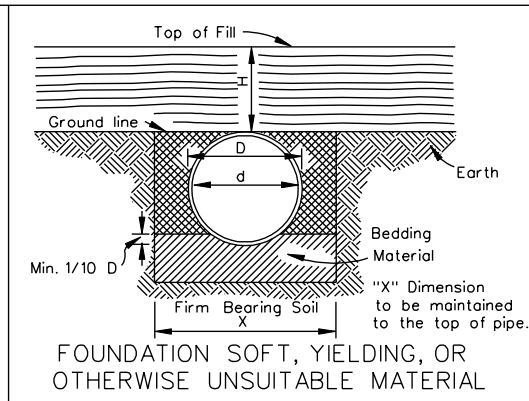
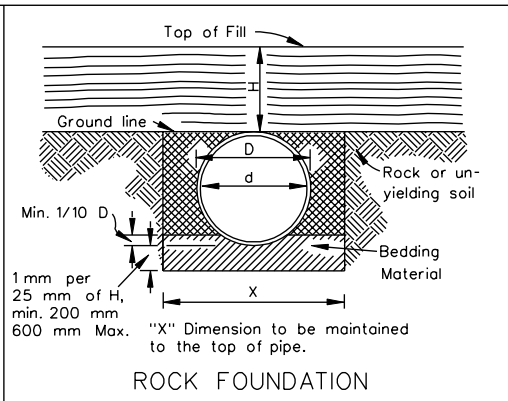
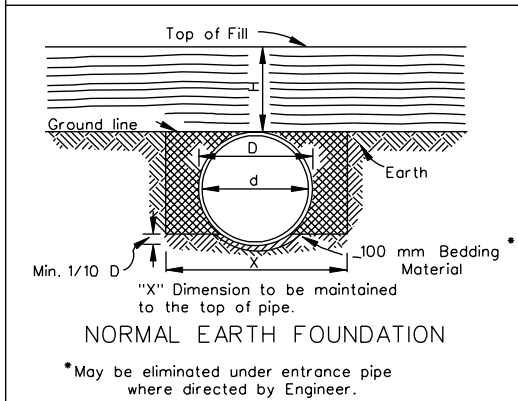
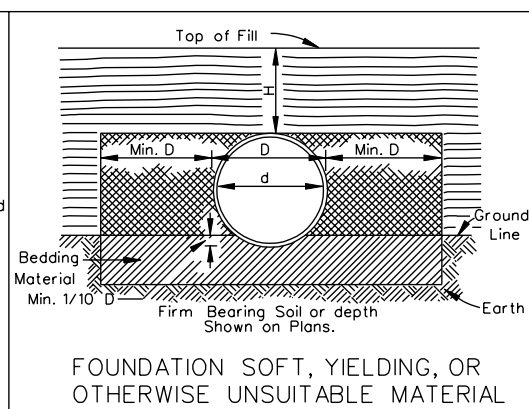
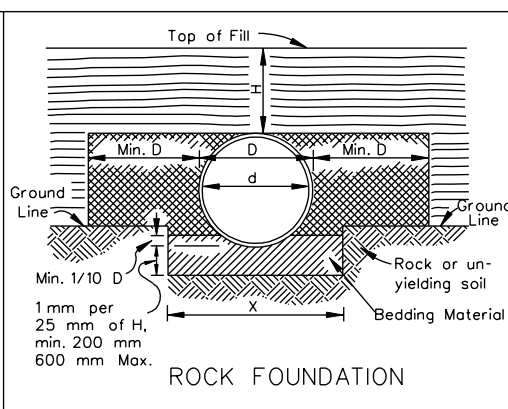
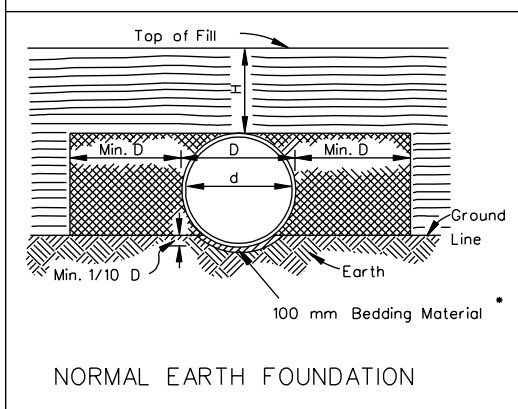


PB-1 NO PROJECTION OF PIPE ABOVE GROUND LINE



PIPE PROJECTION ABOVE GROUND LINE



Culverts less than $d = 900$ mm
 $x = D + 600$ mm

Culverts where $d = 900$ mm and over
 $x = D + 900$ mm




Method "A" Pipe Bedding shall be used as follows unless otherwise noted on plans:

To determine "D" for Elliptical Concrete Pipe, use the larger dimension in the "Span-Rise" designation.

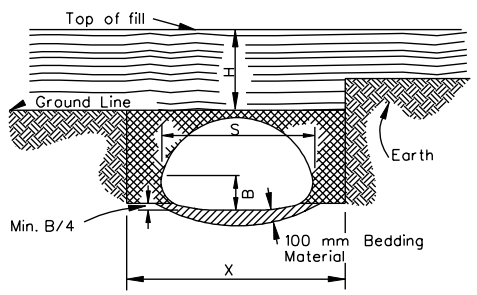
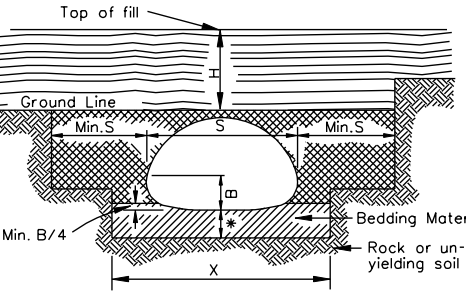
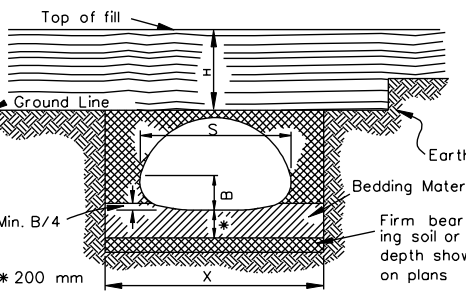
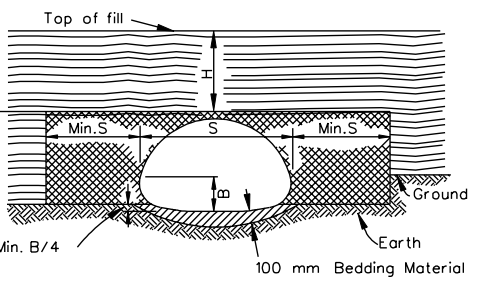
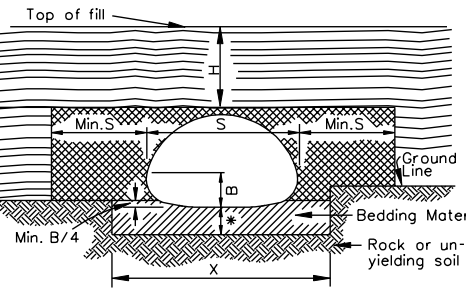
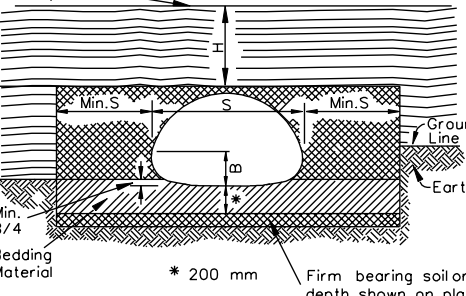



RIGID PIPE
 When H is less than or equal to 9.0 meters
 (No projection of pipe above ground line.)

