



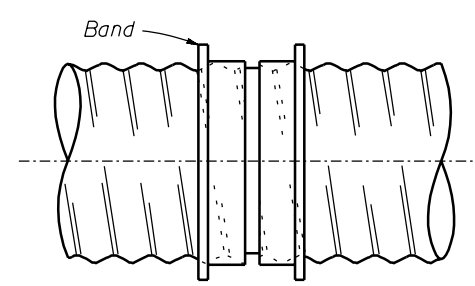
COUPLING BANDS FOR METAL PIPE CULVERT <sup>1/</sup>					
CORRUGATION SIZE <sup>2/</sup>	ROUND PIPE DIAMETER	PIPE-ARCH SPAN X RISE	MINIMUM BAND WIDTH		
			ANNULAR <sup>3/</sup> CORRUGATED BANDS	HELICALLY <sup>4/</sup> CORRUGATED BANDS	SEMI- <sup>5/</sup> CORRUGATED BANDS
38 x 6.5	underdrain <sup>6/</sup>	-	265	180	265
	300 to 900	430 x 330 to 1060 x 740	180	300	
68 x 13	1050 to 1800	1240 x 840 to 2100 x 1450	265	300	
	1950 to 2100	-	265	300	265
75 x 25	900 to 1800	1520 x 1170 to 2050 x 1500	300	350	265
	1950 to 3600	2200 x 1620 to 3600 x 2320	300	350	265
125 x 25	900 to 1800	1520 x 1170 to 2050 x 1500	500	560	
	1950 to 3600	2200 x 1620 to 3600 x 2320	500	560	

<sup>1/</sup> Fabricate annular, helical and semi-corrugated type coupling bands from the same metal as the connecting pipe. Provide coupling bands not more than 3 nominal sheet thicknesses thinner than the thickness of the pipe to be connected, and no thinner than 1.32 mm for steel or 1.2 mm for aluminum. Fasten coupling bands with the following diameter of bolt:  
M10 for 450 mm round culvert (530x380 mm pipe arch) or less  
M12 for 525 mm round culvert (610x460 mm pipe arch) or more

- <sup>2/</sup> For helically corrugated pipe with rerolled ends, the nominal corrugations size refers to the dimension of the end corrugation in the pipe.
- <sup>3/</sup> Use annular corrugated bands with pipes having annular corrugations or with helical pipe having rerolled end to form annular corrugations. A 265 mm band is acceptable on pipe ends rerolled with 68x13 mm corrugations. A 300 mm band is acceptable on pipe ends rerolled with 75x25 mm pipe corrugations.
- <sup>4/</sup> Use helical corrugated bands with pipes having helically corrugated ends.
- <sup>5/</sup> The minimum band widths shown for 75x25 mm and 125x25 mm corrugated sizes apply to 68x13 mm corrugations on rerolled pipe ends.
- <sup>6/</sup> Smooth sleeve-type couplers and flat bands may be used for pipe diameters of 300 mm or less. Use a matching metal having a nominal thickness of not less than 1.02 mm for steel, or 0.91 mm for aluminum, or a plastic with an equivalent strength to metal.

**NOTE:**

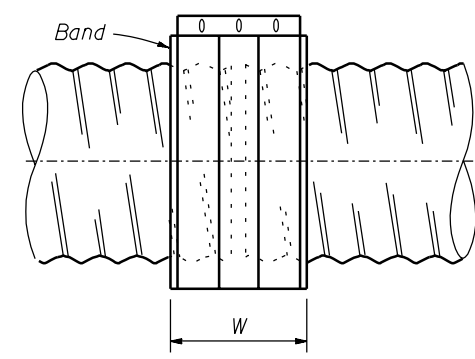
1. Dimensions not labeled are in millimeters.
2. Watertight pipe joints are not required unless specified in the Special Contract Requirements.
3. Other types of coupling bands or fastening devices that comply with the joint performance criteria of AASHTO Standard specifications for Highway Bridges, Division II Section 26 may be used.



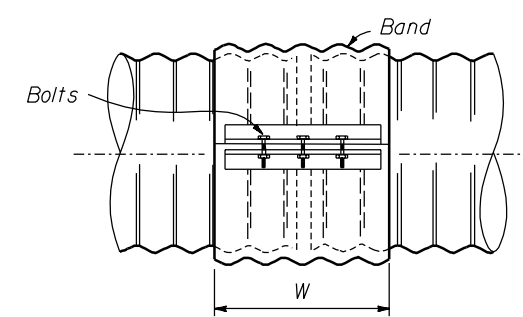
**SLEEVE JOINT**

Smoother sleeve with center stop.  
Stab type joint.

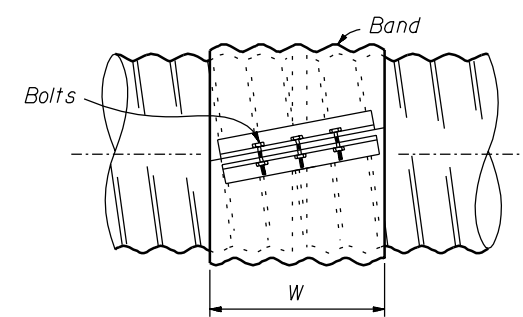
**SMOOTH SLEEVE BAND**



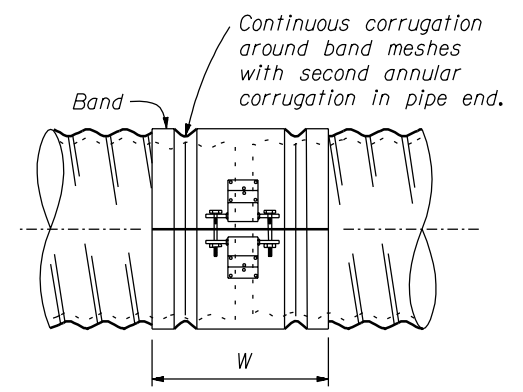
**FLAT BAND**



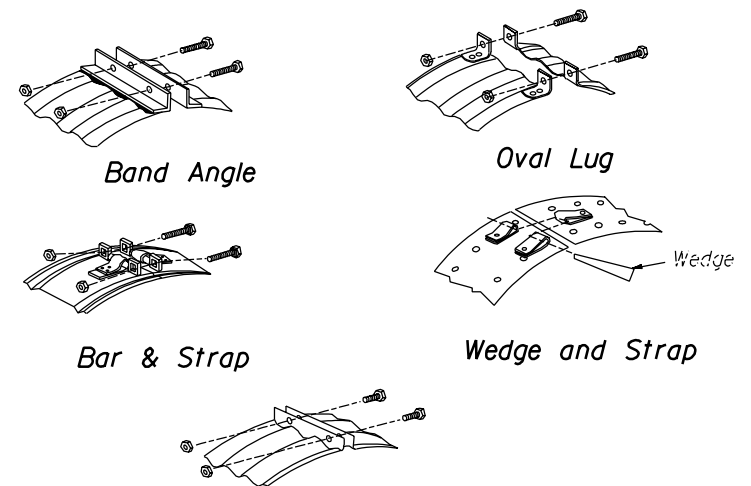
**SIDE VIEW**



**SIDE VIEW**

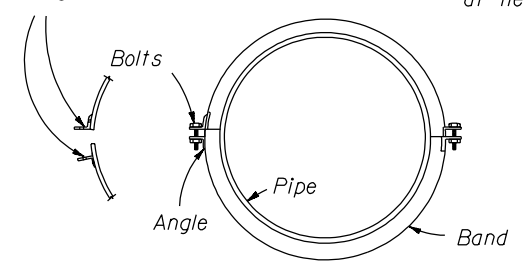


**SIDE VIEW**



**STANDARD BAND CONNECTIONS**

Rivet, spot weld, or fillet weld at crest of corrugation at heel and toe of angle.

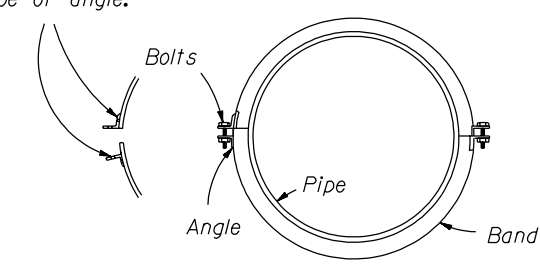


**END VIEW**

Second angle connection optional to 1050 mm diameter, required above 1065 mm diameter.

**ANNULAR BAND**

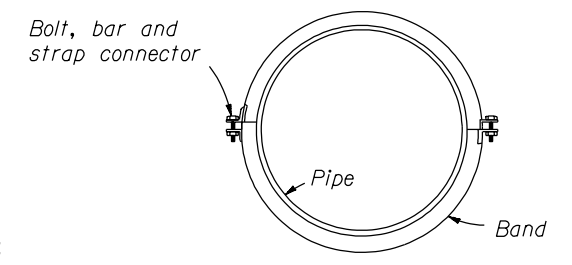
Rivet, spot weld, or fillet weld at crest of corrugation at heel and toe of angle.



**END VIEW**

Second angle connection optional to 1050 mm diameter, required above 1050 mm diameter.

**HELICAL BAND**



**END VIEW**

**SEMI-CORRUGATED BAND**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

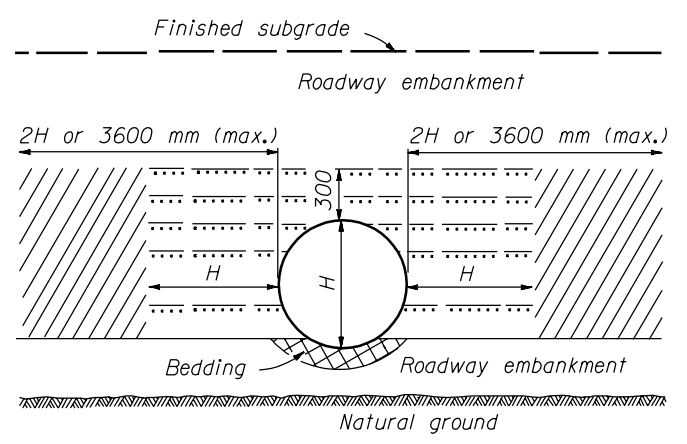
**METRIC STANDARD**

**METAL PIPE CULVERT  
COUPLING BAND**

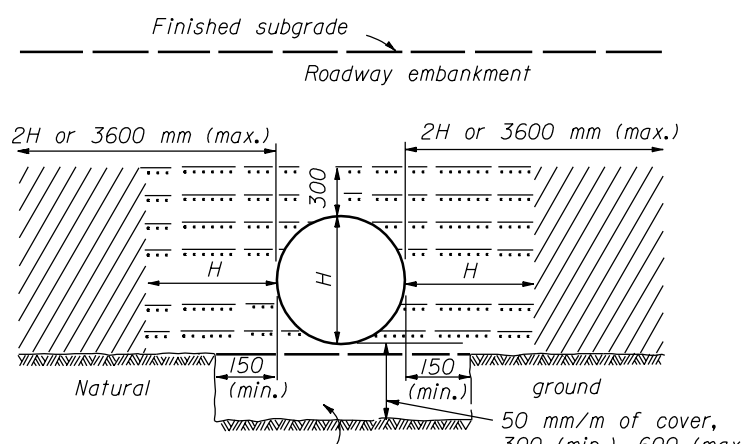
STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M602-2**

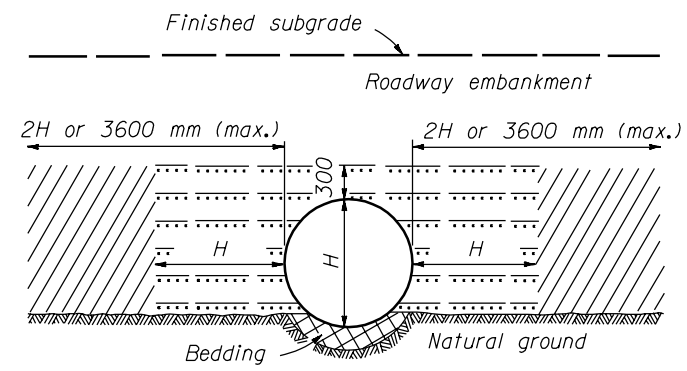
NO SCALE



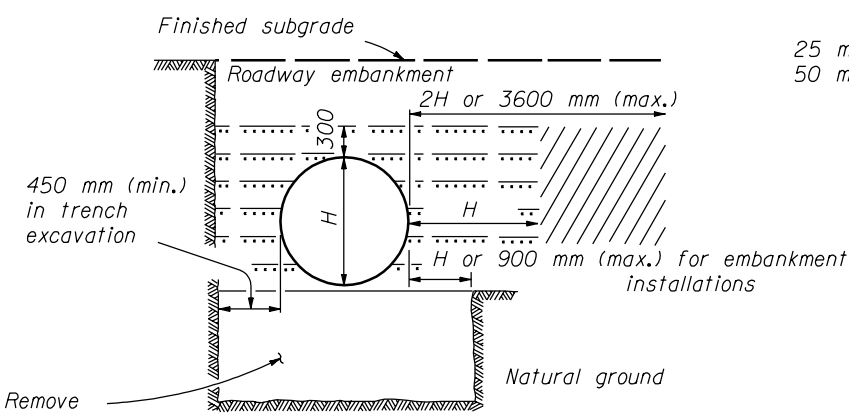
**ABOVE NATURAL GROUND**



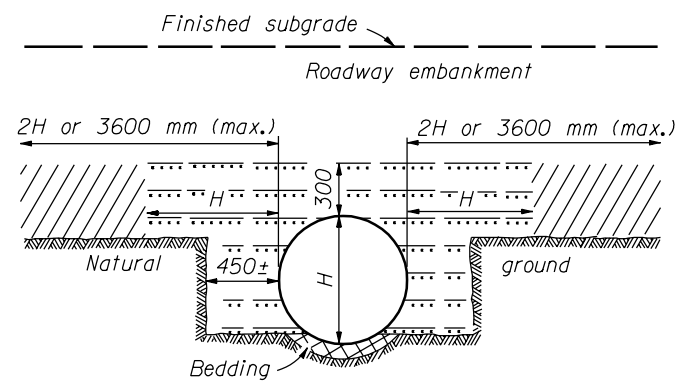
**ON UNYIELDING MATERIAL**



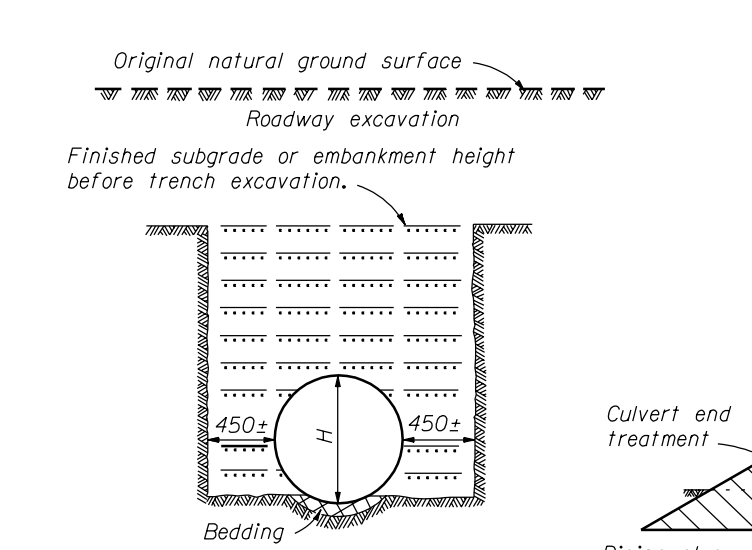
**ON NATURAL GROUND**



**ON UNSTABLE MATERIAL**

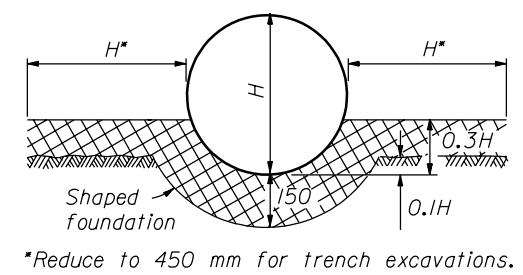


**ABOVE AND BELOW NATURAL GROUND**

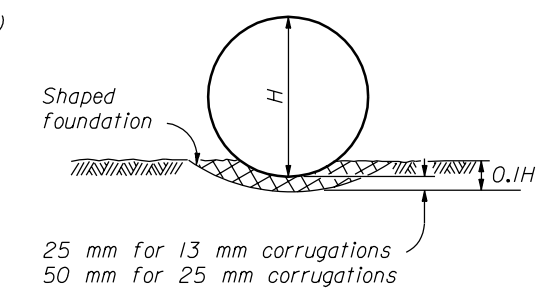


**BELOW NATURAL GROUND OR TRENCH EXCAVATION IN EMBANKMENT**

- Bedding material
- Embankment material placed in layers not exceeding 150 mm compacted depth.
- Approved granular material or fine compactable soil placed in layers not exceeding 150 mm compacted depth.



**CLASS B BEDDING**



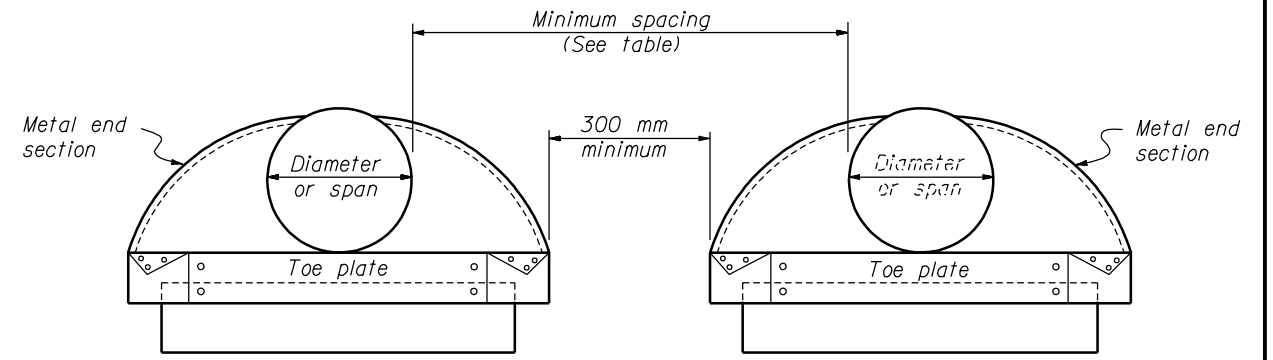
**CLASS C BEDDING**

**NOTE:**

1. Dimensions not labeled are in millimeters.
2. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
3. H equals the diameter of all round pipe culverts or the rise dimension of all pipe arch culverts.
4. Bed pipe culverts 1200 mm and larger in diameter and pipe arch culverts 960 mm and greater in rise in Class B bedding. Bed smaller pipe culverts in Class B or C bedding.

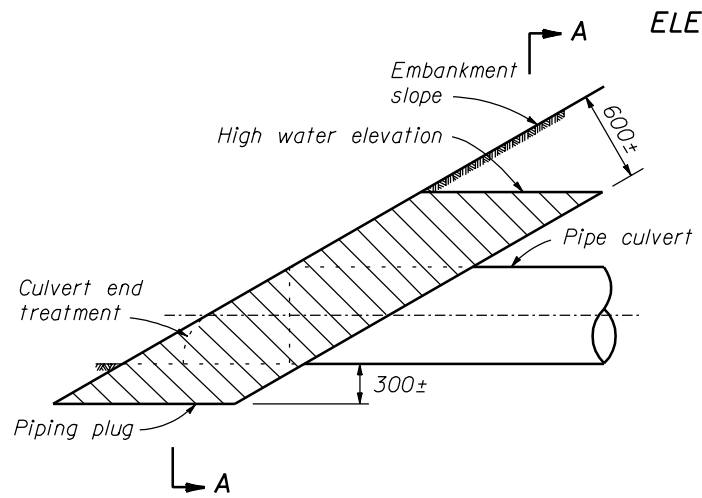
MINIMUM SPACING	
DIAMETER or SPAN	SPACING
UP to 1200	610
1200 and UP	0.5 Diameter or span or 900 whichever is less

**MULTIPLE PIPE INSTALLATION**



**ELEVATION**

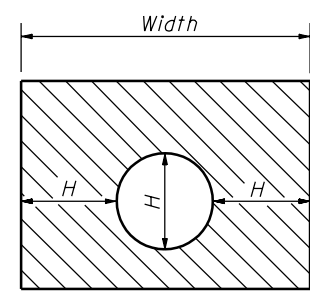
**ELEVATION**



**PIPING PLUG**

Construct piping plug of impermeable backfill material at the pipe culvert inlet where granular material is used for backfill. Width may be adjusted to tie into impervious material.

NO SCALE



**SECTION A-A**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

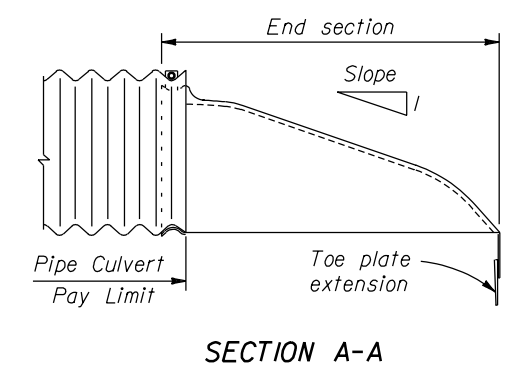
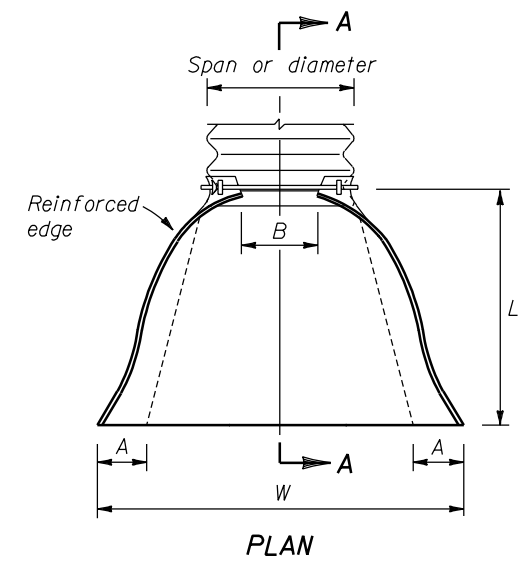
**METAL AND PLASTIC PIPE CULVERT BEDDING**

STANDARD APPROVED FOR USE 3/1996  
REVISED: 12/1998

STANDARD  
**M602-3**

### END SECTIONS FOR PIPE ARCH CULVERT

PIPE SIZE SPAN X RISE	STEEL	ALU-MINUM	DIMENSIONS						SLOPE Approx.
	METAL THICKNESS		A	B	H	F	L	W	
430 x 330	1.63	1.52	125	225	150	700	500	1300	2.1
530 x 380	1.63	1.52	150	275	150	850	600	1450	2.0
610 x 460	1.63	1.52	175	300	150	1000	700	1575	2.1
710 x 510	1.63	1.52	175	400	150	1150	800	1750	2.0
885 x 610	2.01	1.91	225	400	150	1450	925	2125	1.9
1060 x 740	2.01	1.91	275	450	175	1825	1150	2600	1.9
1240 x 840	2.77	2.67	300	525	225	2050	1325	2925	1.8
1440 x 990	2.77	2.67	400	650	300	2200	1550	3300	1.9
1620 x 1100	2.77	2.67	425	750	300	2500	1725	3600	1.9
1520 x 1170	2.77	2.67	425	900	300	2500	1750	3550	1.9
1800 x 1200	2.77	2.67	425	900	300	2800	1925	3900	1.9
1670 x 1300	2.77	2.67	425	900	300	2800	1925	3900	1.8
1950 x 1320	2.77	2.67	425	900	300	3100	1925	4175	1.6
1850 x 1400	2.77	2.67	425	900	300	3100	1925	4200	1.5
2110 x 1450	2.77	2.67	425	1100	300	3250	1925	4425	1.5
2050 x 1500	2.77	2.67	425	1100	300	3400	1925	4475	1.6
2200 x 1620	2.77	2.67	425	1100	300	3400	1925	4650	1.5
2400 x 1720	2.77	2.67	425	1100	300	4000	2175	5250	1.5
2600 x 1820	2.77	2.67	425	1100	300	4300	2175	5550	1.3
2840 x 1920	2.77	2.67	425	1100	300	4300	2175	5650	1.2



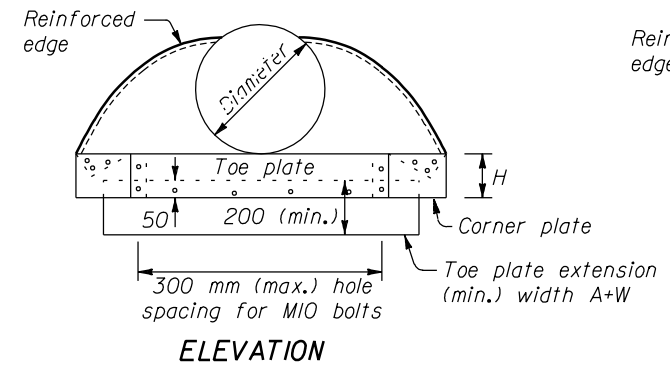
ROUND OR PIPE ARCH CULVERT

**NOTE:**

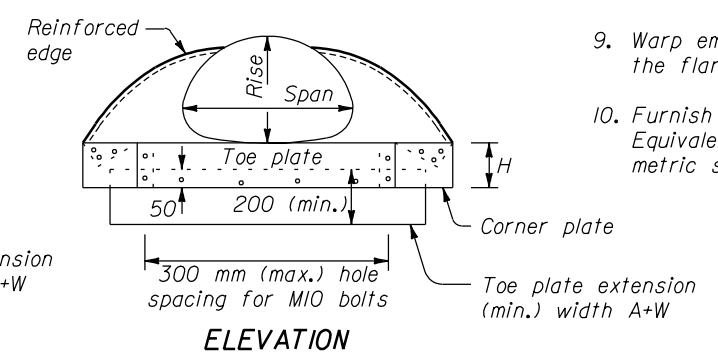
- Dimensions not labeled are in millimeters.
- Variations in design and dimensions are permitted to allow for manufacturer's standards.
- Fabricate the diameter of the end section of Design B to match the inside diameter of the concrete pipe culvert.
- Design C may be used in lieu of design A for all metal pipe culvert sizes. Coupling bands may be any acceptable type for the pipe culvert specified.
- Fabricate multiple piece bodies with lap seams tightly joined by M10 rivets or bolts. Fabricate end section center panels for 1500 mm and larger diameter pipe and 1800 x 1200 mm and larger pipe arch from 3.51 mm steel or 3.43 mm aluminum.
- On end section center panels for 1950 x 1320, 1850 x 1400 mm and larger pipe arch, provide 64 x 64 x 6.4 mm angle reinforcement bolted or riveted under the center panel seam.
- Supplement the reinforced edges of end sections for 1500 mm and larger diameter pipe and 1950 x 1320, 1850 x 1400 mm and larger pipe arch with 51 x 51 x 6.4 mm stiffener angles attached with bolts or rivets.
- Fabricate connector section, corner plate and toe plate extensions from the same metal thickness as the panel body. Use toe plate extension where shown on the plans.
- Warp embankment slopes to match the slope of the flared end sections.
- Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.

