREL LB.	REINFORCING STEEL PER LIN. FT. OF BARREL LB.	REINFORCING STEEL ADDITIONAL PER LAP LB.
5'-0"	9' @ 3	5'	5'	135	29'-8"	9"	7"	9"	9"	6'-6"	91'-11 1/2"	93'-11 1/2"	2.142	24,761	377.01	120.72
		6'	6'	162	29'-11"		7 1/2"	10"		7'-6"	92'-2 1/2"	94'-2 1/2"	2.310	25,348	387.21	124.93
		7'	7'	189	29'-11"		7 1/2"	10"		8'-6"	"	"	2.478	25,833	395.23	129.14
		8'	8'	216	30'-0"		8"	10"		9'-6"	92'-5 1/2"	94'-5"	2.556	26,822	411.21	134.76
		9'	9'	243	30'-4"		9"	11"		10'-6"	92'-10 1/2"	94'-10 1/2"	2.796	28,367	437.60	140.76
		10'	10'	270	30'-8"		10"	12"		11'-6"	93'-2 1/2"	95'-2 1/2"	3.062	29,699	457.00	154.77
		11'	11'	297	30'-10"		11"	12"		12'-6"	93'-7 1/2"	95'-7 1/2"	3.275	30,923	477.29	153.78
	10' @ 3	5'	5'	150	32'-8"		7"	9"		6'-7"	94'-2 1/2"	98'-2 1/2"	2.909	28,789	493.34	132.99
		6'	6'	180	32'-11"		7 1/2"	10"		7'-7"	94'-6 1/2"	98'-6 1/2"	2.578	29,937	513.31	142.95
		7'	7'	210	32'-11"		7 1/2"	10"		8'-7"	"	"	2.684	29,982	514.83	142.96
		8'	8'	240	33'-6"	9 1/2"	8"	10"	9 1/2"	9'-7"	94'-10"	98'-10"	2.824	31,471	477.91	122.87
		9'	9'	270	33'-6"		9"	11"		10'-7"	95'-1 1/2"	99'-1 1/2"	3.066	32,747	506.74	152.98
		10'	10'	300	33'-8"		10"	12"		11'-7"	95'-7 1/2"	99'-7 1/2"	3.232	33,859	529.50	162.79
		11'	11'	330	33'-10"		11"	12"		12'-7"	95'-10 1/2"	99'-10 1/2"	3.596	35,132	546.94	162.50
		12'	12'	360	34'-0"		12"	12"		13'-7"	96'-1"	100'-1"	3.772	37,198	577.67	172.51
	11' @ 3	6'	6'	198	36'-0"		8"	10"		7'-8"	50'-11"	52'-11"	2.889	34,502	522.98	151.91
		7'	7'	231	36'-0"		8"	10"		8'-8"	"	"	3.000	34,987	531.00	156.92
		8'	8'	264	36'-0"		8"	10"		9'-8"	"	"	3.111	35,925	546.54	161.93
		9'	9'	297	36'-6"	10"	9"	11"	10"	10'-8"	51'-9 1/2"	53'-9 1/2"	3.354	37,624	573.79	164.94
		10'	10'	330	36'-8"		10"	12"		11'-8"	51'-10 1/2"	53'-10 1/2"	3.621	39,028	593.87	171.95
		11'	11'	363	36'-10"		11"	12"		12'-8"	52'-1 1/2"	54'-1"	3.835	40,051	614.97	176.96
		12'	12'	396	37'-0"		12"	12"		13'-8"	52'-3 1/2"	54'-3"	4.062	41,903	647.94	181.97
	12' @ 3	6'	6'	216	39'-0"		8"	10"		7'-9"	55'-1 1/2"	57'-1 1/2"	3.194	37,005	560.85	159.63
		7'	7'	252	39'-0"		8"	10"		8'-9"	"	"	3.306	37,990	568.87	169.69
		8'	8'	288	39'-0"		8"	10"		9'-9"	"	"	3.417	38,931	584.50	169.65
		9'	9'	324	39'-4"	10 1/2"	9"	11"	10 1/2"	10'-9"	55'-7 1/2"	57'-7 1/2"	3.660	40,260	611.85	179.66
		10'	10'	360	39'-8"		10"	12"		11'-9"	56'-1 1/2"	58'-1"	3.929	41,911	631.98	179.67
		11'	11'	396	39'-10"		11"	12"		12'-9"	56'-9"	58'-9"	4.146	42,713	652.63	189.68
		12'	12'	432	40'-0"		12"	12"		13'-9"	56'-6 1/2"	58'-6 1/2"	4.370	44,775	685.72	189.69

* For quantities in Wings see Standard Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

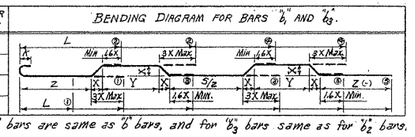
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"

BENDING DIAGRAM FOR BARS "b" AND "b₂"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"

BENDING DIAGRAM FOR BARS "b₁" AND "b₃"

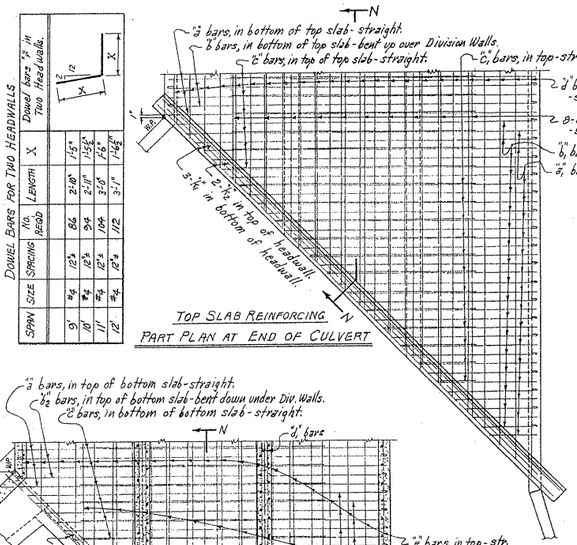


NOTE:- Dimensions are to centers of bars. (b, b_1, b_2 & b_3). The X, Y & Z values for "b_1" bars are same as "b" bars, and for "b_3" bars same as for "b_2" bars. ⓪-①-②-③ Min. & Max. Lengths of "L" for bars "b_1" & "b_3" for each type bend.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

These bars are in the skewed portion of barrel only. The length of "a_1" and "c" bars and overall length "L" of "b_1" and "b_3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.

⊠ These bars are spliced to make full length bars, "k_1" bars being spliced at alt. division walls and "k_2" bars at center span.

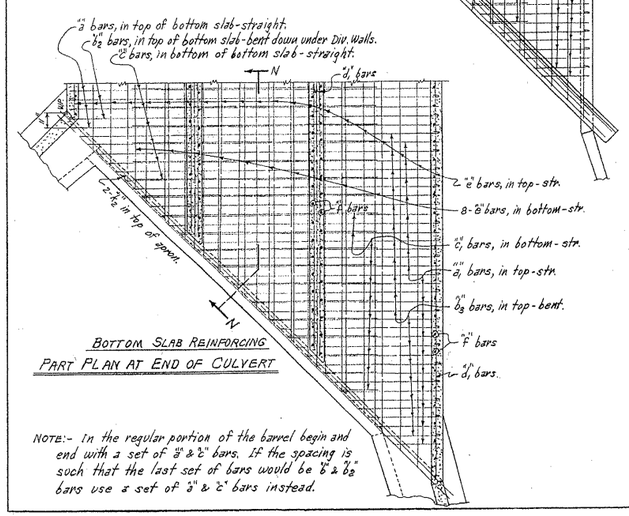


DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#6	12"	86	2'-10"	1'-5"
10'	#6	12"	94	2'-11"	1'-5 1/2"
11'	#6	12"	104	3'-0"	1'-6"
12'	#6	12"	112	3'-1"	1'-6 1/2"

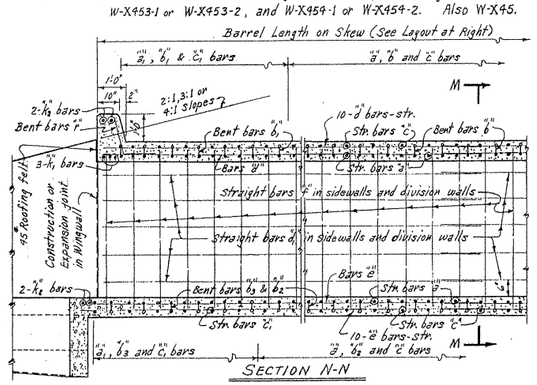
Dowel bars 1/2" in Two Headwalls.

TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

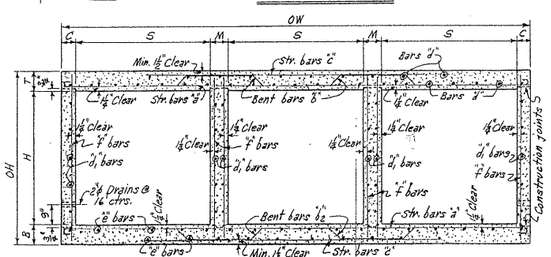


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

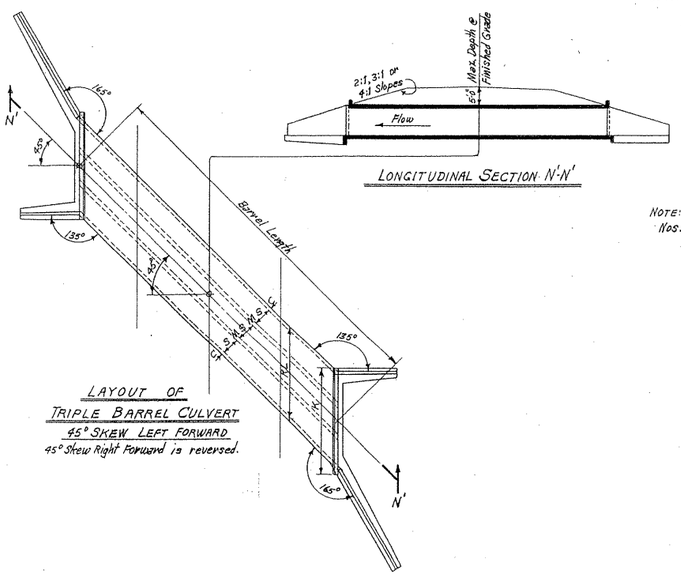
NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b₂" bars use a set of "a" & "c" bars instead.



SECTION N-N



TYPICAL SECTION M-M



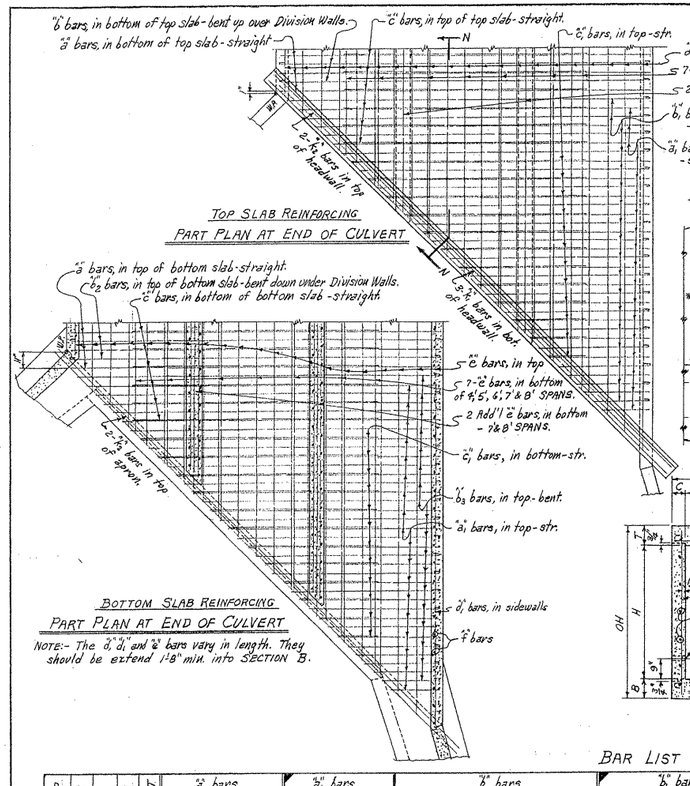
LONGITUDINAL SECTION N'-N'

LAYOUT OF
TRIPLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have 3/4" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or h

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

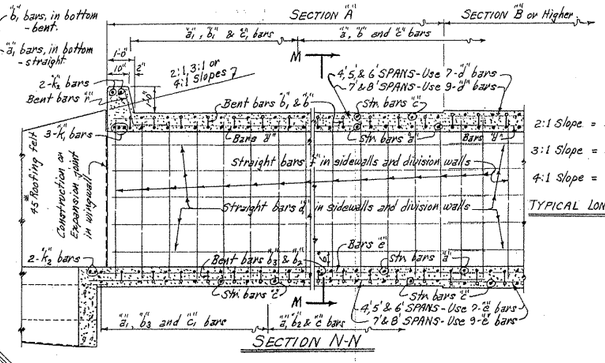


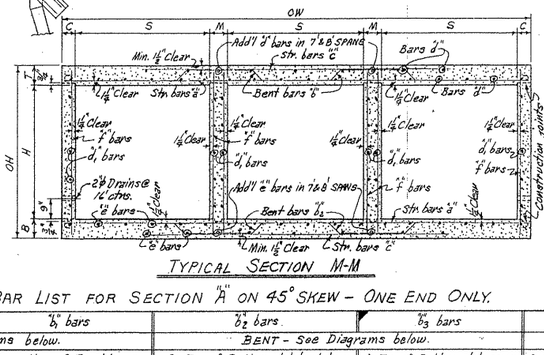
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- The "d₁" and "e" bars vary in length. They should be extend 1'-8" min. into SECTION "B".

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

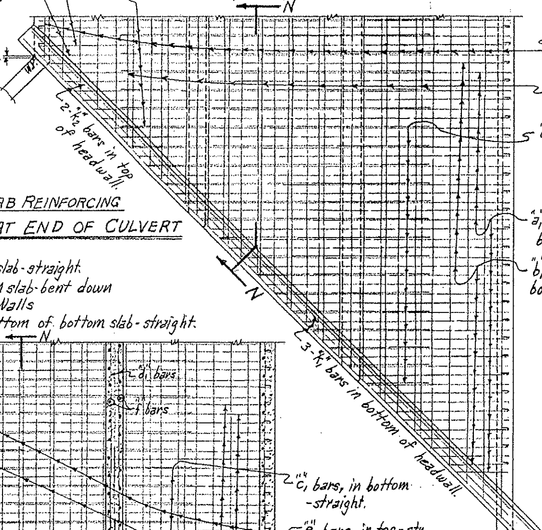




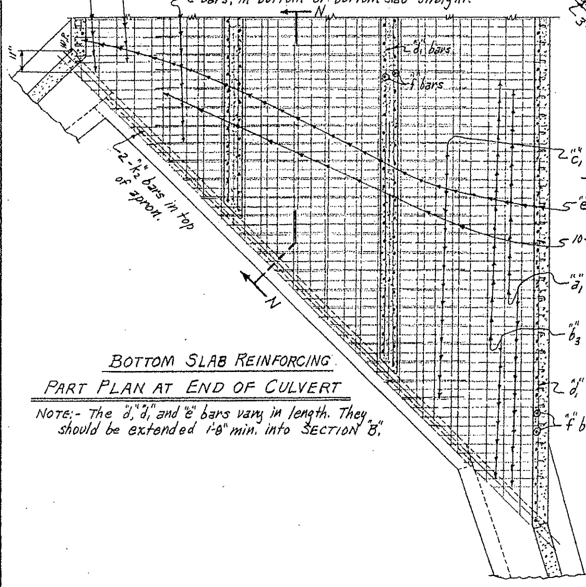
TYPICAL SECTION M-M

| | | | | |

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					



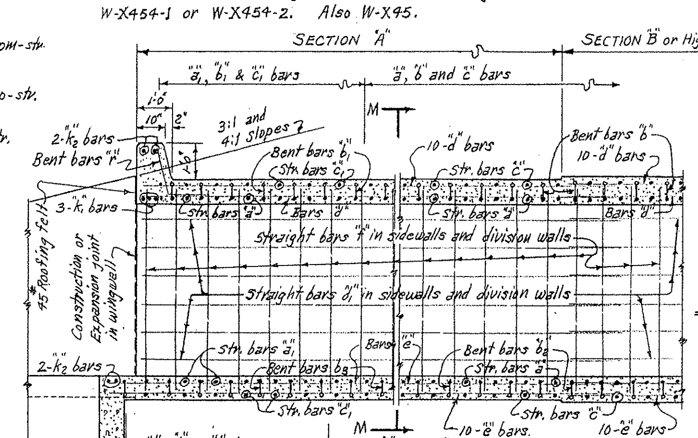
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT



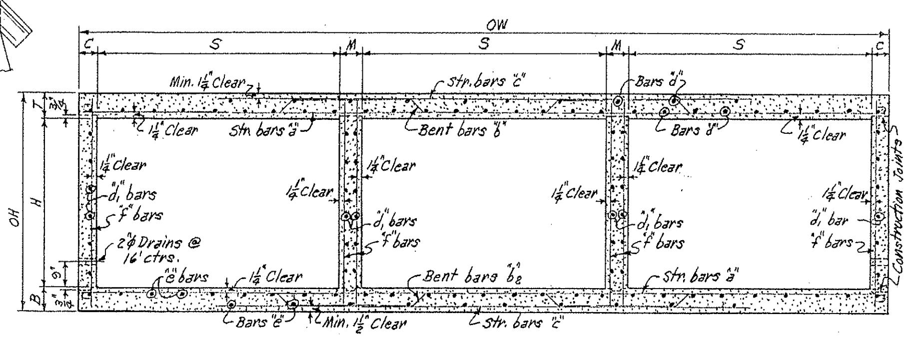
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-6" min. into SECTION "B".

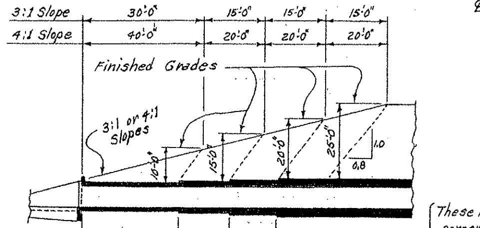
NOTE:- For Details of Standard Wings and bar lists, see Drawing Nos W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.



SECTION N-N



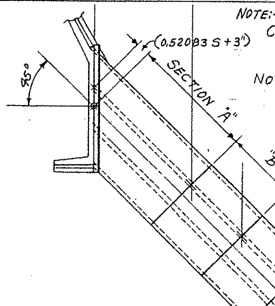
TYPICAL SECTION M-M



3:1 Slope =	SECTIONS	A=22'-0"	B=11'-0"	C=11'-0"	MID-SECTION D-Varies	These lengths are perpendicular to ¢ of roadway near ¢ of Division Wall on Long Side. See Table of Skewed Lengths above.
	Bar Group	A	B	C	D	
4:1 Slope	SECTIONS	A=32'-0"	B=16'-0"	C=16'-0"	MID-SECTION D-Varies	
	Bar Group	A	B	C	D	

TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.



PART PLAN

NOTE:- To prevent over loading of the (inside) side span, Regular Skewed ¢ Length of SECTION "A" have been shortened by (0.52083 S+3"). See below and Table above.

For 3:1 Slope = 31.125 - (0.52083 S + 3")
For 4:1 Slope = 45.25 - (0.52083 S + 3")
Minimum ¢ Length on Skew = (0.5 OW + 1").

NOTE:- For Details and Bar Lists for SECTIONS B, C & D, see Barrel Drawing Nos. R-300X-X2 and R-300X-X3.

¢ LENGTH OF SECTIONS ON 45° SKEW

SLOPE		3:1		4:1	
SECTIONS		A	B&C	A	B&C
SPANS	9'	26'-2¼"	15'-6¾"	40'-3¾"	22'-7½"
	10'	25'-8"	"	39'-9½"	"
	11'	25'-1¾"	"	39'-3¼"	"
	12'	24'-7½"	"	38'-9"	"

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C	MID-SECTION AND BAR GROUP		DEPTHS OF COVER	SECT'S & BAR GROUPS FOR END SECTIONS A	B	C	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A			A	OR	5.0' to 9.5'	A			A
10.0' to 14.5'	A			B	ALT.	10.0' to 14.5'	A			B
15.0' to 19.5'	A	B		C		15.0' to 19.5'	A	B		C
20.0' to 25.0'	A	B	C	D		20.0' to 25.0'	A	2@C		D

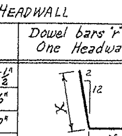
BARREL DIMENSIONS AND * QUANTITIES-ONE SECTION "A"

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ.FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONCRETE BARREL ONLY 3:1 CU.YD.	4:1 CU.YD.	REINFORCING STEEL BARREL, APRON AND HEADWALL 3:1 LB.	4:1 LB.
SECTION "A" = 10'-0"	3@9'	5'	135	29'-8"	9¼"	7"	9"	9¾"	6'-7"	41'-11½"	43'-11½"	58.50	90.06	10,656	15,764
		6'	162	29'-11"		7½"	10"		7'-7"	42'-3¾"	44'-3¾"	62.93	96.87	10,965	16,219
		7'	189	29'-11"		7½"	10"		8'-7"	"	"	65.76	101.22	11,352	16,822
		8'	216	30'-0"		8"	10"		9'-7"	42'-5⅛"	44'-5"	69.34	106.75	11,990	17,775
		9'	243	30'-4"		9"	11"		10'-7"	42'-10⅜"	44'-10⅜"	75.68	116.50	12,549	18,884
		10'	270	30'-8"		10"	12"		11'-7"	43'-4⅜"	45'-4⅞"	82.65	127.23	13,456	20,097
		11'	297	30'-10"		11"	12"		12'-7"	43'-7⅞"	45'-7⅞"	88.25	135.85	14,153	21,093
	3@10'	5'	150	32'-8"	10"	7"	9"	10½"	6'-8½"	46'-2⅜"	48'-2⅜"	65.73	101.91	12,096	18,028
		6'	180	32'-11"		7½"	10"		7'-8½"	46'-6⅜"	48'-6½"	70.10	108.67	12,410	18,387
		7'	210	32'-11"		7½"	10"		8'-8½"	"	"	72.87	112.97	12,795	18,983
		8'	240	33'-0"		8"	10"		9'-8½"	46'-8"	48'-8"	76.41	118.46	13,296	19,949
		9'	270	33'-4"		9"	11"		10'-8½"	47'-1⅝"	49'-1¾"	82.65	128.13	13,974	21,051
		10'	300	33'-8"		10"	12"		11'-8½"	47'-7¾"	49'-7¼"	89.53	138.79	14,927	22,454
		11'	330	33'-10"		11"	12"		12'-8½"	47'-10⅝"	49'-10¼"	95.02	147.31	15,609	23,279
		12'	360	34'-0"		12"	12"		13'-8½"	48'-1"	50'-1"	100.82	156.34	16,343	25,979
	3@11'	6'	198	36'-0"	10¾"	8"	10"	11¼"	7'-10"	50'-11"	52'-11"	78.23	122.17	13,747	20,474
		7'	231	36'-0"		8"	10"		8'-10"	"	"	81.02	126.53	14,037	20,917
		8'	264	36'-0"		8"	10"		9'-10"	"	"	83.81	130.89	14,721	21,962
		9'	297	36'-4"		9"	11"		10'-10"	51'-4⅝"	53'-4½"	89.97	140.51	15,271	22,997
		10'	330	36'-8"		10"	12"		11'-10"	51'-10⅝"	53'-10⅝"	96.76	151.11	16,166	24,232
		11'	363	36'-10"		11"	12"		12'-10"	52'-1⅛"	54'-1"	102.17	159.56	16,834	25,234
		12'	396	37'-0"		12"	12"		13'-10"	52'-3⅞"	54'-4"	107.88	168.47	17,962	27,043
	3@12'	6'	216	39'-0"	11½"	8"	10"	12"	7'-11½"	55'-1⅞"	57'-1¾"	86.06	135.43	15,357	23,472
		7'	252	39'-0"		8"	10"		8'-11½"	"	"	88.80	139.73	15,563	23,791
		8'	288	39'-0"		8"	10"		9'-11½"	"	"	91.56	144.07	16,317	24,430
		9'	324	39'-4"		9"	11"		10'-11½"	55'-7½"	57'-7¼"	97.61	153.61	16,891	25,565
		10'	360	39'-8"		10"	12"		11'-11½"	56'-1⅛"	58'-1"	104.29	164.11	17,004	26,121
		11'	396	39'-10"		11"	12"		12'-11½"	56'-4"	58'-4"	109.61	172.48	18,457	27,759
		12'	432	40'-0"		12"	12"		13'-11½"	56'-6⅝"	58'-6¾"	115.22	181.31	19,593	29,564

* For remainder of quantities see Std. Wing and Barrel Drawings listed below. Total steel quantities include one lap of all longitudinal bars for 4:1 slopes and one lap for one-half of bars for 3:1 slopes. (1'-3" lap).

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
9'	#4	12"±	43	2'-11"	1'-5½"
10'	#4	12"±	47	3'-0"	1'-6"
11'	#4	12"±	52	3'-2"	1'-7"
12'	#4	12"±	56	3'-4"	1'-8"



DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.
For Barrels of 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.
For 2:1 Slopes for 8', 9', 10', 11' & 12' spans, see Drawing Nos. R-345X-3 & R-3452-1.

BAR LIST FOR SECTION "A" ON 45° SKEW ~ ONE END ONLY.

SECTION & BAR GROUP: SECTION "A" & BAR GROUP "A". LENGTH OF SECTION: Lengths vary with Clear Span "S" per slope, see Table at upper right. DEPTH OF COVER D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars (in the skewed portion) — STRAIGHT — In Top and Bottom Slab of Barrel - (Two of each Length). "b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	"a" Size	Spacing	No. Req'd 3:1	4:1	Length	"a1" Size	Spacing	No. Req'd	Length Max.	Min.	"b" Size	Spacing	No. Req'd 3:1	4:1	Length	X	Y	Z
3@9'	5'	#6	12"	25	53	29'-5"	#6	12"	54	28'-5"	2'-5"	#6	12"	11	25	31'-2"	0'-5¾"	4'-3½"	7'-2"
	6'			25	53	29'-8"			54	28'-8"	2'-8"			11	25	31'-5"	"	4'-4½"	7'-2½"
	7'			25	53	"			54	"	"			11	25	"	"	"	"
	8'			25	53	29'-9"			54	28'-9"	2'-9"			11	25	31'-6"	"	"	7'-3"
	9'			23	53	30'-1"			54	29'-1"	3'-1"			11	25	31'-10"	"	4'-5½"	7'-4"
	10'			23	51	30'-5"			56	29'-5"	2'-5"			11	25	32'-2"	"	4'-6½"	7'-5"
	11'			23	51	30'-7"			56	29'-7"	2'-7"			11	25	32'-4"	0'-5¾"	4'-6½"	7'-6"
3@10'	5'	#6	11"	23	53	32'-5"	#6	11"	64	31'-6"	3'-1"	#6	11"	10	26	34'-3"	0'-6½"	4'-8"	7'-11"
	6'			23	53	32'-8"			64	31'-9"	3'-4"			10	25	34'-6"	"	4'-9"	7'-11½"
	7'			23	53	"			64	"	"			10	25	"	"	"	"
	8'			21	53	32'-9"			66	31'-10"	2'-6"			10	25	34'-7"	"	"	8'-0"
	9'			21	53	33'-1"			66	32'-2"	2'-10"			10	25	34'-11"	"	4'-10"	8'-1"
	10'			21	53	33'-5"			66	32'-6"	3'-2"			10	25	35'-3"	"	4'-11"	8'-2"
	11'			21	51	33'-7"			66	32'-8"	3'-4"			10	25	35'-5"	"	"	8'-3"
	12'			21	51	33'-9"			68	32'-10"	2'-7"			10	25	35'-7"	0'-6½"	4'-11"	8'-4"
3@11'	6'	#6	12"	17	45	35'-9"	#6	12"	66	34'-9"	2'-9"	#7	12"	7	21	37'-10"	0'-7"	5'-2"	8'-9"
	7'			17	45	"			66	"	"			7	21	"	"	"	"
	8'			17	45	"			66	"	"			7	21	"	"	"	"
	9'			15	45	36'-1"			66	35'-1"	3'-1"			7	21	38'-2"	"	5'-3"	8'-10"
	10'			15	43	36'-5"			68	35'-5"	2'-5"			7	21	38'-6"	"	5'-4"	8'-11"
	11'			15	43	36'-7"			68	35'-7"	2'-7"			7	21	38'-8"	"	"	9'-0"
	12'			15	43	36'-9"			68	35'-9"	2'-9"			7	21	38'-10"	0'-7"	5'-4"	9'-1"
3@12'	6'	#6	11"	13	43	38'-9"	#6	11"	78	37'-10"	3'-0"	#7	11"	6	21	40'-11"	0'-7¾"	5'-6½"	9'-6"
	7'			13	43	"			78	"	"			6	21	"	"	"	"
	8'			13	43	"			78	"	"			6	21	"	"	"	"
	9'			13	43	39'-1"			78	38'-2"	3'-4"			5	21	41'-3"	"	5'-7½"	9'-7"
	10'			13	43	39'-5"			80	38'-6"	2'-9"			5	21	41'-7"	"	5'-8½"	9'-8"
	11'			13	43	39'-7"			80	38'-8"	2'-11"			5	20	41'-9"	"	"	9'-9"
	12'			13	43	39'-9"			80	38'-10"	3'-1"			5	20	41'-11"	0'-7¾"	5'-8½"	9'-10"

"b1" bars (in the skewed portion) — BENT - See Diagrams below — In Bottom of Top Slab-some bent up over Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars. "b2" bars — BENT — In Top of Bottom Slab bent down under Division Walls-hooked. Alternate with "a" and "c" bars.

S	H	"b1" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	L Min.	"b2" Size	Spacing	No. Req'd 3:1	4:1	Length	X	Y	Z
3@9'	5'	#6	12"	27	30'-2"	3'-5"	28'-10"	2'-10"	#6	12"	12	26	31'-3"	0'-6½"	4'-2½"	7'-2"
	6'			27	30'-5"	3'-8"	29'-1"	3'-1"			12	26	31'-6"	"	4'-3½"	7'-2½"
	7'			27	"	"	"	"			12	26	"	"	"	"
	8'			27	30'-6"	3'-9"	29'-2"	3'-2"			12	26	31'-7"	"	"	7'-3"
	9'			28	30'-10"	3'-1"	29'-6"	2'-6"			12	26	31'-11"	"	4'-4½"	7'-4"
	10'			28	31'-2"	3'-5"	29'-10"	2'-10"			12	26	32'-3"	"	4'-5½"	7'-5"
	11'			28	31'-4"	3'-7"	30'-0"	3'-0"			12	26	32'-5"	0'-6½"	4'-5½"	7'-6"
3@10'	5'	#6	11"	33	33'-4"	3'-2"	31'-11"	2'-7"	#6	11"	11	27	34'-4"	0'-7"	4'-7"	7'-11"
	6'			33	33'-7"	3'-5"	32'-2"	2'-10"			11	26	34'-7"	"	4'-8"	7'-11½"
	7'			33	"	"	"	"			11	26	"	"	"	"
	8'			33	33'-8"	3'-6"	32'-3"	2'-11"			11	26	34'-8"	"	"	8'-0"
	9'			33	34'-0"	3'-10"	32'-7"	3'-3"			11	26	35'-0"	"	4'-9"	8'-1"
	10'			34	34'-4"	4'-2"	32'-11"	2'-8"			11	26	35'-4"	"	4'-10"	8'-2"
	11'			34	34'-6"	4'-4"	33'-1"	2'-10"			11	26	35'-6"	"	"	8'-3"
	12'			34	34'-8"	4'-6"	33'-3"	3'-0"			11	26	35'-8"	0'-7"	4'-10"	8'-4"
3@11'	6'	#7	12"	33	36'-9"	3'-10"	35'-2"	3'-2"	#7	12"	8	22	37'-11"	0'-7½"	5'-1"	8'-9"
	7'			33	"	"	"	"			8	22	"	"	"	"
	8'			33	"	"	"	"			8	22	"	"	"	"
	9'			34	37'-1"	3'-2"	35'-6"	2'-6"			8	22	38'-3"	"	5'-2"	8'-10"
	10'			34	37'-5"	3'-6"	35'-10"	2'-10"			8	22	38'-7"	"	5'-3"	8'-11"
	11'			34	37'-7"	3'-8"	36'-0"	3'-0"			8	22	38'-9"	"	"	9'-0"
	12'			34	37'-9"	3'-10"	36'-2"	3'-2"			8	22	38'-11"	0'-7½"	5'-3"	9'-1"
3@12'	6'	#7	11"	40	39'-11"	3'-2"	38'-3"	2'-6"	#7	11"	7	22	41'-0"	0'-8¼"	5'-5½"	9'-6"
	7'			40	"	"	"	"			7	22	"	"	"	"
	8'			40	"	"	"	"			7	22	"	"	"	"
	9'			40	40'-3"	3'-6"	38'-7"	2'-10"			6	22	41'-4"	"	5'-6½"	9'-7"
	10'			40	40'-7"	3'-10"	38'-11"	3'-2"			6	22	41'-8"	"	5'-7½"	9'-8"
	11'			40	40'-9"	4'-0"	39'-1"	3'-4"			6	21	41'-10"	"	5'-7½"	9'-9"
	12'			41	40'-11"	3'-3"	39'-3"	2'-7"			6	21	42'-0"	0'-8¼"	5'-7½"	9'-10"

"b3" bars (in the skewed portion) — BENT — In Top of Bottom Slab-some bent down under Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars. "c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" & "b2" bars. "c1" bars (in the skewed portion) — STRAIGHT — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length).

