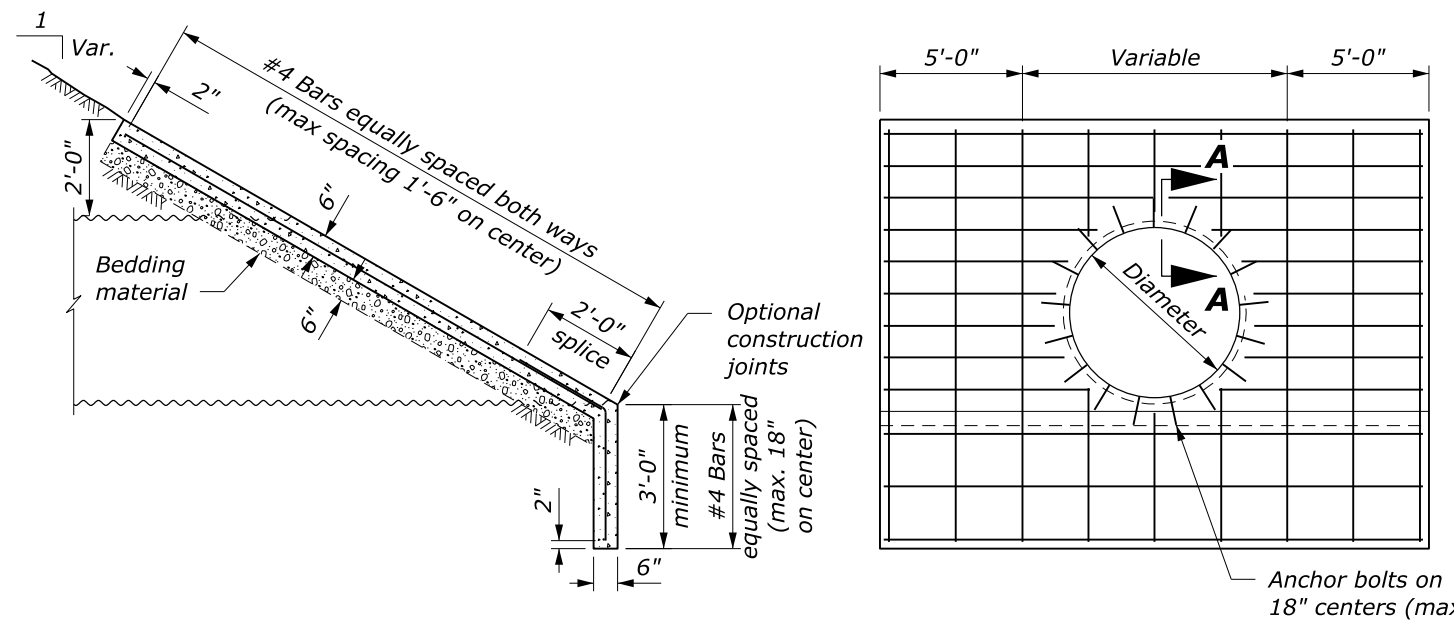
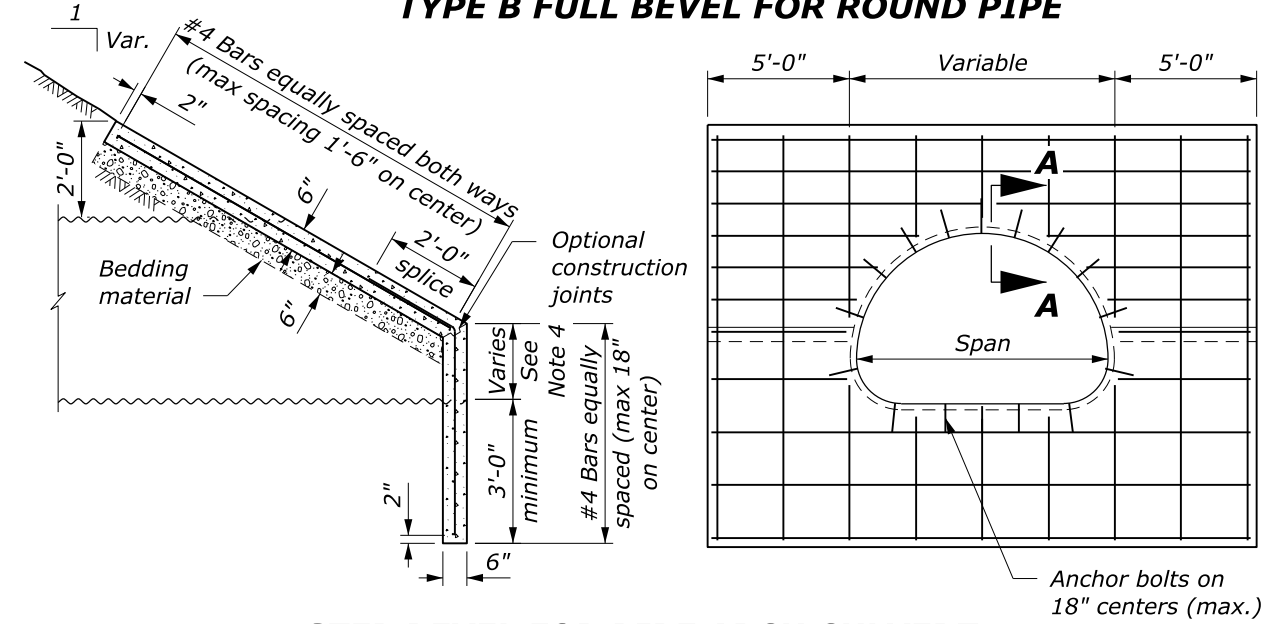


