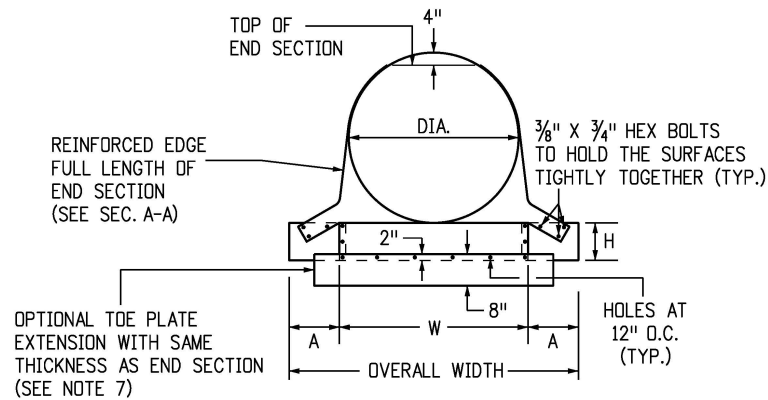
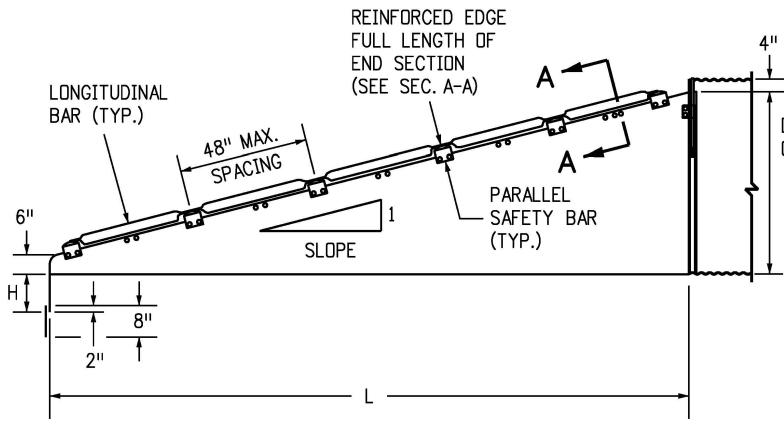
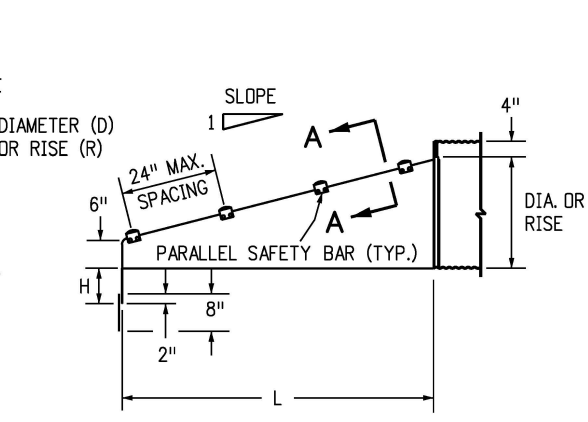




FRONT VIEW
ROUND PIPE CULVERT

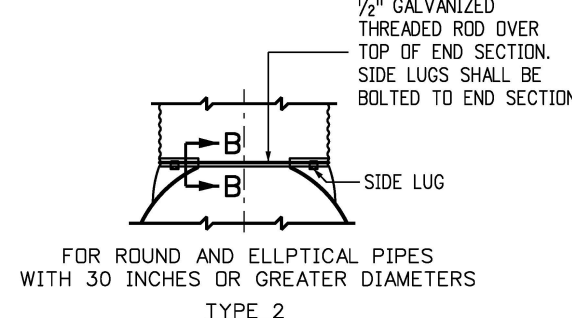
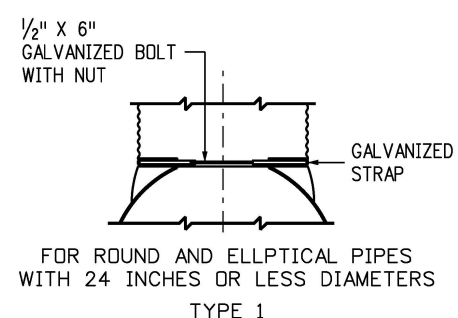


ELEVATION VIEW
CROSS DRAINAGE END SECTION



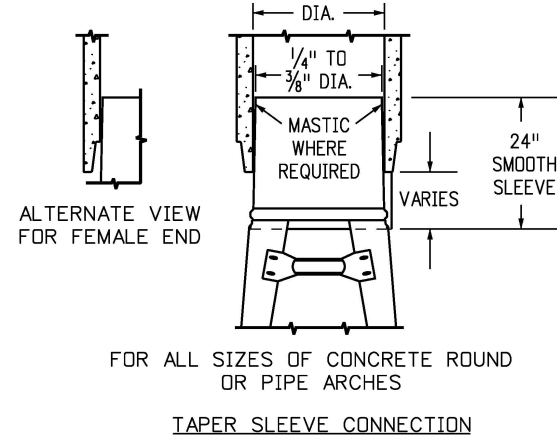
ELEVATION VIEW
PARALLEL DRAINAGE END SECTION