S	H	"b3" Size	Spacing	No. Req'd	Length Max.	Min.	L Max.	L Min.	"c" Size	Spacing	No. Req'd 3:1	4:1	Length	"c1" Size	Spacing	No. Req'd	Length Max.	Min.
3@9'	5'	#6	12"	27	30'-3"	3'-5"	28'-10"	2'-10"	#7	12"	35	63	19'-6"	#7	12"	34	18'-6"	2'-6"
	6'			27	30'-6"	3'-8"	29'-1"	3'-1"			35	63	19'-8"			34	18'-8"	2'-8"
	7'			27	"	"	"	"			35	63	"			34	"	"
	8'			27	30'-7"	3'-9"	29'-2"	3'-2"			35	63	"			34	18'-9"	2'-9"
	9'			28	30'-11"	3'-1"	29'-6"	2'-6"			33	63	19'-10"			34	19'-0"	3'-0"
	10'			28	31'-3"	3'-5"	29'-10"	2'-10"			33	61	20'-0"			34	19'-3"	3'-3"
	11'			28	31'-5"	3'-7"	30'-0"	3'-0"			33	61	20'-0"			34	19'-4"	3'-4"
3@10'	5'	#6	11"	33	33'-5"	3'-2"	31'-11"	2'-7"	#7	11"	35	65	21'-6"	#7	11"	42	20'-7"	2'-4"
	6'			33	33'-8"	3'-5"	32'-2"	2'-10"			35	65	21'-8"			42	20'-9"	2'-6"
	7'			33	"	"	"	"			35	65	"			42	"	"
	8'			33	33'-9"	3'-6"	32'-3"	2'-11"			33	65	"			42	20'-10"	2'-7"
	9'			33	34'-1"	3'-10"	32'-7"	3'-3"			33	65	21'-10"			42	21'-1"	2'-10"
	10'			34	34'-5"	4'-2"	32'-11"	2'-8"			33	65	22'-0"			42	21'-4"	3'-1"
	11'			34	34'-7"	4'-4"	33'-1"	2'-10"			33	63	"			42	21'-5"	3'-2"
	12'			34	34'-9"	4'-6"	33'-3"	3'-0"			33	63	"			42	21'-6"	3'-3"
3@11'	6'	#7	12"	33	36'-9"	3'-10"	35'-2"	3'-2"	#7	12"	29	57	23'-8"	#7	12"	42	22'-9"	2'-9"
	7'			33	"	"	"	"			29	57	"			42	"	"
	8'			33	"	"	"	"			29	57	"			42	"	"
	9'			34	37'-1"	3'-2"	35'-6"	2'-6"			27	55	23'-10"			42	23'-0"	3'-0"
	10'			34	37'-5"	3'-6"	35'-10"	2'-10"			27	55	24'-0"			42	23'-3"	3'-3"
	11'			34	37'-7"	3'-8"	36'-0"	3'-0"			27	55	"			42	23'-4"	3'-4"
	12'			34	37'-9"	3'-10"	36'-2"	3'-2"			27	55	"			44	23'-5"	2'-5"
3@12'	6'	#7	11"	40	40'-0"	3'-2"	38'-3"	2'-6"	#7	11"	27	57	25'-8"	#7	11"	50	24'-11"	2'-11"
	7'			40	"	"	"	"			27	57	"			50	"	"
	8'			40	"	"	"	"			27	57	"			50	"	"
	9'			40	40'-4"	3'-6"	38'-7"	2'-10"			27	57	25'-10"			50	25'-2"	3'-2"
	10'			40	40'-8"	3'-10"	38'-11"	3'-2"			27	57	26'-0"			52	25'-5"	2'-6"
	11'			40	40'-10"	4'-0"	39'-1"	3'-4"			27	57	"			52	25'-6"	2'-7"
	12'			41	41'-0"	3'-3"	39'-3"	2'-7"			27	57	"			52	25'-7"	2'-8"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — STRAIGHT — Longitudinal in Sidewalls and Division Walls. "e" bars — STRAIGHT — Longitudinal in Bottom Slab of Barrel. "f" bars — STRAIGHT — Verticals in Sidewalls and Division Walls. Lengths ⊙ of "d", "d1" and "e" bars: Lengths vary with Clear Span "S", skew and slope, see Table for ave. Lengths.

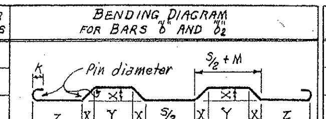
S	H	"d" Size	Spacing	No. Req'd	"d1" Size	Spacing	No. Req'd	"e" Size	Spacing	No. Req'd	"f" Size	Spacing	No. Req'd 3:1	4:1	Length
3@9'	5'	#4	12"	40	#4	12"	30	#4	12"	40	#4	12"	159	243	6'-4"
	6'			40			36			40			159	243	7'-4"
	7'			40			42			40		10"	189	291	8'-4"
	8'			40			48			40	#5	12"	159	243	9'-4"
	9'			40			54			40		10"	189	291	10'-4"
	10'			40			60			40	#6	12"	159	243	11'-4"
	11'			40			66			40		11"	174	266	12'-4"
3@10'	5'	#4	12"	43	#4	12"	30	#4	12"	43	#4	12"	156	241	6'-5"
	6'			43			36			43			156	241	7'-5"
	7'			43			42			43		10"	186	288	8'-5"
	8'			43			48			43	#5	12"	156	241	9'-5"
	9'			43			54			43		10"	186	288	10'-5"
	10'			43			60			43	#6	12"	156	241	11'-5"
	11'			43			66			43		11"	171	263	12'-5"
	12'			43			72			43		10"	186	288	13'-5"
3@11'	6'	#4	12"	46	#4	12"	36	#4	12"	46	#4	12"	153	237	7'-7"
	7'			46			42			46		11"	167	258	8'-7"
	8'			46			48			46	#5	12"	153	237	9'-7"
	9'			46			54			46		10"	183	284	10'-7"
	10'			46			60			46	#6	12"	153	237	11'-7"
	11'			46			66			46		11"	167	258	12'-7"
	12'			46			72			46		9"	201	315	13'-7"
3@12'	6'	#4	12"	49	#4	12"	36	#4	12"	49	#4	12"	150	234	7'-8"
	7'			49			42			49			150	234	8'-8"
	8'			49			48			49	#5	12"	150	234	9'-8"
	9'			49			54			49		10"	179	281	10'-8"
	10'			49			60			49	#6	12"	150	234	11'-8"
	11'			49			66			49		11"	163	255	12'-8"
	12'			49			72			49		9"	197	311	13'-8"

"k1" bars (in the skewed portion) — STRAIGHT — In Bottom of Headwall. (3 of each length per Headwall) ⊠. "k2" bars (in the skewed portion) — STRAIGHT — In Top of Headwall and Apron. (2 Rows Each) ⊕.

S	H	"k1" Size	No. Req'd	Length Max.	Min.	"k2" Size	No. Req'd	Length
3@9'	5'	#8	6	29'-6"	14'-9"	#8	8	23'-2"
	6'		6	29'-9"	14'-10"		8	23'-4"
	7'		6	"	"		8	"
	8'		6	29'-10"	14'-10"		8	23'-5"
	9'		6	30'-2"	15'-0"		8	23'-8"
	10'		6	30'-6"	15'-2"		8	23'-11"
	11'		6	30'-7"	15'-3"		8	24'-0"
3@10'	5'	#8	6	32'-4"	16'-2"	#8	8	25'-4"
	6'		6	32'-7"	16'-3"		8	25'-6"
	7'		6	"	"		8	"
	8'		6	32'-8"	16'-3"		8	25'-7"
	9'		6	33'-0"	16'-5"		8	25'-9"
	10'		6	33'-3"	16'-7"		8	26'-0"
	11'		6	33'-5"	16'-8"		8	26'-2"
	12'		6	33'-7"	16'-9"		8	26'-3"
3@11'	6'	#9	6	35'-8"	17'-10"	#9	8	27'-10"
	7'		6	"	"		8	"
	8'		6	"	"		8	"
	9'		6	36'-0"	18'-0"		8	28'-1"
	10'		6	36'-3"	18'-2"		8	28'-4"
	11'		6	36'-5"	18'-3"		8	28'-5"
	12'		6	36'-7"	18'-4"		8	28'-7"
3@12'	6'	#9	6	38'-6"	19'-3"	#9	8	29'-11"
	7'		6	"	"		8	"
	8'		6	"	"		8	"
	9'		6	38'-10"	19'-5"		8	30'-2"
	10'		6	39'-1"	19'-7"		8	30'-5"
	11'		6	39'-3"	19'-8"		8	30'-7"
	12'		6	39'-5"	19'-9"		8	30'-8"

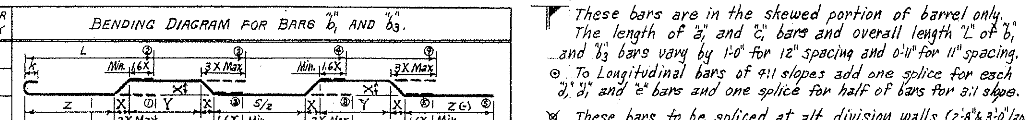
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3".



▼ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊙ To Longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bars and one splice for half of bars for 3:1 slope.
⊠ These bars to be spliced at alt. division walls. (2'-8" & 3'-0" laps).
⊕ Splice "k2" bars at center of center span.

NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars. ①②-⑤⑤ Min. & Max. lengths "L" for bars "b1" & "b3" for each type bend.

AVERAGE LENGTHS OF LONG. BARS "d", "d1" & "e"

SLOPE		3:1		4:1	
BARS		d&d1	e	d&d1	e
SPANS	9'	27'-10"	29'-3"	42'-0"	43'-5"
	10'	27'-4"	28'-9"	41'-5"	42'-10"
	11'	26'-10"	28'-3"	40'-11"	42'-4"
	12'	26'-4"	27'-9"	40'-5"	41'-10"

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW — SECTIONS "A" ONLY

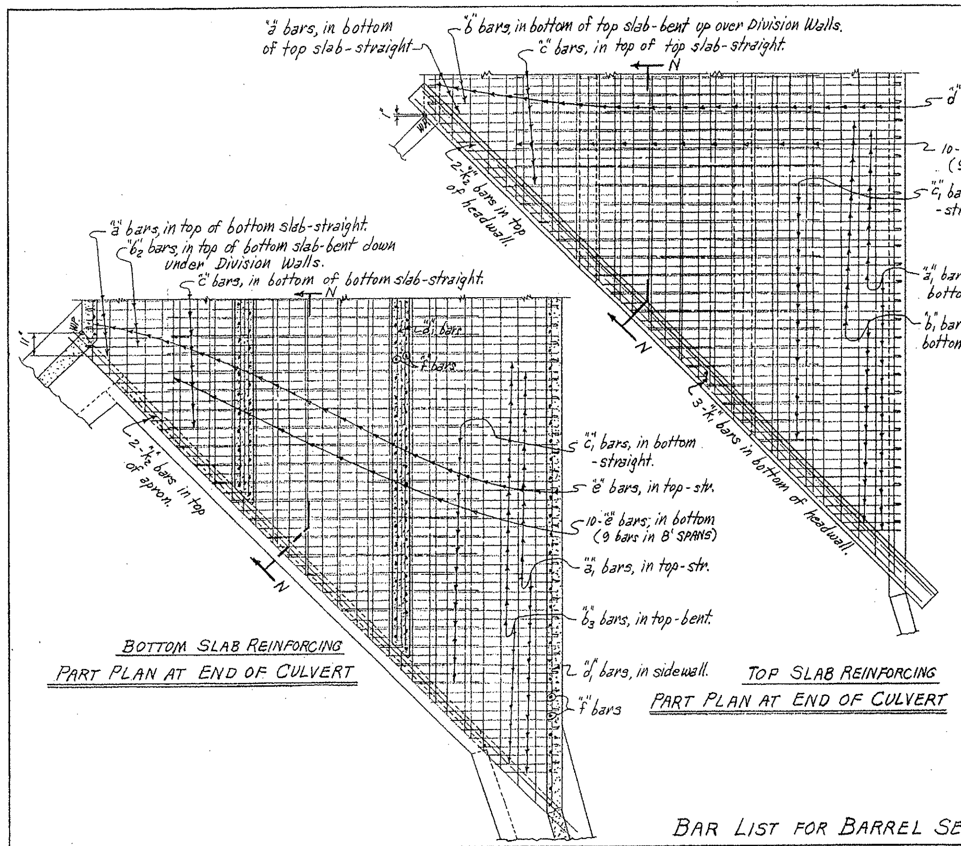
9', 10', 11' AND 12' SPANS — 3:1 OR 4:1 SLOPES
TRIPLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-345X-2

Designed by:- W.C.H. 9-17-62 — Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 8-28-64 — Checked by:-
Quantities by:- W.C.H. 11-9-64 — Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

NOTE:- For Details of Standard Wings and bar lists, see Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

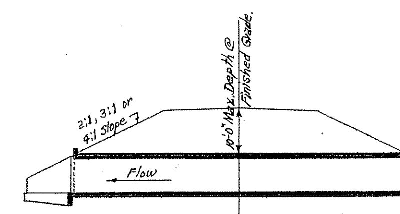


BOTTOM SLAB REINFORCING

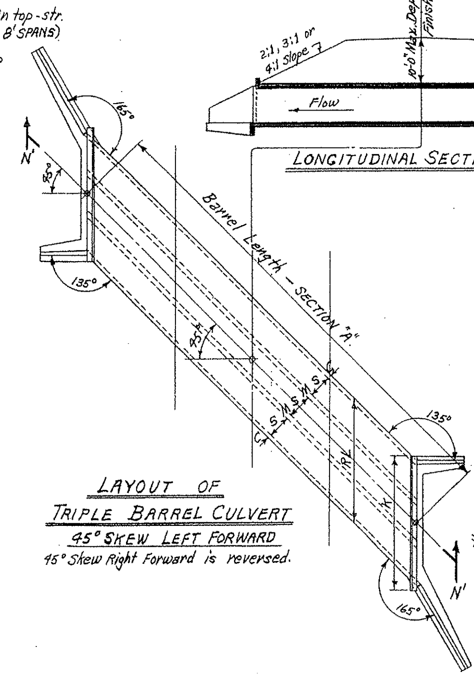
PART PLAN AT END OF CULVERT

TOP SLAB REINFORCING

PART PLAN AT END OF CULVERT



LONGITUDINAL SECTION N-N'

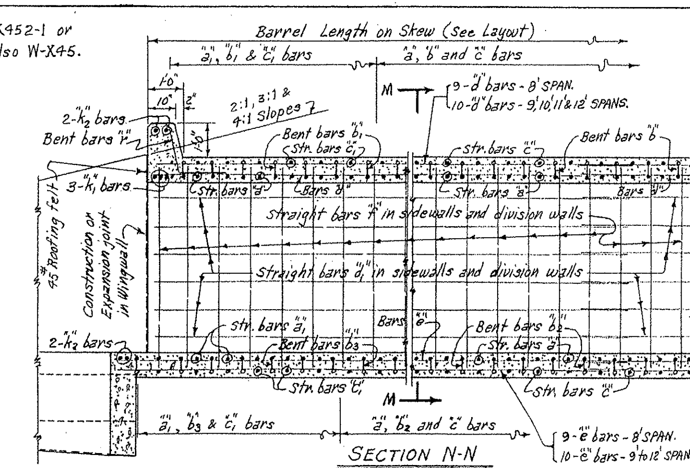


LAYOUT OF

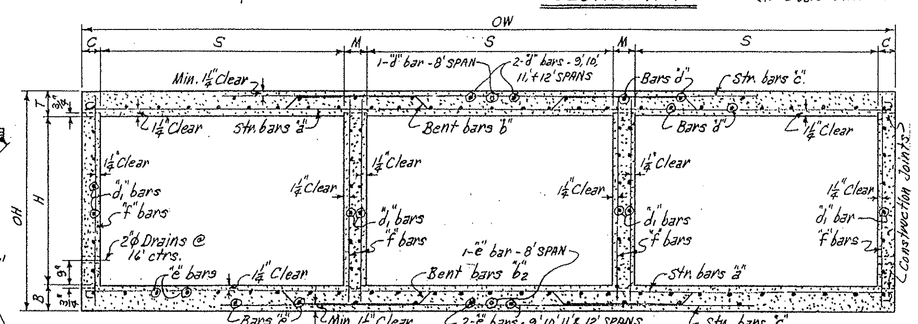
TRIPLE BARREL CULVERT

45° SKEW LEFT FORWARD

45° Skew Right Forward is reversed.



SECTION N-N



TYPICAL SECTION M-M

BAR LIST FOR BARREL SECTION "A" - 60'-0" IN LENGTH - TWO 45° SKEWED ENDS

DEPTH OF COVER	CLEAR SPAN	CLEAR HEIGHT	"a" bars				"a_1" bars					"b" bars						
			STRAIGHT									BENT - See Diagrams below.						
			In Top and Bottom Slab of Barrel.				In Top and Bottom Slab of Barrel. (Four of Each Length)					In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.						
D	S	H	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	SIZE	SPACING	NO. REQ'D	LENGTH	X	Y	Z
5'-0" TO 10'-0" MAXIMUM		4'			72	26'-1"			92	25'-1"	3'-1"			33	27'-9"	0'-5"	3'-10"	6'-4"
		5'			70	26'-5"			96	25'-5"	2'-5"			33	28'-1"	"	3'-11"	6'-5"
	3 @ 8'	6'	#5	12"	70	"	#5	12"	96	"	"	#6	12"	33	"	"	"	"
		7'			70	26'-8"			96	25'-8"	2'-8"			33	28'-4"	"	4'-0"	6'-5½"
		8'			70	26'-9"			96	25'-9"	2'-9"			33	28'-5"	"	4'-0"	6'-6"
		9'			70	27'-1"			96	26'-1"	3'-1"			32	28'-9"	"	4'-1"	6'-7"
		10'			68	27'-5"			100	26'-5"	2'-5"			32	29'-1"	0'-5"	4'-2"	6'-8"
		5'			64	29'-5"			108	28'-5"	2'-5"			30	31'-2"	0'-5¾"	4'-3½"	7'-2"
		6'			64	29'-8"			108	28'-8"	2'-8"			30	31'-5"	"	4'-4½"	7'-2½"
		7'			64	"			108	"	"			30	"	"	"	"
	3 @ 9'	8'	#6	12"	64	29'-9"	#6	12"	108	28'-9"	2'-9"	#6	12"	30	31'-6"	"	"	7'-3"
		9'			64	30'-1"			108	29'-1"	3'-1"			29	31'-10"	"	4'-5½"	7'-4"
		10'			62	30'-5"			112	29'-5"	2'-5"			29	32'-2"	"	4'-6½"	7'-5"
		11'			62	30'-7"			112	29'-7"	2'-7"			29	32'-4"	0'-5¾"	4'-6½"	7'-6"
		5'			64	32'-5"			128	31'-6"	3'-1"			29	34'-3"	0'-6½"	4'-8"	7'-11"
		6'			64	32'-8"			128	31'-9"	3'-4"			29	34'-6"	"	4'-9"	7'-11½"
		7'			64	"			128	"	"			29	"	"	"	"
	3 @ 10'	8'	#6	11"	64	32'-9"	#6	11"	132	31'-10"	2'-6"	#6	11"	29	34'-7"	"	"	8'-0"
		9'			62	33'-1"			132	32'-2"	2'-10"			29	34'-11"	"	4'-10"	8'-1"
		10'			62	33'-5"			132	32'-6"	3'-2"			29	35'-3"	"	4'-11"	8'-2"
		11'			62	33'-7"			132	32'-8"	3'-4"			28	35'-5"	"	"	8'-3"
		12'			60	33'-9"			136	32'-10"	2'-7"			28	35'-7"	0'-6½"	4'-11"	8'-4"
		6'			52	35'-9"			132	34'-9"	2'-9"			24	37'-10"	0'-7"	5'-2"	8'-9"
		7'			52	"			132	"	"			24	"	"	"	"
		8'			52	"			132	"	"			24	"	"	"	"
	3 @ 11'	9'	#6	12"	52	36'-1"	#6	12"	132	35'-1"	3'-1"	#7	12"	23	38'-2"	"	5'-3"	8'-10"
		10'			50	36'-5"			136	35'-5"	2'-5"			23	38'-6"	"	5'-4"	8'-11"
		11'			50	36'-7"			136	35'-7"	2'-7"			23	38'-8"	"	"	9'-0"
		12'			50	36'-9"			136	35'-9"	2'-9"			23	38'-10"	0'-7"	5'-4"	9'-1"
		6'			50	38'-9"			156	37'-10"	3'-0"			23	40'-11"	0'-7¾"	5'-6½"	9'-6"
		7'			50	"			156	"	"			23	"	"	"	"
	3 @ 12'	8'	#6	11"	50	"	#6	11"	156	"	"	#7	11"	23	"	"	"	"
		9'			50	39'-1"			156	38'-2"	3'-4"			22	41'-3"	"	5'-7½"	9'-7"
		10'			48	39'-5"			160	38'-6"	2'-9"			22	41'-7"	"	5'-8½"	9'-8"
		11'			48	39'-7"			160	38'-8"	2'-11"			22	41'-9"	"	"	9'-9"
		12'			48	39'-9"			160	38'-10"	3'-1"			21	41'-11"	0'-7¾"	5'-8½"	9'-10"

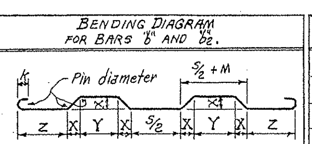
CLEAR SPAN	CLEAR HEIGHT	"b_1" bars							"b_2" bars						
		BENT - See Diagrams below.							BENT - See Diagrams below.						
		In Bottom of Top Slab - some bent up over Division Walls - one end hooked. (2 of Each Length). Alt. with "a_1" and "c" or "c_1" bars.							In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.						
S	H	SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.	SIZE	SPACING	NO. REQ'D	LENGTH	X	Y	Z
	4'			48	26'-8"	3'-1"	25'-6"	2'-6"			35	27'-10"	0'-5½"	3'-9"	6'-4"
	5'			48	27'-0"	3'-5"	25'-10"	2'-10"			35	28'-2"	"	3'-10"	6'-5"
3 @ 8'	6'	#6	12"	48	"	"	"	"	#6	12"	35	"	"	"	"
	7'			48	27'-3"	3'-8"	26'-1"	3'-1"			35	28'-5"	"	3'-11"	6'-5½"
	8'			48	27'-4"	3'-9"	26'-2"	3'-2"			35	28'-6"	"	"	6'-6"
	9'			50	27'-8"	3'-1"	26'-6"	2'-6"			34	28'-10"	"	4'-0"	6'-7"
	10'			50	28'-0"	3'-5"	26'-10"	2'-10"			34	29'-2"	0'-5½"	4'-1"	6'-8"
	5'			54	30'-2"	3'-5"	28'-10"	2'-10"			32	31'-3"	0'-6¼"	4'-2½"	7'-2"
	6'			54	30'-5"	3'-8"	29'-1"	3'-1"			32	31'-6"	"	4'-3½"	7'-2½"
	7'			54	"	"	"	"			32	"	"	"	"
3 @ 9'	8'	#6	12"	54	30'-6"	3'-9"	29'-2"	3'-2"	#6	12"	32	31'-7"	"	"	7'-3"
	9'			56	30'-10"	3'-1"	29'-6"	2'-6"			31	31'-11"	"	4'-4½"	7'-4"
	10'			56	31'-2"	3'-5"	29'-10"	2'-10"			31	32'-3"	"	4'-5½"	7'-5"
	11'			56	31'-4"	3'-7"	30'-0"	3'-0"			31	32'-5"	0'-6¼"	4'-5½"	7'-6"
	5'			66	33'-4"	3'-2"	31'-11"	2'-7"			31	34'-4"	0'-7"	4'-7"	7'-11"
	6'			66	33'-7"	3'-5"	32'-2"	2'-10"			31	34'-7"	"	4'-8"	7'-11½"
	7'			66	"	"	"	"			31	"	"	"	"
3 @ 10'	8'	#6	11"	66	33'-8"	3'-6"	32'-3"	2'-11"	#6	11"	31	34'-8"	"	"	8'-0"
	9'			66	34'-0"	3'-10"	32'-7"	3'-3"			31	35'-0"	"	4'-9"	8'-1"
	10'			68	34'-4"	4'-2"	32'-11"	2'-8"			31	35'-4"	"	4'-10"	8'-2"
	11'			68	34'-6"	4'-4"	33'-1"	2'-10"			30	35'-6"	"	"	8'-3"
	12'			68	34'-8"	4'-6"	33'-3"	3'-0"			30	35'-8"	0'-7"	4'-10"	8'-4"
	6'			66	36'-9"	3'-10"	35'-2"	3'-2"			26	37'-11"	0'-7½"	5'-1"	8'-9"
	7'			66	"	"	"	"			26	"	"	"	"
	8'			66	"	"	"	"			26	"	"	"	"
3 @ 11'	9'	#7	12"	68	37'-1"	3'-2"	35'-6"	2'-6"	#7	12"	25	38'-3"	"	5'-2"	8'-10"
	10'			68	37'-5"	3'-6"	35'-10"	2'-10"			25	38'-7"	"	5'-3"	8'-11"
	11'			68	37'-7"	3'-8"	36'-0"	3'-0"			25	38'-9"	"	"	9'-0"
	12'			68	37'-9"	3'-10"	36'-2"	3'-2"			25	38'-11"	0'-7½"	5'-3"	9'-1"
	6'			80	39'-11"	3'-2"	38'-3"	2'-6"			25	41'-0"	0'-8¼"	5'-5½"	9'-6"
	7'			80	"	"	"	"			25	"	"	"	"
3 @ 12'	8'	#7	11"	80	"	"	"	"	#7	11"	25	"	"	"	"
	9'			80	40'-3"	3'-6"	38'-7"	2'-10"			24	41'-4"	"	5'-6½"	9'-7"
	10'			80	40'-7"	3'-10"	38'-11"	3'-2"			24	41'-8"	"	5'-7½"	9'-8"
	11'			80	40'-9"	4'-0"	39'-1"	3'-4"			24	41'-10"	"	"	9'-9"
	12'			82	40'-11"	4'-2"	39'-3"	2'-7"			23	42'-0"	0'-8¼"	5'-7½"	9'-10"

CLEAR SPAN	CLEAR HEIGHT	"b_3" bars							"c" bars				"c_1" bars				
		BENT - See Diagrams below.							STRAIGHT								
		In Top of Bottom Slab - some bent down under Division Walls - one end hooked. (2 of Each Length) Alt. with "a_1" and "c" or "c_1" bars							In Top and Bottom Slab of Barrel. Alternate with "b" and "b_2" bars.				In Top and Bottom Slab of Barrel. Alt. with "b_1" & "b_3" bars. (Four of each Length)				
S	H	SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH MAX.	LENGTH MIN.
	4'			48	26'-9"	3'-1"	25'-6"	2'-6"			88	17'-4"			60	16'-9"	2'-9"
	5'			48	27'-1"	3'-5"	25'-10"	2'-10"			86	17'-6"			60	17'-0"	3'-0"
3 @ 8'	6'	#6	12"	48	"	"	"	"	#6	12"	86	"	#6	12"	60	"	"
	7'			48	27'-4"	3'-8"	26'-1"	3'-1"			86	17'-8"			60	17'-2"	3'-2"
	8'			48	27'-5"	3'-9"	26'-2"	3'-2"			86	17'-8"			60	17'-3"	3'-3"
	9'			50	27'-9"	3'-1"	26'-6"	2'-6"			86	17'-10"			64	17'-6"	2'-6"
	10'			50	28'-1"	3'-5"	26'-10"	2'-10"			84	18'-0"			64	17'-9"	2'-9"
	5'			54	30'-3"	3'-5"	28'-10"	2'-10"			84	19'-6"			68	18'-6"	2'-6"
	6'			54	30'-6"	3'-8"	29'-1"	3'-1"			84	19'-8"			68	18'-8"	2'-8"
	7'			54	"	"	"	"			84	"			68	"	"
3 @ 9'	8'	#6	12"	54	30'-7"	3'-9"	29'-2"	3'-2"	#7	12"	84	"	#7	12"	68	18'-9"	2'-9"
	9'			56	30'-11"	3'-1"	29'-6"	2'-6"			84	19'-10"			68	19'-0"	3'-0"
	10'			56	31'-3"	3'-5"	29'-10"	2'-10"			82	20'-0"			68	19'-3"	3'-3"
	11'			56	31'-5"	3'-7"	30'-0"	3'-0"			82	20'-0"			68	19'-4"	3'-4"
	5'			66	33'-5"	3'-2"	31'-11"	2'-7"			88	21'-6"			84	20'-7"	2'-4"
	6'			66	33'-8"	3'-5"	32'-2"	2'-10"			88	21'-8"			84	20'-9"	2'-6"
	7'			66	"	"	"	"			88	"			84	"	"
3 @ 10'	8'	#6	11"	66	33'-9"	3'-6"	32'-3"	2'-11"	#7	11"	88	"	#7	11"	84	20'-10"	2'-7"
	9'			66	34'-1"	3'-10"	32'-7"	3'-3"			86	21'-10"			84	21'-1"	2'-10"
	10'			68	34'-5"	4'-2"	32'-11"	2'-8"			86	22'-0"			84	21'-4"	3'-1"
	11'			68	34'-7"	4'-4"	33'-1"	2'-10"			86	"			84	21'-5"	3'-2"
	12'			68	34'-9"	4'-6"	33'-3"	3'-0"			84	"			84	21'-6"	3'-3"
	6'			66	36'-9"	3'-10"	35'-2"	3'-2"			76	23'-8"			84	22'-9"	2'-9"
	7'			66	"	"	"	"			76	"			84	"	"
	8'			66	"	"	"	"			76	"			84	"	"
3 @ 11'	9'	#7	12"	68	37'-1"	3'-2"	35'-6"	2'-6"	#7	12"	76	23'-10"	#7	12"	84	23'-0"	3'-0"
	10'			68	37'-5"	3'-6"	35'-10"	2'-10"			74	24'-0"			84	23'-3"	3'-3"
	11'			68	37'-7"	3'-8"	36'-0"	3'-0"			74	"			84	23'-4"	3'-4"
	12'			68	37'-9"	3'-10"	36'-2"	3'-2"			74	"			88	23'-5"	2'-5"
	6'			80	40'-0"	3'-2"	38'-3"	2'-6"			78	25'-8"			100	24'-11"	2'-11"
	7'			80	"	"	"	"			78	"			100	"	"
3 @ 12'	8'	#7	11"	80	"	"	"	"	#7	11"	78	"	#7	11"	100	"	"
	9'			80	40'-4"	3'-6"	38'-7"	2'-10"			78	25'-10"			100	25'-2"	3'-2"
	10'			80	40'-8"	3'-10"	38'-11"	3'-2"			76	26'-0"			104	25'-5"	2'-6"
	11'			80	40'-10"	4'-0"	39'-1"	3'-4"			76	26'-0"			104	25'-6"	2'-7"
	12'			82	41'-0"	4'-2"	39'-3"	2'-7"			76	26'-0"			104	25'-7"	2'-8"

CLEAR SPAN	CLEAR HEIGHT	"d" bars				"d_1" bars				"e" bars				"f" bars				"k_1" bars				"k_2" bars		
		STRAIGHT												STRAIGHT				STRAIGHT						
		Longitudinal in Top Slab of Barrel.				Longitudinal in Sidewalls and Division Walls.				Longitudinal in Bottom Slab of Barrel.				Verticals in Sidewalls and Division Walls.				In Bottom of Headwalls (3 of Each Length per Headwall)				In Top of Headwalls and Aprons. (2 Rows Each)		
S	H	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	SPACING	NO. REQ'D	LENGTH	SIZE	NO. REQ'D	LENGTH MAX.	LENGTH MIN.	SIZE	NO. REQ'D	LENGTH
	4'			36	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)			24	2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap)			36	2 @ 31'-10" for 60'-0" Length Barrel (1'-3" Lap)			360	5'-2"	⊠	12	26'-2"	13'-0"	⊕	16	20'-8"
	5'			36				30				36		#4	12"	360	6'-2"		12	26'-5"	13'-3"		16	20'-11"
3 @ 8'	6'	#4	12"	36		#4	12"	36		#4	12"	36				360	7'-2"		12	"	"	#7	16	"
	7'			36				42				36			10"	432	8'-2"	#7	12	26'-8"	13'-4"		16	21'-1"
	8'			36				48				36		#5	12"	360	9'-2"		12	26'-9"	13'-5"		16	21'-2"
	9'			36				54				36			11"	396	10'-2"		12	27'-1"	13'-6"		16	21'-5"
	10'			36				60				36		#6	12"	360	11'-2"		12	27'-5"	13'-8"		16	21'-7"
	5'			40				30				40			12"	360	6'-4"	⊠	12	29'-6"	14'-9"	⊕	16	23'-2"
	6'			40				36				40		#4		360	7'-4"		12	29'-9"	14'-10"		16	23'-4"
	7'			40				42				40			10"	432	8'-4"		12	"	"		16	"
3 @ 9'	8'	#4	12"	40		#4	12"	48		#4	12"	40			12"	360	9'-4"	#8	12	29'-10"	14'-10"	#8	16	23'-5"
	9'			40				54				40		#5	10"	432	10'-4"		12	30'-2"	15'-0"		16	23'-8"
	10'			40				60				40		#6	12"	360	11'-4"		12	30'-6"	15'-2"		16	23'-11"
	11'			40				66				40			11"	396	12'-4"		12	30'-7"	15'-3"		16	24'-0"
	5'			43				30				43			12"	360	6'-5"	⊠	12	32'-4"	16'-2"	⊕	16	25'-4"
	6'			43				36				43		#4		360	7'-5"		12	32'-7"	16'-3"		16	25'-6"
	7'			43				42				43			10"	432	8'-5"		12	"	"		16	"
3 @ 10'	8'	#4	12"	43		#4	12"	48		#4	12"	43		#5	12"	360	9'-5"	#8	12	32'-8"	16'-3"	#8	16	25'-7"
	9'			43				54				43			10"	432	10'-5"		12	33'-0"	16'-5"		16	25'-9"
	10'			43				60				43			12"	360	11'-5"		12	33'-3"	16'-7"		16	26'-0"
	11'			43				66				43		#6	11"	396	12'-5"		12	33'-5"	16'-8"		16	26'-2"
	12'			43				72				43			10"	432	13'-5"		12	33'-7"	16'-9"		16	26'-3"
	6'			46				36				46		#4	12"	360	7'-7"	⊠	12	35'-8"	17'-10"	⊕	16	27'-10"
	7'			46				42				46			11"	396	8'-7"		12	"	"		16	"
	8'			46				48				46		#5	12"	360	9'-7"		12	"	"		16	"
3 @ 11'	9'	#4	12"	46		#4	12"	54		#4	12"	46			10"	432	10'-7"	#9	12	36'-0"	18'-0"	#9	16	28'-1"
	10'			46				60				46			12"	360	11'-7"		12	36'-3"	18'-2"		16	28'-4"
	11'			46				66				46		#6	11"	396	12'-7"		12	36'-5"	18'-3"		16	28'-5"
	12'			46				72				46			9"	480	13'-7"		12	36'-7"	18'-4"		16	28'-7"
	6'			49				36				49		#4	12"	360	7'-8"	⊠	12	38'-6"	19'-3"	⊕	16	29'-11"
	7'			49				42				49				360	8'-8"		12	"	"		16	"
	8'			49				48				49		#5	12"	360	9'-8"		12	"	"		16	"
3 @ 12'	9'	#4	12"	49		#4	12"	54		#4	12"	49			10"	432	10'-8"	#9	12	38'-10"	19'-5"	#9	16	30'-2"
	10'			49				60				49			12"	360	11'-8"		12	39'-1"	19'-7"		16	30'-5"
	11'			49				66				49		#6	11"	396	12'-8"		12	39'-3"	19'-8"		16	30'-7"
	12'			49				72				49			9"	480	13'-8"		12	39'-5"	19'-9"		16	30'-8"

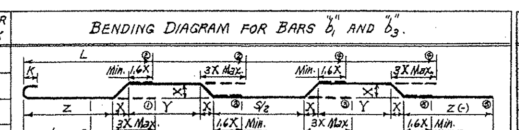
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b_2".