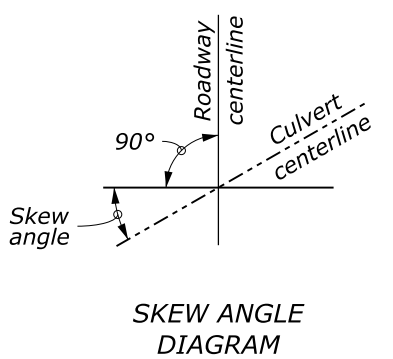
TYPE A STEP BEVEL FOR ROUND PIPE



TYPE B FULL BEVEL FOR ROUND PIPE



STEP BEVEL FOR PIPE ARCH CULVERT



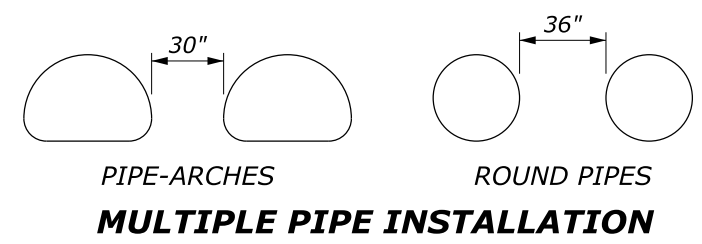
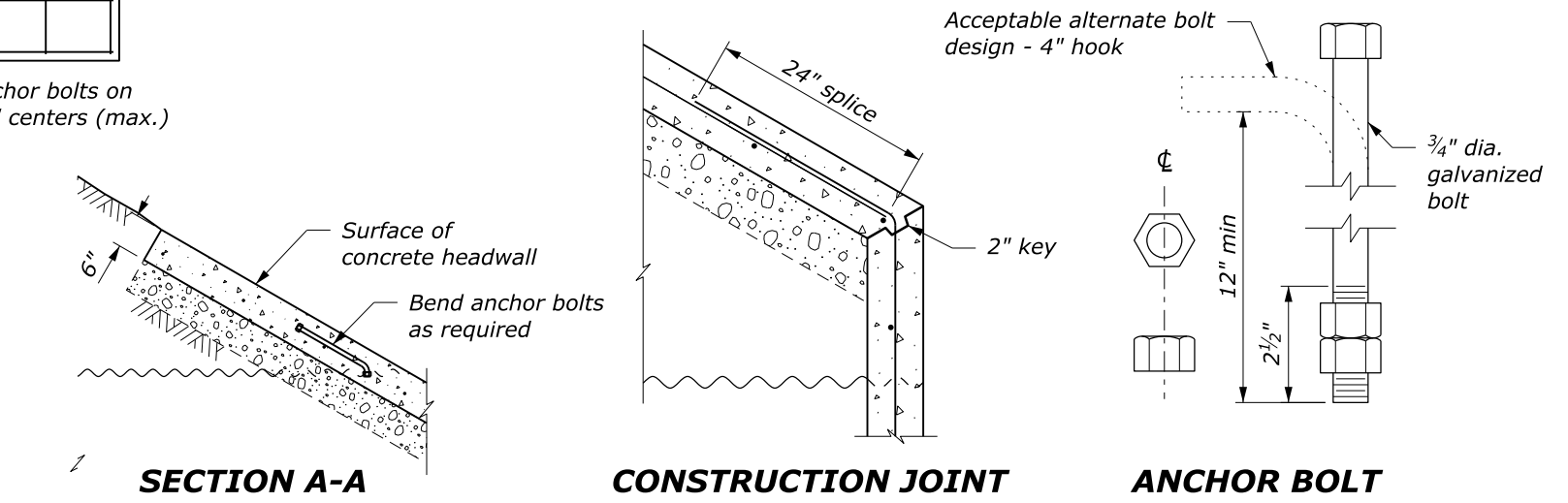
SKIEW ANGLE DIAGRAM