When H is less than or equal to 9.0 meters
 (Pipe projection above ground line.)

FLEXIBLE PIPE
 As shown on tables
 H = Height of cover measured from top of drainage structure to finished grade.

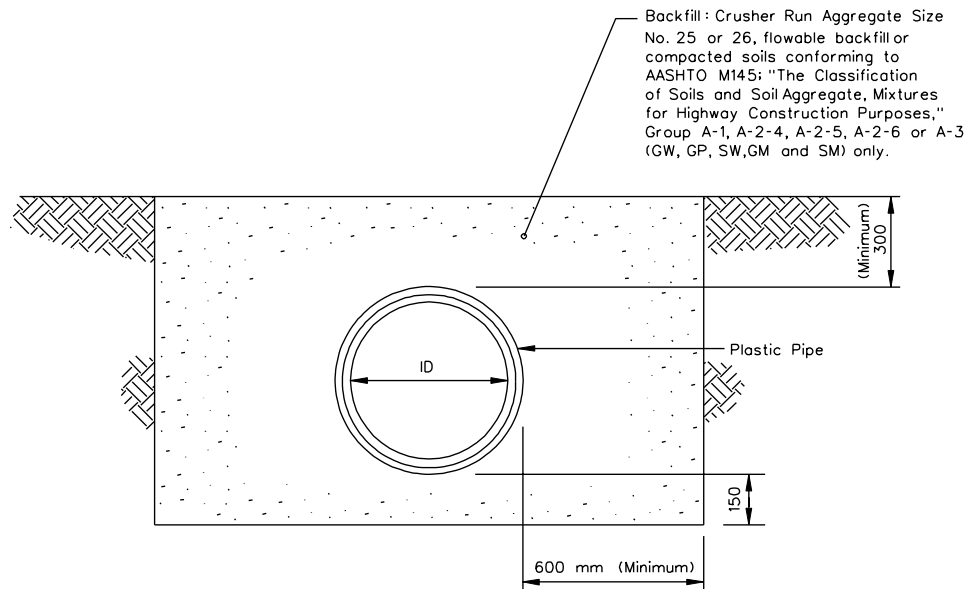
 Bedding material in accordance with Section 302 of the Road and Bridge Specifications
 Backfill material in accordance with Section 302 of the Road and Bridge Specifications
 Embankment

Sheet 1 of 3

PB-1	NO PROJECTION OF PIPE ARCH ABOVE GROUND LINE			
 <p>NORMAL EARTH FOUNDATION</p>	 <p>ROCK FOUNDATION</p>	 <p>FOUNDATION SOFT, YIELDING, OR OTHERWISE UNSUITABLE MATERIAL</p>		
PIPE ARCH PROJECTION ABOVE GROUND LINE				
 <p>NORMAL EARTH FOUNDATION</p>	 <p>ROCK FOUNDATION</p>	 <p>FOUNDATION SOFT, YIELDING, OR OTHERWISE UNSUITABLE MATERIAL</p>		
<p>  Bedding material in accordance with Section 302 of the Road and Bridge Specifications  Backfill material in accordance with Section 302 of the Road and Bridge Specifications  Embankment </p> <p> $X = S + 900 \text{ mm}$ for S greater than 875 mm $X = S + 600 \text{ mm}$ for S less than 875 mm H = Height of cover measured from top of drainage structure to finished grade. </p>				
<p>INSTALLATION OF PIPE CULVERTS AND STORM SEWERS PIPE ARCH BEDDING</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		<p style="text-align: right;">Sheet 2 of 3</p> <table border="1" style="width: 100%;"> <tr> <td style="text-align: center;">SPECIFICATION REFERENCE</td> </tr> <tr> <td style="text-align: center;">302 303</td> </tr> </table>	SPECIFICATION REFERENCE	302 303
SPECIFICATION REFERENCE				
302 303				
107.02	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS			

Notes:

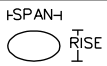
When corrugated metal culvert pipe is permitted on the plans, the Contractor will have the option to furnish and install corrugated PE culvert pipe conforming to AASHTO M294 or PVC ribbed culvert pipe conforming to AASHTO F794, provided the diameter of the pipe used is equal to or greater than the diameter of the corrugated metal pipe.




SPECIFICATION REFERENCE	PLASTIC CULVERT PIPE BEDDING		
302 303	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	107.03

REVISED ON 2/01

PC - 1	CONCRETE PIPE CULVERT CRUSHING STRENGTH (kN PER METER ULTIMATE STRENGTH, OR CLASS)					
DIAMETER (mm)	AREA (m ²)	METHOD A BEDDING				
		MAXIMUM HEIGHT OF COVER IN METERS				
		STRENGTH OR CLASS				
		NON REINF.	III	IV	V	
300	0.07	4.2 (26.5)	4.2	5.8	8.8	
375	0.11	4.2 (31.0)	4.2	5.8	8.8	
450	0.16	4.2 (35.0)	4.2	6.1	8.8	
525	0.22	4.0 (39.5)	4.2	6.1	8.8	
600	0.29	4.0 (44.0)	4.2	6.1	8.8	
675	0.37		4.2	6.1	8.8	
750	0.46		4.2	6.1	8.8	
825	0.55		4.2	6.1	8.8	
900	0.66		4.2	6.1	9.1	
1050	0.89		4.2	6.4	9.1	
1200	1.17		4.2	6.4	9.1	
1350	1.48		4.2	6.4	9.1	
1500	1.82		4.2	6.4	9.1	
1650	2.21		4.2	6.4	9.1	
1800	2.63		4.2	6.4	9.1	
1950	3.08		4.2	6.4	9.1	
2100	3.57		4.2	6.4	9.1	
2250	4.10		4.2	6.4	9.1	
2400	4.67		4.2	6.4	9.1	
2550	5.27		4.2	6.4	9.1	
2700	5.91		4.2	6.4	9.1	
<p>Heights of cover shown in table are for finished construction.</p> <p>To protect pipe <u>during construction</u>, minimum heights of cover prior to allowing construction traffic to cross installation are to be $\frac{Dia}{2}$ or 900 mm whichever is greater. This cover shall extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of 10(Dia.+900 mm) on each side of the culvert, or to the intersection with a cut.</p> <p>Minimum <u>finished</u> height of cover to be $\frac{Dia}{2}$ or 600 mm whichever is greater, except pipe under entrances and median crossovers where a 230 mm min. will be permitted.</p> <p>For Height of Cover greater than 9.0 meters, a special design concrete pipe using Method A bedding and in accordance with section 105 of the specifications is to be utilized.</p>						
Sheet 1 of 17	<p>CONCRETE PIPE CLASS TABLE FOR H-18 LIVE LOAD</p>				<p>SPECIFICATION REFERENCE</p>	
107.04	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS	VIRGINIA DEPARTMENT OF TRANSPORTATION			<p>302 232</p>	

