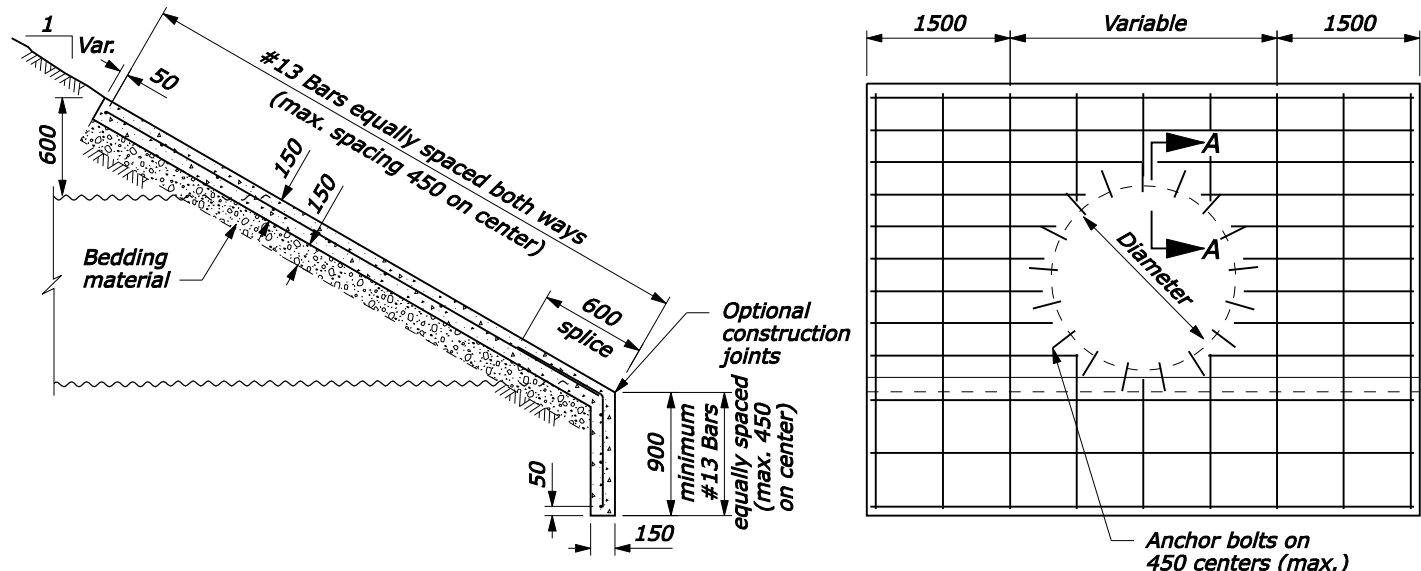
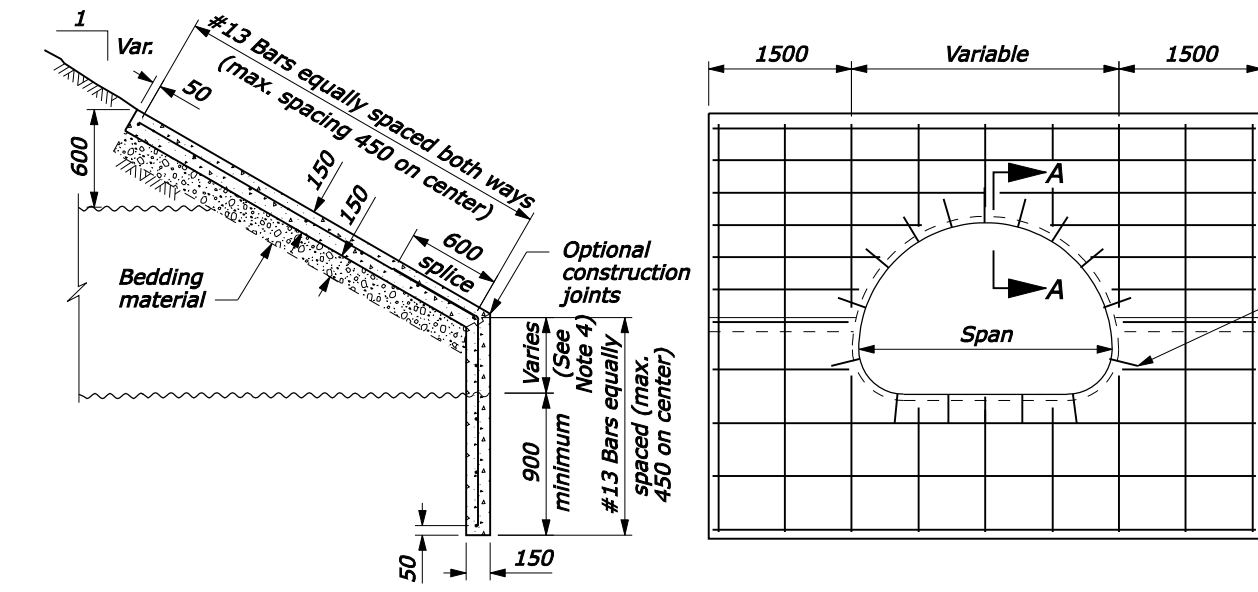


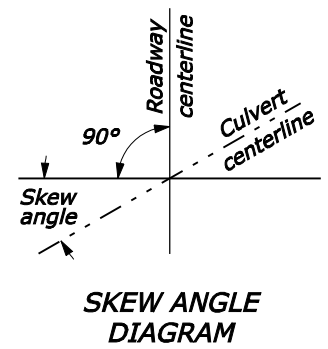
TYPE A STEP BEVEL FOR ROUND PIPE



TYPE B FULL BEVEL FOR ROUND PIPE



STEP BEVEL FOR PIPE ARCH CULVERT



SKEW ANGLE DIAGRAM

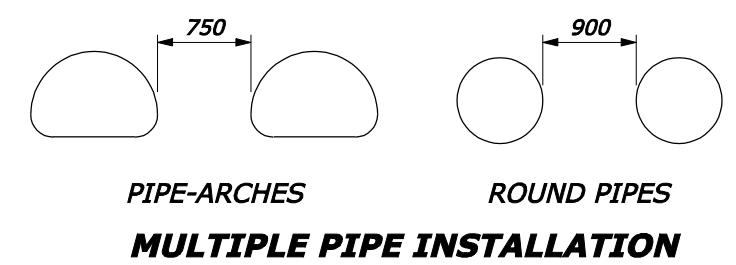
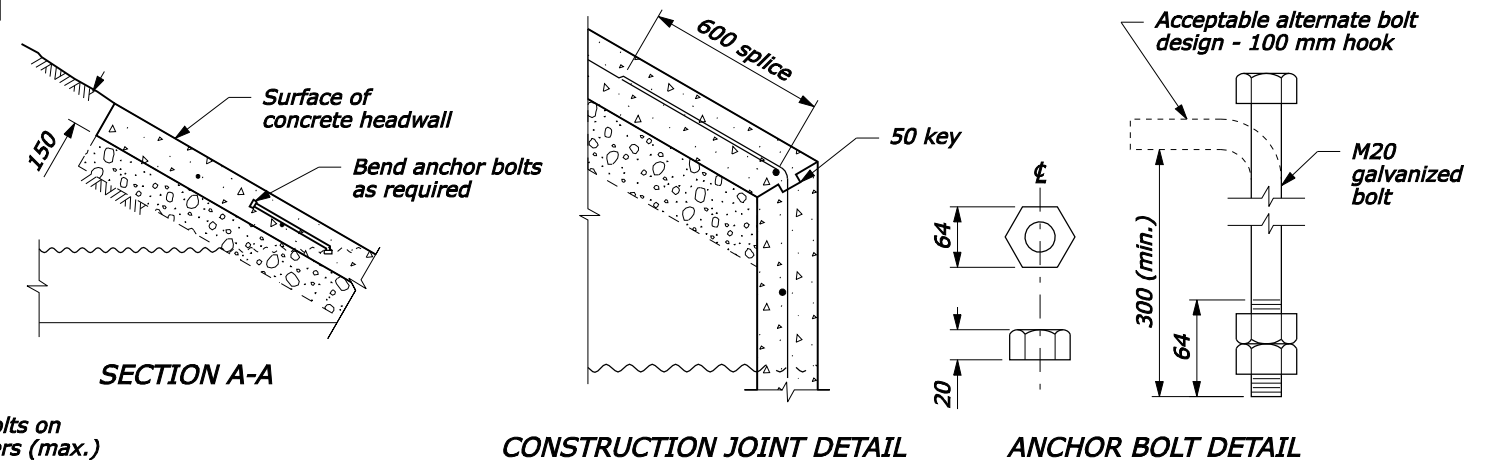
REINFORCED CONCRETE HEADWALL

PIPE ARCH SIZE Span x rise	CONCRETE (m3)			
	Skew Angle			
	0°	15°	30°	45°
1855 x 1400	2.4	2.6	2.8	3.5
2060 x 1500	2.7	2.8	3.1	3.8
2415 x 1700	3.1	3.2	3.3	4.4
2845 x 1905	3.4	3.5	3.9	4.7
3480 x 2210	3.8	4.0	4.4	5.4
3910 x 2540	4.5	4.6	5.1	6.3
4240 x 2615	4.7	4.9	5.4	6.7
4675 x 3150	5.0	5.2	5.8	7.1
4955 x 3300	5.6	5.7	6.3	7.3

REINFORCED CONCRETE HEADWALL

PIPE SIZE Diameter	CONCRETE (m3)							
	TYPE A STEP BEVEL				TYPE B FULL BEVEL			
	Skew Angle				Skew Angle			
	0°	15°	30°	45°	0°	15°	30°	45°
1200	2.5	2.5	2.6	2.8	2.2	2.4	2.7	2.7
1500	2.8	2.8	2.9	3.1	2.8	2.8	2.9	3.1
1800	3.1	3.1	3.2	3.4	3.2	3.3	3.4	3.5
2100	3.4	3.5	3.6	3.8	3.7	3.7	3.8	4.1
2400	3.9	4.0	4.1	4.4	4.1	4.1	4.3	4.5
2700	4.3	4.4	4.5	4.8	4.5	4.6	4.7	5.1
3000	4.6	4.7	4.8	5.2	5.0	5.0	5.2	5.6
3300	5.3	5.4	5.6	6.0	5.4	5.5	5.7	6.1
3600	5.7	5.7	6.0	6.5	5.9	6.0	6.2	6.7
3900	6.0	6.1	6.3	7.0	6.4	6.5	6.7	7.3
4200	6.6	6.7	7.0	7.6	6.9	7.0	7.3	8.0
4500	6.8	7.0	7.2	7.8	7.4	7.5	7.8	8.5

- NOTE:**
1. CONCRETE: Chamfer all exposed edges 20 mm.
 2. REINFORCING STEEL: Grade 420 (ASTM A615M or A996M) deformed billet steel bars conforming to AASHTO M 31. The minimum concrete cover to the face of any bar is 50 mm unless otherwise shown.
 3. HEADWALL TYPE: Use Type A Step Bevel headwalls for round pipe unless otherwise specified in the special contract requirements.
 4. STEP BEVEL: The variable dimension indicated for the height or step conform to manufacturer's recommendations unless otherwise specified in the special contract requirements.
 5. CUTOFF WALLS: The minimum depth shown may be reduced in solid rock, provided wall is keyed into the rock at least 300 mm.
 6. ANCHOR BOLTS: Conform to ASTM A307-04. Galvanize in accordance with ASTM A153M.
 7. BEDDING: Construct a firm and uniform foundation before placing the bedding. Use clean 10 mm sandy material for bedding unless otherwise specified in the special contract requirements.
 8. ESTIMATED QUANTITIES: The concrete quantities are based on a 900 mm cut-off wall and 1:1.5 fill slopes for each of the skew angles. Interpolate concrete quantities for headwalls not shown. Reinforcing steel is estimated at 32 kg/m3 of concrete excluding the weight of the anchor bolts.
 9. Furnish hardware in the metric sizes shown. Equivalent US Customary sizes may be used when metric sizes are not available.
 10. Dimensions without units are millimeters.



NO SCALE

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

METRIC DETAIL

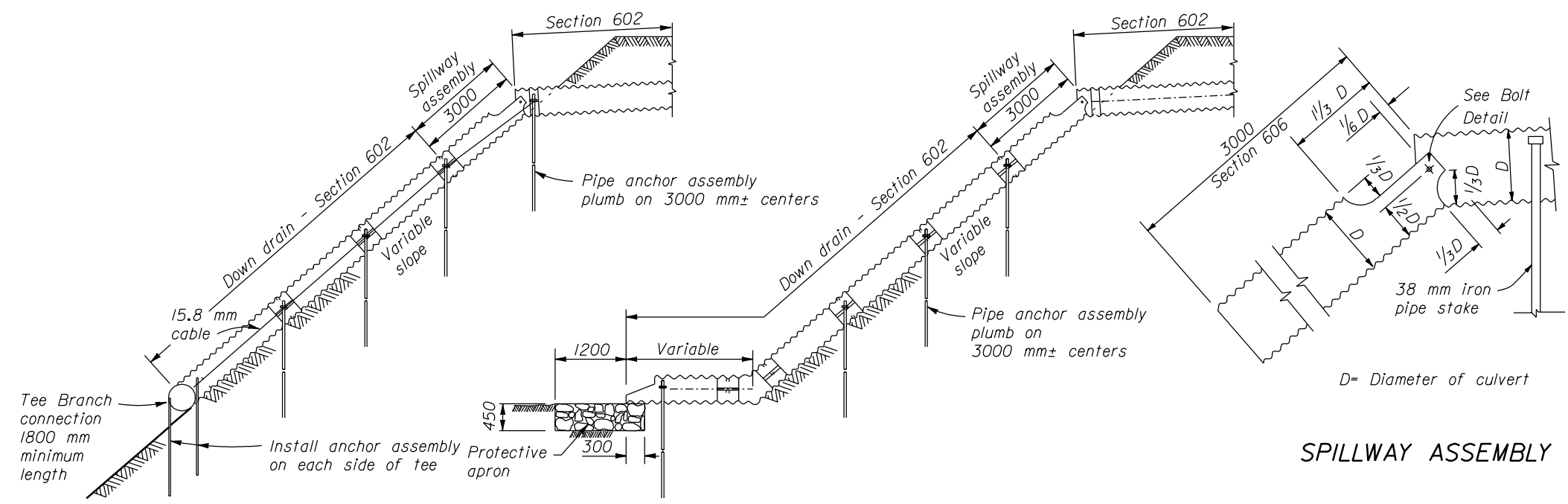
REINFORCED CONCRETE HEADWALL

DETAIL APPROVED FOR USE 11/2006

REVISID: _____

DETAIL
WM601-10

20-Nov-2006 01:31 PM F:\StandDraw\Western\w60110.dgn [Metric]



SPILLWAY ASSEMBLY

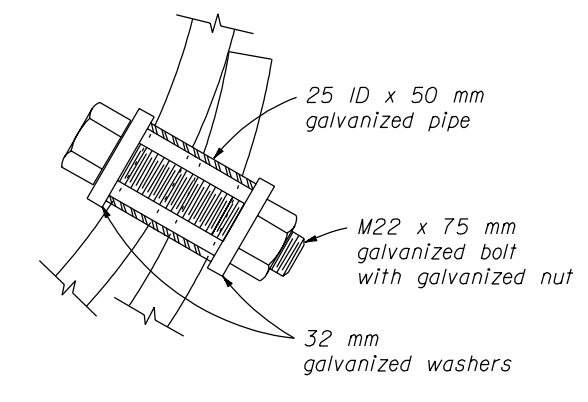
- NOTE:**
- Dimensions not labeled are in millimeters.
 - Fabricate spillway assembly from annular corrugated pipe, or from helically corrugated pipe with factory annular or reformed ends. Use 1.6 mm galvanized steel or 1.5 mm aluminum.
 - Make all banded connections watertight by placing 5 mm bead of approved caulking under each half of the band before tightening.
 - Payment for Tee Branch connection under Section 602 is included in the linear foot measurement for culvert pipe for the applicable sizes. Measure Tee Branch connections along the top of the Tee.
 - Place Class 2 riprap conforming to Section 251 for protective apron.
 - Galvanized all items of anchor assembly after fabrication.
 - Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
 - Approved alternate designs may be used.