### END SECTIONS FOR ROUND PIPE CULVERT

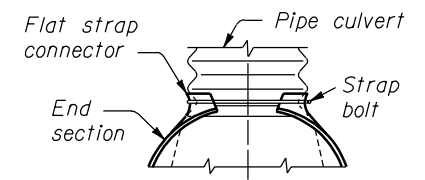
PIPE SIZE DIAMETER	STEEL	ALU-MINUM	DIMENSIONS						SLOPE Approx.
	METAL THICKNESS		A	B	H	F	L	W	
300	1.63	1.52	125	175	150	550	525	1100	2.2
375	1.63	1.52	150	200	150	700	650	1300	2.2
450	1.63	1.52	175	250	150	850	775	1450	2.1
600	1.63	1.52	225	325	150	1150	1025	1800	2.1
750	2.01	1.91	275	400	200	1375	1275	2200	2.1
900	2.01	1.91	325	475	225	1750	1500	2650	2.0
1050	2.77	2.67	375	625	250	2050	1725	3050	2.1
1200	2.77	2.67	425	725	300	2200	1950	3275	2.0
1350	2.77	2.67	425	825	300	2500	2100	3575	2.0
1500	2.77	2.67	425	900	300	2800	2175	3925	1.9
1650	2.77	2.67	425	975	300	2950	2175	4050	1.6
1800	2.77	2.67	425	1100	300	3000	2175	4225	1.5
1950	2.77	2.67	425	1200	300	3250	2175	4450	1.4
2100	2.77	2.67	425	1300	300	3400	2175	4600	1.3
2250	2.77	2.67	425	1450	300	3550	2175	4700	1.2
2400	2.77	2.67	425	1450	300	3600	2175	4925	1.1



ROUND PIPE CULVERT

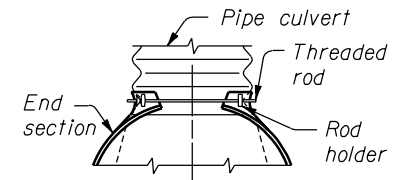


PIPE ARCH CULVERT

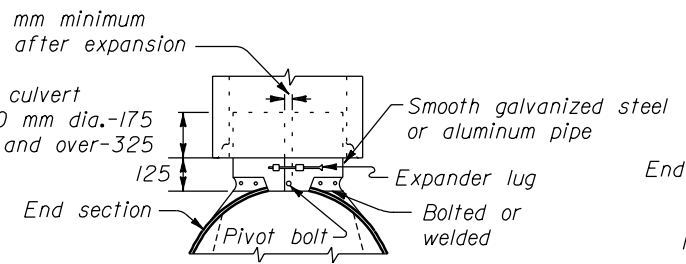


For 300 thru 600 mm round pipe and 430 x 330 thru 710 x 510 mm pipe arch.

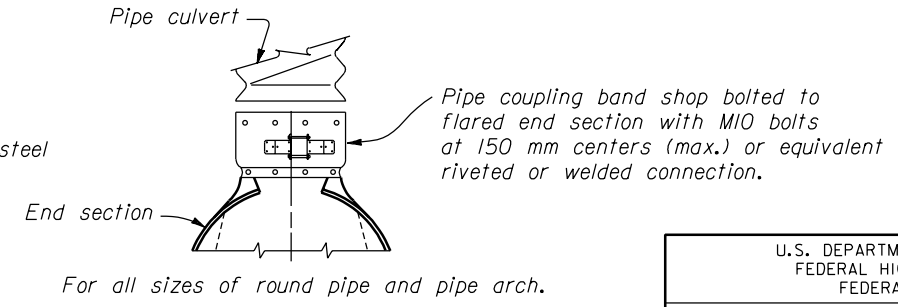
**DESIGN A**  
CONNECTION TO ANNULAR CORRUGATED METAL PIPE



For 750 thru 1500 mm round pipe and 890 x 610 thru 1670 x 1290 mm pipe arch.



**DESIGN B**  
CONNECTION TO CONCRETE PIPE INLET END



**DESIGN C**  
CONNECTION TO METAL PIPE OR OUTLET END OF CONCRETE PIPE  
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

**METAL END SECTION**

STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M602-4**

17 NOV 2000 f:\standrow\metric\m60204.dgn

**POLYETHYLENE (PE) PLASTIC ROUND PIPE CULVERT**

FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 3350

SMOOTH WALL, CORRUGATED AND RIBBED PIPE CULVERT

SMOOTH WALL (SOLID WALL)								CORRUGATED				RIBBED							
PIPE SIZE DIAMETER	MINIMUM COVER	CELL CLASSIFICATION NUMBER 335434C						PIPE SIZE DIAMETER	MINIMUM COVER	CELL CLASS. NO. 315412C	CELL CLASS. NO. 324420C	PIPE SIZE DIAMETER	MINIMUM COVER	CELL CLASS. NO. 334433C	CELL CLASS. NO. 335434C				
		MINIMUM WALL THICKNESS														MAXIMUM FILL HEIGHT IN METERS			
		15.4	21.7	23.4	29.3	35.1	32.8									37.5			
300	300	17.5						300	300	3.5	3.0	450	300	5.5	7.5				
450	300		16					375	300	3.5	3.0	600	300	6.5	8.5				
600	300			11.5				450	300	3.5	3.0	750	300	6.5	8.5				
750	300				11.5			600	300	3.5	3.0	900	300	7.5	9.5				
900	300					11.5		750	300	3.5	3.0	1050	300	6.5	8.0				
1050	300						8.0	900	300	3.5	3.0	1200	300	6.5	8.0				
1200	300						8.0												

**NOTE:**

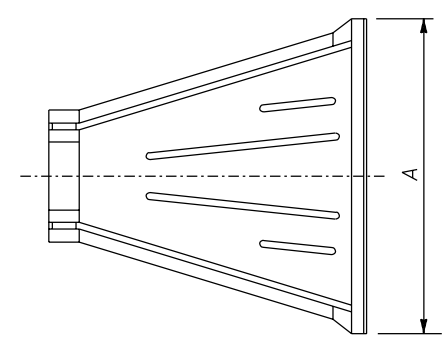
- Dimensions not labeled are in millimeters.
- When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
- Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.

**POLYVINYL CHLORIDE (PVC) PLASTIC ROUND PIPE CULVERT**

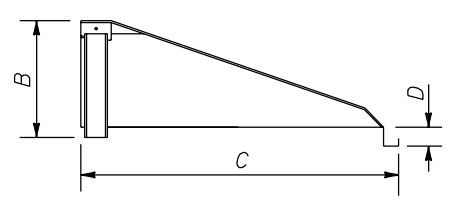
FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 1784

SMOOTH WALL AND RIBBED PIPE CULVERT

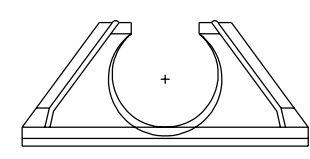
SMOOTH WALL (SOLID WALL)						RIBBED							
PIPE SIZE DIAMETER	MINIMUM COVER	CELL CLASS. NO. 12454C		CELL CLASS. NO. 12364C		PIPE SIZE DIAMETER	MINIMUM COVER	CELL CLASS. NO. 12454C	CELL CLASS. NO. 12364C				
		MINIMUM WALL THICKNESS								MAXIMUM FILL HEIGHT IN METERS			
		9.1	11.1	9.1	11.1								
300	300	20		21		300	300	11.0	8.0				
375	300		19		20	375	300	9.5	6.5				
						450	300	10.0	7.0				
						600	300	9.0	6.5				
						750	300	8.5	6.0				
						900	300	8.5	6.0				
						1050	300	8.0	5.5				
						1200	300	7.5	5.5				



TOP



SIDE



FRONT

**PLASTIC PIPE END SECTION**

PIPE SIZE DIAMETER	DIMENSIONS			
	A	B	C	D
300	1065	370	840	150
375	1170	620	1155	150
450	1370	735	1395	150
600	1625	940	1650	150
750	2235	915	1615	150
900	2235	1090	1690	150

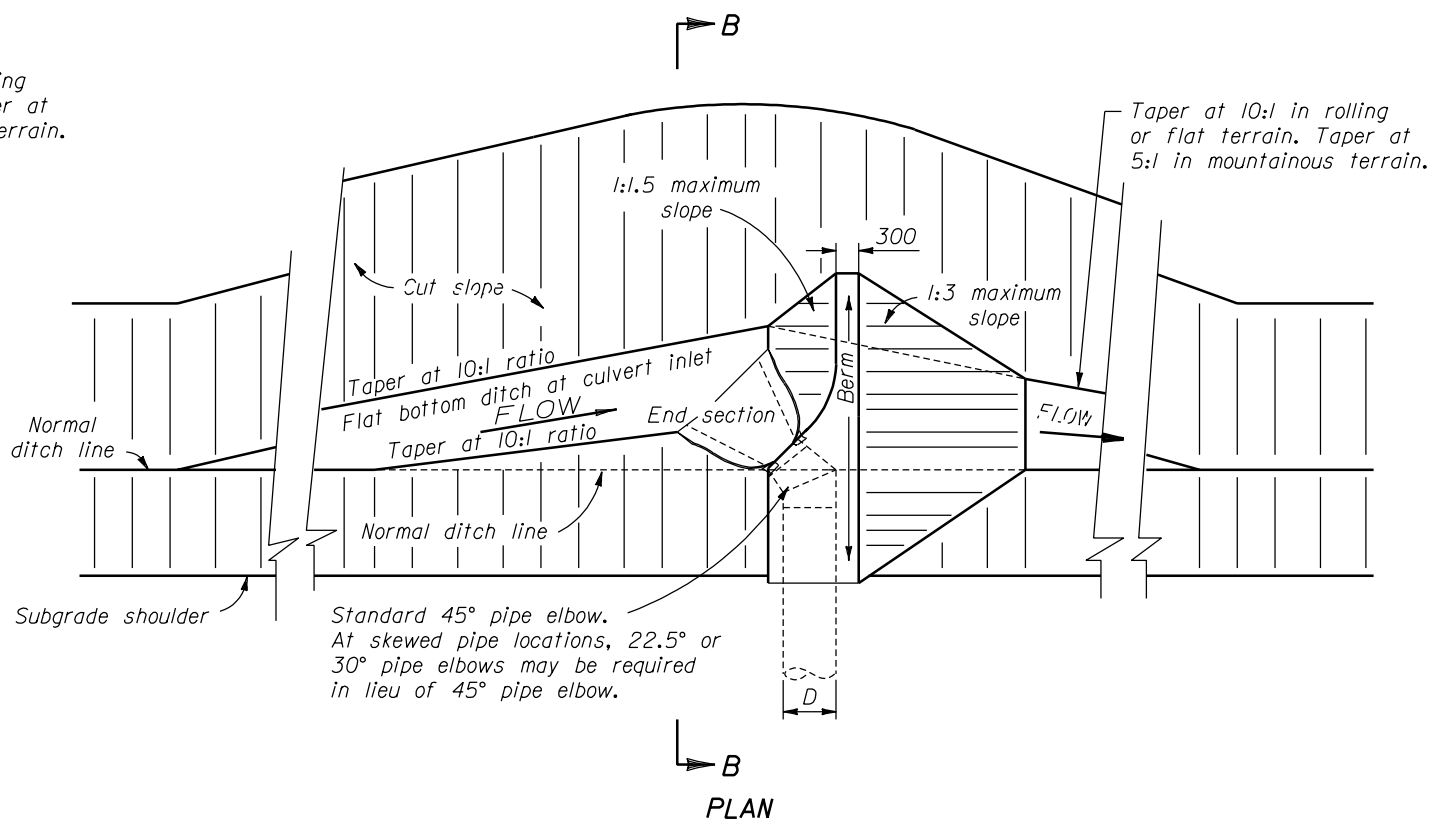
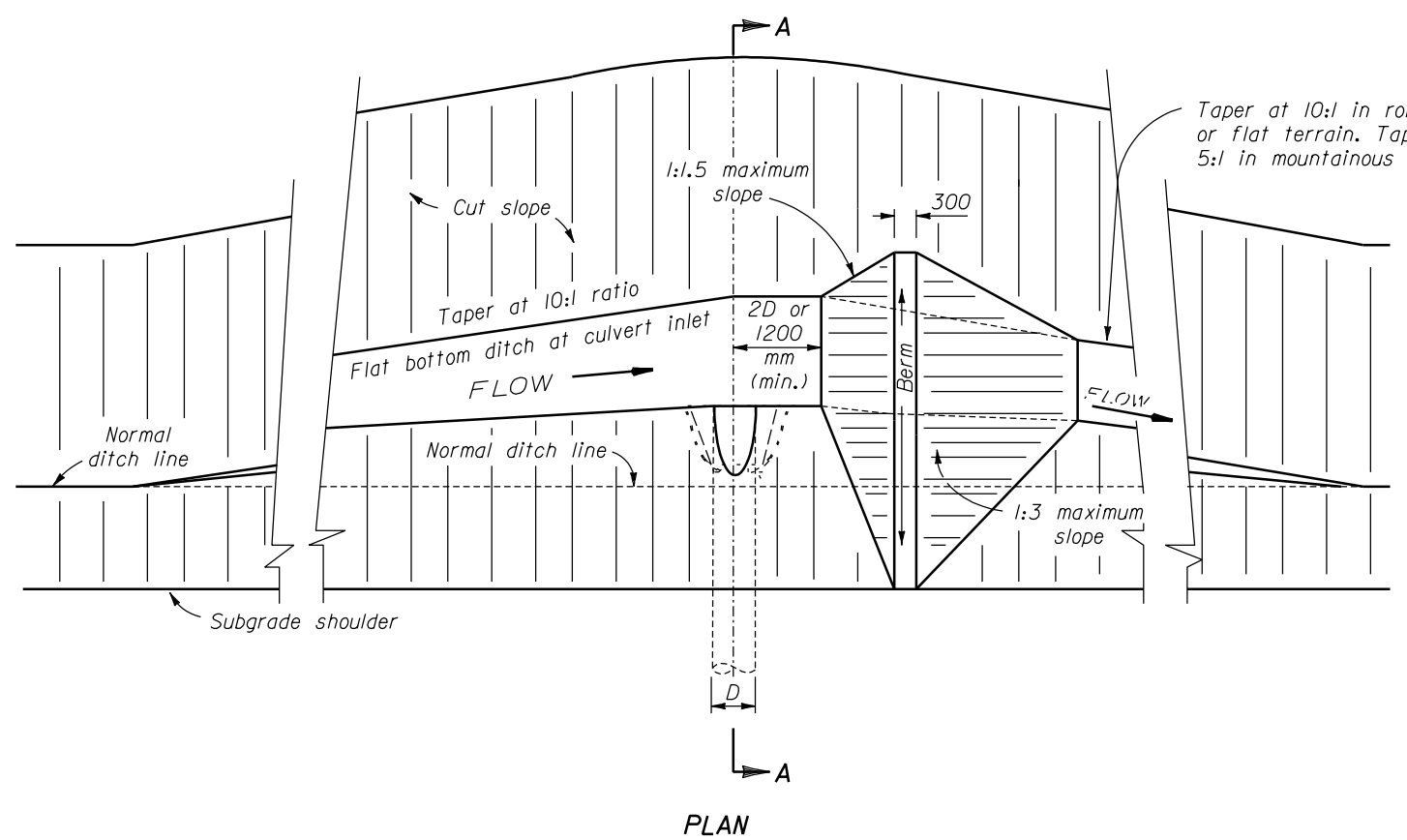
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
PLASTIC PIPE CULVERT	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED:	M602-5

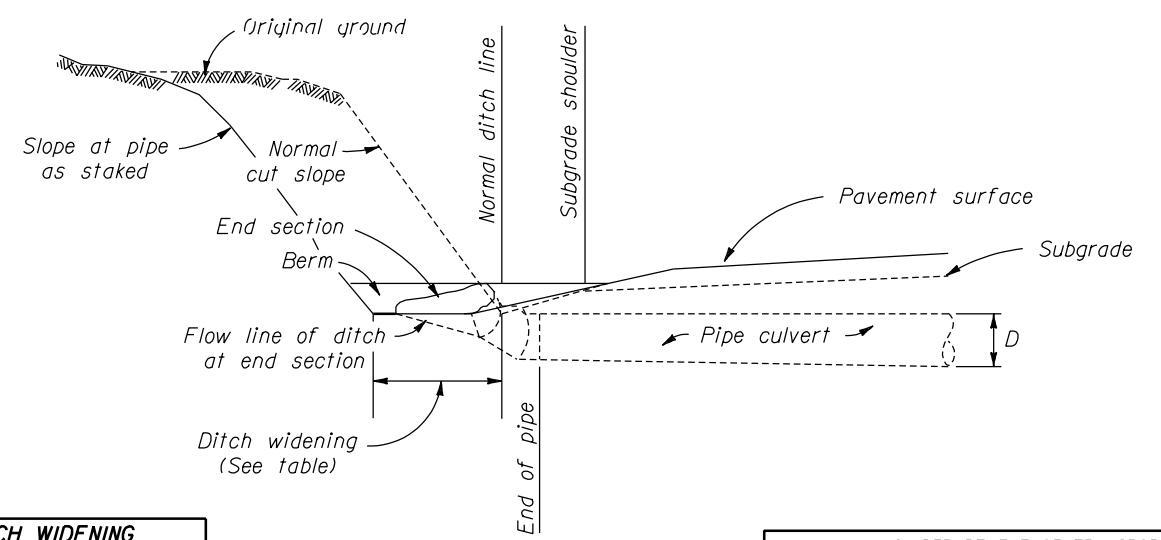
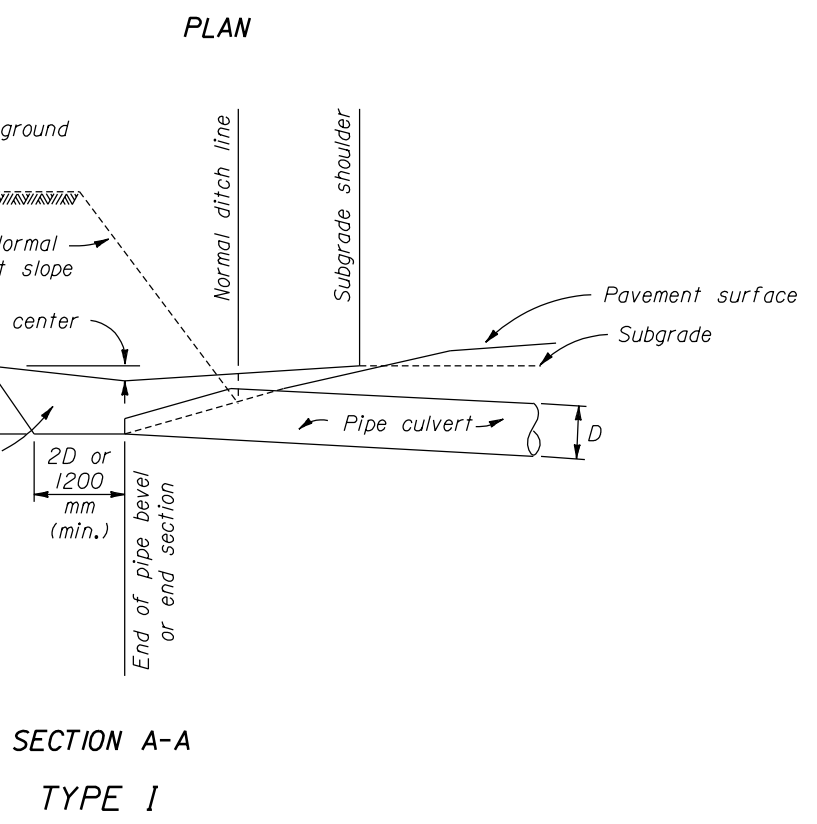
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**NOTE:**

- Dimensions not labeled are in millimeters.
- D equals the diameter of all round pipe or the rise dimension of all pipe arch culverts.



Standard 45° pipe elbow.  
At skewed pipe locations, 22.5° or 30° pipe elbows may be required in lieu of 45° pipe elbow.