HORIZONTAL INSTALLATION			
EQUIVALENT ROUND SIZE (mm)	SPAN X RISE (mm)	MAX. HEIGHT OF COVER IN METERS	
		0.3 - 3.9	4.00 - 6.4
		HE - III	HE - IV
450	575 X 365		
600	770 X 490		
675	865 X 550		
750	960 X 610		
825	1055 X 670		
900	1150 X 730		
975	1250 X 795		
1050	1345 X 855		
1200	1535 X 975		
1350	1730 X 1095		
1500	1920 X 1220		
1650	2110 X 1340		
1800	2305 X 1465		
1950	2495 X 1585		
2100	2690 X 1705		

VERTICAL INSTALLATION						PC 1
SPAN X RISE (mm)	MAX. HEIGHT OF COVER IN METERS				METHOD "A" BEDDING	METHOD "B" BEDDING
	0.3 - 3.9	4.0 - 6.4	6.5 - 8.8	8.9 - 12.2		
	VE - III	VE - IV	VE - V	VE - V		
730 X 1150						
795 X 1250						
855 X 1345						
975 X 1535						
1095 X 1730						
1220 X 1920						
1340 X 2110						
1465 X 2305						
1585 X 2495						
1705 X 2690						

Heights of cover shown in table are for finished construction. To protect pipe during construction, minimum heights of cover prior to allowing construction traffic to cross installation are to be $\frac{Span}{2}$ or 900 mm whichever is greater. This cover shall extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of $10(Span + 900 \text{ mm})$ on each side of the culvert or to the intersection with a cut. Minimum finished height of cover to be $\frac{Span}{2}$ or 600 mm whichever is greater, except pipe under entrances and median crossovers where a 230 mm minimum will be permitted.

Sheet 2 of 17

SPECIFICATION REFERENCE	<h2 style="margin: 0;">ELLIPTICAL CONCRETE PIPE</h2> <h2 style="margin: 0;">TABLE FOR H-18 LIVE LOAD</h2> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<small>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS</small>	107.05
302 232			

PIPE DIAMETER (mm)	AREA (m ²)	CORRUGATED STEEL PIPE - 68 mm x 12 mm CORRUGATIONS										MINIMUM SHEET THICKNESS FOR ENTRANCES WITH LESS THAN 0.3 METER COVER.	Notes: Cover heights indicated in tables are for finished construction. To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.
		MAXIMUM HEIGHT OF COVER LIMITS IN METERS											
		SHEET THICKNESS IN MILLIMETERS											
		1.63		2.01		2.77		3.51		4.27			
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED		
300	0.07	28.0		30.8								1.63	
375	0.11	21.0	22.5	24.4		31.7		32.9				1.63	
450	0.16	14.3	18.6	16.7	20.4	21.6	26.2	27.1	27.4	28.6		1.63	
525	0.22	10.9	16.1	12.5	17.3	15.5	22.5	18.9	23.4	22.5	24.7	2.01	
600	0.29	8.8	14.0	10.0	15.2	12.2	19.8	14.3	20.7	16.7	21.6	2.77	
675	0.37	7.9	12.5	8.5	13.4	10.0	17.3	11.6	18.3	13.4	19.2		
750	0.46	7.0	11.3	7.6	12.2	8.5	15.8	9.7	16.4	10.9	17.0		
825	0.55	6.4	10.0	7.0	10.9	7.6	14.3	8.5	14.9	9.4	15.5		
900	0.66	6.1	9.1	6.4	10.0	7.0	13.1	7.9	13.7	8.5	14.3		
1050	0.89	5.8	10.3	6.1	12.2	6.4	12.8	6.7	13.7	7.3	14.6		
1200	1.17	5.5	9.1	5.8	11.6	5.8	11.9	6.1	12.5	6.4	13.1		
1350	1.48			5.5	9.7	5.8	11.6	5.8	11.9	6.1	12.2		
1500	1.82					5.5	10.3	5.8	11.6	5.8	11.9		
1650	2.21							5.5	10.3	5.5	11.3		
1800	2.63							5.5	7.9	5.5	10.0		
1950	3.08									5.5	7.9		
2100	3.58									5.2	6.1		

PIPE DIAMETER (mm)	AREA (m ²)	CORRUGATED STEEL PIPE - 75 mm x 25 mm and 125 mm x 25 mm CORRUGATIONS											
		MAXIMUM HEIGHT OF COVER LIMITS IN METERS											
		SHEET THICKNESS IN MILLIMETERS											
		1.63		2.01		2.77		3.51		4.27			
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED		
900	0.66	10.3	16.1	11.6	20.1	14.3	28.9	17.3	34.7	20.1	39.6		
1050	0.89	8.2	13.7	9.1	17.0	10.9	21.9	12.8	25.6	14.6	29.5		
1200	1.17	7.3	11.9	7.9	14.9	9.1	18.3	10.3	20.7	11.6	23.1		
1350	1.48	6.7	10.6	7.0	13.4	7.9	15.8	8.5	17.3	9.4	19.2		
1500	1.82	6.1	9.4	6.4	11.9	7.0	14.3	7.6	15.5	8.2	16.7		
1650	2.21	5.8	8.5	6.1	11.0	6.7	13.4	7.0	14.3	7.6	15.2		
1800	2.63	5.8	7.9	5.8	10.0	6.1	12.5	6.7	13.4	7.0	14.0		
1950	3.08	5.5	7.3	5.8	9.1	6.1	12.2	6.4	12.8	6.4	13.1		
2100	3.58	5.5	6.7	5.5	8.5	5.8	11.9	6.1	12.2	6.4	12.8		
2250	4.10	5.5	6.4	5.5	7.9	5.8	11.6	5.8	11.9	6.1	12.2		
2400	4.67			5.5	7.3	5.5	10.9	5.8	11.6	5.8	11.9		
2550	5.27			5.5	6.7	5.5	9.4	5.5	11.3	5.8	11.6		
2700	5.91					5.5	7.9	5.5	10.3	5.5	11.3		
2850	6.59					5.5	6.7	5.5	8.8	5.5	10.9		
3000	7.30					5.2	5.8	5.5	7.6	5.5	9.4		
3300	8.83							5.2	5.5	5.5	7.0		
3600	10.51									5.2	5.5		

CORRUGATED STEEL PIPE												SPECIFICATION REFERENCE
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD												
107.06	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS					VIRGINIA DEPARTMENT OF TRANSPORTATION					302	
											232	

Pipe Diameter	Min. Cover Height * During Construction
300 mm to 750 mm	450 mm
900 mm and above	Diameter 2

*The cover shall extend the full length of the pipe. The approach fill is to extend a minimum of (15) Diameters on each side of the structure, or to the intersection with a cut.