ELEVATION

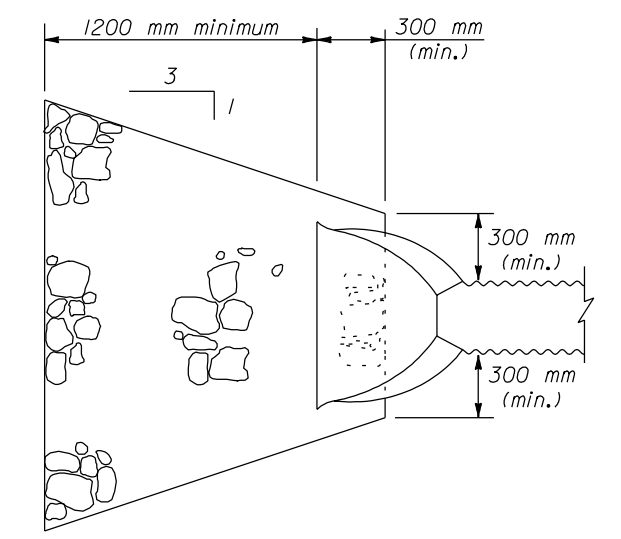
SPILLWAY ASSEMBLY WITH DOWN DRAIN OUTLET ON NON-ERODIBLE MATERIAL

ELEVATION

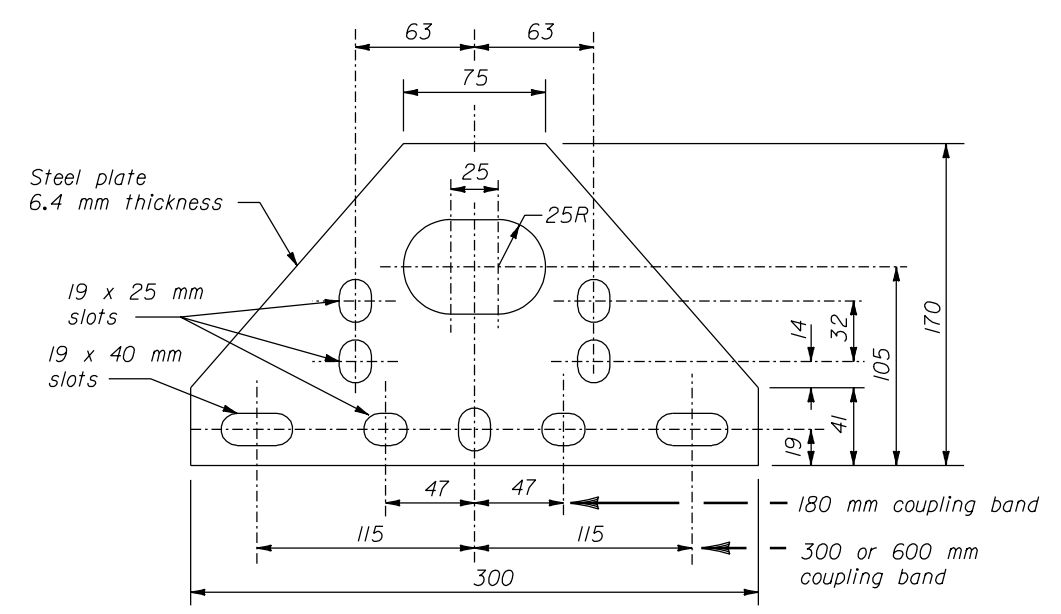
SPILLWAY ASSEMBLY WITH DOWN DRAIN OUTLET ON ERODIBLE MATERIAL



BOLT DETAIL

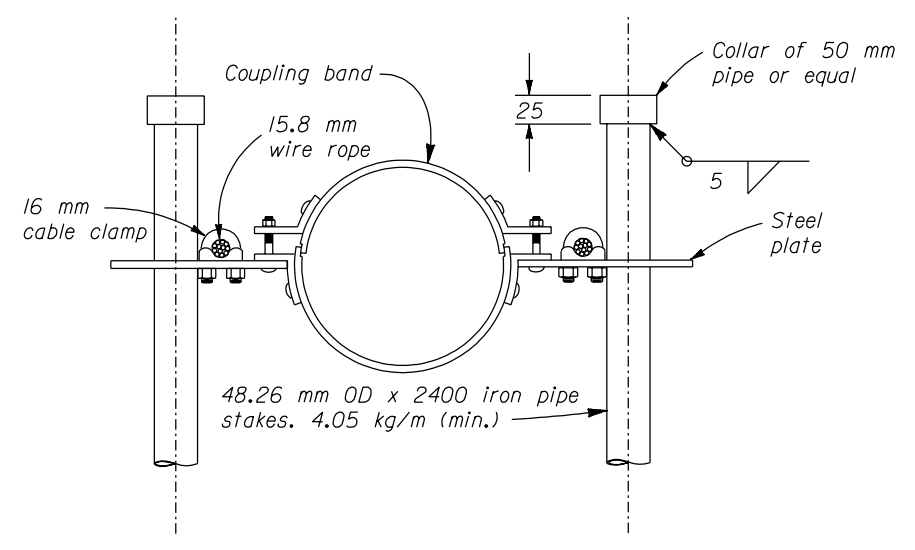


**PLAN
PROTECTIVE APRON**



Measure length of coupling band parallel to the centerline of the pipe.

STEEL PLATE



ANCHOR ASSEMBLY

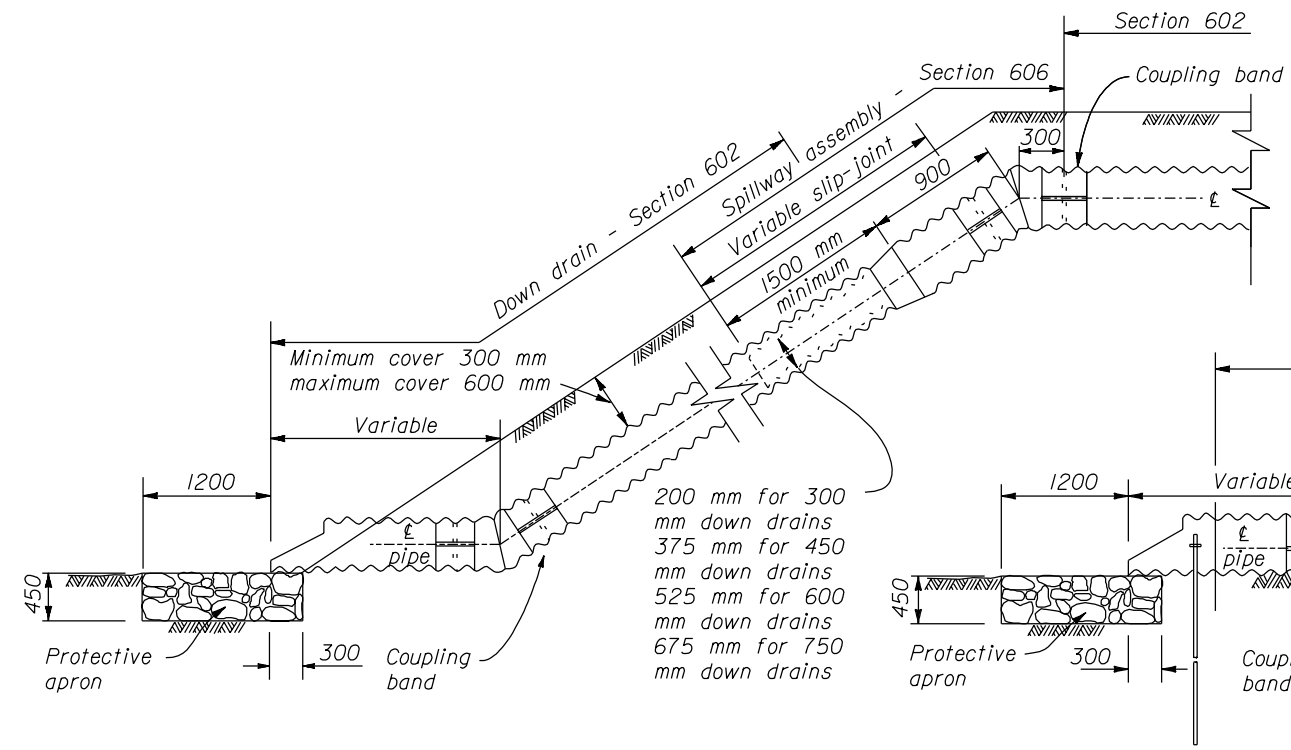
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
SPILLWAY ASSEMBLY WITH DOWN DRAIN	
DETAIL APPROVED FOR USE 3/1996	DETAIL
REVISED:	WM606-50

13 DEC 2000 f:\standrow\metric\details\wm60650.dgn

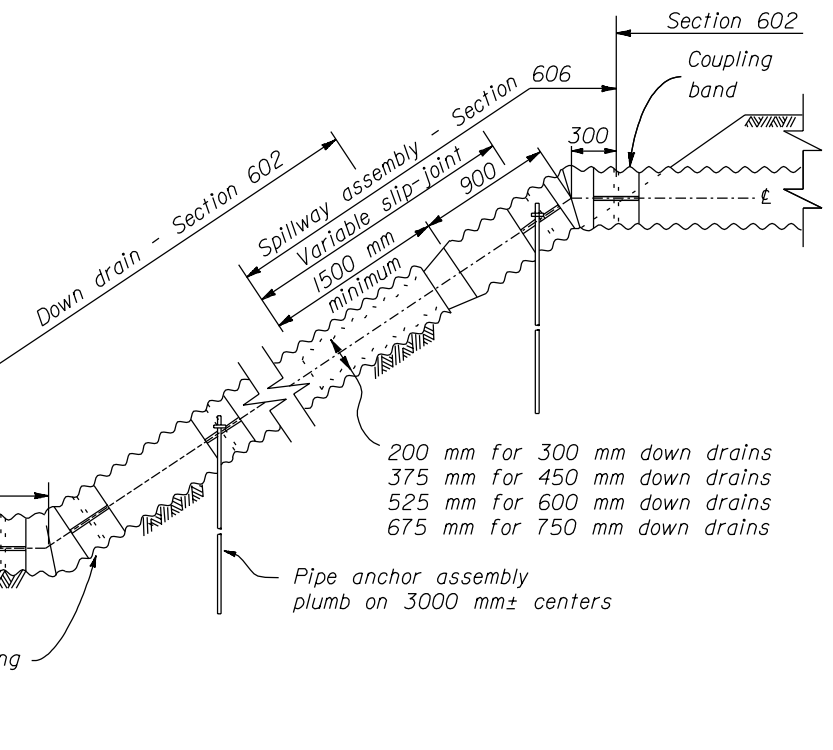
NOTE:

1. Dimensions not labeled are in millimeters.
2. Fabricate spillway assembly from annular corrugated pipe, or from helically corrugated pipe with factory annular or reformed ends. Use 1.6 mm galvanized steel or 1.5 mm aluminum.
3. Make all coupling band connections water tight by placing 5 mm bead of approved caulking under each half of the band before tightening.
4. Place Class 2 riprap conforming to Section 251 for protective apron.
5. Galvanize all items of anchor assembly after fabrication.
6. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes all not available.
7. Approved alternate designs may be used.



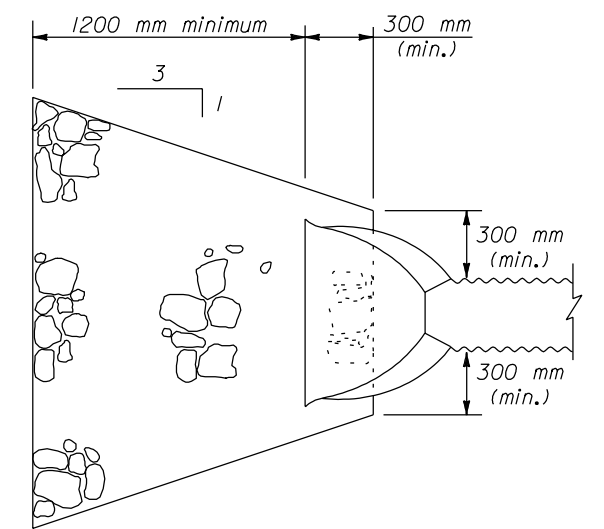
ELEVATION

SPILLWAY ASSEMBLY WITH BURIED DOWN DRAIN

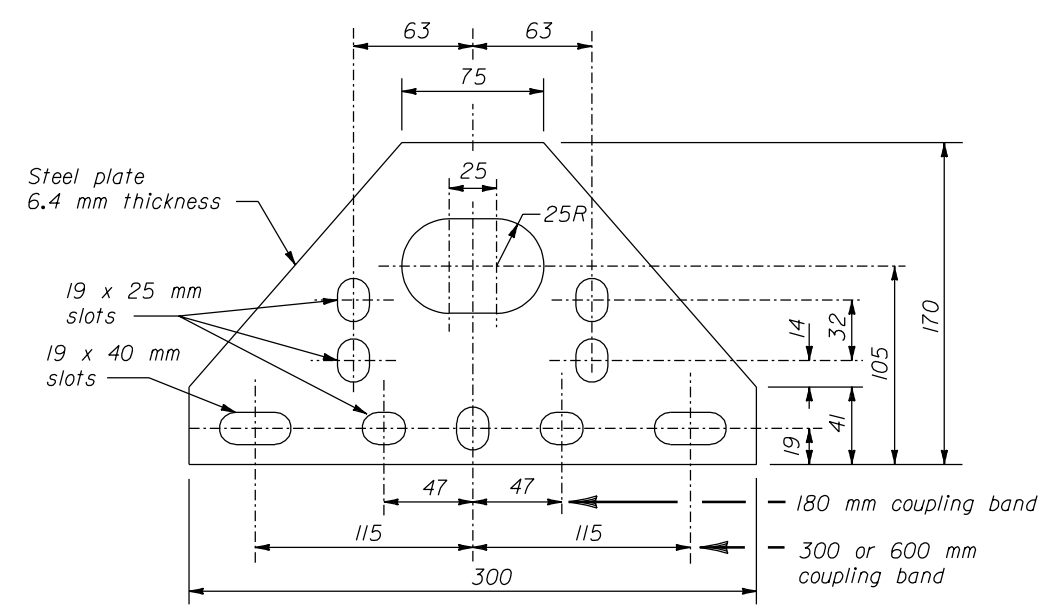


ELEVATION

SPILLWAY ASSEMBLY WITH SURFACE DOWN DRAIN

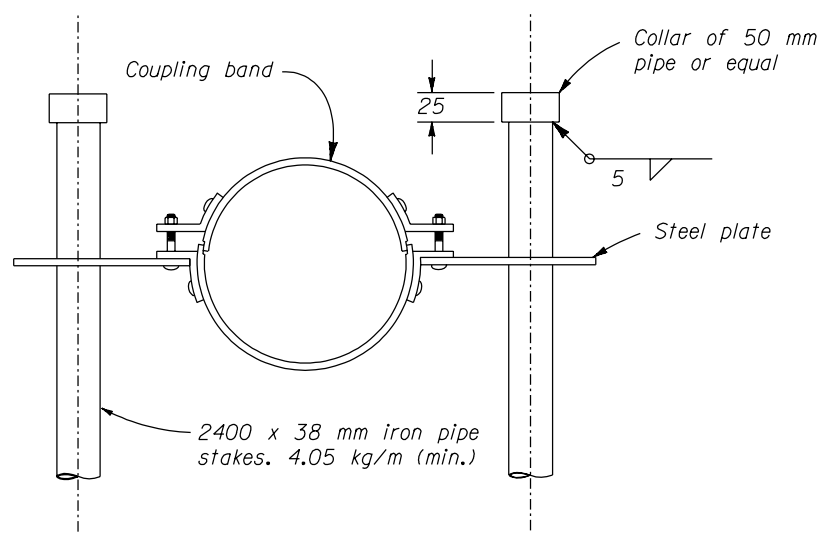


PLAN
PROTECTIVE APRON



Measure length of coupling band parallel to the centerline of the pipe.