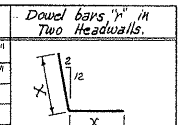
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b_1" AND "b_3".



SPAN	SIZE	SPACING	NO. REQ'D	LENGTH	X
8'	#4	12½	76	2'-9"	1'-4½"
9'	#4	12½	86	2'-11"	1'-5½"
10'	#4	12½	94	3'-0"	1'-6"
11'	#4	12½	104	3'-2"	1'-7"
12'	#4	12½	112	3'-4"	1'-8"

Dowel bars "r" in Two Headwalls.



◤ These bars are in the skewed portion of barrel only. The length of "a_1" and "c_1" bars and overall length "L" of "b_1" and "b_3" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.

⊠ These bars to be spliced at alt. division walls (2'-4", 2'-8" & 3'-0" Laps).

⊕ Splice "k_2" bars at center of center span. (2'-4", 2'-8" & 3'-0" Laps).

NOTE:- Dimensions are to centers of bars (b, b_1, b_2 & b_3). The X, Y & Z values for "b_1" bars are same as "b" bars, and for "b_3" bars same as for "b_2" bars. ①① - ⑤⑤ Min. & Max. lengths "L" for bars "b_1" & b_3 for each type bend.

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ. FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* CLASS S CONC. PER LIN. FT. OF BARREL	TOTAL FOR 60'-0" LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
	BARREL DIMENSIONS											* QUANTITIES	REINFORCING STEEL		
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	LB.	LB.	LB.
SECTION "A" = 10'-0"		4'	96	26'-4"		6"	8"		5'-5¼"	37'-2⅞"	39'-3"	1.768	17,981	278.34	81.83
		5'	120	26'-8"		7"	9"		6'-5¼"	37'-8½"	39'-8½"	1.939	18,566	286.35	86.84
	3 @ 8'	6'	144	26'-8"		7"	9"		7'-5¼"	"	"	2.033	19,003	294.37	91.85
		7'	168	26'-11"	8½"	7½"	10"	9"	8'-5¼"	38'-0¾"	40'-0¾"	2.210	20,080	310.70	96.86
		8'	192	27'-0"		8"	10"		9'-5¼"	38'-2¼"	40'-2¼"	2.347	21,457	338.44	101.87
		9'	216	27'-4"		9"	11"		10'-5¼"	38'-7⅞"	40'-8"	2.587	22,604	358.91	106.88
		10'	240	27'-8"		10"	12"		11'-5¼"	39'-1½"	41'-1½"	2.852	24,785	388.90	111.89
		5'	135	29'-8"		7"	9"		6'-7"	41'-11½"	43'-11½"	2.234	23,712	360.70	91.85
		6'	162	29'-11"		7½"	10"		7'-7"	42'-3¾"	44'-3¾"	2.403	24,390	370.90	96.86
		7'	189	29'-11"		7½"	10"		8'-7"	"	"	2.511	25,276	385.59	101.87
	3 @ 9'	8'	216	30'-0"	9¼"	8"	10"	9¾"	9'-7"	42'-5⅝"	44'-5⅝"	2.648	26,679	408.43	106.88
		9'	243	30'-4"		9"	11"		10'-7"	42'-10¾"	44'-10¾"	2.890	28,254	434.31	111.89
		10'	270	30'-8"		10"	12"		11'-7"	43'-4⅜"	45'-4⅜"	3.156	30,066	465.54	116.90
		11'	297	30'-10"		11"	12"		12'-7"	43'-7¼"	45'-7¼"	3.370	31,623	489.67	121.91
		5'	150	32'-8"		7"	9"		6'-8½"	46'-2¾"	48'-2¾"	2.561	27,382	417.70	96.86
		6'	180	32'-11"		7½"	10"		7'-8½"	46'-6⅝"	48'-6⅝"	2.731	28,082	428.10	101.87
		7'	210	32'-11"		7½"	10"		8'-8½"	"	"	2.839	28,972	442.86	106.88
	3 @ 10'	8'	240	33'-0"	10"	8"	10"	10½"	9'-8½"	46'-8"	48'-8"	2.977	30,406	465.86	111.89
		9'	270	33'-4"		9"	11"		10'-8½"	47'-1⅝"	49'-1⅝"	3.220	31,954	492.09	116.90
		10'	300	33'-8"		10"	12"		11'-8½"	47'-7⅜"	49'-7⅜"	3.488	34,024	522.69	121.91
		11'	330	33'-10"		11"	12"		12'-8½"	47'-10⅝"	49'-10⅝"	3.702	35,498	547.98	126.92
		12'	360	34'-0"		12"	12"		13'-8½"	48'-1"	50'-1"	3.929	37,006	576.10	131.93
		6'	198	36'-0"		8"	10"		7'-10"	50'-11"	52'-11"	3.111	31,668	474.87	106.88
		7'	231	36'-0"		8"	10"		8'-10"	"	"	3.222	32,359	486.02	111.89
		8'	264	36'-0"		8"	10"		9'-10"	"	"	3.333	33,932	512.47	116.90
	3 @ 11'	9'	297	36'-4"	10¾"	9"	11"	11¼"	10'-10"	51'-4⅝"	53'-4⅝"	3.578	35,528	539.03	121.91
		10'	330	36'-8"		10"	12"		11'-10"	51'-10¼"	53'-10¼"	3.898	37,383	570.99	126.92
		11'	363	36'-10"		11"	12"		12'-10"	52'-1⅛"	54'-1"	4.063	38,982	595.50	131.93
		12'	396	37'-0"		12"	12"		13'-10"	52'-3⅞"	54'-4"	4.290	41,688	640.20	136.94
		6'	216	39'-0"		8"	10"		7'-11½"	55'-1⅞"	57'-1⅞"	3.495	36,147	544.35	111.89
		7'	252	39'-0"		8"	10"		8'-11½"	"	"	3.606	36,632	552.37	116.90
		8'	288	39'-0"		8"	10"		9'-11½"	"	"	3.718	38,422	582.13	121.91
	3 @ 12'	9'	324	39'-4"	11½"	9"	11"	12"	10'-11½"	55'-7½"	57'-7½"	3.964	39,741	609.07	126.92
		10'	360	39'-8"		10"	12"		11'-11½"	56'-1⅛"	58'-1"	4.235	41,644	641.44	131.93
		11'	396	39'-10"		11"	12"		12'-11½"	56'-4"	58'-4"	4.451	43,268	666.13	136.94
		12'	432	40'-0"		12"	12"		13'-11½"	56'-6⅝"	58'-6¾"	4.679	45,994	711.11	141.95

* For remainder of quantities see Std. Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.

REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.

BAR LAPS:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.

CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.

SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD

H20-S16 LOADING A.A.S.H.O. 1961

AND

SPECIAL MILITARY LOADING

Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-

Class S Concrete (n=10) 1200#/□"

Reinforcing Steel 20,000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS

FOR

REINFORCED CONCRETE BOX CULVERTS

45° SKEW — SECTIONS "A" ONLY.

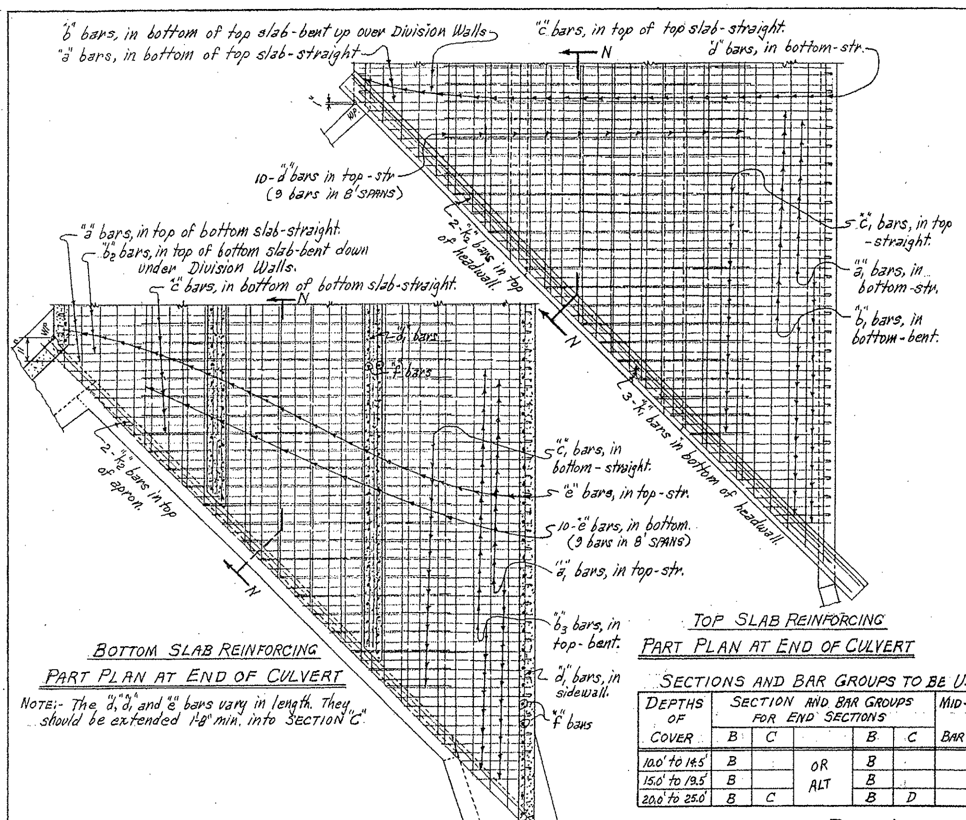
8', 9', 10', 11' AND 12' SPANS — 2:1, 3:1 OR 4:1 SLOPES

TRIPLES — COVER 10'-0" MAX.

STANDARD DRAWING NO. R-345X-3.

Designed by:- W.C.H. 9-17-62. Checked by:- R.H.S. 11-12-62.
Drawn by:- W.C.H. 9-2-64 Checked by:-
Quantities by:- W.C.H. 11-12-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

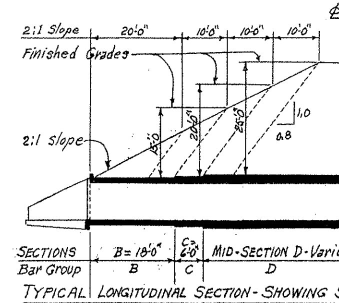


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-8" min. into SECTION "C".

NOTE:- For Details of Standard Wings and bar lists, see Drawing Nos. W-X452-1 or W-X452-2. Also W-X45.



TYPICAL LONGITUDINAL SECTION - SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

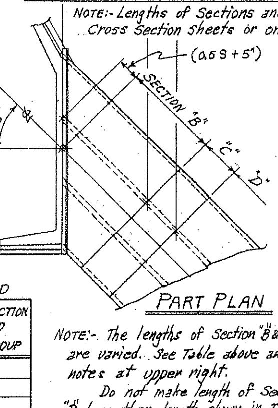
NOTE:- Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.

℄ L'GTH OF SECTS. ON 45° SKEW

SPANS	SECTIONS B	SECTIONS C	
8'	21'-1"	8'-6"	
9'	20'-10"	8'-3"	
10'	20'-7"	8'-0"	
11'	20'-4"	7'-9"	
12'	20'-1"	7'-6"	

See note at far right

These lengths are perpendicular to ℄ of roadway, near ℄ of Division Wall on Long Side. See Table of Skewed Lengths above.

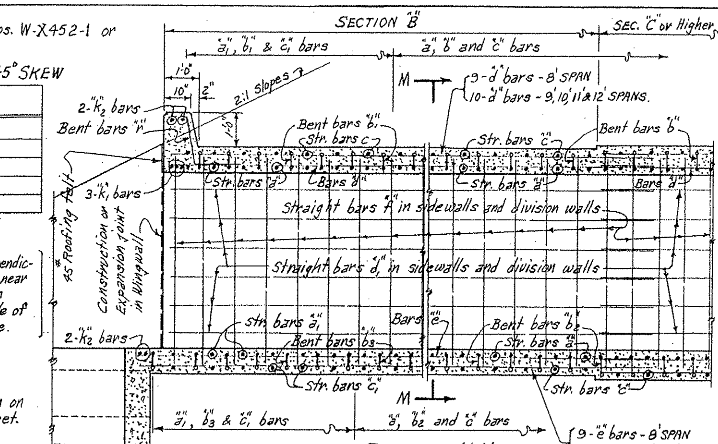


PART PLAN

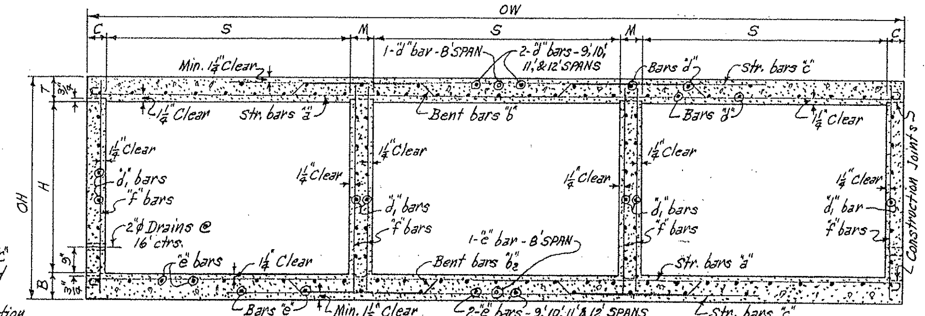
NOTE:- The lengths of Section "B" & "C" are varied. See Table above and notes at upper right.
Do not make length of Section "B" less than length shown in Table above.

SECTIONS AND BAR GROUPS TO BE USED

DEPTHS OF COVER	SECTION AND BAR GROUPS FOR END SECTIONS B	C		B	C	MID-SECTION AND BAR GROUP
10.0' to 14.5'	B		OR	B		B
15.0' to 19.5'	B		ALT	B		C
20.0' to 25.0'	B	C		B	D	D



SECTION N-N



TYPICAL SECTION M-M

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ℄ Length of the combined Sections "B" & "C" (34'-0") have been shortened by (0.5S + 5"). The lengths of Section "B" & "C" are varied.

SECTIONS "B"	SECTIONS "C"
8'-0" SPANS = (25'-6") - (0.5S+5") + 0"	(8'-6") - 0"
9'-0" SPANS = (25'-6") - (0.5S+5") + 3"	(8'-6") - 3"
10'-0" SPANS = (25'-6") - (0.5S+5") + 6"	(8'-6") - 6"
11'-0" SPANS = (25'-6") - (0.5S+5") + 9"	(8'-6") - 9"
12'-0" SPANS = (25'-6") - (0.5S+5") + 12"	(8'-6") - 12".

BARREL DIMENSIONS - SECTION "B" ONLY; * TOTAL QUANTITIES - ONE SECTION B; & UNIT QUANTITIES

MAX. DESIGN DEPTH OF COVER (D): SECTION "B" = 15'-0" MAXIMUM

CLEAR SPANS S	CLEAR HEIGHT H	SQ.FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	CLASS S CONCRETE: TOTAL FOR SECTION "B" - BARREL ONLY CU.YD.	PER LIN. FT. OF BARREL SECTIONS B CU.YD.	C CU.YD.	D CU.YD.	REINFORCING STEEL: TOTAL FOR SECTION "B" BARREL, APRON & HEADWALL LB.	PER LIN. FT. OF BARREL SECTIONS B LB.	C LB.	D LB.	ADDITIONAL PER LAP LB.
3 @ 8'	4'	96	26'-4"	9½"	6"	8"	10"	5'-7½"	37'-2⅝"	39'-3"	40.70	1.931	2.093	2.256	7062	294.62	342.18	353.05	81.83
	5'	120	26'-8"		7"	9"		6'-7½"	37'-8½"	39'-8½"	44.25	2.099	2.263	2.428	7244	305.03	353.13	364.11	86.84
	6'	144	26'-8"		7"	9"		7'-7½"	"	"	46.33	2.198	2.374	2.564	7420	313.05	361.14	379.20	91.85
	7'	168	26'-11"		7½"	10"		8'-7½"	38'-0¾"	40'-0¾"	50.10	2.376	2.556	2.764	8057	341.75	395.50	414.12	96.86
	8'	192	27'-0"		8"	10"		9'-7½"	38'-2¼"	40'-2¼"	53.00	2.514	2.696	2.924	8720	371.95	435.42	449.02	101.87
	9'	216	27'-4"		9"	11"		10'-7½"	38'-7⅞"	40'-8"	58.11	2.756	2.942	3.161	9410	402.07	462.51	488.86	106.88
	10'	240	27'-8"		10"	12"		11'-7½"	39'-1½"	41'-1½"	63.74	3.023	3.212	3.439	10,047	429.44	525.14	525.45	111.89
3 @ 9'	5'	135	29'-8"	10¼"	7"	9"	10¾"	6'-9"	41'-11⅛"	43'-11½"	50.35	2.417	2.646	2.829	9180	385.72	426.98	455.22	91.85
	6'	162	29'-11"		7½"	10"		7'-9"	42'-3¾"	44'-3¾"	53.90	2.587	2.818	3.028	9396	396.11	437.70	469.70	96.86
	7'	189	29'-11"		7½"	10"		8'-9"	"	"	56.15	2.695	2.954	3.167	9972	423.25	470.78	500.45	101.87
	8'	216	30'-0"		8"	10"		9'-9"	42'-5⅝"	44'-5"	59.03	2.833	3.096	3.328	10,770	460.23	503.36	541.85	106.88
	9'	243	30'-4"		9"	11"		10'-9"	42'-10⅞"	44'-10¾"	64.11	3.077	3.328	3.567	11,356	484.78	538.32	585.32	111.89
	10'	270	30'-8"		10"	12"		11'-9"	43'-4¾"	45'-4¼"	69.70	3.346	3.601	3.846	11,851	512.85	586.40	634.23	116.90
	11'	297	30'-10"		11"	12"		12'-9"	43'-7¼"	45'-7¼"	74.17	3.560	3.798	4.069	12,563	546.89	621.99	675.30	121.91
3 @ 10'	5'	150	32'-8"	11¼"	7"	9"	11¾"	6'-11"	46'-2⅜"	48'-2¼"	57.90	2.813	3.065	3.340	9973	430.73	490.77	528.19	96.86
	6'	180	32'-11"		7½"	10"		7'-11"	46'-6⅝"	48'-6½"	61.44	2.985	3.264	3.519	10,358	441.21	503.08	539.38	101.87
	7'	210	32'-11"		7½"	10"		8'-11"	"	"	63.66	3.093	3.375	3.658	10,931	468.72	530.97	573.68	106.88
	8'	240	33'-0"		8"	10"		9'-11"	46'-8"	48'-8"	66.51	3.231	3.517	3.820	11,588	499.70	568.96	607.57	111.89
	9'	270	33'-4"		9"	11"		10'-11"	47'-1⅝"	49'-1¾"	71.58	3.477	3.769	4.079	12,139	522.18	605.06	644.93	116.90
	10'	300	33'-8"		10"	12"		11'-11"	47'-7⅜"	49'-7¼"	77.15	3.748	4.026	4.363	12,988	559.23	640.31	694.10	121.91
	11'	330	33'-10"		11"	12"		12'-11"	47'-10⅝"	49'-10¼"	81.58	3.963	4.225	4.568	13,494	590.37	688.98	751.41	126.92
	12'	360	34'-0"		12"	12"		13'-11"	48'-1"	50'-1"	86.27	4.191	4.454	4.782	14,319	628.01	731.61	801.57	131.93
3 @ 11'	6'	198	36'-0"	12"	8"	10"	12¾"	8'-0¾"	50'-11"	52'-11"	69.47	3.417	3.722	4.000	12,787	545.28	585.64	642.61	106.88
	7'	231	36'-0"		8"	10"		9'-0¾"	"	"	71.73	3.528	3.833	4.155	13,365	573.17	613.90	669.96	111.89
	8'	264	36'-0"		8"	10"		10'-0¾"	"	"	73.99	3.629	3.992	4.319	14,136	610.52	652.64	709.38	116.90
	9'	297	36'-4"		9"	11"		11'-0¾"	51'-4⅝"	53'-4½"	79.03	3.887	4.230	4.582	14,765	636.03	678.43	735.96	121.91
	10'	320	36'-8"		10"	12"		12'-0¾"	51'-10⅞"	53'-10¾"	84.57	4.159	4.489	4.850	15,469	679.34	724.85	783.32	126.92
	11'	363	36'-10"		11"	12"		13'-0¾"	52'-1⅛"	54'-1"	88.97	4.375	4.709	5.076	16,230	714.21	774.49	833.73	131.93
	12'	396	37'-0"		12"	12"		14'-0¾"	52'-3⅞"	54'-4"	93.62	4.604	4.918	5.293	16,999	751.47	817.41	906.31	136.94
3 @ 12'	6'	216	39'-0"	13"	8"	10"	13½"	8'-2½"	55'-1⅞"	57'-1¾"	77.45	3.856	4.218	4.579	14,220	622.65	677.02	733.92	111.89
	7'	252	39'-0"		8"	10"		9'-2½"	"	"	79.68	3.968	4.329	4.735	14,631	642.57	710.88	769.34	116.90
	8'	288	39'-0"		8"	10"		10'-2½"	"	"	81.91	4.079	4.488	4.900	15,546	688.30	745.16	804.65	121.91
	9'	324	39'-4"		9"	11"		11'-2½"	55'-7⅛"	57'-7½"	86.92	4.328	4.728	5.165	15,884	714.12	782.14	842.91	126.92
	10'	360	39'-8"		10"	12"		12'-2½"	56'-1⅛"	58'-1"	92.43	4.602	4.989	5.435	16,890	757.69	832.09	893.38	131.93
	11'	396	39'-10"		11"	12"		13'-2½"	56'-4"	58'-4"	96.80	4.820	5.209	5.663	17,644	792.68	868.67	952.37	136.94
	12'	432	40'-0"		12"	12"		14'-2½"	56'-6⅞"	58'-6¾"	101.41	5.049	5.442	5.904	18,426	830.04	941.08	1003.92	141.95

* For remainder of quantities see Standard Wing and Barrel Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.
For each lap of longitudinal bars for SECTIONS "D", add 6.88# for 11'-0" spans and 5.01# for 12'-0" Spans, to quantity shown above.

BAR LIST FOR BARREL SECTION "B" ON 45° SKEW — ONE END ONLY.

SECTION "B" AND BAR GROUP "B". Lengths vary with Clear Span "S", see Table at Upper Center. D = 0'-0" TO 15'-0" MAXIMUM.

"a" bars — STRAIGHT — In Top and Bottom Slab of Barrel. "a1" bars — STRAIGHT — In Top and Bottom Slab of Barrel - (Two of Each Length).

S	H	"a" SIZE	SPACING	No. REQ'D	LENGTH	"a1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
3 @ 8'	4'	#5	11"	19	26'-1"	#5	11"	50	25'-2"	3'-2"
	5'			19	26'-5"			52	25'-6"	2'-7"
	6'			19	26'-5"			52	25'-6"	"
	7'			19	26'-8"			52	25'-9"	2'-10"
	8'			19	26'-9"			52	25'-10"	2'-11"
	9'			19	27'-1"			52	26'-2"	3'-3"
	10'			19	27'-5"			54	26'-6"	2'-8"
3 @ 9'	5'	#6	11"	15	29'-5"	#6	11"	58	28'-6"	2'-10"
	6'			15	29'-8"			58	28'-9"	3'-1"
	7'			15	29'-8"			58	28'-9"	"
	8'			15	29'-9"			58	28'-10"	3'-2"
	9'			15	30'-1"			60	29'-2"	2'-7"
	10'			13	30'-5"			60	29'-6"	2'-11"
	11'			13	30'-7"			60	29'-8"	3'-1"
3 @ 10'	5'	#6	13"	9	32'-5"	#6	13"	54	31'-4"	3'-2"
	6'			9	32'-8"			56	31'-7"	2'-4"
	7'			9	32'-8"			56	31'-7"	"
	8'			9	32'-9"			56	31'-8"	2'-5"
	9'			9	33'-1"			56	32'-0"	2'-9"
	10'			9	33'-5"			56	32'-4"	3'-1"
	11'			9	33'-7"			56	32'-6"	3'-3"
	12'			9	33'-9"			58	32'-8"	2'-4"
3 @ 11'	6'	#7	12"	7	35'-9"	#7	12"	66	34'-9"	2'-9"
	7'			7	35'-9"			66	34'-9"	"
	8'			7	35'-9"			66	34'-9"	"
	9'			7	36'-1"			66	35'-1"	3'-1"
	10'			5	36'-5"			68	35'-5"	2'-5"
	11'			5	36'-7"			68	35'-7"	2'-7"
	12'			5	36'-9"			68	35'-9"	2'-9"
3 @ 12'	6'	#7	12"	3	38'-9"	#7	12"	72	37'-9"	2'-9"
	7'			3	38'-9"			72	37'-9"	"
	8'			3	38'-9"			72	37'-9"	"
	9'			1	39'-1"			72	38'-1"	3'-1"
	10'			1	39'-5"			74	38'-5"	2'-5"
	11'			1	39'-7"			74	38'-7"	2'-7"
	12'			1	39'-9"			74	38'-9"	2'-9"

"b" bars — BENT - See Diagrams below — In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. "b1" bars — In Bottom of Top Slab - some bent up over Division Wall - one end hooked. Alternate with "a1" and "c" or "c1" bars.

S	H	"b" SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 8'	4'	#6	11"	9	27'-11"	0'-6"	3'-8"	6'-4"	#6	11"	26	26'-11"	3'-3"	25'-7"	2'-8"
	5'			8	28'-3"	"	3'-9"	6'-5"			26	27'-3"	3'-7"	25'-11"	3'-0"
	6'			8	28'-3"	"	"	"			26	27'-3"	"	"	"
	7'			8	28'-6"	"	3'-10"	6'-5½"			26	27'-6"	3'-10"	26'-2"	3'-3"
	8'			8	28'-7"	"	"	6'-6"			26	27'-7"	3'-11"	26'-3"	3'-4"
	9'			8	28'-11"	"	3'-11"	6'-7"			27	27'-11"	3'-4"	26'-7"	2'-9"
	10'			8	29'-3"	0'-6"	4'-0"	6'-8"			27	28'-3"	3'-8"	26'-11"	3'-1"
3 @ 9'	5'	#6	11"	6	31'-4"	0'-6¾"	4'-1½"	7'-2"	#6	11"	29	30'-4"	3'-10"	28'-11"	3'-3"
	6'			6	31'-7"	"	4'-2½"	7'-2½"			30	30'-7"	3'-2"	29'-2"	2'-7"
	7'			6	31'-7"	"	"	"			30	30'-7"	"	"	"
	8'			6	31'-8"	"	"	7'-3"			30	30'-8"	3'-3"	29'-3"	2'-8"
	9'			6	32'-0"	"	4'-3½"	7'-4"			30	31'-0"	3'-7"	29'-7"	3'-0"
	10'			6	32'-4"	"	4'-4½"	7'-5"			30	31'-4"	3'-11"	29'-11"	3'-4"
	11'			6	32'-6"	0'-6¾"	4'-4½"	7'-6"			30	31'-6"	4'-1"	30'-1"	3'-6"
3 @ 10'	5'	#7	13"	4	34'-7"	0'-7½"	4'-6"	7'-11"	#7	13"	28	33'-6"	3'-3"	31'-10"	2'-7"
	6'			4	34'-10"	"	4'-7"	7'-11½"			28	33'-9"	3'-6"	32'-1"	2'-10"
	7'			4	34'-10"	"	"	"			28	33'-9"	"	"	"
	8'			4	34'-11"	"	"	8'-0"			28	33'-10"	3'-7"	32'-2"	2'-11"
	9'			4	35'-3"	"	4'-8"	8'-1"			28	34'-2"	3'-11"	32'-6"	3'-3"
	10'			4	35'-7"	"	4'-9"	8'-2"			29	34'-6"	3'-2"	32'-10"	2'-6"
	11'			3	35'-9"	"	"	8'-3"			29	34'-8"	3'-4"	33'-0"	2'-8"
	12'			3	35'-11"	0'-7½"	4'-9"	8'-4"			29	34'-10"	3'-6"	33'-2"	2'-10"
3 @ 11'	6'	#7	12"	2	38'-1"	0'-8¼"	4'-11½"	8'-9"	#7	12"	33	36'-11"	3'-10"	35'-2"	3'-2"
	7'			2	38'-1"	"	"	"			33	36'-11"	"	"	"
	8'			2	38'-1"	"	"	"			33	36'-11"	"	"	"
	9'			2	38'-5"	"	5'-0½"	8'-10"			34	37'-3"	3'-2"	35'-6"	2'-6"
	10'			2	38'-9"	"	5'-1½"	8'-11"			34	37'-7"	3'-6"	35'-10"	2'-10"
	11'			2	38'-11"	"	"	9'-0"			34	37'-9"	3'-8"	36'-0"	3'-0"
	12'			2	39'-1"	0'-8¼"	5'-1½"	9'-1"			34	37'-11"	3'-10"	36'-2"	3'-2"
3 @ 12'	6'	#7	12"	0	41'-2"	0'-9¾"	5'-3½"	9'-6"	#7	12"	36	40'-0"	3'-10"	38'-2"	3'-2"
	7'			0	41'-2"	"	"	"			36	40'-0"	"	"	"
	8'			0	41'-2"	"	"	"			36	40'-0"	"	"	"
	9'			0	41'-6"	"	5'-4½"	9'-7"			37	40'-4"	3'-2"	38'-6"	2'-6"
	10'			0	41'-10"	"	5'-5½"	9'-8"			37	40'-8"	3'-6"	38'-10"	2'-10"
	11'			0	42'-0"	"	"	9'-9"			37	40'-10"	3'-8"	39'-0"	3'-0"
	12'			0	42'-2"	0'-9¾"	5'-5½"	9'-10"			37	41'-0"	3'-10"	39'-2"	3'-2"

"b2" bars — BENT - See Diagrams below — In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. "b3" bars — In Top of Bottom Slab - some bent down under Division Walls - one end hooked. Alt. with "a1" and "c" or "c1" bars.