Allowable cover height, as indicated in the tables to the left, in excess of 30 meters are to be considered as special design installations and will require detailed foundation determination.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

CORRUGATED ALUMINUM ALLOY PIPE - 68 mm X 13 mm CORRUGATIONS											
PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS									
		SHEET THICKNESS IN MILLIMETERS									
		1.53		1.90		2.67		3.43		4.17	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
300	0.07	15.2		15.2		24.4	26.2	27.4		28.3	
375	0.11	10.6	12.2	11.9	12.2	14.9	21.0	18.3	21.6	21.6	22.5
450	0.16	8.2	10.0	9.1	10.0	10.6	17.4	12.5	18.3	14.6	18.9
525	0.22	7.0	8.5	7.6	8.5	8.5	14.9	9.7	15.5	11.0	16.1
600	0.29	6.4	7.6	6.7	7.6	7.6	13.1	8.2	13.7	9.1	14.0
675	0.37	6.1	6.7	6.1	6.7	6.7	11.6	7.3	12.2	7.9	12.5
750	0.46	5.8	6.1	5.8	6.1	6.1	10.3	6.7	11.0	7.0	11.3
825	0.55	5.5		5.5		5.8	9.4	6.4	9.7	6.7	10.0
900	0.66	4.9		4.9		5.8	8.5	6.1	9.1	6.4	9.4
1050	0.89	5.2	5.5	5.5	7.3	5.5	10.3	5.8	11.6	5.8	11.9
1200	1.17					5.5	7.0	5.5	9.1	5.5	11.3
1350	1.48					4.9		5.5	6.4	5.5	8.2
1500	1.82							4.5		5.2	5.8
1650	2.21									4.3	
1800	2.63									3.3	

MINIMUM SHEET THICKNESS FOR ENTRANCES WITH LESS THAN 0.3 METER COVER

Notes:

Cover heights indicated in tables are for finished construction.
 To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Diameter	Min. Cover Height * During Construction
300 mm to 600 mm	450 mm
750 mm and over	Equal to Diameter

CORRUGATED ALUMINUM ALLOY PIPE - 75 mm X 25 mm CORRUGATIONS											
PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS									
		SHEET THICKNESS IN MILLIMETERS									
		1.53		1.90		2.67		3.43		4.17	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
900	0.66	7.0	9.1	7.3	11.3	8.2	15.5	9.1	18.6	10.3	20.7
1050	0.89	6.1	7.9	6.4	9.7	7.0	13.4	7.6	15.5	8.2	16.7
1200	1.17	5.8	6.7	6.1	8.5	6.4	11.6	6.7	13.7	7.3	14.6
1350	1.48	5.5	6.1	5.8	7.6	6.1	10.3	6.4	12.8	6.7	13.4
1500	1.82	5.5		5.5	6.7	5.8	9.4	6.1	12.2	6.1	12.5
1650	2.21			5.5	6.1	5.5	8.5	5.8	11.6	5.8	11.9
1800	2.63			5.5		5.5	7.6	5.5	11.3	5.8	11.6
1950	3.08			5.2		5.5	7.0	5.5	9.4	5.5	11.3
2100	3.58					5.2	5.8	5.5	7.6	5.5	9.4
2250	4.10					4.5		5.2	6.1	5.5	7.6
2400	4.67					3.6		4.9		5.2	6.4
2550	5.27							4.2		5.2	
2700	5.91							3.3		4.2	
2850	6.59									3.6	
3000	7.30									3.0	

Minimum finished height of cover to be Dia./8 or 300 mm, whichever is greater except pipe under entrances and median crossovers where a 230 mm minimum will be permitted for pipe up to 450 mm diameter in which case the tabulated minimum thickness for entrances with less than 300 mm cover shall be used.

*The cover shall extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of (20)Diameters on each side of the culvert, or to the intersection with a cut.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

SPECIFICATION REFERENCE
302 232

CORRUGATED ALUMINUM ALLOY PIPE
 HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

PC-1

CORRUGATED ALUMINUM ALLOY PIPE - 150 mm X 25 mm CORRUGATIONS

PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS									
		SHEET THICKNESS IN MILLIMETERS									
		1.53		1.90		2.67		3.43		4.17	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
900	0.66	6.7	8.8	7.3	10.9	7.9	15.5	9.1	18.3	10.0	20.1
1050	0.89	6.1	7.6	6.4	9.4	7.0	13.4	7.6	15.2	8.2	16.4
1200	1.17	5.8	6.7	6.1	8.2	6.4	11.6	6.7	13.7	7.0	14.3
1350	1.48	5.5	5.8	5.8	7.3	6.1	10.3	6.4	12.8	6.4	13.1
1500	1.82	5.2		5.5	6.7	5.8	9.4	5.8	11.9	6.1	12.5
1650	2.21	4.9		5.5	6.1	5.5	8.5	5.8	10.9	5.8	11.9
1800	2.63			5.5		5.5	7.6	5.8	10.0	5.8	11.6
1950	3.08			4.9		5.5	7.0	5.5	9.1	5.5	11.3
2100	3.58					5.2	5.5	5.5	7.3	5.5	8.8
2250	4.10					4.5		5.2	5.8	5.5	7.3
2400	4.67							4.9		5.2	5.8
2550	5.27							3.9		4.9	
2700	5.91									4.2	
2850	6.59									3.3	

Notes:

Cover heights indicated in tables are for finished construction.

To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Diameter	Min. Cover Height * During Construction
750 mm and over	Equal to Diameter

Minimum finished height of cover to be 1/8 Dia. or 0.3 meter, whichever is greater.

*The cover shall extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of (20) Diameters on each side of the culvert, or to the intersection with a cut.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

CORRUGATED ALUMINUM ALLOY PIPE
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

SPECIFICATION REFERENCE
302 232

107.08 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

MINIMUM SHEET THICKNESS AND DESIGN DATA								
PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM COVER HEIGHT (METERS)		
NOMINAL SIZE SPAN - RISE (mm)	EQUIVALENT PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM "B" (mm)	Rc (mm)		MAXIMUM CORNER PRESSURE		
						190 kPa	* 290 kPa	
68 mm X 12 mm CORRUGATIONS								
430 X 330	375	0.10	105	90	1.63	3.3	5.2	
530 X 380	450	0.15	125	105	1.63	2.7	4.2	
610 X 460	525	0.20	145	125	1.63	2.4	3.6	
710 X 510	600	0.26	165	140	1.63	2.1	3.0	
885 X 610	750	0.41	205	175	1.63	1.5	2.4	
1060 X 740 †	900	0.59	250	210	1.63	1.5	2.4	
1240 X 840 †	1050	0.81	290	245	2.01	1.5	2.4	
1440 X 970 †	1200	1.06	330	280	2.77	1.5	2.4	
1620 X 1100 †	1350	1.33	370	315	2.77	1.8	2.7	
1800 X 1200 †	1500	1.64	415	350	3.51	1.8	2.7	
1950 X 1320 †	1650	1.98	455	385	4.27	1.8	3.0	
2100 X 1450 †	1800	2.35	495	420	4.27	2.1	3.0	
75 mm X 25 mm AND 125 mm X 25 mm CORRUGATIONS								
1010 X 790 †	900	0.59	330	300	2.77	2.4	3.6	
1160 X 920 †	1050	0.81	395	360	2.77	2.4	3.6	
1340 X 1050 †	1200	1.06	385	360	2.77	2.4	3.9	
1520 X 1170 †	1350	1.33	520	475	2.77	2.4	3.9	
1670 X 1300 †	1500	1.64	580	525	2.77	2.7	3.9	
1850 X 1400 †	1650	2.04	640	580	2.77	3.3	4.9	
2050 X 1500 †	1800	2.42	605	530	2.77	3.3	5.2	
2200 X 1620	1950	2.88	655	575	2.77	3.0	4.9	
2400 X 1720	2100	3.25	705	620	2.77	3.3	4.9	
2600 X 1820	2250	3.72	755	665	2.77	3.0	4.5	
2840 X 1920	2400	4.27	805	705	2.77	3.0	4.9	
2970 X 2020	2550	4.83	855	750	2.77	3.0	4.5	
3240 X 2120	2700	5.39	905	795	3.50	2.8	4.3	
3470 X 2200	2850	5.95	955	840	3.50	2.4	3.9	
3600 X 2320	3000	6.60	1005	885	4.27	2.4	3.6	