STEEL PLATE

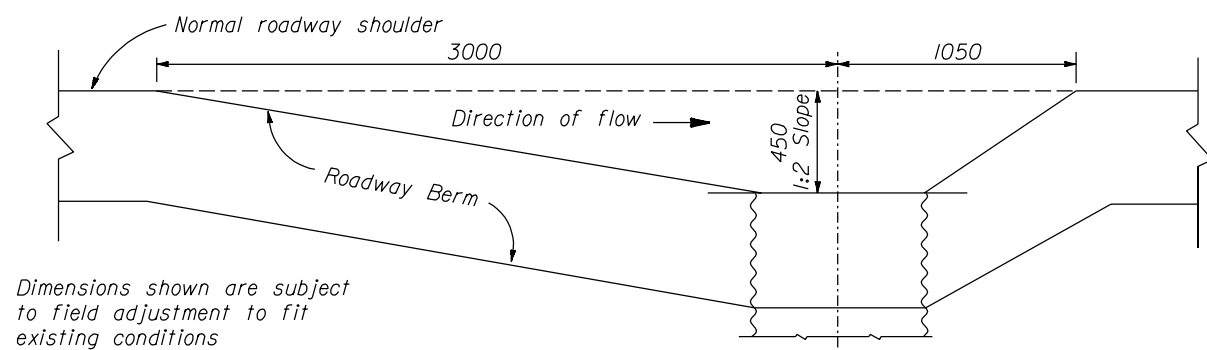


ANCHOR ASSEMBLY

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
SPILLWAY ASSEMBLY WITH DOWN DRAIN AND SLIP-JOINT	
DETAIL APPROVED FOR USE 3/1996	DETAIL
REVISED:	WM606-51

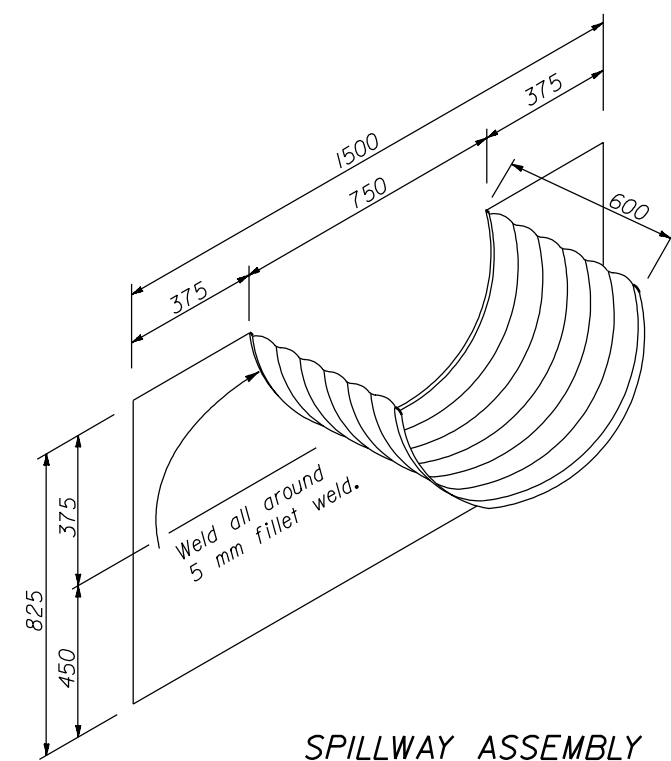
NO SCALE

13 DEC 2000 f:\standrow\metric\details\wm60651.dgn



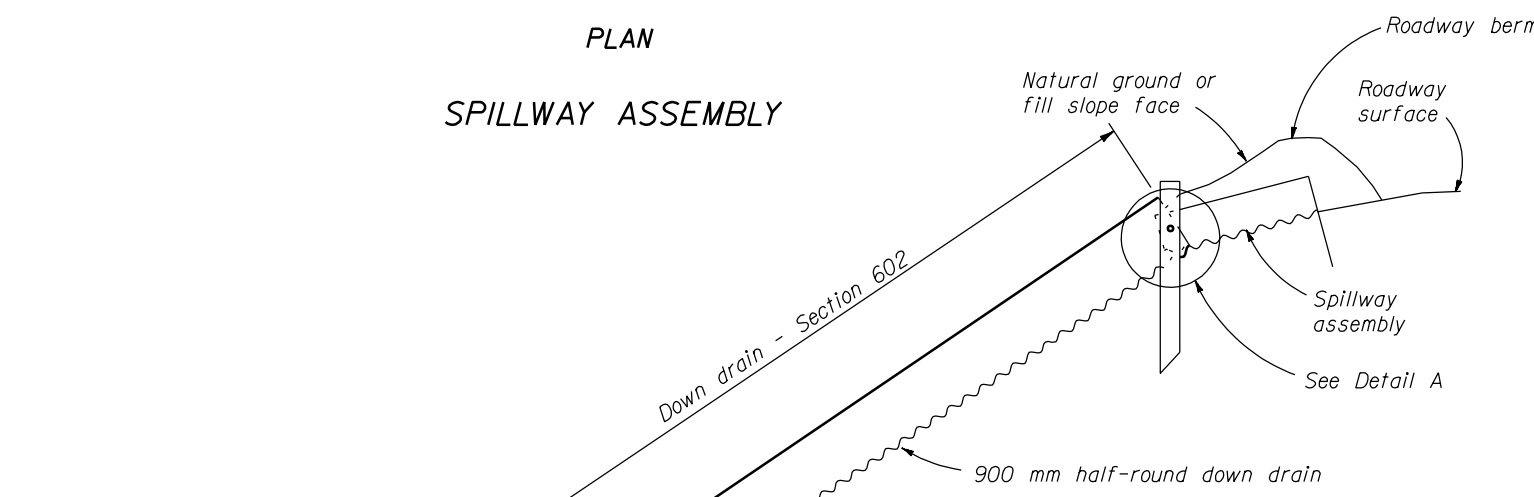
Dimensions shown are subject to field adjustment to fit existing conditions

PLAN
SPILLWAY ASSEMBLY

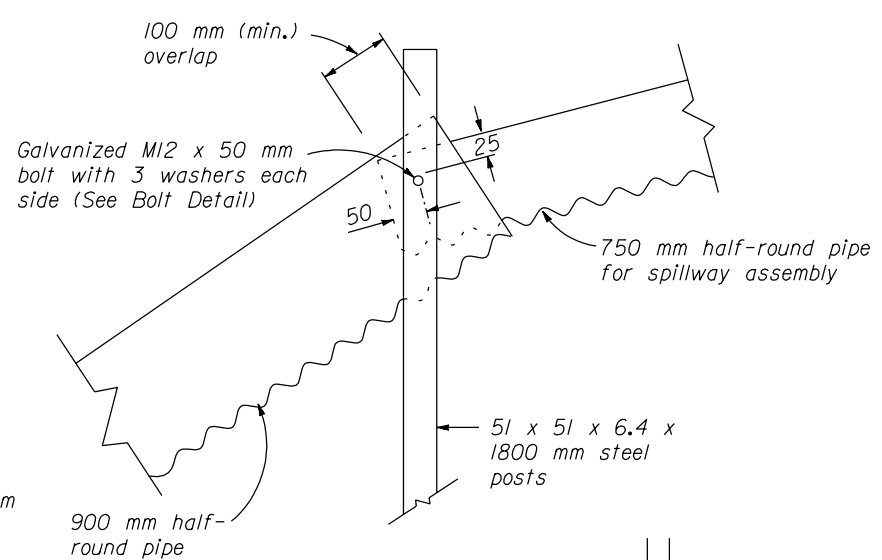
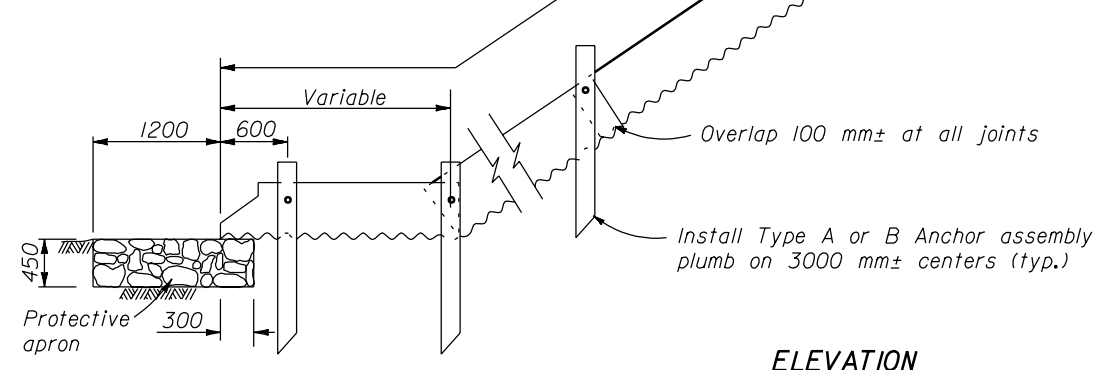


SPILLWAY ASSEMBLY

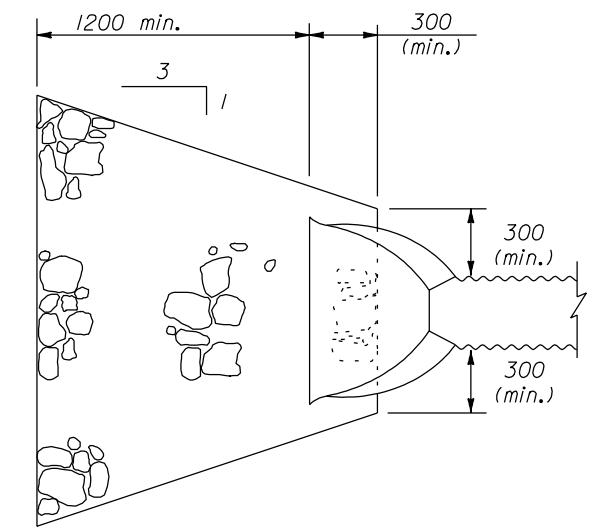
- NOTE:**
1. Dimensions not labeled are in millimeters.
 2. Fabricate spillway assembly from 1.6 mm thick galvanized steel or 1.5 mm aluminum.
 3. Place Class 2 riprap conforming to Section 251 for protective apron.
 4. Construct down drain from annular corrugated pipe, or from helically corrugated pipe with factory annular or flanged reformed ends.
 5. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
 6. Approved alternate designs may be used.



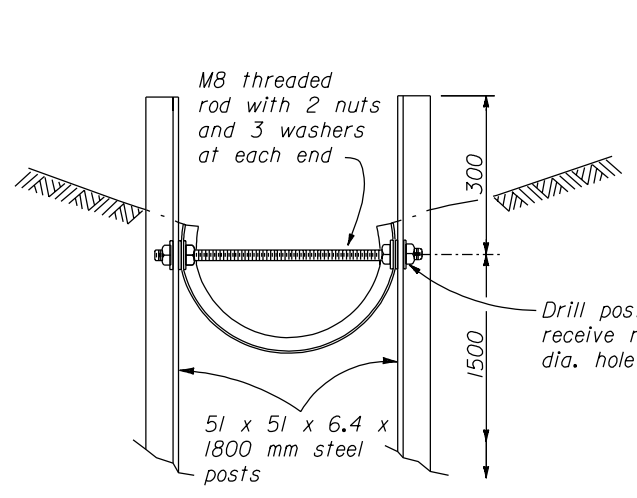
ELEVATION
SPILLWAY ASSEMBLY AND DOWN DRAIN



DETAIL A

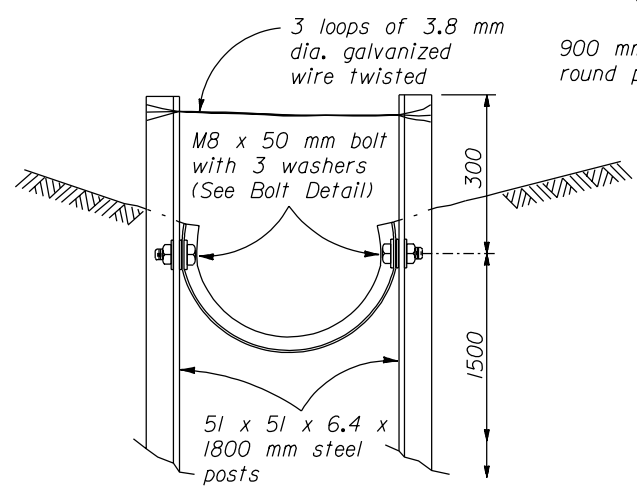


PLAN
PROTECTIVE APRON

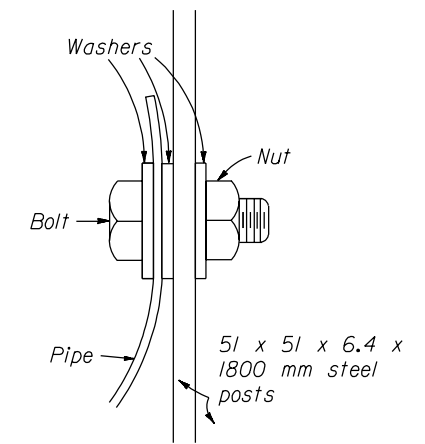


TYPE A

ANCHOR ASSEMBLY



TYPE B



BOLT DETAIL

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

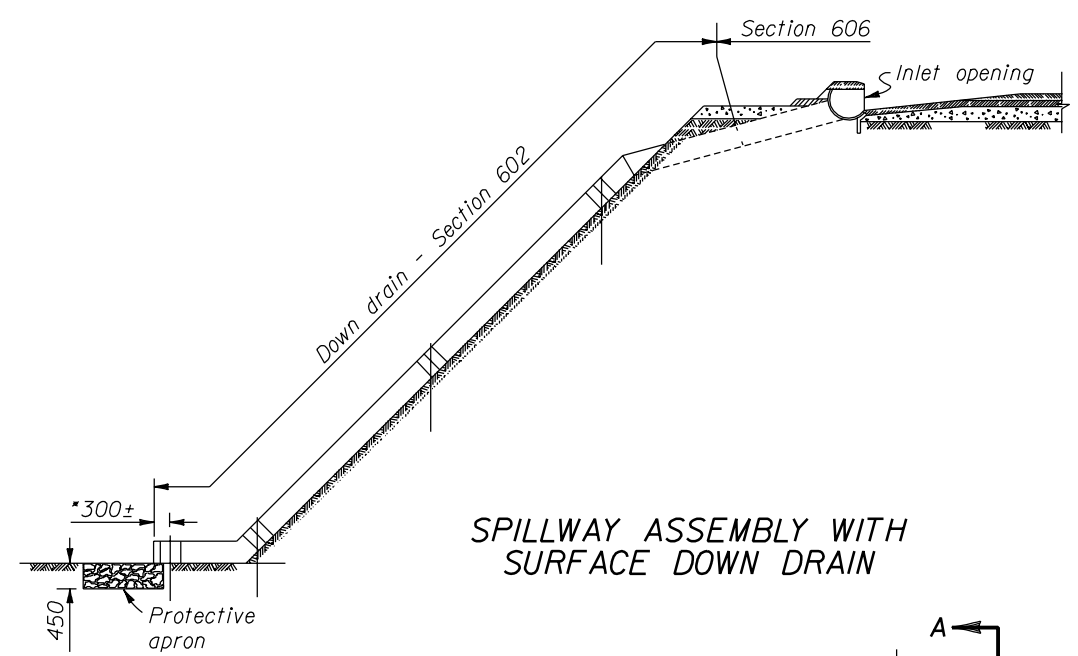
METRIC DETAIL

**SPILLWAY ASSEMBLY WITH
HALF-ROUND DOWN DRAIN**

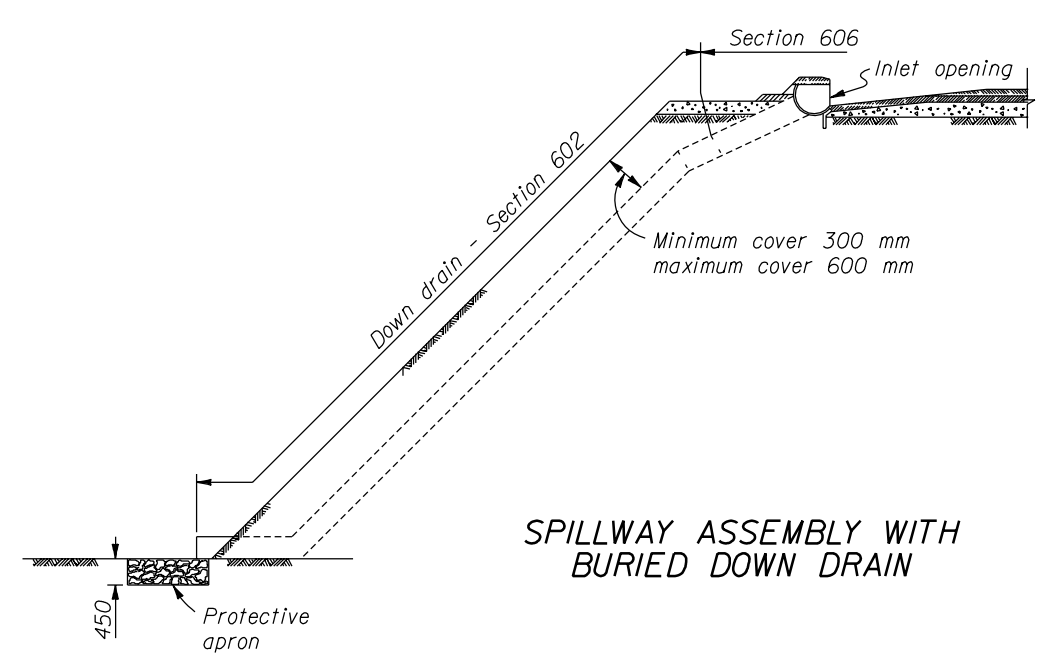
DETAIL APPROVED FOR USE 3/1996
REVISED: 3/1999 3/2000

