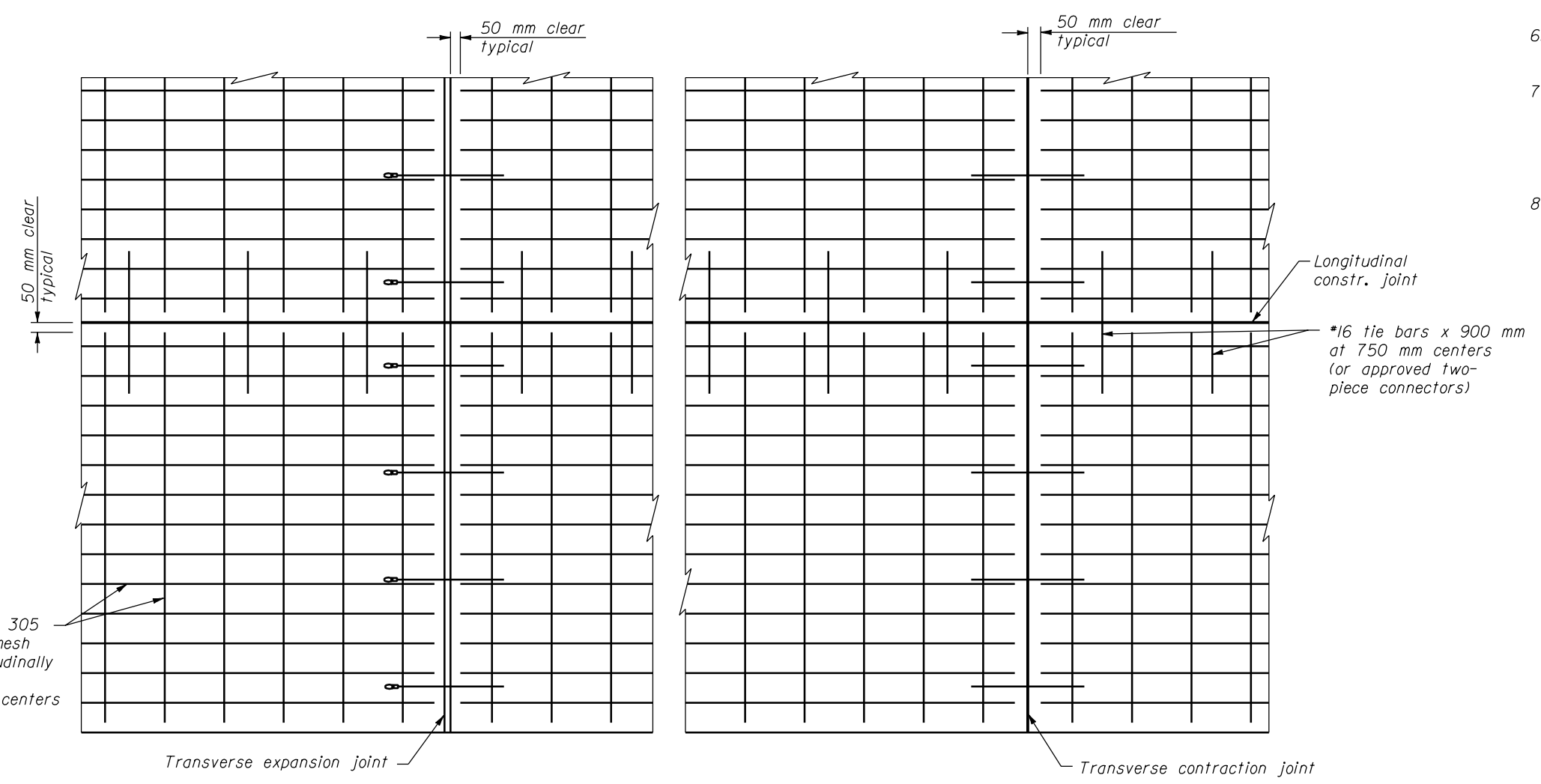


NOTE:

1. Dimensions not labeled are in millimeters.
2. Lap longitudinal reinforcement not less than 325 mm.
3. Lap transverse reinforcement not less than 225 mm.
4. Eliminate all longitudinal and transverse reinforcing steel, wire, or bars where plain portland cement concrete pavement or base is required.
5. Provide the same type of dowel assemblies and tie bars for joints in plain portland cement concrete pavement as shown for joints in reinforced pavement.
6. Space transverse expansion joints at a minimum of 90 meters.
7. Space transverse contraction joints for reinforced concrete pavement at not more than 12 meter intervals and for plain concrete pavement or base at not more than 6 meter intervals.
8. See Standard M501-2 for Joint Details and Joint Sealing Details.



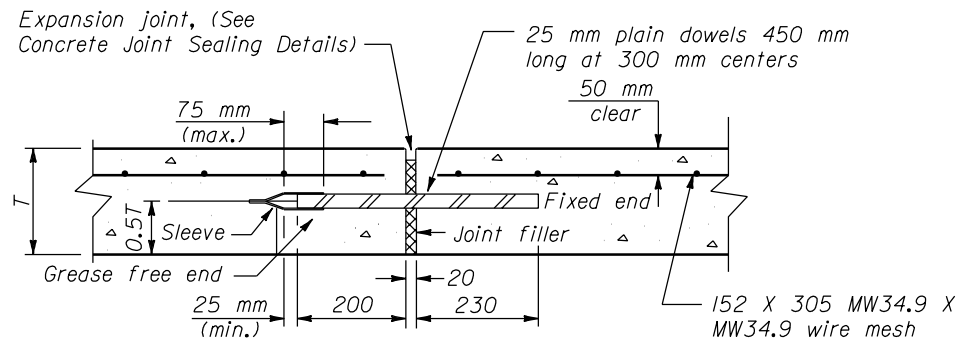
PLAN

NO SCALE

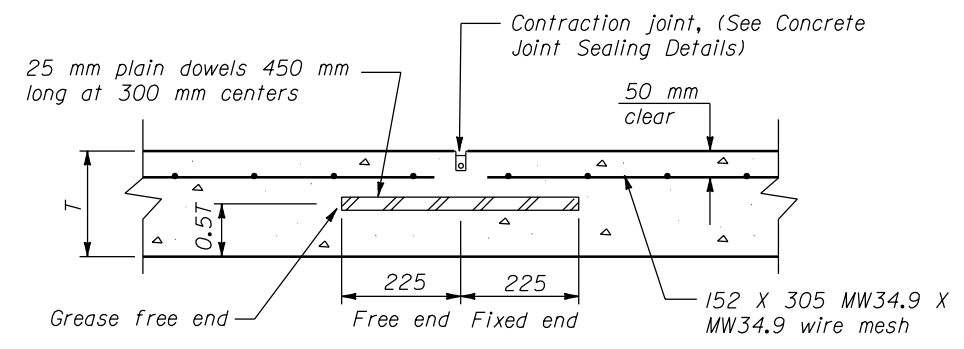
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
PORTLAND CEMENT CONCRETE PAVEMENT	
STANDARD APPROVED FOR USE 3/1996 REVISED: 5/1997	STANDARD M501-1

16 NOV 2000

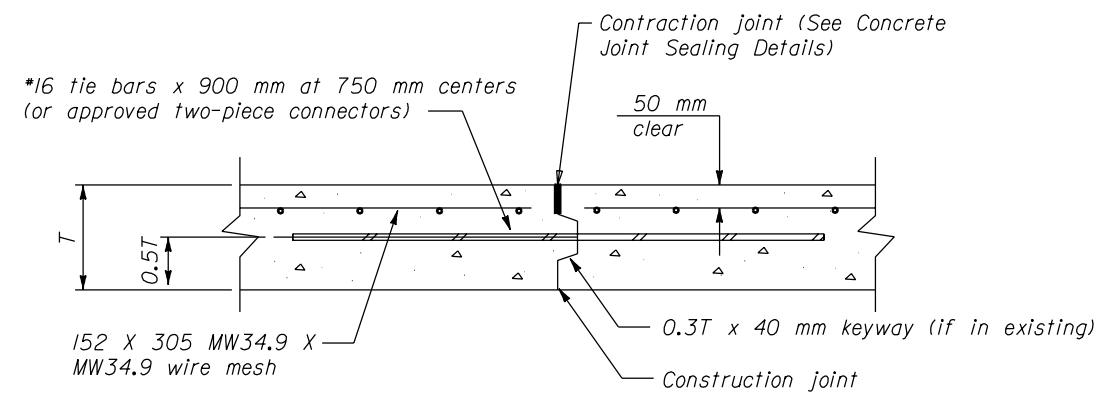
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TRANSVERSE EXPANSION JOINT



TRANSVERSE CONTRACTION JOINT

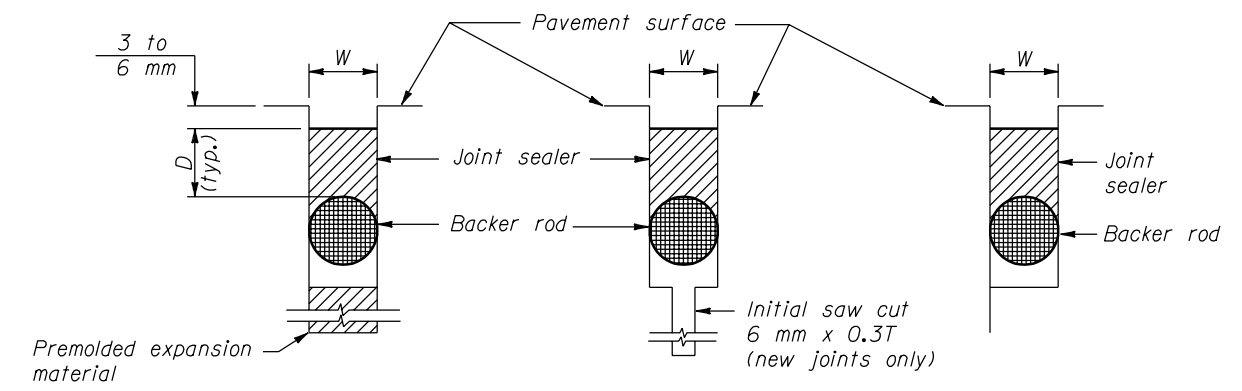


LONGITUDINAL CONSTRUCTION JOINT

REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT JOINT DETAILS

NOTE:

1. Dimensions not labeled are in millimeters.
2. Anchor tie bars and dowels into existing concrete pavement with epoxy resin adhesive.
3. Space expansion joints a minimum of 90 meters.
4. W= 10 mm for longitudinal contraction joints and 20 mm for transverse expansion and contraction joints field conditions require larger openings.
5. Maintain joint sealant shape factor of 1:1 except that when silicone sealant is used, the width to depth (W:D) shape factor is 1:2.