Notes:

Cover heights indicated in tables are for finished construction.
 To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Arch Span	** Min. Cover Height During Construction
425 mm to 875 mm	450 mm
1050 mm and above	$\frac{\text{Span}}{2}$

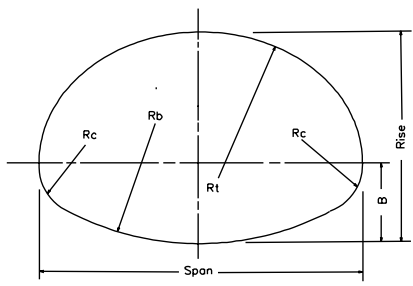
† Minimum finished height of cover to be $\frac{1}{8}$ Span or 0.3 meter, whichever is greater.

** The cover shall extend the full length of the pipe arch. The approach fill ramp is to extend a minimum of (10)(Height + $\frac{1}{2}$ Span) on each side of the structure, or the intersection with a cut.

* When design height of cover falls within this category, foundation and backfill must be approved by the engineer.

† Indicates pipe arches for which dimensions for either corrugation may be used within fill height limitations.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.



SPECIFICATION REFERENCE
232 302

CORRUGATED STEEL PIPE ARCH
 HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD
 VIRGINIA DEPARTMENT OF TRANSPORTATION

PC-1

MINIMUM SHEET THICKNESS AND DESIGN DATA

PIPE ARCH DIMENSION				MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM COVER HEIGHT METERS	
NOMINAL SIZE	EQUIVALENT PIPE DIAMETER (mm)	AREA (m ²)	Rc (mm)		MAXIMUM CORNER PRESSURE	
SPAN - RISE (mm)					190 kPa	* 290 kPa
68 mm X 12 mm CORRUGATIONS						
430 X 330	375	0.10	75	1.52	3.3	5.2
530 X 380	450	0.15	75	1.52	2.7	4.2
610 X 460	525	0.20	75	1.52	2.4	3.6
710 X 510	600	0.26	75	1.91	2.1	3.0
885 X 610	750	0.41	75	1.91	1.5	2.4
1060 X 740	900	0.59	90	2.67	1.5	2.4
1240 X 840	1050	0.81	100	2.67	1.5	2.4
1440 X 920	1200	1.06	130	3.43	1.5	2.4
1620 X 1100	1350	1.33	155	3.43	1.8	2.7
1800 X 1200	1500	1.64	180	4.17	1.8	2.7
75 mm X 25 mm CORRUGATIONS						
1010 X 790	900	0.59	125	1.52	2.4	3.6
1160 X 920	1050	0.81	150	1.52	2.4	3.6
1340 X 1050	1200	1.06	175	1.52	2.4	3.9
1520 X 1170	1350	1.33	200	1.91	2.4	3.9
1670 X 1300	1500	1.64	300	1.91	2.7	3.9
1850 X 1400	1650	2.04	350	2.67	3.3	4.9
2050 X 1500	1800	2.42	350	2.67	3.3	5.2
2200 X 1620	1950	2.88	400	3.43	3.0	4.9
2400 X 1720	2100	3.25	450	3.43	3.3	4.9
2600 X 1820	2250	3.72	450	4.17	3.0	4.5
2840 X 1920	2400	4.27	450	4.17	3.0	3.9
2970 X 2020	2550	4.83	450	4.17	3.0	3.3

Notes:

Cover heights indicated in tables are for finished construction.
 To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Arch Span	** Min. Cover Height During Construction
425 mm to 875 mm	450 mm
1050 mm and above	$\frac{\text{Span}}{2}$

Minimum finished height of cover to be $\frac{1}{8}$ Span or 0.3 meter, whichever is greater.

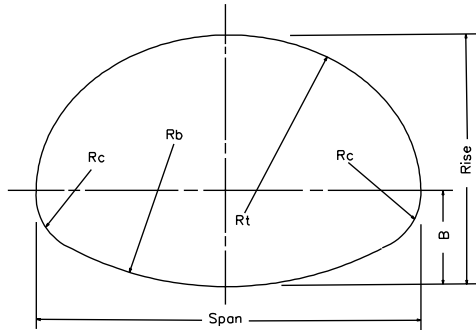
** The cover shall extend the full length of the pipe arch. The approach fill ramp is to extend a minimum of (10)(Height $\cdot \frac{1}{2}$ Span) on each side of the structure, or the intersection with a cut.

Lapped longitudinal seams shall be staggered so as to alternate on each side of the center of arch top by approximately 15 percent of the periphery.

A tolerance of plus, or minus, 25 mm is permissible for dimensions of span, rise, and corner radius.

* When design height of cover falls within this category, foundation and backfill must be approved by the engineer.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.



CORRUGATED ALUMINUM ALLOY PIPE ARCH
 HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

232
302

107.10 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

STRUCTURAL PLATE STEEL PIPE - 150 mm X 50 mm CORRUGATIONS

PC-1

PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS													
		SHEET THICKNESS IN MILLIMETERS													
		2.77		3.50		4.27		4.76		5.54		6.33		7.11	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
1500	1.82	13.0	14.3	15.2	20.7	17.7	27.4	19.2	31.4	21.6	37.8	24.1	44.5	26.8	48.8
1650	2.21	11.0	13.1	12.8	18.9	14.6	24.7	15.5	28.3	17.7	34.4	19.5	39.0	21.3	43.0
1800	2.63	9.7	11.9	11.0	17.4	12.2	22.8	13.1	26.2	14.6	29.6	16.1	32.3	17.7	35.3
1950	3.08	8.5	11.0	9.7	15.8	10.7	21.0	11.6	23.1	12.5	25.3	13.7	27.7	14.9	30.2
2100	3.58	7.9	10.3	8.8	14.9	9.7	19.5	10.0	20.4	11.0	22.2	11.9	24.1	13.1	26.2
2250	4.10	7.3	9.4	8.2	13.7	8.8	17.7	9.1	18.6	10.0	20.1	10.7	21.6	11.6	23.1
2400	4.67	7.0	8.8	7.6	13.1	8.2	16.4	8.5	17.1	9.1	18.3	9.7	19.5	10.3	20.7
2550	5.27	6.7	8.5	7.0	12.2	7.6	15.2	7.9	16.1	8.5	17.0	8.8	18.0	9.4	19.2
2700	5.91	6.4	7.9	6.7	11.6	7.3	14.6	7.6	15.2	7.9	15.8	8.2	16.7	8.8	17.7
2850	6.59	6.1	7.6	6.4	11.0	7.0	14.0	7.0	14.3	7.6	15.2	7.9	15.8	8.2	16.4
3000	7.30	6.1	7.0	6.4	10.3	6.7	13.4	6.7	13.7	7.0	14.3	7.3	14.9	7.6	15.5
3300	8.83	5.8	6.4	6.1	9.4	6.1	12.2	6.4	12.8	6.7	13.4	6.7	13.7	7.0	14.3
3600	10.51	5.5	5.8	5.8	8.5	6.1	11.3	6.1	12.2	6.4	12.8	6.4	13.1	6.7	13.4
3900	12.33	5.5		5.5	7.9	5.8	10.3	5.8	11.9	6.1	12.2	6.1	12.5	6.4	12.8
4200	14.30	5.2		5.5	7.3	5.5	9.7	5.8	11.0	5.8	11.9	5.8	11.9	6.1	12.2
4500	16.42	4.6		5.5	6.7	5.5	9.1	5.5	10.3	5.8	11.6	5.8	11.6	5.8	11.9
4800	18.68			5.5	6.4	5.5	8.5	5.5	9.7	5.5	11.3	5.8	11.3	5.8	11.6
5100	21.09			5.2	5.8	5.5	7.3	5.5	8.2	5.5	9.7	5.5	11.3	5.5	11.3
5400	23.65					5.2	6.1	5.5	7.0	5.5	8.2	5.5	9.4	5.5	10.7
5700	26.34					5.2		5.2	5.8	5.5	7.0	5.5	7.9	5.5	9.1
6000	29.20							4.9		5.2	5.8	5.5	6.7	5.5	7.6