- GENERAL NOTES**
1. USE END SECTIONS ON 1V:4H TO 1V:6H SLOPES ONLY. USE TOE PLATE EXTENSION WHERE SHOWN ON THE PLANS.
 2. FABRICATE SAFETY AND LONGITUDINAL BARS FROM STEEL PIPE CONFORMING TO ASTM A53 SCHEDULE 40 SPECIFICATIONS. GALVANIZE BARS HOT DIPPED AFTER FABRICATION.
 3. A LONGITUDINAL BAR IS REQUIRED FOR CROSS DRAINAGE END SECTIONS WHEN THE SPAN IS GREATER THAN 30 INCHES. USE ADDITIONAL LONGITUDINAL BARS IF SPACING EXCEEDS 30 INCHES ON LARGER END SECTIONS.
 4. SAFETY AND LONGITUDINAL BARS ARE NOT REQUIRED ON 30 INCHES AND SMALLER CROSS DRAINAGE END SECTIONS.
 5. SAFETY BARS ARE NOT REQUIRED ON 18 INCHES AND SMALLER PARALLEL DRAINAGE END SECTIONS.
 6. WHEN REQUIRED, TOE PLATE EXTENSIONS SHALL BE THE SAME GAGE AS END SECTIONS. DIMENSIONS SHALL BE OVERALL WIDTH LESS 6 INCHES BY 8 INCHES HIGH.

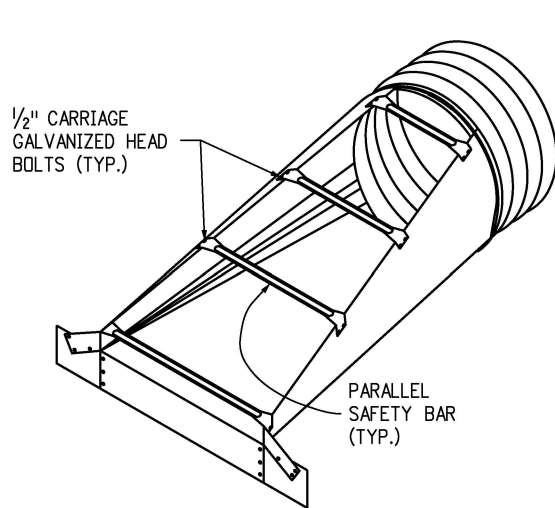


CONNECTOR DETAILS

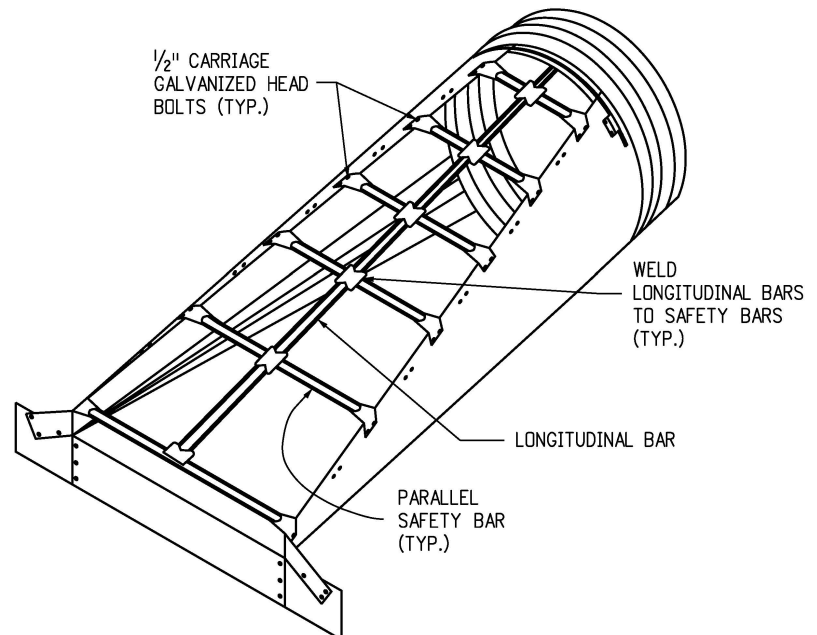
NOTE: SIZES THRU 24" ATTACH TO PIPE WITH TYPE 1 STRAPS.
ALL OTHER SIZES ATTACH WITH TYPE 2 RODS AND LUGS.