EXPANSION JOINT
CONTRACTION JOINT
 (Method A- Saw cut) (Method B- Formed joint)

REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT JOINT SEALING DETAILS

16 NOV 2000

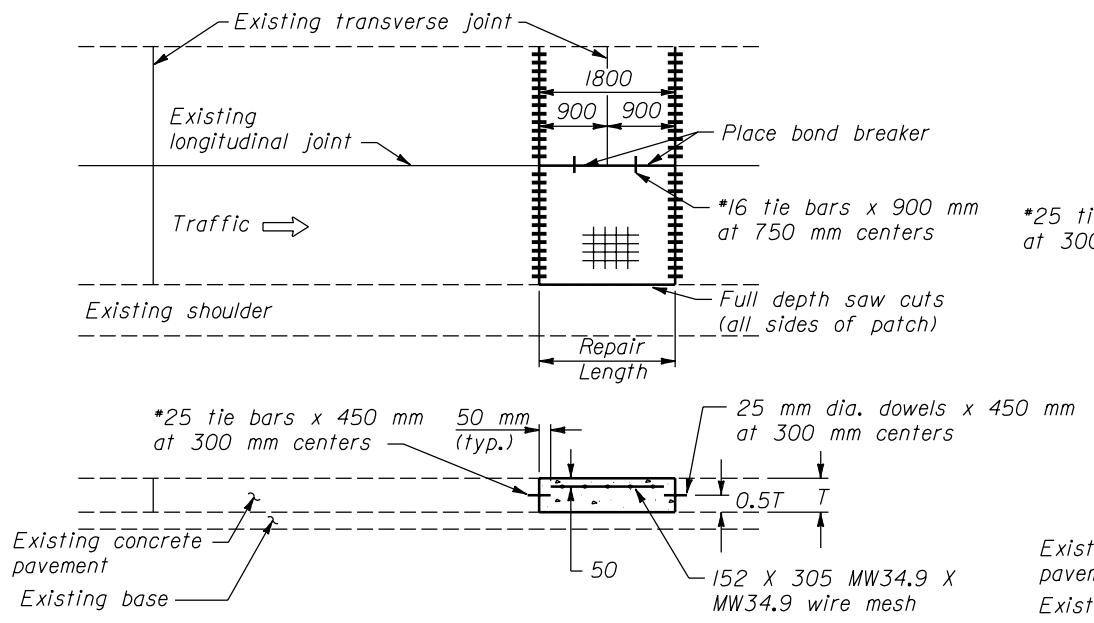
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NO SCALE

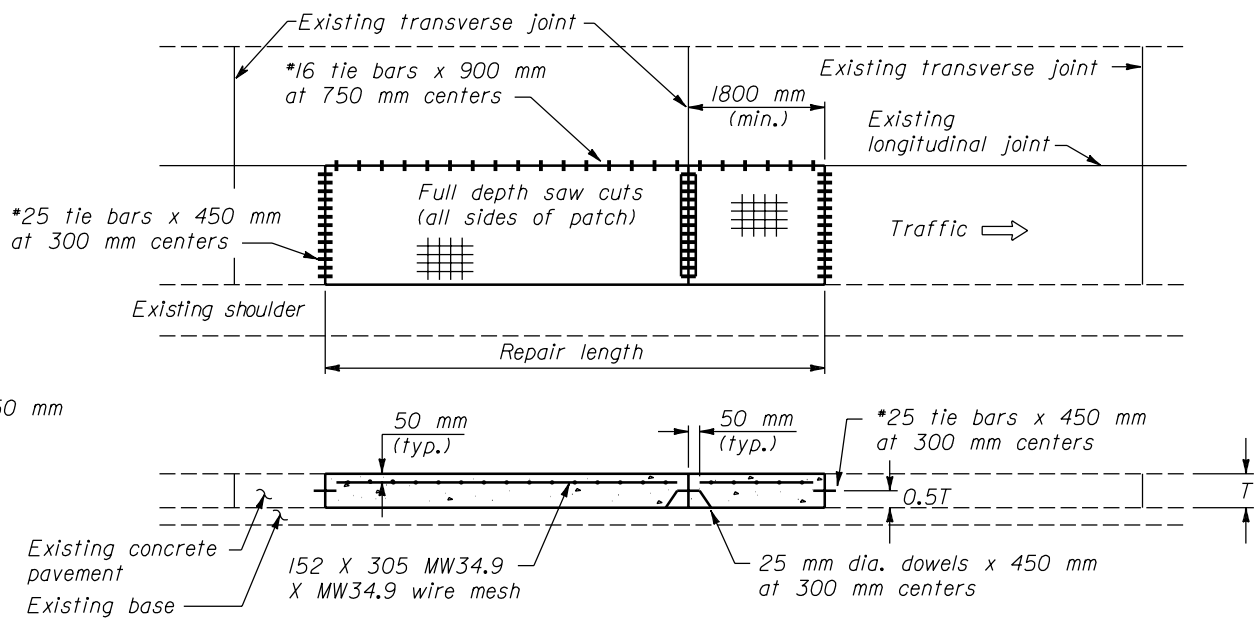
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
PORTLAND CEMENT CONCRETE PAVEMENT JOINTS	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED: 6/1997	M501-2

NOTE:

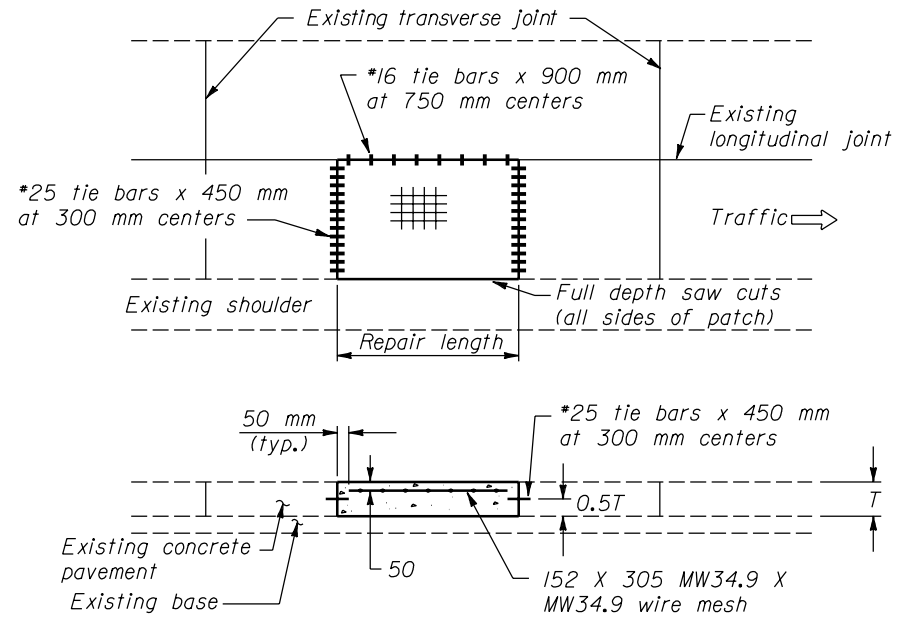
1. Dimensions not labeled are in millimeters.
2. Drill holes for the dowels and tie bars simultaneously to the required depth using frame mounted drills which will maintain the drills parallel to profile and longitudinal joint.
3. Provide epoxy coated tie bars and dowels.
4. See Standard M501-4 for pavement repair saw cuts for lift-out method.
5. Orient wire mesh so that the 300 mm dimension parallels the existing longitudinal joint.
6. An approved two-piece longitudinal tie device may be used in lieu of the #16 tie bars.
7. Construction joints that use #25 tie bars will not require sealing.
8. See Standard M501-1 for reinforcement for full depth concrete pavement repair.



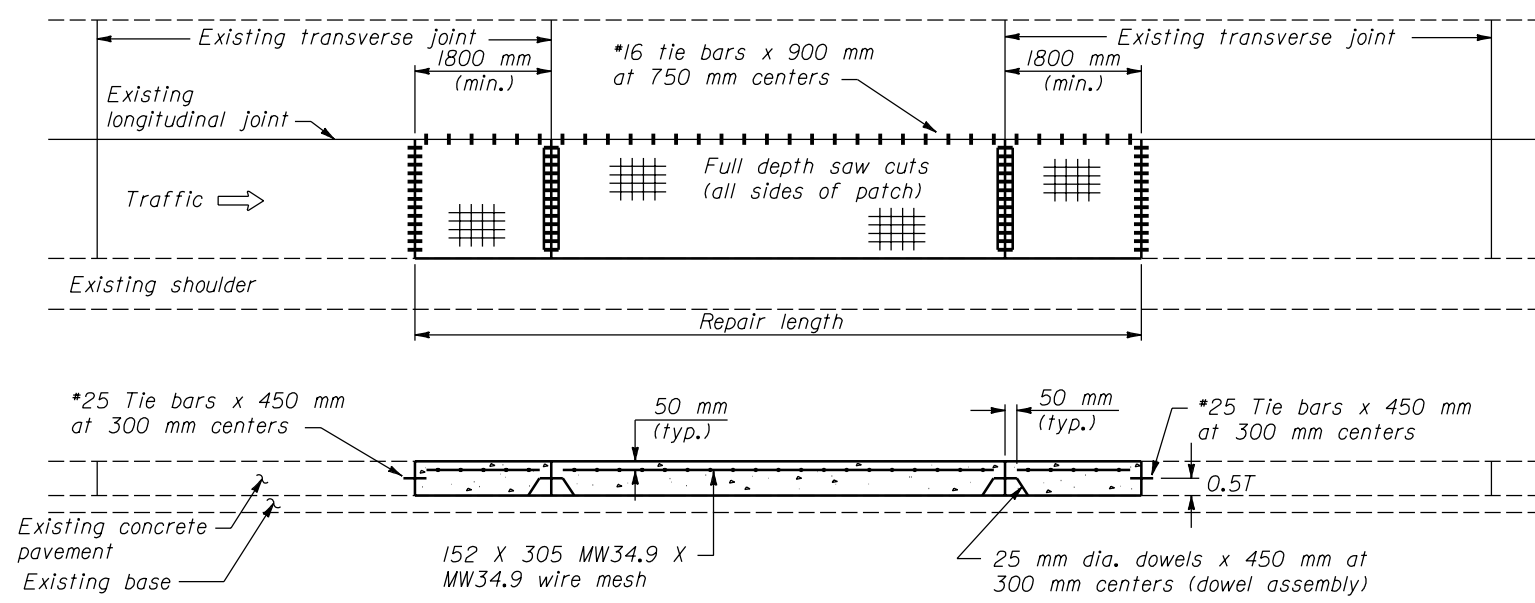
METHOD A



METHOD C



METHOD B



METHOD D

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

METRIC STANDARD

**CONCRETE
 PAVING PATCHING**

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

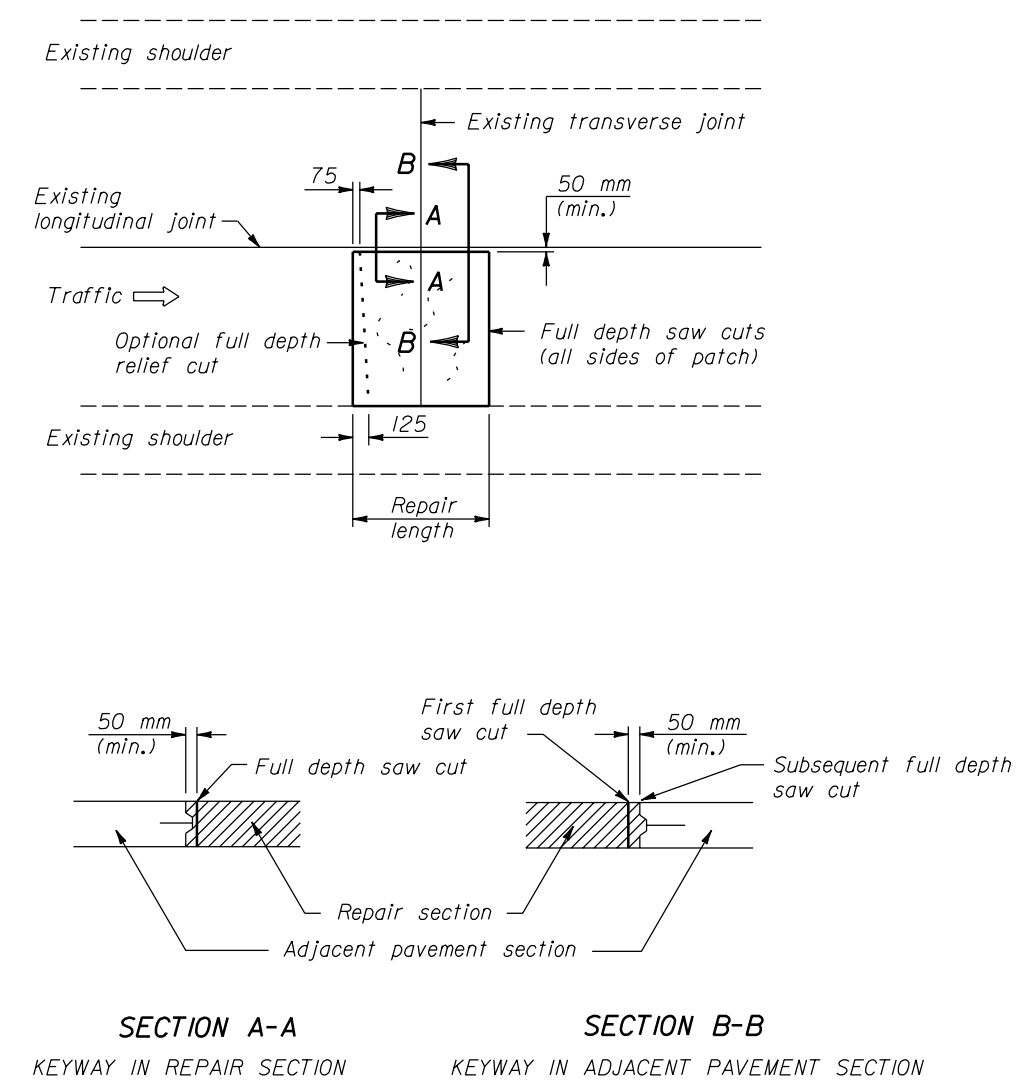
STANDARD
M501-3

NO SCALE

16 NOV 2000 f:\standrow\metric\m501-3.dgn

NOTE:

1. Dimensions not labeled are in millimeters.
2. Shoulder joints may be cut directly into the existing joint.
3. Make cuts running parallel and adjacent to a lane of traffic a minimum of 50 mm from the existing joint.
4. Saw cuts may be made into the shoulder.
5. If it is determined that the keyway is formed in the adjacent pavement section, the subsequent full depth saw cut may be made on the longitudinal joint.



**REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT
SAW CUTS FOR LIFT OUT METHOD**

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
CONCRETE PAVEMENT REMOVAL METHODS	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED:	M501-4

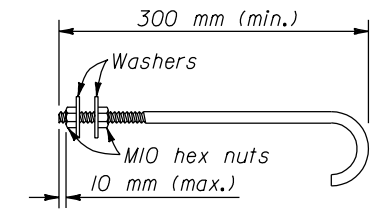
16 NOV 2000

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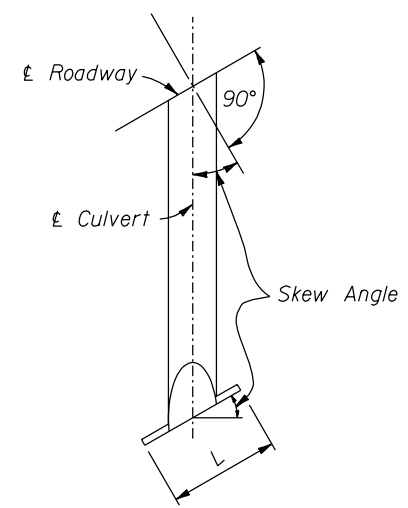
HEADWALL FOR DOUBLE PIPE CULVERT

DIMENSIONS, REINFORCING STEEL AND CONCRETE TABLE OF QUANTITIES

D mm	H m	SQUARE HEADWALL					15° SKEW					30° SKEW					45° SKEW				
		A m	B m	L m	CONC. m ³	STEEL kg	A m	B m	L m	CONC. m ³	STEEL kg	A m	B m	L m	CONC. m ³	STEEL kg	A m	B m	L m	CONC. m ³	STEEL kg
1200	1.500	1.2	1.8	4.2	1.55	71	1.3	1.9	4.5	1.60	73	1.4	2.1	4.9	1.79	82	1.7	2.6	6.0	2.19	100
1350	1.575	1.4	2.1	4.9	1.86	84	1.5	2.1	5.1	1.95	87	1.6	2.4	5.6	2.18	97	2.0	3.0	7.0	2.67	119
1500	1.650	1.6	2.3	5.5	2.19	99	1.7	2.4	5.8	2.27	102	1.9	2.6	6.4	2.53	114	2.3	3.2	7.8	3.10	140
1650	1.725	1.8	2.5	6.1	2.52	114	1.9	2.6	6.4	2.60	118	2.1	2.9	7.1	2.90	131	2.6	3.5	8.7	3.56	161
1800	1.800	2.0	2.7	6.7	2.85	130	2.1	2.8	7.0	2.95	135	2.3	3.2	7.8	3.30	150	2.8	3.9	9.5	4.04	184
1950	1.875	2.2	3.0	7.7	3.44	147	2.2	3.1	7.5	3.56	152	2.5	3.4	8.4	3.97	170	3.1	4.2	10.4	4.86	208
2100	1.950	2.4	3.2	8.0	3.64	164	2.4	3.4	8.2	3.77	170	2.7	3.6	9.0	4.21	190	3.4	4.5	11.3	5.15	232
2250	2.025	2.6	3.4	8.6	4.03	183	2.6	3.6	8.8	4.17	189	3.0	3.9	9.9	4.66	211	3.6	4.9	12.1	5.70	258
2400	2.100	2.7	3.6	9.0	4.31	202	2.8	3.7	9.3	4.46	209	3.2	4.2	10.6	4.98	233	3.9	5.2	13.0	6.10	285
2550	2.175	2.9	3.8	9.6	4.73	220	3.0	4.0	10.0	4.90	227	3.4	4.4	11.2	5.47	254	4.2	5.4	13.8	6.69	310
2700	2.250	3.1	4.0	10.2	5.17	238	3.2	4.1	10.5	5.35	247	3.6	4.6	11.8	5.97	275	4.4	5.6	14.4	7.31	337
2850	2.325	3.3	4.1	10.7	5.55	257	3.4	4.3	11.1	5.75	266	3.8	4.7	12.3	6.41	297	4.7	5.9	15.3	7.85	363
3000	2.400	3.5	4.3	11.3	6.02	277	3.6	4.4	11.6	6.23	286	4.0	4.9	12.9	6.95	320	5.0	6.0	16.0	8.63	391
3150	2.475	3.7	4.4	11.8	6.42	297	3.8	4.6	12.2	6.65	307	4.3	5.1	13.7	7.42	343	5.2	6.2	16.6	9.08	419
3300	2.550	3.9	4.6	12.4	6.92	318	4.0	4.7	12.7	7.16	329	4.5	5.3	14.3	7.99	367	5.5	6.5	17.5	9.79	449
3450	2.625	4.1	4.7	12.9	7.35	339	4.2	4.9	13.3	7.60	351	4.7	5.4	14.8	8.49	392	5.8	6.7	18.3	10.39	480
3600	2.700	4.3	4.9	13.5	7.88	362	4.4	5.0	13.8	8.16	374	4.9	5.6	15.4	9.10	418	6.1	6.8	19.0	11.15	511
3750	2.775	4.5	5.0	14.0	8.34	384	4.6	5.2	14.4	8.64	398	5.1	5.8	16.0	9.64	444	6.3	7.1	19.7	11.80	543
3900	2.850	4.6	5.2	14.4	8.73	408	4.8	5.3	14.9	9.04	422	5.4	6.0	16.8	10.08	471	6.6	7.3	20.5	12.34	577
4050	2.925	4.8	5.3	14.9	9.21	432	5.0	5.5	15.5	9.53	447	5.6	6.2	17.4	10.64	499	6.9	7.5	21.3	13.03	611
4200	3.000	5.0	5.5	15.5	9.80	456	5.2	5.6	16.0	10.14	472	5.8	6.3	17.9	11.31	527	7.1	7.8	22.0	13.85	645
4350	3.075	5.2	5.6	16.0	10.30	482	5.4	5.8	16.6	10.66	499	6.0	6.5	18.5	11.90	556	7.4	8.0	22.8	14.60	681
4500	3.150	5.4	5.8	16.6	10.91	508	5.6	6.0	17.2	11.29	525	6.2	6.7	19.1	12.60	586	7.7	8.2	23.6	15.43	722



MIO HOOK BOLT DETAILS



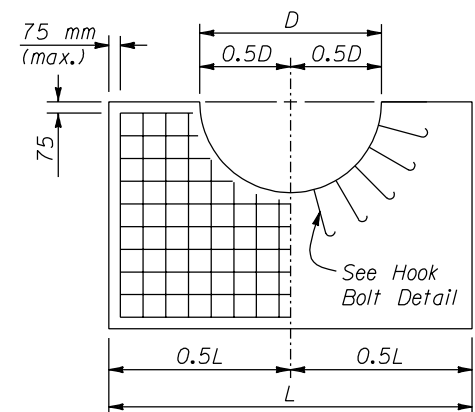
TYPICAL HALF PLAN

- NOTE:**
- Dimensions not labeled are in millimeters.
 - Concrete conforms to Section 601. Pour concrete monolithically. Chamfer all exposed edges 20 mm and finish all exposed surfaces with a Class 1 ordinary finish.
 - Clearance for reinforcing steel is 50 mm unless otherwise noted.
 - Headwall dimension "H" may be reduced in solid rock provided the wall is keyed into the rock at least 300 mm. Excavate and backfill according to Section 209.
 - Set hook bolts on nominal 450 mm centers around pipe perimeter at center of headwall. Hook bolts conform to ASTM A307. Galvanize according to ASTM A153.
 - For installations with more than two pipe culverts, increase the dimension "L" and all quantities shown for double pipe installation by adding a length equal to dimension "B" and the incremental change in quantities for each additional pipe culvert.
 - For skews other than those shown, multiply quantities and dimensions "A", "B" & "L" for square headwalls by secant of the skew angle.
 - Final quantities will be determined by using the tables on this standard.
 - Do not order materials until the length, skew angle, and slope bevel in the field have been approved.

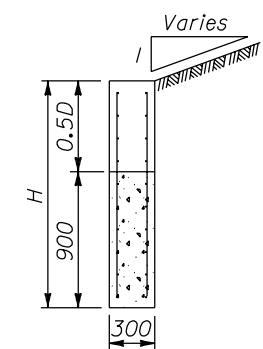
HEADWALL FOR SINGLE PIPE CULVERT

DIMENSIONS, REINFORCING STEEL AND CONCRETE TABLE OF QUANTITIES

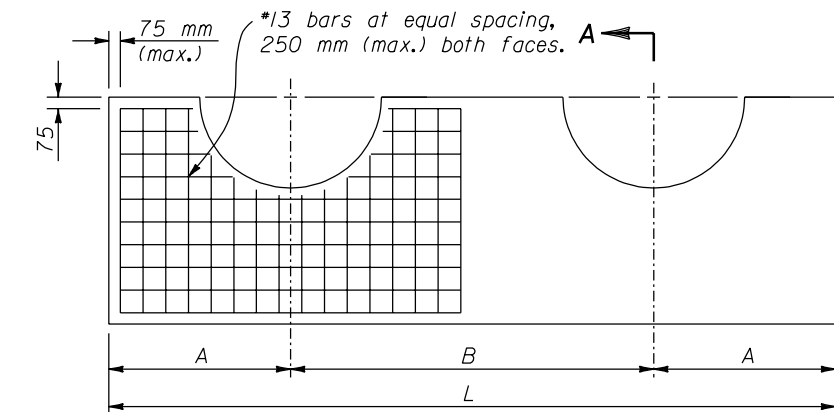
D mm	H m	SQUARE HEADWALL			15° SKEW			30° SKEW			45° SKEW		
		L m	CONC. m ³	STEEL kg	L m	CONC. m ³	STEEL kg	L m	CONC. m ³	STEEL kg	L m	CONC. m ³	STEEL kg
1200	1.500	2.4	0.91	41	2.5	0.94	43	2.8	1.05	48	3.4	1.28	58
1350	1.575	2.8	1.11	50	3.0	1.15	52	3.3	1.28	58	4.0	1.57	71
1500	1.650	3.2	1.32	59	3.3	1.37	61	3.7	1.52	69	4.6	1.86	84
1650	1.725	3.6	1.54	69	3.7	1.60	72	4.1	1.78	80	5.1	2.18	98
1800	1.800	4.0	1.78	80	4.1	1.84	83	4.6	2.05	92	5.6	2.51	113
1950	1.875	4.3	1.97	91	4.5	2.04	94	5.0	2.28	105	6.2	2.79	129
2100	1.950	4.7	2.23	102	4.9	2.31	106	5.5	2.58	118	6.7	3.15	145
2250	2.025	5.1	2.47	115	5.3	2.56	119	5.9	2.86	133	7.2	3.50	162
2400	2.100	5.5	2.79	127	5.7	2.88	132	6.3	3.22	147	7.8	3.94	180
2550	2.175	5.9	3.08	141	6.1	3.19	146	6.8	3.56	163	8.3	4.36	199
2700	2.250	6.2	3.33	155	6.5	3.44	162	7.2	3.84	181	8.8	4.70	222
2850	2.325	6.6	3.75	169	6.9	3.88	175	7.7	4.33	195	9.4	5.30	239
3000	2.400	7.0	3.98	185	7.3	4.12	191	8.1	4.60	213	9.9	5.63	261
3150	2.475	7.4	4.38	200	7.7	4.53	207	8.5	5.06	231	10.4	6.19	283
3300	2.550	7.8	4.68	216	8.1	4.85	224	9.0	5.41	250	11.0	6.62	306
3450	2.625	8.2	5.05	233	8.5	5.23	241	9.4	5.84	269	11.5	7.14	330
3600	2.700	8.5	5.36	250	8.8	5.55	259	9.9	6.19	289	12.1	7.58	354
3750	2.775	8.9	5.75	268	9.2	5.95	277	10.3	6.64	310	12.6	8.13	379
3900	2.850	9.3	6.16	287	9.6	6.38	297	10.7	7.12	331	13.2	8.71	405
4050	2.925	9.7	6.58	306	10.0	6.81	316	11.2	7.60	353	13.7	9.31	432
4200	3.000	10.1	7.01	326	10.4	7.26	337	11.6	8.10	376	14.2	9.92	461
4350	3.075	10.4	7.37	346	10.8	7.62	358	12.0	8.51	399	14.8	10.42	489
4500	3.150	10.8	7.82	366	11.2	8.10	379	12.5	9.03	423	15.3	11.06	518