DITCH WIDENING	
PIPE SIZE (D)	WIDENING
450	1500
600	1800
750	2100

**SECTION B-B  
TYPE II**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

**PIPE CULVERT INLET  
TREATMENT IN CUT SLOPES**

STANDARD APPROVED FOR USE 3/1996  
REVISED:




STANDARD  
**M602-6**

NO SCALE

17 NOV 2000  
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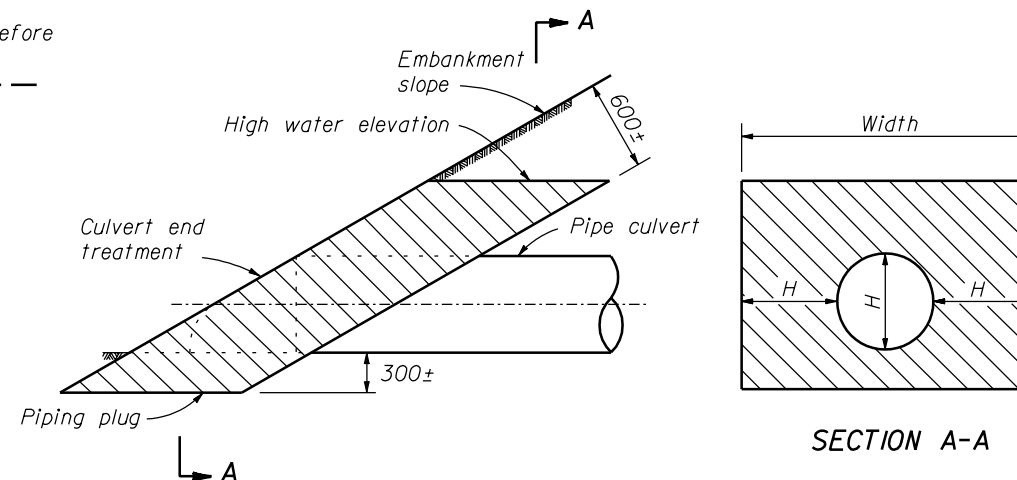
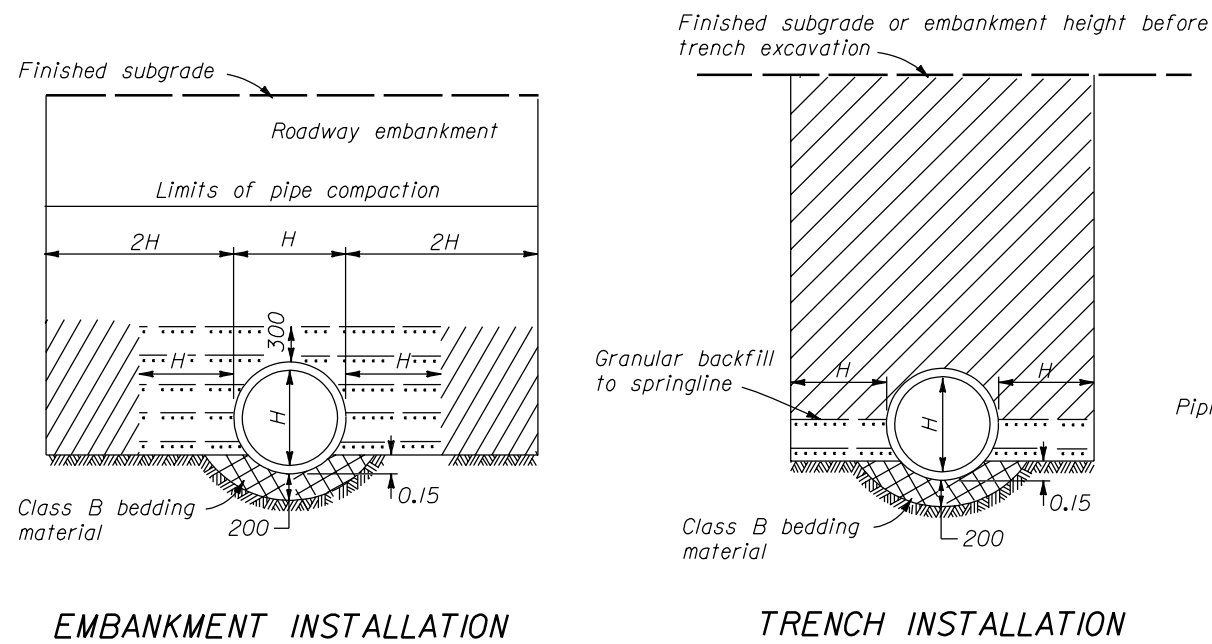
CONCRETE ROUND PIPE CULVERT									
FILL HEIGHT AND PIPE CLASS TABLE									
PIPE SIZE DIAMETER	EMBANKMENT MINIMUM COVER	EMBANKMENT				TRENCH			
		CLASS II	CLASS III	CLASS IV	CLASS V	CLASS II	CLASS III	CLASS IV	CLASS V
MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE IN METERS									
300	300	3	3.0	4.5	7.0	5.5	5.5	8.0	4.0
450	300	3	3.0	7.5	12.0	4.0	4.0	9.0	13.5
600	300	3	3.0	4.5	9.0	4.5	4.5	6.5	12.0
750	300	2.5	4.0	4.5	10.5	4.0	5.0	6.0	14.0
900	300	2.5	2.5	6.0	12.5	3.0	4.0	8.0	17.0
1200	300	3.5	4.0	8.0	13.5	4.5	5.0	9.0	15.0
1500	300	4.5	5.0	8.5	13.5	4.5	6.0	9.5	15.0
1800	300	4.0	5.0	9.0	12.5	4.5	6.0	10.5	15.0
2100	300	4.0	5.5	9.0		4.5	7.0	11.0	
2400	300	4.0	6.0			4.5	7.0		
2700	350	4.5	6.0			5.5	8.0		

**LEGEND:**

-  Bedding material
-  Embankment material placed in layers not exceeding 150 mm compacted depth.
-  Approved granular material or fine compactable soil placed in layers not exceeding 150 mm compacted depth.

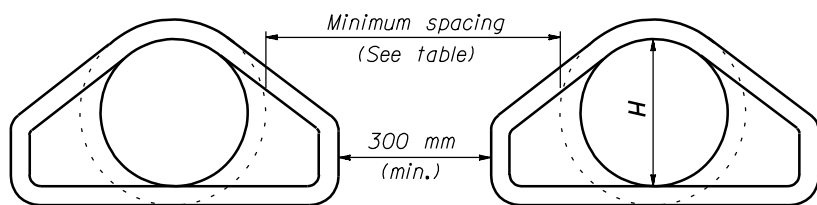
**NOTE:**

- Dimensions not labeled are in millimeters.
- When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
- Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavements.
- Pipe compaction limits shown are for pipe installation in an embankment. For pipe installation in a trench, the compaction limits shall be the walls of the trench.
- Where unyielding or unstable material is encountered, install the pipe culvert according to the limits of pipe compaction shown on Standard M602-3.
- When grades exceed 10% install supplemental concrete pipe ties on pipe culvert or install bell and spigot pipe.
- Maximum fill heights for pipe culvert installations may be increased on approval of site-specific structural pipe designs meeting the criteria of AASHTO Standard Specifications for Highway Bridges.



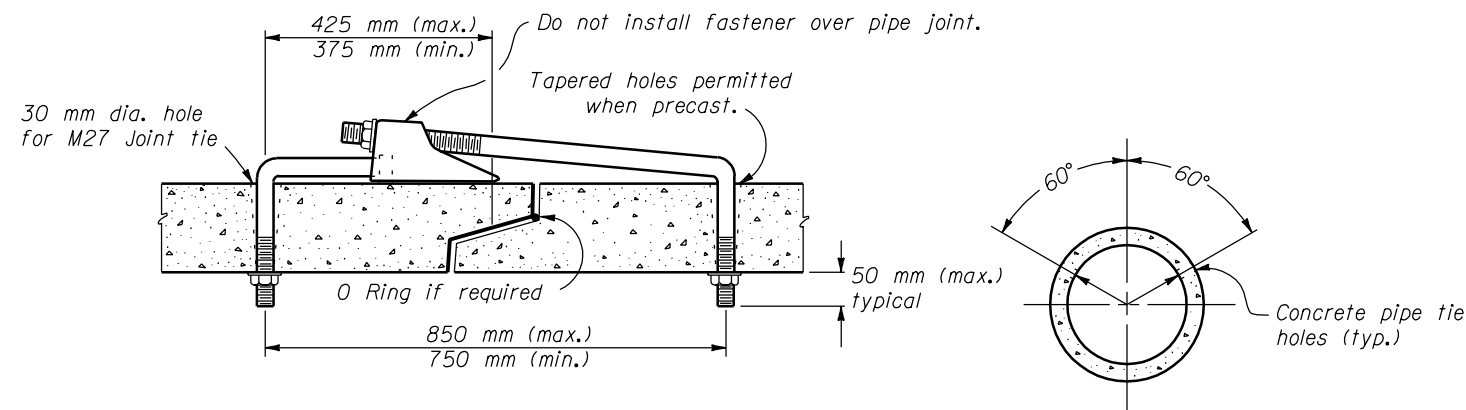
Construct a piping plug of impermeable backfill material at the pipe inlet where granular material is used for backfill. Width may be adjusted to tie into impervious material.

**PIPING PLUG**



MINIMUM SPACING		
DIAMETER	EMBANKMENT	TRENCH
300-900	380	2H
900-2400	0.5H	1830
OVER 2400	1220	1830

**MULTIPLE ROUND PIPE INSTALLATION**



**SUPPLEMENTAL CONCRETE PIPE TIE**

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FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

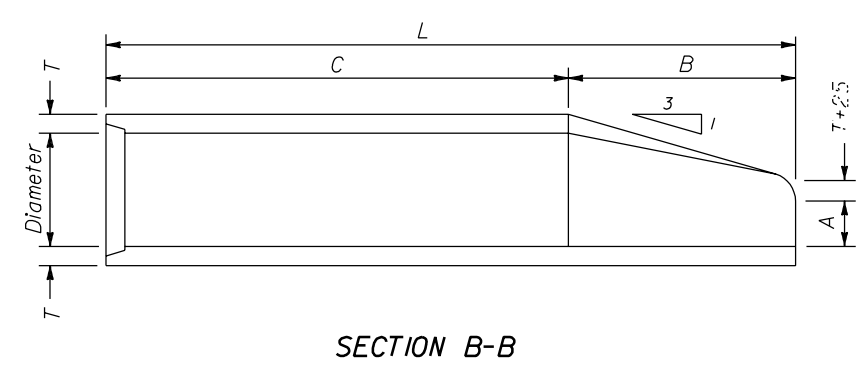
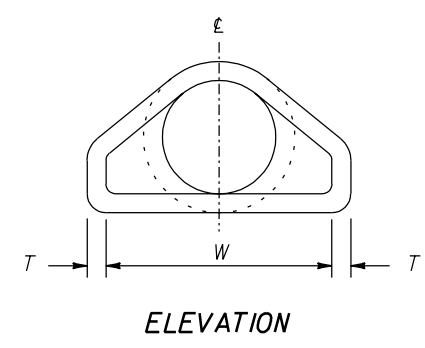
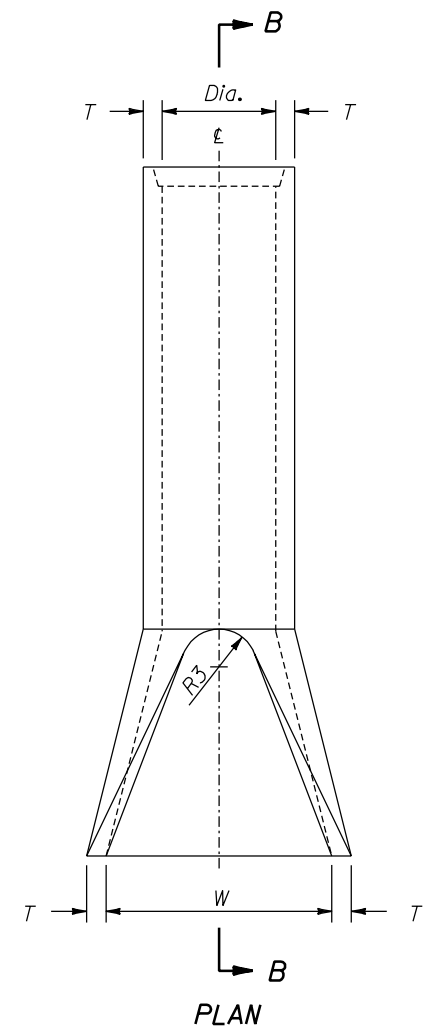
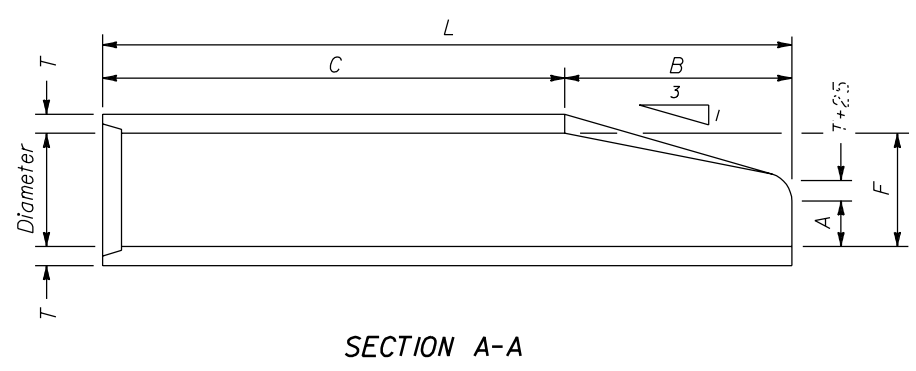
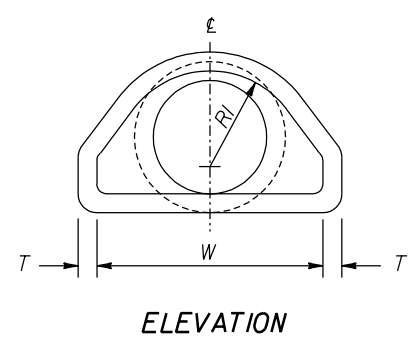
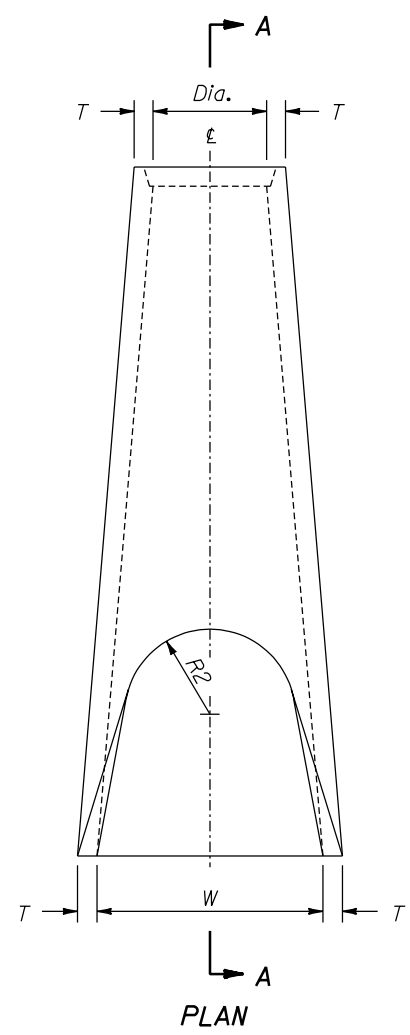
**METRIC STANDARD**

**CONCRETE PIPE CULVERT INSTALLATION**

STANDARD APPROVED FOR USE 3/1996

REVISOR: STANDARD M602-7

NO SCALE



**NOTE:**

1. Dimensions not labeled are in millimeters.
2. Variations in design and dimensions are permitted to allow for manufacturer's standards.
3. Fabricate the outlet end section with a groove end and the inlet end section with a tongue end.
4. Warp embankment slopes to match the slope of the flared end section.

END SECTIONS FOR ROUND PIPE CULVERT										
PIPE SIZE DIAMETER	DIMENSIONS									
	T	A	B	C	L	W	F	R1	R2	R3
300	50	100	600	1222	1822	600	325	253	225	100
375	57	150	675	1150	1825	750	400	312	275	150
450	63	225	675	1150	1825	900	475	388	300	188
525	69	225	900	925	1825	1050	550	412	325	125
600	75	238	1088	750	1838	1200	625	420	350	200
675	82	263	1200	638	1838	1350	700	--	362	225
750	88	300	1350	494	1844	1500	775	462	375	200
825	94	345	1485	938	2400	1650	865	594	438	225
900	100	375	1585	825	2400	1800	925	580	500	275
1050	113	525	1585	825	2400	1950	1095	--	550	275
1200	125	600	1800	600	2400	2100	1225	--	550	300

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

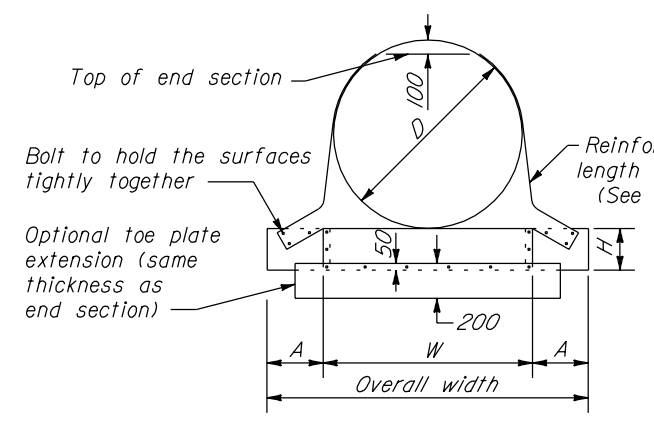
**CONCRETE END SECTION  
FOR ROUND PIPE**

STANDARD APPROVED FOR USE 3/1996

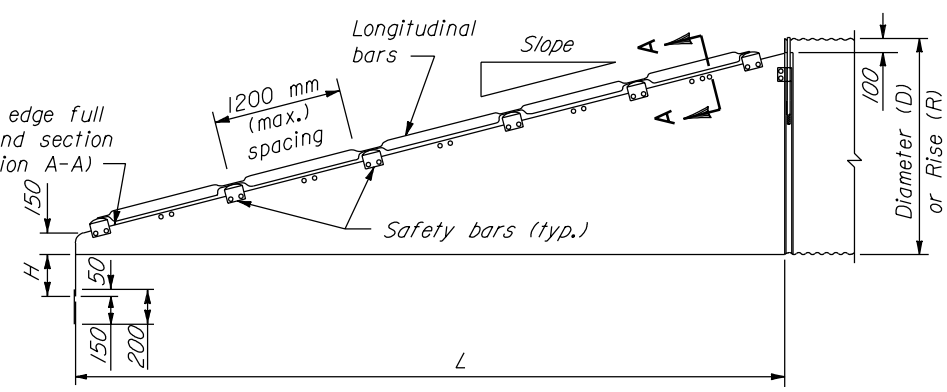
REVISID: STANDARD  
**M602-8**

NO SCALE

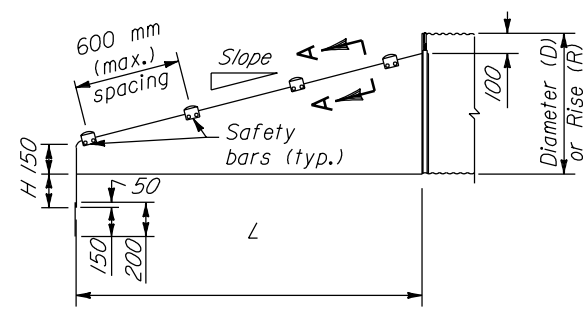




**FRONT VIEW  
ROUND PIPE CULVERT**

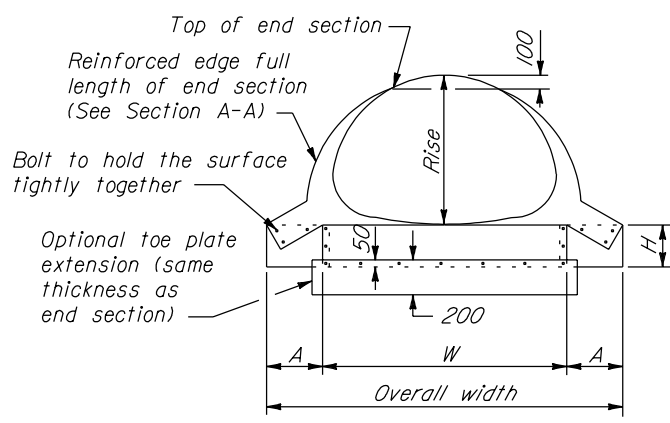


**ELEVATION  
CROSS DRAINAGE END SECTION**

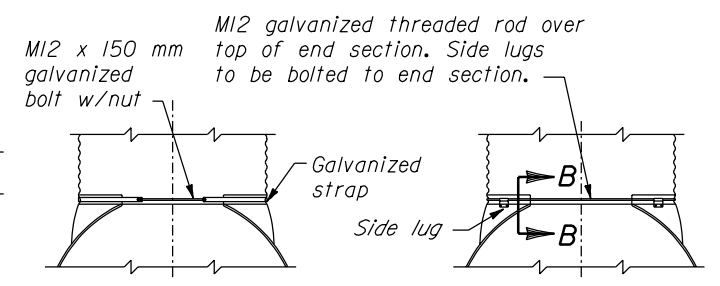


**ELEVATION  
PARALLEL DRAINAGE END SECTION**

- NOTE:**
1. Dimensions not labeled are in millimeters.
  2. Use end sections on 1:4 to 1:6 slopes only. Use toe plate extension where shown on the plans.
  3. Fabricate safety and longitudinal bars from steel pipe conforming to ASTM A53 schedule 40 specifications. Galvanize bars hot dipped after fabrication.
  4. A longitudinal bar is required for cross drainage end sections when the span is greater than 750 mm. Use additional longitudinal bars if spacing exceeds 750 mm on larger end sections.
  5. Safety and longitudinal bars are not required on 750 mm and smaller cross drainage end sections.
  6. Safety bars are not required on 450 mm and smaller parallel drainage end sections.
  7. 450 mm diameter sleeves have a thickness of 2.01 mm, all others are 2.77 mm.
  8. Provide hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.

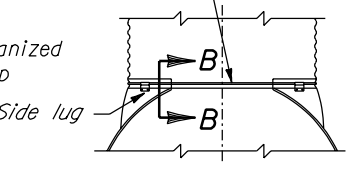


**FRONT VIEW  
PIPE ARCH CULVERT**



**FOR METAL ROUND PIPES  
375 mm THRU 600 mm**

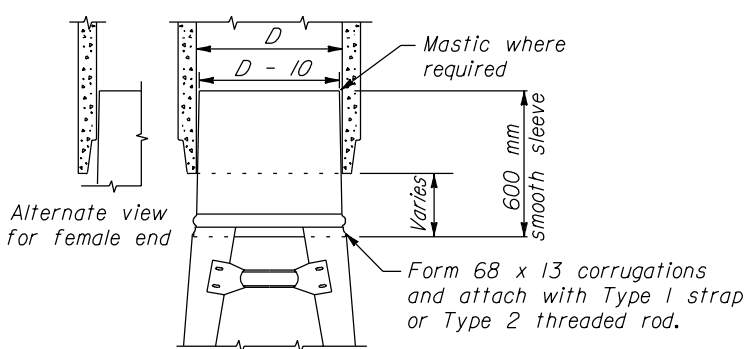
**TYPE #1**



**FOR METAL ROUND PIPES 750 mm  
AND LARGER. FOR PIPE ARCHES  
525 x 375 mm AND LARGER**

**TYPE #2**

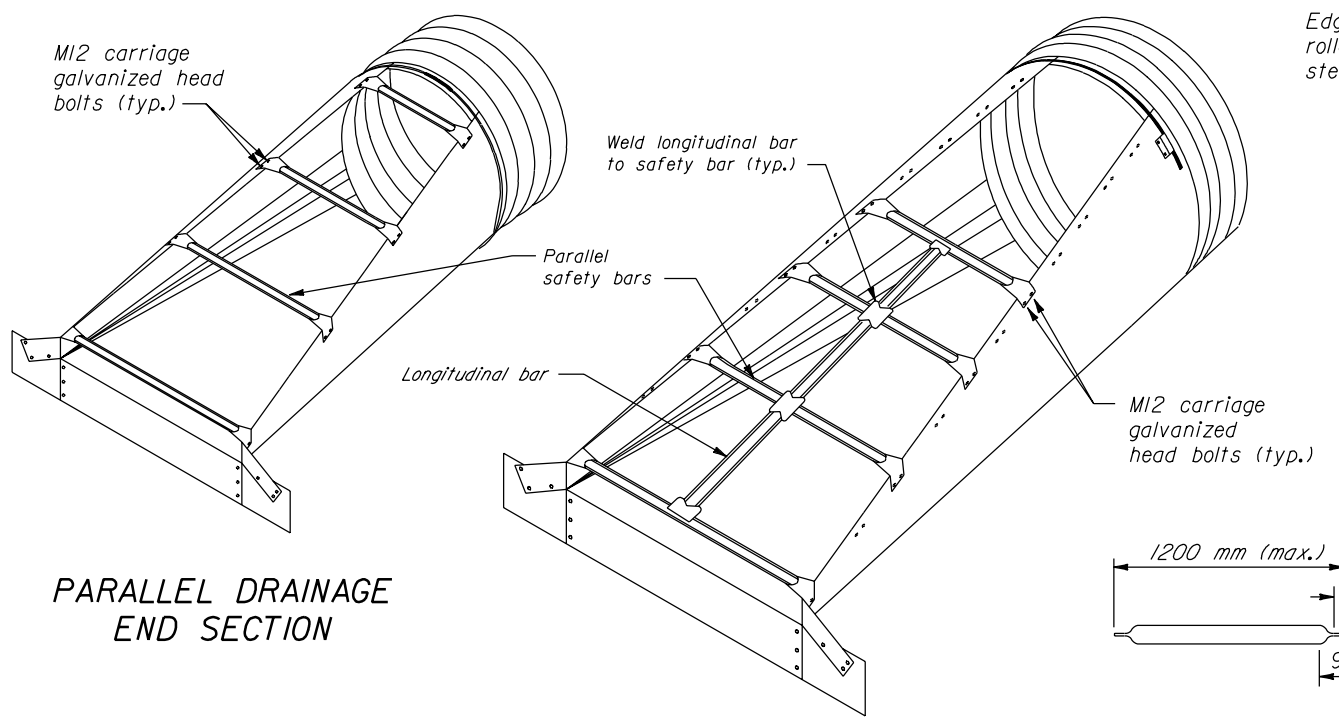
**CONNECTOR DETAILS**



**FOR ALL SIZES OF CONCRETE  
ROUND OR PIPE ARCHES**

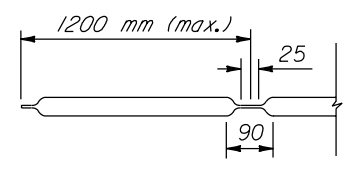
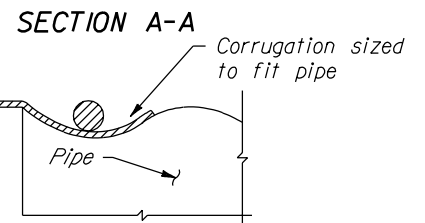
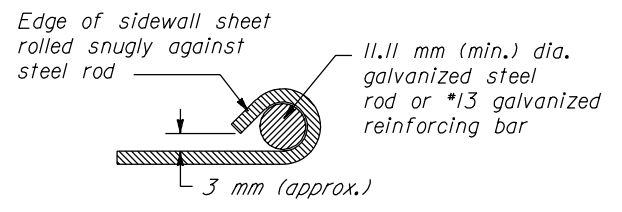
**TYPE #3**