DETAIL
WM606-52

NO SCALE

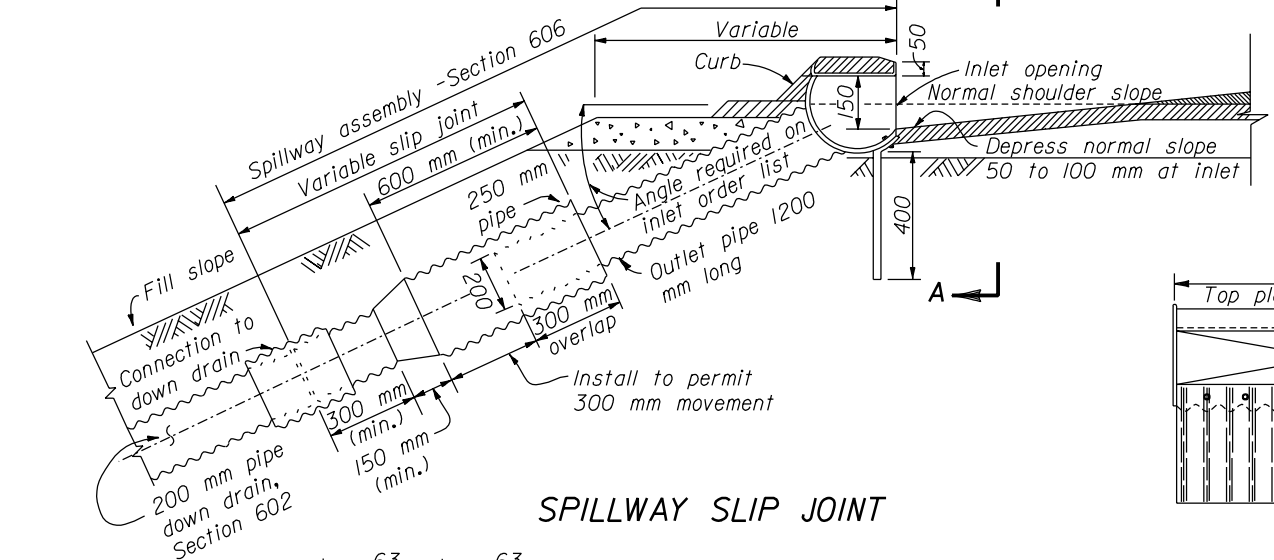


SPILLWAY ASSEMBLY WITH SURFACE DOWN DRAIN

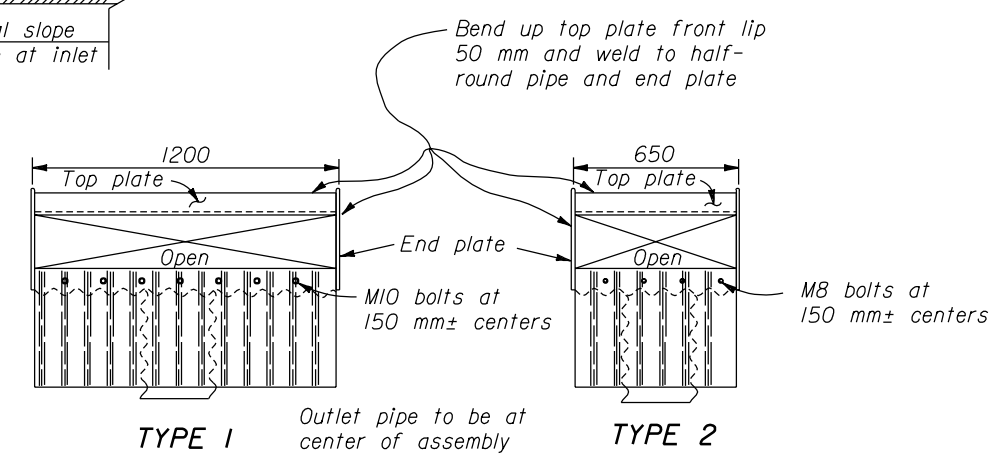


SPILLWAY ASSEMBLY WITH BURIED DOWN DRAIN

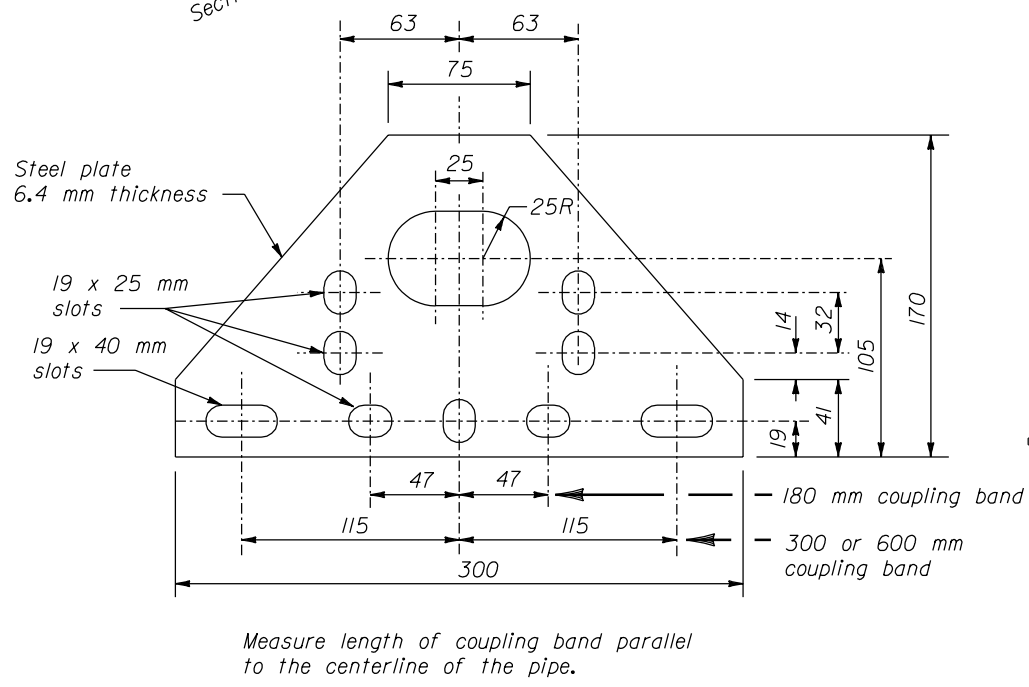
- NOTE:**
1. Dimensions not labeled are in millimeters.
 2. Fabricate half-round pipe, outlet pipe, and curtain wall for spillway assembly from 1.6 mm galvanized steel or 1.5 mm aluminum. Fabricate top plate and end plate from 4.6 mm flat steel or 5.0 mm aluminum plate. Fabricate tapered portion of slip joint from either flat or corrugated sheets.
 3. Make all coupling band connections watertight by placing a 5 mm bead of approved caulking under each half of the band before tightening.
 4. Install pipe anchor assemblies at 3000 mm± spacing on down drain installed above ground.
 5. Use Type 2 spillway assembly inlets where profile grades are greater than 2 percent. Use Type 1 on grades 2 percent or flatter.
 6. Place class 2 riprap conforming to Section 251 for protective apron.
 7. Galvanized items of the anchor assembly after fabrication.
 8. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.
 9. Approved alternate designs may be used.



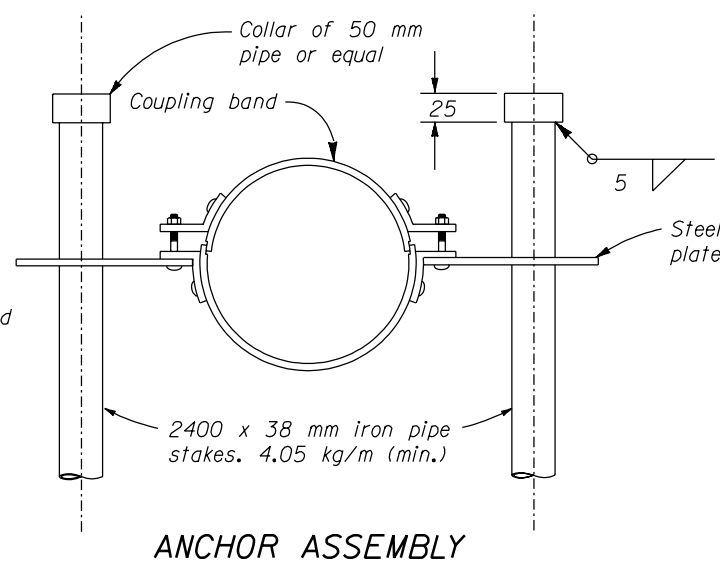
SPILLWAY SLIP JOINT



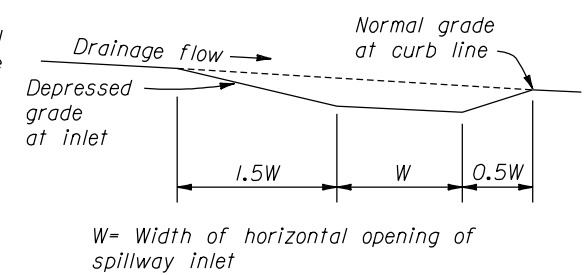
SECTION A-A SPILLWAY ASSEMBLY INLETS



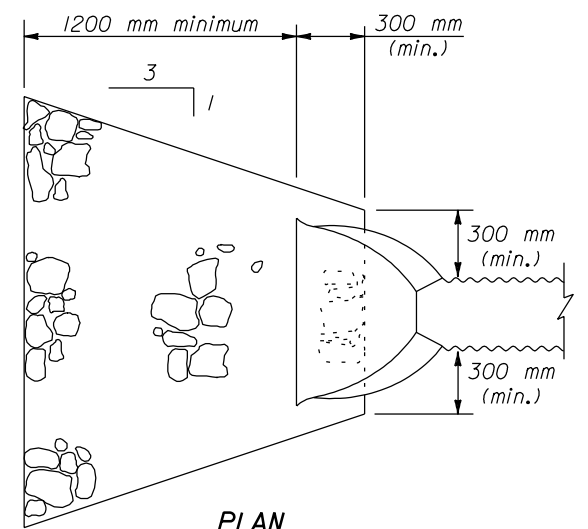
STEEL PLATE



ANCHOR ASSEMBLY



SCHEMATIC PROFILE OF INLET BASIN



PLAN PROTECTIVE APRON

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

METRIC DETAIL

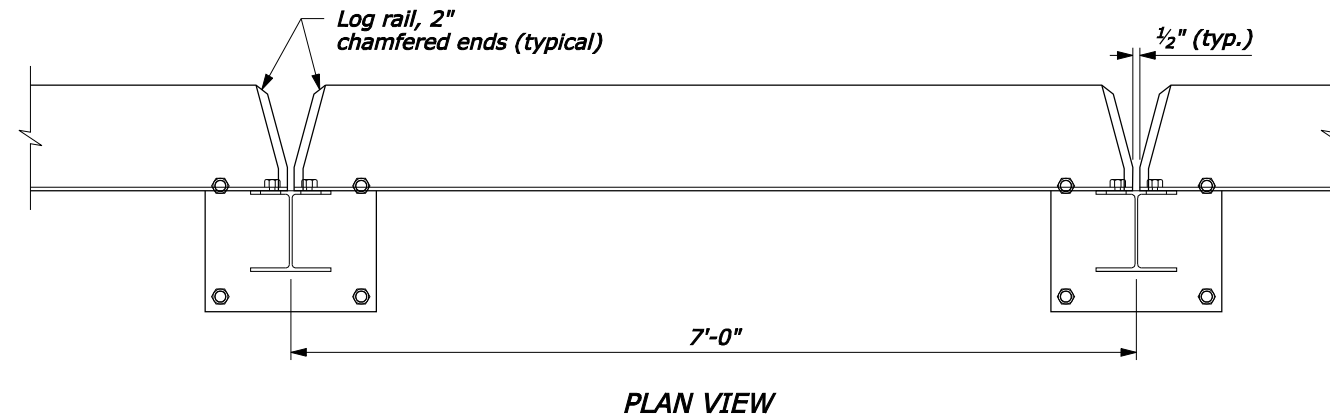
CORRUGATED METAL SPILLWAYS AND INLETS

DETAIL APPROVED FOR USE 3/1996
REVISID:

DETAIL
WM606-53

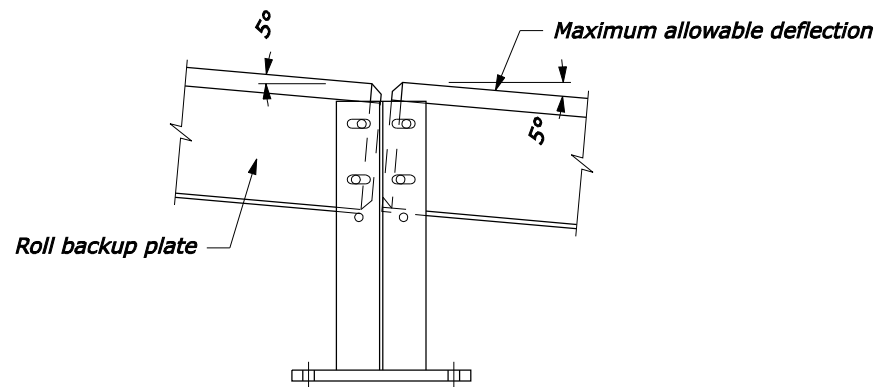
NO SCALE

13 DEC 2000 f:\standrow\metric\details\wm60653.dgn

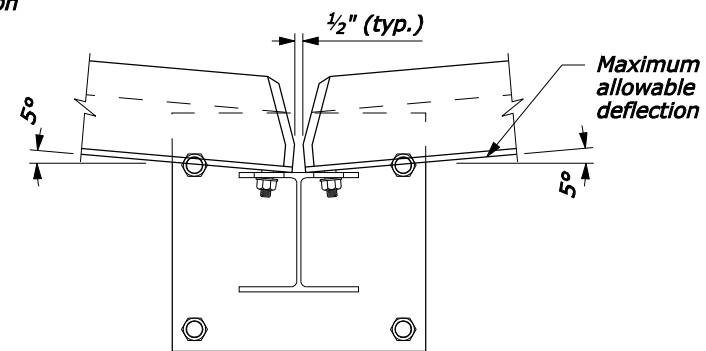


NOTE:

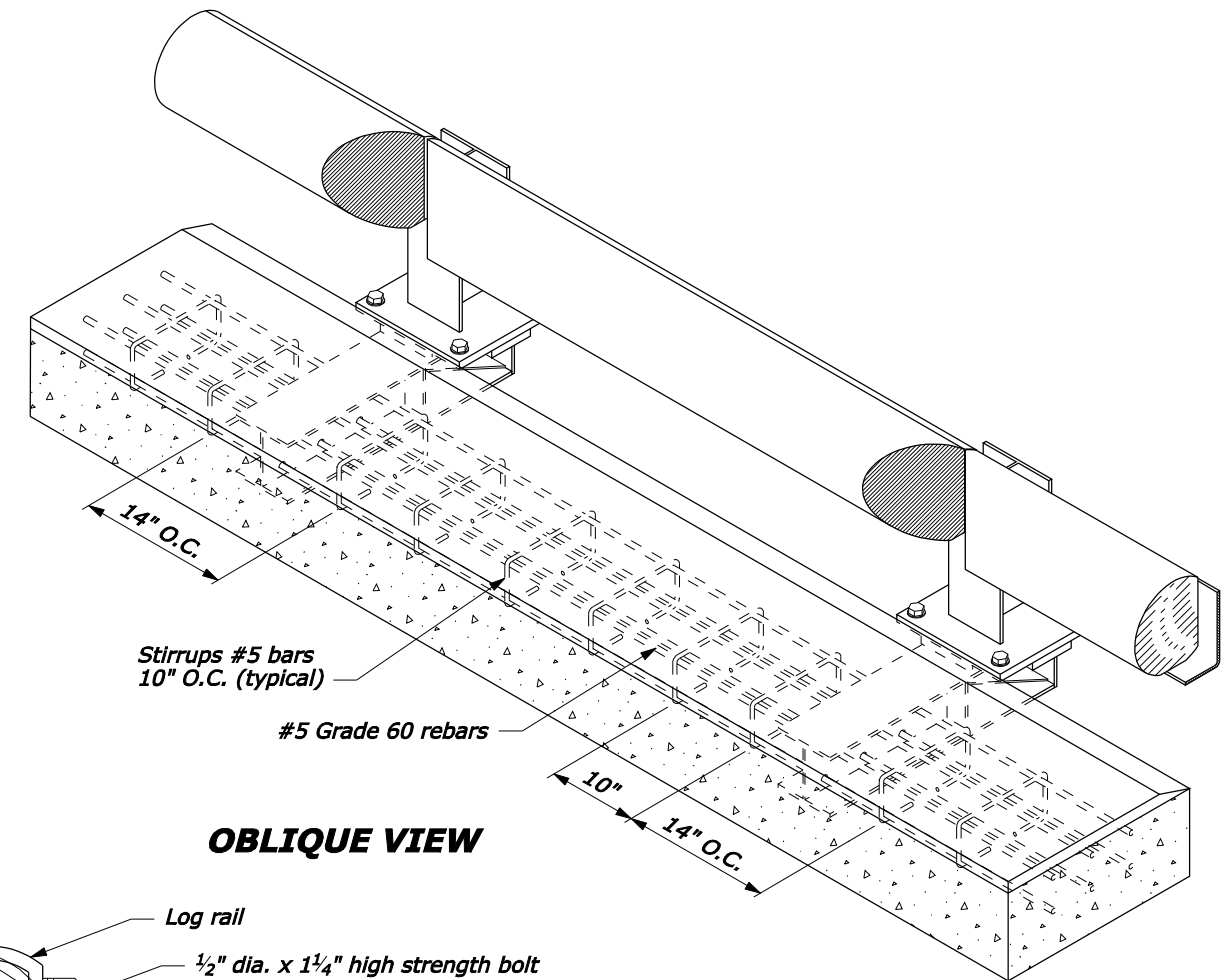
1. Steel is ASTM A242, Grade 50.
2. Concrete: minimum $f_c' = 3500$ psi.



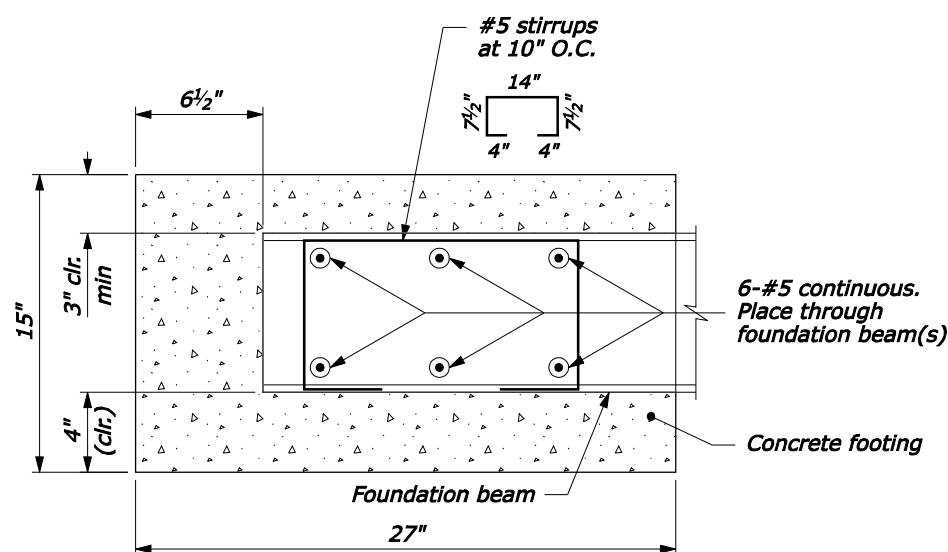
**ENDS OF RAILS AT POST:
MAXIMUM VERTICAL
DEFLECTION ALLOWABLE
ELEVATION**



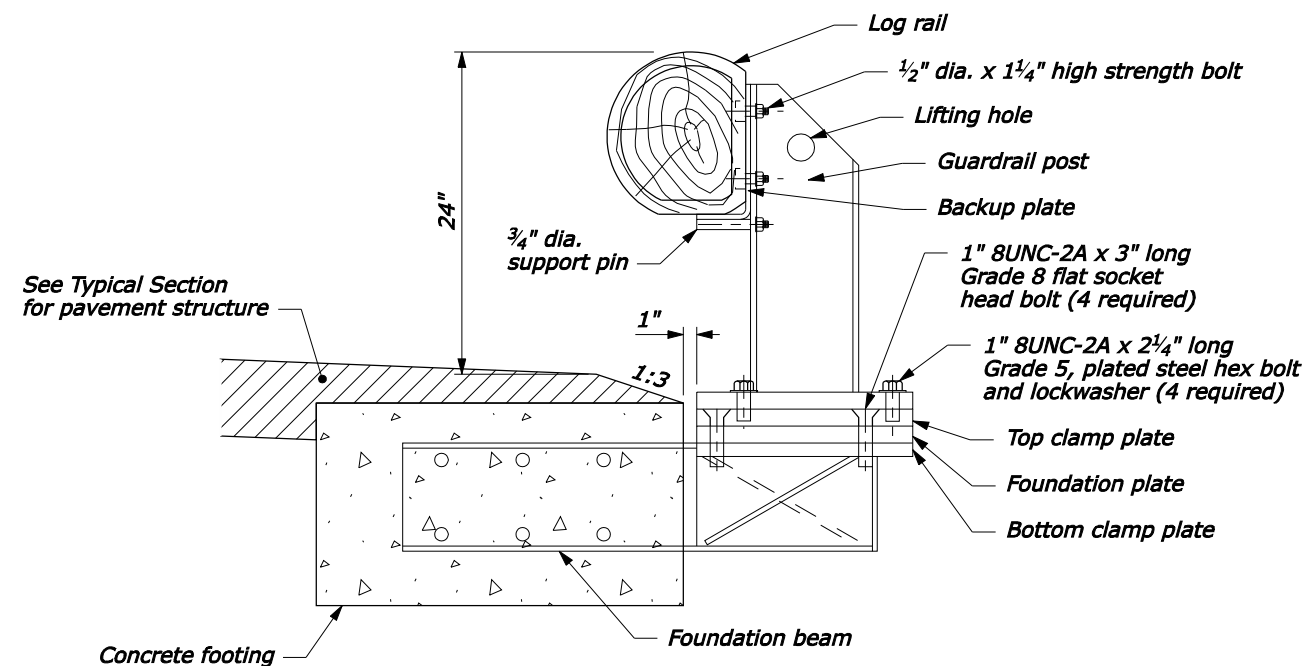
**MAXIMUM HORIZONTAL
DEFLECTION ALLOWABLE
PLAN VIEW**



OBLIQUE VIEW



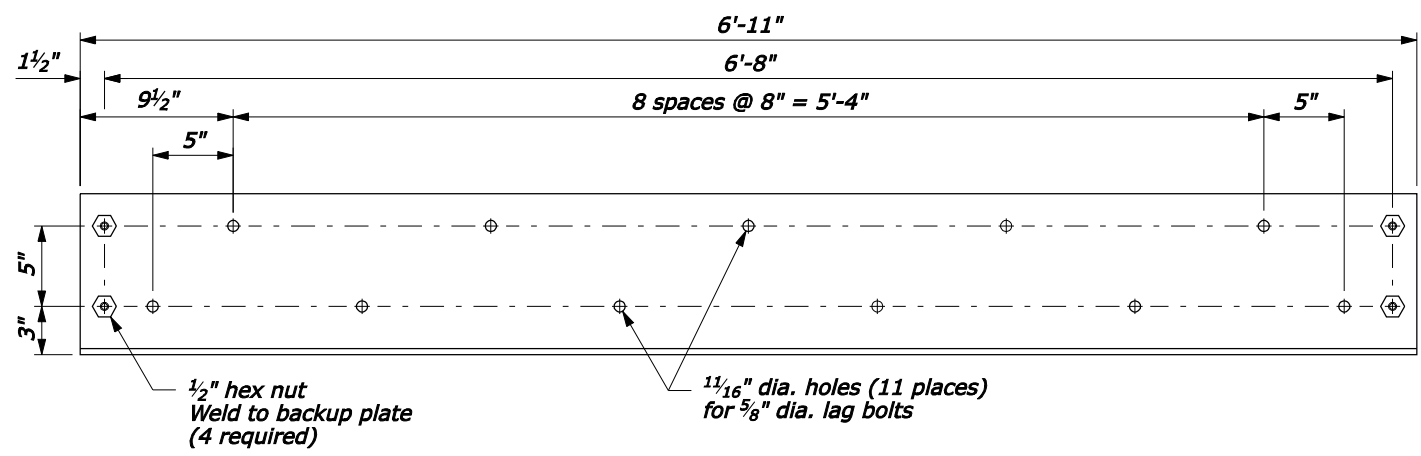
**FOOTING DETAIL
TYPICAL SECTION**



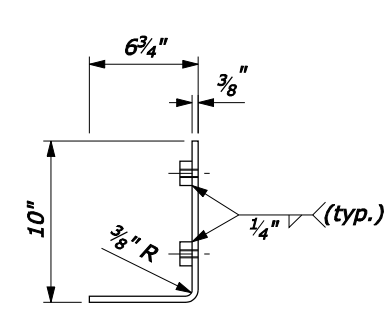
TYPICAL SECTION

NO SCALE

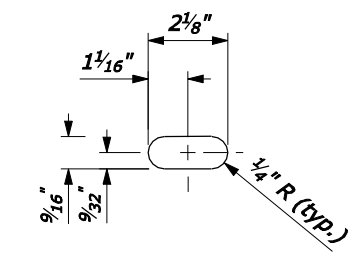
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
U.S. CUSTOMARY DETAIL REMOVABLE STEEL-BACKED LOG RAIL Sheet 1 of 3	
DETAIL APPROVED FOR USE	DETAIL
REVISED: DRAFT: 3/2008	617-83