Notes:

Cover heights indicated in the table are for finished construction.

To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation is to be Dia./2. This cover shall extend the full length of the pipe.

Structural Plate Pipe dimensions are to inside crest and are subject to manufacturing tolerances.

The approach fill ramp is to extend a minimum of 10(Dia.+900 mm) on each side of the culvert, or to the intersection with a cut.

Minimum finished height of cover to be Dia./8 or 300 mm whichever is greater.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa.

All other design criteria are in accordance with AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

Sheet 8 of 17

SPECIFICATION REFERENCE

232
302

STRUCTURAL PLATE STEEL PIPE
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

107.11

PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS													
		SHEET THICKNESS IN MILLIMETERS													
		2.54		3.18		3.81		4.44		5.08		5.72		6.35	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
1500	1.82	8.8	9.4	9.7	13.7	10.6	18.2	11.5	21.3	12.5	24.6	13.7	27.1	14.6	29.2
1650	2.21	7.9	8.5	8.5	12.5	9.4	16.4	10.0	19.5	10.6	21.6	11.6	23.1	12.1	24.3
1800	2.63	7.3	7.6	7.6	11.2	8.2	15.2	8.8	17.9	9.4	18.9	10.0	20.1	10.6	21.3
1950	3.08	6.7	7.0	7.3	10.3	7.6	14.0	7.9	16.1	8.5	17.0	8.8	17.9	9.4	18.9
2100	3.58	6.4	6.7	6.7	9.7	7.0	12.8	7.6	14.9	7.9	15.8	8.2	16.4	8.5	17.0
2250	4.10	6.1		6.4	9.1	6.7	12.1	7.0	14.0	7.3	14.6	7.6	15.2	7.9	15.8
2400	4.67	5.8		6.1	8.5	6.4	11.2	6.7	13.4	7.0	14.0	7.0	14.3	7.3	14.9
2550	5.27	5.5		6.1	7.9	6.1	10.6	6.4	12.5	6.7	13.4	6.7	13.7	7.0	14.0
2700	5.91	5.2		5.8	7.6	6.1	10.0	6.1	11.8	6.4	12.8	6.4	13.1	6.7	13.4
2850	6.59	4.9		5.8	7.3	5.7	9.4	6.1	11.2	6.1	12.1	6.4	12.8	6.4	13.1
3000	7.30	4.6		5.5	6.7	5.7	9.1	5.7	10.6	6.1	12.2	6.1	12.5	6.1	12.5
3300	8.83	4.3		5.5	6.1	5.4	8.2	5.7	9.7	5.7	11.3	5.7	11.8	5.7	11.8
3600	10.51	3.6		5.5	5.7	5.4	7.6	5.4	8.8	5.4	10.0	5.7	11.5	5.7	11.5
3900	12.33			5.2		5.4	7.0	5.4	8.2	5.4	9.4	5.4	10.6	5.4	11.2
4200	14.30					5.1	5.7	5.4	6.7	5.4	7.9	5.4	8.8	5.4	9.7
4500	16.42							5.1	5.4	5.4	6.4	5.4	7.0	5.4	7.9
4800	18.68									5.1		5.1	5.7	5.1	6.4
5100	21.09									4.2		4.8		5.1	5.4
5400	23.64											3.9		4.5	
5700	26.34													3.9	

Notes:

To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation is to be Dia./2. This cover shall extend the full length of the pipe

The approach fill ramp is to extend a minimum of 10(Dia. + 900 mm) on each side of the structure, or to the intersection with a cut.

Steelbolts only to be used.

Bolts are 20 mm diameter, high strength to meet current A.S.T.M. designation A-325M and galvanized to meet current A.S.T.M. designation A-153M. Bolts are to be located in the valley and crest of each corrugation in double rows spaced 45 mm apart.

Cover heights indicated in table are for finished construction.

Minimum finished height of cover to be Dia./8 or 300 mm whichever is greater.

[For details of elongated pipe see sheet 17 of 17.](#)

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

REVISED ON 8/97

MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES 150 mm X 50 mm CORRUGATIONS								PC-1
PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM ALLOWABLE COVER HEIGHT (m)		
NOMINAL SIZE		AREA (m ²)	MAXIMUM "B" (mm)	Rc (mm)		MAXIMUM CORNER PRESSURE		
SPAN m	RISE m					190 MPa	* 290 MPa	
1.85	1.40	2.04	533	458	2.77	4.8	7.3	
1.95	1.45	2.23	521	458	2.77	4.5	7.0	
2.05	1.50	2.42	559	458	2.77	4.2	6.7	
2.15	1.55	2.60	544	458	2.77	4.2	6.4	
2.20	1.60	2.88	528	458	2.77	3.9	6.1	
2.35	1.65	3.07	569	458	2.77	3.6	5.7	
2.40	1.70	3.25	551	458	2.77	3.6	5.4	
2.50	1.75	3.53	531	458	2.77	3.6	5.4	
2.60	1.80	3.72	577	458	2.77	3.3	5.1	
2.70	1.85	3.99	554	458	2.77	3.3	4.8	
2.85	1.90	4.27	605	458	2.77	3.0	4.8	
2.90	1.95	4.55	582	458	2.77	3.0	4.5	
2.95	2.00	4.83	556	458	2.77	3.0	4.5	
3.10	2.05	5.11	607	458	2.77	2.7	4.2	
3.25	2.10	5.39	663	458	2.77	2.7	4.2	
3.30	2.15	5.67	638	458	2.77	2.7	3.9	
3.45	2.20	5.95	696	458	2.77	2.4	3.9	
3.50	2.25	6.22	668	458	2.77	2.4	3.6	
3.60	2.30	6.60	640	458	2.77	2.4	3.6	
3.75	2.35	6.87	699	458	2.77	2.4	3.6	
3.80	2.40	7.25	671	458	2.77	2.4	3.6	
3.85	2.45	7.52	640	458	2.77	2.1	3.3	
3.90	2.50	7.90	610	458	2.77	2.1	3.3	
4.10	2.55	8.27	668	458	2.77	2.1	3.3	
4.25	2.60	8.64	734	458	2.77	2.1	3.0	
4.30	2.65	9.01	701	458	2.77	2.1	3.0	
4.35	2.70	9.38	668	458	2.77	1.8	3.0	
4.50	2.75	9.75	734	458	2.77	1.8	3.0	
4.65	2.80	10.13	803	458	2.77	1.8	2.7	
4.70	2.85	10.50	767	458	2.77	1.8	2.7	
4.75	2.90	10.96	732	458	2.77	1.8	2.7	
4.80	3.00	11.33	696	458	2.77	1.8	2.7	
5.00	3.00	11.71	765	458	2.77	1.8	2.7	
5.05	3.05	12.17	729	458	2.77	1.8	2.7	

NOTES

* When design height of cover falls within this category, foundation and backfill must be approved by the Engineer.