METAL END SECTIONS FOR ROUND PIPE CULVERT									
DIMENSIONS IN MILLIMETERS									
PIPE DIA.	(MIN.) THICK	A	H	W	OVERALL WIDTH	SLOPE	L	SLOPE	L
450	1.63	200	150	600	1000	1:4	800	1:6	1200
600	1.63	200	150	750	1150	1:4	1400	1:6	2100
750	2.77	300	225	900	1500	1:4	2000	1:6	3000
900	2.77	300	225	1050	1650	1:4	2600	1:6	3900
1050	2.77	400	300	1200	2000	1:4	3200	1:6	4800
1200	2.77	400	300	1350	2150	1:4	3800	1:6	5700
1350	2.77	400	300	1500	2300	1:4	4400	1:6	6600
1500	2.77	400	300	1650	2450	1:4	5000	1:6	7500

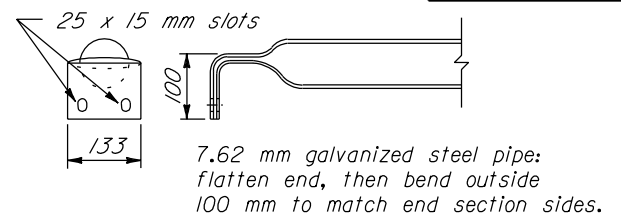


**PARALLEL DRAINAGE  
END SECTION**

**CROSS DRAINAGE END SECTION**



**LONGITUDINAL DRAINAGE BAR**



**PARALLEL BARS**

**SAFETY BAR DETAILS**

METAL END SECTIONS FOR PIPE ARCH CULVERT										
DIMENSIONS IN MILLIMETERS										
EQUIV. DIA.	SPAN	RISE	(MIN.) THICK	A	H	W	OVERALL WIDTH	SLOPE	L	L
450	525	375	1.63	200	150	675	1075	1:4	500	750
600	700	500	1.63	200	150	850	1250	1:4	1000	1500
750	875	600	2.77	300	225	1025	1625	1:4	1400	2100
900	1050	725	2.77	300	225	1200	1800	1:4	1900	2850
1050	1225	825	2.77	400	300	1375	2175	1:4	2300	3450
1200	1425	950	2.77	400	300	1575	2375	1:4	2800	4200
1350	1600	1075	2.77	400	300	1750	2550	1:4	3300	4950
1500	1775	1175	2.77	400	300	1925	2725	1:4	3700	5550
1800	2075	1425	2.77	400	300	2225	3025	1:4	4700	7050

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FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

**METAL END SECTIONS  
WITH SAFETY BARS**

STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M602-9**

NO SCALE

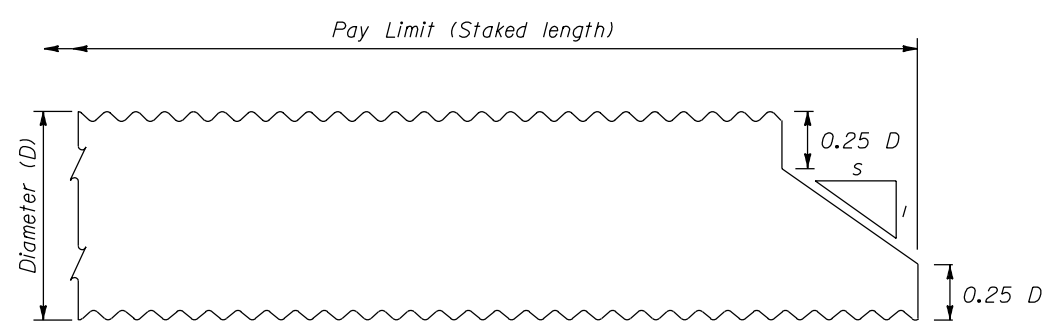
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**STRUCTURAL PLATE PIPE CULVERT**  
FILL HEIGHT AND METAL THICKNESS TABLE

STEEL											ALUMINUM								
PIPE SIZE	MINIMUM COVER	152 x 51 CORRUGATIONS									PIPE SIZE	MINIMUM COVER	230 x 64 CORRUGATIONS						
		METAL THICKNESS/BOLTS PER CORRUGATION											METAL THICKNESS/BOLTS PER CORRUGATION						
		2.82/2	3.56/2	4.32/2	4.79/2	5.54/2	6.32/2	7.11/2	7.87/3	9.65/4			2.54/4	3.18/4	3.81/4	4.44/4	5.08/4	5.72/4	6.35/4
DIAMETER		MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE IN METERS									DIAMETER		MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE IN METERS						
1500	300	14.0	20.7	27.4	30.0	30.0	30.0	30.0	30.0	30.0	1500	375	9.5	13.7	18.3	21.3	24.7	28.0	30.0
1655	300	12.8	18.9	24.7	28.4	30.0	30.0	30.0	30.0	30.0	1655	375	8.5	12.5	16.5	19.5	22.6	25.6	28.7
1810	300	11.6	17.4	22.9	26.2	30.0	30.0	30.0	30.0	30.0	1810	450	7.6	11.3	15.2	17.7	20.4	23.5	26.2
1965	300	10.7	15.9	21.0	24.1	29.0	30.0	30.0	30.0	30.0	1965	450	7.0	10.7	14.0	16.5	18.9	21.6	24.1
2120	300	10.1	14.9	19.5	22.3	28.8	30.0	30.0	30.0	30.0	2120	450	6.7	9.8	12.8	15.2	17.7	20.1	22.3
2275	300	9.6	13.7	18.3	25.0	28.6	30.0	30.0	30.0	30.0	2275	525	6.1	9.1	12.2	14.3	16.5	18.6	20.7
2430	300	8.8	13.1	17.1	19.6	23.5	27.7	30.0	30.0	30.0	2430	525	5.8	8.5	11.3	13.4	15.2	17.4	19.5
2585	450	8.2	12.2	15.9	18.3	22.3	26.2	28.7	30.0	30.0	2585	600	5.5	7.9	10.7	12.5	14.3	16.5	18.3
2740	450	7.6	11.6	15.2	17.4	21.0	24.7	26.8	30.0	30.0	2740	600	5.2	7.6	10.1	11.9	13.7	15.5	17.4
2895	450	7.3	11.0	14.3	16.5	19.8	23.5	25.6	30.0	30.0	2895	675	4.9	7.0	9.5	11.3	12.8	14.6	16.5
3050	450	7.0	10.4	13.7	15.5	18.9	22.3	24.4	30.0	30.0	3050	675	4.6	6.7	9.1	10.7	12.2	14.0	15.5
3205	450	6.7	9.8	12.8	14.9	18.0	21.0	23.2	29.0	30.0	3205	750	4.3	6.4	8.5	10.1	11.6	13.4	14.9
3360	450	6.4	9.5	12.2	14.0	17.1	20.1	22.0	27.7	29.6	3360	750	4.3	6.1	8.2	9.8	11.3	12.8	14.3
3515	450	6.1	8.8	11.9	13.4	16.5	19.2	21.0	26.5	28.4	3515	825	4.0	5.8	7.9	9.1	10.7	12.2	13.4
3670	450	5.8	8.5	11.3	13.1	15.5	18.6	20.1	25.3	27.1	3670	825	3.7	5.5	7.6	8.8	10.1	11.6	13.1
3825	600	5.5	8.2	11.0	12.5	14.9	17.7	19.5	24.4	26.2	3825	825		5.5	7.3	8.5	9.8	11.0	12.5
3980	600	5.2	7.9	10.4	11.9	14.3	17.1	18.6	23.2	25.0	3980	825		5.2	7.0	8.2	9.5	10.7	11.9
4135	600	5.2	7.6	10.1	11.6	14.0	16.6	18.0	22.3	24.1	4135	825			6.7	7.9	9.1	10.4	11.6
4290	600	4.9	7.3	9.8	11.0	13.4	15.9	17.4	21.6	23.2	4290	825			6.4	7.6	8.8	10.1	11.0
4445	600	4.9	7.0	9.5	10.7	12.8	15.2	16.8	20.7	22.6	4445	825			6.1	7.3	8.5	9.5	10.7
4600	600	4.6	6.7	9.1	10.4	12.5	14.6	16.2	20.1	21.6	4600	825				7.0	8.2	9.1	10.4
4755	600	4.6	6.7	8.8	10.1	12.2	14.3	15.5	19.5	21.0	4755	825			6.7	7.9	8.8	10.1	
4910	600		6.4	8.5	9.8	11.6	13.7	15.2	18.9	20.4	4910	900					7.6	8.5	9.8
5065	750		6.1	8.2	9.5	11.3	13.4	14.6	18.3	19.8	5030	900					7.3	8.5	9.5
5220	750		6.1	7.9	9.1	11.0	13.1	14.3	17.7	19.2	5220	900					7.0	8.2	9.1
5375	750		5.8	7.5	8.8	10.7	12.5	13.7	17.1	18.6	5385	900						7.9	8.8
5530	750			7.5	8.5	10.4	12.2	13.4	16.5	18.0	5530	900						7.6	8.5
5685	750			7.3	8.2	10.0	11.9	13.1	16.2	17.7	5685	900							8.2
5840	750			7.0	7.9	9.8	11.6	12.8	15.5	17.1	5840	900							8.2
5995	750			7.0	7.6	9.5	11.3	12.5	15.2	16.8									
6150	900				7.6	9.5	11.0	12.2	14.9	16.2									
6305	900					9.1	10.7	11.9	14.6	15.9									
6460	900					8.8	10.4	11.6	14.0	15.5									
6615	900					8.5	10.4	11.3	13.7	14.9									
6770	900					8.5	10.1	11.0	13.4	11.6									
6925	900					8.2	9.8	10.7	13.1	14.3									
7080	900						9.5	13.4	12.8	14.0									
7235	900						9.5	13.4	12.5	13.7									
7390	900						9.1	10.1	12.2	13.4									
7545	1050							9.8	12.2	13.1									
7700	1050							9.8	11.9	12.8									
7855	1050							9.5	11.6	12.5									

**NOTE:**

- Dimensions not labeled are in millimeters.
- Fabricate the bottom plates one (1) thickness heavier than the side plates but not heavier than 9.65 mm for steel or 6.35 mm for aluminum.
- Fasten plates with galvanized steel M20 bolts and nuts conforming to AASHTO M167M. Imperial sized 3/4 inch bolts and nuts conforming to AASHTO M167 may be used until metric fasteners are available.
- When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
- Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.



$S = 1.5$  for 1:1.5 fill slopes  
 $S = 2$  for 1:2 or flatter slopes

**END TREATMENT DIAGRAM**

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 FEDERAL LANDS HIGHWAY  
**METRIC STANDARD**  
**STRUCTURAL PLATE PIPE CULVERT**  
 STANDARD APPROVED FOR USE 3/1996  
 STANDARD M603-1

NO SCALE

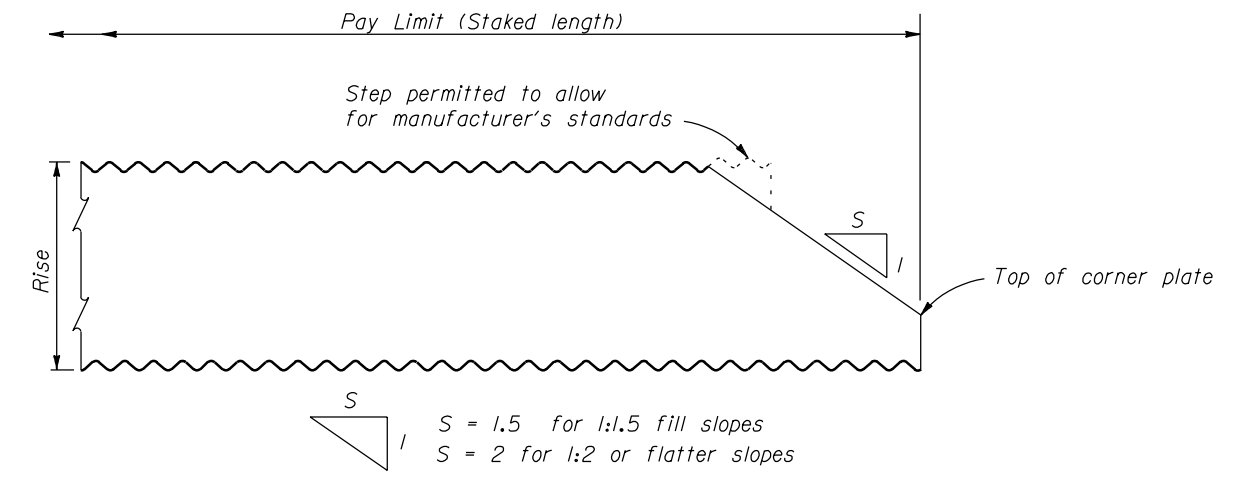
### STRUCTURAL PLATE PIPE ARCH CULVERT

#### FILL HEIGHT AND METAL THICKNESS TABLE

STEEL					ALUMINUM				
152 x 51 CORRUGATIONS					230 x 64 CORRUGATIONS				
2 Bolts per corrugation					4 Bolts per corrugation				
PIPE ARCH SIZE	CORNER RADIUS	MINIMUM COVER	METAL THICKNESS	MAX. FILL HEIGHT ABOVE TOP OF PIPE METERS	PIPE ARCH SIZE	CORNER RADIUS	MINIMUM COVER	METAL THICKNESS	MAX. FILL HEIGHT ABOVE TOP OF PIPE METERS
SPAN X RISE					SPAN X RISE				
1850 x 1400	460	300	2.82	4.9	2010 x 1730	805	450	2.54	7.0
1930 x 1450	460	300	2.82	4.6	2110 x 1750	805	450	2.54	6.7
2060 x 1500	460	300	2.82	4.3	2210 x 1800	805	450	2.54	6.4
2130 x 1550	460	300	2.82	4.3	2360 x 1830	805	450	2.54	6.1
2210 x 1600	460	300	2.82	4.0	2460 x 1850	805	525	2.54	5.8
2340 x 1650	460	300	2.82	4.0	2570 x 1910	805	525	2.54	5.5
2410 x 1700	460	300	2.82	3.7	2690 x 1930	805	525	2.54	5.2
2490 x 1750	460	450	2.82	3.7	2820 x 1960	805	600	2.54	4.9
2620 x 1800	460	450	2.82	3.4	2920 x 1980	805	600	2.54	4.9
2690 x 1850	460	450	2.82	3.4	3020 x 2030	805	675	2.54	4.6
2840 x 1910	460	450	2.82	3.0	3120 x 2060	805	675	2.54	4.6
2900 x 1960	460	450	2.82	3.0	3280 x 2080	805	675	2.54	4.3
2970 x 2010	460	450	2.82	3.0	3380 x 2130	805	750	2.54	4.3
3120 x 2060	460	450	2.82	2.7	3480 x 2160	805	750	2.54	4.0
3250 x 2110	460	450	2.82	2.7	3580 x 2180	805	750	2.54	4.0
3330 x 2160	460	450	2.82	2.7	3730 x 2210	805	825	2.54	3.7
3480 x 2210	460	450	2.82	2.4	3840 x 2260	805	825	2.54	3.7
3530 x 2260	460	450	2.82	2.4	3940 x 2290	805	900	2.54	3.7
3610 x 2310	460	450	2.82	2.4	3990 x 2490	805	900	2.54	3.4
3760 x 2360	460	600	2.82	2.1	3990 x 2540	805	900	2.54	3.4
3810 x 2410	460	600	2.82	2.1	4240 x 2570	805	900	2.54	3.4
3860 x 2460	460	600	2.82	2.1	4240 x 2870	805	900	2.54	3.4
3910 x 2540	460	600	2.82	1.8	4240 x 2620	805	900	2.54	3.4
4090 x 2570	460	600	2.82	1.8	4340 x 2920	805	900	2.54	3.0
4240 x 2620	460	600	2.82	1.8	4470 x 2950	805	900	3.18	3.7
4290 x 2670	460	600	2.82	1.5	4550 x 3000	805	900	3.18	3.4
4340 x 2720	460	600	2.82	1.5	4670 x 3050	805	900	3.18	3.4
4040 x 2840	790	750	2.82	3.7	4670 x 3100	805	900	3.18	3.4
4110 x 2900	790	750	2.82	3.7	4750 x 3100	805	900	3.18	3.4
4270 x 2950	790	750	2.82	3.7	4900 x 3150	805	900	3.18	3.0
4320 x 3000	790	750	2.82	3.7	4980 x 3200	805	900	3.81	3.0
4390 x 3050	790	750	2.82	3.4	5110 x 3250	805	900	3.81	3.0
4550 x 3100	790	750	2.82	3.4	5180 x 3300	805	900	3.81	3.0
4670 x 3150	790	750	2.82	3.4	5260 x 3350	805	900	3.81	3.0
4750 x 3200	790	750	2.82	3.4	5410 x 3400	805	900	4.44	2.7
4830 x 3250	790	750	2.82	3.0	5490 x 3450	805	900	4.44	2.7
4950 x 3300	790	750	2.82	3.0	5610 x 3510	805	900	4.44	2.7
5030 x 3350	790	750	2.82	3.0	5690 x 3560	805	900	5.08	2.7
5180 x 3400	790	750	2.82	3.0	5840 x 3580	805	900	5.08	2.7
5230 x 3450	790	750	2.82	3.0	5920 x 3630	805	900	5.08	2.7
5310 x 3510	790	750	2.82	2.7	6050 x 3680	805	900	5.08	2.4
5460 x 3560	790	750	2.82	2.7	6120 x 3730	805	900	5.08	2.4
5510 x 3610	790	750	2.82	2.7	6120 x 3810	805	900	5.08	2.4
5660 x 3660	790	750	2.82	2.7	6350 x 3840	805	900	5.72	2.1
5720 x 3710	790	750	2.82	2.7	6430 x 3890	805	900	5.72	2.1
5870 x 3760	790	750	3.56	2.4	6550 x 3940	805	750	5.72	2.1
5940 x 3810	790	750	3.56	2.4					
5990 x 3860	790	750	3.56	2.4					
6070 x 3910	790	750	3.56	2.4					
6220 x 3960	790	750	3.56	2.1					
6270 x 4010	790	750	3.56	2.1					

**NOTE:**

1. Dimensions not labeled are in millimeters
2. Fabricate the bottom plates one (1) thickness heavier than the side plates but not heavier than 4.32 mm for steel or 4.44 mm for aluminum.
3. Fasten plates with galvanized steel M20 bolts and nuts conforming to AASHTO M167M. Imperial sized 3/4 inch bolts and nuts conforming to AASHTO M167 may be used until metric fasteners are available.
4. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
5. Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for flexible and rigid pavement.



**END TREATMENT DIAGRAM**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

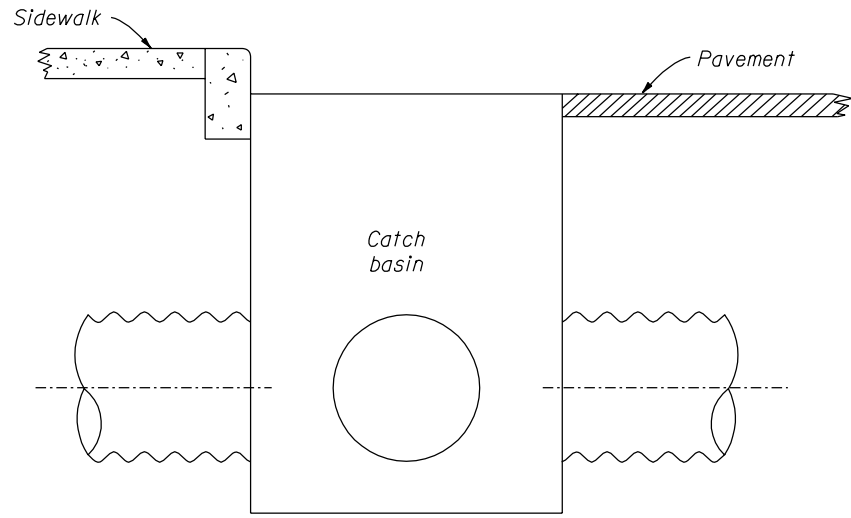
**METRIC STANDARD**

**STRUCTURAL PLATE  
PIPE ARCH CULVERT**

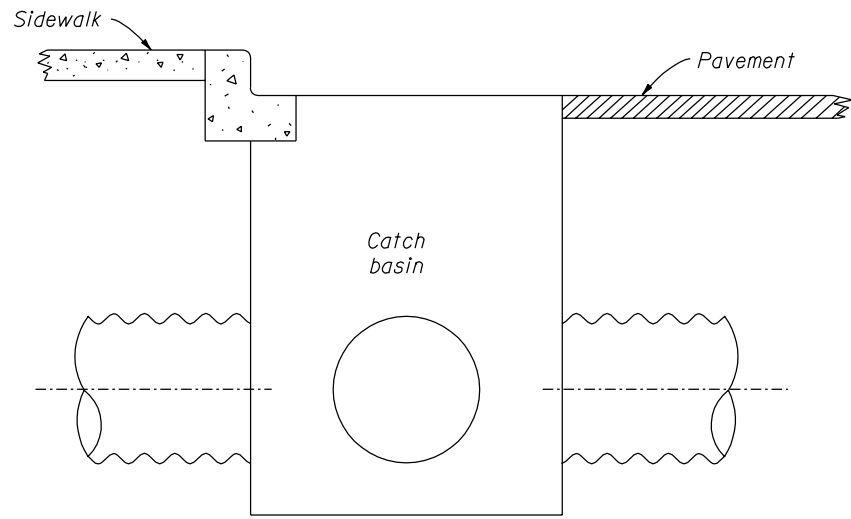
STANDARD APPROVED FOR USE 3/1996

REVISID: STANDARD  
M603-2

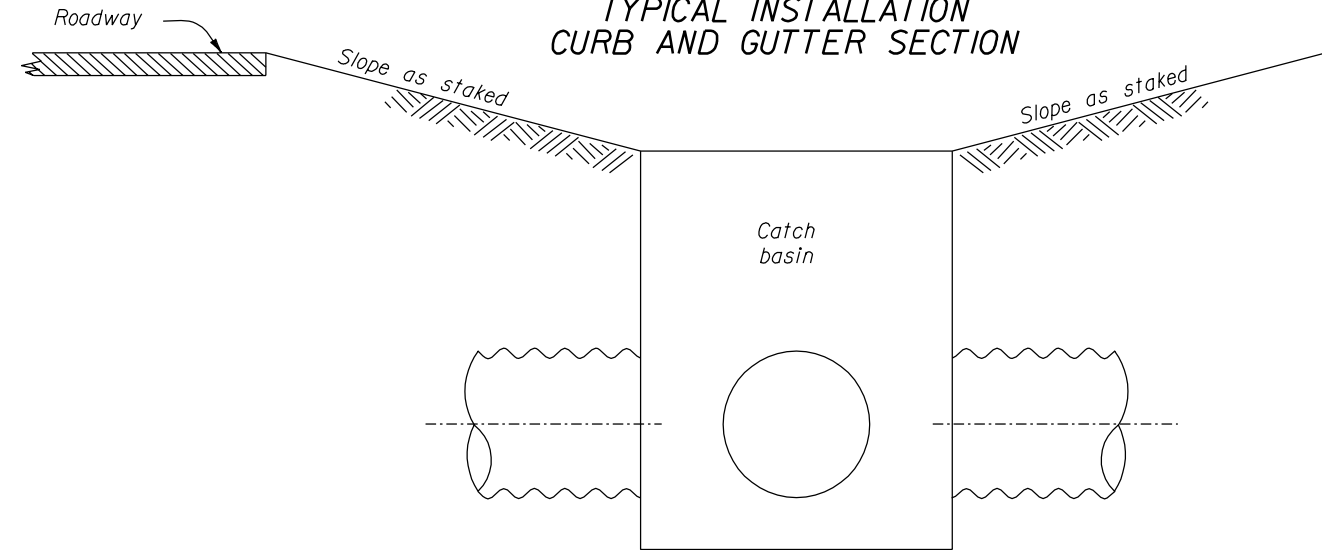
NO SCALE



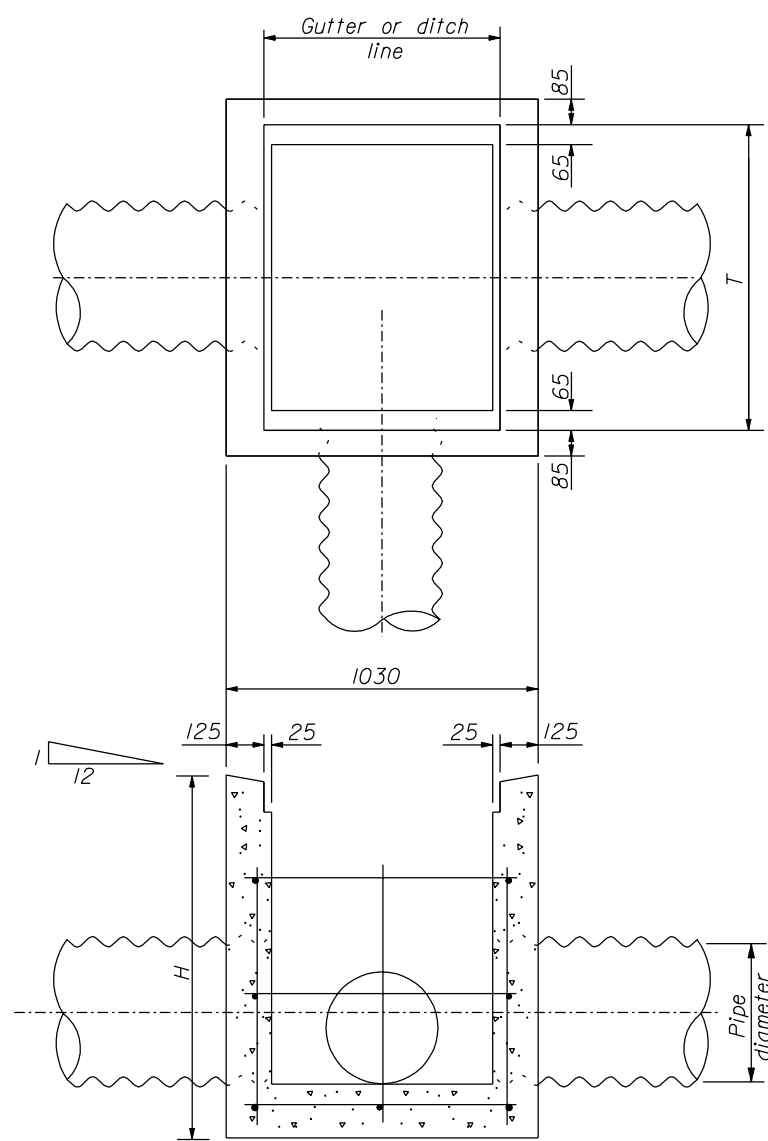
TYPICAL INSTALLATION CURB SECTION



TYPICAL INSTALLATION CURB AND GUTTER SECTION



TYPICAL INSTALLATION DITCH SECTION



All reinforcing steel #13 at 300 mm±. Bend to clear pipe.