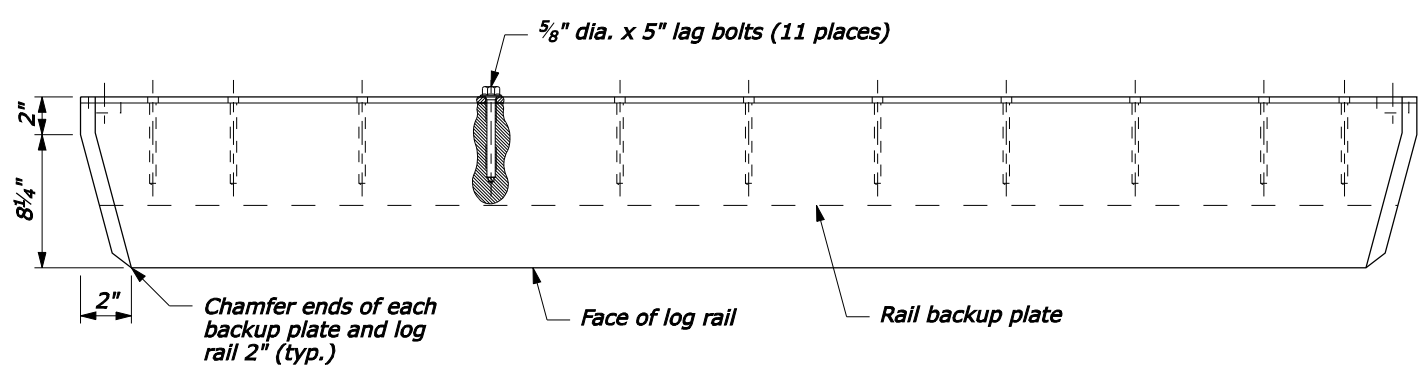
**RAIL BACKUP PLATE
ELEVATION VIEW**



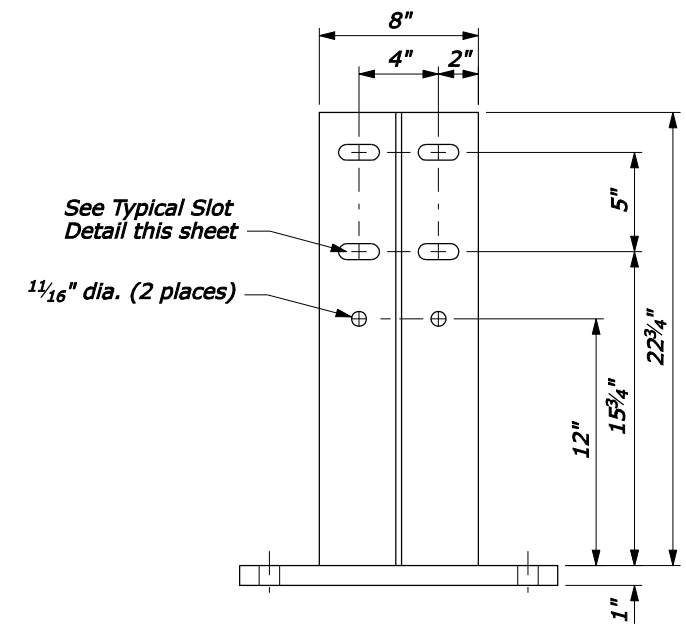
**RAIL BACKUP PLATE
SECTION VIEW**



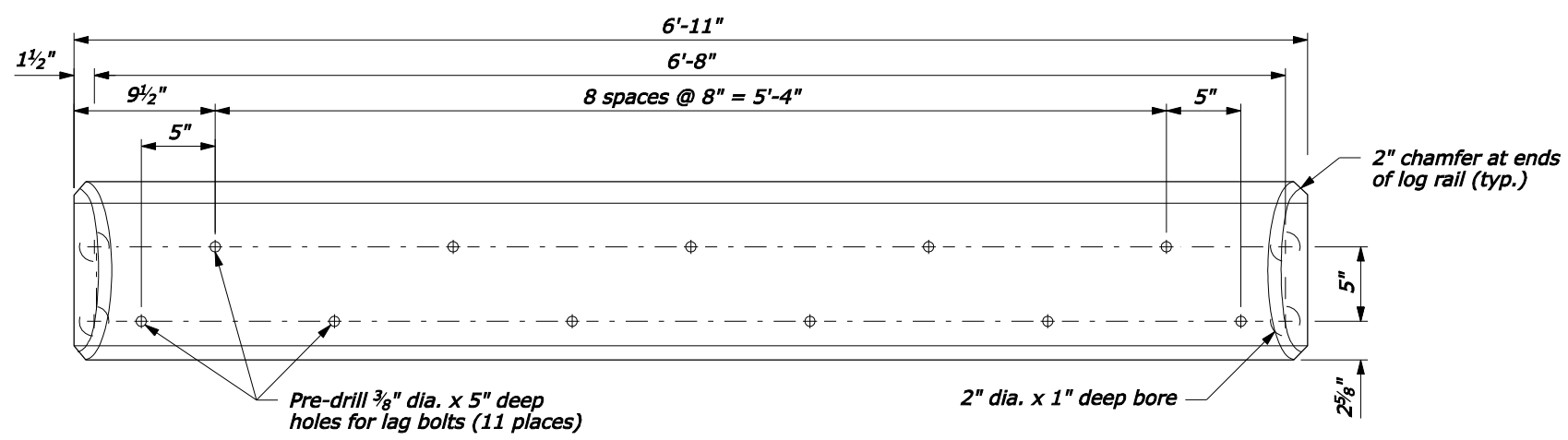
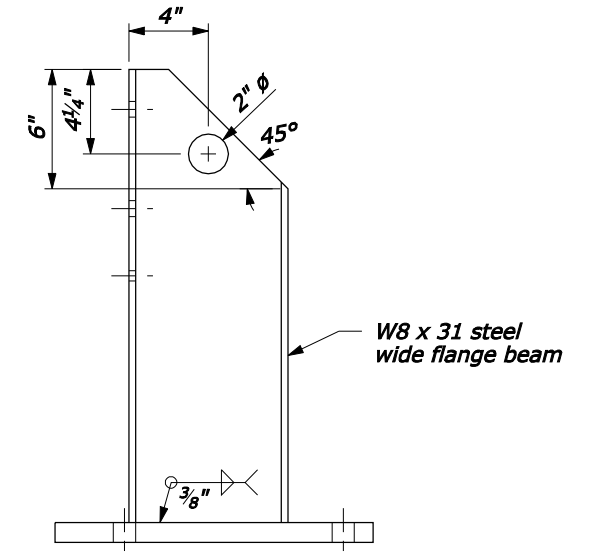
TYPICAL SLOT DETAIL



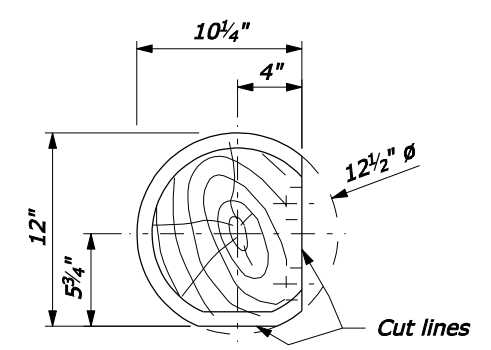
**LOG RAIL & RAIL BACKUP PLATE
PLAN VIEW**



GUARDRAIL POST



**LOG RAIL
ELEVATION VIEW**



**LOG RAIL
SECTION VIEW**

NO SCALE

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

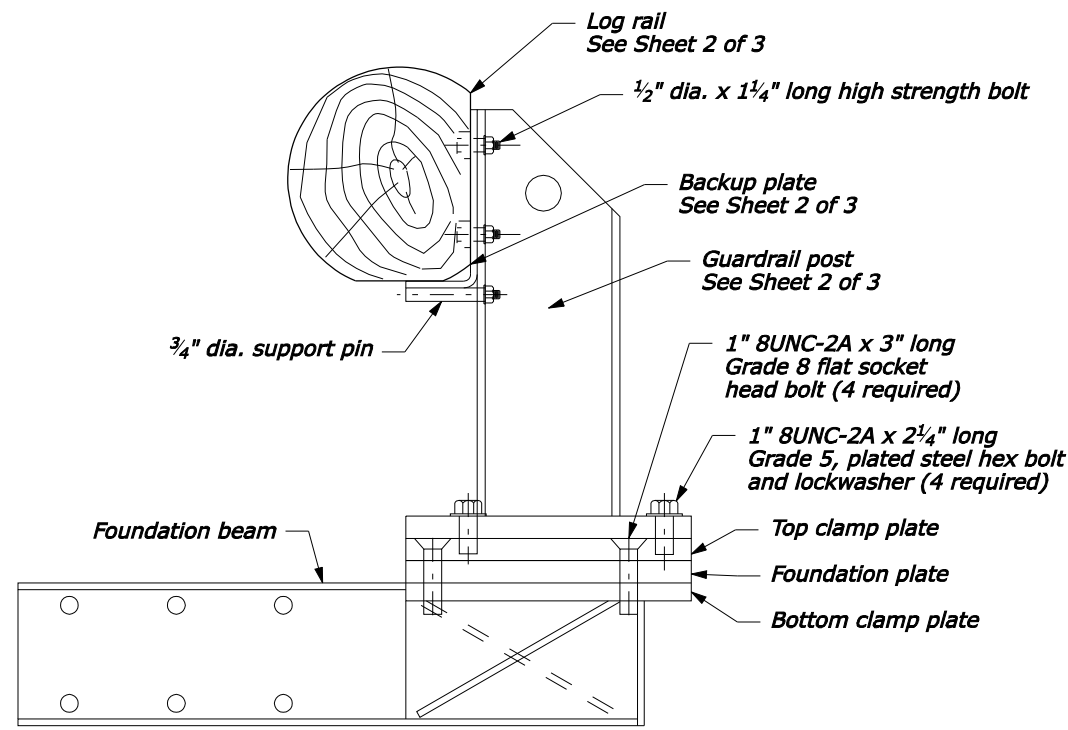
U.S. CUSTOMARY DETAIL

**REMOVABLE
STEEL-BACKED LOG RAIL**

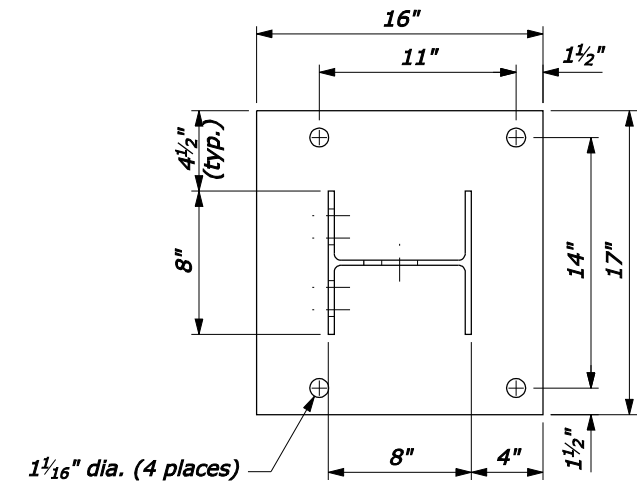
Sheet 2 of 3

DETAIL APPROVED FOR USE	DETAIL
REVISED:	617-83
DRAFT: 3/2008	

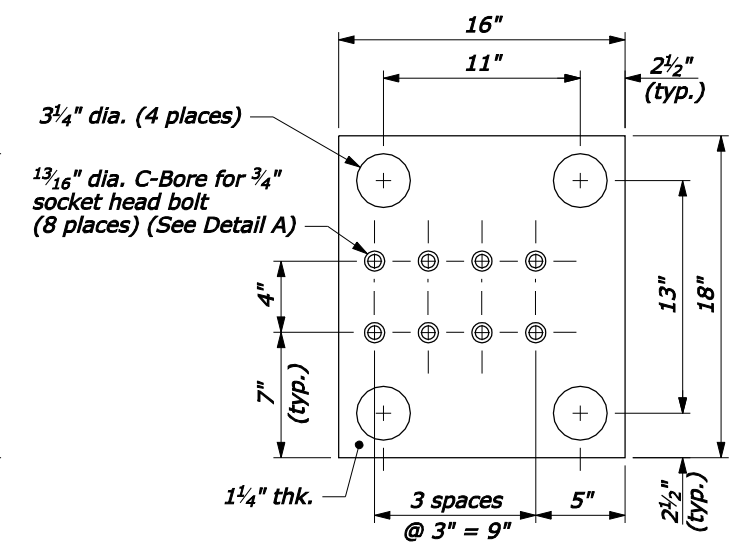
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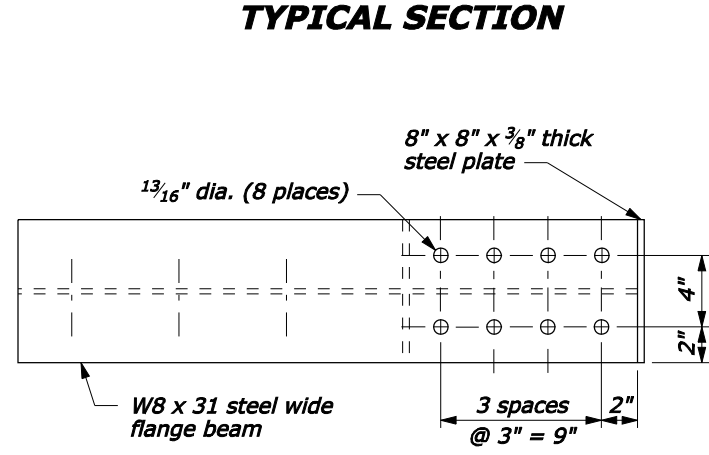
TYPICAL SECTION



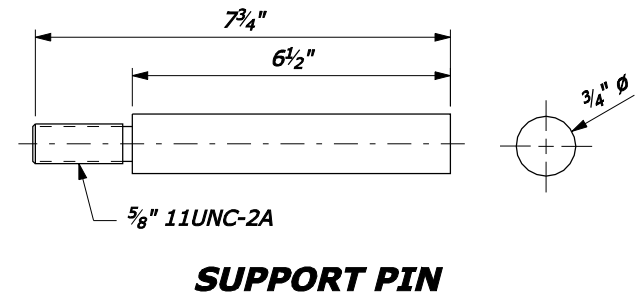
RAIL POST BASE PLATE



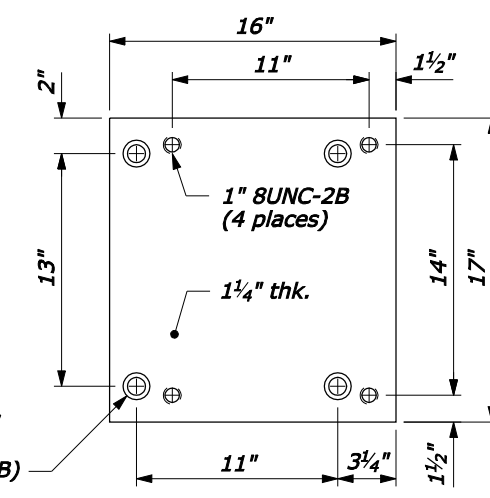
FOUNDATION PLATE



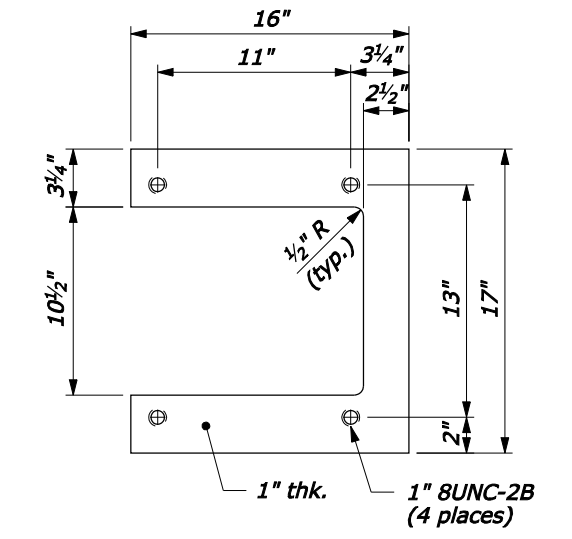
FOUNDATION BEAM



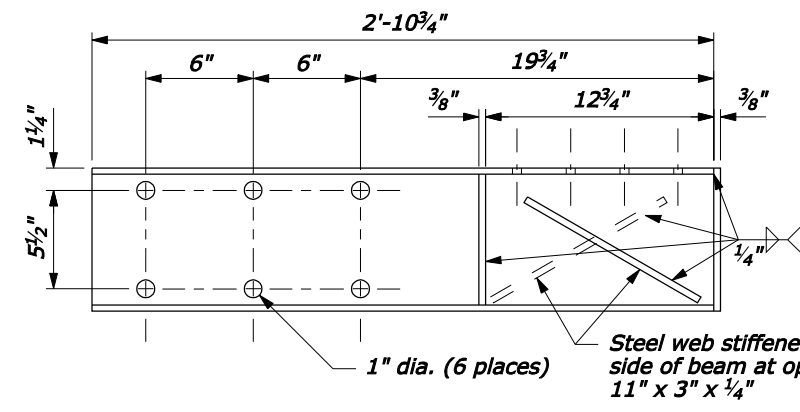
SUPPORT PIN



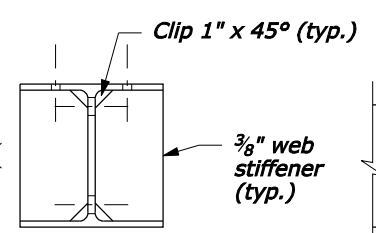
TOP CLAMP PLATE



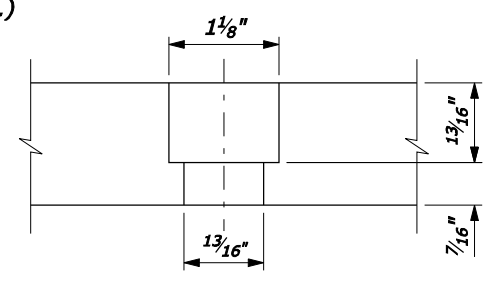
BOTTOM CLAMP PLATE



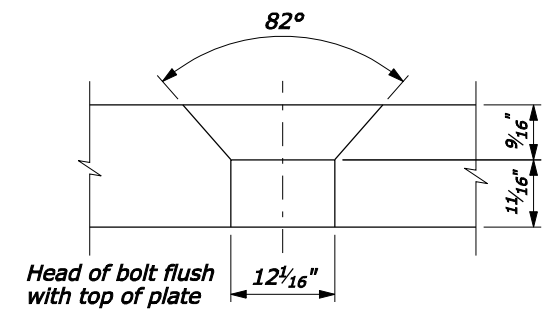
FOUNDATION BEAM



DETAIL A



DETAIL B



DETAIL B

NO SCALE

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

U.S. CUSTOMARY DETAIL

**REMOVABLE
 STEEL-BACKED LOG RAIL**

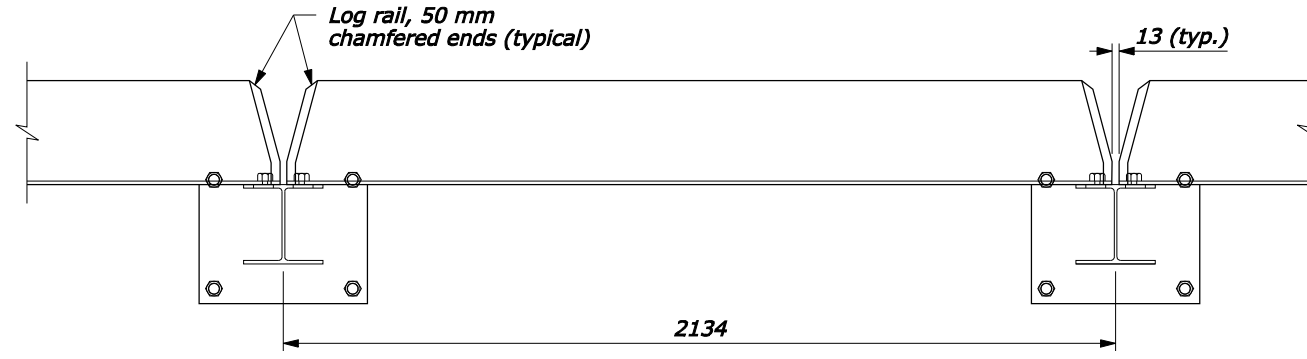
Sheet 3 of 3

DETAIL APPROVED FOR USE -/---

REVISIONS:
 DRAFT: 3/2008

DETAIL
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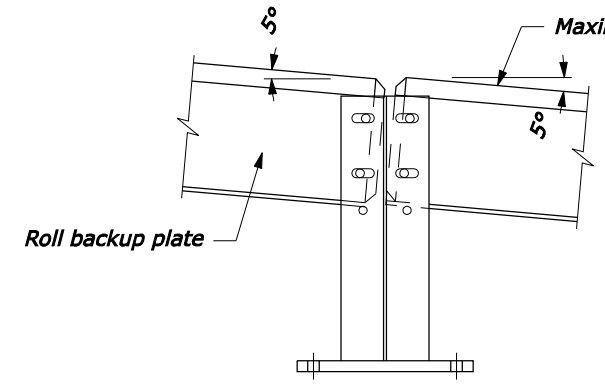
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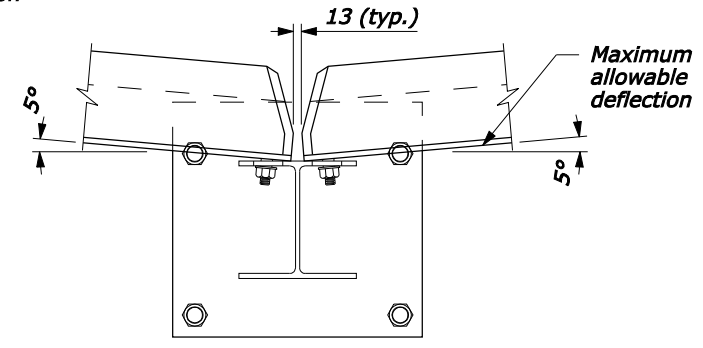
PLAN VIEW