REINFORCED CONCRETE HEADWALL				
STEP BEVEL PIPE ARCH CULVERT				
PIPE ARCH SIZE Span x rise	CONCRETE (cuyd)			
	Skew Angle			
	0°	15°	30°	45°
6'-1" x 4'-7"	3.2	3.4	3.7	4.6
7'-0" x 5'-1"	3.5	3.7	4.1	5.0
8'-2" x 5'-9"	4.0	4.2	4.7	5.7
9'-6" x 6'-5"	4.4	4.6	5.1	6.2
11'-5" x 7'-3"	5.0	5.2	5.8	7.1
12'-10" x 8'-4"	5.8	6.0	6.7	8.2
13'-11" x 8'-7"	6.2	6.4	7.1	8.7
15'-4" x 10'-4"	6.6	6.8	7.6	9.3
16'-3" x 10'-10"	7.3	7.5	8.3	9.5

REINFORCED CONCRETE HEADWALL								
ROUND PIPE CULVERT								
PIPE SIZE Diameter	CONCRETE (cuyd)							
	TYPE A STEP BEVEL				TYPE B FULL BEVEL			
	Skew Angle				Skew Angle			
	0°	15°	30°	45°	0°	15°	30°	45°
48"	3.2	3.2	3.3	3.5	2.7	3.0	3.4	3.4
60"	3.6	3.7	3.8	4.0	3.7	3.7	3.8	4.0
72"	4.1	4.1	4.2	4.5	4.2	4.3	4.4	4.6
84"	4.5	4.6	4.7	5.0	4.8	4.8	5.0	5.3
96"	5.1	5.2	5.3	5.7	5.3	5.4	5.6	5.9
108"	5.6	5.7	5.9	6.3	5.9	6.0	6.2	6.7
120"	6.0	6.1	6.3	6.8	6.5	6.6	6.8	7.3
132"	6.9	7.0	7.3	7.9	7.1	7.2	7.5	8.0
144"	7.4	7.5	7.8	8.5	7.7	7.9	8.1	8.8
156"	7.9	8.0	8.3	9.1	8.4	8.5	8.8	9.5
168"	8.6	8.8	9.2	10.0	9.0	9.2	9.5	10.4
180"	8.9	9.1	9.4	10.3	9.7	9.8	10.2	11.1

NOTE:

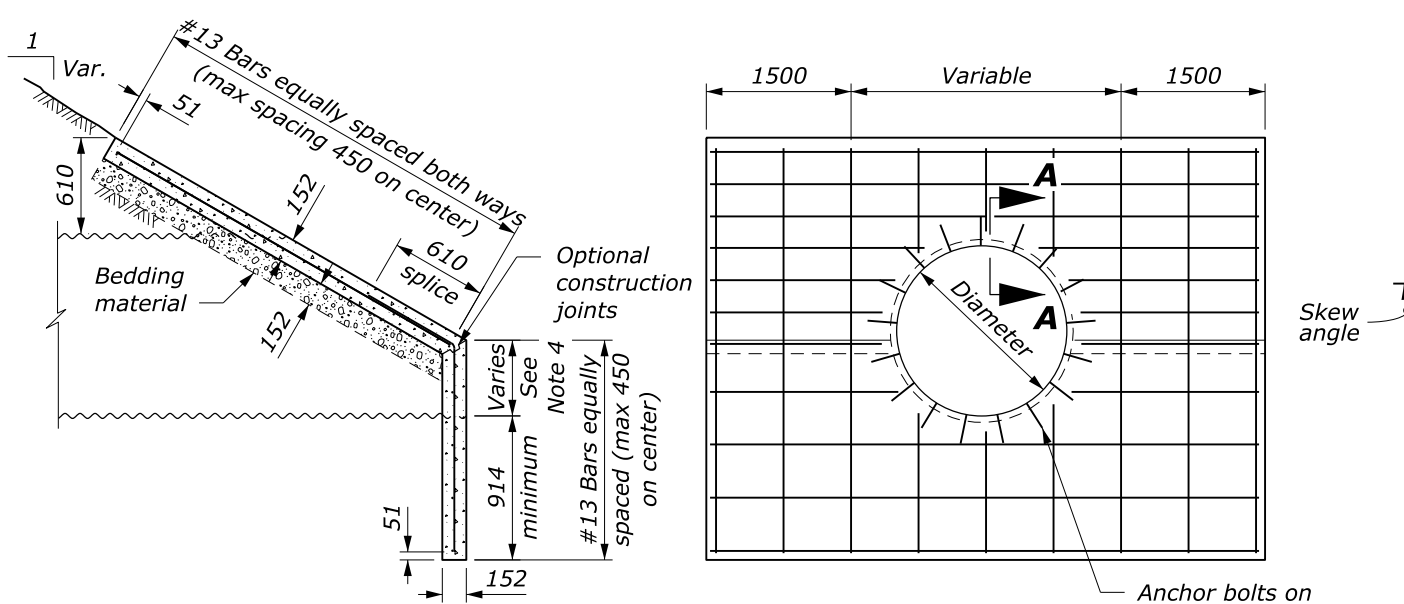
1. CONCRETE: Chamfer all exposed edges 3/4 inch.
2. REINFORCING STEEL: Grade 60 (ASTM A615 or A996) deformed billet steel bars conforming to AASHTO M 31. The minimum concrete cover to the face of any bar is 2 inches unless otherwise shown.
3. HEADWALL TYPE: Use type A Step Bevel headwalls for round pipe unless otherwise specified.
4. STEP BEVEL: The variable dimension indicated for the height or step conform to manufacturer's recommendations unless otherwise specified.
5. CUTOFF WALLS: The minimum depth shown may be reduced in solid rock, provided wall is keyed into the rock at least 12".
6. ANCHOR BOLTS: Conform to ASTM A307. Galvanize in accordance with ASTM A153.
7. BEDDING: Construct a firm and uniform foundation before placing the bedding. Use clean 3/8 inch sandy material for bedding unless otherwise specified.
8. ESTIMATED QUANTITIES: The concrete quantities are based on a 3 foot 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 68 lb/cuyd of concrete excluding the weight of the anchor bolts.



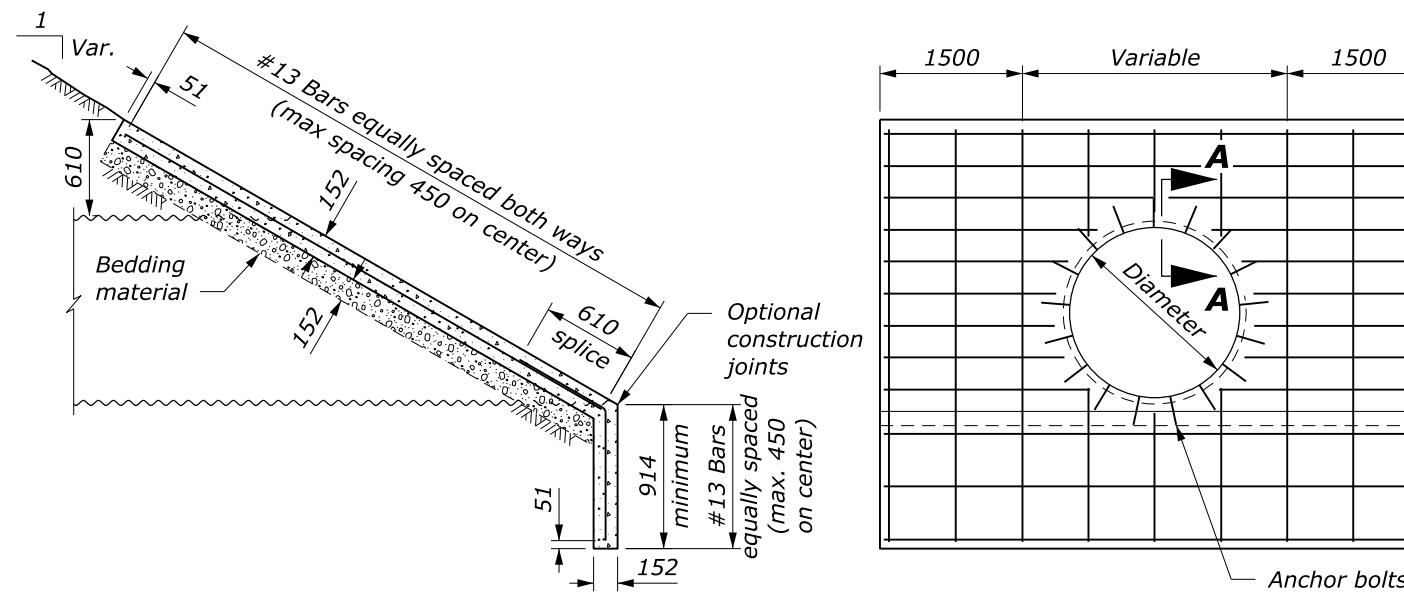
**PIPE-ARCHES ROUND PIPES
MULTIPLE PIPE INSTALLATION**