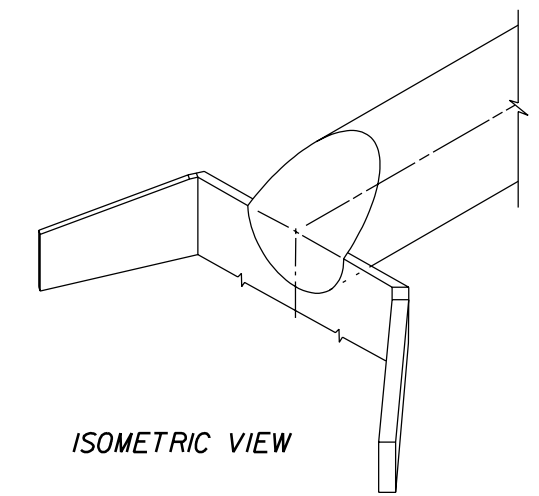
SINGLE PIPE CULVERT



SECTION A-A



DOUBLE PIPE CULVERT HEADWALLS



ISOMETRIC VIEW

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

METRIC STANDARD

CONCRETE HEADWALLS

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

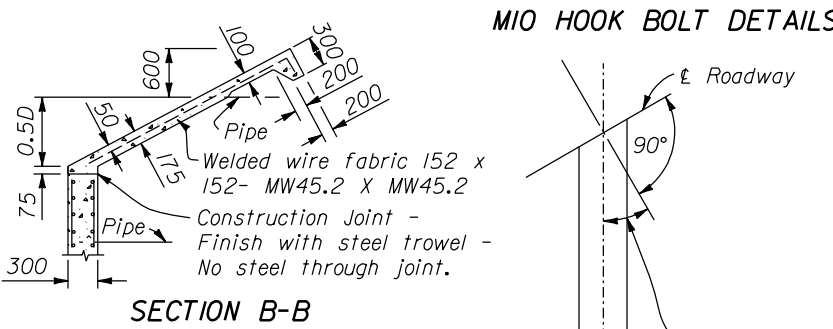
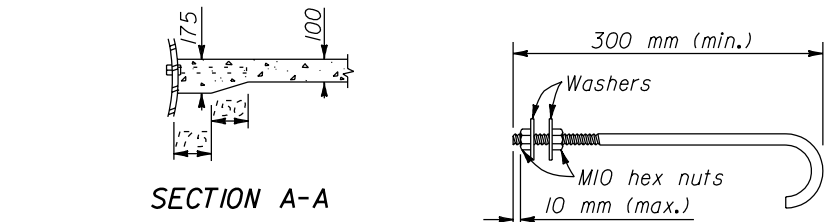
STANDARD
M601-1

NO SCALE

SLOPE PAVING FOR DOUBLE PIPE CULVERT

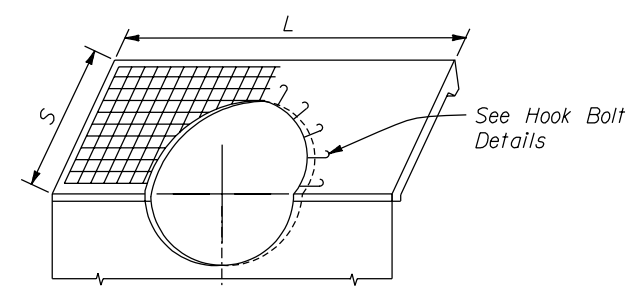
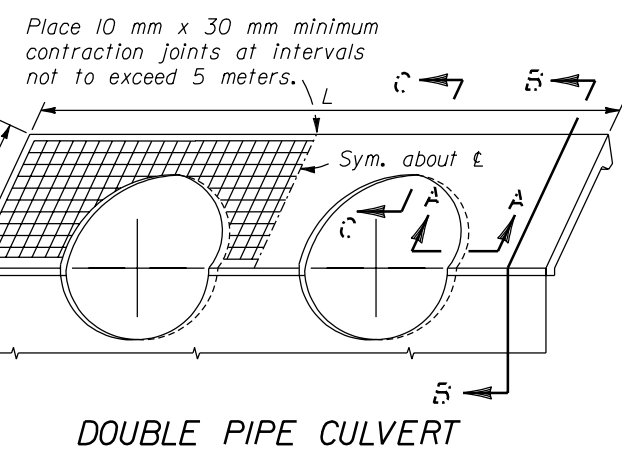
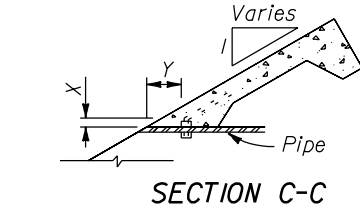
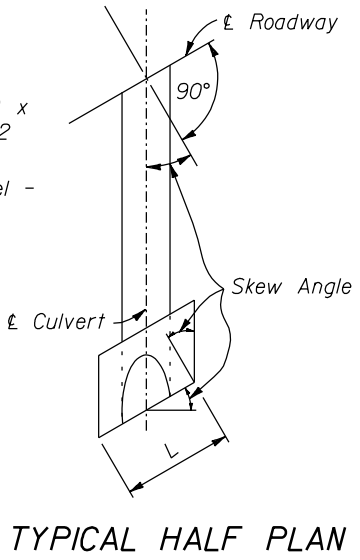
DIMENSIONS, REINFORCING STEEL AND CONCRETE TABLE OF QUANTITIES

D mm	SQUARE HEADWALL				15° SKEW				30° SKEW				45° SKEW			
	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg
1200	2.16	4.2	1.20	35	2.24	4.5	1.24	37	2.49	4.9	1.39	41	3.05	6.0	1.70	50
1350	2.30	4.9	1.45	43	2.38	5.1	1.50	44	2.66	5.6	1.68	49	3.25	7.0	2.05	60
1500	2.43	5.5	1.73	51	2.52	5.8	1.79	53	2.81	6.4	2.00	59	3.44	7.8	2.44	72
1650	2.57	6.1	1.97	58	2.66	6.4	2.04	60	2.97	7.1	2.28	67	3.63	8.7	2.79	81
1800	2.70	6.7	2.28	67	2.79	7.0	2.36	69	3.12	7.8	2.63	77	3.82	9.5	3.22	94
1950	2.84	7.7	2.61	76	2.94	7.5	2.70	79	3.28	8.4	3.01	88	4.02	10.4	3.69	108
2100	2.97	8.0	2.96	87	3.07	8.2	3.06	90	3.43	9.0	3.42	100	4.20	11.3	4.18	123
2250	3.11	8.6	3.33	98	3.22	8.8	3.44	101	3.59	9.9	3.84	113	4.40	12.1	4.70	138
2400	3.24	9.0	3.64	106	3.35	9.3	3.77	109	3.74	10.6	4.20	122	4.58	13.0	5.15	149
2550	3.38	9.6	4.00	116	3.50	10.0	4.14	120	3.90	11.2	4.62	134	4.78	13.8	5.65	164
2700	3.51	10.2	4.37	127	3.63	10.5	4.53	131	4.05	11.8	5.05	147	4.96	14.4	6.18	180
2850	3.65	10.7	4.76	138	3.78	11.1	4.93	143	4.22	12.3	5.50	160	5.16	15.3	6.73	195
3000	3.78	11.3	5.17	151	3.91	11.6	5.35	156	4.37	12.9	5.97	174	5.34	16.0	7.31	213
3150	3.92	11.8	5.50	159	4.06	12.2	5.69	164	4.53	13.7	6.35	183	5.54	16.6	7.77	224
3300	4.05	12.4	5.93	171	4.19	12.7	6.14	177	4.68	14.3	6.85	198	5.73	17.5	8.39	242
3450	4.19	12.9	6.38	184	4.34	13.3	6.61	191	4.83	14.8	7.37	213	5.92	18.3	9.03	261
3600	4.32	13.5	6.85	198	4.47	13.8	7.09	205	4.99	15.4	7.91	229	6.11	19.0	9.69	280
3750	4.46	14.0	7.33	212	4.62	14.4	7.59	220	5.15	16.0	8.46	245	6.31	19.7	10.37	300
3900	4.59	14.4	7.71	221	4.75	14.9	7.98	229	5.30	16.8	8.91	256	6.49	20.5	10.91	313
4050	4.73	14.9	8.23	236	4.90	15.5	8.51	245	5.46	17.4	9.50	273	6.69	21.3	11.63	334
4200	4.87	15.5	8.75	252	5.04	16.0	9.06	261	5.62	17.9	10.11	291	6.89	22.0	12.38	356
4350	5.00	16.0	9.17	262	5.18	16.6	9.49	271	5.78	18.5	10.59	302	7.07	22.8	12.96	370
4500	5.14	16.6	9.86	284	5.32	17.2	10.20	294	5.94	19.1	11.38	328	7.27	23.6	13.93	402

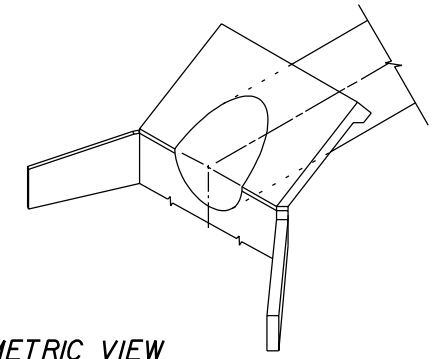


x = 50 mm (1:1.5 Slope)
 = 50 mm (1:2 Slope)
 = 50 mm (1:2.5 Slope)

y = 75 mm (1:1.5 Slope)
 = 100 mm (1:2 Slope)
 = 125 mm (1:2.5 Slope)



- NOTE:**
- Dimensions not labeled are in millimeters
 - Concrete conforms to Section 601. Chamfer all exposed edges 20 mm and finish all exposed surfaces with a Class 1 ordinary finish.
 - Clearance for reinforcing steel is 50 mm unless otherwise noted.
 - Set hook bolts on nominal 450 mm centers around pipe perimeter. Hook bolts conform to ASTM A307. Galvanize according to ASTM A153.
 - For installations with more than two pipe culverts, increase the dimension "L" and all quantities shown for double pipe installation by adding a length equal to dimension "B" as shown on Standard M601-1 and the incremental change in quantities for each additional pipe culvert.
 - For skews other than those shown, multiply quantities and dimensions "A", "B" & "L" for square headwalls by secant of the skew angle.
 - For the skew angle shown, the dimension "S" and the quantities for slope paving are computed for a 1:1.5 sideslope. To compute dimension "S" and slope paving quantities for a 1:2 slope multiply the values for that particular skew by 1.24, and for a 1:2.5 slope multiply by 1.49.
 - Final quantities will be determined by using the tables on this standard.
 - Do not order materials until the length, skew angle, and slope bevel in the field have been approved.