Cover heights indicated in table are for finished construction.

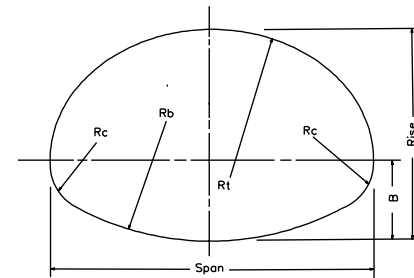
The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

Structural Plate Pipe-Arch dimensions are to inside of crest and are subject to manufacturing tolerances.

Minimum finished height of cover shall be $\frac{1}{8}$ Span or 300 mm, whichever is greater.

To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation shall be $\frac{\text{Span}}{2}$.

This cover shall extend the full length of the pipe arch. The approach fill ramp is to extend a minimum of $(10)(\text{Height} + \frac{\text{Span}}{2})$ on each side of the structure, or to the intersection with a cut.



Sheet 10 of 17

SPECIFICATION REFERENCE
232
302

STRUCTURAL PLATE STEEL PIPE ARCH
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

107.13

REVISED ON 8/97

PC-1 MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES 150 mm X 50 mm CORRUGATIONS							
PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM ALLOWABLE COVER HEIGHT (m)	
SPAN m	RISE m	AREA (m ²)	MAXIMUM "B" (mm)	Rc (mm)		MAXIMUM CORNER PRESSURE	
						190 MPa	290 MPa ☆
4.05	2.85	9.01	978	788	2.80	3.6	5.4 *
4.10	2.90	9.48	958	788	2.80	3.6	5.1 *
4.25	2.95	9.75	1006	788	2.80	3.6	5.1 *
4.30	3.00	10.13	986	788	2.80	3.6	4.8 *
4.40	3.05	10.59	963	788	2.80	3.3	4.8 *
4.55	3.10	10.96	1011	788	2.80	3.3	4.8 *
4.65	3.15	11.43	1062	788	2.80	3.3	4.5 *
4.75	3.20	11.80	1039	788	2.80	3.3	4.5 *
4.80	3.25	12.26	1016	788	2.80	3.0	4.2 *
4.95	3.30	12.73	1069	788	2.80	3.0	4.2 *
5.00	3.35	13.19	1044	788	2.80	3.0	4.2 *
5.20	3.40	13.56	1100	788	2.80	3.0	4.2 *
5.25	3.45	14.03	1074	788	2.80	3.0	3.9 *
5.30	3.50	14.59	1049	788	2.80	2.7	3.9 *
5.45	3.55	14.96	1105	788	2.80	2.7	3.9 *
5.50	3.60	15.51	1072	788	2.80	2.7	3.9 *
5.65	3.65	15.98	1135	788	2.80	2.7	3.6 *
5.70	3.70	16.44	1107	788	2.80	2.7	3.6 *
5.85	3.75	16.91	1166	788	3.50	2.4	3.9
5.95	3.80	17.47	1138	788	3.50	2.4	3.9
6.00	3.85	18.02	1110	788	3.50	2.4	3.9
6.05	3.90	18.58	1080	788	3.50	2.4	3.6
6.20	3.95	19.04	1040	788	3.50	2.4	3.6
6.25	4.00	19.60	1110	788	3.50	2.4	3.6

☆ When design height of cover falls within this category, foundation and backfill must be approved by the Engineer.

Cover heights indicated in table are for finished construction.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

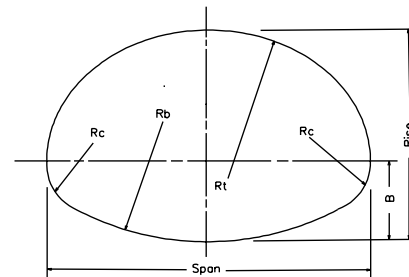
Structural Plate Pipe-Arch dimensions are to inside of crest and are subject to manufacturing tolerances.

Minimum finished height of cover shall be $\frac{\text{Span}}{8}$ or 0.3 meter, whichever is greater.

To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation shall be $\frac{\text{Span}}{2}$.

This cover shall extend the full length of the pipe arch. The approach fill ramp is to extend a minimum of $(10)(\frac{\text{Height} + \frac{\text{Span}}{2}}{2})$ side of the structure, or to the intersection with a cut.

* Maximum cover heights shown may be increased by a maximum of 0.3 meter if a sheet thickness greater than 2.80 mm is used.



Sheet 11 of 17

STRUCTURAL PLATE STEEL PIPE ARCH
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