NO SCALE

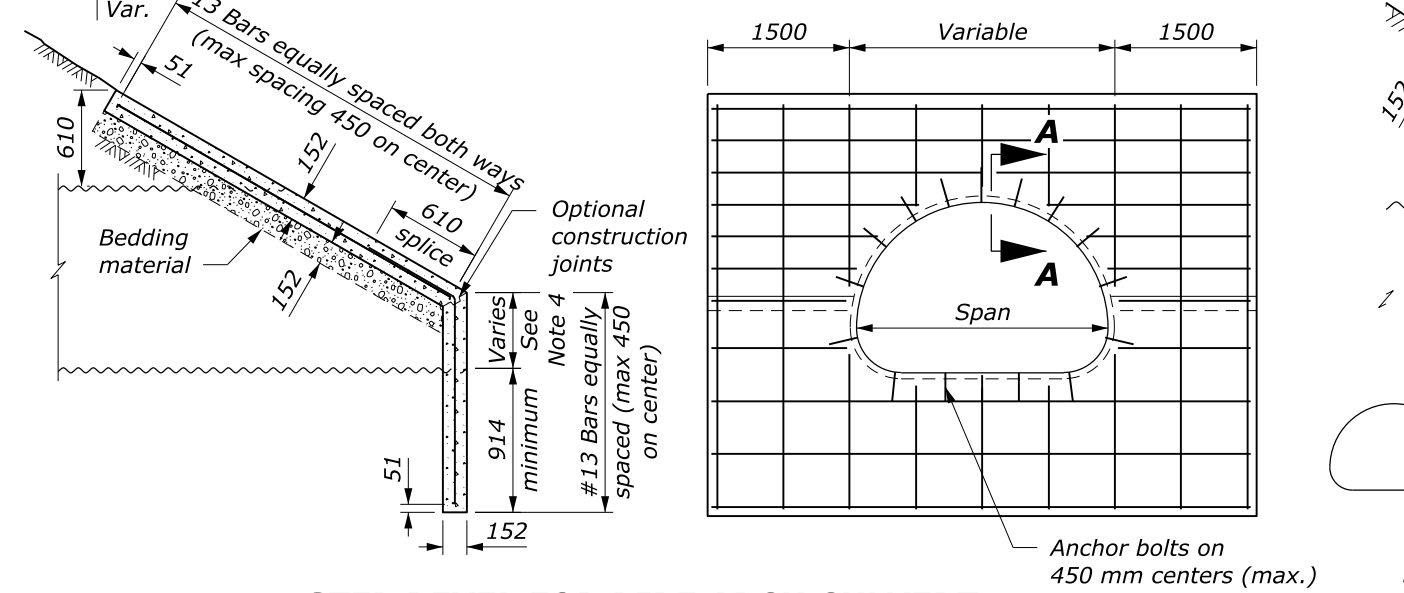
U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	WFLHD DETAIL W601-10
REINFORCED CONCRETE HEADWALL	SPECIFICATION FP-24, FP-14
	APPROVED FOR USE 11/2024