SLOPE PAVING FOR SINGLE PIPE CULVERT

DIMENSIONS, REINFORCING STEEL AND CONCRETE TABLE OF QUANTITIES

D mm	SQUARE HEADWALL				15° SKEW				30° SKEW				45° SKEW			
	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg	S m	L m	CONC. m ³	STEEL kg
1200	2.16	2.4	0.71	20	2.24	2.5	0.74	21	2.49	2.8	0.82	24	3.05	3.4	1.01	29
1350	2.30	2.8	0.88	25	2.38	3.0	0.91	26	2.66	3.3	1.02	29	3.25	4.0	1.24	36
1500	2.43	3.2	1.06	31	2.52	3.3	1.09	32	2.81	3.7	1.22	36	3.44	4.6	1.49	44
1650	2.57	3.6	1.22	35	2.66	3.7	1.27	37	2.97	4.1	1.41	41	3.63	5.1	1.73	50
1800	2.70	4.0	1.42	41	2.79	4.1	1.47	43	3.12	4.5	1.64	48	3.82	5.6	2.01	58
1950	2.84	4.3	1.64	48	2.94	4.5	1.70	49	3.28	5.0	1.90	55	4.02	6.2	2.32	67
2100	2.97	4.7	1.87	54	3.07	4.9	1.94	56	3.43	5.5	2.16	61	4.20	6.7	2.65	77
2250	3.11	5.1	2.12	62	3.22	5.3	2.19	64	3.59	5.9	2.45	69	4.40	7.2	2.99	87
2400	3.24	5.5	2.33	67	3.35	5.7	2.41	69	3.74	6.3	2.69	78	4.58	7.8	3.30	95
2550	3.38	5.9	2.61	75	3.50	6.1	2.70	78	3.90	6.8	3.01	87	4.78	8.3	3.69	106
2700	3.51	6.2	2.89	83	3.63	6.5	2.99	86	4.05	7.2	3.34	96	4.96	8.8	4.09	118
2850	3.65	6.6	3.19	92	3.78	6.9	3.30	95	4.22	7.7	3.68	106	5.16	9.4	4.51	130
3000	3.78	7.0	3.50	101	3.91	7.3	3.62	105	4.37	8.1	4.04	117	5.34	9.9	4.95	143
3150	3.92	7.4	3.77	108	4.06	7.7	3.90	112	4.53	8.5	4.35	125	5.54	10.4	5.33	153
3300	4.05	7.8	4.11	118	4.19	8.1	4.25	122	4.68	9.0	4.74	136	5.73	11.0	5.81	167
3450	4.19	8.2	4.46	128	4.34	8.5	4.61	132	4.83	9.4	5.15	148	5.92	11.5	6.30	181
3600	4.32	8.5	4.82	139	4.47	8.8	4.99	144	4.99	9.9	5.56	160	6.11	12.1	6.81	196
3750	4.46	8.9	5.20	150	4.62	9.2	5.38	155	5.15	10.3	6.00	173	6.31	12.6	7.35	212
3900	4.59	9.3	5.52	158	4.75	9.6	5.33	163	5.30	10.7	6.38	182	6.49	13.2	7.81	223
4050	4.73	9.7	5.92	170	4.90	10.0	6.13	176	5.46	11.2	6.84	196	6.69	13.7	8.37	240
4200	4.87	10.1	6.34	181	5.04	10.4	6.56	188	5.62	11.6	7.32	210	6.89	14.2	8.96	257
4350	5.00	10.4	6.69	190	5.18	10.8	6.92	197	5.78	12.0	7.73	220	7.07	14.8	9.46	269
4500	5.14	10.8	7.22	207	5.32	11.2	7.47	214	5.94	12.5	8.34	239	7.27	15.3	10.20	292

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

METRIC STANDARD

SLOPE PAVING FOR CONCRETE HEADWALLS

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

STANDARD
M601-2

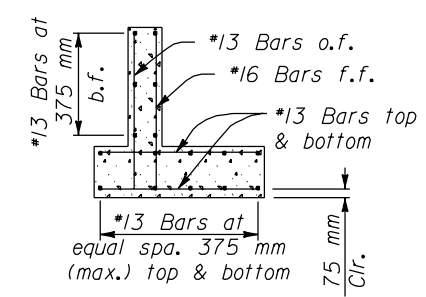
NO SCALE

WINGWALLS FOR CONCRETE HEADWALLS																	
DIMENSIONS, REINFORCING STEEL AND CONCRETE TABLE OF QUANTITIES																	
D mm	H m	0° WINGWALL SKEW			15° WINGWALL SKEW			30° WINGWALL SKEW			45° WINGWALL SKEW			60° WINGWALL SKEW			
		W m	CONC. m ³	STEEL kg	W m	CONC. m ³	STEEL kg	W m	CONC. m ³	STEEL kg	W m	CONC. m ³	STEEL kg	W m	CONC. m ³	STEEL kg	
1200	1.500	1.8	2.11	77	1.8	2.13	77	1.8	2.13	77	1.8	2.14	77	1.8	2.15	77	
1350	1.575	1.8	2.14	79	1.8	2.15	79	1.8	2.16	79	1.8	2.17	79	2.1	2.40	86	
1500	1.650	1.8	2.17	82	1.8	2.19	82	1.8	2.19	82	1.8	2.20	82	2.3	2.67	98	
1650	1.725	1.8	2.20	82	1.8	2.22	82	1.8	2.22	82	1.8	2.23	82	2.5	2.94	107	
1800	1.800	1.8	2.24	84	1.8	2.25	84	1.8	2.26	84	2.0	2.42	88	2.7	3.21	116	
1950	1.875	1.8	2.27	86	1.8	2.28	86	1.8	2.29	86	2.1	2.61	95	3.0	3.49	127	
2100	1.950	1.8	2.30	86	1.8	2.31	86	1.8	2.32	86	2.3	2.81	104	3.2	3.77	138	
2250	2.025	1.8	2.33	88	1.8	2.34	88	2.0	2.52	93	2.4	3.00	111	3.4	4.06	147	
2400	2.100	1.8	2.36	88	1.9	2.45	93	2.1	2.71	102	2.6	3.20	118	3.6	4.36	159	

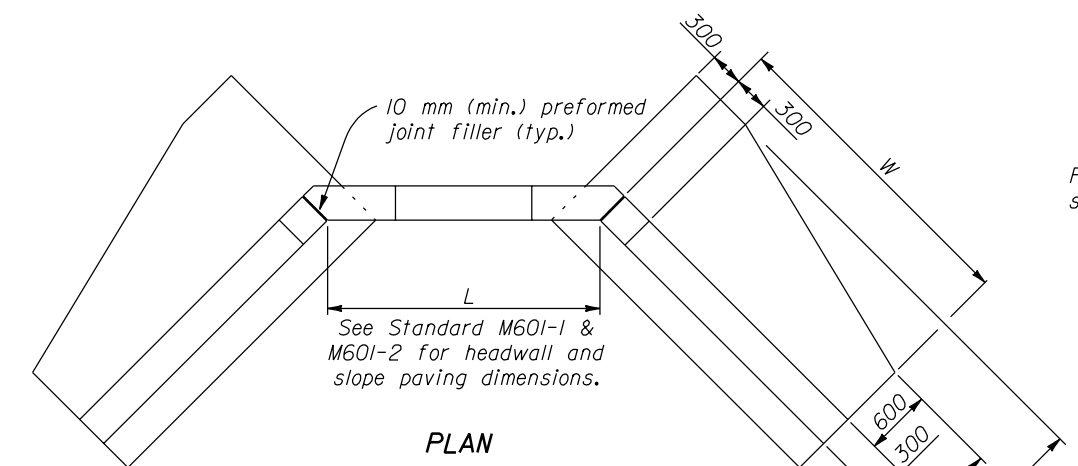
WINGWALL	PIPE SKEW			
	0°	15°	30°	45°
①	45°	45°	60°	60°
②	45°	30°	15°	0°
③	45°	30°	15°	0°
④	45°	45°	60°	60°

NOTE:

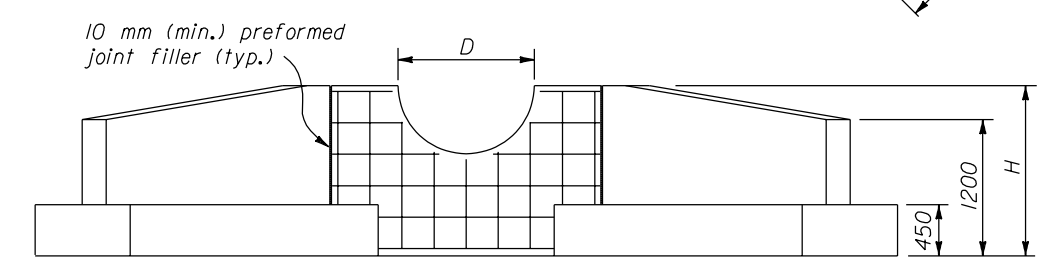
- Dimensions not labeled are in millimeters.
- Concrete conforms to Section 601. Chamfer all exposed edges 20 mm and finish all exposed surfaces with a Class 1 ordinary finish.
- Clearance for reinforcing steel is 50 mm unless otherwise noted.
- For skew angles shown in table, the length W and quantities for wingwalls are computed for a 1:1.5 side slope. For slopes other than 1:1.5 compute length W with the following equations:
 (1:2 slope) $W = (H - 0.9) \times 2 \times \text{secant (wingwall skew angle)}$
 (1:2.5 slope) $W = (H - 0.9) \times 2.5 \times \text{secant (wingwall skew angle)}$
 Minimum W not less than 1.8 meters
- Quantities shown in table are for one wing wall only. For lengths not shown in table, compute quantities with the following method:
 Multiply the quantities for 0° skew and a given height, H, by the factor $1 + [(W - 1.8) \times 0.14]$.
- Final quantities will be determined by using the tables on this standard.
- Do not order materials until the length, skew angle, and slope bevel in the field have been approved.