INLET DETAIL

**NOTE:**

1. Dimensions not labeled are in millimeters.
2. CONCRETE: Chamfer exposed edges 20 mm unless otherwise shown. Give all concrete surfaces a Class 1 finish.
3. The minimum concrete cover to the face of any bar is 50 mm unless otherwise shown.
4. See Detail M604-2 for Type A Frame and Grate and Detail M604-3 for Type B Frame and Grate.

CONCRETE CATCH BASINS				
PIPE SIZE DIAMETER	DEPTH H	DIMENSIONS FRAME AND GRATE		
		TYPE A		TYPE B
		T	T	T
300	900	780	780	780
450	900	780	780	780
600	1200	1010	1020	1020
750	1200	1240	1260	1260
900	1350	1470	1500	1500
1050	1500	1700	1680	1680
1200	1650	1930	1920	1920

CONCRETE CATCH BASINS				
TABLE OF ESTIMATED QUANTITIES				
PIPE SIZE DIAMETER	CONCRETE m <sup>3</sup>	MASS (kilograms)		
		REINFORCING STEEL	FRAME AND GRATE TYPE A	FRAME AND GRATE TYPE B
300	0.6	24	98	108
450	0.6	24	98	108
600	0.8	37	123	142
750	0.9	42	148	177
900	1.2	46	174	211
1050	1.4	59	199	263
1200	1.7	68	225	297

NO SCALE

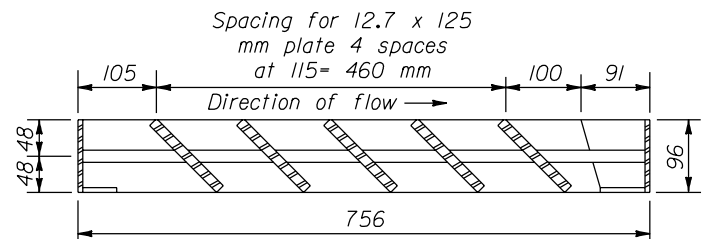
U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

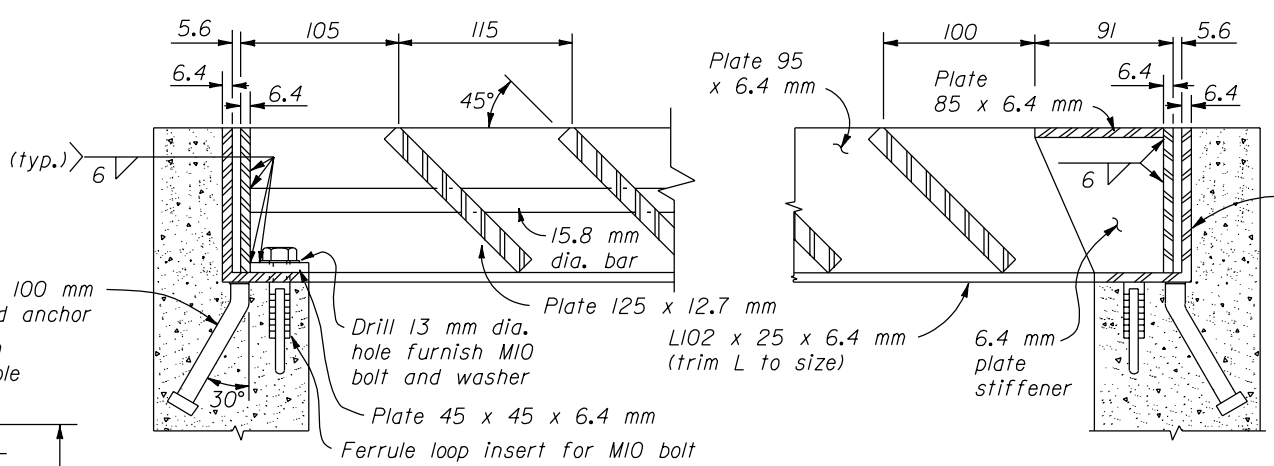
**CATCH BASIN TYPE I**

STANDARD APPROVED FOR USE 3/1996  
REVISED: 5/1997

STANDARD  
**M604-1**



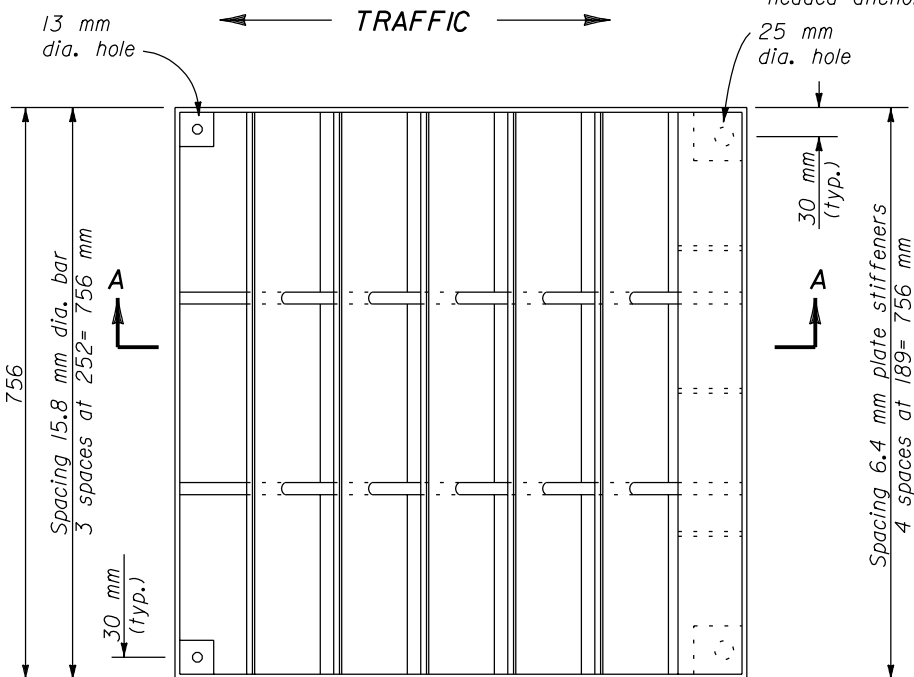
SECTION A-A



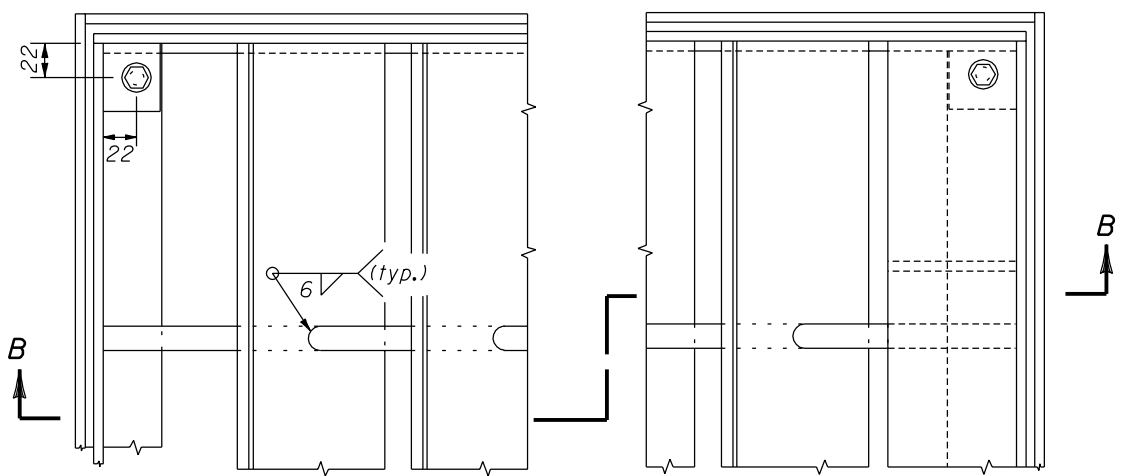
SECTION B-B

L102 x 64 x 6.4 mm (trim L to size)

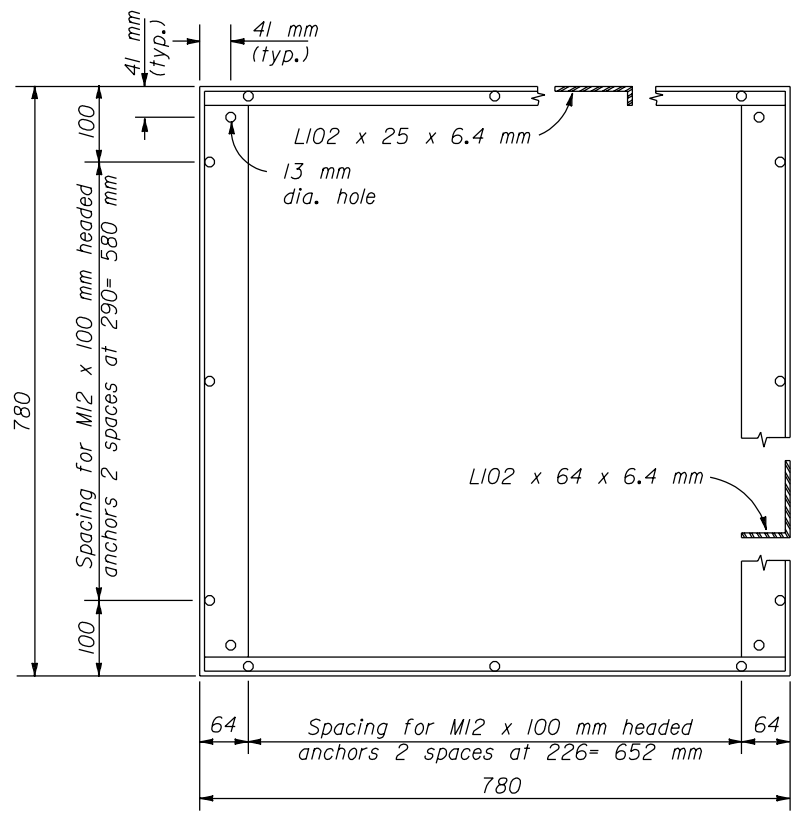
- NOTE:**
- Dimensions not labeled are in millimeters.
  - STRUCTURAL STEEL: AASHTO M 183 (ASTM A 36M).
  - BOLTS & WASHERS: ASTM A 307, Galvanized.
  - THREADED CONCRETE ANCHORS: Ferrule loop inserts for M10 bolt or approved equal.
  - HEADED CONCRETE ANCHORS: Weld to frame with a full penetration butt weld.
  - WELDING: Weld in conformance with the Standard Specifications. Unless otherwise indicated seal weld all joints with a minimum size fillet weld, based on material thickness. Grind smooth all contact surfaces. FINISH: Galvanized after fabrication.
  - Estimated weight, frame and grate (756 x 756 mm) 97.5 kg. Increase or decrease weight by 12.7 kg for each 115 mm increment.
  - Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.



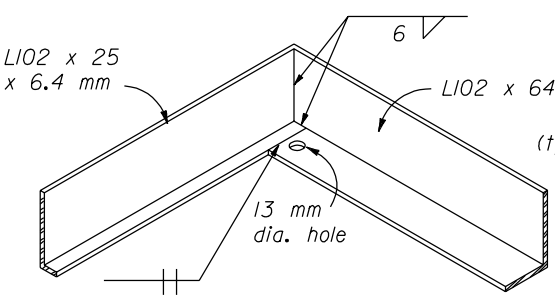
GRATE DETAILS



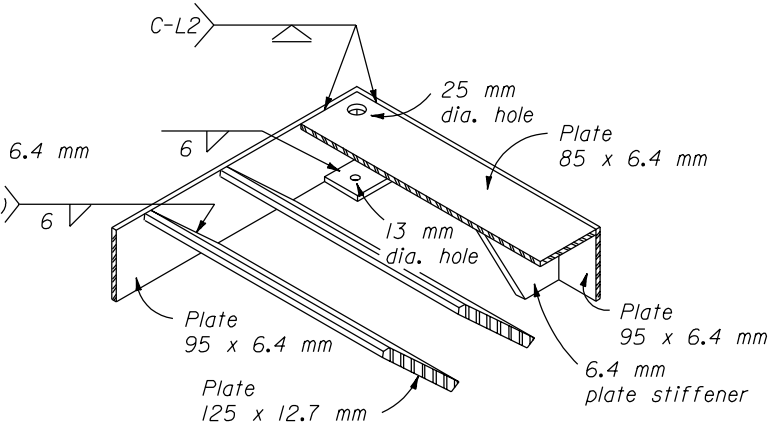
FRAME AND GRATE DETAILS



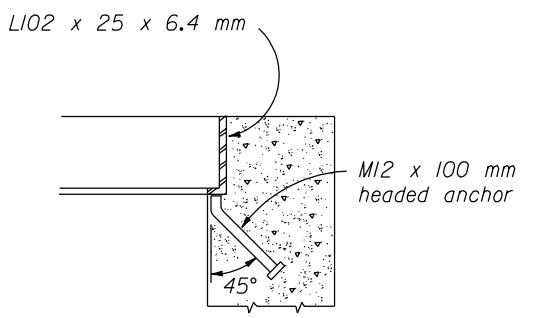
FRAME DETAIL



FRAME CORNER DETAIL



GRATE CORNER DETAIL

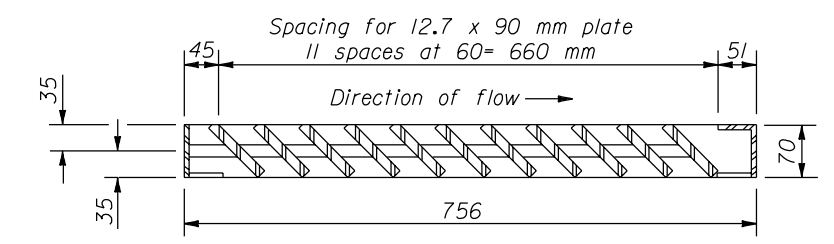


FRAME ANCHOR DETAIL

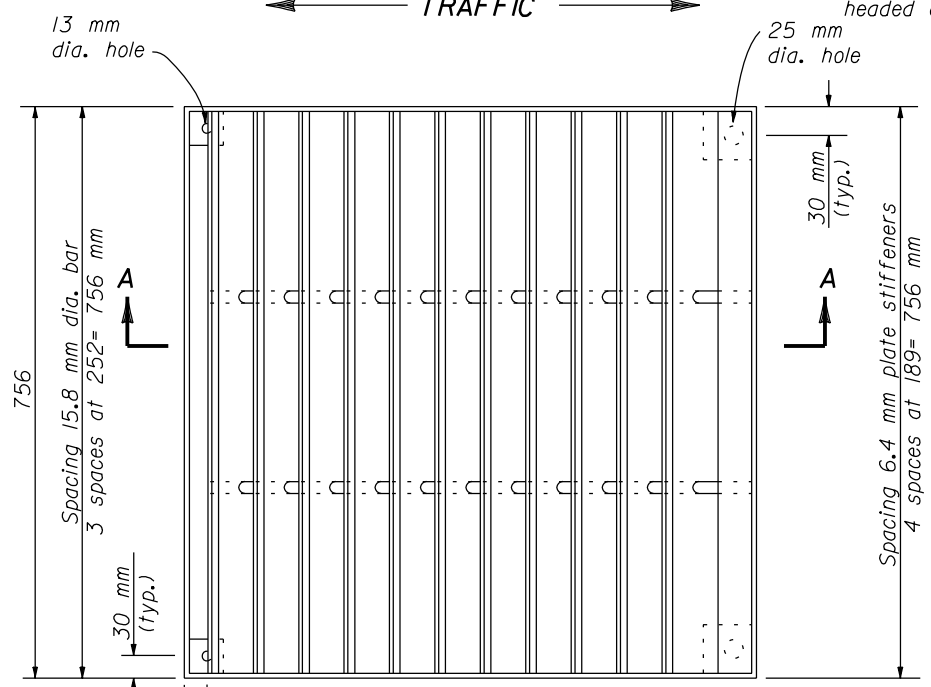
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
METAL FRAME AND GRATE TYPE A	
STANDARD APPROVED FOR USE 3/1996 REVISED: 8/1997	STANDARD M604-2

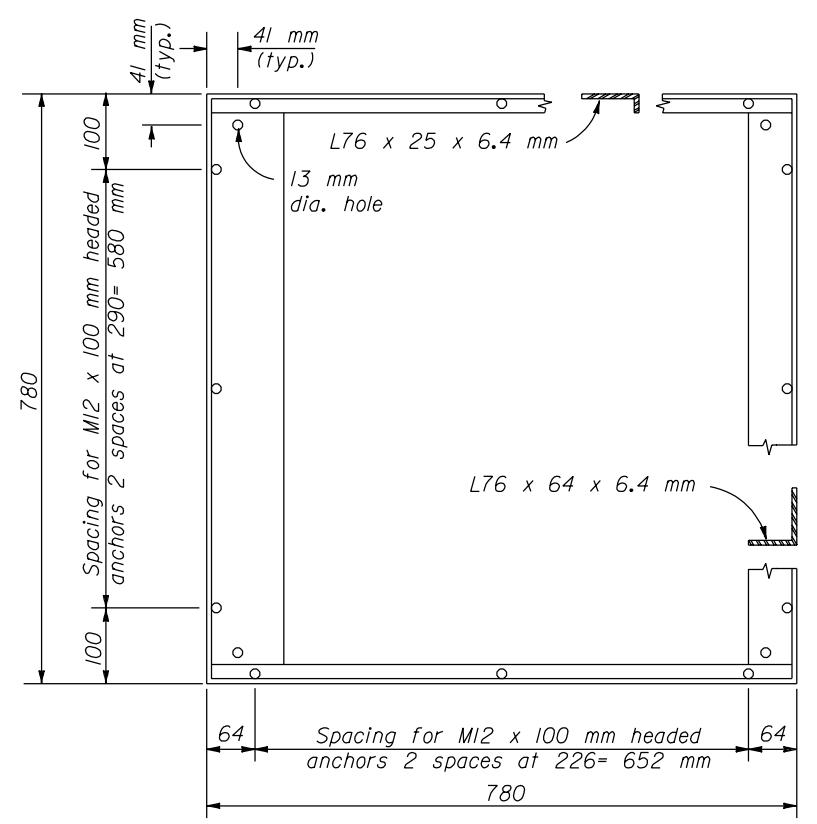
17 NOV 2000 f:\standrow\metric\m60402.dgn



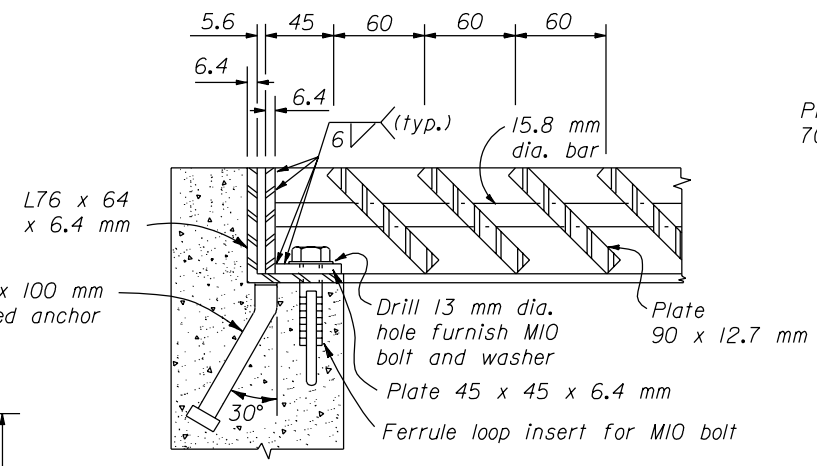
**SECTION A-A**  
TRAFFIC



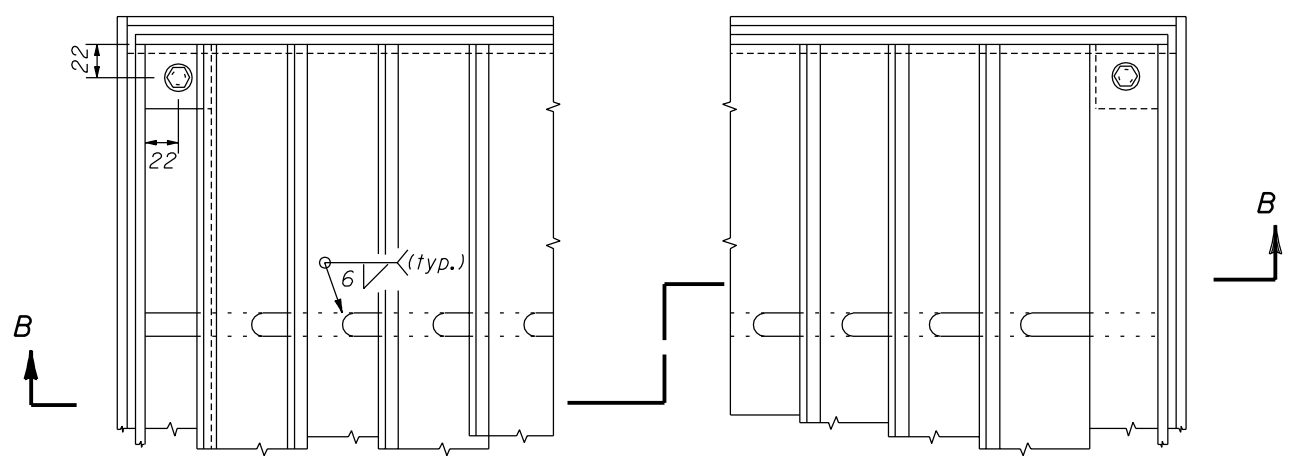
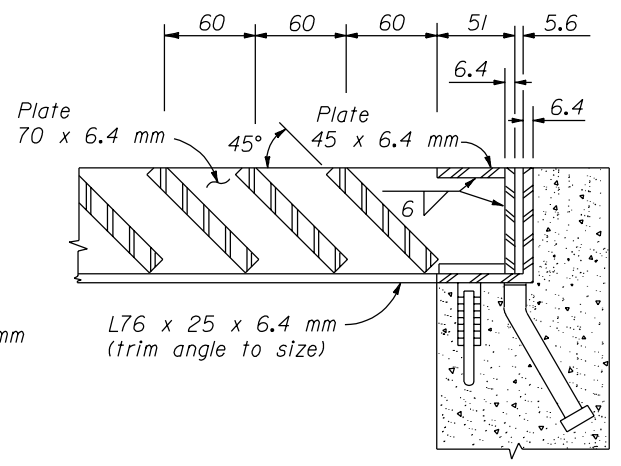
**GRATE DETAILS**