NOTE:

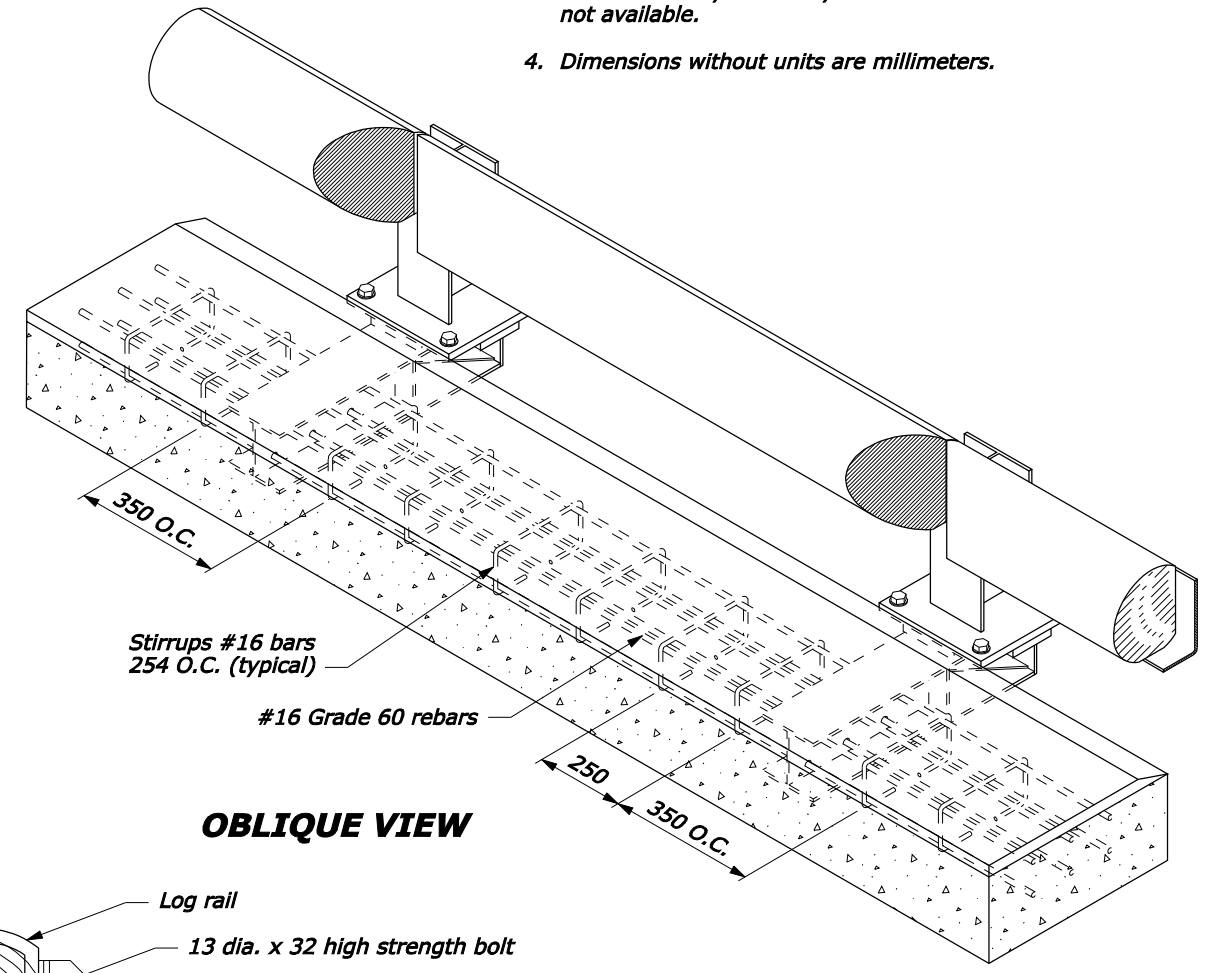
1. Steel is ASTM A242, Grade 50.
2. Concrete: minimum $f'c = 24$ MPa.
3. Furnish hardware in the metric sizes shown. Equivalent U.S. Customary sizes may be used when metric sizes are not available.
4. Dimensions without units are millimeters.



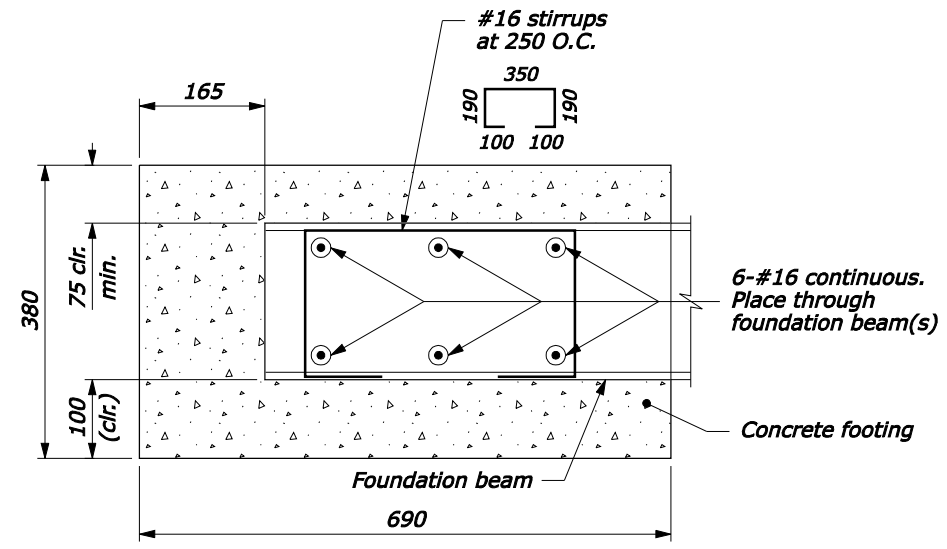
**ENDS OF RAILS AT POST:
MAXIMUM VERTICAL
DEFLECTION ALLOWABLE
ELEVATION**



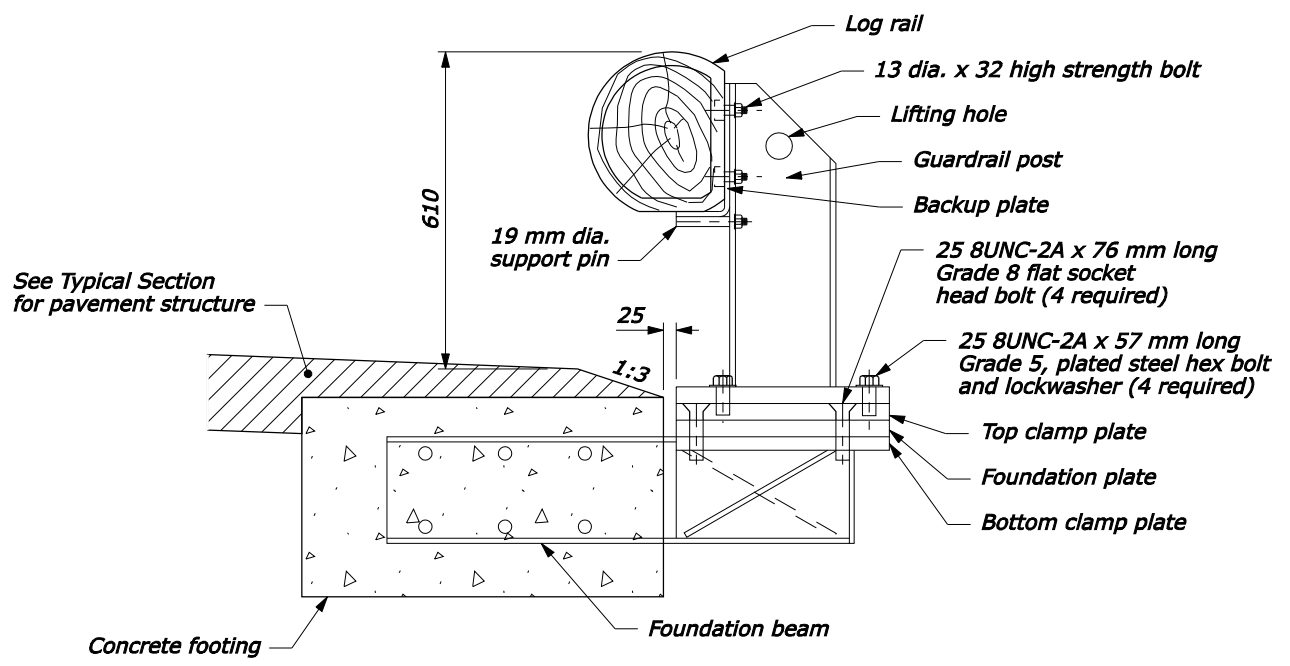
**MAXIMUM HORIZONTAL
DEFLECTION ALLOWABLE
PLAN VIEW**



OBLIQUE VIEW



**FOOTING DETAIL
TYPICAL SECTION**

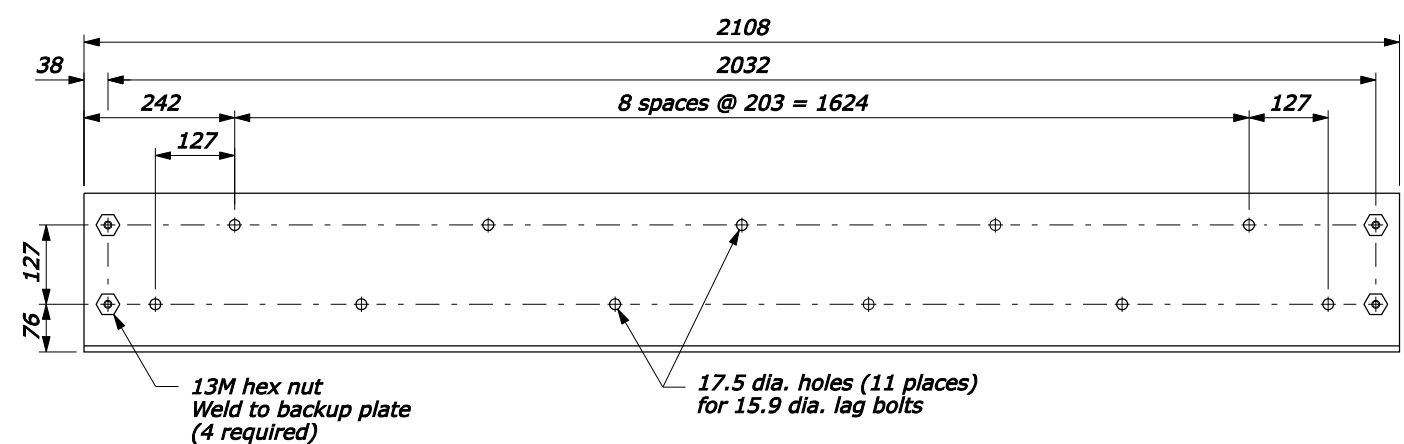


TYPICAL SECTION

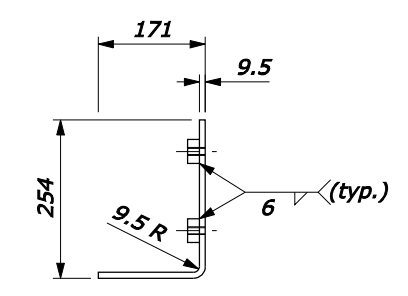
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL REMOVABLE STEEL-BACKED LOG RAIL Sheet 1 of 3	
REVISOR: DRAFT: 3/2008	DETAIL WM617-83

NO SCALE

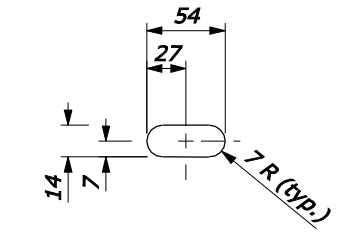
18-Mar-2008 01:54 PM
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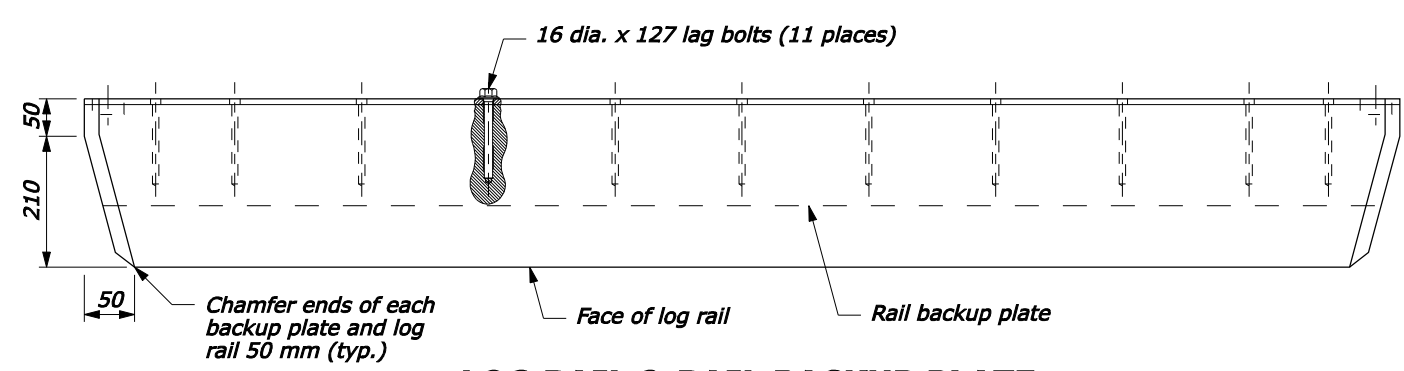
**RAIL BACKUP PLATE
ELEVATION VIEW**



