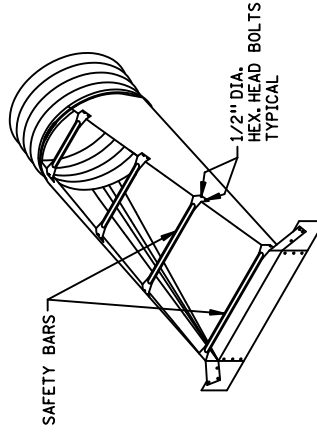


WITH CROSS DRAINAGE BAR



WITHOUT CROSS DRAINAGE BAR

ISOMETRIC VIEWS

NOTES:

GALVANIZE ALL HARDWARE AS PER SPEC. 3392.
CONNECTORS ROUND SIZED 15" THRU 24" ATTACH TO PIPE WITH TYPE NO. 1 STRAPS. ALL OTHER SIZES ATTACH WITH TYPE NO. 2 RODS AND LUGS.
OPTIONAL TOE EXTENSIONS WHEN REQUIRED ARE TO BE THE SAME GAGE AS END SECTION. DIMENSIONS SHALL BE OVERALL WIDTH LESS 6 INCHES BY 8 INCHES HIGH.
SAFETY BARS SHALL BE FABRICATED FROM STRUCTURAL STEEL PIPE AS PER SPEC. 3362 AND GALVANIZED AFTER FABRICATION AS PER SPEC. 3394.
NO GRATE IS OF ANY KIND ALLOWED ON AN OUTLET WITHOUT A GRATE BEING PLACED ON THE INLET ALSO.

TABLE FOR CIRCULAR PIPES

PIPE DIA. (IN.)	THICKNESS (INCHES)			DIMENSIONS (INCHES)			L DIMENSIONS			
	IN.	GAGE	A	H	W	OVERALL WIDTH	LENGTH (IN.)	SLOPE	LENGTH (IN.)	
18	.064	16	8	6	24	40	4:1	32	6:1	48
21	.064	16	8	6	27	43	4:1	44	6:1	66
24	.064	16	8	6	30	46	4:1	56	6:1	84
30	.109	12	12	9	36	60	4:1	80	6:1	120
36	.109	12	12	9	42	66	4:1	104	6:1	156
42	.109	12	16	12	48	80	4:1	128	6:1	192
48	.109	12	16	12	54	86	4:1	152	6:1	228
54	.109	12	16	12	60	92	4:1	176	6:1	264
60	.109	12	16	12	66	98	4:1	200	6:1	300

①

TABLE FOR ARCHED PIPES

EQUIV. DIA. (IN.)	THICKNESS (INCHES)			DIMENSIONS (INCHES)			L DIMENSIONS					
	SPAN RISE	IN.	GAGE	A	H	W	OVERALL WIDTH	LENGTH (IN.)	SLOPE	LENGTH (IN.)		
18	21	15	.064	16	8	6	27	43	4:1	20	6:1	30
21	24	18	.064	16	8	6	30	46	4:1	32	6:1	48
24	28	20	.064	16	8	6	34	50	4:1	40	6:1	60
30	35	24	.079	14	12	9	41	65	4:1	56	6:1	84
36	42	29	.109	12	12	9	48	72	4:1	76	6:1	114
42	49	33	.109	12	16	12	55	87	4:1	92	6:1	138
48	57	38	.109	12	16	12	63	95	4:1	112	6:1	168
54	64	43	.109	12	16	12	70	102	4:1	132	6:1	198
60	71	47	.109	12	16	12	77	109	4:1	148	6:1	222
72	83	57	.109	12	16	12	89	121	4:1	188	6:1	282

①

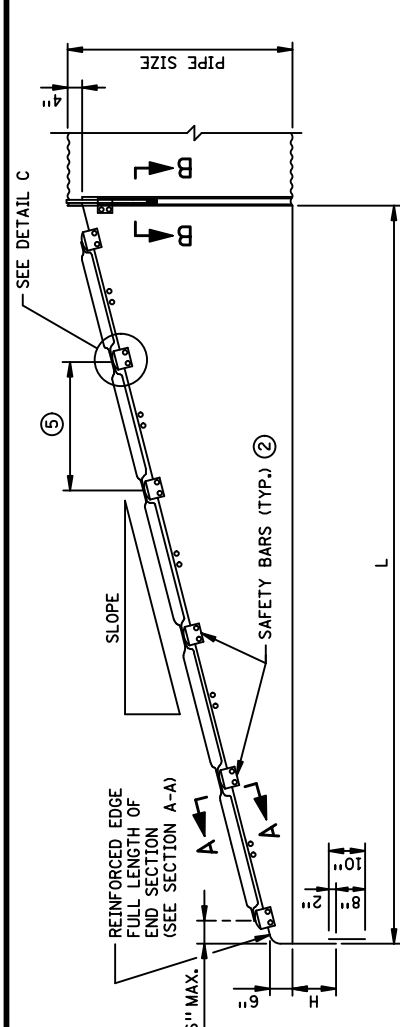
① MINIMUM SIZE FOR CROSS-DRAINAGE STRUCTURES.