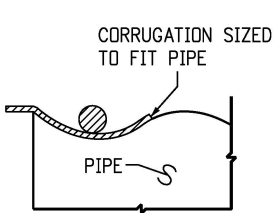
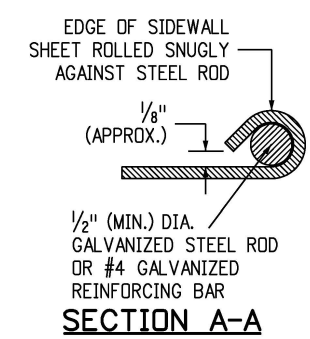
METAL END SECTIONS FOR ROUND PIPE CULVERT								
PIPE DIA. SIZE (INCHES)	METAL THICK MIN. (INCH/GAGE)	DIMENSIONS IN INCHES						
		A	H	W	OVERALL WIDTH	L		
						Slope = 4	Slope = 6	
18	0.064/16	8	6	24	40	32	47	
24	0.064/16	8	6	30	46	55	83	
30	0.109/12	12	9	36	60	79	118	
36	0.109/12	12	9	42	66	102	154	
42	0.109/12	16	12	48	80	126	189	
48	0.109/12	16	12	54	86	150	224	
54	0.109/12	16	12	60	92	173	260	
60	0.109/12	16	12	66	98	197	295	



PARALLEL DRAINAGE END SECTION

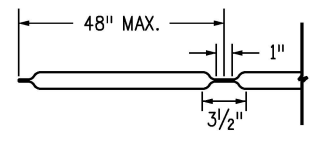


CROSS DRAINAGE END SECTION

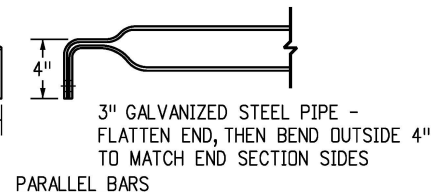
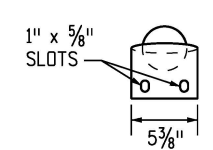


SECTION B-B

METAL END SECTIONS FOR PIPE ARCH CULVERT									
PIPE SIZE (INCHES)			METAL THICK MIN. (INCH/GAGE)	DIMENSIONS (INCHES)					
EQUIV. DIA.	SPAN	RISE		A	H	W	OVERALL WIDTH	L	
								Slope = 4	Slope = 6
18	21	15	0.064/16	8	6	27	43	20	30
24	28	20	0.064/16	8	6	33	49	40	60
30	35	24	0.109/12	12	9	40	64	55	83
36	41	29	0.109/12	12	9	47	71	75	112
42	48	32	0.109/12	16	12	54	86	90	136
48	56	37	0.109/12	16	12	62	94	110	165
54	63	42	0.109/12	16	12	69	101	130	195
60	70	46	0.109/12	16	12	76	107	146	218
72	82	56	0.109/12	16	12	88	120	185	278

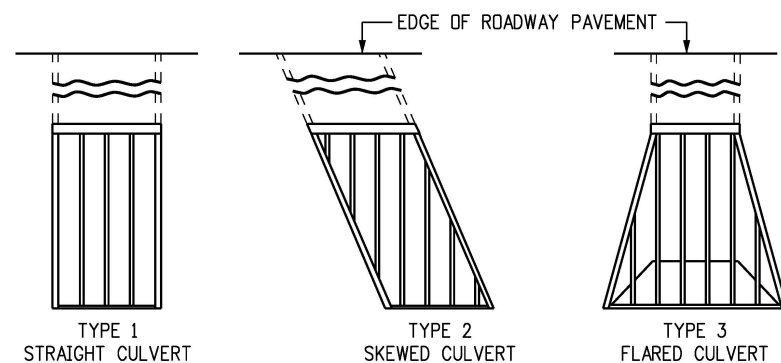


LONGITUDINAL DRAINAGE BAR



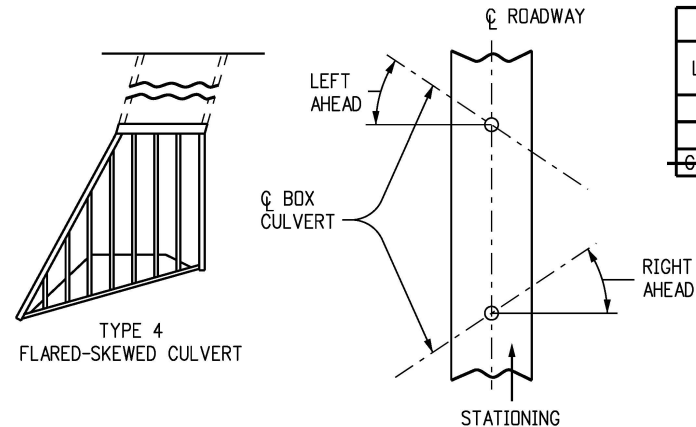
SAFETY BAR DETAILS

Computer File Information		Sheet Revisions		Colorado Department of Transportation 2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch JBK	TRAVERSABLE END SECTIONS AND SAFETY GRATES	Issued by the Project Development Branch: July 31, 2019	STANDARD PLAN NO.	
Creation Date: 07/31/19		Date:	Comments				M-603-12	
Designer Initials: JJP	(R-X)						Standard Sheet No. 1 of 3	
Last Modification Date: 07/31/19	(R-X)						Project Sheet Number:	
Detailer Initials: LTA	(R-X)							
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)							



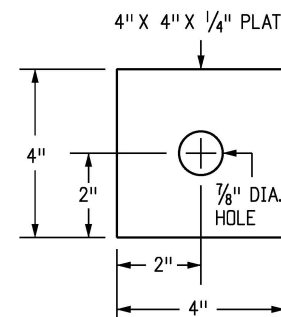
INSTALLATION TYPES

GRATE BARS SHALL BE PERPENDICULAR TO DIRECTION OF TRAFFIC FLOW.