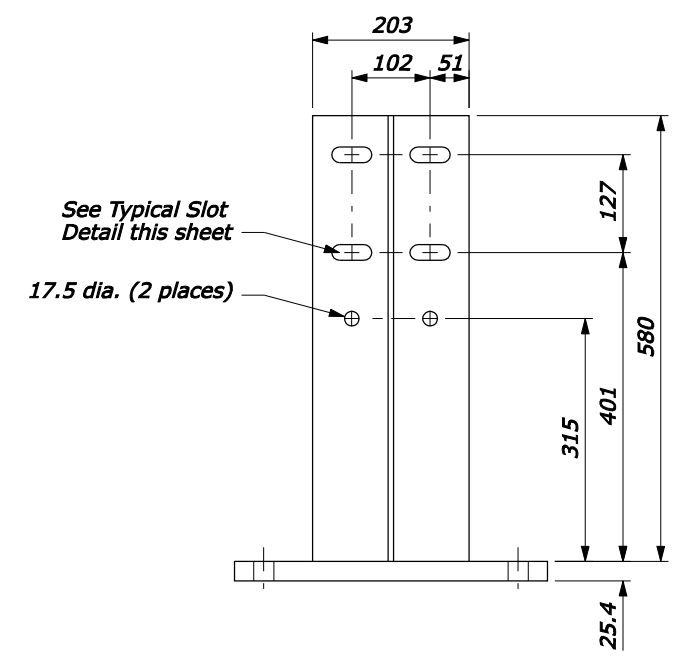
**RAIL BACKUP PLATE
SECTION VIEW**



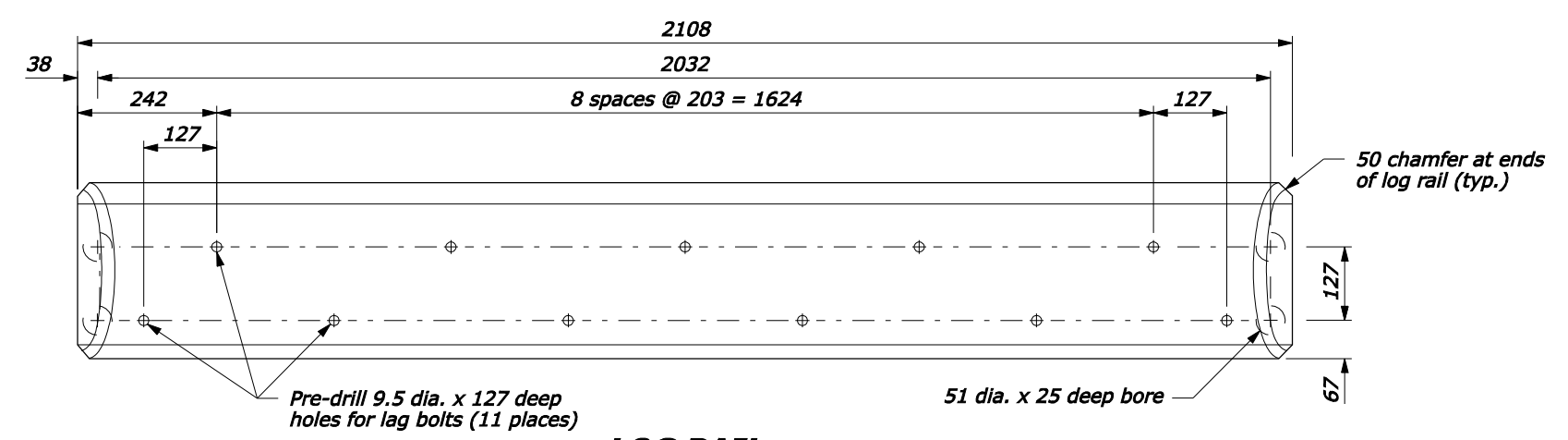
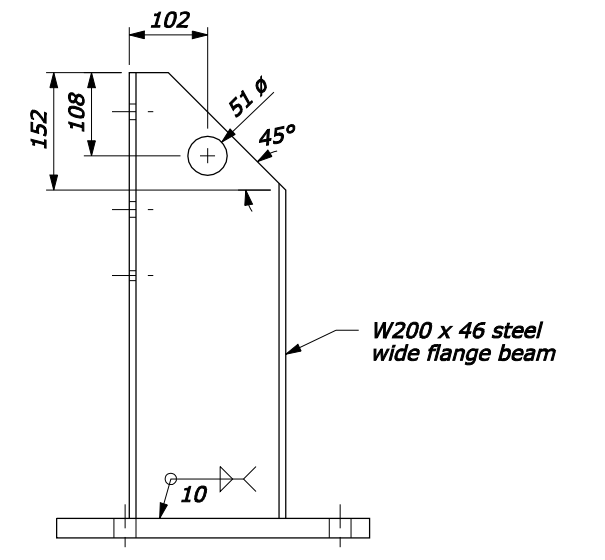
**TYPICAL SLOT DETAIL
VIEW**



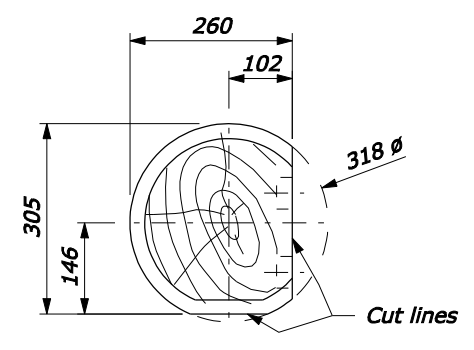
**LOG RAIL & RAIL BACKUP PLATE
PLAN VIEW**



GUARDRAIL POST



**LOG RAIL
ELEVATION VIEW**

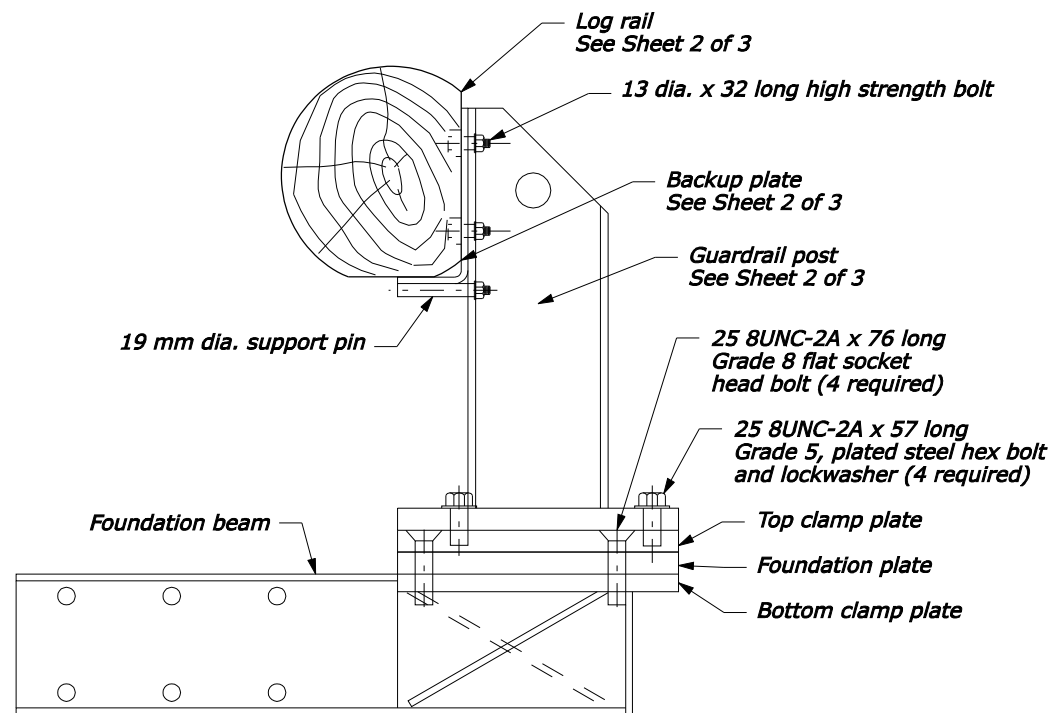


**LOG RAIL
SECTION VIEW**

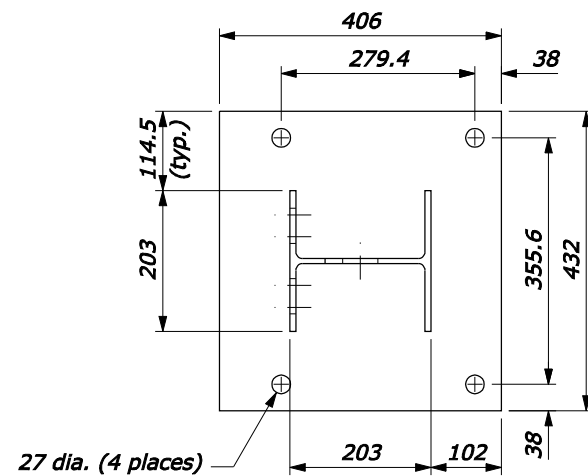
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL	
REMOVABLE STEEL-BACKED LOG RAIL	
Sheet 2 of 3	
DETAIL APPROVED FOR USE --/----	DETAIL
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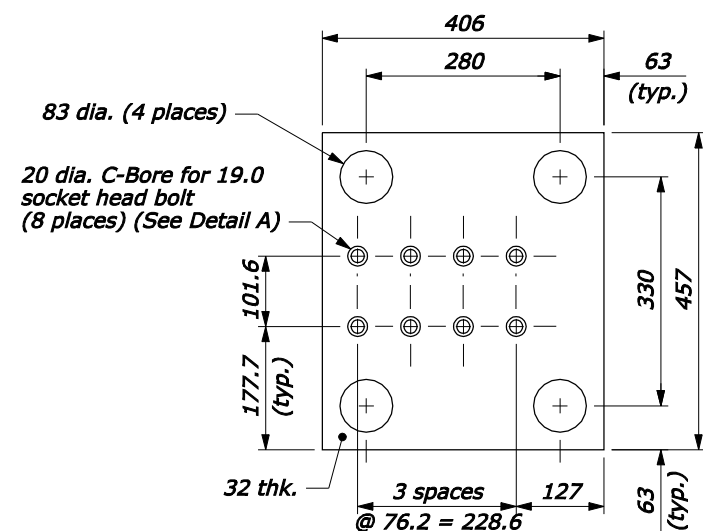
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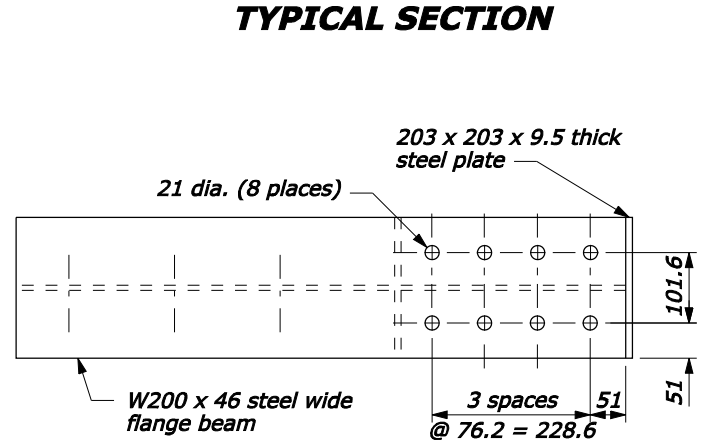
TYPICAL SECTION



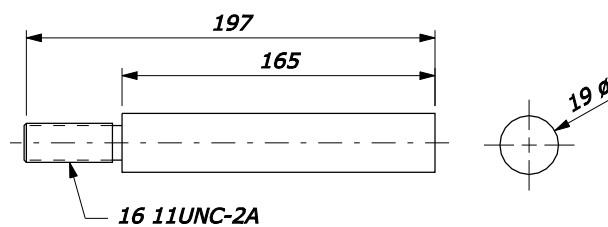
RAIL POST BASE PLATE



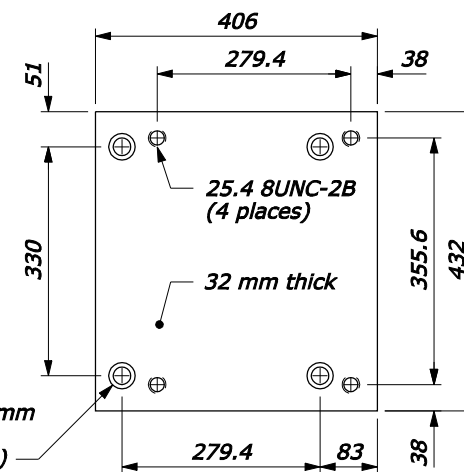
FOUNDATION PLATE



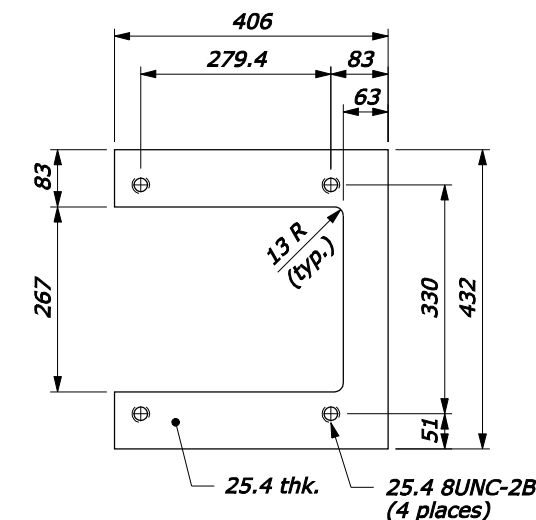
FOUNDATION BEAM



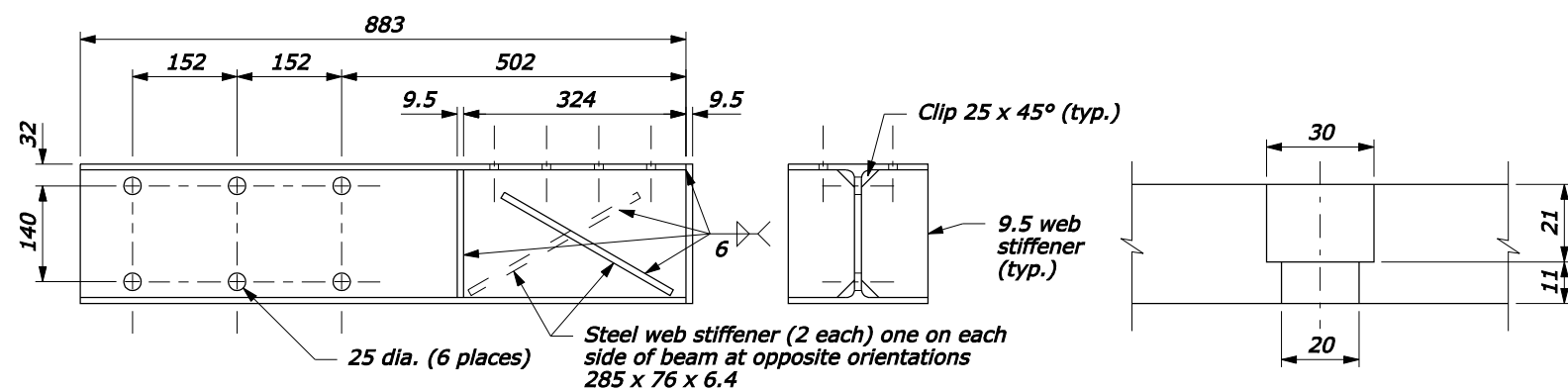
SUPPORT PIN



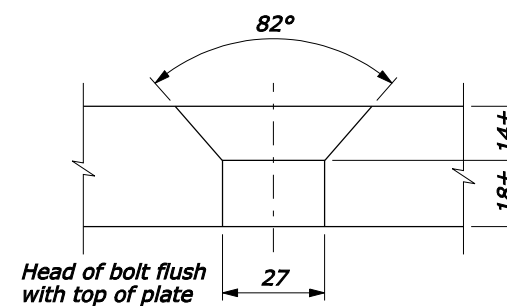
TOP CLAMP PLATE



BOTTOM CLAMP PLATE



DETAIL A



DETAIL B

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION WESTERN FEDERAL LANDS HIGHWAY DIVISION	
METRIC DETAIL REMOVABLE STEEL-BACKED LOG RAIL Sheet 3 of 3	
REVISOR: DRAFT: 3/2008	DETAIL APPROVED FOR USE --/--- DETAIL WM617-83