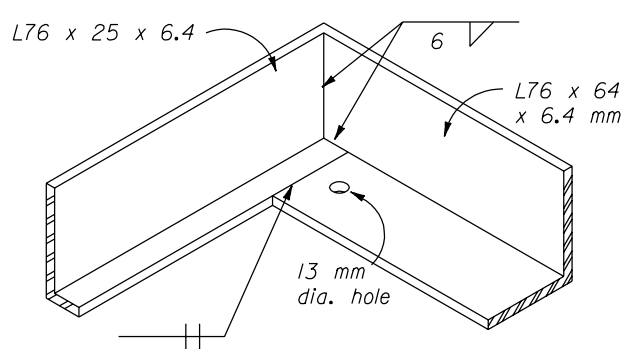
**FRAME DETAIL**



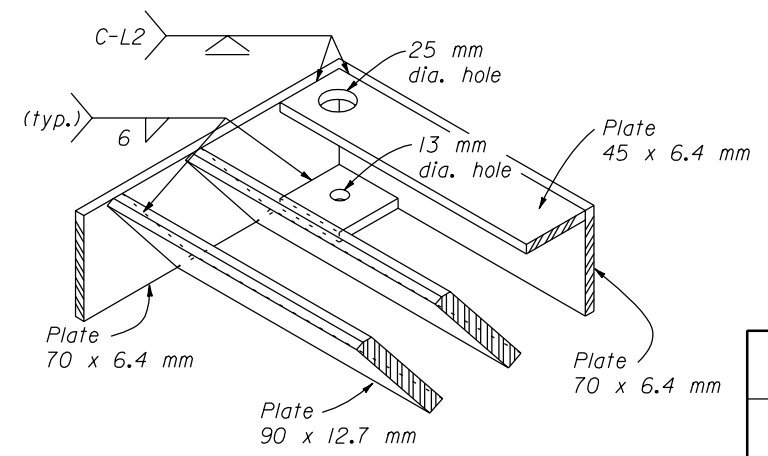
**SECTION B-B**



**FRAME AND GRATE DETAILS**



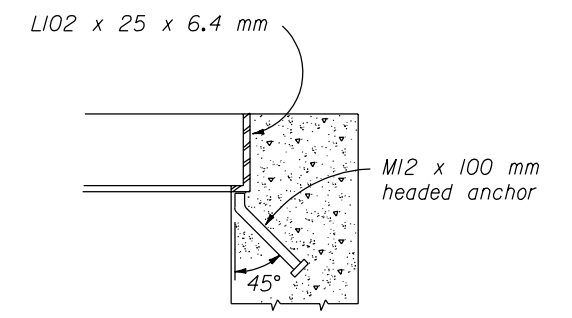
**FRAME CORNER DETAIL**



**GRATE CORNER DETAIL**

NO SCALE

- NOTE:**
- Dimensions not labeled are in millimeters.
  - STRUCTURAL STEEL: AASHTO M 183 (ASTM A 36M).
  - BOLTS & WASHERS: ASTM A 307, Galvanized.
  - THREADED CONCRETE ANCHOR: Ferrule loop inserts for M10 bolt or approved equal.
  - WELDING: Weld in conformance with the Standard Specifications. Unless otherwise indicated seal weld all joints with a minimum size fillet weld, based on material thickness. Grind smooth all contact surfaces. FINISH: Galvanized after fabrication.
  - Estimated weight, frame and grate (756 X 756 mm grate) 108 kg. Increase or decrease weight by 8.6 kg for each 60 mm increment.
  - Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.



**FRAME ANCHOR DETAIL**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

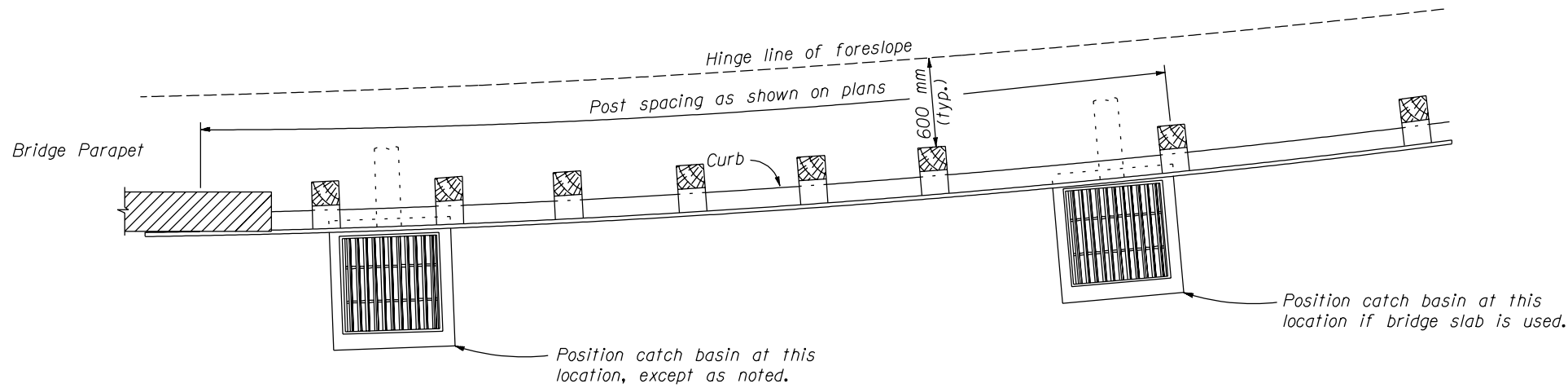
**METRIC STANDARD**

**METAL FRAME AND GRATE  
TYPE B**

STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M604-3**

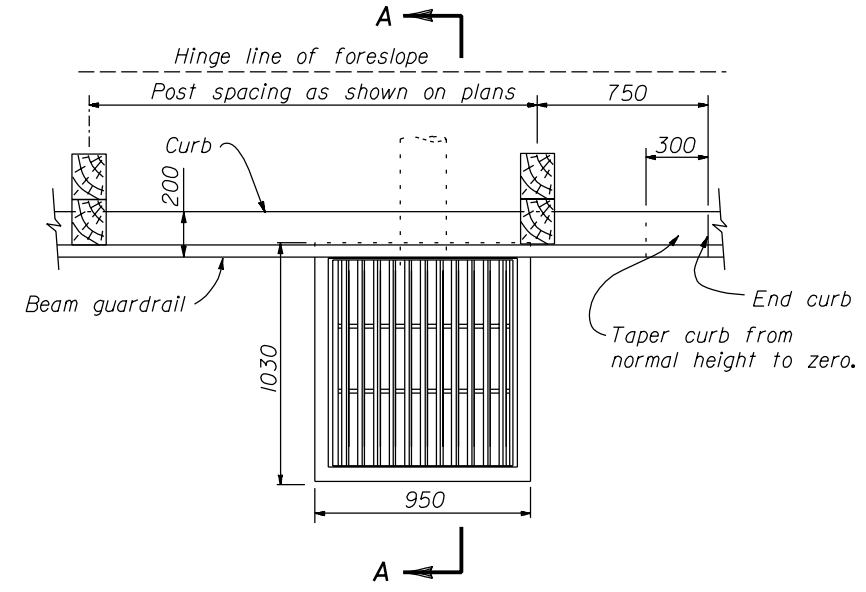
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PLAN

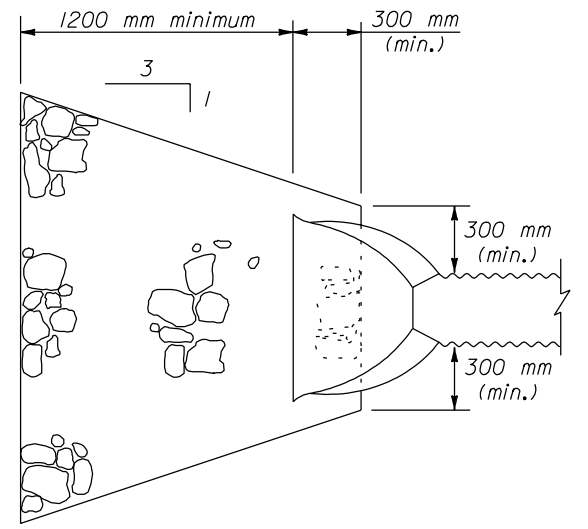
CATCH BASIN LAYOUT AT BRIDGE ENDS

DESCRIPTION	FRAME AND GRATE	
	TYPE A	TYPE B
Reinforcing Steel	32 kg	32 kg
Structural Steel	98 kg	108 kg
Concrete	0.6 m <sup>3</sup>	0.6 m <sup>3</sup>

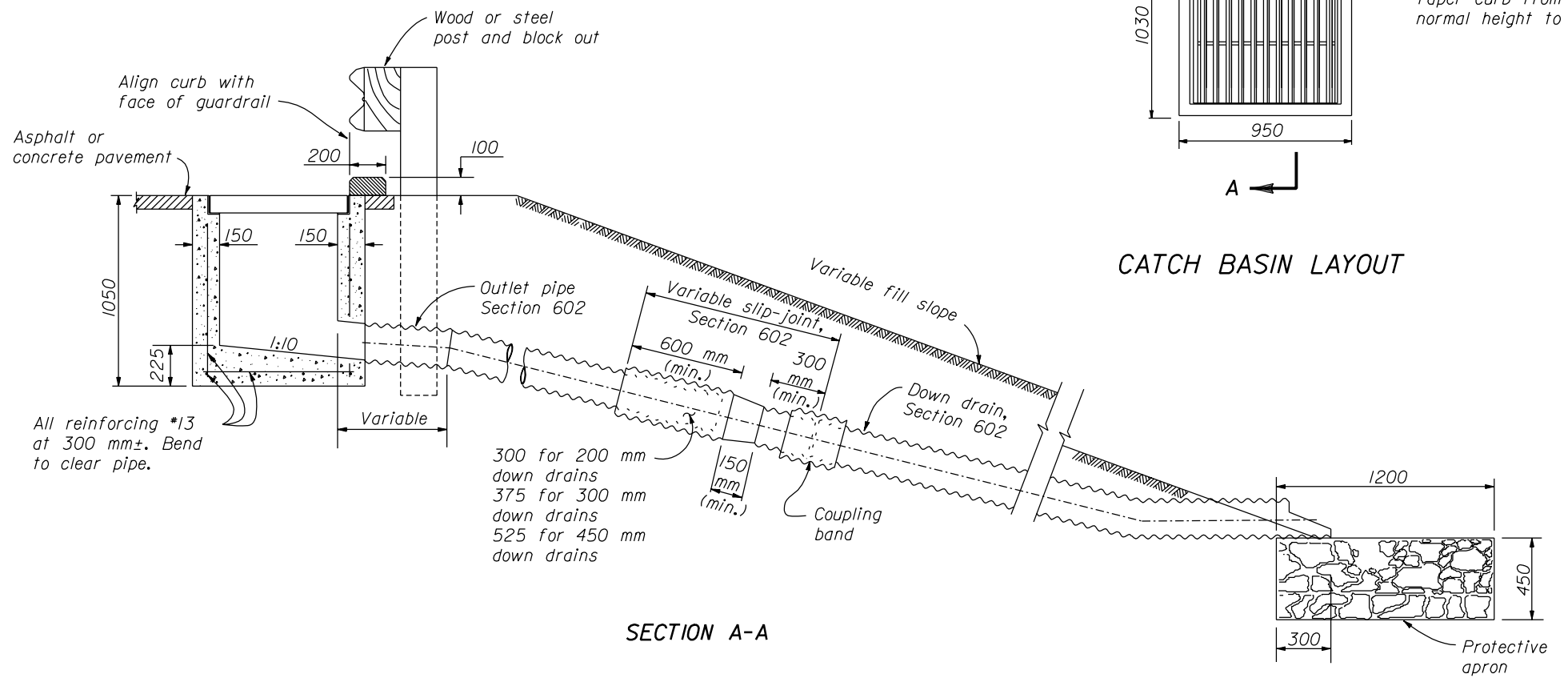


CATCH BASIN LAYOUT

- NOTE:**
- Dimensions not labeled are in millimeters.
  - CONCRETE: Chamfer exposed edges 20 mm unless otherwise shown. Give all concrete surfaces a Class 1 finish.
  - The minimum concrete cover to the face of any bar is 50 mm unless otherwise shown.
  - See Standard M604-2 for Type A Frame and Grate and Standard M604-3 for Type B Frame and Grate.
  - Make all coupling band connections watertight by placing 5 mm bead of approved caulking under each half of the bands before tightening.
  - Fabricate tapered portion of slip-joint from either flat or corrugated sheets.
  - Place Class 2 riprap conforming to Section 251 for protective apron.



PLAN  
PROTECTIVE APRON



SECTION A-A

NO SCALE

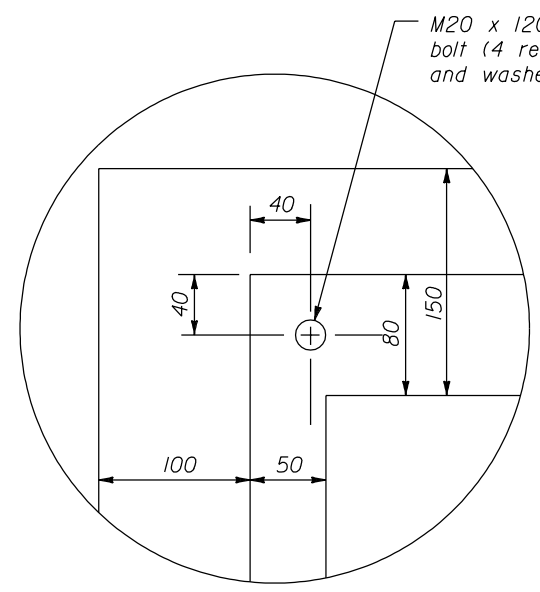
U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

**CATCH BASIN TYPE 2  
WITH DOWN DRAIN**

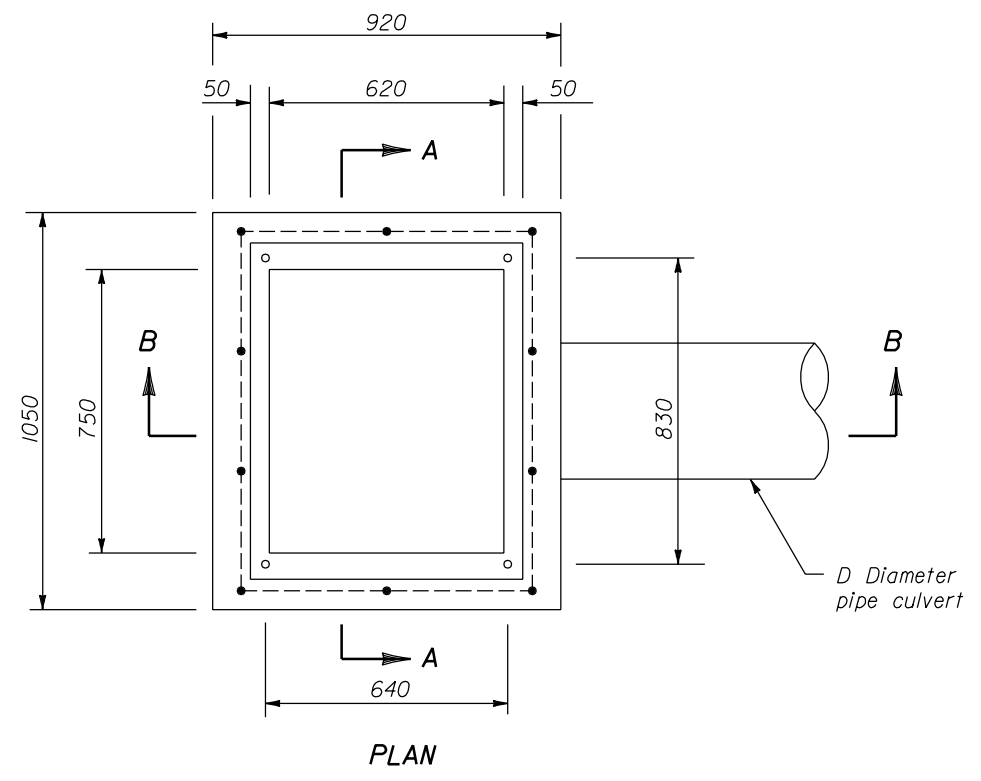
STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M604-4**



DETAIL A

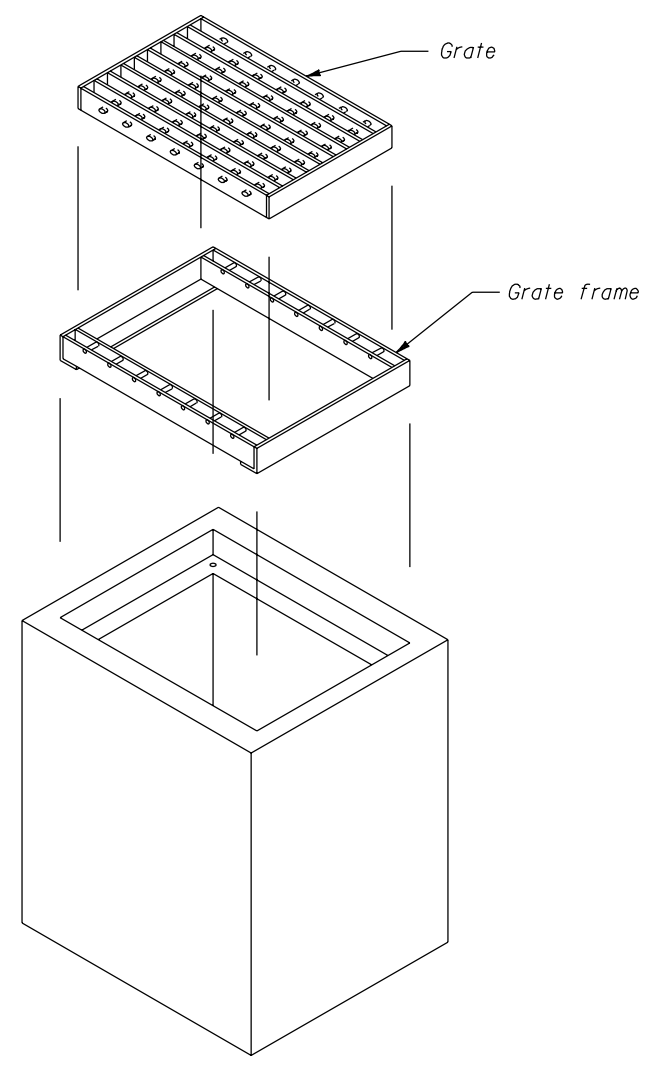
M20 x 120 x 200 mm anchor bolt (4 required with nuts and washers)



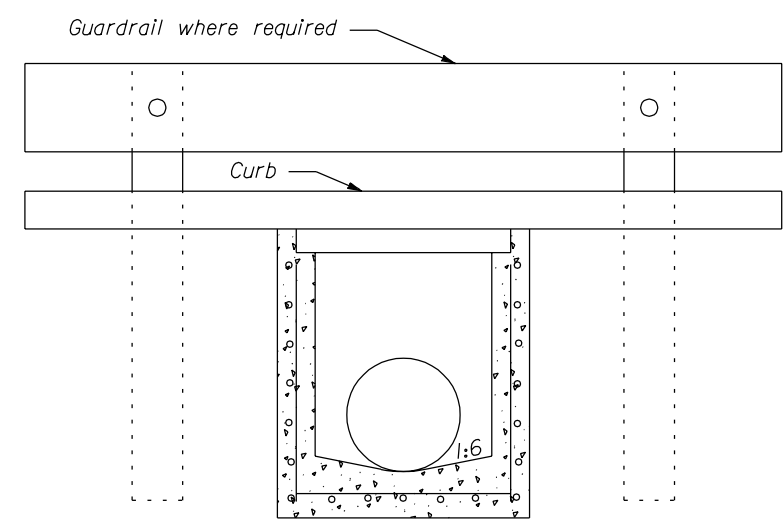
PLAN

**NOTE:**

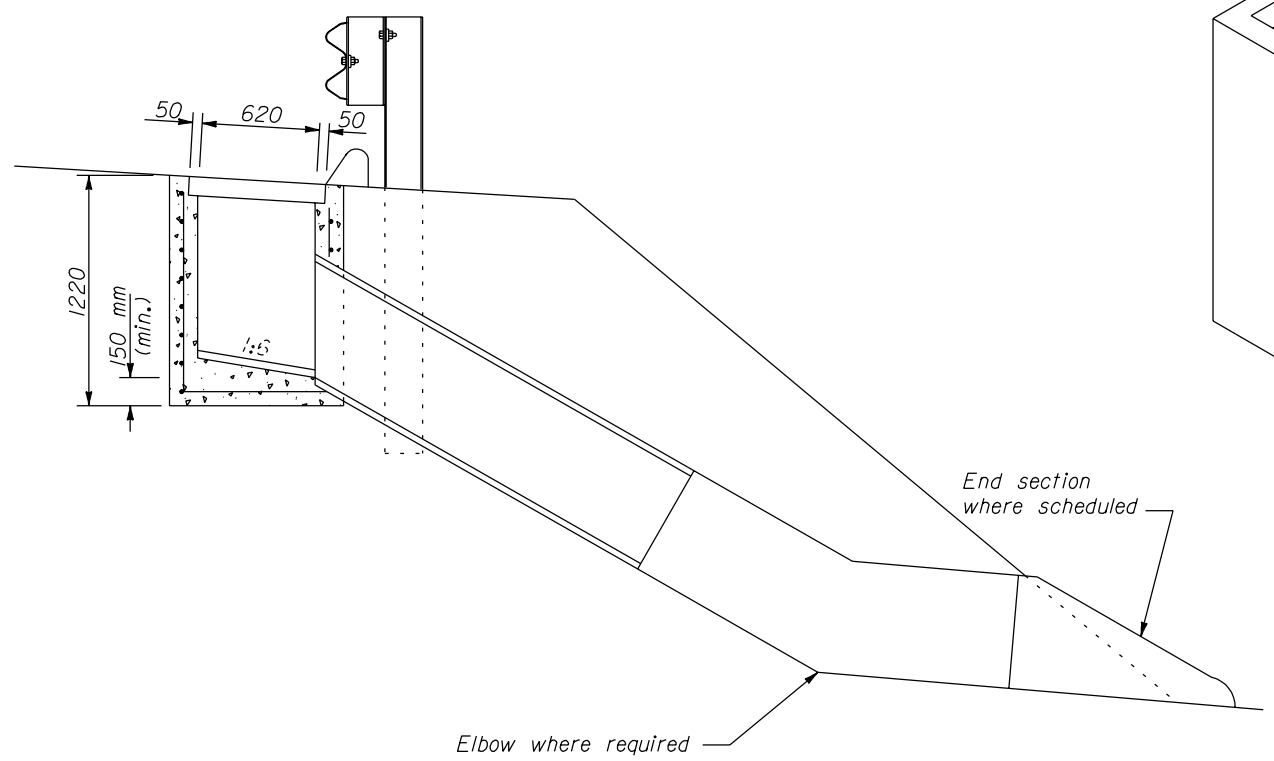
1. Dimensions not labeled are in millimeters.
2. All reinforcing bars are #16 placed a minimum 40 mm clear from face of concrete. In floors, place bars on 150 mm centers each way. In walls, place horizontal bars in 150 mm centers and vertical bars on 300 mm centers.
3. See Standard M604-6 for frame and grate details.