S	H	"b2" SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b3" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
3 @ 8'	4'	#6	11"	10	28'-0"	0'-6½"	3'-7"	6'-4"	#6	11"	26	27'-0"	3'-3"	25'-7"	2'-8"
	5'			9	28'-4"	"	3'-8"	6'-5"			26	27'-4"	3'-7"	25'-11"	3'-0"
	6'			9	28'-4"	"	"	"			26	27'-4"	"	"	"
	7'			9	28'-7"	"	3'-9"	6'-5½"			26	27'-7"	3'-10"	26'-2"	3'-3"
	8'			9	28'-8"	"	"	6'-6"			26	27'-8"	3'-11"	26'-3"	3'-4"
	9'			9	29'-0"	"	3'-10"	6'-7"			27	28'-0"	3'-4"	26'-7"	2'-9"
	10'			9	29'-4"	0'-6½"	3'-11"	6'-8"			27	28'-4"	3'-8"	26'-11"	3'-1"
3 @ 9'	5'	#6	11"	7	31'-5"	0'-7¼"	4'-0½"	7'-2"	#6	11"	29	30'-5"	3'-10"	28'-11"	3'-3"
	6'			7	31'-8"	"	4'-1½"	7'-2½"			30	30'-8"	3'-2"	29'-2"	2'-7"
	7'			7	31'-8"	"	"	"			30	30'-8"	"	"	"
	8'			7	31'-9"	"	"	7'-3"			30	30'-9"	3'-3"	29'-3"	2'-8"
	9'			7	32'-1"	"	4'-2½"	7'-4"			30	31'-1"	3'-7"	29'-7"	3'-0"
	10'			7	32'-5"	"	4'-3½"	7'-5"			30	31'-5"	3'-11"	29'-11"	3'-4"
	11'			7	32'-7"	0'-7¼"	4'-3½"	7'-6"			30	31'-7"	4'-1"	30'-1"	3'-6"
3 @ 10'	5'	#7	13"	5	34'-8"	0'-8"	4'-5"	7'-11"	#7	13"	28	33'-6"	3'-3"	31'-10"	2'-7"
	6'			5	34'-11"	"	4'-6"	7'-11½"			28	33'-9"	3'-6"	32'-1"	2'-10"
	7'			5	34'-11"	"	"	"			28	33'-9"	"	"	"
	8'			5	35'-0"	"	"	8'-0"			28	33'-10"	3'-7"	32'-2"	2'-11"
	9'			5	35'-4"	"	4'-7"	8'-1"			28	34'-2"	3'-11"	32'-6"	3'-3"
	10'			5	35'-8"	"	4'-8"	8'-2"			29	34'-6"	3'-2"	32'-10"	2'-6"
	11'			4	35'-10"	"	"	8'-3"			29	34'-8"	3'-4"	33'-0"	2'-8"
	12'			4	36'-0"	0'-8"	4'-8"	8'-4"			29	34'-10"	3'-6"	33'-2"	2'-10"
3 @ 11'	6'	#7	12"	3	38'-2"	0'-9"	4'-10"	8'-9"	#7	12"	33	37'-0"	3'-10"	35'-2"	3'-2"
	7'			3	38'-2"	"	"	"			33	37'-0"	"	"	"
	8'			3	38'-2"	"	"	"			33	37'-0"	"	"	"
	9'			3	38'-6"	"	4'-11"	8'-10"			34	37'-4"	3'-2"	35'-6"	2'-6"
	10'			3	38'-10"	"	5'-0"	8'-11"			34	37'-8"	3'-6"	35'-10"	2'-10"
	11'			3	39'-0"	"	"	9'-0"			34	37'-10"	3'-8"	36'-0"	3'-0"
	12'			3	39'-2"	0'-9"	5'-0"	9'-1"			34	38'-0"	3'-10"	36'-2"	3'-2"
3 @ 12'	6'	#7	12"	1	41'-3"	0'-9¾"	5'-2½"	9'-6"	#7	12"	36	40'-1"	3'-10"	38'-2"	3'-2"
	7'			1	41'-3"	"	"	"			36	40'-1"	"	"	"
	8'			1	41'-3"	"	"	"			36	40'-1"	"	"	"
	9'			1	41'-7"	"	5'-3½"	9'-7"			37	40'-5"	3'-2"	38'-6"	2'-6"
	10'			1	41'-11"	"	5'-4½"	9'-8"			37	40'-9"	3'-6"	38'-10"	2'-10"
	11'			1	42'-1"	"	"	9'-9"			37	40'-11"	3'-8"	39'-0"	3'-0"
	12'			1	42'-3"	0'-9¾"	5'-4½"	9'-10"			37	41'-1"	3'-10"	39'-2"	3'-2"

"c" bars — STRAIGHT — In Top and Bottom Slab of Barrel. Alternate with "b" and "b2" bars. "c1" bars — In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars (Two of Each Length).

S	H	"c" SIZE	SPACING	No. REQ'D	LENGTH	"c1" SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
3 @ 8'	4'	#6	11"	29	17'-4"	#6	11"	32	16'-3"	2'-6"
	5'			29	17'-6"			32	16'-6"	2'-9"
	6'			29	17'-6"			32	"	"
	7'			29	17'-8"			32	16'-8"	2'-11"
	8'			29	17'-8"			32	16'-9"	3'-0"
	9'			29	17'-10"			32	17'-0"	3'-3"
	10'			29	18'-0"			34	17'-3"	2'-7"
3 @ 9'	5'	#7	11"	25	19'-6"	#7	11"	38	19'-0"	2'-6"
	6'			25	19'-8"			38	19'-2"	2'-8"
	7'			25	19'-8"			38	"	"
	8'			25	19'-8"			38	19'-3"	2'-9"
	9'			25	19'-10"			38	19'-6"	3'-0"
	10'			23	20'-0"			38	19'-9"	3'-3"
	11'			23	20'-0"			38	19'-10"	3'-4"
3 @ 10'	5'	#8	13"	19	21'-6"	#8	13"	34	20'-6"	3'-2"
	6'			19	21'-8"			34	20'-8"	3'-4"
	7'			19	21'-8"			34	"	"
	8'			19	21'-8"			34	20'-9"	3'-5"
	9'			19	21'-10"			36	21'-0"	2'-7"
	10'			19	22'-0"			36	21'-3"	2'-10"
	11'			19	22'-0"			36	21'-4"	2'-11"
	12'			19	22'-0"			36	21'-5"	3'-0"
3 @ 11'	6'	#8	12"	19	23'-8"	#8	12"	42	22'-9"	2'-9"
	7'			19	23'-8"			42	"	"
	8'			19	23'-8"			42	"	"
	9'			19	23'-10"			42	23'-0"	3'-0"
	10'			17	24'-0"			42	23'-3"	3'-3"
	11'			17	24'-0"			42	23'-4"	3'-4"
	12'			17	24'-0"			42	23'-5"	3'-5"
3 @ 12'	6'	#9	12"	15	25'-8"	#9	12"	46	25'-3"	3'-3"
	7'			15	25'-8"			46	"	"
	8'			15	25'-8"			46	"	"
	9'			13	25'-10"			48	25'-6"	2'-6"
	10'			13	26'-0"			48	25'-9"	2'-9"
	11'			13	26'-0"			48	25'-10"	2'-10"
	12'			13	26'-0"			48	25'-11"	2'-11"

"d" bars — STRAIGHT — Longitudinal in Top Slab of Barrel. "d1" bars — Longitudinal in Sidewalls and Division Walls. "e" bars — Longitudinal in Bottom Slab of Barrel.

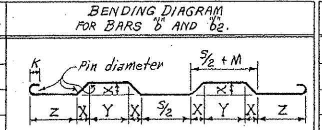
S	H	"d" SIZE	SPACING	No. REQ'D	LENGTH	"d1" SIZE	SPACING	No. REQ'D	LENGTH	"e" SIZE	SPACING	No. REQ'D	LENGTH
3 @ 8'	4'	#4	12"	37	22'-8" Ave.	#4	12"	24	22'-8" Ave.	#4	12"	37	24'-0" Ave.
	5'			37				30				37	
	6'			37				36				37	
	7'			37				42				37	
	8'			37				48				37	
	9'			37				54				37	
	10'			37				60				37	
3 @ 9'	5'	#4	12"	40	22'-5" Ave.	#4	12"	30	22'-5" Ave.	#4	12"	40	23'-9" Ave.
	6'			40				36				40	
	7'			40				42				40	
	8'			40				48				40	
	9'			40				54				40	
	10'			40				60				40	
	11'			40				66				40	
3 @ 10'	5'	#4	12"	43	22'-2" Ave.	#4	12"	30	22'-2" Ave.	#4	12"	43	23'-6" Ave.
	6'			43				36				43	
	7'			43				42				43	
	8'			43				48				43	
	9'			43				54				43	
	10'			43				60				43	
	11'			43				66				43	
	12'			43				72				43	
3 @ 11'	6'	#4	12"	46	21'-11" Ave.	#4	12"	36	21'-11" Ave.	#4	12"	46	23'-3" Ave.
	7'			46				42				46	
	8'			46				48				46	
	9'			46				54				46	
	10'			46				60				46	
	11'			46				66				46	
	12'			46				72				46	
3 @ 12'	6'	#4	12"	49	21'-8" Ave.	#4	12"	36	21'-8" Ave.	#4	12"	49	23'-0" Ave.
	7'			49				42				49	
	8'			49				48				49	
	9'			49				54				49	
	10'			49				60				49	
	11'			49				66				49	
	12'			49				72				49	

"f" bars — STRAIGHT — Vertical in Sidewalls and Division Walls. "k1" bars — STRAIGHT — In Bottom of Headwall. (3 of Each Length per Headwall). "k2" bars — In Top of Headwalls and Aprons - (2 Rows Each).

S	H	"f" SIZE	SPACING	No. REQ'D	LENGTH	"k1" SIZE	No. REQ'D	LENGTH MAX.	LENGTH MIN.	"k2" SIZE	No. REQ'D	LENGTH
3 @ 8'	4'	#4	12"	127	5'-4"	⊠ #7	6	26'-2"	13'-0"	⊕ #7	8	20'-8"
	5'	#4	12"	127	6'-4"		6	26'-5"	13'-3"		8	20'-11"
	6'	#4		127	7'-4"		6	"	"		8	"
	7'	#5	12"	127	8'-4"		6	26'-8"	13'-4"		8	21'-1"
	8'	#5	9"	170	9'-4"		6	26'-9"	13'-5"		8	21'-2"
	9'	#6	11"	139	10'-4"		6	27'-1"	13'-6"		8	21'-5"
	10'	#6	10"	153	11'-4"		6	27'-5"	13'-8"		8	21'-7"
3 @ 9'	5'	#4	12"	126	6'-6"	⊠ #8	6	29'-6"	14'-9"	⊕ #8	8	23'-2"
	6'	#4		126	7'-6"		6	29'-9"	14'-10"		8	23'-4"
	7'	#5	12"	126	8'-6"		6	"	"		8	"
	8'	#6	12"	126	9'-6"		6	29'-10"	14'-10"		8	23'-5"
	9'	#6	11"	138	10'-6"		6	30'-2"	15'-0"		8	23'-8"
	10'	#6	10"	153	11'-6"		6	30'-6"	15'-2"		8	23'-11"
	11'	#7	12"	126	12'-6"		6	30'-7"	15'-3"		8	24'-0"
3 @ 10'	5'	#4	12"	125	6'-8"	⊠ #8	6	32'-4"	16'-2"	⊕ #8	8	25'-4"
	6'	#4		125	7'-8"		6	32'-7"	16'-3"		8	25'-6"
	7'	#5	12"	125	8'-8"		6	"	"		8	"
	8'	#5	9"	165	9'-8"		6	32'-8"	16'-3"		8	25'-7"
	9'	#6	12"	125	10'-8"		6	33'-0"	16'-5"		8	25'-8"
	10'	#6	10"	150	11'-8"		6	33'-3"	16'-7"		8	26'-0"
	11'	#6	9"	165	12'-8"		6	33'-5"	16'-8"		8	26'-2"
	12'	#6	8"	186	13'-8"		6	33'-7"	16'-9"		8	26'-3"
3 @ 11'	6'	#4	12"	123	7'-10"	⊠ #9	6	35'-8"	17'-10"	⊕ #9	8	27'-10"
	7'	#5	12"	123	8'-10"		6	"	"		8	"
	8'	#6	12"	123	9'-10"		6	"	"		8	"
	9'	#6	11"	135	10'-10"		6	36'-0"	18'-0"		8	28'-1"
	10'	#6	9"	165	11'-10"		6	36'-3"	18'-2"		8	28'-4"
	11'	#7	11"	135	12'-10"		6	36'-5"	18'-2"		8	28'-5"
	12'	#7	10"	147	13'-10"		6	36'-7"	18'-4"		8	28'-7"
3 @ 12'	6'	#4	12"	120	7'-11"	⊠ #9	6	38'-6"	19'-3"	⊕ #9	8	29'-11"
	7'	#4	9"	161	8'-11"		6	"	"		8	"
	8'	#6	12"	120	9'-11"		6	"	"		8	"
	9'	#6	11"	133	10'-11"		6	38'-10"	19'-5"		8	30'-2"
	10'	#6	9"	161	11'-11"		6	39'-1"	19'-7"		8	30'-5"
	11'	#7	11"	133	12'-11"		6	39'-3"	19'-8"		8	30'-7"
	12'	#7	10"	146	13'-11"		6	39'-5"	19'-9"		8	30'-8"

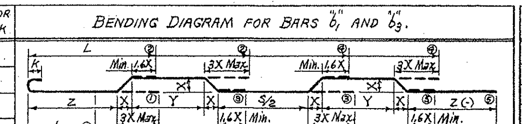
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"
#7	3½"	5¾"	1'-4"

BENDING DIAGRAM FOR BARS "b" AND "b2".



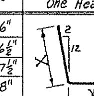
BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"
#7	3½"	5¾"	0'-8"

BENDING DIAGRAM FOR BARS "b1" AND "b3".



SPAN	SIZE	SPACING	No. REQ'D	LENGTH	X
8'	#4	12½"	38	3'-0"	1'-6"
9'	#4	12½"	43	3'-1"	1'-6½"
10'	#4	12½"	47	3'-3"	1'-7½"
11'	#4	12½"	51	3'-4"	1'-8"
12'	#4	12½"	56	3'-6"	1'-9"

Dowel bars "r" in One Headwall



◤ These bars are in the skewed portion of barrel only.
The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-1" for 13" spacing, 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊠ These bars to be spliced at alternate division walls. (Lap 2'-4", 2'-8" & 3'-0").
⊕ Splice "k2" bars at center of center span. (Lap 2'-4", 2'-8" & 3'-0").

NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values for "b1" bars are same as "b" bars, and for "b3" bars same as for "b2" bars. ①-⑤ Min. & Max. lengths "L" for bars "b1" & "b3" for each type bend.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24000 lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing 20000#/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2. Also W-X45.

For Barrels of 8', 10' and 12' Spans, see Drawing No. R-300X-X2.
For " " 9' and 11' Spans, see Drawing No. R-300X-X3.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS FOR REINFORCED CONCRETE BOX CULVERTS

45° SKEW — SECTIONS "B" ONLY

8', 9', 10', 11' AND 12' SPANS
TRIPLES

ONLY 2:1 SLOPES
OVER 10'-0" COVER

STANDARD DRAWING No. R-3452-1

Designed by:- W.C.H. 9-17-62 Checked by:- R.H.S. 11-12-62
Drawn by:- W.C.H. 9-14-64 Checked by:-
Quantities by:- W.C.H. 11-16-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 45° SKEWED ENDS

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH	"a'" bars STRAIGHT In Top and Bottom Slab of Barrel (Four of Each Length) SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.
0'-0" TO 5'-0" MAXIMUM	4@4	2'	#5	12"	86	18'-9"	#5	12"	64	17'-9"	2'-9"
		3'			86	18'-9"			64	"	"
		4'			86	18'-9"			64	"	"
		5'			86	18'-9"			64	"	"
		6'			86	19'-2"			64	18'-2"	3'-2"
	4@5	3'	#6	12"	78	22'-9"	#5	12"	80	21'-9"	2'-9"
		4'			78	22'-9"			80	"	"
		5'			78	22'-9"			80	"	"
		6'			78	23'-2"			80	22'-2"	3'-2"
		7'			76	23'-6"			84	22'-6"	2'-6"
	4@6	4'	#6	11"	76	26'-9"	#6	11"	104	25'-10"	2'-11"
		5'			76	26'-9"			104	"	"
		6'			76	26'-9"			104	"	"
		7'			76	27'-2"			108	26'-3"	2'-5"
		8'			76	27'-6"			108	26'-7"	2'-9"
		9'			74	27'-7"			108	26'-8"	2'-10"
	4@7	4'	#6	12"	62	30'-9"	#6	12"	112	29'-9"	2'-9"
		5'			62	30'-9"			112	"	"
		6'			62	31'-2"			112	30'-2"	3'-2"
		7'			60	31'-6"			116	30'-6"	2'-6"
		8'			60	31'-7"			116	30'-7"	2'-7"
		9'			60	32'-0"			116	31'-0"	3'-0"
	4@8	4'	#6	11"	58	34'-9"	#6	11"	140	33'-10"	2'-8"
		5'			58	35'-2"			140	34'-8"	3'-1"
		6'			58	35'-2"			140	"	"
		7'			58	35'-6"			144	34'-7"	2'-6"
		8'			56	35'-7"			144	34'-8"	2'-7"
		9'			56	36'-0"			144	35'-1"	3'-0"
		10'			56	36'-5"			148	35'-6"	2'-6"

DEPTH OF COVER D	CLEAR SPAN S	"b" bars BENT - See Diagrams below In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z	"b₁" bars BENT - See Diagrams below In Bottom of Top Slab - some bent up over Division Walls - one end hooked (2 of Each Length) Alternate with "a" and "c" or "c₁" bars. SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
0'-0" TO 5'-0" MAXIMUM	4@4	#5	12"	41	20'-2"	0'-3"	2'-8"	3'-6½"	#5	12"	32	19'-2"	3'-8"	18'-2"	3'-2"
				41	20'-2"	"	"	"			32	"	"	"	"
				41	20'-2"	"	"	"			32	"	"	"	"
				41	20'-2"	"	"	"			32	"	"	"	"
				40	20'-7"	0'-3"	2'-9"	3'-5½"			34	19'-7"	3'-1"	18'-7"	2'-7"
	4@5	#5	12"	37	24'-3"	0'-3½"	2'-7"	4'-1½"	#5	12"	40	23'-3"	3'-8"	22'-2"	3'-2"
				37	24'-3"	"	"	"			40	"	"	"	"
				37	24'-3"	"	"	"			40	"	"	"	"
				36	24'-8"	"	2'-8"	4'-2½"			42	23'-8"	3'-1"	22'-7"	2'-7"
				36	25'-0"	0'-3½"	2'-9"	4'-2½"			42	24'-0"	3'-5"	22'-11"	2'-11"
	4@6	#5	11"	36	28'-4"	0'-4"	3'-0"	4'-10½"	#5	11"	54	27'-5"	2'-11"	26'-3"	2'-5"
				36	28'-4"	"	"	"			54	"	"	"	"
				36	28'-9"	"	"	"			54	"	"	"	"
				35	29'-2"	"	3'-1"	4'-11½"			54	27'-10"	3'-4"	26'-8"	2'-10"
				35	29'-7"	"	3'-2"	4'-11½"			54	28'-2"	3'-8"	27'-0"	3'-2"
				35	29'-2"	0'-4"	3'-2"	5'-0½"			54	28'-3"	3'-9"	27'-1"	3'-3"
	4@7	#6	12"	29	32'-8"	0'-4½"	3'-5"	5'-7"	#6	12"	56	31'-7"	3'-9"	30'-2"	3'-2"
				29	32'-8"	"	3'-5"	5'-7"			56	"	"	"	"
				28	33'-1"	"	3'-6"	5'-8"			58	32'-0"	3'-8"	30'-7"	2'-7"
				28	33'-5"	"	3'-7"	5'-8½"			58	32'-4"	3'-6"	30'-11"	2'-11"
				28	33'-6"	"	3'-7"	5'-9"			58	32'-5"	3'-7"	31'-0"	3'-0"
				28	33'-11"	0'-4½"	3'-8"	5'-10"			60	32'-10"	3'-0"	31'-5"	2'-5"
	4@8	#6	11"	27	36'-9"	0'-5"	3'-10"	6'-4"	#6	11"	70	35'-9"	3'-8"	34'-3"	3'-1"
				27	37'-2"	"	3'-11"	6'-5"			72	36'-2"	3'-8"	34'-8"	2'-7"
				26	37'-2"	"	"	6'-5"			72	"	"	"	"
				26	37'-6"	"	4'-0"	6'-5½"			72	36'-6"	3'-6"	35'-0"	2'-11"
				26	37'-7"	"	"	6'-6"			72	36'-7"	3'-7"	35'-1"	3'-0"
				26	38'-0"	"	4'-1"	6'-7"			74	37'-0"	3'-7"	35'-6"	2'-6"
				25	38'-5"	0'-5"	4'-2"	6'-8"			74	37'-5"	3'-6"	35'-11"	2'-11"

DEPTH OF COVER D	CLEAR SPAN S	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z	"b₃" bars BENT - See Diagrams below. In Top of Bottom Slab - some bent down under Division Walls - one end hooked (2 of Each Length) Alternate with "a" and "c" or "c₁" bars. SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
0'-0" TO 5'-0" MAXIMUM	4@4	#5	12"	43	20'-1"	0'-2½"	2'-3"	3'-4½"	#5	12"	32	19'-1"	3'-8"	18'-2"	3'-2"
				43	20'-1"	"	"	"			32	"	"	"	"
				43	20'-1"	"	"	"			32	"	"	"	"
				43	20'-1"	"	"	"			32	"	"	"	"
				42	20'-6"	0'-2½"	2'-4"	3'-5½"			34	19'-6"	3'-1"	18'-7"	2'-7"
	4@5	#5	12"	39	24'-2"	0'-3"	2'-8"	4'-1½"	#5	12"	40	23'-2"	3'-8"	22'-2"	3'-2"
				39	24'-2"	"	"	"			40	"	"	"	"
				39	24'-2"	"	"	"			40	"	"	"	"
				38	24'-7"	"	2'-9"	4'-2½"			42	23'-7"	3'-1"	22'-7"	2'-7"
				38	24'-11"	0'-3"	2'-10"	4'-2½"			42	24'-0"	3'-5"	22'-11"	2'-11"
	4@6	#5	11"	38	28'-3"	0'-3½"	3'-1"	4'-10½"	#5	11"	54	27'-4"	2'-11"	26'-3"	2'-5"
				38	28'-3"	"	"	"			54	"	"	"	"
				38	28'-3"	"	"	"			54	"	"	"	"
				37	28'-8"	"	3'-2"	4'-11½"			54	27'-9"	3'-4"	26'-8"	2'-10"
				37	29'-0"	"	3'-3"	4'-11½"			54	28'-1"	3'-8"	27'-0"	3'-2"
				37	29'-1"	0'-3½"	3'-3"	5'-0½"			54	28'-2"	3'-9"	27'-1"	3'-3"
	4@7	#6	12"	31	32'-7"	0'-4½"	3'-5½"	5'-7"	#6	12"	56	31'-6"	3'-9"	30'-2"	3'-2"
				31	32'-7"	"	"	"			56	"	"	"	"
				30	33'-0"	"	3'-6½"	5'-8"			58	31'-11"	3'-2"	30'-7"	2'-7"
				30	33'-4"	"	3'-7½"	5'-8½"			58	32'-3"	3'-6"	30'-11"	2'-11"
				30	33'-5"	"	"	5'-9"			58	32'-4"	3'-7"	31'-0"	3'-0"
				30	33'-10"	0'-4½"	3'-8½"	5'-10"			60	32'-9"	3'-0"	31'-5"	2'-5"
	4@8	#6	11"	29	36'-9"	0'-5"	3'-10"	6'-4"	#6	11"	70	35'-9"	3'-8"	34'-3"	3'-1"
				28	37'-2"	"	3'-11"	6'-5"			72	36'-2"	3'-8"	34'-8"	2'-7"
				28	37'-2"	"	"	6'-5"			72	"	"	"	"
				28	37'-6"	"	4'-0"	6'-5½"			72	36'-6"	3'-6"	35'-0"	2'-11"
				28	37'-7"	"	"	6'-6"			72	36'-7"	3'-7"	35'-1"	3'-0"
				28	38'-0"	"	4'-1"	6'-7"			74	37'-0"	3'-7"	35'-6"	2'-6"
				27	38'-5"	0'-5"	4'-2"	6'-8"			74	37'-5"	3'-6"	35'-11"	2'-11"

DEPTH OF COVER D	CLEAR SPAN S	"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with b' and b₂' bars. SIZE	SPACING	No. REQD	LENGTH	"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with b₁' & b₃' bars (Four of each Length) SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.
0'-0" TO 5'-0" MAXIMUM	4@4	#5	12"	94	14'-0"	#5	12"	48	13'-5"	2'-5"
				94	14'-0"			48	"	"
				94	14'-0"			48	"	"
				94	14'-0"			48	"	"
				94	14'-3"			48	13'-9"	2'-9"
	4@5	#5	12"	90	17'-0"	#5	12"	54	15'-11"	2'-11"
				90	17'-0"			54	"	"
				90	17'-0"			54	"	"
				90	17'-3"			54	16'-3"	3'-3"
				88	17'-6"			60	16'-6"	2'-6"
	4@6	#6	11"	88	20'-0"	#6	11"	80	19'-2"	2'-9"
				88	20'-0"			80	"	"
				88	20'-0"			80	"	"
				88	20'-3"			80	20'-1"	2'-8"
				86	20'-6"			80	20'-4"	2'-11"
				86	20'-6"			80	20'-5"	3'-0"
	4@7	#6	12"	78	23'-0"	#6	12"	80	21'-11"	2'-11"
				78	23'-0"			80	"	"
				78	23'-3"			80	22'-3"	3'-3"
				76	23'-6"			84	22'-6"	2'-6"
				76	23'-6"			84	22'-7"	2'-7"
				76	23'-9"			84	22'-11"	2'-11"
	4@8	#6	11"	74	26'-0"	#6	11"	104	25'-10"	2'-11"
				74	26'-3"			104	25'-9"	2'-9"
				74	"			104	"	"
				74	26'-6"			104	25'-7"	2'-8"
				74	26'-9"			104	25'-11"	3'-0"
				76	27'-0"			108	26'-3"	2'-5"

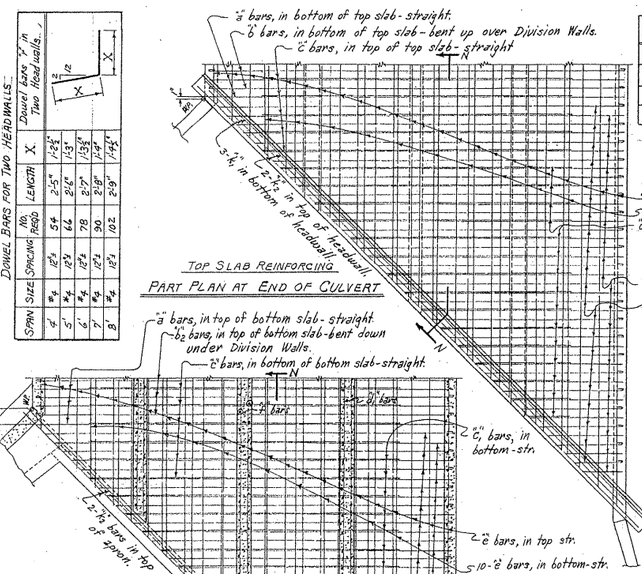
DEPTH OF COVER D	CLEAR SPAN S	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH	"d₁" bars STRAIGHT Longitudinal in Sidewalls and Division Walls. SIZE	SPACING	No. REQD	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH
0'-0" TO 5'-0" MAXIMUM	4@4	#4	12"	30		#4	12"	16		#4	12"	30	
				30				24				30	
				30				32				30	
				30				40				30	
				30				48				30	
	4@5	#4	12"	34		#4	12"	24		#4	12"	34	
				34				32				34	
				34				40				34	
				34				48				34	
	4@6	#4	12"	38		#4	12"	24		#4	12"	38	
				38				32				38	
				38				40				38	
				38				48				38	
				38				56				38	
	4@7	#4	12"	42		#4	12"	32		#4	12"	42	
				42				40				42	
				42				48				42	
				42				56				42	
				42				64				42	
	4@8	#4	12"	46		#4	12"	32		#4	12"	46	
				46				40				46	
				46				48				46	
				46				56				46	
				46				64				46	
				46				72				46	
				46				80				46	

DEPTH OF COVER D	CLEAR SPAN S	"f" bars STRAIGHT Verticals in Sidewalls and Division Walls. SIZE	SPACING	No. REQD	LENGTH	"k₁" bars STRAIGHT In Bottom of Headwalls SIZE	No. REQD	LENGTH	"k₂" bars STRAIGHT In Top of Headwalls and Aprons. (2 Each) ⊠ SIZE	No. REQD	LENGTH
0'-0" TO 5'-0" MAXIMUM	4@4	#4	12"	480	2'-10"		6	26'-6"	#5	8	28'-7"
				480	3'-10"	#5	6	"		8	"
				480	4'-10"		6	"		8	"
				480	5'-10"		6	"		8	"
				480	6'-10"		6	27'-1"		8	29'-2"
	4@5	#4	12"	480	3'-11"		6	32'-1"		8	34'-3"
				480	4'-11"	#6	6	"	#6	8	"
				480	5'-11"		6	"		8	"
				480	6'-11"		6	32'-9"		8	34'-10"
				480	7'-11"		6	33'-2"		8	35'-4"
	4@6	#4	12"	480	4'-0"	⊠	12	19'-11"	⊠	16	21'-0"
				480	5'-0"		12	"		16	"
				480	6'-0"	#6	12	"	#6	16	"
				480	7'-0"		12	20'-2"		16	21'-3"
				480	8'-0"		12	20'-5"		16	21'-6"
				576	9'-0"		12	20'-6"		16	21'-7"
	4@7	#4	12"	480	5'-1"	⊠	12	22'-11"	⊠	16	24'-0"
				480	6'-1"		12	"		16	"
				480	7'-1"	#7	12	23'-2"	#7	16	24'-3"
				480	8'-1"		12	23'-5"		16	24'-6"
				576	9'-1"		12	23'-6"		16	24'-7"
		#5	12"	480	10'-1"		12	23'-9"		16	24'-10"
	4@8	#4	12"	480	5'-2"	⊠	12	25'-9"	⊠	16	26'-10"
				480	6'-2"		12	26'-0"		16	27'-1"
				480	7'-2"		12	"		16	"
				480	8'-2"	#7	12	26'-3"	#7	16	27'-4"
				576	9'-2"		12	26'-4"		16	27'-5"
				576	10'-2"		12	26'-7"		16	27'-10"
		#5	12"	480	11'-2"		12	26'-10"		16	28'-0"

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	BARREL DIMENSIONS: SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALL M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY LENGTH RL	LENGTH OF HEADWALL K	* QUANTITIES: CLASS S CONC. PER LIN. FT. OF BARREL CU.YD.	REINFORCING STEEL: TOTAL FOR 60'-0 LENGTH OF BARREL LB.	PER LIN. FT. OF BARREL LB.	ADDITIONAL PER LAP LB.
5'-0"	4@4	2'	32	19'-0"	7"	6"	8"	6"	3'-0½"	26'-10½"	28'-10½"	0.955	11,906	187.46	90.56
		3'	48	19'-0"		6"	8"		4'-0½"	"	"	1.066	12,553	198.14	97.24
		4'	64	19'-0"	6½"	6"	8"		5'-0½"	"	"	1.177	13,199	208.83	103.92
		5'	80	19'-0"		6"	8"		6'-0½"	"	"	1.289	13,846	219.52	110.60
		6'	96	19'-5"		7"	9"		7'-0½"	27'-5½"	29'-3½"	1.508	14,493	232.47	117.28
	4@5'	3'	60	23'-0"	7"	6"	8"	6½"	4'-1½"	32'-6½"	34'-6½"	1.292	16,933	265.05	107.53
		4'	80	23'-0"		6"	8"		5'-1½"	"	"	1.403	17,580	275.73	114.21
		5'	100	23'-0"		6"	8"		6'-1½"	"	"	1.514	18,227	286.42	120.89
		6'	120	23'-5"		7"	9"		7'-1½"	33'-1½"	35'-1½"	1.735	19,077	299.98	127.57
		7'	140	23'-9"		7½"	10"		8'-1½"	33'-7"	35'-7"	1.962	19,829	313.12	134.25
	4@6'	3'	72	27'-0"	7½"	6"	8"	7"	4'-2½"	38'-2½"	40'-2½"	1.592	20,506	320.01	117.83
		4'	96	27'-0"		6"	8"		5'-2½"	"	"	1.653	21,153	330.70	124.51
		5'	120	27'-0"		6"	8"		6'-2½"	"	"	1.764	21,799	341.39	131.19
		6'	144	27'-5"		7"	9"		7'-2½"	38'-9½"	40'-9½"	1.986	22,635	355.21	137.87
		7'	168	27'-9"		7½"	10"		8'-2½"	39'-3"	41'-3"	2.214	23,373	368.57	144.55
		8'	192	27'-10"		8"	10"		9'-2½"	39'-4½"	41'-4½"	2.381	24,949	389.94	151.23
	4@7'	4'	112	31'-0"	8"	6"	8"	7½"	5'-3½"	43'-10½"	45'-10"	1.951	24,735	381.94	138.28
		5'	140	31'-0"		6"	8"		6'-3½"	"	"	2.063	25,381	392.65	144.96
		6'	168	31'-5"		7"	9"		7'-3½"	44'-5½"	46'-5½"	2.284	26,250	406.09	151.64
		7'	196	31'-9"		7½"	10"		8'-3½"	44'-10½"	46'-10½"	2.514	27,010	420.03	158.32
		8'	224	31'-10"		8"	10"		9'-3½"	45'-0½"	47'-0½"	2.645	28,298	440.93	165.00
		9'	252	32'-3"		9"	11"		10'-3½"	45'-7½"	49'-7½"	2.984	30,501	475.41	171.68
	4@8'	4'	128	35'-0"	8½"	6"	8"	8½"	5'-5"	49'-6"	51'-6"	2.281	28,920	449.30	148.57
		5'	160	35'-5"		7"	9"		6'-5"	50'-1"	52'-1"	2.491	29,882	463.53	155.25
		6'	192	35'-5"		7"	9"		7'-5"	"	"	2.618	30,978	479.22	161.93
		7'	224	35'-9"		7½"	10"		8'-5"	50'-6½"	52'-6½"	2.848	31,921	493.79	168.61
		8'	256	35'-10"		8"	10"		9'-5"	50'-9"	52'-9"	3.016	32,533	508.35	175.29
		9'	288	36'-3"		9"	11"		10'-5"	51'-3½"	53'-3½"	3.319	34,732	543.88	181.97
		10'	320	36'-8"		10"	12"		11'-5"	51'-10½"	53'-10½"	3.652	36,492	562.59	188.65

* For quantities in wings, see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.