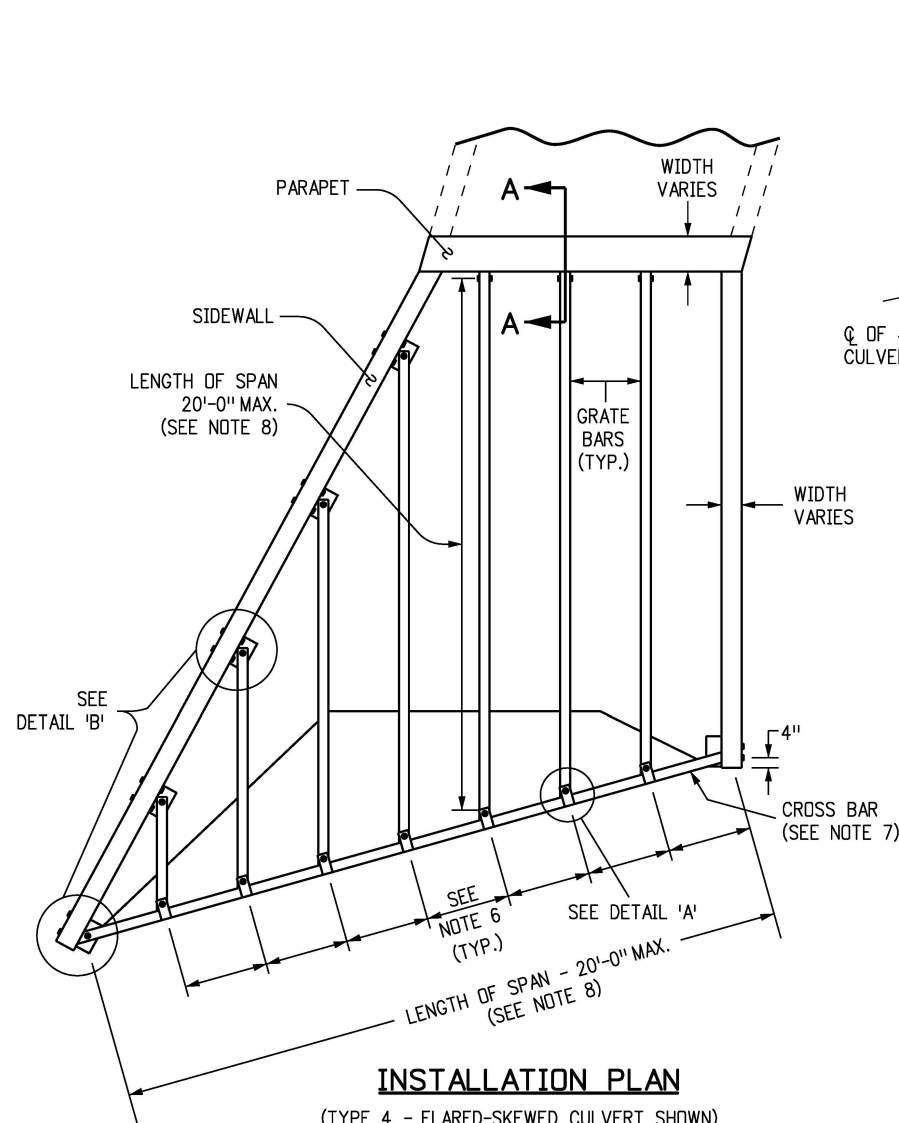
SKEW ANGLE DETERMINATION

GRATE & CROSS BAR SIZE REQUIREMENTS		
LENGTH OF SPAN	NOMINAL PIPE SIZE (SEE NOTE 7)	O.D. SIZE
LESS THAN 12'	3.0"	3.0"
12' - 16'	3.5"	3.5"
GREATER THAN 16'	4.0"	4.0"



