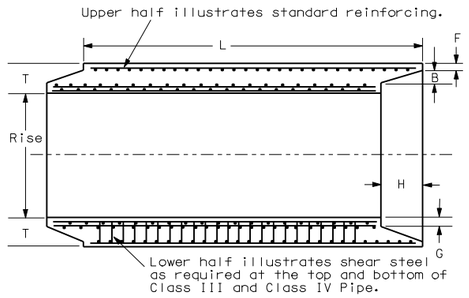
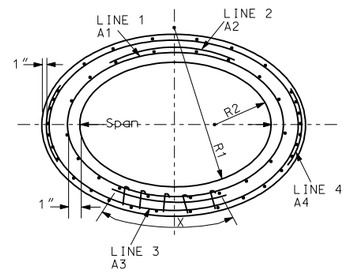
REINFORCED CONCRETE HORIZONTAL ELLIPTICAL CULVERTS & END SECTIONS

D-714-3



LONGITUDINAL SECTION



TRANSVERSE SECTION

REINFORCED CONCRETE HORIZONTAL ELLIPTICAL CULVERTS

TABLE OF DIMENSIONS FOR HORIZONTAL ELLIPTICAL CULVERTS													MINIMUM REINFORCEMENTS[b]																	
SIZE	SPAN	RISE	T	WATER AREA	WEIGHT PER FOOT	RADIUS "1"	RADIUS "2"	F	G	H	B	LAYING LENGTH "L"	STIRRUP REQUIREMENTS								CLASS A		CLASS I		CLASS II		CLASS III[c]		CLASS IV	
													CLASS III				CLASS IV													
													X	Ax	Y	Ay	X	Ax	Y	Ay	A1 + A2	A3 + A4	A1 + A2	A3 + A4	A1 + A2	A3 + A4	A1 + A2	A3 + A4	A1 + A2	A3 + A4
IN.	IN.	IN.	IN.	SQ.FT.	LBS.	IN.	IN.	IN.	IN.	IN.	IN.	FT.									in^2	in^2	in^2	in^2	in^2	in^2	in^2	in^2	in^2	in^2
72	91	58	7 1/2	29.5	2040	78.12	24.84	3	3	3 3/4	1	6 & 8									0.31	0.31	0.41	0.41	0.52	0.52	0.70	0.70		
78	98	63	8	34.6	2350	84.63	26.91	3 1/4	3	4	1 1/4	6	64"	0.85							0.34	0.34	0.45	0.45	0.56	0.56	0.78	0.78		
84	106	68	8 1/2	40.1	2680	91.14	28.98	3 1/8	3 3/16	4 1/4	1 3/4	6	69"	1.02	① See Footnote		Special Designs				0.38	0.38	0.50	0.50	0.63	0.63	0.88	0.88	Special Designs	
90	113	72	9	46.1	3050	97.65	31.05	3 1/4	3 3/4	4 1/2	1 3/8	6	74"	1.19							0.44	0.44	0.58	0.58	0.72	0.72	0.98	0.98		
96	121	77	9 1/2	52.4	3420	104.16	33.12	3 1/2	4	4 3/4	1 1/2	6	79"	1.36							0.46	0.46	0.62	0.62	0.78	0.78	1.04	1.04		
102	128	82	9 3/4	59.2	3725	110.67	35.19	3 11/16	4	4 7/8	1 1/2	6	84"	1.58							0.50	0.50	0.68	0.68	0.84	0.84	1.14	1.14		
108	136	87	10	66.4	4050	117.18	37.26	3 3/4	4 1/8	5	1 5/8	6	89"	1.80							0.56	0.56	0.74	0.74	0.92	0.92	1.24	1.24		

NOTE: Size equals equivalent round pipe size.

All reinforcing is minimum required area of circumferential steel in square inches per lineal foot of pipe.

For Class IV pipe, steel areas are dependent on fill height and special designs are available.

X = Arc at bottom of section over which shear reinforcement is placed.

SEE STANDARD D-714-22 FOR DETAILS OF CONCRETE PIPE TIES (TIE BOLTS).

LINE 1 = FULL INNER CAGE

LINE 2 = INNER LAP SECTION, 1/4 CIRCUMFERENCE MINIMUM ARC

LINE 3 = FULL OUTER CAGE

LINE 4 = OUTER LAP SECTION, 1/4 CIRCUMFERENCE MINIMUM ARC

Ax = Radial shear reinforced bottom of section in square inches per lineal feet of pipe.