DOWEL BARS FOR TWO HEADWALLS					
SPAN	SIZE	SPACING	No. REQD	LENGTH	X
4'	#4	12"	54	2'-5"	1'-2½"
5'	#4	12"	66	2'-6"	1'-3"
6'	#4	12"	78	2'-7"	1'-3½"
7'	#4	12"	90	2'-8"	1'-4"
8'	#4	12"	102	2'-9"	1'-4½"

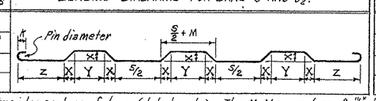


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#5	2½"	4½"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b₂".

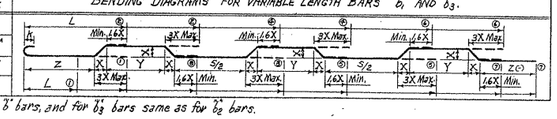


NOTE:- Dimensions are to centers of bars (b, b₁, b₂ & b₃). The X, Y & Z values of "b₁" bars are same as for "b" bars, and for "b₃" bars same as for "b₂" bars.
⓪-⓪ ⓪-⓪ Min. & Max. lengths "L" for bars "b₁" & "b₃" for each type bend.

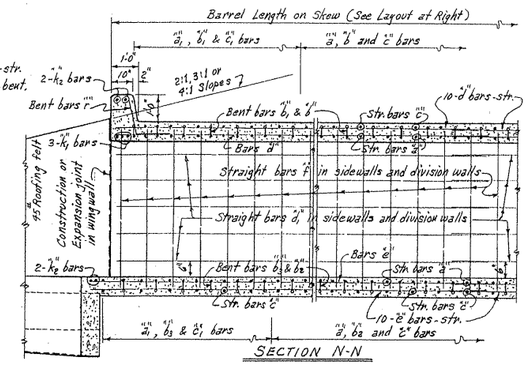
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#5	2½"	4½"	0'-5¾"
#6	3"	5"	0'-7"

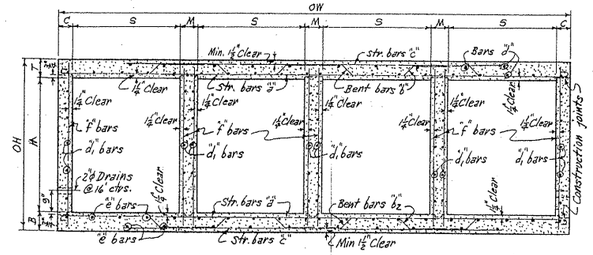
BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b₁" AND "b₃".



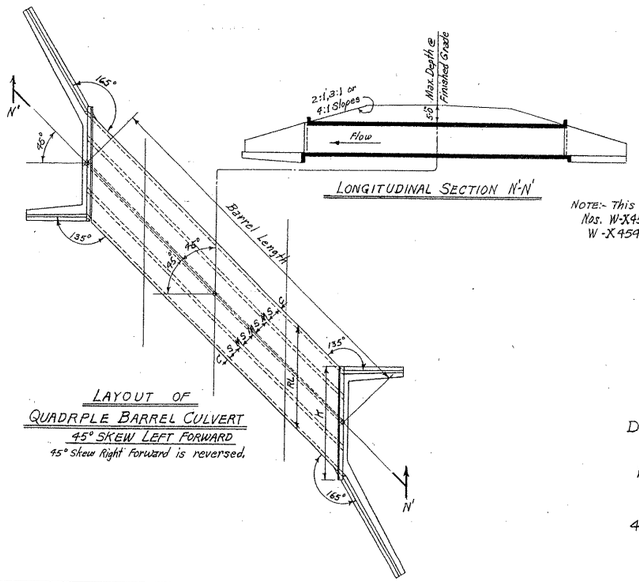
These bars are in the skewed portion of barrel only.
The length of "a₁" and "c₁" bars and overall length "L" of "b₁" and "b₃" bars vary by 1'-0" for 12" spacing and 8'-11" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" and "b₂" bars, use a set of "a" and "c" bars instead.
⊠ These bars are to be spliced at center Division Wall.



SECTION N-N



TYPICAL SECTION M-M



LAYOUT OF
QUADRPLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

LONGITUDINAL SECTION N'-N'

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 33 diameters minimum.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 29,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

4', 5', 6', 7' AND 8' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUADRUPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-445X-01

Designed by:- W.C.H. 1-23-63 — Checked by:- R.H.S. 5-21-63
Drawn by:- W.C.H. 7-29-64 — Checked by:-
Quantities by:- W.C.H. 10-9-64 — Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH - TWO 45° SKEWED ENDS

D = Depth of Cover: 0'-0" to 5'-0" Maximum. S = Clear Span. H = Clear Height.

"a" bars – Straight – In Top and Bottom Slab of Barrel. **"a₁" bars** – Straight – In Top and Bottom Slab of Barrel. (Eight of Each Length)

D	S	H	"a" Size	"a" Spacing	"a" No. Req'd	"a" Length	"a₁" Size	"a₁" Spacing	"a₁" No. Req'd	"a₁" Length Max.	"a₁" Length Min.
0'-0" to 5'-0" Maximum	4 @ 9'	5'	⊠		180	20'-7"			152	19'-8"	3'-2"
		6'			180	20'-9"			152	19'-10"	3'-4"
		7'			180	20'-9"			152	"	"
		8'	#6	11"	180	20'-10"	#6	11" ±	152	19'-11"	3'-5"
		9'			176	21'-0"			152	20'-1"	3'-7"
		10'			176	21'-3"			160	20'-4"	2'-11"
		11'			176	21'-4"			160	20'-5"	3'-0"
	4 @ 10'	5'			156	22'-9"			152	21'-9"	3'-9"
		6'	⊠		156	22'-11"			152	21'-11"	3'-11"
		7'			156	22'-11"			152	"	"
		8'			156	23'-0"			152	22'-0"	4'-0"
		9'	#7	12"	156	23'-2"	#7	12" ±	160	22'-2"	3'-2"
		10'			156	23'-5"			160	22'-5"	3'-5"
		11'			152	23'-6"			160	22'-6"	3'-6"
		12'			152	23'-7"			160	22'-7"	3'-7"
	4 @ 11'	6'			160	25'-0"			184	24'-1"	3'-11"
		7'	⊠		160	25'-0"			184	"	"
		8'			160	25'-0"			184	"	"
		9'	#7	11"	160	25'-2"	#7	11" ±	192	24'-3"	3'-2"
		10'			160	25'-5"			192	24'-6"	3'-5"
		11'			160	25'-6"			192	24'-7"	3'-6"
		12'			156	25'-7"			192	24'-8"	3'-7"
	4 @ 12'	6'			152	27'-0"			208	26'-1"	3'-2"
		7'	⊠		152	27'-0"			208	"	"
		8'			152	27'-0"			208	"	"
		9'	#7	11"	152	27'-2"	#7	11" ±	208	26'-3"	3'-4"
		10'			148	27'-5"			208	26'-6"	3'-7"
		11'			148	27'-6"			208	26'-7"	3'-8"
		12'			148	27'-7"			208	26'-8"	3'-9"

"b" bars – Bent – See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	Size	Spacing	No. Req'd	Length	X	Y	Z
4 @ 9'	5'	⊠		84	21'-8"	0'-5½"	4'-4"	7'-2"
	6'			84	21'-10"	"	4'-5"	7'-2½"
	7'			84	21'-10"	"	"	"
	8'	#6	11"	84	21'-10"	"	"	7'-3"
	9'			84	22'-1"	"	4'-6"	7'-4"
	10'			84	22'-3"	"	4'-7"	7'-5"
	11'			84	22'-4"	0'-5½"	"	7'-6"
4 @ 10'	5'			74	23'-8"	0'-6"	4'-9"	7'-11"
	6'	⊠		74	23'-10"	"	4'-10"	7'-11½"
	7'			74	23'-10"	"	"	"
	8'	#6	12"	74	23'-11"	"	"	8'-0"
	9'			72	24'-1"	"	4'-11"	8'-1"
	10'			72	24'-3"	"	5'-0"	8'-2"
	11'			72	24'-4"	"	"	8'-3"
	12'			72	24'-5"	0'-6"	5'-0"	8'-4"
4 @ 11'	6'			76	25'-11"	0'-6½"	5'-3"	8'-9"
	7'	⊠		76	25'-11"	"	"	"
	8'			76	25'-11"	"	"	"
	9'	#6	11"	76	26'-2"	"	5'-4"	8'-10"
	10'			74	26'-4"	"	5'-5"	8'-11"
	11'			74	26'-5"	"	"	9'-0"
	12'			74	26'-6"	0'-6½"	5'-5"	9'-1"
4 @ 12'	6'	⊠		70	28'-0"	0'-7"	5'-8"	9'-6"
	7'			70	28'-0"	"	"	"
	8'			70	28'-0"	"	"	"
	9'	#6	11"	70	28'-3"	"	5'-9"	9'-7"
	10'			70	28'-5"	"	5'-10"	9'-8"
	11'			70	28'-6"	"	"	9'-9"
	12'			70	28'-7"	0'-7"	5'-10"	9'-10"

"b₁" & "b₄" bars – Bent – In Bottom of Top Slab - some bent up over Division Walls. (2 of Each Length) "b₁" hooked one end. "b₄" bars spliced to "b" bars. Alternate with "a₁" and "c" or "c₁" bars.

S	H	Size	Spacing	No. Req'd "b₁"	No. Req'd "b₄"	"b₁" Max.	"b₁" Min.	"b₄" Max.	"b₄" Min.	L Max.	L Min.
4 @ 9'	5'			38	38	21'-2"	4'-2"	20'-7"	3'-7"	20'-1"	3'-7"
	6'			40	40	21'-4"	3'-5"	20'-9"	2'-10"	20'-3"	2'-10"
	7'			40	40	"	"	"	"	"	"
	8'	#6	11" ±	40	40	21'-5"	3'-6"	20'-10"	2'-11"	20'-4"	2'-11"
	9'			40	40	21'-7"	3'-8"	21'-0"	3'-1"	20'-6"	3'-1"
	10'			40	40	21'-10"	3'-11"	21'-3"	3'-4"	20'-9"	3'-4"
	11'			40	40	21'-11"	4'-0"	21'-4"	3'-5"	20'-10"	3'-5"
4 @ 10'	5'			40	40	23'-4"	3'-9"	22'-9"	3'-2"	22'-2"	3'-2"
	6'			40	40	23'-6"	3'-11"	22'-11"	3'-4"	22'-4"	3'-4"
	7'			40	40	"	"	"	"	"	"
	8'			40	40	23'-7"	4'-0"	23'-0"	3'-5"	22'-5"	3'-5"
	9'	#6	12" ±	40	40	23'-9"	4'-2"	23'-2"	3'-7"	22'-7"	3'-7"
	10'			42	42	24'-0"	3'-5"	23'-5"	2'-10"	22'-10"	2'-10"
	11'			42	42	24'-1"	3'-6"	23'-6"	2'-11"	22'-11"	2'-11"
	12'			42	42	24'-2"	3'-7"	23'-7"	3'-0"	23'-0"	3'-0"
4 @ 11'	6'			48	48	25'-8"	4'-0"	25'-1"	3'-5"	24'-6"	3'-5"
	7'			48	48	"	"		"	"	"
	8'			48	48	"	"		"	"	"
	9'	#6	11" ±	48	48	25'-10"	4'-2"	25'-3"	3'-7"	24'-8"	3'-7"
	10'			50	50	26'-1"	3'-6"	25'-6"	2'-11"	24'-11"	2'-11"
	11'			50	50	26'-2"	3'-7"	25'-7"	3'-0"	25'-0"	3'-0"
	12'			50	50	26'-3"	3'-8"	25'-8"	3'-1"	25'-1"	3'-1"
4 @ 12'	6'			52	52	27'-9"	4'-2"	27'-2"	3'-7"	26'-6"	3'-7"
	7'			52	52	"	"	"	"	"	"
	8'			52	52	"	"	"	"	"	"
	9'	#6	11" ±	54	54	27'-11"	3'-5"	27'-4"	2'-10"	26'-8"	2'-10"
	10'			54	54	28'-2"	3'-8"	27'-7"	3'-1"	26'-11"	3'-1"
	11'			54	54	28'-3"	3'-9"	27'-8"	3'-2"	27'-0"	3'-2"
	12'			54	54	28'-4"	3'-10"	27'-9"	3'-3"	27'-1"	3'-3"

"b₂" bars – Bent – See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars.

S	H	Size	Spacing	No. Req'd	Length	X	Y	Z
4 @ 9'	5'	⊠		88	21'-8"	0'-5½"	4'-4"	7'-2"
	6'			88	21'-10"	"	4'-5"	7'-2½"
	7'			88	21'-10"	"	"	"
	8'	#6	11"	88	21'-10"	"	"	7'-3"
	9'			88	22'-1"	"	4'-6"	7'-4"
	10'			88	22'-3"	"	4'-7"	7'-5"
	11'			88	22'-4"	0'-5½"	"	7'-6"
4 @ 10'	5'			78	23'-8"	0'-6"	4'-9"	7'-11"
	6'	⊠		78	23'-10"	"	4'-10"	7'-11½"
	7'			78	23'-10"	"	"	"
	8'	#6	12"	78	23'-11"	"	"	8'-0"
	9'			76	24'-1"	"	4'-11"	8'-1"
	10'			76	24'-3"	"	5'-0"	8'-2"
	11'			76	24'-4"	"	"	8'-3"
	12'			76	24'-5"	0'-6"	5'-0"	8'-4"
4 @ 11'	6'			80	26'-0"	0'-7"	5'-2"	8'-9"
	7'	⊠		80	26'-0"	"	"	"
	8'			80	26'-0"	"	"	"
	9'	#6	11"	80	26'-3"	"	5'-3"	8'-10"
	10'			78	26'-5"	"	5'-4"	8'-11"
	11'			78	26'-6"	"	"	9'-0"
	12'			78	26'-7"	0'-7"	5'-4"	9'-1"
4 @ 12'	6'	⊠		74	28'-1"	0'-8"	5'-6"	9'-6"
	7'			74	28'-1"	"	"	"
	8'			74	28'-1"	"	"	"
	9'	#6	11"	74	28'-4"	"	5'-7"	9'-7"
	10'			74	28'-6"	"	5'-8"	9'-8"
	11'			74	28'-7"	"	"	9'-9"
	12'			74	28'-8"	0'-8"	5'-8"	9'-10"

"b₃" & "b₅" bars – Bent – See Diagrams below. In Top of Bottom Slab - some bent down under Division Walls. (2 of Each Length) "b₃" hooked one end. "b₅" bars spliced to "b₂" bars. Alternate with "a₁" and "c" or "c₁" bars.

S	H	Size	Spacing	No. Req'd "b₃"	No. Req'd "b₅"	"b₃" Max.	"b₃" Min.	"b₅" Max.	"b₅" Min.	L Max.	L Min.
4 @ 9'	5'			38	38	21'-2"	4'-2"	20'-7"	3'-7"	20'-1"	3'-7"
	6'			40	40	21'-4"	3'-5"	20'-9"	2'-10"	20'-3"	2'-10"
	7'			40	40	"	"	"	"	"	"
	8'	#6	11"	40	40	21'-5"	3'-6"	20'-10"	2'-11"	20'-4"	2'-11"
	9'			40	40	21'-7"	3'-8"	21'-0"	3'-1"	20'-6"	3'-1"
	10'			40	40	21'-10"	3'-11"	21'-3"	3'-4"	20'-9"	3'-4"
	11'			40	40	21'-11"	4'-0"	21'-4"	3'-5"	20'-10"	3'-5"
4 @ 10'	5'			40	40	23'-4"	3'-9"	22'-9"	3'-2"	22'-2"	3'-2"
	6'			40	40	23'-6"	3'-11"	22'-11"	3'-4"	22'-4"	3'-4"
	7'			40	40	"	"	"	"	"	"
	8'			40	40	23'-7"	4'-0"	23'-0"	3'-5"	22'-5"	3'-5"
	9'	#6	12" ±	40	40	23'-9"	4'-2"	23'-2"	3'-7"	22'-7"	3'-7"
	10'			42	42	24'-0"	3'-5"	23'-5"	2'-10"	22'-10"	2'-10"
	11'			42	42	24'-1"	3'-6"	23'-6"	2'-11"	22'-11"	2'-11"
	12'			42	42	24'-2"	3'-7"	23'-7"	3'-0"	23'-0"	3'-0"
4 @ 11'	6'			48	48	25'-9"	4'-0"	25'-2"	3'-5"	24'-6"	3'-5"
	7'			48	48	"	"	"	"	"	"
	8'			48	48	"	"	"	"	"	"
	9'	#6	11" ±	48	48	25'-11"	4'-2"	25'-4"	3'-7"	24'-8"	3'-7"
	10'			50	50	26'-2"	3'-6"	25'-7"	2'-11"	24'-11"	2'-11"
	11'			50	50	26'-3"	3'-7"	25'-8"	3'-0"	25'-0"	3'-0"
	12'			50	50	26'-4"	3'-8"	25'-9"	3'-1"	25'-1"	3'-1"
4 @ 12'	6'			52	52	27'-10"	4'-2"	27'-3"	3'-7"	26'-6"	3'-7"
	7'			52	52	"	"	"	"	"	"
	8'			52	52	"	"	"	"	"	"
	9'	#6	11" ±	54	54	28'-0"	3'-5"	27'-5"	2'-10"	26'-8"	2'-10"
	10'			54	54	28'-3"	3'-8"	27'-8"	3'-1"	26'-11"	3'-1"
	11'			54	54	28'-4"	3'-9"	27'-9"	3'-2"	27'-0"	3'-2"
	12'			54	54	28'-5"	3'-10"	27'-10"	3'-3"	27'-1"	3'-3"

"c" bars – Straight – In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. **"c₁" bars** – Straight – In Top and Bottom Slab of Barrel. Alt. with "b₁" & "b₃" bars. (Four of Each Length)

S	H	"c" Size	"c" Spacing	"c" No. Req'd	"c" Length	"c₁" Size	"c₁" Spacing	"c₁" No. Req'd	"c₁" Length Max.	"c₁" Length Min.
4 @ 9'	5'			74	29'-3"			116	28'-9"	3'-1"
	6'			74	29'-6"			120	29'-0"	2'-5"
	7'			74	29'-6"			120	"	"
	8'	#6	11"	74	29'-6"	#6	11"	120	29'-1"	2'-6"
	9'			72	29'-9"			120	29'-5"	2'-10"
	10'			72	30'-0"			120	29'-9"	3'-2"
	11'			72	30'-0"			120	29'-10"	3'-3"
4 @ 10'	5'			62	32'-3"			120	31'-9"	2'-9"
	6'			62	32'-6"			120	32'-0"	3'-0"
	7'			62	32'-6"			120	"	"
	8'			62	32'-6"			120	32'-1"	3'-1"
	9'	#7	12"	60	32'-9"	#7	12"	120	32'-5"	3'-5"
	10'			60	33'-0"			124	32'-9"	2'-9"
	11'			58	33'-0"			124	32'-10"	2'-10"
	12'			58	33'-0"			124	32'-11"	2'-11"
4 @ 11'	6'			58	35'-6"			144	35'-2"	3'-1"
	7'			58	35'-6"			144	"	"
	8'			58	35'-6"			144	"	"
	9'	#7	11"	58	35'-9"	#7	11"	148	35'-6"	2'-6"
	10'			56	36'-0"			148	35'-10"	2'-10"
	11'			56	36'-0"			148	35'-11"	2'-11"
	12'			60	36'-0"			144	35'-1"	3'-0"
4 @ 12'	6'			54	38'-6"			156	37'-9"	2'-11"
	7'			54	38'-6"			156	"	"
	8'			54	38'-6"			156	"	"
	9'	#7	11"	54	38'-9"	#7	11"	156	38'-1"	3'-3"
	10'			52	39'-0"			160	38'-5"	2'-8"
	11'			52	39'-0"			160	38'-6"	2'-9"
	12'			52	39'-0"			160	38'-7"	2'-10"

"d" bars – Straight – Longitudinal in Top Slab of Barrel. **"d₁" bars** – Straight – Longitudinal in Sidewalls and Division Walls. **"e" bars** – Straight – Longitudinal in Bottom Slab of Barrel.

"d" bars Length: 2 @ 30'-8" for 60'-0" Length Barrel (1'-8" Lap). "d₁" bars Length: 2 @ 30'-6" for 60'-0" Length Barrel (1'-3" Lap). "e" bars Length: 2 @ 31'-10" for 60'-0" Length Barrel (1'-3" Lap).

S	H	"d" Size	"d" Spacing	"d" No. Req'd	"d₁" Size	"d₁" Spacing	"d₁" No. Req'd	"e" Size	"e" Spacing	"e" No. Req'd
4 @ 9'	5'			55			40			53
	6'			55			48			53
	7'			55			56			53
	8'	#5	11½"	55	#4	12"	64	#4	12"	53
	9'			55			72			53
	10'			55			80			53
	11'			55			88			53
4 @ 10'	5'			59			40			57
	6'			59			48			57
	7'			59			56			57
	8'			59			64			57
	9'	#5	11½"	59	#4	12"	72	#4	12"	57
	10'			59			80			57
	11'			59			88			57
	12'			59			96			57
4 @ 11'	6'			63			48			61
	7'			63			56			61
	8'			63			64			61
	9'	#5	11½"	63	#4	12"	72	#4	12"	61
	10'			63			80			61
	11'			63			88			61
	12'			63			96			61
4 @ 12'	6'			67			48			65
	7'			67			56			65
	8'			67			64			65
	9'	#5	11½"	67	#4	12"	72	#4	12"	65
	10'			67			80			65
	11'			67			88			65
	12'			67			96			65

"f" bars – Straight – Verticals in Sidewalls and Division Walls. **"k₁" bars** – Straight – In Bottom of Headwalls. **"k₂" bars** – Straight – In Top of Headwalls and Aprons. (2 Rows Each)

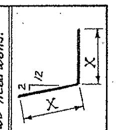
S	H	"f" Size	"f" Spacing	"f" No. Req'd	"f" Length	"k₁" Size	"k₁" No. Req'd	"k₁" Length	"k₂" Size	"k₂" No. Req'd	"k₂" Length
4 @ 9'	5'	#4	12"	480	6'-3"	⊠	12	29'-0"	⊠	16	30'-1"
	6'			480	7'-3"		12	29'-3"		16	30'-4"
	7'			480	8'-3"		12	"		16	"
	8'		10"	576	9'-3"	#8	12	29'-4"	#8	16	30'-5"
	9'	#5	12"	480	10'-3"		12	29'-7"		16	30'-8"
	10'		11"	528	11'-3"		12	29'-11"		16	31'-0"
	11'		10"	576	12'-3"		12	30'-0"		16	31'-1"
4 @ 10'	5'	#4	12"	480	6'-4"		12	31'-10"		16	32'-11"
	6'			480	7'-4"	⊠	12	32'-1"	⊠	16	33'-2"
	7'			480	8'-4"		12	"		16	"
	8'		10"	576	9'-4"	#8	12	32'-2"	#8	16	33'-3"
	9'	#5	12"	480	10'-4"		12	32'-5"		16	33'-6"
	10'		11"	528	11'-4"		12	32'-9"		16	33'-10"
	11'		10"	576	12'-4"		12	32'-10"		16	33'-11"
	12'	#6	12"	480	13'-4"		12	33'-0"		16	34'-1"
4 @ 11'	6'	#4	12"	480	7'-5"		12	35'-2"		16	36'-3"
	7'			480	8'-5"	⊠	12	"	⊠	16	"
	8'		10"	576	9'-5"		12	"		16	"
	9'	#5	12"	480	10'-5"	#9	12	35'-5"	#9	16	36'-6"
	10'		11"	528	11'-5"		12	35'-9"		16	36'-10"
	11'		10"	576	12'-5"		12	35'-10"		16	36'-11"
	12'	#6	12"	480	13'-5"		12	36'-0"		16	37'-1"
4 @ 12'	6'	#4	12"	480	7'-7"		12	38'-0"		16	39'-1"
	7'			480	8'-7"	⊠	12	"	⊠	16	"
	8'		10"	576	9'-7"		12	"		16	"
	9'	#5	12"	480	10'-7"	#9	12	38'-3"	#9	16	39'-4"
	10'		11"	528	11'-7"		12	38'-7"		16	39'-8"
	11'		10"	576	12'-7"		12	38'-8"		16	39'-9"
	12'	#6	12"	480	13'-7"		12	38'-10"		16	39'-11"

BARREL DIMENSIONS / * QUANTITIES

Max. Design Depth of Cover D	Clear Spans S	Clear Height H	Sq. Ft. Opening A	Overall Width OW	Thickness of Top Slab T	Thickness of Sidewalls C	Thickness of Division Walls M	Thickness of Bottom Slab B	Overall Height OH	Roadway Length RL	Length of Headwalls K	Class S Conc. per Lin. Ft. of Barrel Cu.Yd.	Reinforcing Steel Total for 60'-0" Length of Barrel LB.	Per Lin. Ft. of Barrel LB.	Additional per Lap LB.
5'-0"	4 @ 9'	5'	180	39'-5"	9"	7"	9"	9"	6'-6"	55'-8⅞"	57'-9"	2.823	34,455	525.66	173.26
		6'	216	39'-9"		7½"	10"		7'-6"	56'-2⅝"	58'-2½"	3.042	35,491	539.35	179.94
		7'	252	39'-9"		7½"	10"		8'-6"	"	"	3.181	36,088	550.04	186.62
		8'	288	39'-10"		8"	10"		9'-6"	56'-4"	58'-4"	3.349	37,410	571.16	193.30
		9'	324	40'-3"		9"	11"		10'-6"	56'-11½"	58'-11"	3.653	39,357	606.26	199.98
		10'	360	40'-8"		10"	12"		11'-6"	57'-6⅛"	59'-6¼"	3.988	41,121	632.03	206.66
		11'	396	40'-10"		11"	12"		12'-6"	57'-9"	59'-9"	4.238	42,715	658.72	213.34
	4 @ 10'	5'	200	43'-5"	9½"	7"	9"	9½"	6'-7"	61'-4¾"	63'-4¾"	3.179	40,648	620.21	183.56
		6'	240	43'-9"		7½"	10"		7'-7"	61'-10½"	63'-10½"	3.399	41,589	634.28	190.24
		7'	280	43'-9"		7½"	10"		8'-7"	"	"	3.538	42,236	644.97	196.92
		8'	320	43'-10"		8"	10"		9'-7"	61'-11⅞"	64'-0"	3.706	43,599	666.82	203.60
		9'	360	44'-3"		9"	11"		10'-7"	62'-7"	64'-7"	4.012	45,596	701.92	210.28
		10'	400	44'-8"		10"	12"		11'-7"	63'-2"	65'-2"	4.348	47,449	728.27	216.96
		11'	440	44'-10"		11"	12"		12'-7"	63'-4⅞"	65'-5"	4.598	48,737	755.12	223.64
		12'	480	45'-0"		12"	12"		13'-7"	63'-7⅝"	65'-7⅝"	4.861	51,353	798.37	230.32
	4 @ 11'	6'	264	47'-10"	10"	8"	10"	10½"	7'-8½"	67'-7¾"	69'-7¾"	3.878	48,199	729.59	200.53
		7'	308	47'-10"		8"	10"		8'-8½"	"	"	4.020	48,846	740.28	207.21
		8'	352	47'-10"		8"	10"		9'-8½"	"	"	4.162	50,096	761.03	213.89
		9'	396	48'-3"		9"	11"		10'-8½"	68'-2⅞"	70'-2¾"	4.470	52,461	797.14	220.57
		10'	440	48'-8"		10"	12"		11'-8½"	68'-9¾"	70'-10"	4.808	54,049	823.93	227.25
		11'	484	48'-10"		11"	12"		12'-8½"	69'-0¾"	71'-0¾"	5.059	55,685	850.97	233.93
		12'	528	49'-0"		12"	12"		13'-8½"	69'-3½"	71'-3½"	5.323	58,160	894.49	240.61
	4 @ 12'	6'	288	51'-10"	10½"	8"	10"	11½"	7'-10"	73'-3⅞"	75'-3¾"	4.371	51,725	782.20	210.82
		7'	336	51'-10"		8"	10"		8'-10"	"	"	4.513	52,372	792.88	217.50
		8'	384	51'-10"		8"	10"		9'-10"	"	"	4.655	53,633	813.82	224.18
		9'	432	52'-3"		9"	11"		10'-10"	73'-10¾"	75'-10¾"	4.965	55,998	850.25	230.86
		10'	480	52'-8"		10"	12"		11'-10"	74'-5¾"	76'-5¾"	5.305	57,510	877.16	237.54
		11'	528	52'-10"		11"	12"		12'-10"	74'-8⅝"	76'-8½"	5.557	59,157	904.35	244.22
		12'	576	53'-0"		12"	12"		13'-10"	74'-11⅝"	76'-11½"	5.821	61,865	948.21	250.90

* For quantities in Wings see Standard Wing Drawings listed below. Total steel quantities listed above include one lap of longitudinal bars.

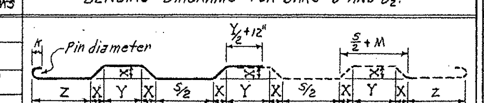
DOWEL BARS FOR TWO HEADWALLS (Dowel bars "r" in Two Headwalls.)



Span	Size	Spacing	No. Req'd	Length	X
9'	#4	12¼	114	2'-10"	1'-5"
10'	#4	12¼	124	2'-11"	1'-5½"
11'	#4	12¼	136	3'-0"	1'-6"
12'	#4	12½	148	3'-1"	1'-6½"

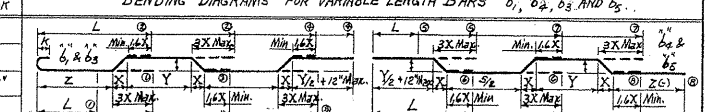
BENDING DIAGRAMS FOR BARS "b" AND "b₂".

Bar Size	Pin Diam.	K	Add for 2 Hooks
#6	3"	5"	1'-2"



BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b₁", "b₄", "b₃" AND "b₅".

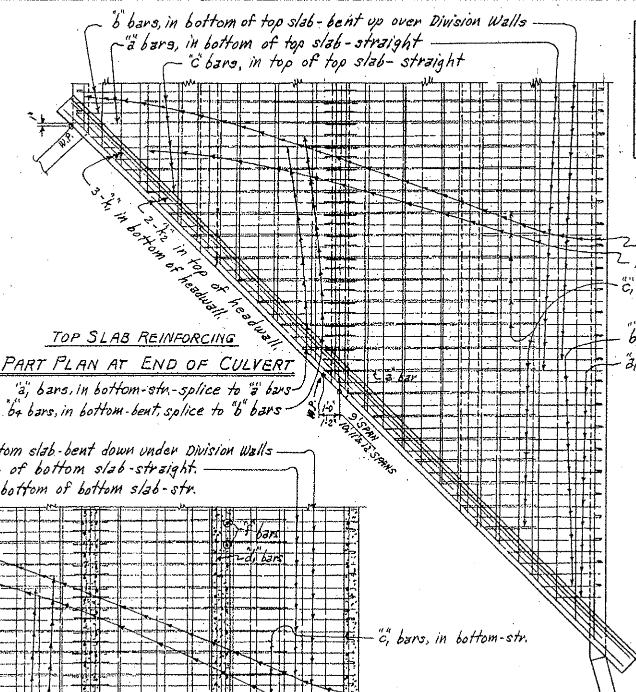
Bar Size	Pin Diam.	K	Add for 1 Hook
#6	3"	5"	0'-7"



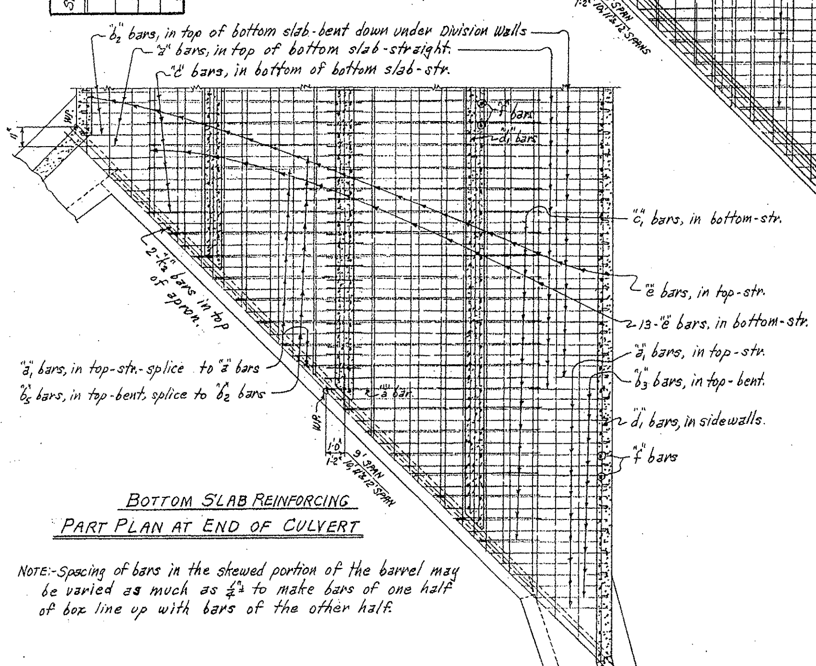
NOTE:- Dimensions are to centers of bars (b, b₁, b₂, b₃, b₄ & b₅). The X, Y & Z values of "b₁" & "b₄" bars are same as for "b" bars, and for "b₃" & "b₅" bars same as for "b₂" bars.
①②--⑦⑧ Min. & Max. lengths "L" for bars "b₁", "b₄", "b₃" & "b₅" for each type bend.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

▼ These bars are in the skewed portion of barrel only. The length of "a₁" and "c₁" bars and overall length "L" of "b₁" and "b₄" bars vary by 1'-0" for 12" spacing and 0'-11" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" and "b₂" bars, use a set of "a" and "c" bars instead.
⊠ These bars are to be spliced at center Division Wall. Some "b" bars are to be spliced to "b₄" bars and some "b₂" bars to "b₅" bars to make full length bars.