SECTION A-A

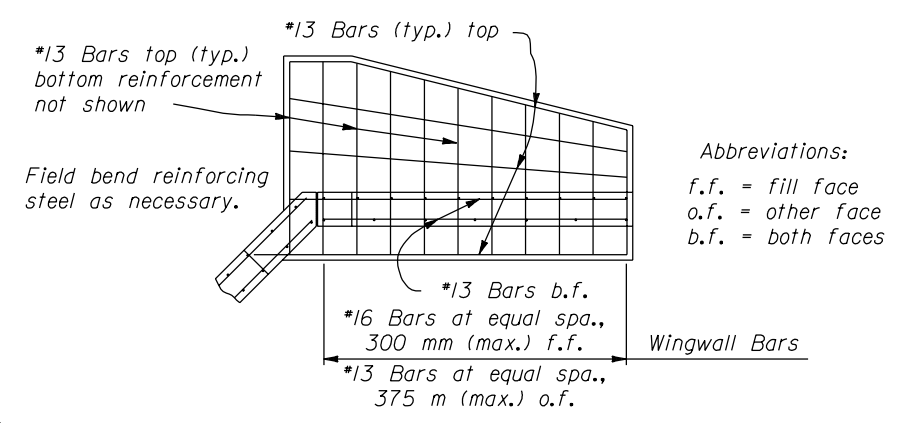


PLAN

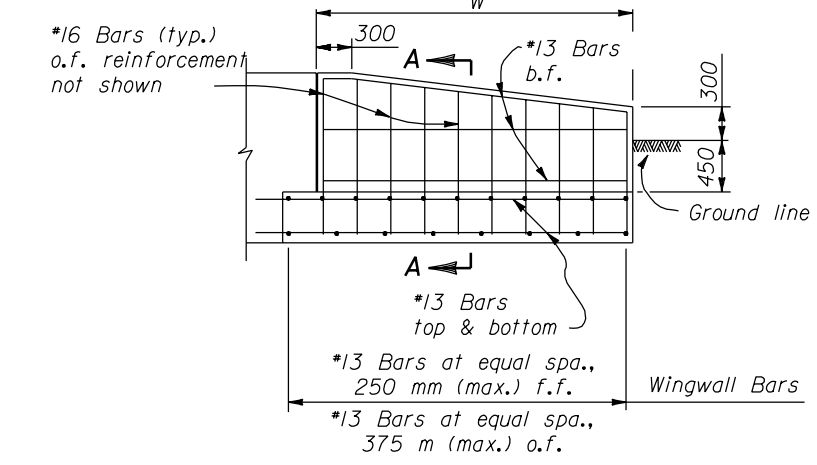


ELEVATION

HEADWALL AND WINGWALL

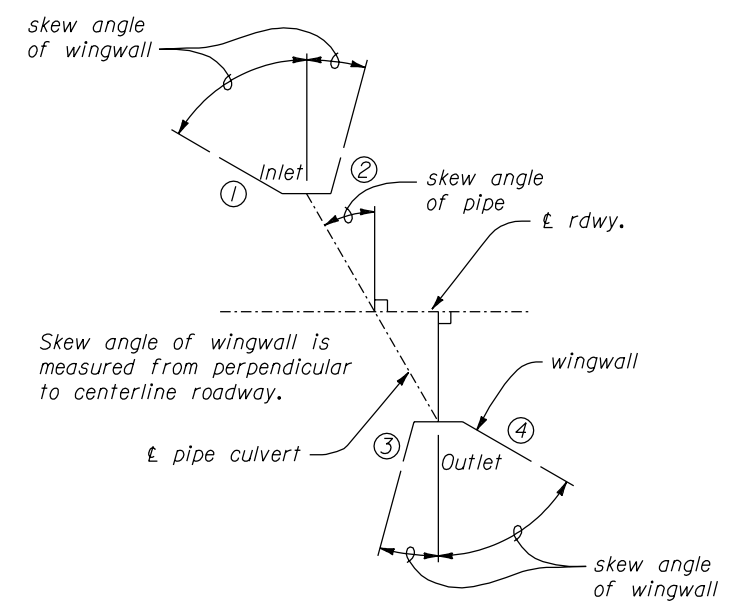


PLAN



ELEVATION

TYPICAL WINGWALL



WINGWALL LAYOUT

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

METRIC STANDARD

WINGWALLS FOR
 CONCRETE HEADWALLS

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

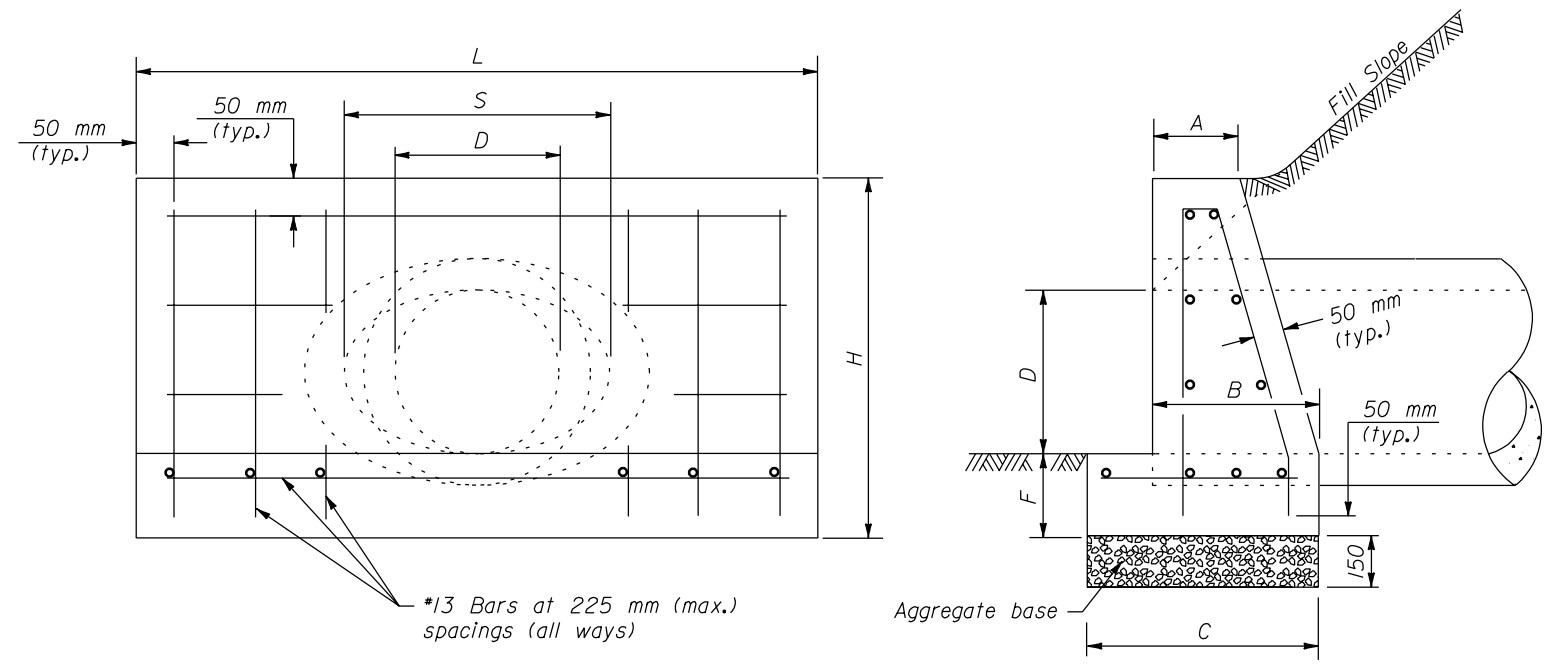
STANDARD
 M601-3

NO SCALE

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NOTE:

1. Dimensions not labeled are in millimeters.
2. All headwalls are oriented parallel to the roadway centerline unless otherwise indicated in the plans or by the CO.
3. When pipes are on a skew, adapt and lengthen headwalls as directed.
4. Chamfer all exposed corners not rounded to 20 mm.
5. Quantities shown are for one headwall with pipe at right angles.
6. Construct headwalls using dimensions shown under values for 1:1.5 slope, unless otherwise designated by the CO.



FRONT ELEVATION

SIDE ELEVATION

*13 Bars at 225 mm (max.) spacings (all ways)

HEADWALL FOR CIRCULAR PIPE						
DIAMETER OF PIPE CULVERT						
	300	375	450	525 or 600	675 or 750	825 or 900
A	150	200	225	275	300	300
B	225	325	375	450	525	600
C	350	475	525	650	750	825
D	300	375	450	600	750	900
F	150	200	200	225	225	225
H	600	875	950	1125	1275	1425
L	1100	1500	1800	2400	3000	3600
CUBIC METERS OF CONCRETE						
Conc. Pipe	0.127	0.359	0.516	0.974	1.528	2.185
C.M. Pipe	0.137	0.379	0.546	1.032	1.624	2.326

HEADWALL FOR ELLIPTICAL PIPE										
SIZE OF ELLIPTICAL PIPE CULVERT (SPAN X RISE)										
	575 X 350	750 X 475	850 X 550	950 X 600	1050 X 675	1125 X 725	1225 X 800	1325 X 850	1500 X 950	1700 X 1075
A	200	225	250	275	275	300	300	300	300	300
B	350	425	450	500	525	550	575	575	575	600
C	500	575	625	700	725	775	800	825	975	1050
D	350	475	550	600	675	725	800	850	950	1075
F	200	200	225	225	225	225	225	225	225	225
H	850	975	1075	1125	1200	1250	1325	1375	1475	1600
L	1625	2150	2550	2750	3050	3275	3625	3875	3900	3900
S	575	750	850	950	1050	1125	1225	1325	1500	1700
CUBIC METERS OF CONCRETE										
Conc. Pipe	0.378	0.639	0.913	1.119	1.352	1.569	1.876	2.074	2.241	2.363

NO SCALE

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

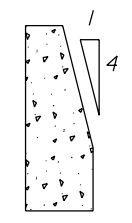
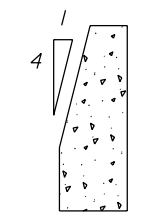
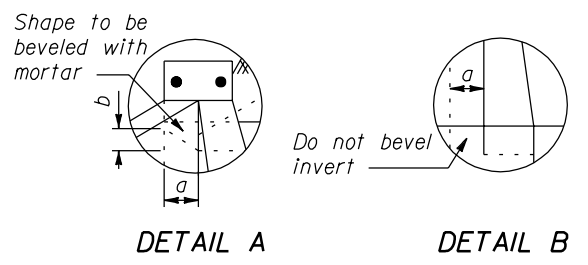
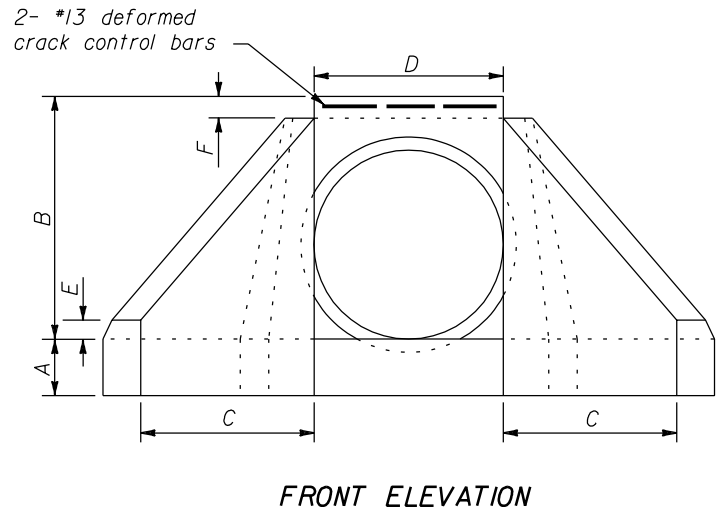
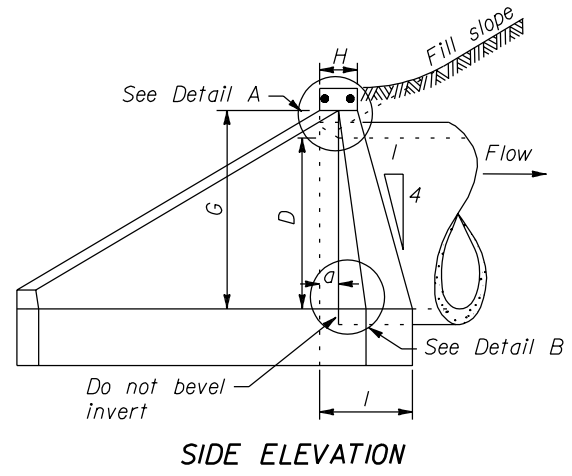
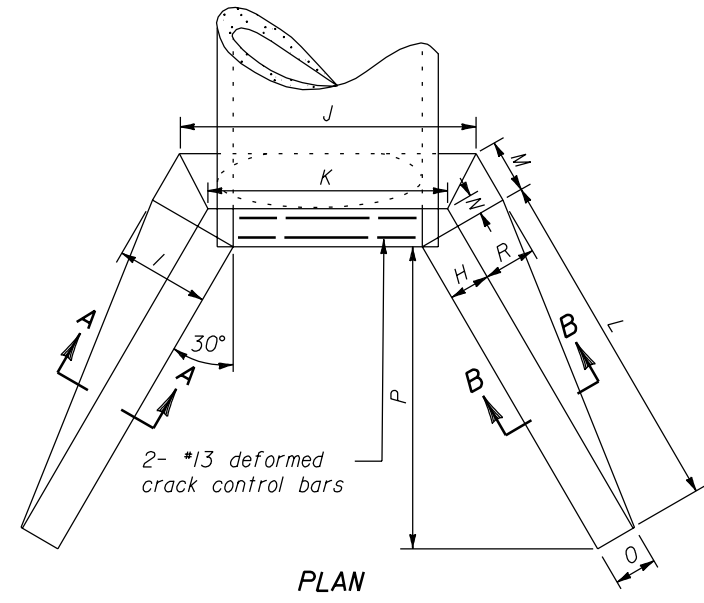
METRIC STANDARD

**CONCRETE HEADWALL FOR
SMALL PIPE CULVERT**

STANDARD APPROVED FOR USE 3/1996 REVISED: 8/1997	STANDARD M601-4
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NOTE:

- Dimensions not labeled are in millimeters.
- Use this Standard for normal crossings and skews up to 15°.
- On shallow fill, where headwall is 600 mm or less below shoulder line, construct the headwall parallel to line and grade of the shoulder.
- Do not allow top of wingwall to project above fill slope, ditch slope or shoulder.
- Chamfer all exposed corners 20 mm.
- Bevel required at inlet only.
- Concrete quantities as shown will be used as the basis for final payment for wingwalls constructed according to this Standard.