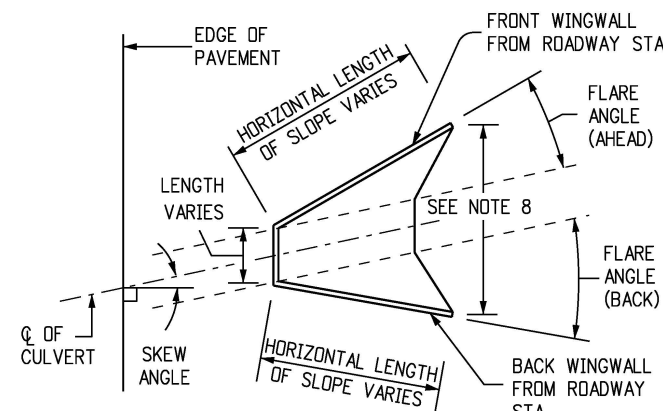
SHIM DETAIL

1. SHOP DRAWINGS SHALL BE SUBMITTED PER 105.02
2. HARDWARE SUCH AS BOLTS, WASHERS, AND LOCK NUTS SHALL BE HOT-DIPPED GALVANIZED PER ASTM A123
3. INTENDED FOR USE ON TERRAIN XX SLOPES WITH A CLEAR RUNOUT FOR ERRANT VEHICLES. GUARDRAIL IS THE PREFERRED OPTION ON STEEPER TERRAIN OR WITH HIGHER TRAFFIC VOLUMES
4. MINIMUM SCHEDULE 40 PIPE SHALL BE USED. GALVANIZE ALL PIPES, FITTINGS AND HARDWARE AFTER ALL CUTTING, WELDING, DRILLING, AND FABRICATION.
5. BOTH ENDS OF CULVERT SHALL BE TREATED TO PREVENT DEBRIS FROM ENTERING
6. EQUALLY SPACED 24 INCHES MIN. TO 30 INCHES MAX. FROM EDGE OF SIDEWALL TO CENTER OF BRACKET, OR FROM CENTER TO CENTER OF BRACKET.
7. THE CROSS BAR DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE GRATE BAR DIAMETER.
8. IF MORE THAN 20 FEET THAN A MIDSPAN SUPPORT SHALL BE REQUIRED. SEE SHEETS 3 AND 4.
9. DRILL HOLES USING EQUIPMENT DESIGNED TO CUT THROUGH CONCRETE AND REINFORCING STEEL.
10. A 3/4 INCH BOLT, LOCK NUT AND WASHERS. ALL HOLES ARE TO BE 7/8 INCH IN DIAMETER.
11. BEND PLATES OR STRIPS WITHOUT CRACKING MATERIAL.
12. SHIM THICKNESS EQUALS THE DIFFERENCE IN DIAMETERS OF THE GRATE BAR AND CROSS BAR.

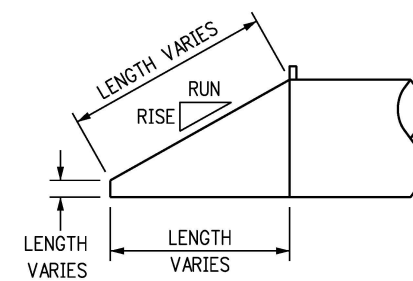


INSTALLATION PLAN

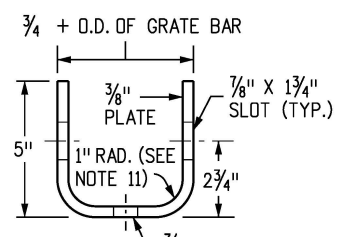
(TYPE 4 - FLARED-SKEWED CULVERT SHOWN)