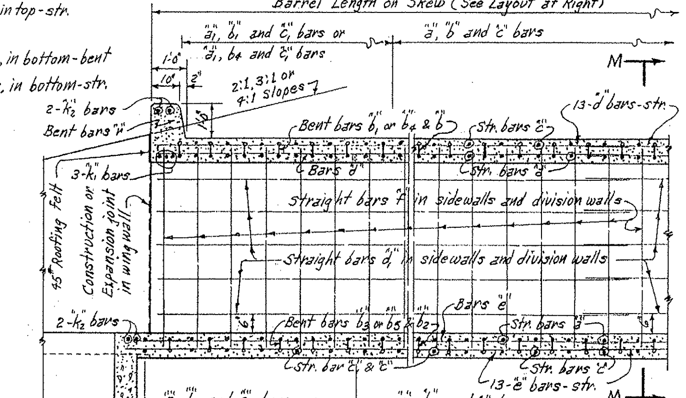


TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

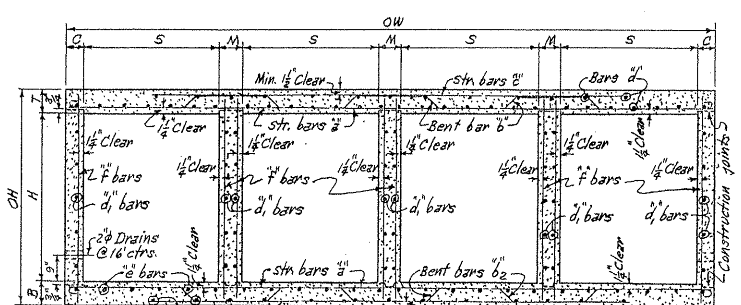


BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

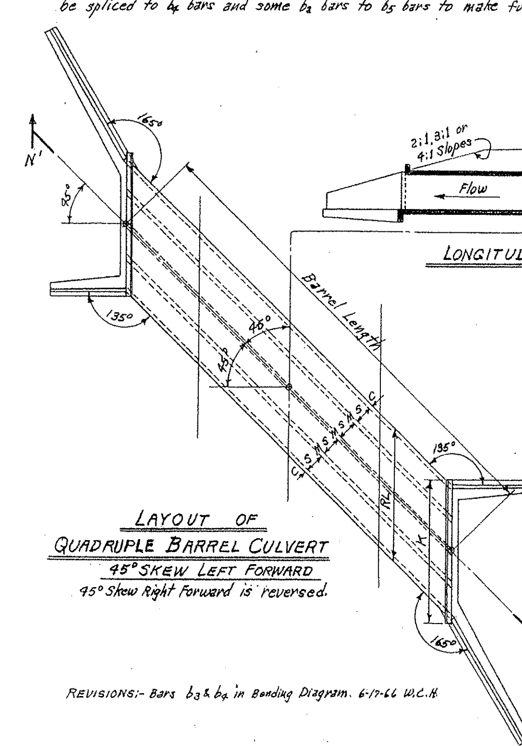
NOTE:- Spacing of bars in the skewed portion of the barrel may be varied as much as ¼" to make bars of one half of box line up with bars of the other half.



SECTION N-N

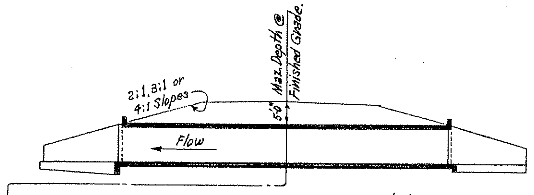


TYPICAL SECTION M-M



LAYOUT OF
QUADRUPLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

REVISIONS:- Bars b₃ & b₄ in Bending Diagram. 6-17-66 W.C.H.



LONGITUDINAL SECTION N'-N'

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters minimum.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

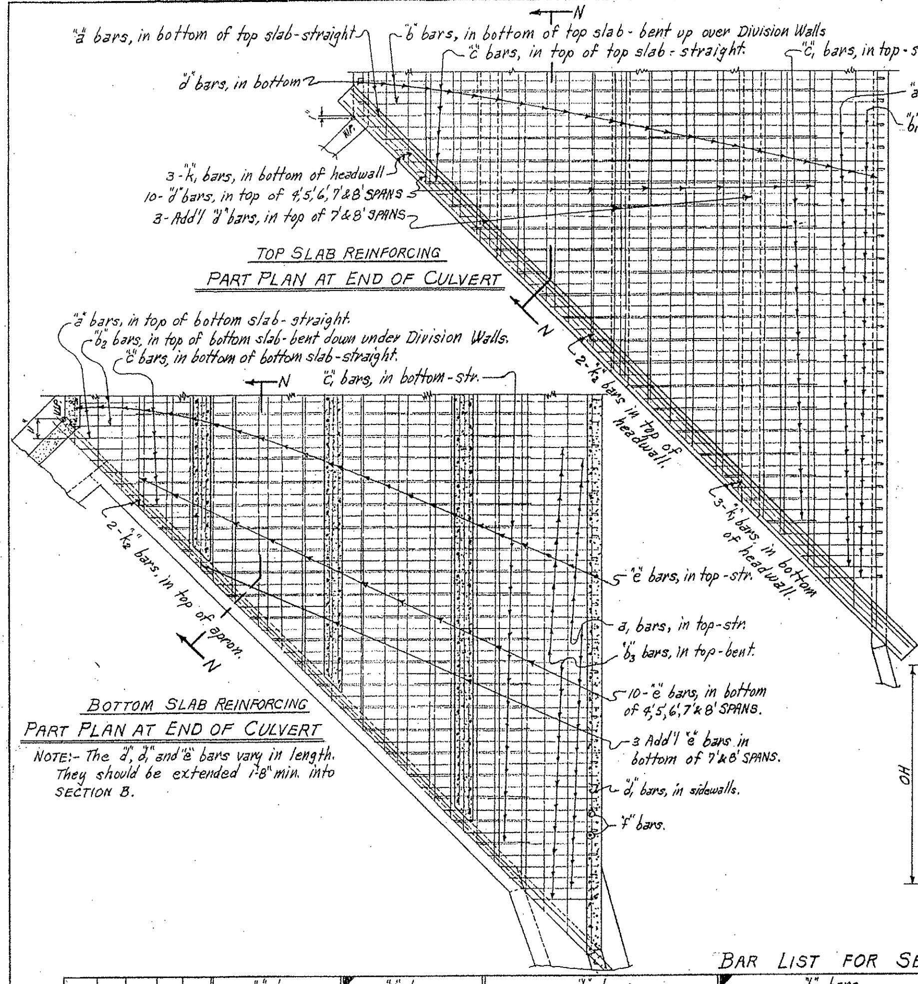
9', 10', 11' AND 12' SPANS
QUADRUPLES
2:1, 3:1 OR 4:1 SLOPES
UNDER 5'-0" COVER

STANDARD DRAWING No. R-445X-02

Designed by:- W.C.H. 1-23-63. Checked by:- R.H.S. 5-21-63.
Drawn by:- W.C.H. 7-29-64. Checked by:-
Quantities by:- W.C.H. 10-12-64. Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

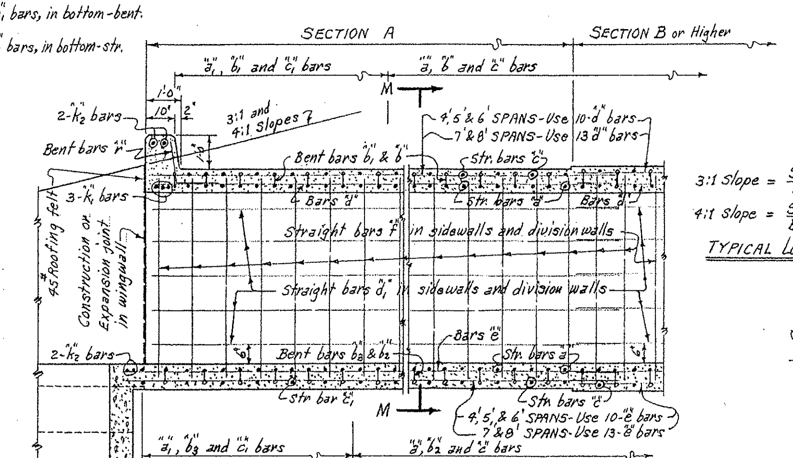
NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.



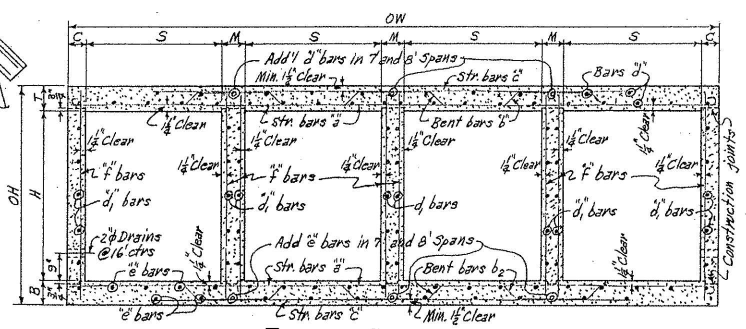
TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

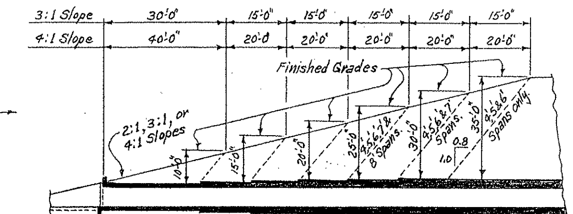
NOTE:- The "d", "d1" and "e" bars vary in length. They should be extended 1'-8" min. into SECTION B.



SECTION N-N



TYPICAL SECTION



	Sections						
3:1 Slope =	SECTIONS	A=22'-0"	B=11'-0"	C=11'-0"	D=11'-0"	E=11'-0"	MID-SECTION F-Varies
	Bar Group	A	B	C	D	E	F
4:1 Slope =	SECTIONS	A=32'-0"	B=16'-0"	C=16'-0"	D=16'-0"	E=16'-0"	MID-SECTION F-Varies
	Bar Group	A	B	C	D	E	F

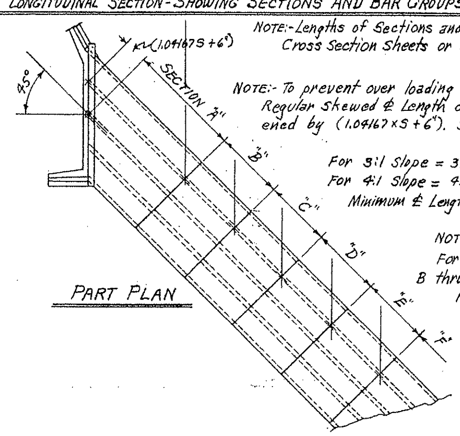
TYPICAL LONGITUDINAL SECTION-SHOWING SECTIONS AND BAR GROUPS FOR VARIOUS DEPTHS OF COVER

NOTE:-Lengths of Sections and Bar Groups are to be shown on Cross Section Sheets or on Special Culvert Layout Sheet.

These lengths are perpendicular to ℄ of roadway near ℄ of Division Wall on long side. See Table of Skewed Lengths above.

℄ LENGTHS OF SECTIONS ON 45° SKEW

SLOPE		3:1		4:1	
SECTIONS		A	B,C,D & E	A	B,C,D & E
SPANS	4'	26'-5½"	15'-6¾"	37'-7"	22'-7½"
	5'	25'-5"	"	36'-6½"	"
	6'	24'-4½"	"	35'-6"	"
	7'	23'-4"	"	34'-5½"	"
	8'	22'-3½"	"	33'-5"	"



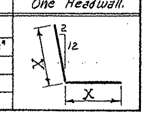
PART PLAN

NOTE:- To prevent over loading of the (inside) side span, the Regular Skewed ℄ Length of Section "A" have been shortened by (1.04167×S+6"). See below and Table above.

For 3:1 Slope = 31.125'-(1.04167×S+6").
For 4:1 Slope = 45.250'-(1.04167×S+6").
Minimum ℄ Length on Skew = (0.5×OW+1").

NOTE:-
For Details and Bar Lists for SECTION B thru F, see Barrel Drawing Nos. R-400X-X1 and R-400X-X2.

DOWEL BARS FOR ONE HEADWALL

SPAN	SIZE	SPACING	No. REQD	LENGTH	X	Dowel bars "r" in One Headwall.
4'	#4	12"±	27	2'-4"	1'-2"	
5'	#4	12"±	33	2'-5"	1'-2½"	
6'	#4	12"±	39	2'-6"	1'-3"	
7'	#4	12"±	45	2'-8"	1'-4"	
8'	#4	12"±	50	2'-10"	1'-5"	

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200#/□"
Reinforcing Steel 20,000#/□"

MAX. DESIGN DEPTH OF COVER	CLEAR SPANS	CLEAR HEIGHT	SQ.FT. OPENING	OVERALL WIDTH	THICKNESS OF TOP SLAB	THICKNESS OF SIDEWALLS	THICKNESS OF DIVISION WALLS	THICKNESS OF BOTTOM SLAB	OVERALL HEIGHT	ROADWAY LENGTH	LENGTH OF HEADWALL	* CLASS S CONCRETE, BARREL ONLY 3:1	4:1	* REINFORCING STEEL, BARREL, APRON AND HEADWALL 3:1	4:1
D	S	H	A	OW	T	C	M	B	OH	RL	K	CU.YD.	CU.YD.	LB.	LB.
SECTION "A" = 10'-0"	4 @ 4'	2'	32	19'-0"	6"	6"	8"	6"	3'-0"	26'-10½"	28'-10½"	24.50	34.80	4000	5780
		3'	48	19'-0"		6"	8"		4'-0"	"	"	27.44	38.97	4297	6200
		4'	64	19'-0"		6"	8"		5'-0"	"	"	30.37	43.15	4589	6620
		5'	80	19'-0"		6"	8"		6'-0"	"	"	33.31	47.22	4883	7039
		6'	96	19'-5"		7"	9"		7'-0"	27'-5½"	29'-5½"	39.11	55.55	5236	7515
	4 @ 5'	3'	60	23'-0"	6½"	6"	8"	6½"	4'-1"	32'-6¾"	34'-6¾"	31.92	45.90	5390	7878
		4'	80	23'-0"		6"	8"		5'-1"	"	"	34.74	49.95	5674	8286
		5'	100	23'-0"		6"	8"		6'-1"	"	"	37.57	54.01	5957	8676
		6'	120	23'-5"		7"	9"		7'-1"	33'-1⅜"	35'-1½"	43.18	62.08	6248	9169
		7'	140	23'-9"		7½"	10"		8'-1"	33'-7"	35'-7"	48.93	70.34	7200	10,719
	4 @ 6'	3'	72	27'-0"	7"	6"	8"	7¼"	4'-2¼"	38'-2¼"	40'-2¼"	37.07	54.00	6879	9374
		4'	96	27'-0"		6"	8"		5'-2¼"	"	"	39.78	57.94	7152	9771
		5'	120	27'-0"		6"	8"		6'-2¼"	"	"	42.49	61.88	7425	10,169
		6'	144	27'-5"		7"	9"		7'-2¼"	38'-9¼"	40'-9¼"	47.90	69.76	7735	11,359
		7'	168	27'-9"		7½"	10"		8'-2¼"	39'-3"	41'-3"	53.45	77.85	8688	12,725
		8'	192	27'-10"		8"	10"		9'-2¼"	39'-4⅜"	41'-4¼"	57.53	83.78	9203	13,476
	4 @ 7'	4'	112	31'-0"	7¾"	6"	8"	8¼"	5'-4"	43'-10⅜"	45'-10"	46.08	68.06	8603	12,989
		5'	140	31'-0"		6"	8"		6'-4"	"		48.67	71.88	8865	13,376
		6'	168	31'-5"		7"	9"		7'-4"	44'-5⅛"	46'-5¼"	53.92	79.63	9248	13,922
		7'	196	31'-9"		7½"	10"		8'-4"	44'-10⅜"	46'-10¾"	59.27	87.52	10,183	15,281
		8'	224	31'-10"		8"	10"		9'-4"	45'-0¼"	47'-0¼"	63.19	93.31	10,697	16,034
		9'	252	32'-3"		9"	11"		10'-4"	45'-7½"	47'-7½"	70.21	103.69	11,278	16,971
	4 @ 8'	4'	128	35'-0"	8½"	6"	8"	9¼"	5'-5¾"	49'-6"	51'-6"	52.65	78.93	9899	15,998
		5'	160	35'-5"		7"	9"		6'-5¾"	50'-1"	52'-1"	57.36	85.98	10,117	16,198
		6'	192	35'-5"		7"	9"		7'-5¾"	"	"	60.19	90.23	10,367	16,574
		7'	224	35'-9"		7½"	10"		8'-5¾"	50'-6¾"	52'-6¾"	65.34	97.94	10,905	17,367
		8'	256	35'-10"		8"	10"		9'-5¾"	50'-8"	52'-8"	69.08	103.56	11,642	18,453
		9'	288	36'-3"		9"	11"		10'-5¾"	51'-3¼"	53'-3¼"	75.86	113.72	12,147	19,365
		10'	320	36'-8"		10"	12"		11'-5¾"	51'-10¼"	53'-10¼"	83.30	124.88	13,382	21,177

BARREL DIMENSIONS; * QUANTITIES-ONE SECTION "A".

* For remainder of quantities see Std. Wing and Barrel Drawings listed below.

SECTIONS AND BAR GROUPS TO BE USED FOR VARIOUS DEPTHS OF COVER

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	B	C			D
25.0' to 29.5'	A	B	C	D		E
30.0' to 35.0'	A	B	C	D	E	F

OR ALT.

DEPTHS OF COVER	SECTIONS & BAR GROUPS FOR END SECTIONS A	B	C	D	E	MID-SECTION AND BAR GROUP
5.0' to 9.5'	A					A
10.0' to 14.5'	A					B
15.0' to 19.5'	A	B				C
20.0' to 24.5'	A	2@C				D
25.0' to 29.5'	A	B	2@D			E
30.0' to 35.0'	A	2@C		2@E		F

BAR LIST FOR SECTION "A" ON 45° SKEW - ONE END ONLY.

SECTION "A" & BAR GROUP "A". LENGTH OF SECTION: Lengths vary with Clear Span "S" per Slope, see Table at upper right. DEPTH OF COVER D: 0'-0" TO 10'-0" MAXIMUM.

"a" bars – STRAIGHT – In Top and Bottom Slab of Barrel. "a1" bars – STRAIGHT – In Top and Bottom Slab of Barrel- (Two of each Length).

S	H	"a" Size	"a" Spacing	"a" No. 3:1	"a" No. 4:1	"a" Length	"a1" Size	"a1" Spacing	"a1" No. Reqd	"a1" Length Max.	"a1" Length Min.
4@4'	2'	#4	12"	37	65	18'-9"	#4	12"	32	17'-9"	2'-9"
	3'			37	65	"			32	"	"
	4'			37	65	"			32	"	"
	5'			37	65				32	"	"
	6'			37	64	19'-2"			32	18'-2"	3'-2"
4@5'	3'	#4	11"	33	63	22'-9"	#4	11"	44	21'-10"	2'-7"
	4'			33	63	"			44	"	
	5'			33	63	"			44	"	
	6'			31	63	23'-2"			44	22'-3"	3'-0"
	7'			31	63	23'-6"			44	22'-7"	3'-4"
4@6'	3'	#5	13"	23	49	26'-9"	#5	13"	44	25'-8"	2'-11"
	4'			23	49	"			44	"	"
	5'			23	49	"			44	"	"
	6'			23	47	27'-2"			44	26'-1"	3'-4"
	7'			23	47	27'-6"			46	26'-5"	2'-7"
	8'			23	47	27'-7"			46	26'-6"	2'-8"
4@7'	4'	#5	11"	19	49	30'-9"	#5	11"	60	29'-10"	3'-3"
	5'			19	49	"			60	"	"
	6'			19	49	31'-2"			62	30'-3"	2'-9"
	7'			19	49	31'-6"			62	30'-7"	3'-1"
	8'			19	49	31'-7"			62	30'-8"	3'-2"
	9'			17	49	32'-0"			64	31'-1"	2'-8"
4@8'	4'	#5	13"	13	43	34'-9"	#5	13"	60	33'-8"	2'-4"
	5'			11	43	35'-2"			60	34'-1"	2'-9"
	6'			11	43	"			60	"	"
	7'			11	43	35'-6"			60	34'-5"	3'-1"
	8'			11	43	35'-7"			60	34'-6"	3'-2"
	9'			11	43	36'-0"			62	34'-11"	2'-6"
	10'			11	43	36'-5"			62	35'-4"	2'-11"

"b" bars – BENT- See Diagrams below. In Bottom of Top Slab bent up over Division Walls-hooked. Alternate with "a" and "c" bars. "b1" bars – In Bottom of Top Slab-some bent up over Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars.

S	H	"b" Size	"b" Spacing	"b" No. 3:1	"b" No. 4:1	"b" Length	X	Y	Z	"b1" Size	"b1" Spacing	"b1" No. Reqd	"b1" Length Max.	"b1" Length Min.	L Max.	L Min.
4@4'	2'	#4	12"	17	31	20'-1"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	16	19'-1"	3'-7"	18'-2"	3'-2"
	3'			17	31	"	"	"	"			16	"	"	"	"
	4'			17	31	"	"	"	"			16	"	"	"	"
	5'			17	31	"	"	"	"			16	"	"	"	"
	6'			17	31	20'-6"	0'-2¾"	2'-3½"	3'-5¼"			17	19'-6"	3'-0"	18'-7"	2'-7"
4@5'	3'	#4	11"	15	31	24'-2"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	22	23'-3"	3'-5"	22'-3"	3'-0"
	4'			15	31	"	"	"	"			22	"	"	"	"
	5'			15	31	"	"	"	"			22	"	"	"	"
	6'			15	30	24'-7"	"	2'-8½"	4'-2¼"			23	23'-8"	2'-11"	22'-8"	2'-6"
	7'			15	30	24'-11"	0'-3¼"	2'-9½"	4'-2¾"			23	24'-0"	3'-3"	23'-0"	2'-10"
4@6'	3'	#5	13"	11	23	28'-3"	0'-3½"	3'-1"	4'-10¼"	#5	13"	22	27'-2"	3'-10"	26'-1"	3'-4"
	4'			11	23	"	"	"	"			22	"	"	"	"
	5'			11	23	"	"	"	"			22	"	"	"	"
	6'			10	23	28'-8"	"	3'-2"	4'-11¼"			23	27'-7"	3'-2"	26'-6"	2'-8"
	7'			10	23	29'-0"	"	3'-3"	4'-11¾"			23	27'-11"	3'-6"	26'-10"	3'-0"
	8'			10	23	29'-1"	0'-3½"	3'-3"	5'-0¼"			23	28'-0"	3'-7"	26'-11"	3'-1"
4@7'	4'	#5	11"	8	24	32'-5"	0'-4¼"	3'-5½"	5'-7"	#5	11"	31	31'-6"	3'-3"	30'-3"	2'-9"
	5'			8	24	"	"	"	"			31	"	"	"	"
	6'			8	24	32'-10"	"	3'-6½"	5'-8"			31	31'-11"	3'-8"	30'-8"	3'-2"
	7'			8	24	33'-2"	"	3'-7½"	5'-8½"			32	32'-3"	3'-1"	31'-0"	2'-7"
	8'			8	24	33'-3"	"	3'-7½"	5'-9"			32	32'-4"	3'-2"	31'-1"	2'-8"
	9'			8	23	33'-8"	0'-4¼"	3'-8½"	5'-10"			32	32'-9"	3'-7"	31'-6"	3'-1"
4@8'	4'	#6	13"	5	21	36'-9"	0'-5"	3'-10"	6'-4"	#6	13"	36	35'-7"	3'-2"	34'-1"	2'-9"
	5'			5	20	37'-2"	"	3'-11"	6'-5"			30	36'-0"	3'-9"	34'-6"	3'-2"
	6'			5	20	"	"	"	"			30	"	"	"	"
	7'			5	20	37'-6"	"	4'-0"	6'-5½"			31	36'-4"	3'-0"	34'-10"	2'-5"
	8'			5	20	37'-7"	"	4'-0"	6'-6"			31	36'-5"	3'-1"	34'-11"	2'-6"
	9'			4	20	38'-0"	"	4'-1"	6'-7"			31	36'-10"	3'-6"	35'-4"	2'-11"
	10'			4	20	38'-5"	0'-5"	4'-2"	6'-8"			31	37'-3"	3'-11"	35'-9"	3'-4"

"b2" bars – BENT- See Diagrams below. In Top of Bottom Slab bent down under Division Walls-hooked. Alternate with "a" and "c" bars. "b3" bars – In Top of Bottom Slab-some bent down under Division Walls-one end hooked. Alt. with "a1" and "c" or "c1" bars.

S	H	"b2" Size	"b2" Spacing	"b2" No. 3:1	"b2" No. 4:1	"b2" Length	X	Y	Z	"b3" Size	"b3" Spacing	"b3" No. Reqd	"b3" Length Max.	"b3" Length Min.	L Max.	L Min.
4@4'	2'	#4	12"	18	32	20'-1"	0'-2¾"	2'-2½"	3'-4¼"	#4	12"	16	19'-1"	3'-7"	18'-2"	3'-2"
	3'			18	32	"	"	"	"			16	"	"	"	"
	4'			18	32	"	"	"	"			16	"	"	"	"
	5'			18	32	"	"	"	"			16	"	"	"	"
	6'			18	32	20'-6"	0'-2¾"	2'-3½"	3'-5¼"			17	19'-6"	3'-0"	18'-7"	2'-7"
4@5'	3'	#4	11"	16	32	24'-2"	0'-3¼"	2'-7½"	4'-1¼"	#4	11"	22	23'-3"	3'-5"	22'-3"	3'-0"
	4'			16	32	"	"	"	"			22	"	"	"	"
	5'			16	32	"	"	"	"			22	"	"	"	"
	6'			16	31	24'-7"	"	2'-8½"	4'-2¼"			23	23'-8"	2'-11"	22'-8"	2'-6"
	7'			16	31	24'-11"	0'-3¼"	2'-9½"	4'-2¾"			23	24'-0"	3'-3"	23'-0"	2'-10"
4@6'	3'	#5	13"	12	24	28'-4"	0'-3½"	3'-0½"	4'-10¼"	#5	13"	22	27'-3"	3'-10"	26'-1"	3'-4"
	4'			12	24	"	"	"	"			22	"	"	"	"
	5'			12	24	"	"	"	"			22	"	"	"	"
	6'			11	24	28'-9"	"	3'-1½"	4'-11¼"			23	27'-8"	3'-2"	26'-6"	2'-8"
	7'			11	24	29'-1"	"	3'-2½"	4'-11¾"			23	28'-0"	3'-6"	26'-10"	3'-0"
	8'			11	24	29'-2"	0'-3½"	3'-2½"	5'-0¼"			23	28'-1"	3'-7"	26'-11"	3'-1"
4@7'	4'	#5	11"	9	25	32'-6"	0'-4¾"	3'-4½"	5'-7"	#5	11"	31	31'-7"	3'-3"	30'-3"	2'-9"
	5'			9	25	"	"	"	"			31	"	"	"	"
	6'			9	25	32'-11"	"	3'-5½"	5'-8"			31	32'-0"	3'-8"	30'-8"	3'-2"
	7'			9	25	33'-3"	"	3'-6½"	5'-8½"			32	32'-4"	3'-1"	31'-0"	2'-7"
	8'			9	25	33'-4"	"	3'-6½"	5'-9"			32	32'-5"	3'-2"	31'-1"	2'-8"
	9'			9	24	33'-9"	0'-4¾"	3'-7½"	5'-10"			32	32'-10"	3'-7"	31'-6"	3'-1"
4@8'	4'	#6	13"	6	22	36'-11"	0'-5¾"	3'-8½"	6'-4"	#6	13"	30	35'-9"	3'-2"	34'-1"	2'-9"
	5'			6	21	37'-4"	"	3'-9½"	6'-5"			30	36'-2"	3'-9"	34'-6"	3'-2"
	6'			6	21	"	"	"	"			30	"	"	"	"
	7'			6	21	37'-8"	"	3'-10½"	6'-5½"			31	36'-6"	3'-0"	34'-10"	2'-5"
	8'			6	21	37'-9"	"	3'-10½"	6'-6"			31	36'-7"	3'-1"	34'-11"	2'-6"
	9'			5	21	38'-2"	"	3'-11½"	6'-7"			31	37'-0"	3'-6"	35'-4"	2'-11"
	10'			5	21	38'-7"	0'-5¾"	4'-0½"	6'-8"			31	37'-5"	3'-11"	35'-9"	3'-4"

"c" bars – STRAIGHT – In Top and Bottom Slab of Barrel. Alternate with "b" & "b2" bars. "c1" bars – In Top and Bottom Slab of Barrel. Alt. with "b1" & "b3" bars. (Two of each Length)

S	H	"c" Size	"c" Spacing	"c" No. 3:1	"c" No. 4:1	"c" Length	"c1" Size	"c1" Spacing	"c1" No. Reqd	"c1" Length Max.	"c1" Length Min.
4@4'	2'	#4	12"	41	69	14'-0"	#4	12"	24	13'-5"	2'-5"
	3'			41	69	"			24	"	"
	4'			41	69	"			24	"	"
	5'			41	69	"			24	"	"
	6'			41	68	14'-3"			24	13'-9"	2'-9"
4@5'	3'	#5	11"	39	69	17'-0"	#5	11"	32	16'-3"	2'-6"
	4'			39	69	"			32	"	"
	5'			39	69	"			32	"	"
	6'			37	69	17'-3"			32	16'-7"	2'-10"
	7'			37	69	17'-6"			32	16'-10"	3'-1"
4@6'	3'	#6	13"	29	55	20'-0"	#6	13"	32	19'-1"	2'-10"
	4'			29	55	"			32	"	"
	5'			29	55	"			32	"	"
	6'			29	53	20'-3"			32	19'-5"	3'-2"
	7'			29	53	20'-6"			34	19'-8"	2'-4"
	8'			29	53	20'-6"			34	19'-9"	2'-5"
4@7'	4'	#6	11"	27	57	23'-0"	#6	11"	44	22'-4"	3'-1"
	5'			27	57	"			44	"	"
	6'			27	57	23'-3"			46	22'-8"	2'-6"
	7'			27	57	23'-6"			46	22'-11"	2'-9"
	8'			27	57	23'-6"			46	23'-0"	2'-10"
	9'			25	57	23'-9"			46	23'-4"	3'-2"
4@8'	4'	#7	13"	21	51	26'-0"	#7	13"	42	24'-11"	3'-3"
	5'			19	51	26'-3"			44	25'-4"	2'-7"
	6'			19	51	"			44	"	"
	7'			19	51	26'-6"			44	25'-7"	2'-10"
	8'			19	51	26'-6"			44	25'-8"	2'-11"
	9'			19	51	26'-9"			44	26'-0"	3'-3"
	10'			19	51	27'-0"			46	26'-4"	2'-6"

"d" bars – STRAIGHT – Longitudinal in Top slab of Barrel. "d1" bars – Longitudinal in Sidewalls and Division Walls. "e" bars – Longitudinal in Bottom slab of Barrel. Length ⊙: Lengths vary with Clear Span "S", skew and slope, see Table for ave. Lengths.