A1 = REINFORCING OF INNER CAGE

A2 = REINFORCING OF INNER LAP SECTION

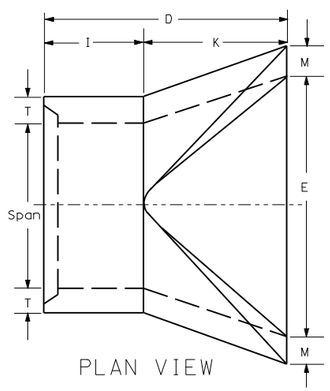
A3 = REINFORCING OF OUTER CAGE

A4 = REINFORCING OF OUTER LAP SECTION

CONCRETE STRENGTH = 4000 PSI

[c]CONCRETE STRENGTH = 5000 PSI

① = Y & Ay are the same as X & Ax for Class III Pipe (Top Reinf.)



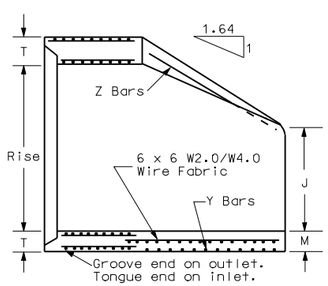
PLAN VIEW

MAXIMUM AND MINIMUM COVER FOR REINFORCED CONCRETE HORIZONTAL ELLIPTICAL CULVERTS											
SPAN	RISE	CLASS A		CLASS I		CLASS II		CLASS III		CLASS IV	
		NORMAL BACKFILL	SEWER TRENCH	NORMAL BACKFILL	SEWER TRENCH	NORMAL BACKFILL	SEWER TRENCH	NORMAL BACKFILL	SEWER TRENCH	NORMAL BACKFILL	SEWER TRENCH
IN.	IN.	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.
91	58	1-4	1-2	4-6	2-4	6-12	4-9	12-15	9-13	15-23	13-22
98	63	1-4	1-2	4-6	2-5	6-12	5-9	12-15	9-14	15-23	14-22
106	68	1-4	1-3	4-7	3-5	7-12	5-9	12-16	9-14	16-23	14-22
113	72	1-5	1-3	5-8	3-5	8-12	5-9	12-16	9-14	16-23	14-23
121	77	1-5	1-3	5-8	3-5	8-13	5-9	13-16	9-14	16-23	14-23
128	82	1-5	1-3	5-8	3-6	8-13	6-10	13-17	10-14	17-23	14-23
136	87	1-5	1-4	5-8	4-6	8-13	6-10	13-17	10-14	17-23	14-23

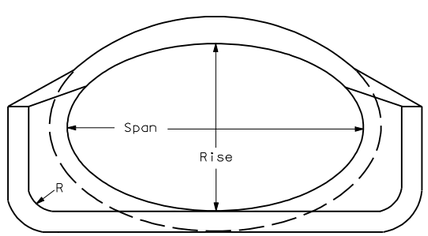
Fill heights in Class IV shown for information purposes only.

NOTES: All reinforcement shall be electrically welded cold drawn steel wire fabric.

Reinforced Concrete Horizontal Elliptical Culverts and End Sections are manufactured in accordance with AASHTO M-207 and Section 714 of the Std. Specs. except as noted in the table of dimensions.



LONGITUDINAL SECTION



END VIEW

REINFORCED CONCRETE HORIZONTAL ELLIPTICAL END SECTIONS*

TABLE OF DIMENSIONS FOR HORIZONTAL ELLIPTICAL END SECTIONS													
SPAN	RISE	WATER AREA	WEIGHT PER SECTION	J	K	I	D	E	T	M	R	REINFORCING STEEL	
												Y	Z
IN.	IN.	SQ.FT.	LBS.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.		
98	63	32.5	15,200	38	57 1/2	40 1/2	98	130	8	6	6	20-1/2"Ø x 10'-6" @ 6" C.C.	4-1/2" Ø x 7'-0"
106	68	37.4	17,200	39	64 3/4	33 1/4	98	138	8 1/2	6 1/2	6	22-1/2"Ø x 11'-6" @ 6" C.C.	4-1/2" Ø x 8'-0"
113	72	42.5	19,400	42	68	30	98	146	9	6 1/2	6	24-1/2"Ø x 12'-0" @ 6" C.C.	4-1/2" Ø x 8'-6"
121	77	46.4	21,800	47 1/2	68	30	98	150	9 1/2	7	6	24-1/2"Ø x 12'-6" @ 6" C.C.	4-1/2" Ø x 9'-0"

* Equivalent to Class II Pipe

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-1-86	
REVISIONS	
DATE	CHANGE
07-03-03	Layout revisions
12-01-04	PE Stamp added

This document was originally issued and sealed by MARK S GAYDOS, Registration Number PE-4518, on 12/01/04 and the original document is stored at the North Dakota Department of Transportation