ISOMETRIC VIEW



SECTION A-A

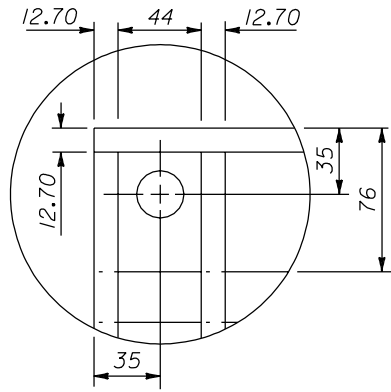
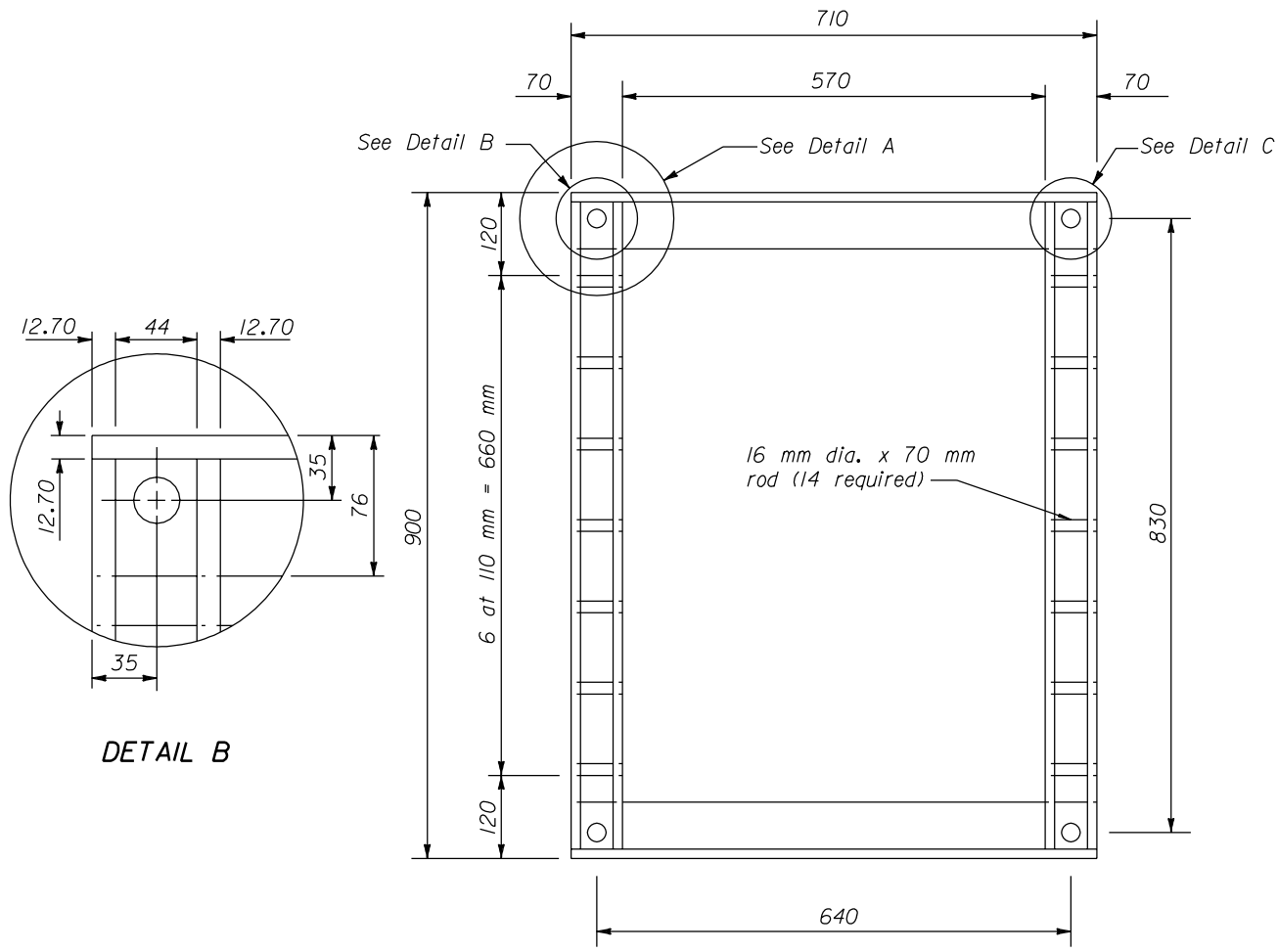


SECTION B-B

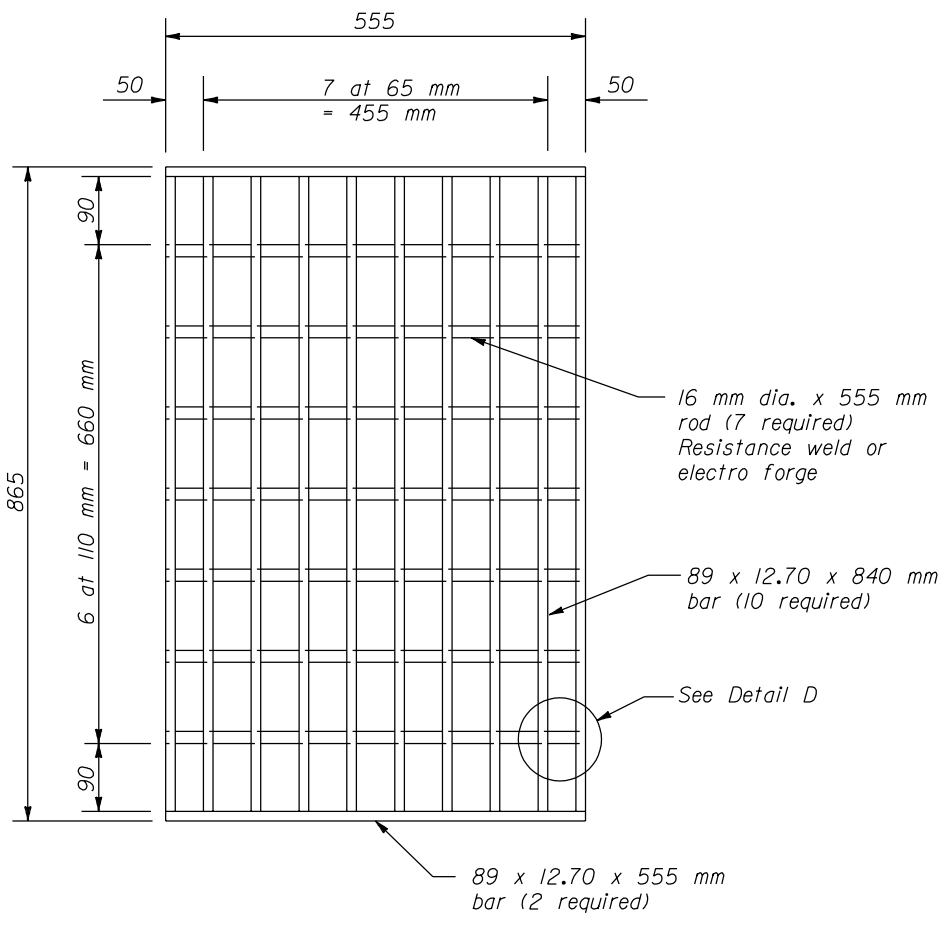
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
INLET, TYPE 5A	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED: 5/1997	M604-5

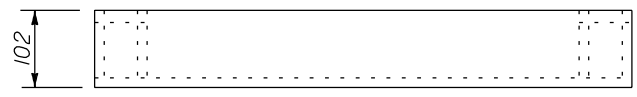




DETAIL B

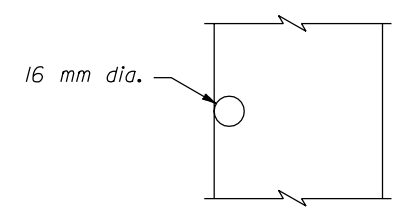


GRATE

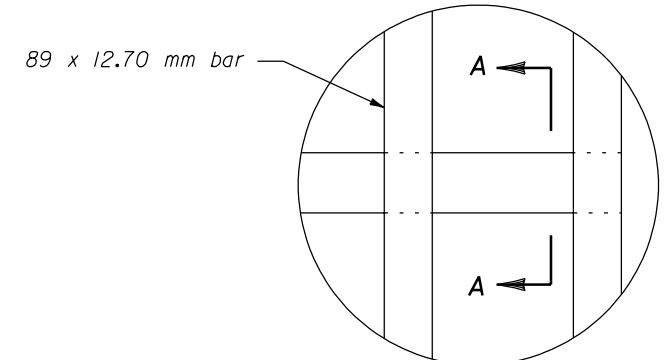


GRATE FRAME

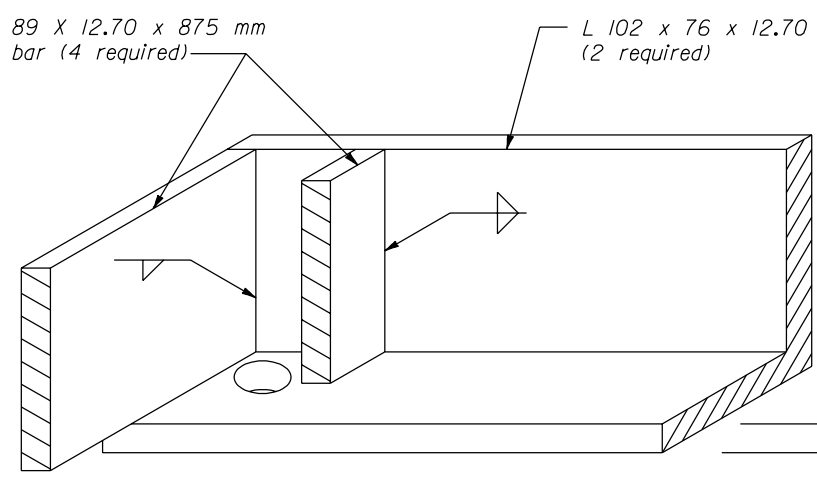
- NOTE:**
- Dimensions not labeled are in millimeters.
  - Hot dip galvanize all metal parts for frame and grate after fabrication.
  - Fabricate frame and grate from structural steel.
  - Furnish M20 x 120 x 200 mm anchor bolts with nuts to attach frame to inlet.
  - Cut holes in 89 x 12.7 mm bar as required to place 16 mm diameter rods.
  - Spot weld 16 mm diameter rods for frame and grate to 89 x 12.70 mm bars.
  - Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.



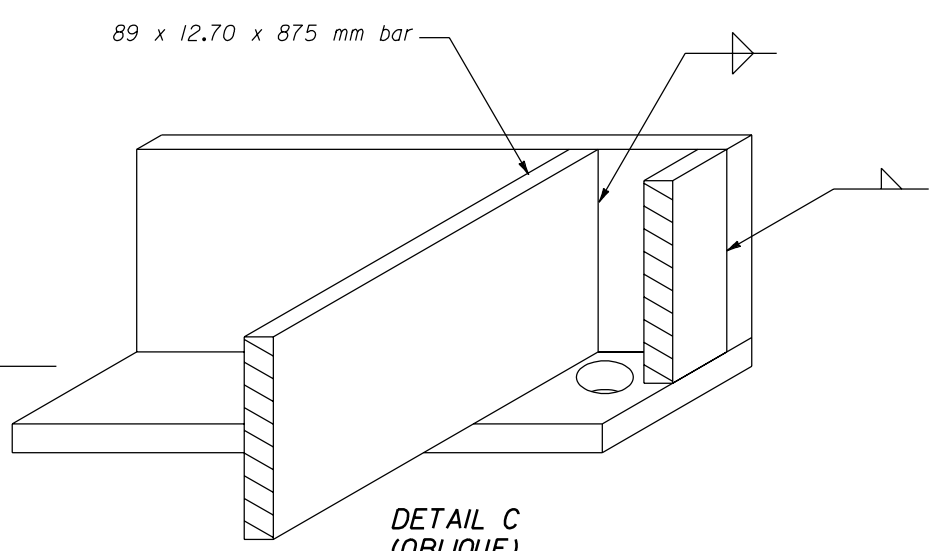
SECTION A-A



DETAIL D



DETAIL A (OBLIQUE)



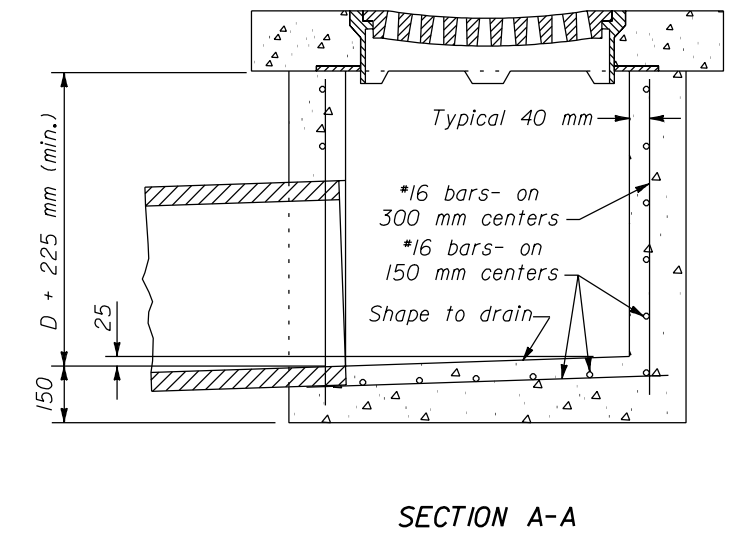
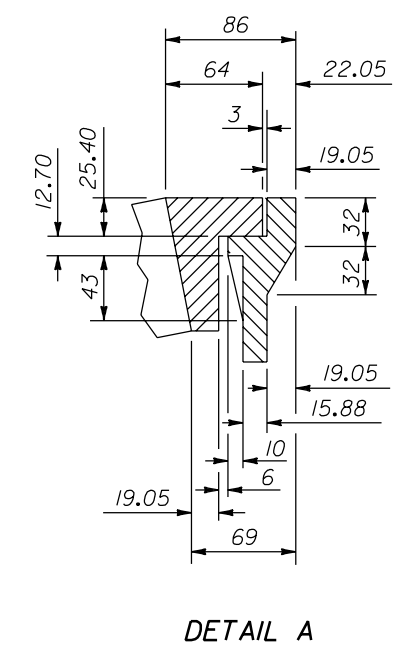
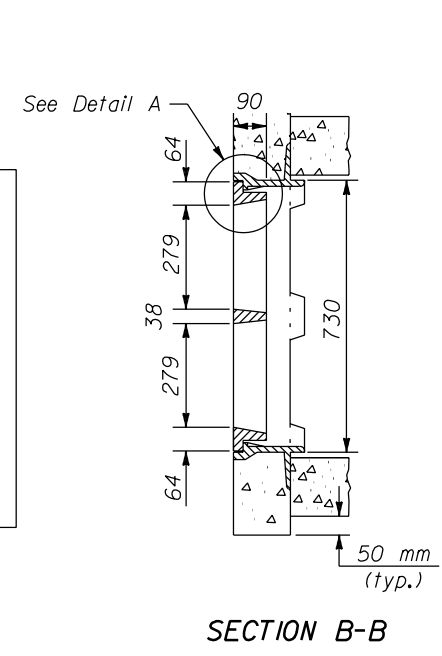
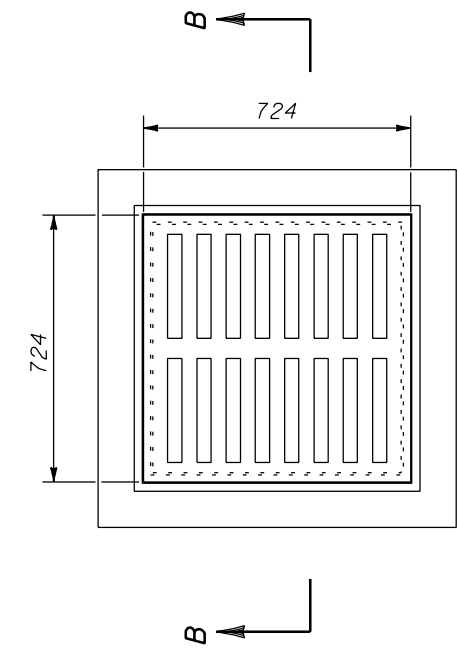
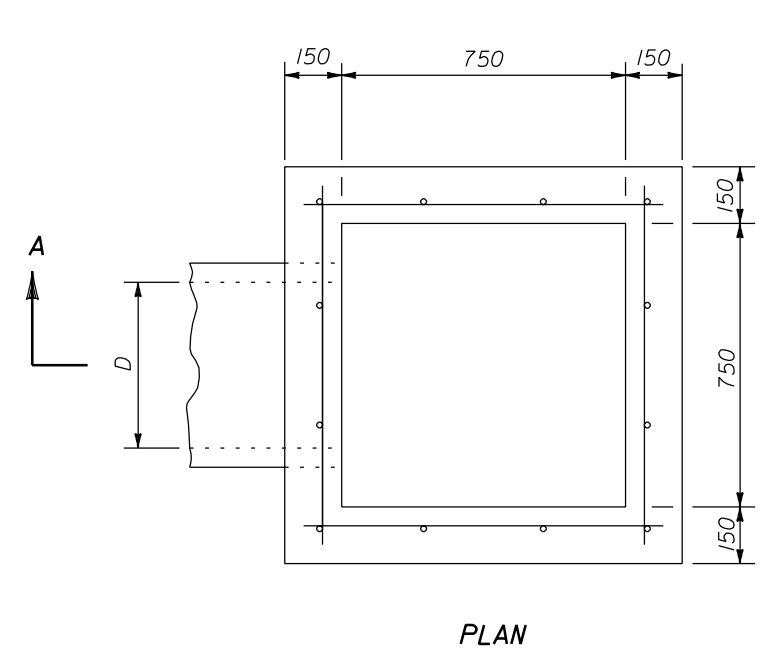
DETAIL C (OBLIQUE)

NO SCALE

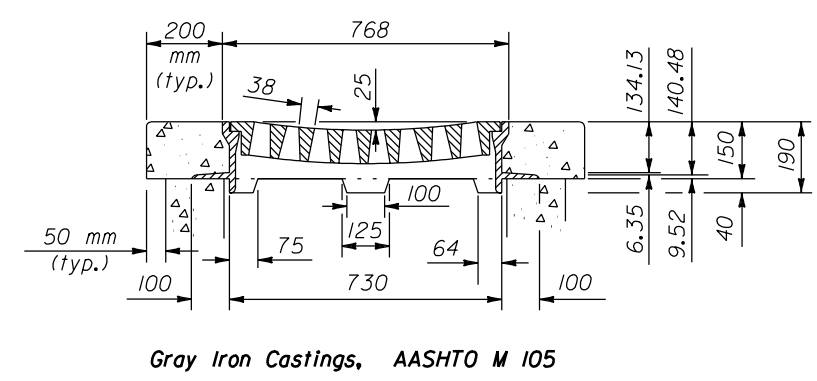
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
FRAME AND GRATE TYPE 5A	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED:	M604-6

**NOTE:**

1. Dimensions not labeled are in millimeters.
2. Construct inlets parallel to the roadway centerline and grade. For pipes on skew, adapt inlets as directed by the CO.
3. For frames and gratings minor variations in design and dimensions are permitted to allow manufacturers standards.



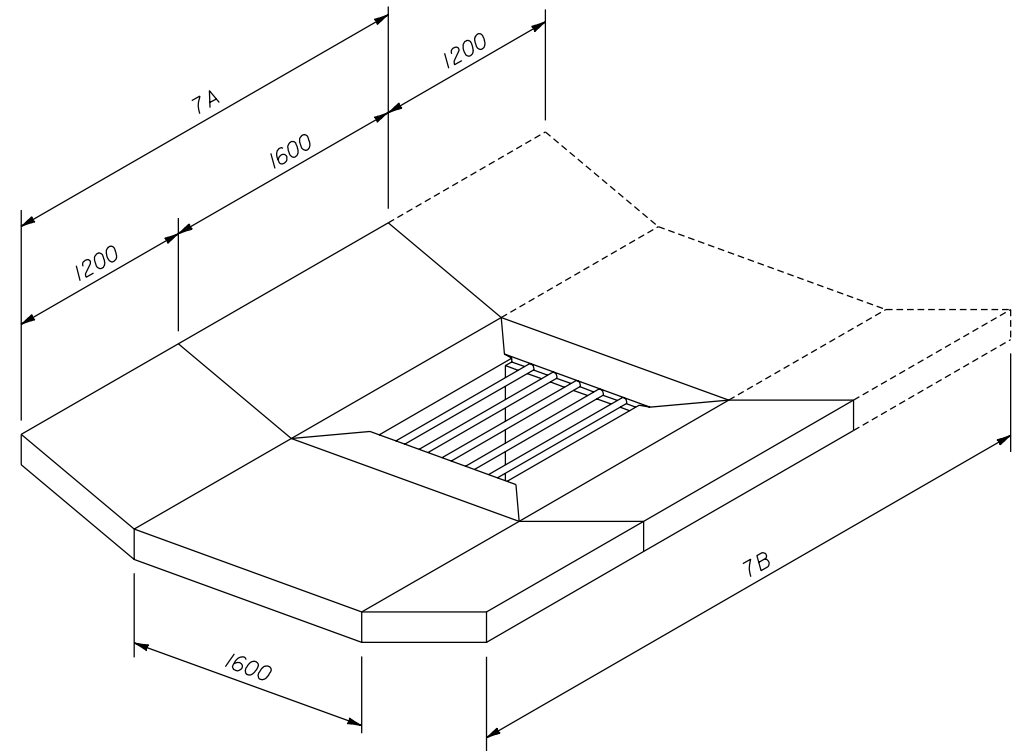
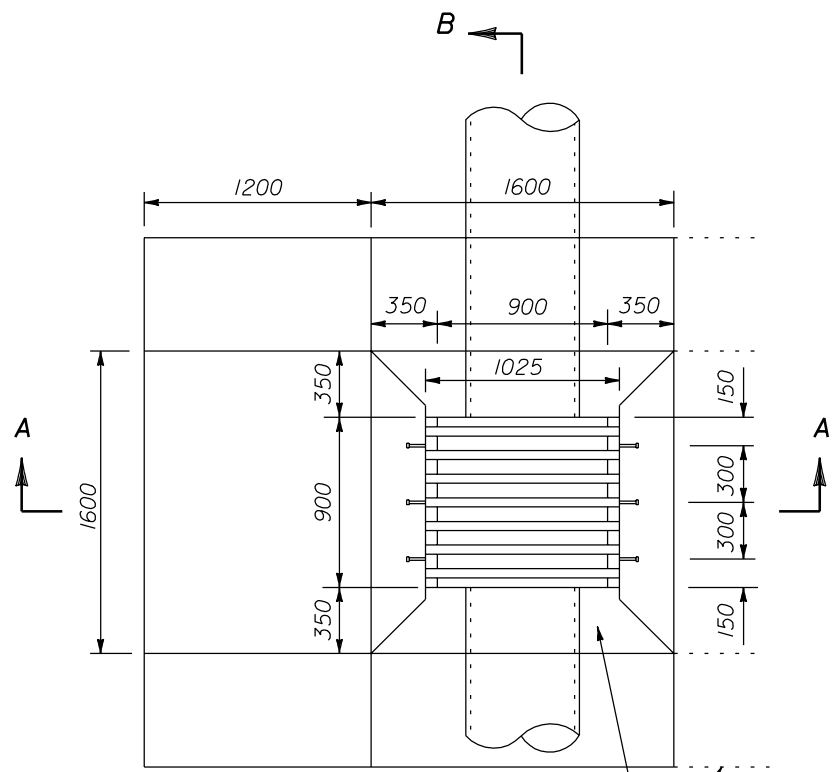
**TYPE 6B INLET**



**METAL FRAMES AND GRATINGS TYPE 6B**

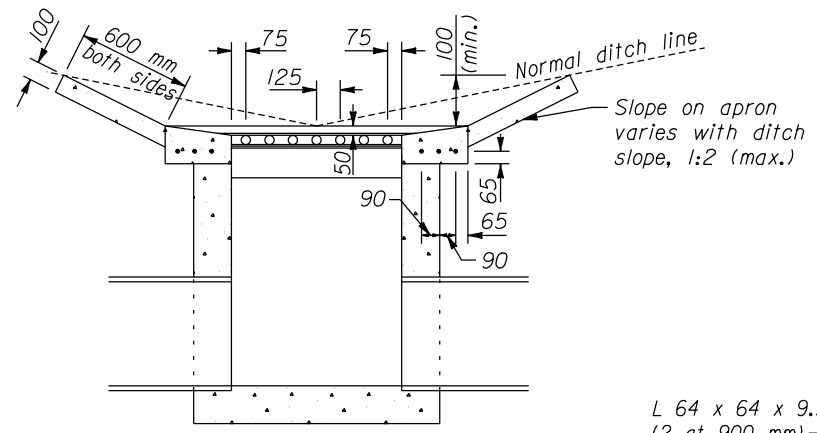
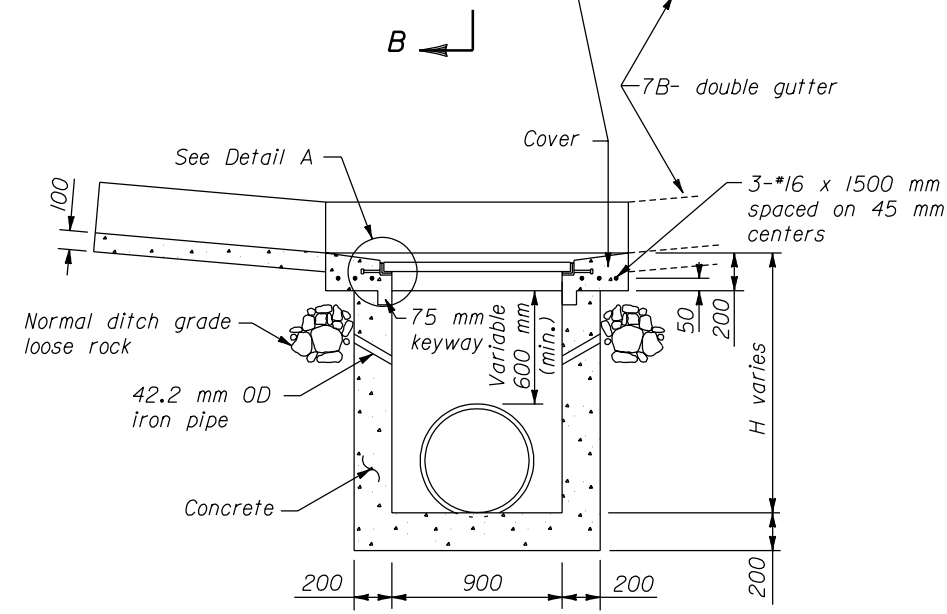
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
INLET, TYPE 6B	
STANDARD APPROVED FOR USE 3/1996 REVISED: 5/1997	STANDARD M604-7



- NOTE:**
- Dimensions not labeled are in millimeters.
  - 7A= single gutter when inlet is on a grade.
  - 7B= double gutter when inlet is in a sag between two grades.
  - Ditch to be warped to tie smoothly into inlet gutter.
  - Outside dimensions of grate to be 1000 x 890 mm
  - Maximum depth (H) is 3800 mm.
  - All reinforcing bars are #16 placed a minimum 40 mm clear from face of concrete. In floors, place bars on 150 mm centers each way. In walls, place horizontal bars on 150 mm centers and vertical bars on 300 mm centers.
  - Galvanize grate after fabrication in accordance with AASHTO M III.
  - Alternate methods of anchoring angle iron will be acceptable if approved by the CO.