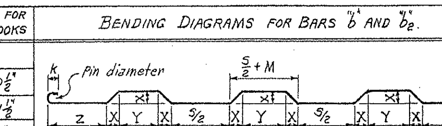
S	H	"d" Size	"d" Spacing	"d" No. Reqd	"d1" Size	"d1" Spacing	"d1" No. Reqd	"e" Size	"e" Spacing	"e" No. Reqd
4@4'	2'	#4	12"	30	#4	12"	16	#4	12"	30
	3'			30			24			30
	4'			30			32			30
	5'			30			40			30
	6'			30			48			30
4@5'	3'			34			24			34
	4'			34			32			34
	5'			34			40			34
	6'			34			48			34
	7'			34			56			34
4@6'	3'			38			24			38
	4'			38			32			38
	5'			38			40			38
	6'			38			48			38
	7'			38			56			38
	8'			38			64			38
4@7'	4'			45			32			45
	5'			45			40			45
	6'			45			48			45
	7'			45			56			45
	8'			45			64			45
	9'			45			72			45
4@8'	4'			49			32			49
	5'			49			40			49
	6'			49			48			49
	7'			49			56			49
	8'			49			64			49
	9'			49			72			49
	10'			49			80			49

"f" bars – STRAIGHT – Verticals in Sidewalls and Division Walls. "k1" bars – STRAIGHT – In Bottom of Headwall. "k2" bars – In Top of Headwall and Apron. (2 Each)

S	H	"f" Size	"f" Spacing	"f" No. 3:1	"f" No. 4:1	"f" Length	"k1" Size	"k1" No. Reqd	"k1" Length	"k2" Size	"k2" No. Reqd	"k2" Length
4@4'	2'	#4	12"	216	304	2'-9"	#5	3	26'-6"	#5	4	28'-7"
	3'			216	304	3'-9"		3	"		4	"
	4'			216	304	4'-9"		3	"		4	"
	5'			216	304	5'-9"		3	"		4	"
	6'			216	304	6'-9"		3	27'-1"		4	29'-2"
4@5'	3'	#4	12"	208	296	3'-10"	#6	3	32'-1"	#6	4	34'-3"
	4'			208	296	4'-10"		3	"		4	"
	5'			208	296	5'-10"		3	"		4	"
	6'			208	296	6'-10"		3	32'-8"		4	34'-10"
	7'	#5	12"	208	296	7'-10"		3	33'-2"		4	35'-4"
4@6'	3'	#4	12"	200	288	3'-11"	⊠ #6	6	19'-11"	⊕ #6	8	21'-0"
	4'			200	288	4'-11"		6	"		8	"
	5'			200	288	5'-11"		6	"		8	"
	6'			200	288	6'-11"		6	20'-2"		8	21'-3"
	7'	#5	12"	200	288	7'-11"		6	20'-5"		8	21'-6"
	8'		11"	216	312	8'-11"		6	20'-6"		8	21'-7"
4@7'	4'	#4	12"	192	280	5'-1"	⊠ #7	6	22'-11"	⊕ #7	8	24'-0"
	5'			192	280	6'-1"		6	"		8	"
	6'			192	280	7'-1"		6	23'-2"		8	24'-3"
	7'	#5	12"	192	280	8'-1"		6	23'-5"		8	24'-6"
	8'		11"	208	304	9'-1"		6	23'-6"		8	24'-7"
	9'		10"	232	336	10'-1"		6	23'-9"		8	24'-10"
4@8'	4'	#4	12"	184	272	5'-3"	⊠ #7	6	25'-9"	⊕ #7	8	26'-10"
	5'			184	272	6'-3"		6	26'-0"		8	27'-1"
	6'			184	272	7'-3"		6	"		8	"
	7'		10"	216	320	8'-3"		6	26'-3"		8	27'-4"
	8'	#5	12"	184	272	9'-3"		6	26'-4"		8	27'-5"
	9'		11"	200	296	10'-3"		6	26'-7"		8	27'-8"
	10'	#6	12"	184	272	11'-3"		6	26'-11"		8	28'-0"

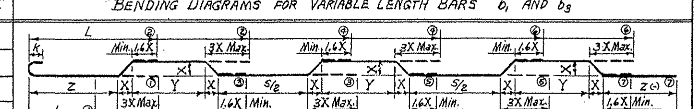
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#4	2"	4"	0'-10½"
#5	2½"	4¼"	0'-11½"
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b2"



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#4	2"	4"	0'-5¼"
#5	2½"	4¼"	0'-5¾"
#6	3"	5"	0'-7"

BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b1" AND "b3"



NOTE:- Dimensions are to centers of bars (b, b1, b2 & b3). The X, Y & Z values of "b1" bars are same as for "b" bars, and for "b3" bars same as for "b2" bars. ①②---⑥⑦ Min. & Max. lengths "L" for bars "b1" & "b3" for each type bend.

AVE. LENGTHS OF LONG. BARS "d", "d1" & "e".

SLOPE		3:1		4:1	
BARS		d&d1	e	d&d1	e
SPANS	4'	28'-1"	29'-6"	39'-3"	40'-8"
	5'	27'-1"	28'-6"	38'-2"	39'-7"
	6'	26'-0"	27'-5"	37'-2"	38'-7"
	7'	25'-0"	26'-5"	36'-1"	37'-6"
	8'	23'-11"	25'-4"	35'-1"	36'-6"

◤ These bars are in the skewed portion of barrel only. The length of "a1" and "c1" bars and overall length "L" of "b1" and "b3" bars vary by 1'-1" for 13" spacing, 1'-0" for 12" spacing and 0'-11" for 11" spacing.
⊙ To longitudinal bars of 4:1 slopes add one splice for each "d", "d1" and "e" bar. (1'-3" lap.)
⊠ These bars to be spliced at center division wall (2'-0" & 2'-4" lap).

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.
* Total steel quantities include one lap of longitudinal bars, plus an add'l lap for 4:1 slopes.

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X453-1 or W-X453-2 and W-X454-1 or W-X454-2. Also W-X45.

For Barrels of 4',5' & 6' Spans, see Drawing No. R-400X-X1.
For Barrels of 7' & 8' Spans, see Drawing No. R-400X-X2.

CLASS S CONCRETE

Designed by:- W.C.H. 10-2-62 Checked by:- R.H.S. 11-16-62
Drawn by:- W.C.H. 8-19-64 Checked by:-
Quantities by:- W.C.H. 11-18-64 Checked by:-

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW — SECTIONS "A" ONLY

4',5',6',7' AND 8' SPANS — 3:1 OR 4:1 SLOPES
QUADRUPLES — OVER 5'-0" COVER

STANDARD DRAWING NO. R-445X-1

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 60'-0" IN LENGTH – TWO 45° SKEWED ENDS

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH	"a'" bars STRAIGHT In Top and Bottom Slab of Barrel- (Four of Each Length) SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#5	12"	76	23'-5"	#5	12"	84	22'-5"	2'-5"
		3'			76	23'-5"			84	" "	"
		4'			76	23'-5"			84	" "	"
		5'			76	23'-5"			84	" "	"
		6'			76	23'-11"			84	22'-11"	2'-11"
	5' @ 6'	3'	#6	12"	66	28'-5"	#6	12"	104	27'-5"	2'-5"
		4'			66	28'-5"			104	" "	"
		5'			66	28'-5"			104	" "	"
		6'			66	28'-11"			104	27'-11"	2'-11"
		7'			66	29'-4"			104	28'-9"	3'-4"
	6' @ 7'	3'	#6	11"	62	33'-5"	#6	11"	132	32'-6"	3'-2"
		4'			62	33'-5"			132	" "	"
		5'			62	33'-5"			132	" "	"
		6'			60	33'-11"			136	33'-9"	2'-9"
		7'			60	33'-9"			136	33'-5"	3'-2"
		8'			60	34'-5"			136	33'-6"	3'-3"
	4'	4'	#6	12"	46	38'-5"	#6	12"	144	37'-5"	2'-5"
		5'			46	38'-5"			144	" "	"
		6'			46	38'-11"			144	37'-11"	2'-11"
		7'			46	39'-4"			144	38'-9"	3'-4"
		8'			44	39'-5"			148	38'-5"	2'-5"
		9'			44	39'-11"			148	38'-11"	2'-11"

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b'" bars BENT - See Diagrams below. In Bottom of Top Slab-some bent up over Division Walls - one end hooked. (2 of Each Length.) Alternate with "a'" and "c'" bars. SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#5	12"	36	25'-0"	0'-8"	2'-12"	3'-4½"	#5	12"	42	24'-0"	3'-4"	22'-10"	2'-10"
		3'			36	25'-0"	"	"	"			42	" "	" "	" "	"
		4'			36	25'-0"	"	"	"			42	" "	" "	" "	"
		5'			36	25'-0"	"	"	"			42	" "	" "	" "	"
		6'			36	25'-6"	0'-9"	2'-8"	3'-5½"			42	24'-6"	3'-10"	23'-4"	3'-4"
	5' @ 6'	3'	#5	12"	31	30'-2"	0'-3½"	2'-7"	4'-1½"	#5	12"	52	29'-1"	3'-4"	27'-10"	2'-10"
		4'			31	30'-2"	"	"	"			52	" "	" "	" "	"
		5'			31	30'-2"	"	"	"			52	" "	" "	" "	"
		6'			30	30'-8"	"	2'-8"	4'-2½"			52	29'-7"	3'-10"	28'-4"	3'-4"
		7'			30	31'-1"	0'-3½"	2'-9"	4'-3½"			54	30'-0"	3'-3"	28'-10"	2'-9"
	6' @ 7'	3'	#6	11"	28	35'-8"	0'-4"	3'-0"	4'-10½"	#6	11"	68	34'-4"	3'-12"	32'-11"	2'-8"
		4'			28	35'-8"	"	"	"			68	" "	" "	" "	"
		5'			28	35'-8"	"	"	"			68	" "	" "	" "	"
		6'			27	36'-1"	"	3'-2"	4'-11½"			68	34'-10"	3'-10"	33'-5"	3'-2"
		7'			27	36'-3"	0'-4"	3'-2"	5'-0½"			70	35'-3"	3'-2"	33'-10"	2'-10"
		8'			27	36'-9"	0'-4½"	3'-3"	5'-0½"			70	35'-9"	3'-3"	33'-11"	2'-9"
	4'	4'	#6	12"	21	40'-7"	0'-4½"	3'-5"	5'-7"	#6	12"	72	39'-6"	3'-5"	37'-10"	2'-10"
		5'			21	40'-7"	"	"	"			72	" "	" "	" "	"
		6'			20	41'-1"	"	3'-6"	5'-8"			72	40'-0"	3'-10"	38'-4"	3'-4"
		7'			20	41'-6"	"	3'-7"	5'-8½"			74	40'-5"	3'-9"	38'-9"	2'-9"
		8'			20	41'-7"	"	"	5'-9"			74	40'-6"	3'-5"	38'-10"	2'-10"
		9'			20	42'-1"	0'-4½"	3'-8"	5'-10"			74	41'-0"	3'-11"	39'-4"	3'-4"

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQ'D	LENGTH	X	Y	Z	"b₃" bars BENT - See Diagrams below. In Top of Bottom Slab-some bent down under Division Walls - one end hooked. (2 of Each Length.) Alternate with "a'" and "c'" bars. SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	L MAX.	L MIN.
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#5	12"	38	24'-10"	0'-2½"	2'-3"	3'-4½"	#5	12"	42	23'-10"	3'-4"	22'-10"	2'-10"
		3'			38	24'-10"	"	"	"			42	" "	" "	" "	"
		4'			38	24'-10"	"	"	"			42	" "	" "	" "	"
		5'			38	24'-10"	"	"	"			42	" "	" "	" "	"
		6'			38	25'-4"	0'-2½"	2'-6"	3'-5½"			42	24'-4"	3'-10"	23'-4"	3'-4"
	5' @ 6'	3'	#5	12"	33	30'-0"	0'-3"	2'-8"	4'-1½"	#5	12"	52	29'-0"	3'-4"	27'-10"	2'-10"
		4'			33	30'-0"	"	"	"			52	" "	" "	" "	"
		5'			33	30'-0"	"	"	"			52	" "	" "	" "	"
		6'			32	30'-6"	"	2'-9"	4'-2½"			52	29'-6"	3'-10"	28'-4"	3'-4"
		7'			32	30'-11"	0'-3½"	2'-10"	4'-2½"			54	29'-11"	3'-3"	28'-9"	2'-9"
	6' @ 7'	3'	#6	11"	30	35'-2"	0'-3½"	3'-1"	4'-10½"	#6	11"	68	34'-2"	3'-12"	32'-11"	2'-8"
		4'			30	35'-2"	"	"	"			68	" "	" "	" "	"
		5'			30	35'-2"	"	"	"			68	" "	" "	" "	"
		6'			30	35'-8"	"	3'-2"	4'-11½"			68	34'-10"	3'-8"	33'-5"	3'-2"
		7'			29	36'-1"	"	3'-3"	4'-11½"			70	35'-3"	3'-12"	33'-10"	2'-10"
		8'			29	36'-6"	0'-3½"	3'-3"	5'-0½"			70	35'-2"	3'-3"	33'-11"	2'-9"
	4'	4'	#6	12"	23	40'-6"	0'-4½"	3'-5"	5'-7"	#6	12"	72	39'-5"	3'-5"	37'-10"	2'-10"
		5'			23	40'-6"	"	3'-5½"	5'-7"			72	" "	" "	" "	"
		6'			22	41'-0"	"	3'-6"	5'-8"			72	39'-11"	3'-11"	38'-4"	3'-4"
		7'			22	41'-5"	"	3'-7"	5'-8½"			74	40'-6"	3'-4"	38'-9"	2'-9"
		8'			22	41'-6"	"	3'-7"	5'-9"			74	40'-6"	3'-5"	38'-10"	2'-10"
		9'			22	42'-0"	0'-4½"	3'-8"	5'-10"			74	40'-11"	3'-11"	39'-4"	3'-4"

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with "b" and "b'" bars. SIZE	SPACING	No. REQ'D	LENGTH	"c'" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with "b₂" & "b₃" bars. (Four of each Length.) SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#5	12"	84	18'-8"	#5	12"	64	18'-1"	3'-1"
		3'			84	18'-8"			64	" "	"
		4'			84	18'-8"			64	" "	"
		5'			84	18'-8"			64	5'-10"	"
		6'			84	19'-0"			68	18'-6"	2'-6"
	5' @ 6'	3'	#6	12"	78	22'-8"	#6	12"	80	21'-7"	2'-7"
		4'			78	22'-8"			80	" "	"
		5'			78	22'-8"			80	" "	"
		6'			78	23'-0"			80	22'-0"	3'-0"
		7'			78	23'-4"			80	22'-4"	3'-4"
	6' @ 7'	3'	#6	11"	74	26'-8"	#6	11"	108	26'-5"	2'-7"
		4'			74	26'-8"			108	" "	"
		5'			74	26'-8"			108	" "	"
		6'			72	27'-0"			108	26'-10"	3'-0"
		7'			72	27'-4"			112	27'-2"	2'-6"
		8'			72	27'-4"			112	27'-3"	2'-6"
	4'	4'	#6	12"	62	30'-8"	#6	12"	112	29'-7"	2'-7"
		5'			62	30'-8"			112	" "	"
		6'			62	31'-4"			112	30'-0"	3'-0"
		7'			62	31'-4"			112	30'-4"	3'-4"
		8'			60	31'-8"			116	30'-5"	2'-5"
		9'			60	31'-8"			116	30'-10"	2'-10"

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"d" bars STRAIGHT Longitudinal in Top Slab of Barrel SIZE	SPACING	No. REQ'D	LENGTH	"d'" bars STRAIGHT Longitudinal in Sidewalls and Division Walls SIZE	SPACING	No. REQ'D	LENGTH	"e" bars STRAIGHT Longitudinal in Bottom Slab of Barrel. SIZE	SPACING	No. REQ'D	LENGTH
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#5	12"	38		#4	12"	20		#4	12"	38	
		3'			38				30				38	
		4'			38				40				38	
		5'			38				50				38	
		6'			38				60				38	
	5' @ 6'	3'	#6	12"	44		#5	12"	30		#5	12"	43	
		4'			44				40				43	
		5'			44				50				43	
		6'			44				60				43	
		7'			44				70				43	
	6' @ 7'	3'	#6	11½"	49	Length Barrel (1'-9" Lap).	#5	12"	30	Length Barrel (1'-9" Lap).	#5	12"	48	Length Barrel (1'-9" Lap).
		4'			49				40				48	
		5'			49				50				48	
		6'			49				60				48	
		7'			49				70				48	
		8'			49				80				48	
	4'	4'	#6	12"	54	2 @ 30'-8" for 60'-0"	#4	12"	30	2 @ 31'-4" for 60'-0"	#4	12"	53	2 @ 31'-0" for 60'-0"
		5'			54				40				53	
		6'			54				50				53	
		7'			54				60				53	
		8'			54				80				53	
		9'			54				90		#5	12"	53	

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"f" bars STRAIGHT Verticals in Sidewalls and Division Walls. SIZE	SPACING	No. REQ'D	LENGTH	"k₁" bars STRAIGHT In Bottom of Headwalls. (Two of Each Length per Headwall) SIZE	SPACING	No. REQ'D	LENGTH MAX.	LENGTH MIN.	"k₂" bars STRAIGHT In Top of Headwalls and Aprons. (2 Rows Each) SIZE	SPACING	No. REQ'D	LENGTH
MAXIMUM 5'-0" TO 0'-0"	4' @ 5'	2'	#4	12"	600	2'-10"	※ 5	12"	12	21'-0"	13'-9"	⊕	16"	16	18'-5"
		3'			600	3'-10"			12	" "	"			16	"
		4'			600	4'-10"			12	" "	"			16	"
		5'			600	5'-10"			12	" "	"			16	"
		6'			600	6'-10"			12	21'-3"	19'-2"			16	18'-10"
	5' @ 6'	3'	#4	12"	600	3'-10"	※ 5	12"	12	25'-9"	14'-10"	⊕	16"	16	22'-2"
		4'			600	4'-11"			12	" "	"			16	"
		5'			600	5'-11"			12	" "	"			16	"
		6'			600	6'-11"			12	25'-8"	17'-2"			16	22'-6"
		7'			600	7'-11"			12	26'-0"	17'-5"			16	22'-10"
	6' @ 7'	3'	#4	12"	600	4'-0"	※ 5	12"	12	29'-6"	19'-8"	⊕	16"	16	25'-8"
		4'			600	5'-0"			12	" "	"			16	"
		5'			600	6'-0"			12	30'-0"	20'-0"			16	26'-1"
		6'			600	7'-0"			12	30'-4"	20'-2"			16	26'-4"
		7'			600	8'-0"			12	30'-5"	20'-3"			16	26'-5"
		8'			600	9'-0"			12	30'-7"	20'-4"			16	26'-7"
	4'	4'	#4	12"	600	5'-1"	※ 5	12"	12	34'-10"	22'-8"	⊕	16"	16	29'-5"
		5'			600	6'-1"			12	" "	"			16	"
		6'			600	7'-1"			12	34'-9"	22'-11"			16	29'-9"
		7'			600	8'-1"			12	34'-9"	23'-2"			16	30'-0"
		8'			600	9'-1"			12	34'-10"	23'-2"			16	30'-1"
		9'			600	10'-1"			12	35'-3"	23'-6"			16	30'-5"

DOWEL BARS FOR TWO HEADWALLS

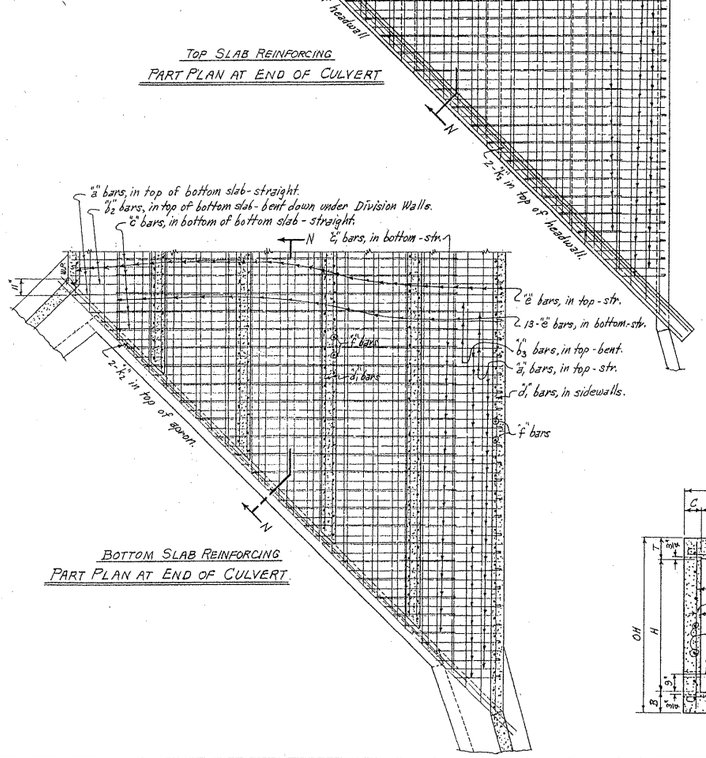
SPAN	SIZE	SPACING	NO REQ'D	LENGTH	X
4'	#4	12"	68	2'-5"	1'-0½"
5'	#4	12"	82	2'-6"	1'-3"
6'	#4	12"	96	2'-7"	1'-5½"
7'	#4	12"	110	2'-8"	1'-9"

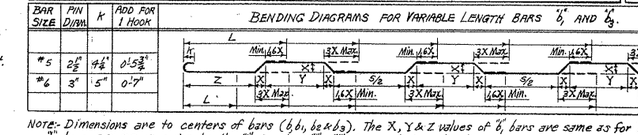
Dowel bars "f" in Two Headwalls

MAX. DESIGN DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY HEIGHT RL	LENGTH OF HEADWALL K	* QUANTITIES CLASS S CONC. PER LIN. FT. OF BARREL	REINFORCING STEEL TOTAL FOR ENTIRE LENGTH OF BARREL	REINFORCING STEEL PER LIN. FOOT OF BARREL	REINFORCING STEEL ADDITIONAL PER LAP
												CU.YD.	LB.	LB.	LB.
5'-0"	4' @ 5'	2'	90	23'-8"	6½"	6"	8"	6"	3'-0½"	33'-5¾"	35'-5¾"	1.185	15,035	237.07	119.49
		3'	60	23'-8"		6"	8"		4'-0½"	"	"	1.321	16,893	250.93	122.84
		4'	80	23'-8"		6"	8"		5'-0½"	"	"	1.456	16,652	263.79	131.19
		5'	100	23'-8"		6"	8"		6'-0½"	"	"	1.592	17,960	277.15	139.54
		6'	120	23'-2"		7"	9"		7'-0½"	34'-2¾"	36'-2"	1.858	19,513	293.29	147.89
	5' @ 6'	3'	75	28'-8"	7"	6"	8"	6½"	4'-1½"	40'-6¾"	42'-6¾"	1.602	21,504	337.03	137.94
		4'	100	28'-8"		6"	8"		5'-1½"	"	"	1.738	22,312	350.39	145.79
		5'	125	28'-8"		6"	8"		6'-1½"	"	"	1.873	23,121	363.75	154.14
		6	150	29'-2"		7"	9"		7'-1½"	41'-3"	43'-3"	2.141	24,184	380.65	162.49
		7'	175	29'-7"		7½"	10"		8'-1½"	41'-10"	43'-10"	2.421	25,278	397.14	170.84
	6' @ 7'	3'	90	33'-8"	7½"	6"	8"	7"	4'-2½"	47'-7¾"	49'-7¾"	1.914	25,975	406.95	150.31
		4'	120	33'-8"		6"	8"		5'-2½"	"	"	2.050	26,783	420.31	158.66
		5'	150	33'-8"		6"	8"		6'-2½"	48'-3"	50'-3"	2.186	27,591	433.67	167.01
		6'	180	34'-2"		7"	9"		7'-2½"	48'-3¾"	50'-3¾"	2.455	28,602	450.90	175.36
		7'	210	34'-7"		7½"	10"		8'-2½"	48'-10¾"	50'-11"	2.736	29,672	462.67	183.71
		8'	240	34'-8"		8"	10"		9'-2½"	49'-0¾"	51'-0¾"	2.934	31,261	493.51	192.06
	4'	4'	140	38'-8"	8"	6"	8"	8"	5'-3¾"	54'-8¾"	56'-8¾"	2.923	31,068	481.72	171.53
		5'	175	38'-8"		6"	8"		6'-3¾"	"	"	2.559	31,877	495.08	179.88
		6'	210	39'-2"		7"	9"		7'-3¾"	55'-4¾"	57'-4¾"	2.830	32,964	512.44	188.23
		7'	245	39'-7"		7½"	10"		8'-3¾"	55'-11¾"	57'-11¾"	3.112	34,099	529.31	196.58
		8'	280	39'-8"		8"	10"		9'-3¾"	56'-1¾"	58'-1¾"	3.311	35,553	555.30	204.93
		9'	315	40'-2"		9"	11"		10'-3¾"	56'-9¾"	58'-9¾"	3.675	38,312	598.36	213.28

* For quantities in Wings, see Standard Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.

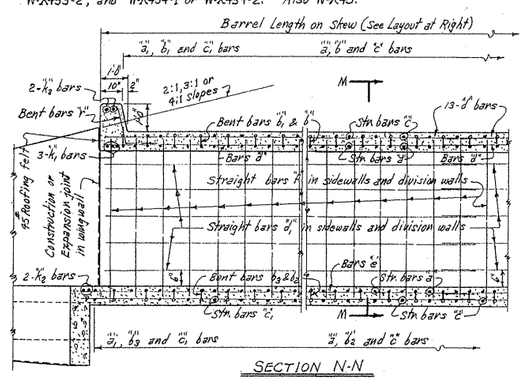
These bars are in the skewed portion of barrel only.
The length of "a" and "c" bars and overall length "L" of "b" and "b₃" bars vary by 1'-9" for 12" spacing and 0'-11" for 11" spacing.
In the regular portion of the barrel begin and end with a set of "a" and "c" bars. If the spacing is such that the last set of bars would be "b" & "b₃" bars, use a set of "a" and "c" bars instead.
⊕ These bars are to be spliced at center of center span. Lap 32 diameters minimum.
※ These bars are to be spliced at alternate 2nd and 3rd division walls. Lap 32 diam. min.



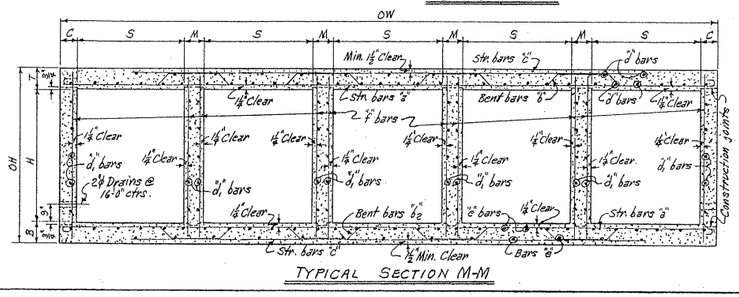


Note:- Dimensions are to centers of bars (b, b₁, b₂ & b₃). The X, Y & Z values of "b" bars are same as for "b" bars and for "b₃" bars same as for "b₂" bars. ⓧⓨⓩ Min. & Max. lengths "L" for bars "b₁" & "b₃" for each type bend.

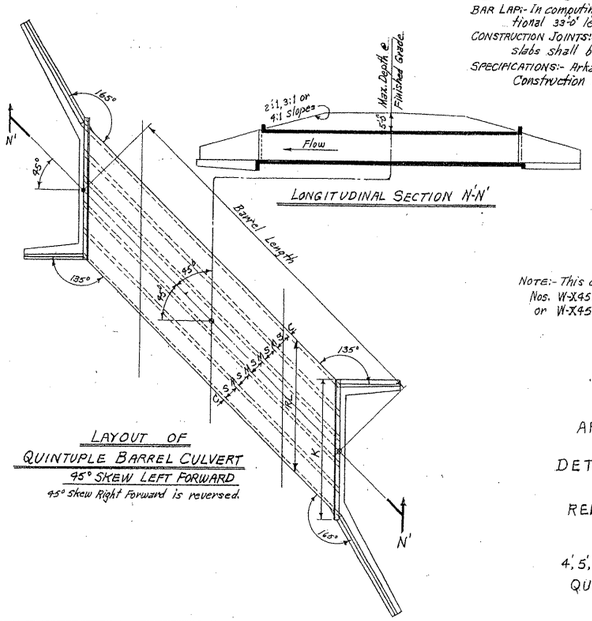
Note:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2; and W-X454-1 or W-X454-2. Also W-X45.



SECTION N-N



TYPICAL SECTION M-M



LAYOUT OF QUINTUPLE BARREL CULVERT
95° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 24,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 24,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2, W-X453-1 or W-X453-2, and W-X454-1 or W-X454-2. Also W-X45.

CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

4', 5', 6' AND 7' SPANS
QUINTUPLES

2:1, 3:1 OR 4:1 SLOPES
UNDER 5'-0" COVER

STANDARD DRAWING No. R-545X-01

Designed by:- W.C.H. 1-23-63 Checked by:- R.M.S
Drawn by:- W.C.H. 8-3-64 Checked by:-
Quantities by:- W.C.H. 10-13-64 Checked by:-

FED. ROAD No.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET No.	TOTAL SHEETS
6	ARK.				
JOB No.					

BAR LIST FOR BARREL SECTION 6'-0" IN LENGTH - TWO 45° SKEWED ENDS

DEPTH OF COVER D	CLEAR SPAN S	CLEAR HEIGHT H	"a" bars STRAIGHT In Top and Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH	"a₁" bars STRAIGHT In Top and Bottom Slab of Barrel. (Eight of Each Length) SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.
0'-0" TO 5'-0" MAXIMUM	5 @ 8	4'	✱		172	22'-9"			168	21'-10"	3'-6"
		5'			168	23'-0"			176	22'-1"	2'-10"
		6'	#6	11" ±	168	23'-10"	#6	11" ±	176	22'-5"	3'-2"
		7'			168	23'-4"			176	22'-5"	3'-2"
		8'			168	23'-4"			176	"	"
		9'			168	23'-6"			176	22'-7"	3'-4"
		10'			168	23'-9"			176	22'-10"	3'-7"
	5 @ 9	5'			160	25'-6"			192	24'-7"	3'-6"
		6'	✱		156	25'-8"			192	24'-9"	3'-8"
		7'			156	25'-8"			192	"	"
		8'	#6	11" ±	156	25'-9"	#6	11" ±	200	24'-10"	2'-10"
		9'			156	26'-0"			200	25'-4"	3'-4"
		10'			156	26'-3"			200	25'-4"	3'-4"
		11'			156	26'-6"			200	25'-5"	3'-5"
	5 @ 10	5'			136	28'-2"			200	27'-2"	3'-2"
		6'	✱		136	28'-4"			200	27'-10"	3'-10"
		7'			136	28'-4"			200	"	"
		8'	#7	12" ±	136	28'-5"	#7	12" ±	200	27'-5"	3'-5"
		9'			132	28'-8"			200	27'-8"	3'-8"
		10'			132	28'-11"			208	27'-11"	2'-11"
		11'			132	29'-0"			208	28'-0"	3'-0"
		12'			132	29'-1"			208	28'-1"	3'-1"

"b" bars BENT - See Diagrams below. In Bottom of Top Slab bent up over Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z
✱		80	23'-10"	0'-5"	3'-10"	6'-4"
		80	24'-1"	"	3'-11"	6'-5"
		80	24'-3"	"	"	"
#6	11" ±	80	24'-4"	"	4'-0"	6'-5½"
		80	24'-6"	"	"	6'-6"
		78	24'-7"	"	4'-1"	6'-7"
		78	24'-10"	0'-5"	4'-2"	6'-8"
✱		74	26'-8"	0'-5½"	4'-4"	7'-2"
		74	26'-11"	"	4'-5"	7'-2½"
		74	26'-11"	"	"	7'-2½"
#6	11" ±	74	26'-11"	"	"	7'-3"
		74	27'-2"	"	4'-6"	7'-4"
		72	27'-5"	"	4'-7"	7'-5"
		72	27'-8"	0'-5½"	"	7'-6"
✱		62	29'-3"	0'-6"	4'-9"	7'-11"
		62	29'-6"	"	4'-10"	7'-11½"
		62	29'-6"	"	"	"
#6	12" ±	62	29'-6"	"	"	8'-0"
		62	29'-9"	"	4'-11"	8'-1"
		62	30'-0"	"	5'-0"	8'-2"
		60	30'-1"	"	"	8'-3"
		60	30'-2"	0'-6"	5'-0"	8'-4"

"b₁" & "b₄" bars BENT - See Diagrams below. In Bottom of Top Slab-some bent up over Division Walls. (2 of Each Length). "b₁" hooked one end, "b₄" bars spliced to "b" bars. Alternate with "a₁" and "c" or "c₁" bars. SIZE	SPACING	No. REQD "b₁"	No. REQD "b₄"	LENGTHS "b₁" MAX.	"b₁" MIN.	"b₄" MAX.	"b₄" MIN.	L MAX.	L MIN.
		44	44	23'-5"	3'-7"	22'-10"	3'-0"	22'-3"	3'-0"
		44	44	23'-8"	3'-10"	23'-1"	3'-3"	22'-6"	3'-9"
		44	44	"	"	"	"	"	"
#6	11" ±	44	44	24'-0"	4'-2"	23'-5"	3'-7"	22'-10"	3'-7"
		44	44	"	"	"	"	"	"
		46	46	24'-2"	3'-5"	23'-7"	2'-10"	23'-0"	2'-10"
		46	46	24'-5"	3'-8"	23'-10"	3'-1"	23'-3"	3'-1"
		50	50	26'-3"	3'-7"	25'-8"	3'-0"	25'-0"	3'-0"
		50	50	26'-5"	3'-9"	25'-10"	3'-2"	25'-2"	3'-2"
		50	50	"	"	"	"	"	"
#6	11" ±	50	50	26'-6"	3'-10"	25'-11"	3'-3"	25'-3"	3'-3"
		50	50	26'-9"	4'-1"	26'-2"	3'-6"	25'-6"	3'-6"
		52	52	27'-0"	3'-5"	26'-5"	2'-10"	25'-9"	2'-10"
		52	52	27'-1"	3'-6"	26'-6"	2'-11"	25'-10"	2'-11"
		50	50	28'-11"	4'-2"	28'-4"	3'-7"	27'-7"	3'-7"
		50	50	29'-1"	4'-4"	28'-6"	3'-9"	27'-9"	3'-9"
		50	50	"	"	"	"	"	"
#6	12" ±	52	52	29'-2"	3'-5"	28'-7"	2'-10"	27'-10"	2'-10"
		52	52	29'-5"	3'-8"	28'-10"	3'-1"	28'-1"	3'-1"
		52	52	29'-6"	3'-11"	29'-1"	3'-4"	28'-4"	3'-4"
		52	52	29'-9"	4'-0"	29'-2"	3'-5"	28'-5"	3'-5"
		52	52	29'-10"	4'-1"	29'-3"	3'-6"	28'-6"	3'-6"