TOP VIEW

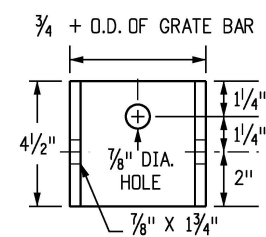


SIDE VIEW



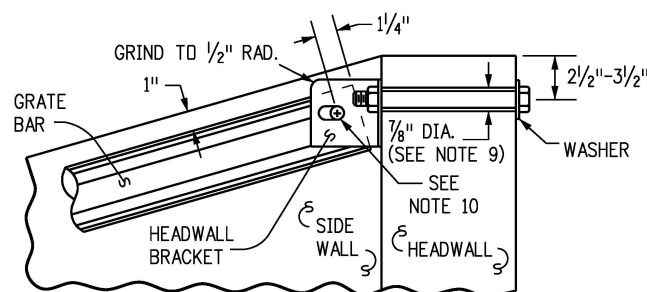
HEADWALL BRACKET

TOP VIEW

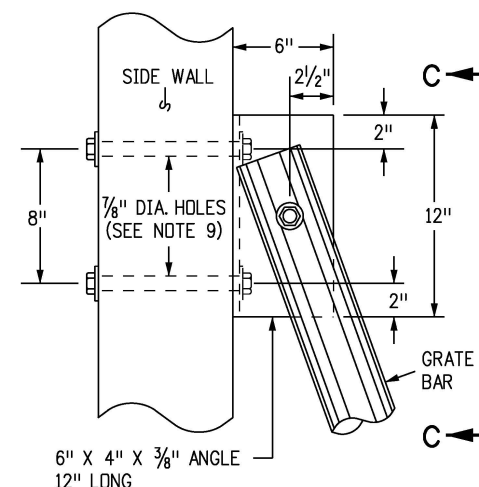


HEADWALL BRACKET

FRONT VIEW

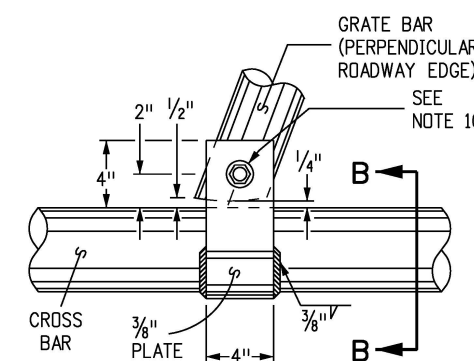


SECTION A-A



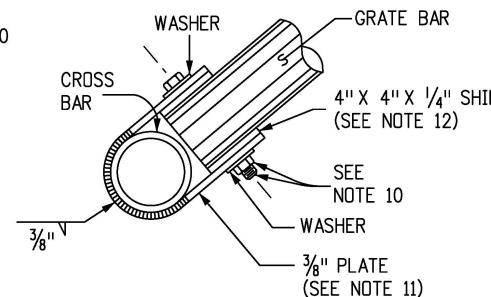
DETAIL "B"

TOP VIEW

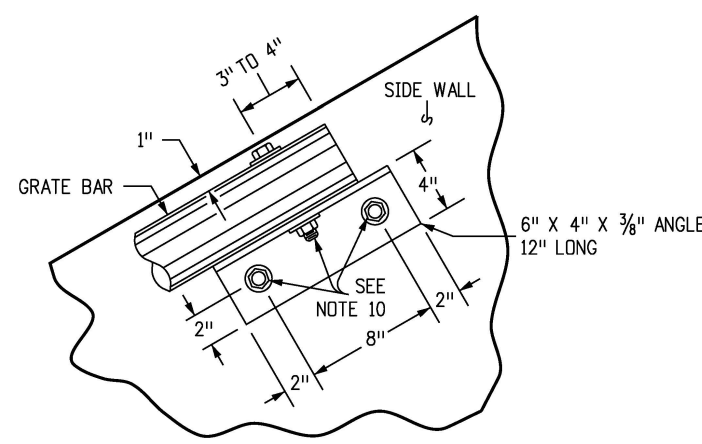


DETAIL "A"

TOP VIEW



SECTION B-B



SECTION C-C

Computer File Information

Creation Date: 07/31/19

Designer Initials: JJP

Last Modification Date: 07/31/19

Detailer Initials: LTA

CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

(R-X)

(R-X)

(R-X)

(R-X)

Sheet Revisions

Date: Comments

Colorado Department of Transportation

2829 West Howard Place
CDOT HQ, 3rd Floor
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch

JBK

TRAVERSABLE END SECTIONS AND SAFETY GRATES

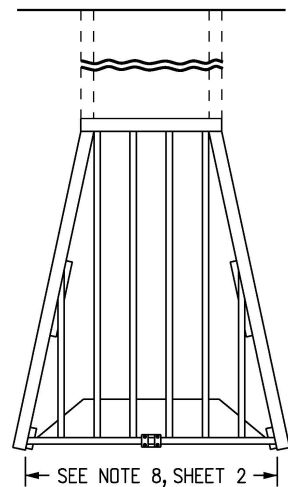
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