APPROVED Nov. 20, 1991
B.M. Hill
DIRECTOR
OFFICE OF TECHNICAL SUPPORT

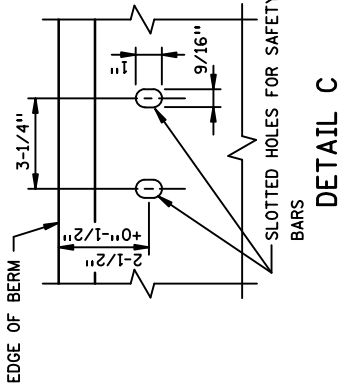
STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION
SAFETY SLOPE METAL END SECTION
FOR CIRCULAR & ARCHED PIPES

SPECIFICATION REFERENCE
2501
REVISED 3-12-03

STANDARD PLATE NO.
3148A
1 OF 2



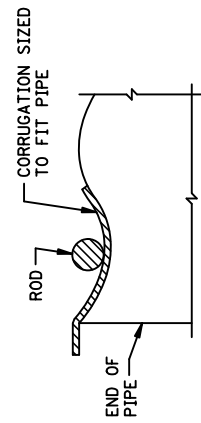
SEE TABLE
SIDE VIEW



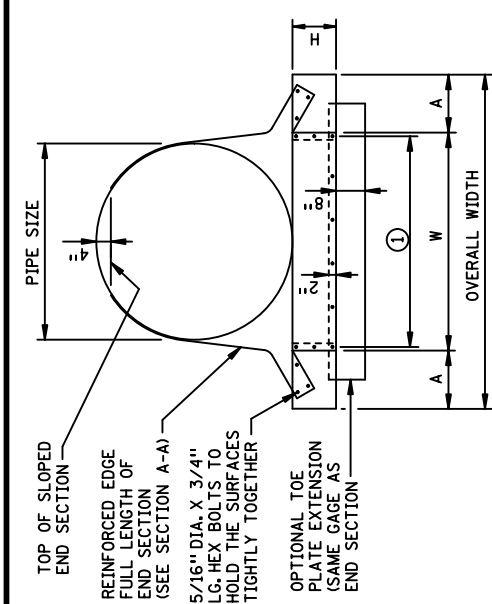
DETAIL C



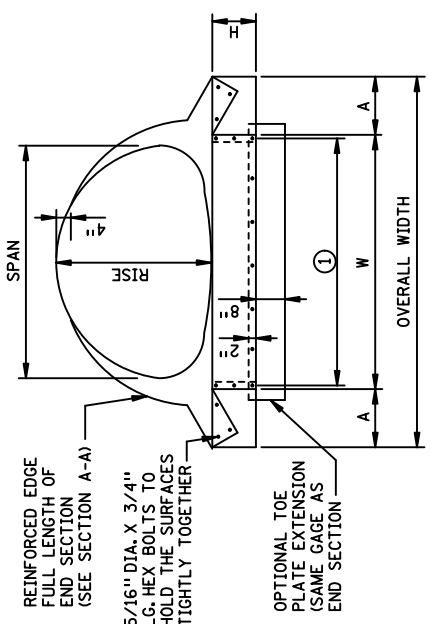
SECTION A-A



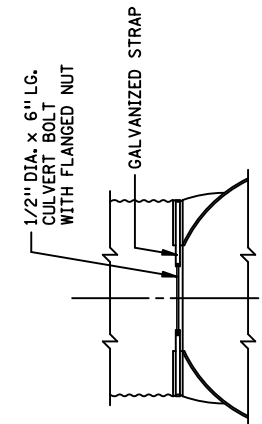
SECTION B-B



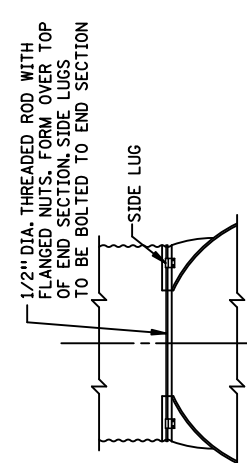
END VIEW CIRCULAR PIPE



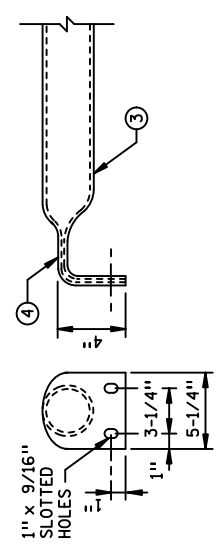
END VIEW ARCHED PIPE



TYPE 1 CONNECTOR DETAIL (6)
(FOR 15" TO 24" DIA.)



TYPE 2 CONNECTOR DETAIL (6)
(FOR 30" DIA. AND LARGER,
& SPANS 21" x 15" AND LARGER)



SAFETY BAR DETAIL

- NOTES:**
- ① HOLES EQUALLY SPACED AT 12" CENTERS MAXIMUM.
 - ② NUMBER OF BARS REQUIRED WILL VARY DEPENDING ON THE LENGTH OF THE END SECTION.
 - ③ 3" GALVANIZED PIPE; FLATTEN END, THEN BEND OUTSIDE 4" TO MATCH PIPE END SECTION SIDES.
 - ④ REPAIR GALVANIZED SURFACES AS PER SPEC. 2471.3L3.
 - ⑤ 4" O" MAXIMUM FOR CENTERLINE CULVERTS.
 - ⑥ 2" O" MAXIMUM FOR ENTRANCE CULVERTS.
 - ⑦ A TAPERED SLEEVE FOR ATTACHING TO CONCRETE PIPE IS AVAILABLE.

APPROVED **Nov. 20, 1991**
B.M. Hill
DIRECTOR
OFFICE OF TECHNICAL SUPPORT

STATE OF MINNESOTA
DEPARTMENT OF TRANSPORTATION
**SAFETY SLOPE METAL END SECTION
FOR CIRCULAR & ARCHED PIPES**

SPECIFICATION
REFERENCE
2501
REVISED
3-22-2013 M.J.E.

STANDARD
PLATE
NO.
3148A
2 OF 2