"b₂" bars BENT - See Diagrams below. In Top of Bottom Slab bent down under Division Walls - hooked. Alternate with "a" and "c" bars. SIZE	SPACING	No. REQD	LENGTH	X	Y	Z
✱		84	23'-10"	0'-5"	3'-10"	6'-4"
		84	24'-1"	"	3'-11"	6'-5"
		84	24'-1"	"	"	"
#6	11" ±	84	24'-3"	"	4'-0"	6'-5½"
		84	24'-4"	"	"	6'-6"
		82	24'-7"	"	4'-1"	6'-7"
		82	24'-10"	0'-5"	4'-2"	6'-8"
✱		78	26'-8"	0'-5½"	4'-4"	7'-2"
		78	26'-11"	"	4'-5"	7'-2½"
		78	26'-11"	"	"	"
#6	11" ±	78	26'-11"	"	"	7'-3"
		78	27'-2"	"	4'-6"	7'-4"
		76	27'-5"	"	4'-7"	7'-5"
		76	27'-8"	0'-5½"	"	7'-6"
✱		66	29'-3"	0'-6"	4'-9"	7'-11"
		66	29'-6"	"	4'-10"	7'-11½"
		66	29'-6"	"	"	"
#6	12" ±	66	29'-6"	"	"	8'-0"
		66	29'-9"	"	4'-11"	8'-1"
		66	30'-0"	"	5'-0"	8'-2"
		64	30'-1"	"	"	8'-3"
		64	30'-2"	0'-6"	5'-0"	8'-4"

"b₃" & "b₅" bars BENT - See Diagrams below. In Top of Bottom Slab-some bent down under Division Walls. (2 of Each Length). "b₃" hooked one end, "b₅" bars spliced to "b₂" bars. Alternate with "a₁" and "c" or "c₁" bars. SIZE	SPACING	No. REQD "b₃"	No. REQD "b₅"	LENGTHS "b₃" MAX.	"b₃" MIN.	"b₅" MAX.	"b₅" MIN.	L MAX.	L MIN.
		44	44	23'-5"	3'-7"	22'-10"	3'-0"	22'-3"	3'-0"
		44	44	23'-8"	3'-10"	23'-1"	3'-3"	22'-6"	3'-9"
		44	44	"	"	"	"	"	"
#6	11" ±	44	44	24'-0"	4'-2"	23'-5"	3'-7"	22'-10"	3'-7"
		44	44	"	"	"	"	"	"
		46	46	24'-2"	3'-5"	23'-7"	2'-10"	23'-0"	2'-10"
		46	46	24'-5"	3'-8"	23'-10"	3'-1"	23'-3"	3'-1"
		50	50	26'-3"	3'-7"	25'-8"	3'-0"	25'-0"	3'-0"
		50	50	26'-5"	3'-9"	25'-10"	3'-2"	25'-2"	3'-2"
		50	50	"	"	"	"	"	"
#6	11" ±	50	50	26'-6"	3'-10"	25'-11"	3'-3"	25'-3"	3'-3"
		50	50	26'-9"	4'-1"	26'-2"	3'-6"	25'-6"	3'-6"
		52	52	27'-0"	3'-5"	26'-5"	2'-10"	25'-9"	2'-10"
		52	52	27'-1"	3'-6"	26'-6"	2'-11"	25'-10"	2'-11"
		50	50	28'-11"	4'-2"	28'-4"	3'-7"	27'-7"	3'-7"
		50	50	29'-1"	4'-4"	28'-6"	3'-9"	27'-9"	3'-9"
		50	50	"	"	"	"	"	"
#6	12" ±	52	52	29'-2"	3'-5"	28'-7"	2'-10"	27'-10"	2'-10"
		52	52	29'-5"	3'-8"	28'-10"	3'-1"	28'-1"	3'-1"
		52	52	29'-6"	3'-11"	29'-1"	3'-4"	28'-4"	3'-4"
		52	52	29'-9"	4'-0"	29'-2"	3'-5"	28'-5"	3'-5"
		52	52	29'-10"	4'-1"	29'-3"	3'-6"	28'-6"	3'-6"

"c" bars STRAIGHT In Top and Bottom Slab of Barrel. Alternate with "b" and "b₂" bars. SIZE	SPACING	No. REQD	LENGTH
		60	34'-8"
		64	35'-0"
		64	35'-4"
#4	12"	62	35'-4"
		62	35'-9"
		60	35'-8"
		60	36'-0"
		52	39'-0"
		50	39'-4"
		50	39'-4"
#4	12"	50	39'-8"
		50	39'-9"
		48	40'-0"
		48	40'-0"
		164	22'-8"
		164	22'-10"
		164	22'-10"
#4	12"	162	23'-0"
		160	23'-0"
		160	23'-2"
		160	23'-2"
		160	23'-2"

"c₁" bars STRAIGHT In Top and Bottom Slab of Barrel. Alt. with "b₁" & "b₄" bars (Four of each Length) SIZE	SPACING	No. REQD	LENGTH MAX.	LENGTH MIN.
		140	39'-6"	3'-4"
		140	39'-0"	2'-10"
		140	"	"
#4	12" ±	140	39'-4"	3'-2"
		140	39'-5"	3'-3"
		140	39'-10"	3'-8"
		140	39'-5"	3'-2"
		154	38'-6"	3'-8"
		140	38'-10"	3'-1"
		140	"	"
#4	12" ±	140	38'-11"	3'-2"
		160	39'-9"	3'-7"
		164	39'-9"	3'-7"
		164	39'-10"	3'-8"
(REQ'D FOR 60'-0" Length Barrel (1'-3" Lap).		152	21'-2"	3'-2"
		152	21'-9"	3'-4"
		152	"	"
#4	12" ±	152	21'-5"	3'-5"
		152	21'-8"	3'-8"
		160	21'-11"	2'-8"
		160	22'-0"	3'-8"
		160	22'-11"	3'-1"

"d" bars Longitudinal 1½" Top Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH
		60	
		60	
		60	
#5	11½" ±	60	
		60	
		60	
		60	
		69	
		69	
		69	
#5	11½" ±	69	
		69	
		69	
		69	
		74	
		74	
		74	
#5	11½" ±	74	
		74	
		74	
		74	

"d₁" bars STRAIGHT Longitudinal in Sidewalls and Division Walls. SIZE	SPACING	No. REQD	LENGTH
		40	
		50	
		60	
#4	12"	70	
		80	
		90	
		100	
		50	
		60	
		70	
#4	12"	80	
		90	
		100	
		110	
		50	
		60	
		70	
#4	12"	80	
		90	
		100	
		110	
		50	
		60	
		70	
#4	12"	80	
		90	
		100	
		110	
		50	
		60	
		70	
#4	12"	80	
		90	
		100	
		110	

"e" bars Longitudinal 1½" Bottom Slab of Barrel. SIZE	SPACING	No. REQD	LENGTH
		58	
		58	
		58	
#4	12"	58	
		58	
		58	
		58	
		67	
		67	
		67	
#4	12"	67	
		67	
		67	
		67	
		72	
		72	
		72	
#4	12"	72	
		72	
		72	
		72	
		72	
		72	
#4	12"	72	
		72	
		72	
		72	

"f" bars STRAIGHT Verticals in Sidewalls and Division Walls. SIZE	SPACING	No. REQD	LENGTH
#4	12"	600	5'-2"
		600	6'-2"
		600	8'-2"
	10"	720	9'-2"
#5	12"	600	10'-2"
	11"	660	11'-2"
	10"	720	12'-2"
#4	12"	600	6'-8"
		600	7'-8"
		600	8'-8"
	10"	720	9'-8"
#5	11"	660	11'-8"
	10"	720	12'-8"
#4	12"	600	6'-4"
		600	7'-4"
		600	8'-4"
	10"	720	9'-4"
#5	12"	600	10'-4"
	11"	660	11'-4"
	10"	720	12'-4"
#4	12"	600	13'-4"

"k₁" & "k₂" bars STRAIGHT In Bottom of Headwalls. (3 Long & 6 Short bars per Headwall) SIZE	No. REQD	LENGTH MAX.	LENGTH MIN.
		6@	12@
	18	23'-6"	21'-3"
	18	23'-9"	21'-6"
	18	"	"
⊕ #7	18	24'-5"	21'-8"
	18	24'-6"	21'-9"
	140	39'-5"	3'-3"
	140	39'-10"	3'-8"
	140	39'-5"	3'-2"
	154	38'-6"	3'-8"
	140	38'-10"	3'-1"
	140	"	"
⊕ #8	140	38'-11"	3'-2"
	160	39'-9"	3'-7"
	164	39'-9"	3'-7"
	164	39'-10"	3'-8"
	152	21'-2"	3'-2"
	152	21'-9"	3'-4"
	152	"	"
⊕ #8	152	21'-5"	3'-5"
	152	21'-8"	3'-8"
	160	21'-11"	2'-8"
	160	22'-0"	3'-8"
	160	22'-11"	3'-1"

"k₂" bars STRAIGHT In Top of Headwalls and Aprons (2 Rows Each) SIZE	No. REQD	LENGTH
	24	22'-9"
	24	23'-0"
	24	"
⊕ #7	24	23'-2"
	24	23'-2"
	24	23'-5"
	24	23'-8"
	24	25'-7"
⊕ #8	24	25'-9"
	24	"
	24	25'-9"
	24	26'-0"
	24	26'-3"
	24	26'-6"
	24	27'-11"
	24	28'-1"
	24	"
⊕ #8	24	28'-2"
	24	28'-4"
	24	28'-7"
	24	28'-9"

BARREL DIMENSIONS

MAX. DESIGN DEPTH OF COVER D	CLEAR SPANS S	CLEAR HEIGHT H	SQ. FT. OPENING A	OVERALL WIDTH OW	THICKNESS OF TOP SLAB T	THICKNESS OF SIDEWALLS C	THICKNESS OF DIVISION WALLS M	THICKNESS OF BOTTOM SLAB B	OVERALL HEIGHT OH	ROADWAY WIDTH RL	LENGTH OF HEADWALL K
5'-0"	5 @ 8'	4'	160	93'-8"	8½"	6"	8"	9"	5'-5"	61'-9"	63'-9"
		5'	200	99'-2"		7"	9"		6'-5"	62'-5½"	64'-5½"
		6'	240	99'-2"		7"	9"		7'-5"	"	"
		7'	280	99'-7"		7½"	10"		8'-5"	63'-0⅜"	65'-0⅜"
		8'	320	99'-8"		8"	10"		9'-5"	63'-2"	65'-2"
		9'	360	99'-8"		9"	11"		10'-5"	63'-10½"	65'-10½"
		10'	400	99'-8"		10"	12"		11'-5"	64'-7"	66'-7"
	5 @ 9'	5'	225	99'-2"		7"	9"		6'-6"	69'-4⅜"	71'-6⅜"
		6'	270	99'-7"		7½"	10"		7'-6"	70'-1⅛"	72'-1⅛"
		7'	315	99'-7"		7½"	10"		8'-6"	"	"
		8'	360	99'-8"	9"	8"	10"	9"	9'-6"	70'-2⅝"	72'-8"
		9'	405	50'-2"		9"	11"		10'-6"	70'-11⅞"	72'-11⅞"
		10'	450	50'-8"		10"	12"		11'-6"	71'-7⅞"	73'-7⅞"
		11'	495	50'-10"		11"	12"		12'-6"	71'-10⅞"	73'-10⅞"
	5 @ 10'	5'	250	54'-2"	9½"	7"	9"	9½"	6'-7"	76'-7⅞"	78'-7⅞"
		6'	300	54'-7"		7½"	10"		7'-7"	77'-2⅝"	79'-2⅝"
		7'	350	54'-7"		7½"	10"		8'-7"	"	"
		8'	400	54'-8"		8"	10"		9'-7"	77'-8⅜"	79'-8⅜"
		9'	450	55'-2"		9"	11"		10'-7"	78'-0⅝"	80'-0⅝"
		10'	500	55'-8"		10"	12"		11'-7"	78'-8⅜"	80'-8⅜"
		11'	550	55'-10"		11"	12"		12'-7"	78'-11⅞"	80'-11⅞"
		12'	600	56'-0"		12"	12"		13'-7"	79'-2⅝"	81'-2⅝"

QUANTITIES

CLASS S CONC. PER LIN. FT. OF BARREL TOTAL FOR BODY LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
2.834	37.704	58.148
3.089	38.820	59.31
3.243	39.629	61.257
3.528	40.770	63.87
3.726	42.333	66.95
4.092	44.812	69.51
4.495	47.097	73.58
3.503	43.355	66.59
3.772	44.927	68.77
3.993	45.235	69.13
4.192	46.668	71.90
4.503	49.699	76.21
4.919	51.631	79.35
5.201	53.414	82.79
3.948	51.684	79.33
4.219	52.833	80.92
4.490	53.490	83.28
4.588	55.355	84.79
4.957	57.772	89.34
5.363	60.066	92.70
5.651	61.847	96.38
5.951	65.184	101.14

CLASS S CONC. PER LIN. FT. OF BARREL TOTAL FOR BODY LENGTH OF BARREL	PER LIN. FT. OF BARREL	ADDITIONAL PER LAP
2.839	37.704	58.148
3.089	38.820	59.31
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4.495	47.097	73.58
3.503	43.355	66.59
3.772	44.927	68.77
3.993	45.235	69.13
4.192	46.668	71.90
4.503	49.699	76.21
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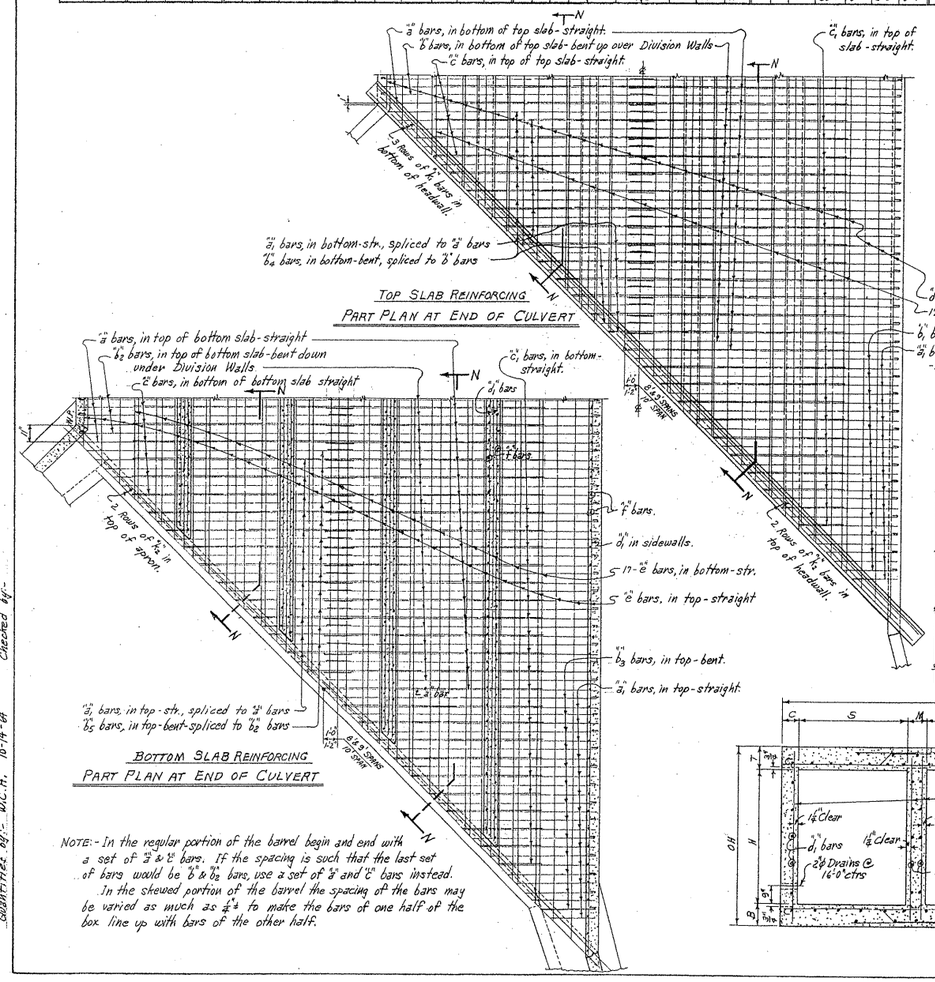
4.490	53.490	83.28
4.588	55.355	84.79
4.957	57.772	89.34
5.363	60.066	92.70
5.651	61.847	96.38
5.951	65.184	101.14

For quantities in wings, see Std. Wing Drawings listed below.
Total steel quantities listed above include one lap of longitudinal bars.



TOP SLAB REINFORCING
PART PLAN AT END OF CULVERT

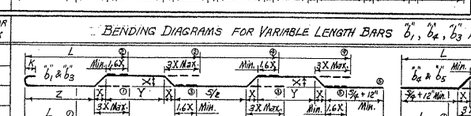
BOTTOM SLAB REINFORCING
PART PLAN AT END OF CULVERT

NOTE:- In the regular portion of the barrel begin and end with a set of "a" & "c" bars. If the spacing is such that the last set of bars would be "b" & "b₂" bars, use a set of "a" and "c" bars instead.
In the skewed portion of the barrel the spacing of the bars may be varied as much as ¼" to make the bars of one half of the box line up with bars of the other half.

Designed by:- W.C.H. 1-23-63. Checked by:-
Drawn by:- W.C.H. 8-7-64 Checked by:-
Quantities by:- W.C.H. 10-14-64

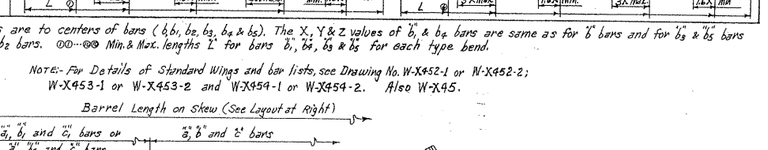
BAR SIZE	PIN DIAM.	K	ADD FOR 2 HOOKS
#6	3"	5"	1'-2"

BENDING DIAGRAMS FOR BARS "b" AND "b₂".



BAR SIZE	PIN DIAM.	K	ADD FOR 1 HOOK
#6	3"	5"	0'-7"

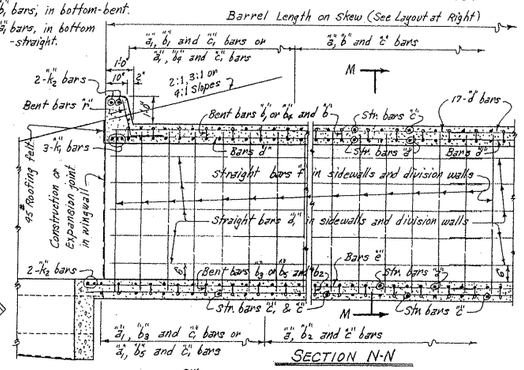
BENDING DIAGRAMS FOR VARIABLE LENGTH BARS "b₁", "b₄", "b₃" AND "b₅".



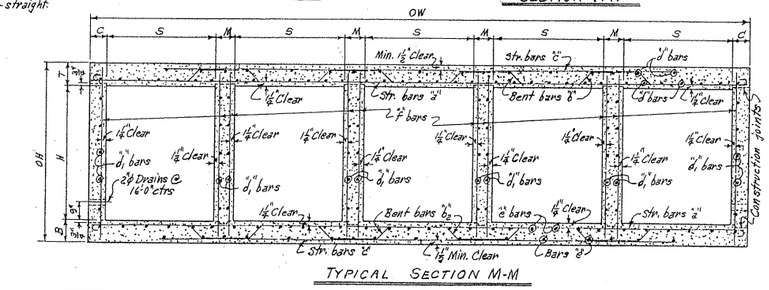
NOTE:- Dimensions are to centers of bars (b, b₁, b₂, b₃, b₄ & b₅). The X, Y & Z values of "b₁" & "b₄" bars are same as for "b" bars and for "b₃" & "b₅" bars same as for "b₂" bars. ⓪⓪···⓪⓪ Min. & Max. lengths "L" for bars "b₁", "b₄", "b₃" & "b₅" for each type bend.

NOTE:- For Details of Standard Wings and bar lists, see Drawing No. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2 and W-X454-1 or W-X454-2. Also W-X45.

Barrel Length on Skew (See Layout at Right)



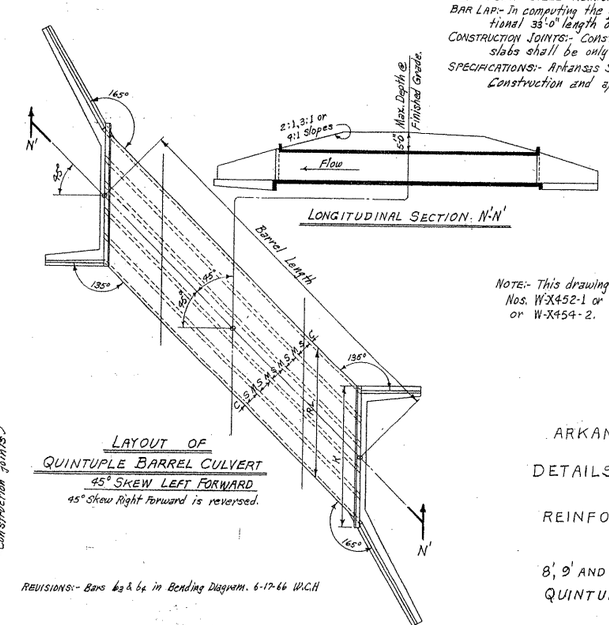
SECTION N-N



TYPICAL SECTION M-M

DOWEL BARS FOR TWO HEADWALLS

SPAN	SIZE	SPACING	No. REQD	LENGTH	X	Dowel bars "f" in Two Headwalls.
8'	#4	12"±	128	2'-9"	1'-4½"	
9'	#4	12"±	142	2'-10"	1'-5"	
10'	#4	12"±	156	2'-11"	1'-5½"	



LONGITUDINAL SECTION N'-N'

LAYOUT OF QUINTUPLE BARREL CULVERT
45° SKEW LEFT FORWARD
45° Skew Right Forward is reversed.

REVISIONS:- Bars b₃ & b₄ in Bending Diagram. 6-17-66 W.C.H.

These bars are in the skewed portion of barrel only. The lengths of "a₁" and "c₁" bars and overall length "L" of "b₁" & "b₄" and "b₃" & "b₅" bars vary by 1'-0" for 12" spacing and 0'-4" for 11" spacing.

✱ These bars are to be spliced at center of center span to make full length bar. Some "b" bars are to be spliced to "b₄" bars and some "b₂" bars to "b₅" to make full length bars. Lap #6 bars 2'-0" and #7 bars 2'-4". Some "a" bars are to be spliced to "a₁" bars, and in 10'-0" SPANS some "c" bars are spliced to "c₁" bars.

⊕ These bars have two splices, the "k₂" bars being of equal lengths, but the "k₁" bars are spliced at quarter points of 2nd & 4th Spans near 2nd and 3rd division walls.

GENERAL NOTES

CONCRETE:- All concrete to be Class S, and shall be poured in the dry. All exposed corners to have ¾" chamfers.
REINFORCING STEEL:- Reinforcing to be deformed bars of intermediate or hard grade.
BAR LAP:- In computing the quantities of steel from the tables add one lap for each additional 33'-0" length of barrel over 32'-0". Lap longitudinal bars 30 diameters min.
CONSTRUCTION JOINTS:- Construction joints between wingwalls, sidewalls, division walls and slabs shall be only where shown on plans.
SPECIFICATIONS:- Arkansas State Highway Commission Standard Specifications for Highway Construction and applicable Special Provisions.

DESIGN LIVE LOAD
H20-S16 LOADING A.A.S.H.O. 1961
AND
SPECIAL MILITARY LOADING
Two 26,000 Lb. Axles @ 4'-0" ctrs.

UNIT STRESSES:-
Class S Concrete (n=10) 1200 #/□"
Reinforcing Steel 20,000 #/□"

NOTE:- This drawing to be used in conjunction with Standard Wing Drawing Nos. W-X452-1 or W-X452-2; W-X453-1 or W-X453-2; and W-X454-1 or W-X454-2. Also W-X45.

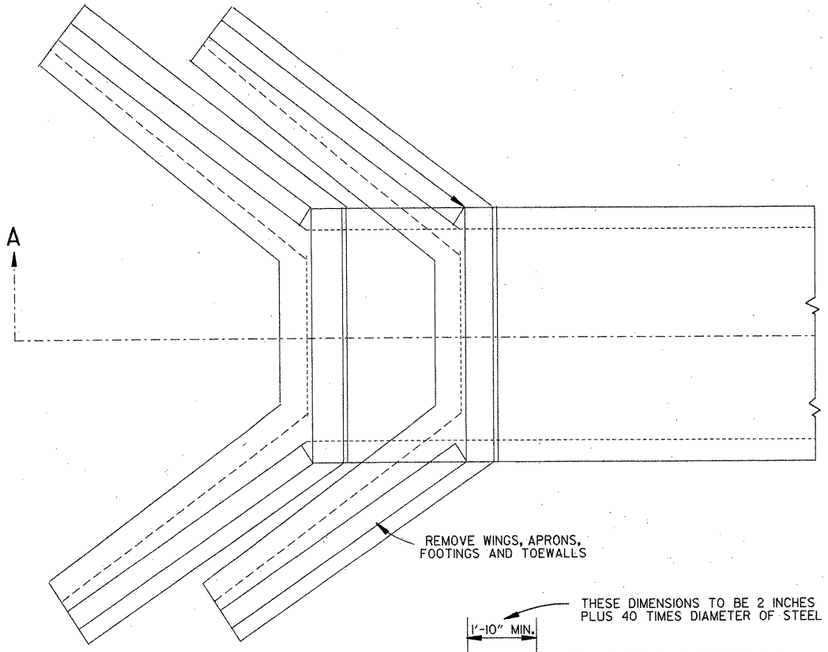
CLASS S CONCRETE

ARKANSAS STATE HIGHWAY COMMISSION

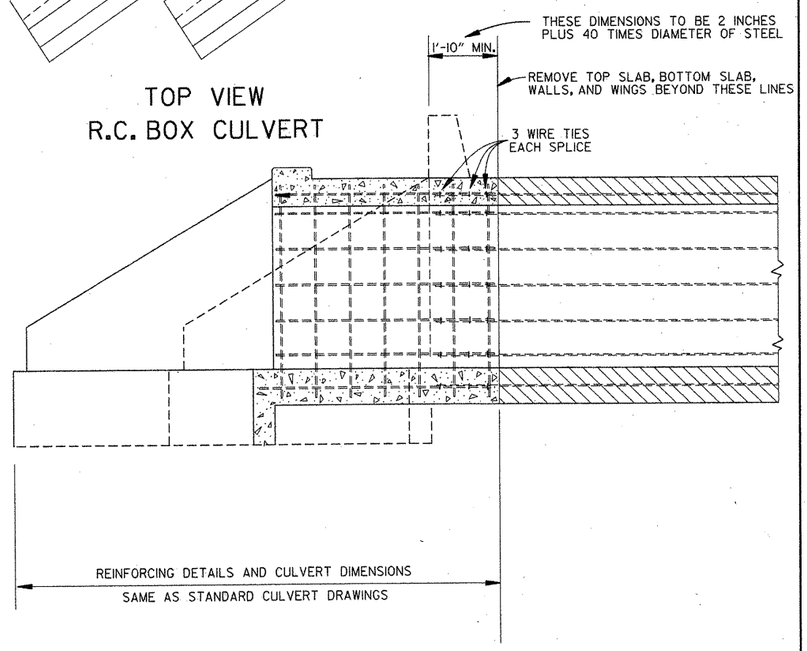
DETAILS OF STANDARD BARREL SECTIONS
FOR
REINFORCED CONCRETE BOX CULVERTS
45° SKEW

8', 9' AND 10' SPANS — 2:1, 3:1 OR 4:1 SLOPES
QUINTUPLES — UNDER 5'-0" COVER

STANDARD DRAWING No. R-545X-02

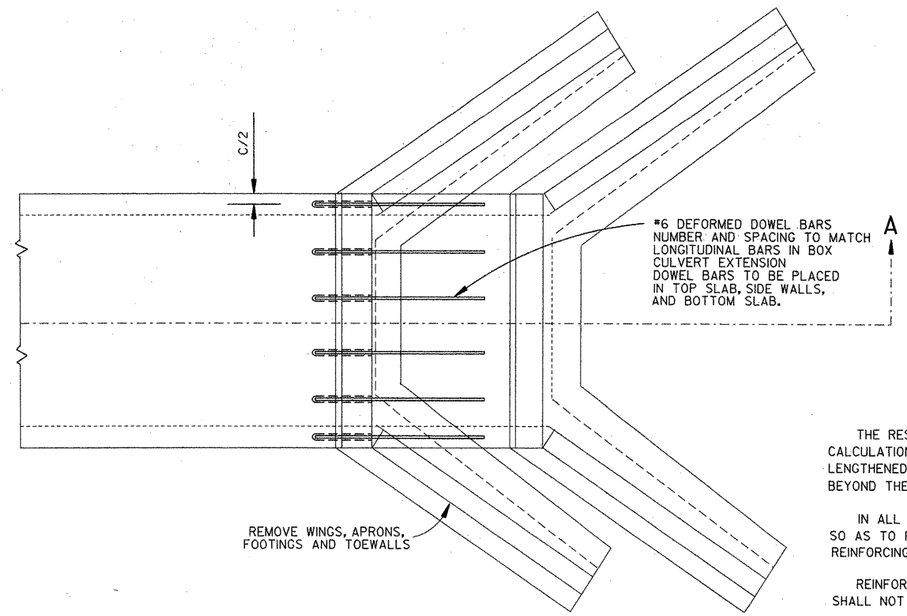


TOP VIEW
R.C. BOX CULVERT

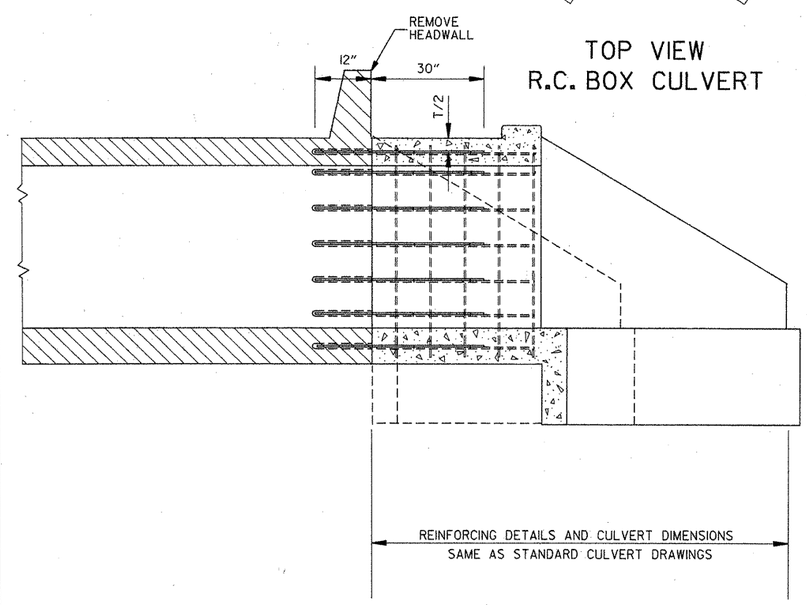


SECTION A-A

METHOD 1



TOP VIEW
R.C. BOX CULVERT



SECTION A-A

METHOD 2

GENERAL NOTES	USE FOR METHOD
THE RESIDENT ENGINEER WILL MAKE INDIVIDUAL CALCULATIONS OF QUANTITIES FOR EACH STRUCTURE LENGTHENED, MAKING NO ALLOWANCE FOR OVERBREAKAGE BEYOND THE LINES INDICATED.	1
IN ALL INSTANCES CONCRETE SHALL BE REMOVED SO AS TO PERMIT FULL 40 DIAMETER SPLICE OF REINFORCING STEEL.	1
REINFORCING STEEL REMOVED FROM EXISTING STRUCTURE SHALL NOT BE REUSED IN CONSTRUCTING EXTENSION.	1&2
ON R.C. BOX CULVERTS THAT HAVE AN EXISTING CONCRETE APRON; THE CONCRETE APRON SHALL BE REMOVED WITH THE WINGS. THE COST OF REMOVING ALL OLD CONCRETE WILL BE INCLUDED IN THE PRICE BID PER CUBIC YARD FOR NEW CONCRETE OF THE CLASS SPECIFIED AND NO ADDITIONAL COMPENSATION WILL BE ALLOWED.	1&2
MATERIALS FOR SECURING DOWEL BARS SHALL MEET THE REQUIREMENTS OF SECTION 507.02 OF THE STANDARD SPECIFICATIONS.	2
DOWEL BARS SHALL BE INSTALLED AS FOLLOWS: THE DRILLING PROCEDURE SHALL BE APPROVED BY THE ENGINEER, THE FILLING SYSTEM SHALL BE APPROVED BY THE ENGINEER. AND SHALL BE AN INJECTION-TYPE SYSTEM WHICH WILL INSURE THAT SUFFICIENT MATERIAL IS INJECTED SO IT COMPLETELY SURROUNDS THE BARS AND FILLS THE HOLES.	2
THE CONTRACTOR SHALL HAVE THE OPTION OF USING EITHER METHOD 1 OR METHOD 2. REGARDLESS OF WHICH METHOD IS USED, PAY QUANTITIES WILL BE CALCULATED BASED ON METHOD 1.	1&2

NOTE:
NO PART OF THIS STANDARD IS TO BE USED FOR ANY DETAILS RELATIVE TO NEW CONSTRUCTION.

SEE STANDARD DRAWING LISTED IN TABULATION OF STRUCTURES FOR ALL NEW CONSTRUCTION DETAILS.

DATE	REVISION	DATE FILM
4-1-93	ADDED GENERAL NOTE	
10-1-92	ADDED ALT. METHOD OF EXTENSION	
11-30-89	REDRAWN	
1-4-83	ELIMINATED CONCRETE CLASS	
12-20-56	RETRACED	

ARKANSAS STATE HIGHWAY COMMISSION

METHOD OF EXTENDING EXISTING R.C. BOX CULVERTS

STANDARD DRAWING 144-A

FILE: STD144A