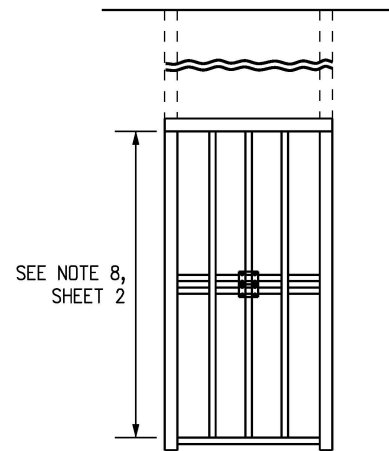
M-603-12

Standard Sheet No. 2 of 3

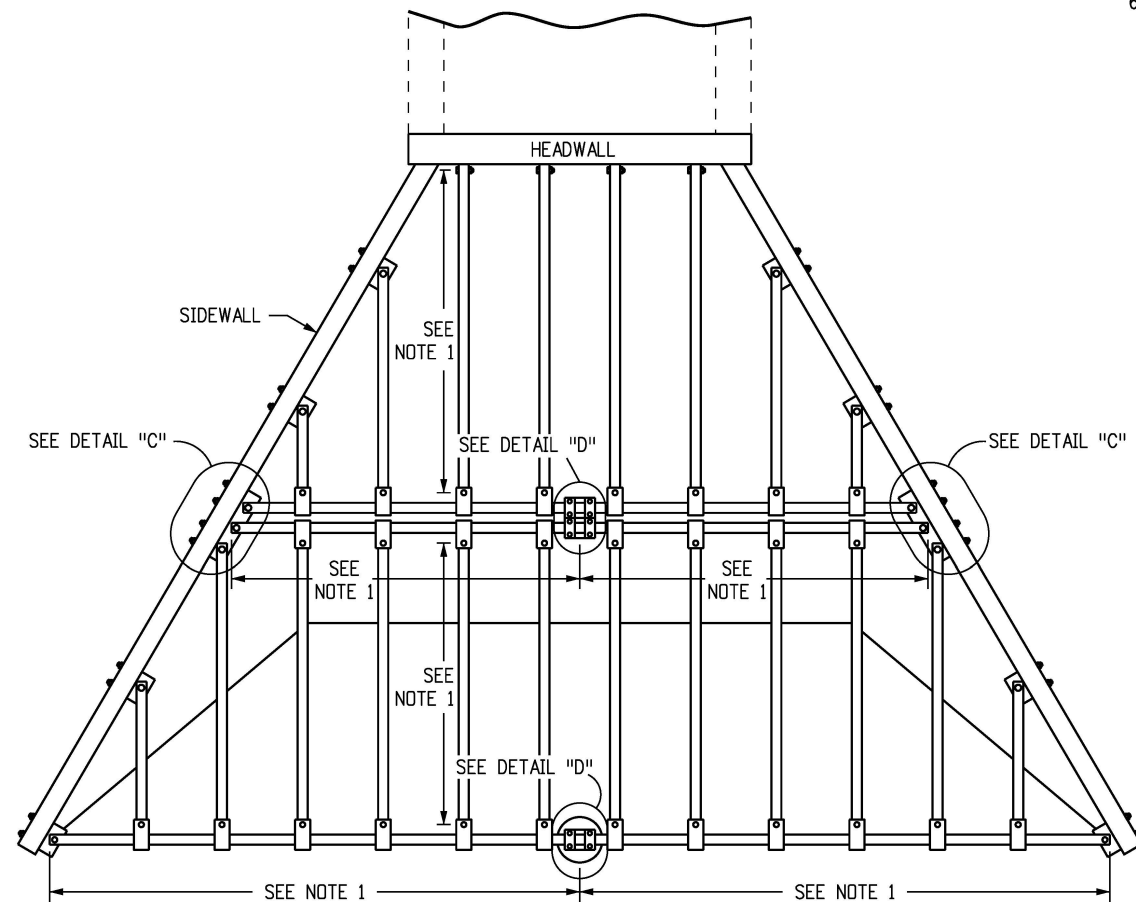
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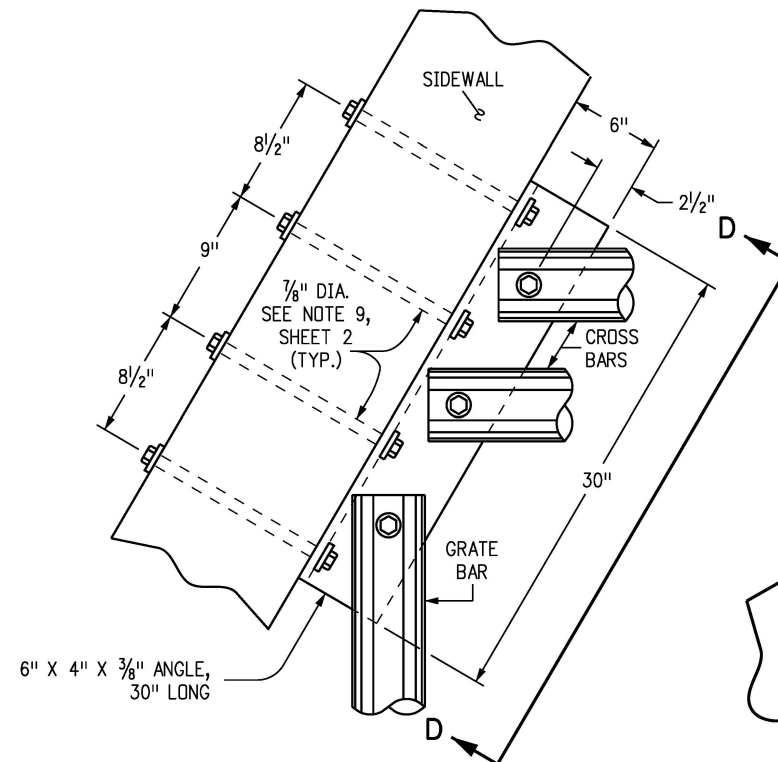
CASE 1