TYPE A STEP BEVEL FOR ROUND PIPE



TYPE B FULL BEVEL FOR ROUND PIPE



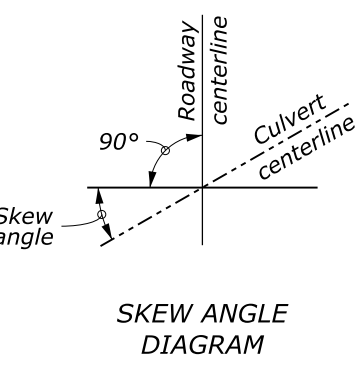
STEP BEVEL FOR PIPE ARCH CULVERT

REINFORCED CONCRETE HEADWALL				
STEP BEVEL PIPE ARCH CULVERT				
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

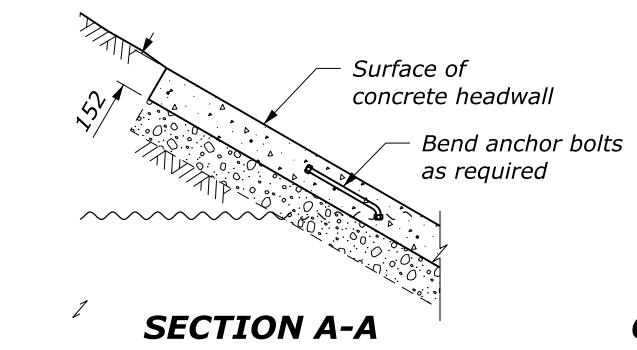
REINFORCED CONCRETE HEADWALL								
ROUND PIPE CULVERT								
PIPE SIZE Diameter	CONCRETE (m3)							
	TYPE A STEP BEVEL				TYPE B FULL BEVEL			
	Skew Angle				Skew Angle			
	0°	15°	30°	45°	0°	15°	30°	45°
1200	2.5	2.5	2.6	2.8	2.2	2.4	2.7	2.7
1500	2.8	2.8	2.9	3.1	2.8	2.8	2.9	3.1
1800	3.1	3.1	3.2	3.4	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:

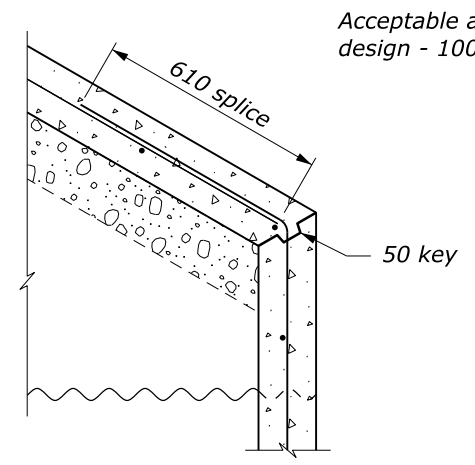
1. CONCRETE: Chamfer all exposed edges 20 mm.
2. REINFORCING STEEL: Grade 420 (ASTM A615M or A996M) deformed billet steel bars conforming to AASHTO M 31. The minimum concrete cover to the face of any bar is 50 mm unless otherwise shown.
3. HEADWALL TYPE: Use type A Step Bevel headwalls for round pipe unless otherwise specified.
4. STEP BEVEL: The variable dimension indicated for the height or step conform to manufacturer's recommendations unless otherwise specified.
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. 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.
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 unavailable.



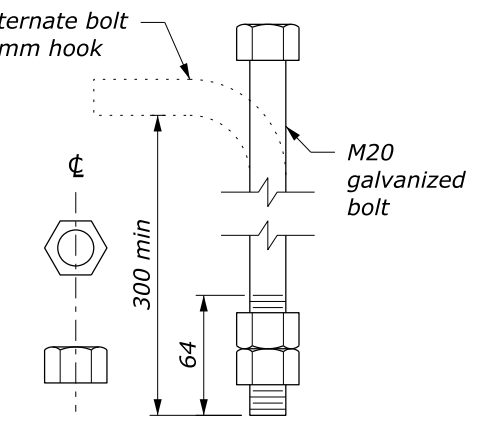
Anchor bolts on 450 mm centers (max.)



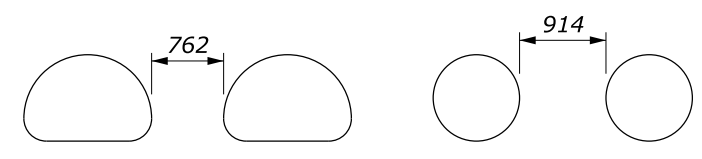
SECTION A-A



CONSTRUCTION JOINT



ANCHOR BOLT



**PIPE-ARCHES ROUND PIPES
MULTIPLE PIPE INSTALLATION**

NO SCALE

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	WFLHD DETAIL WM601-10
REINFORCED CONCRETE HEADWALL	SPECIFICATION FP-24/FP-14
	APPROVED FOR USE 11/2024

30 October 2024 7:13 AM c:\pwwork\0413405\W601-10.dgn [Det. WM601-10]