APPROXIMATE QUANTITIES						
Pipe Size	300	375	450	600	750	900
Min. depth H	600	690	775	940	1100	1270
m <sup>3</sup> conc. Inlet	0.724	0.799	0.874	1.024	1.174	1.323

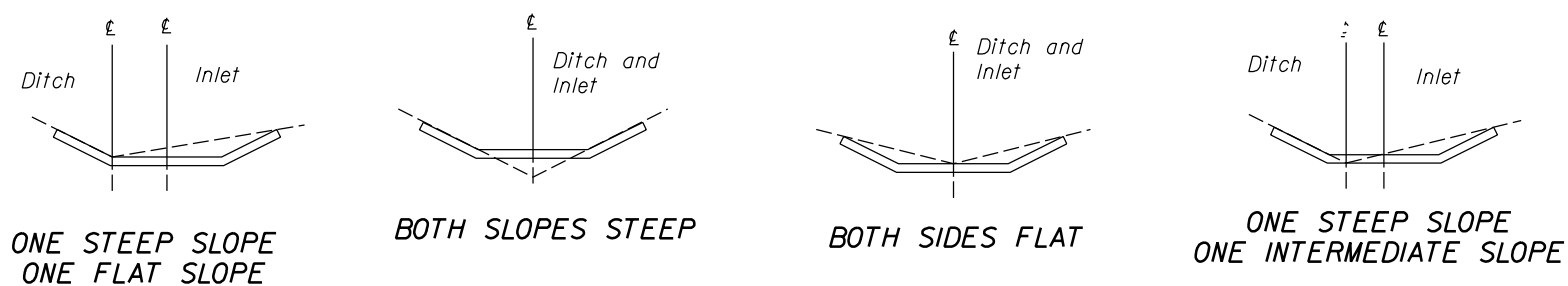
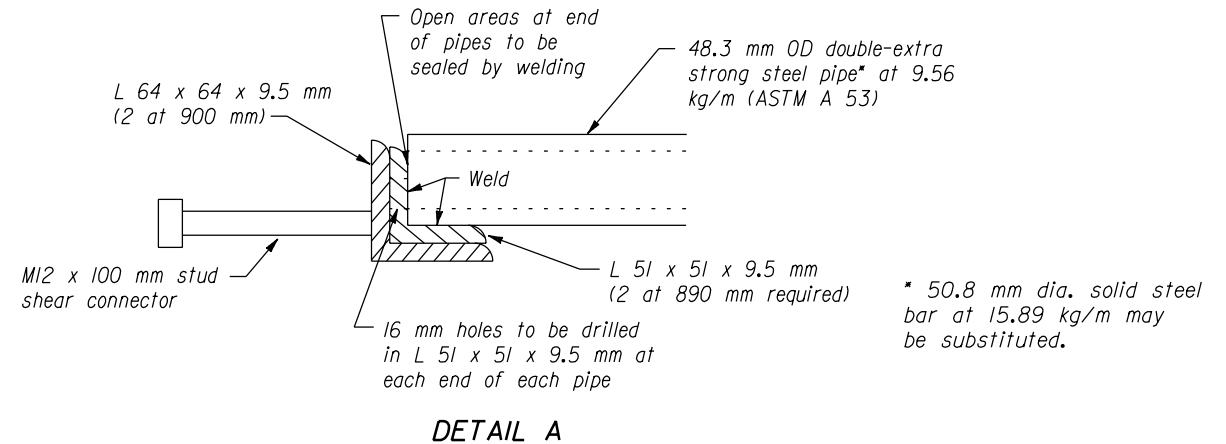


Increment per 300 mm of additional depth, (H)= 0.264 Cubic meters.

Cubic meters concrete for gutter  
7A= 0.528 & B= 0.864.

Cubic meters concrete for cover= 0.323 (not included above).

Reinforcing steel for cover= 28.5 kg.



TYPICAL GUTTER PLACEMENT

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

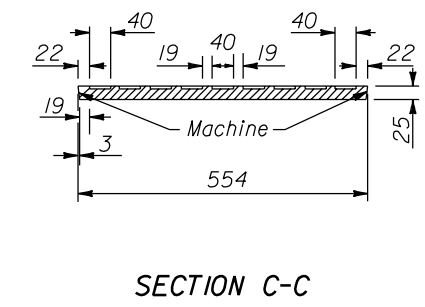
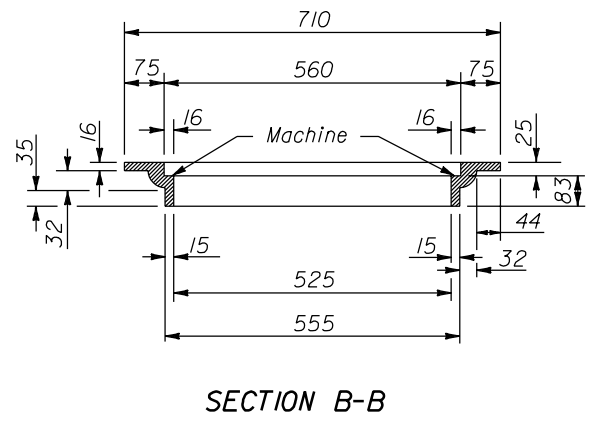
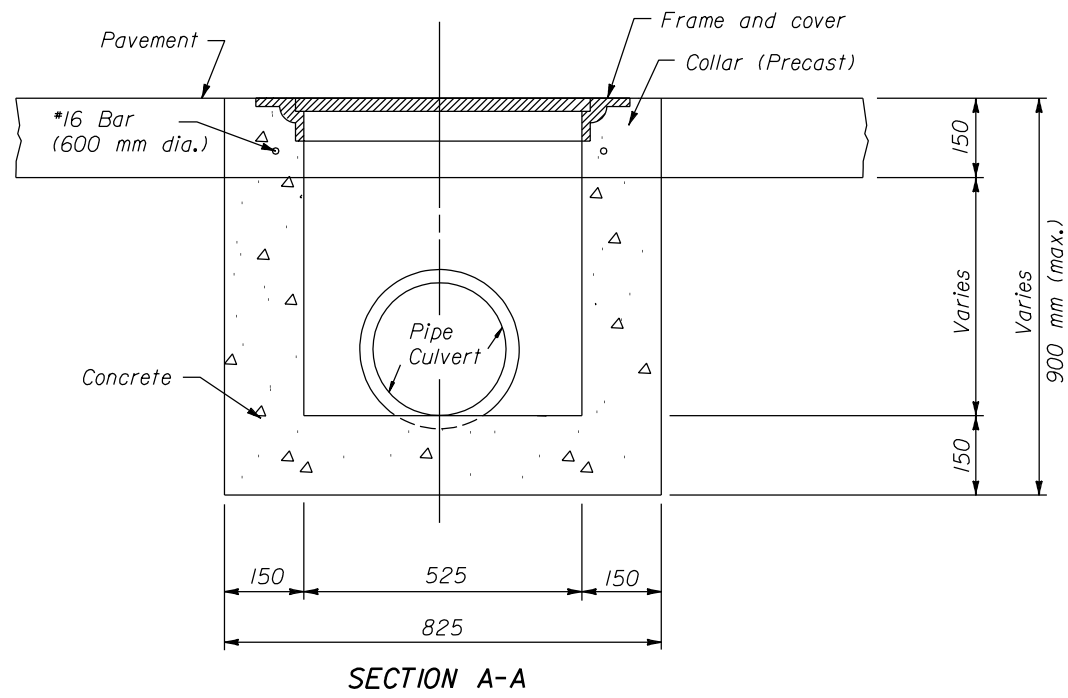
**METRIC STANDARD**

**INLET, TYPE 7A AND 7B FOR USE WITH 300 TO 900 PIPES**

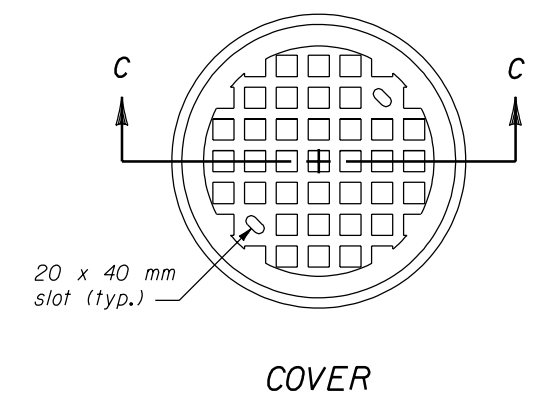
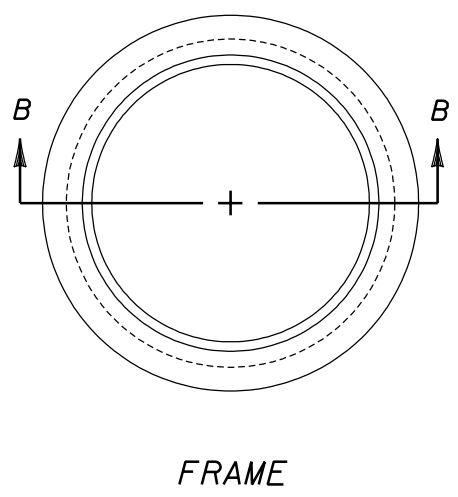
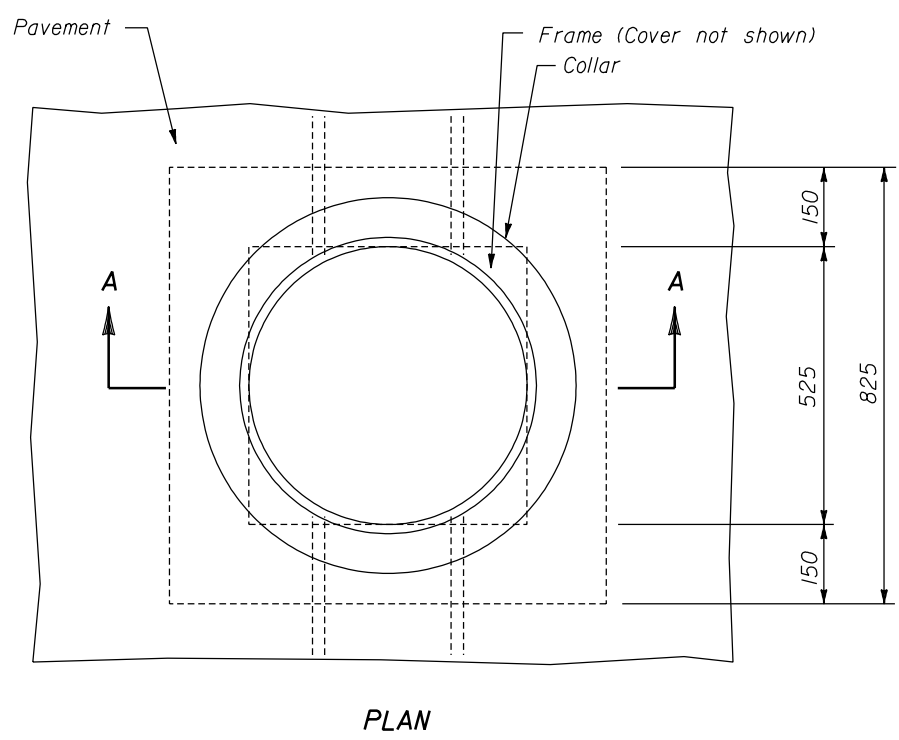
STANDARD APPROVED FOR USE 3/1996  
REVISED: 8/1997

STANDARD  
**M604-8**

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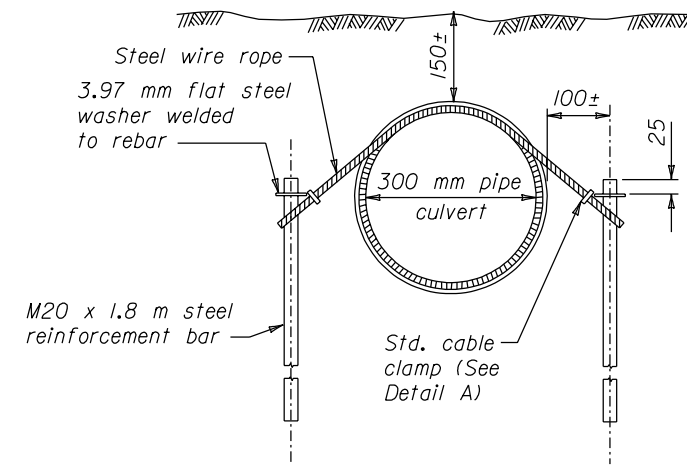


- NOTE:**
- Dimensions not labeled are in millimeters.
  - Frame and cover dimensions may vary slightly to allow manufacturer's standards.
  - MASS: (Approximate, cast iron)  
Frame- 39 ± 2 kg  
Cover- 38 ± 2 kg
  - All reinforcing bars are #16 placed a minimum 40 mm clear from face of concrete. In floors, place bars on 150 mm centers each way. In walls, place horizontal bars on 150 mm centers and vertical bars on 300 mm centers.

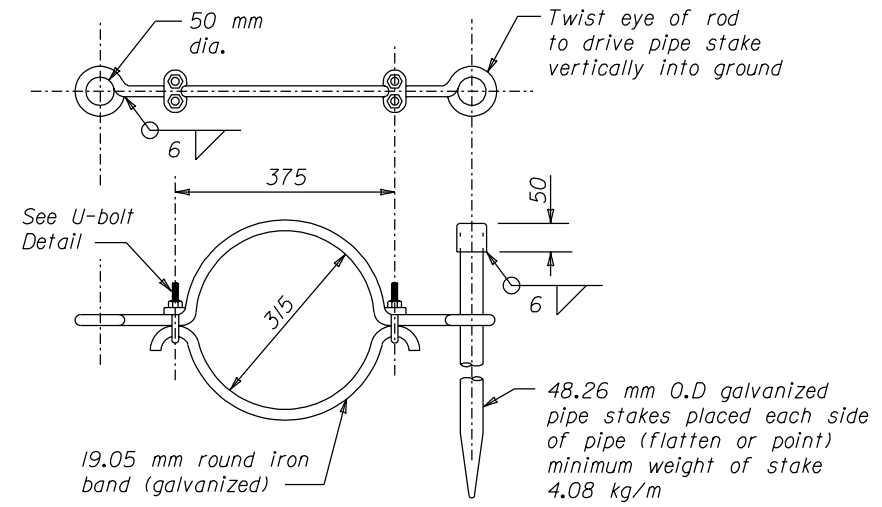


NO SCALE

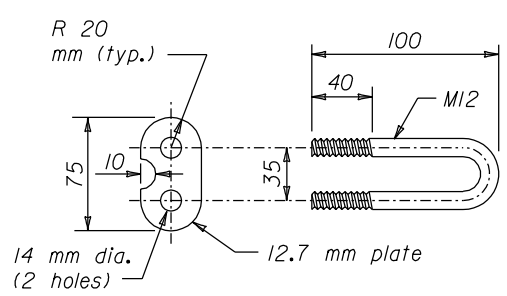
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
MANHOLE	
STANDARD APPROVED FOR USE 3/1996 REVISED: 5/1997	STANDARD M604-9



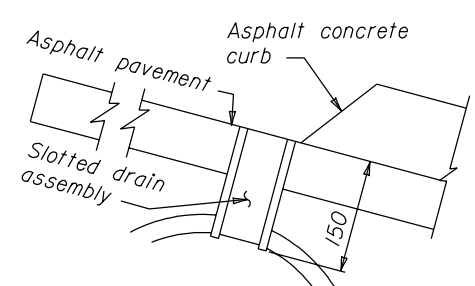
**ALTERNATE 1**



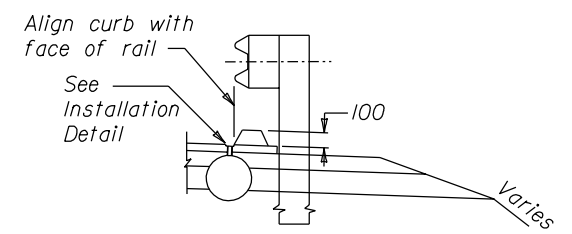
**ALTERNATE 2**



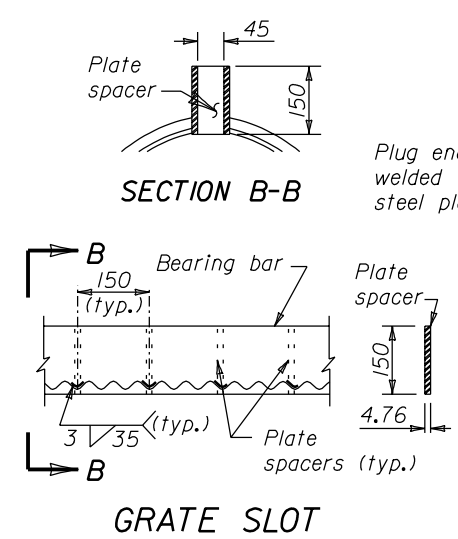
**U-BOLT DETAIL**



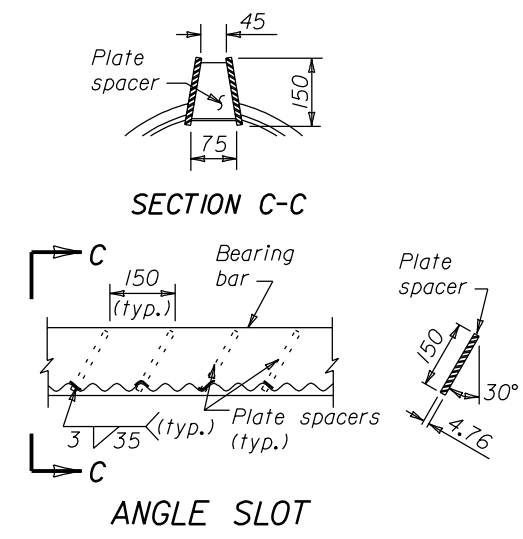
**INSTALLATION DETAIL**



**TYPICAL PLACEMENT AT GUARDRAIL**

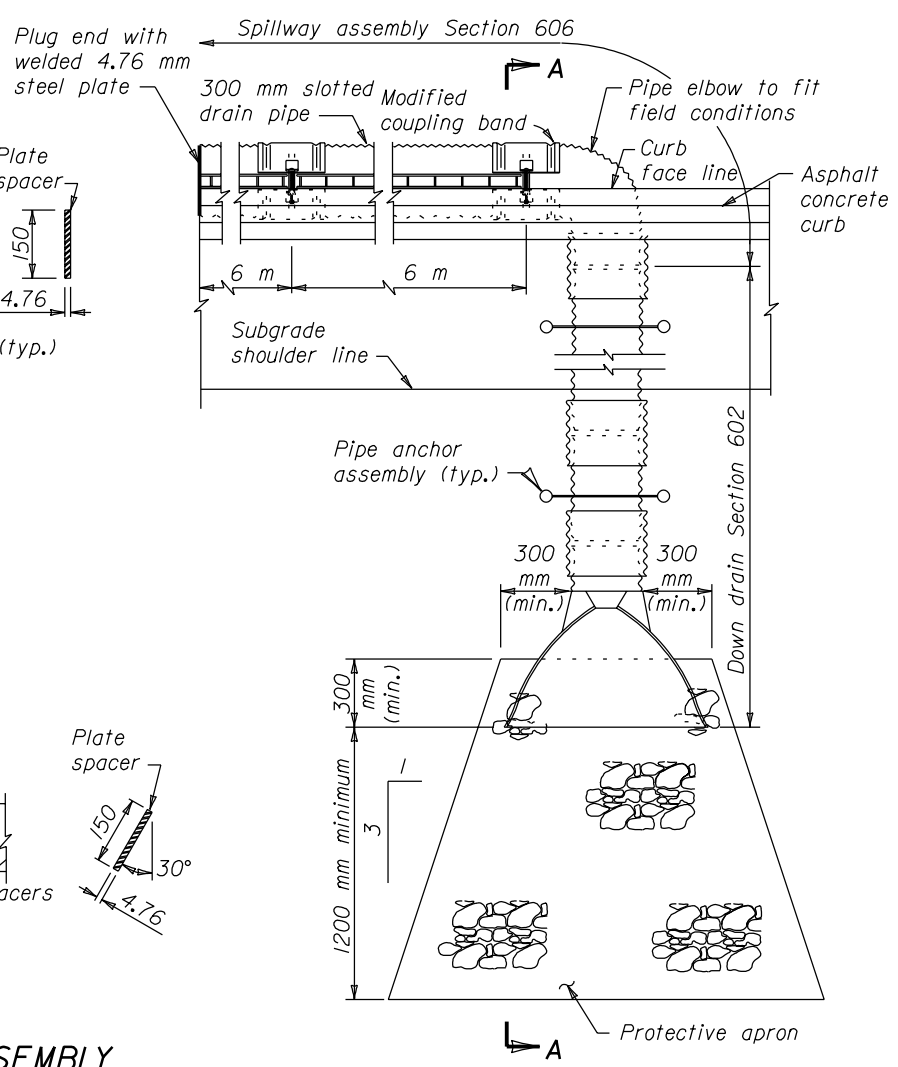


**GRATE SLOT**



**ANGLE SLOT**

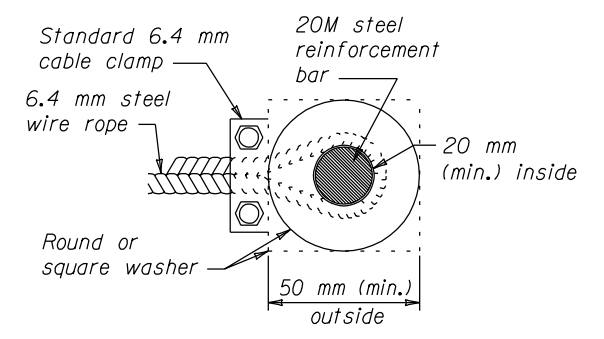
**SLOTTED DRAIN ASSEMBLY**



**SECTION A-A**

**NOTE:**

- Dimensions not labeled are millimeters.
- Fabricate slotted drain pipe, down drain pipe culvert, elbows, end section, and coupling bands from sheets 1.62 mm thickness.
- Grate slot assembly and plate end plug conform to AASHTO M 183.
- Galvanize grate slot assembly, plate end plug, and all hardware according to AASHTO M III.
- Approved alternate pipe anchor assemblies may be used.
- Place Class 2 riprap conforming to Section 251 for protective apron.
- Place pipe anchor assemblies approximately 6 meter intervals along down drain pipe culvert.
- For installations at sag vertical curves, use a tee connection instead of an elbow and a minimum of two 6 meter slotted drain pipe sections.
- Make all band connections watertight by placing gaskets or O-rings under the bands before tightening.
- Use either the grate slot or the angle slot slotted drain assembly.
- Provide hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.



**DETAIL A**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION  
FEDERAL LANDS HIGHWAY

**METRIC STANDARD**

**SLOTTED DRAIN  
SPILLWAY ASSEMBLY**

STANDARD APPROVED FOR USE 3/1996

STANDARD  
**M606-1**

NO SCALE

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