SECTION A-A

SECTION B-B

DIMENSIONS AND QUANTITIES PER WINGWALL

		D (Diameter of pipe culvert)							
		1050	1200	1350	1500	1650	1800	1950	2100
For 1:1.5 fill slope	A	450	450	450	450	450	450	450	450
	B	1460	1625	1790	1955	2120	2285	2450	2615
	C	1010	1140	1275	1400	1540	1670	1805	1935
	D	1065	1220	1370	1525	1675	1830	1980	2135
	E	150	150	150	150	150	150	150	150
	F	140	150	165	180	190	205	215	230
	G	1320	1475	1625	1780	1930	2080	2235	2390
	H	255	255	280	305	330	355	380	405
	I	585	620	685	750	810	875	940	1005
	J	1740	1935	2165	2390	2615	2845	3065	3290
	K	1360	1510	1695	1875	2055	2240	2420	2605
	L	2020	2285	2550	2815	3080	3345	3605	3870
	M	335	360	395	430	470	510	545	580
N	145	145	160	175	190	205	220	235	
O	290	290	320	340	370	395	420	445	
P	1750	1980	2210	2440	2665	2895	3125	3350	
R	330	370	405	445	480	520	560	595	
Conc. m ³	Conc.	2.720	3.343	4.308	5.420	6.710	8.182	9.833	11.700
	CMP	2.898	3.578	4.629	5.843	7.256	8.873	10.692	12.751
For 1:2 fill slope	C	1320	1495	1670	1850	2020	2200	2375	2555
	F	165	180	190	205	215	230	240	255
	G	1295	1450	1600	1755	1905	2055	2210	2360
	I	580	615	680	745	805	870	935	995
	J	1735	1930	2160	2380	2610	2830	3060	3280
	L	2640	2990	3345	3695	4050	4400	4750	5105
	M	335	355	395	430	465	500	540	575
	P	2285	2590	2895	3200	3505	3810	4115	4420
R	325	360	400	440	475	515	550	590	
Conc. m ³	Conc.	3.240	3.999	5.169	6.528	8.106	9.907	11.936	14.238
	CMP	3.417	4.233	5.487	6.948	8.649	10.594	12.791	15.286
	a	140	150	180	190	215	230	255	265
	b	90	100	115	125	140	150	165	180

NO SCALE

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

METRIC STANDARD

**CONCRETE WINGWALLS
 FOR SINGLE NORMAL
 1050 TO 2100 mm CULVERTS**

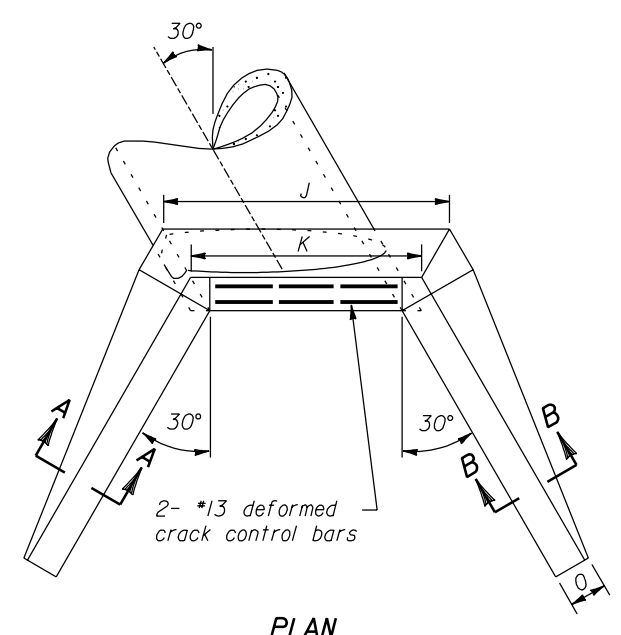
STANDARD APPROVED FOR USE 3/1996
 REVISED: 5/1997

STANDARD
M601-5

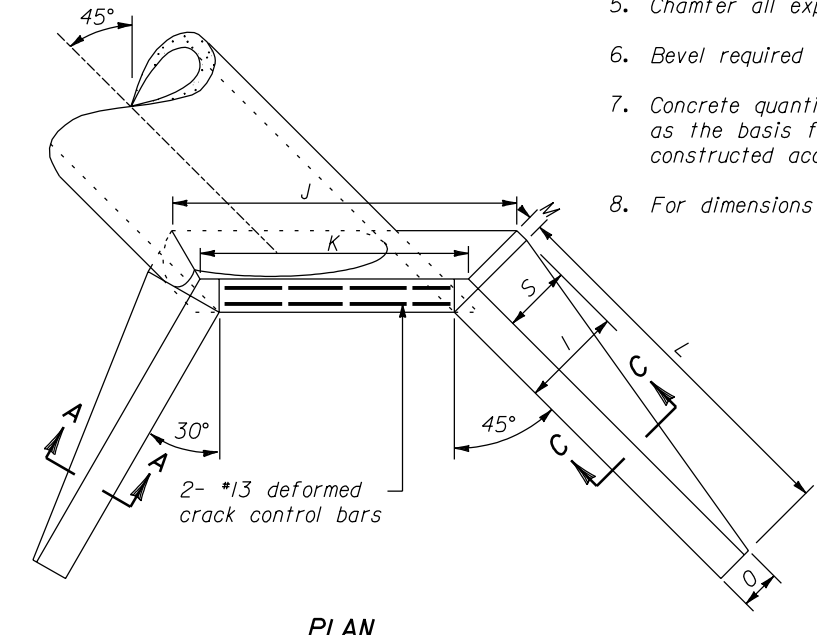
DIMENSIONS AND QUANTITIES PER WINGWALL										
D (Diameter of pipe culvert)										
For 1:1.5 fill slope 30° skew		1050	1200	1350	1500	1650	1800	1950	2100	
	D	1230	1405	1585	1760	1935	2110	2290	2465	
	J	1905	2125	2380	2625	2875	3125	3375	3620	
	K	1525	1700	1910	2110	2320	2525	2725	2935	
	O	290	290	320	345	370	395	420	445	
Conc. m ³	Conc.	2.776	3.409	4.392	5.522	6.831	8.322	9.997	11.892	
	CMP	2.982	3.681	4.762	6.010	7.461	9.120	10.989	13.098	
For 1:1.5 fill slope 45° skew	C	1755	1980	2210	2440	2665	2895	3125	3355	
	D	1510	1725	1940	2155	2370	2590	2800	3015	
	I	720	770	855	935	1015	1090	1170	1250	
	J	2280	2555	2860	3160	3460	3760	4060	4365	
	K	1760	1975	2215	2455	2700	2940	3180	3420	
	L	2480	2800	3125	3450	3770	4095	4420	4740	
	M	105	105	115	125	135	145	160	170	
	O	310	310	335	360	385	410	435	460	
	S	465	520	575	630	685	735	790	845	
	Conc. m ³	Conc.	3.235	3.969	5.132	6.458	7.983	9.721	11.679	13.877
CMP		3.473	4.285	5.561	7.026	8.716	10.648	12.832	15.289	
For 1:2 fill slope 30° skew	D	1230	1405	1585	1760	1935	2110	2290	2465	
	J	1900	2120	2370	2620	2870	3115	3370	3615	
	K	1525	1700	1910	2110	2320	2525	2725	2935	
	O	290	290	320	345	370	395	420	445	
	Conc. m ³	Conc.	3.295	4.064	5.251	6.628	8.224	10.045	12.098	14.422
CMP		3.499	4.334	5.619	7.113	8.851	10.838	13.085	15.631	
For 1:2 fill slope 45° skew	C	2285	2590	2895	3200	3505	3810	4115	4420	
	D	1510	1725	1940	2155	2370	2590	2800	3015	
	I	710	765	845	925	1005	1085	1160	1240	
	J	2270	2545	2850	3150	3450	3750	4050	4350	
	K	1760	1975	2215	2455	2700	2940	3180	3420	
	L	3230	3665	4095	4530	4955	5390	5820	6250	
	M	105	105	115	125	135	145	160	170	
	O	310	310	335	360	385	410	435	460	
	S	455	510	565	620	675	725	780	835	
	Conc. m ³	Conc.	3.856	4.782	6.171	7.871	9.662	11.796	14.209	16.929
CMP		4.091	5.095	6.597	8.435	10.390	12.718	15.357	18.335	
a	140	150	180	190	215	230	255	265		
b	90	100	115	125	140	150	165	180		

NOTE:

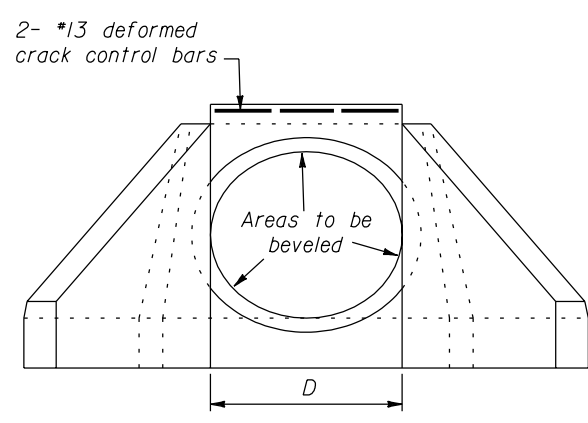
- Dimensions not labeled are in millimeters.
- Use the 30° Skew Detail for skews 15° to 37° 30', use the 45° Skew Detail for skews 37° 30' to 45°.
- On shallow fill, where headwall is 600 mm or less below shoulder line construct the headwall parallel to line and grade of the shoulder.
- Do not allow top of wingwall to project above fill slope, ditch slope, or shoulder.
- Chamfer all exposed corners 20 mm.
- Bevel required at inlet only.
- Concrete quantities as shown will be used as the basis for final payment for wingwalls constructed according to this Standard.
- For dimensions not shown See Standard M601-5.



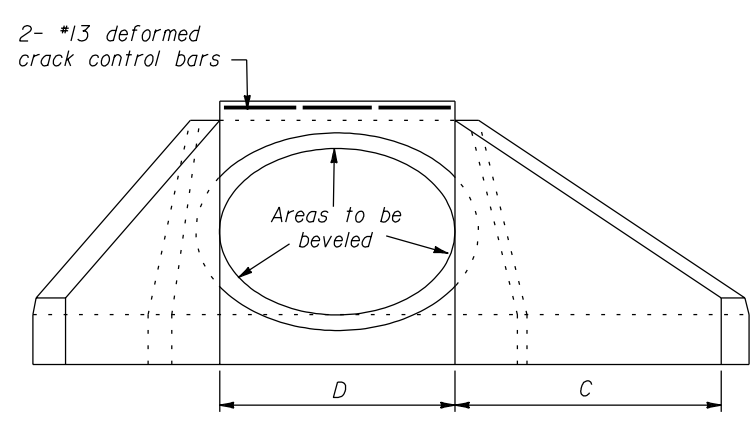
PLAN



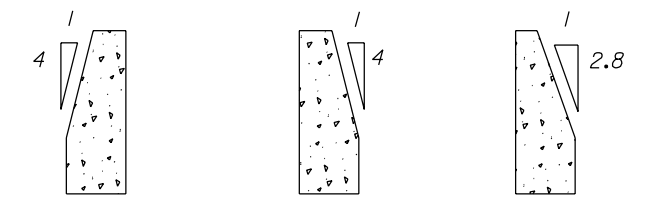
PLAN



ELEVATION



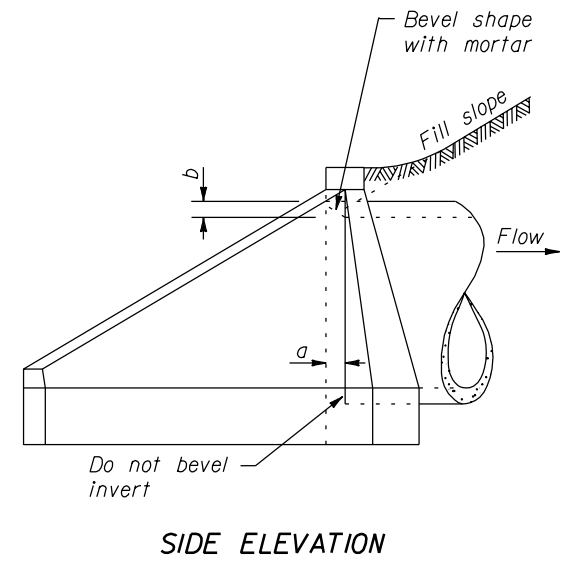
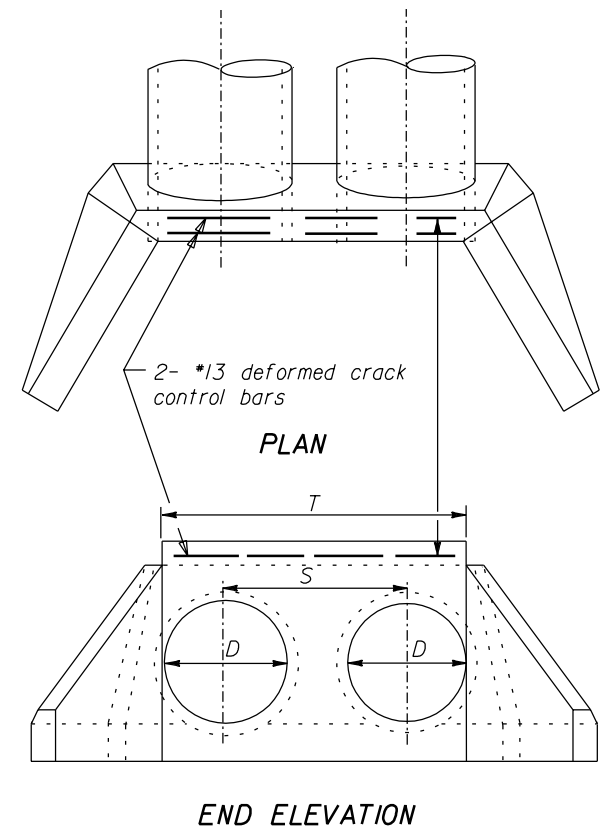
ELEVATION