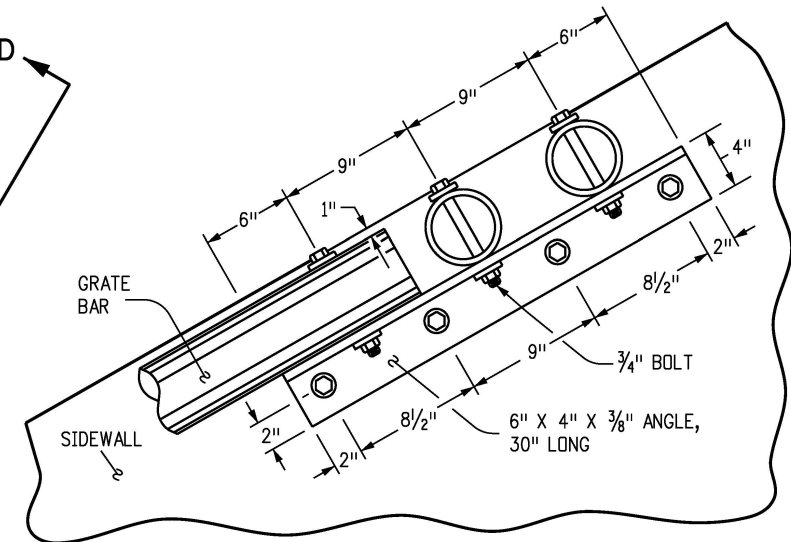
CASE 2



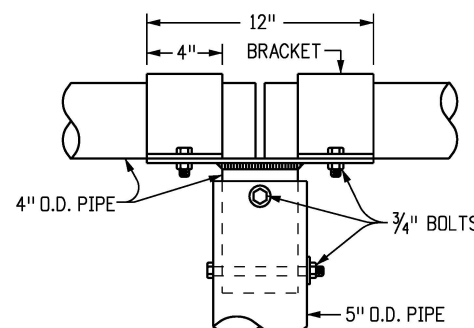
INSTALLATION PLAN WITH MIDSPAN SUPPORT



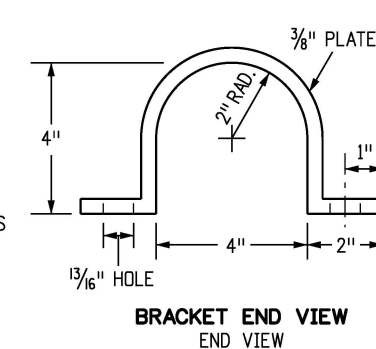
DETAIL "C"



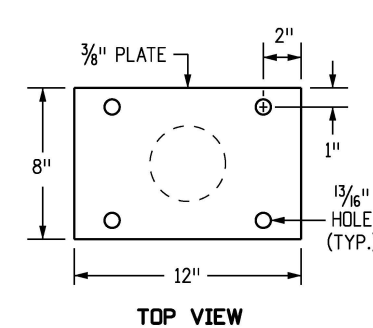
SECTION D-D



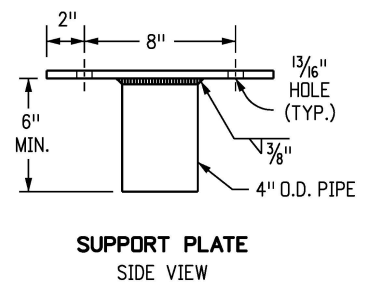
**CROSS BAR SUPPORT ASSEMBLY
SIDE VIEW**



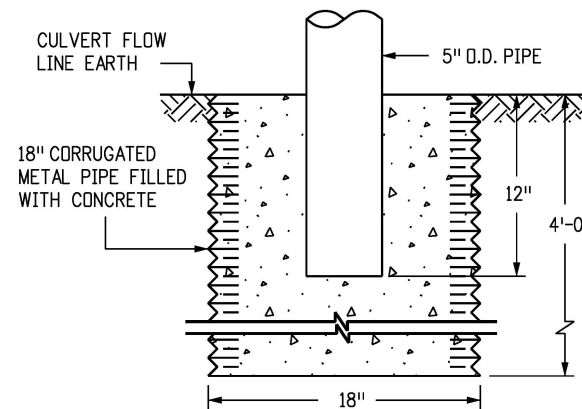
**BRACKET END VIEW
END VIEW**



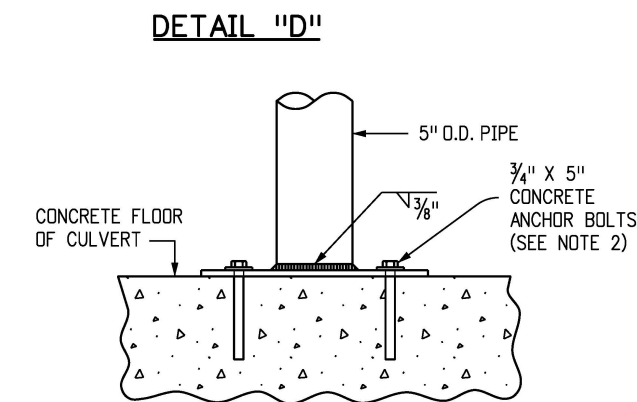
TOP VIEW



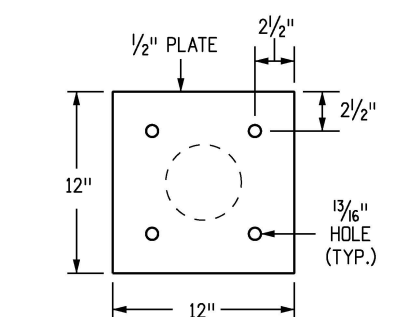
**SUPPORT PLATE
SIDE VIEW**



BOTTOM SUPPORT ON EARTH



BOTTOM SUPPORT ON CULVERT FLOOR



BOTTOM SUPPORT PLATE

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GROUTED IN PLACE WITH A NONSHRINK OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

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Designer Initials: JJP	(R-X)					Standard Sheet No. 3 of 3
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Detailer Initials: LTA	(R-X)					Project Sheet Number:
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				Project Development Branch	JBK	