SECTION A-A SECTION B-B SECTION C-C

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
CONCRETE WINGWALLS FOR SINGLE SKEW 1050 TO 2100 mm CULVERTS	
STANDARD APPROVED FOR USE 3/1996 REVISED: 5/1997	STANDARD M601-6



DIMENSIONS AND QUANTITIES FOR WINGWALL								
FOR CONCRETE PIPE								
DIAMETER D OF PIPE	S	T	FILL SLOPE 1:1.5		FILL SLOPE 1:2		a	b
			m ³ CONC. ONE DOUBLE ENDWALL	INCREASE m ³ CONC. FOR EACH ADDITIONAL PIPE	m ³ CONC. ONE DOUBLE ENDWALL	INCREASE m ³ CONC. FOR EACH ADDITIONAL PIPE		
1050	1830	2895	3.692	0.972	4.200	0.960	140	90
1200	2085	3300	4.560	1.216	5.201	1.202	150	100
1350	2335	3710	5.881	1.573	6.725	1.556	175	115
1500	2590	4115	7.408	1.988	8.496	1.968	190	125
1650	2845	4520	9.187	2.477	10.559	2.453	215	140
1800	3100	4930	11.211	3.028	12.910	3.002	230	150
1950	3350	5335	13.465	3.632	15.540	3.603	255	165
2100	3605	5740	16.169	4.355	18.645	4.295	265	175
FOR CORRUGATED METAL PIPE								
1050	1615	2680	3.876	0.978	4.382	0.966	140	90
1200	1840	3060	4.814	1.236	5.453	1.220	150	100
1350	2070	3440	6.291	1.609	7.078	1.591	175	115
1500	2300	3825	7.889	2.047	8.974	2.026	190	125
1650	2525	4205	9.749	2.493	11.119	2.470	215	140
1800	2755	4585	11.983	3.110	13.677	3.083	230	150
1950	2985	5120	14.464	3.772	16.532	3.741	255	165
2100	3215	5345	17.381	4.515	19.878	4.480	265	175

- NOTE:**
- Dimensions not labeled are in millimeters.
 - See Standard M601-5 for any dimensions not shown.
 - Use this Standard for normal crossing and skews up to 15°.
 - On shallow fill, where headwall is 600 mm or less below shoulder line, construct the headwall parallel to line and grade of the shoulder.
 - Do not allow top of wingwalls to project above fill slope, ditch slope, or shoulder.
 - Chamfer all exposed corners 20 mm.
 - Bevel required at inlet only.
 - Concrete quantities as shown will be used as the basis for final payment for wingwalls constructed according to this Standard.

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
CONCRETE WINGWALLS FOR MULTIPLE NORMAL 1050 TO 2100 mm CULVERTS	
STANDARD APPROVED FOR USE 3/1996	STANDARD
REVISED: 5/1997	M601-7

NOTE:

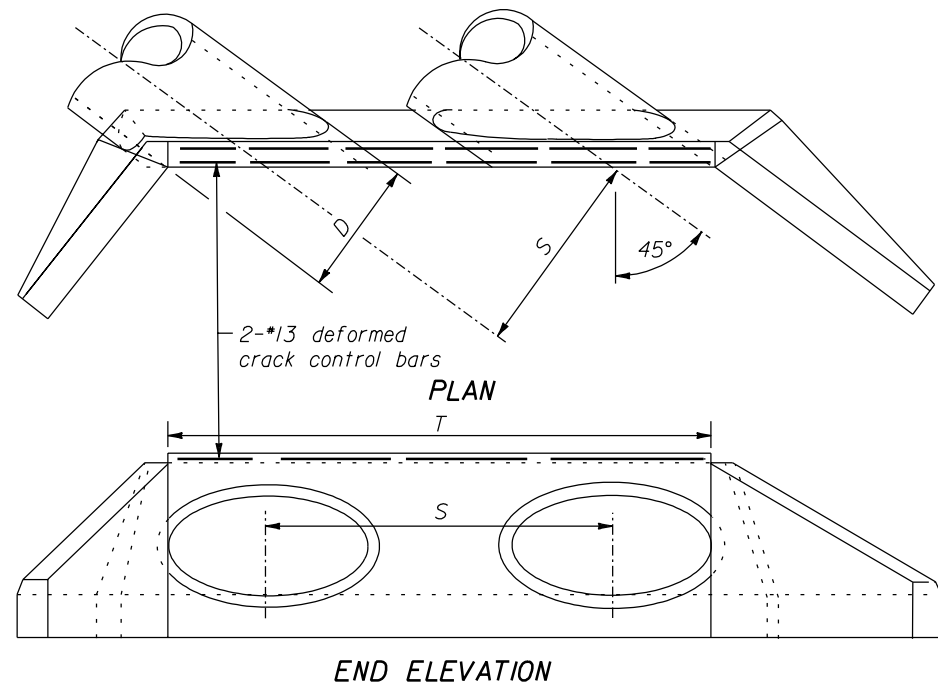
1. Dimensions not labeled are in millimeters.
2. Use the 30° skew detail for skews 15° to 37° 30', use the 45° skew detail for skews 37° 30' to 45°.
3. On shallow fill, where headwall is 600 mm or less below shoulder line construct the headwall parallel to line and grade of the shoulder.
4. Chamfer all exposed corners 20 mm.
5. Do not allow top of wingwall to project above fill slope, ditch slope, or shoulder.
6. Bevel required at inlet only.
7. Concrete quantities as shown will be used as the basis for final payment for wingwalls constructed according to this Standard.
8. For dimensions not shown See Standard M601-5.

DIMENSIONS AND QUANTITIES FOR WINGWALL

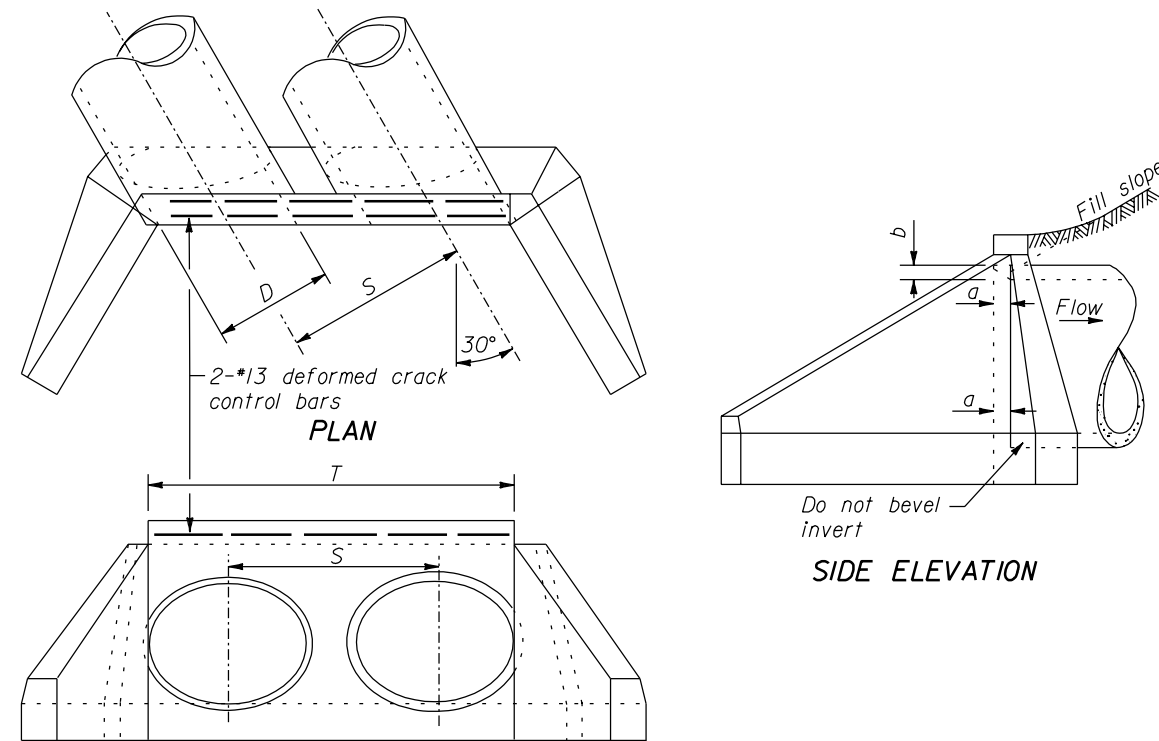
DIAMETER D OF PIPE	S	T	V	a	b	FILL SLOPE 1:1.5		FILL SLOPE 1:2	
						m ³ CONC. DOUBLE ENDWALL	m ³ CONC. Per addn. pipe	m ³ CONC. DOUBLE ENDWALL	m ³ CONC. Per addn. pipe
FOR CONCRETE PIPE									
1050	1830	2110	3345	140	90	3.898	1.122	4.403	1.108
1200	2085	2405	3815	150	100	4.813	1.404	5.451	1.387
1350	2335	2700	4285	175	115	6.209	1.817	7.048	1.797
1500	2590	2990	4750	190	125	7.817	2.294	8.899	2.272
1650	2845	3285	5220	215	140	9.682	2.851	11.048	2.824
1800	3100	3580	5690	230	150	11.802	3.480	13.494	3.450
1950	3350	3870	6160	255	165	14.189	4.191	16.255	4.158
2100	3605	4165	6630	265	175	16.882	4.998	19.382	4.960
FOR CORRUGATED METAL PIPE									
1050	1615	1865	3095	140	90	4.101	1.119	4.603	1.105
1200	1840	2125	3535	150	100	5.094	1.414	5.730	1.397
1350	2070	2390	3975	175	115	6.680	1.842	7.440	1.821
1500	2300	2655	4415	190	125	8.354	2.344	9.434	2.320
1650	2525	2920	4855	215	140	10.387	2.926	11.739	2.888
1800	2755	3180	5295	230	150	12.742	3.622	14.400	3.562
1950	2985	3445	5735	255	165	15.342	4.353	17.402	4.317
2100	3215	3710	6175	265	175	18.314	5.216	20.807	5.176
FOR CONCRETE PIPE									
1050	1830	2590	4095	140	90	4.610	1.375	5.214	1.358
1200	2085	2945	4670	150	100	5.691	1.722	6.483	1.701
1350	2335	3305	5245	175	115	7.356	2.224	8.371	2.200
1500	2590	3665	5820	190	125	9.270	2.811	10.654	2.783
1650	2845	4025	6395	215	140	11.471	3.488	13.111	3.456
1800	3100	4380	6970	230	150	13.981	4.261	16.020	4.223
1950	3350	4740	7545	255	165	16.813	5.134	19.303	5.093
2100	3605	5100	8120	265	175	19.999	6.123	23.005	6.076
FOR CORRUGATED METAL PIPE									
1050	1615	2280	3790	140	90	4.840	1.368	5.442	1.351
1200	1840	2595	4340	150	100	6.014	1.729	6.805	1.710
1350	2070	2925	4865	175	115	7.816	2.255	8.812	2.230
1500	2300	3250	5405	190	125	9.896	2.871	11.277	2.842
1650	2525	3575	5945	215	140	12.302	3.586	13.942	3.552
1800	2755	3900	6485	230	150	15.054	4.406	17.086	4.367
1950	2985	4220	7025	255	165	18.164	5.332	20.645	5.288
2100	3215	4545	7565	265	175	21.673	6.384	24.668	6.334

30° SKEW

45° SKEW



END ELEVATION



SIDE ELEVATION

END ELEVATION

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NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
METRIC STANDARD	
CONCRETE WINGWALLS FOR MULTIPLE SKEW 1050 TO 2100 mm CULVERTS	
STANDARD APPROVED FOR USE 3/1996 REVISED: 5/1997	STANDARD M601-8