SPECIFICATION REFERENCE

232
302

107.14

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURAL PLATE ALUMINUM ALLOY PIPE ARCHES 230 mm X 65 mm CORRUGATIONS											
SPAN m	RISE m	CORNER RADIUS (mm)	MAXIMUM COVER HEIGHT IN (m)								AREA (m ²)
			MINIMUM SHEET THICKNESS IN (mm)								
			MAXIMUM CORNER PRESSURE IN (MPa)								
			2.55 mm		3.20 mm		3.80 mm		4.45 mm		
			190		190	290 *	190	290 *	190	290 *	
1.90	1.50	808	7.6		8.5	10.9	8.5	12.8	8.5	12.8	2.29
2.00	1.50	808	7.0		7.9	10.3	7.9	12.1	7.9	12.1	2.47
2.00	1.70	808	7.0		7.9	10.3	7.9	12.1	7.9	12.1	2.75
2.10	1.75	808	6.7		7.6	9.7	7.6	11.5	7.6	11.5	2.96
2.20	1.80	808	6.4		7.3	9.4	7.3	10.9	7.3	10.9	3.19
2.35	1.80	808	6.1		6.7	8.8	6.7	10.3	6.7	10.3	3.42
2.45	1.85	808	5.8		6.4	8.5	6.4	9.7	6.4	9.7	3.65
2.55	1.90	808	5.5		6.1	8.2	6.1	9.4	6.1	9.4	3.89
2.70	1.90	808	5.1		6.1	7.6	6.1	9.1	6.1	9.1	4.13
2.80	1.95	808	4.8		5.7	7.3	5.7	8.5	5.7	8.5	4.19
2.90	2.00	808	4.8		5.4	7.0	5.4	8.2	5.4	8.2	4.64
3.00	2.00	808	4.5		5.1	6.7	5.1	7.9	5.1	7.9	4.90
3.10	2.05	808	4.5		5.1	6.7	5.1	7.6	5.1	7.6	5.16
3.30	2.10	808	4.2		4.8	6.4	4.8	7.3	4.8	7.3	5.43
3.40	2.15	808	4.2		4.5	6.1	4.5	7.0	4.5	7.0	5.70
3.50	2.15	808	3.9		4.5	5.7	4.5	7.0	4.5	7.0	5.98
3.60	2.20	808	3.9		4.5	5.7	4.5	6.7	4.5	6.7	6.27
3.70	2.20	808	3.6		4.2	5.4	4.2	6.4	4.2	6.4	6.55
3.80	2.25	808	3.6		4.2	5.4	4.2	6.4	4.2	6.4	6.85
3.95	2.30	808	3.6		3.9	5.1	3.9	6.1	3.9	6.1	7.15
4.00	2.50	808	3.3		3.9	5.1	3.9	6.1	3.9	6.1	7.71
4.00	2.55	808	3.3		3.9	5.1	3.9	6.1	3.9	6.1	8.06
4.25	2.55	808	3.3		3.6	4.8	3.6	5.7	3.6	5.7	8.39
4.25	2.60	808	3.3		3.6	4.8	3.6	5.4	3.6	5.4	8.75
4.25	2.85	808	3.3		3.6	4.8	3.6	5.7	3.6	5.7	9.43
4.35	2.90	808	3.0		3.6	4.5	3.6	5.4	3.6	5.4	9.82
4.45	2.95	808			3.6	4.2	3.6	5.1	3.6	5.4	10.21
4.55	3.00	808			3.3	3.9	3.3	4.8	3.3	5.1	10.61
4.65	3.05	808			3.3	3.6	3.3	4.2	3.3	5.1	11.02
4.75	3.10	808			3.3	3.3	3.3	4.2	3.3	4.8	11.44
4.90	3.15	808			3.0		3.0	3.6	3.0	4.5	11.85
5.00	3.20	808					3.0	3.6	3.0	4.2	12.29
5.10	3.25	808					3.0	3.3	3.0	3.9	12.72
5.20	3.30	808					3.0		3.0	3.6	13.17
5.25	3.35	808					3.0		3.0	3.6	
5.50	3.45	808						2.7	3.0		

PC-1

Notes:

Cover heights indicated in table are for finished construction.
 Structural Plate Pipe-Arch dimensions are to inside crest and are subject to manufacturing tolerances.

To protect pipe during construction, minimum height of cover prior to allowing construction traffic to cross installation to be 1/2 Span. This cover shall extend the full length of the pipe arch. The approach fill ramp is to extend a minimum of (10)(Height + 1/2 Span) on each side of the structure, or to the intersection with a cut.

Steel bolts only to be used.

Minimum finished height of cover to be 1/8 Span or 0.3 meter whichever is greater.

Bolts are M20 diameter, high strength to meet current AASHTO designation M-164M and galvanized to meet current A.S.T.M. designation A-194M. Bolts are to be located in the valley and crest of each corrugation in double rows spaced 44 mm apart.

★ When design height of cover falls within this category, foundation and backfill must be approved by the Engineer.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

SPECIFICATION REFERENCE
232 302

STRUCTURAL PLATE ALUMINUM ALLOY PIPE ARCH
 HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

ALUMINUM SPIRAL RIB PIPE 19 mm WIDE x 19 mm DEEP RIBS SPACED @ 190 mm

PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS							
		SHEET THICKNESS IN MILLIMETERS							
		1.63		2.01		2.77		3.43	
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED
300	0.07	23.1	46.3	28.9		41.4			
375	0.11	14.3	28.6	17.4	34.7	23.8		30.5	
450	0.16	10.3	21.0	12.2	24.4	15.8	32.0	19.8	39.6
525	0.22	8.5	17.1	9.4	19.2	11.9	23.8	14.3	28.6
600	0.29	7.3	14.9	7.9	16.1	9.7	19.5	11.3	22.5
675	0.37	6.7	13.4	7.3	14.6	8.2	16.7	9.4	18.9
750	0.46	6.1	12.5	6.7	13.4	7.3	14.9	8.2	16.4
900	0.66	5.8	11.6	6.1	12.2	6.4	12.8	7.0	14.0
1050	0.89	5.5	11.0	5.5	11.3	5.8	11.9	6.1	12.5
1200	1.17			5.5	11.0	5.5	11.3	5.8	11.9
1350	1.48					5.5	11.0	5.5	11.3
1500	1.82					5.5	11.0	5.5	11.0
1650	2.21							5.5	11.0
1800	2.63							5.2	

MINIMUM SHEET THICKNESS FOR ENTRANCES WITH LESS THAN 0.3 METER COVER

Notes:

Cover heights indicated in tables are for finished construction.

To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Diameter	Min. Cover Height • During Construction
300 mm to 600 mm	450 mm
750 mm and over	Equal to Diameter

Minimum finished height of cover to be $\frac{Dia.}{4}$ or 300 mm, whichever is

greater, except pipe under entrances and median crossovers where a 230 mm minimum will be permitted for pipe up to 450 mm diameter in which case the tabulated minimum sheet thickness for entrances with less than 300 mm cover shall be used.

*The cover shall extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of (20)Diam. on each side of the culvert, or to the intersection with a cut.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

ALUMINUM SPIRAL RIB PIPE
HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD

SPECIFICATION REFERENCE

232
302

STEEL SPIRAL RIB PIPE 19 mm WIDE X 19 mm DEEP RIBS SPACED @ 190 mm

PIPE DIAMETER (mm)	AREA (m ²)	MAXIMUM HEIGHT OF COVER LIMITS IN METERS						MINIMUM SHEET THICKNESS FOR ENTRANCES WITH LESS THAN 0.3 METER COVER
		SHEET THICKNESS IN MILLIMETERS						
		1.63		2.01		2.77		
		CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	CIRCULAR	ELONGATED	
300	0.07	48.4						1.63
375	0.11	35.0						1.63
450	0.16	22.5		28.0		39.6		1.63
525	0.22	16.1	32.3	19.5	39.3	26.8		2.01
600	0.29	12.5	25.0	14.6	29.6	19.8	39.6	2.77
675	0.37	10.3	20.7	11.9	23.8	15.2	30.8	
750	0.46	8.8	17.7	10.0	20.1	12.5	25.3	
900	0.66	7.3	14.6	7.9	15.8	9.4	18.9	
1050	0.89	6.4	13.1	7.0	14.0	7.9	15.8	
1200	1.17	6.1	12.2	6.4	12.8	7.0	14.0	
1350	1.48	5.8	11.6	5.8	11.9	6.4	12.8	
1500	1.82	5.5	11.3	5.8	11.6	6.1	12.2	
1650	2.21			5.5	11.3	5.8	11.6	
1800	2.63			5.5	11.0	5.5	11.3	
1950	3.08					5.5	11.0	
2100	3.57					5.5	11.0	

Notes:

Cover heights indicated in tables are for finished construction.

To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Diameter	Min. Cover Height * During Construction
300 mm to 750 mm	450 mm
900 mm and above	$\frac{\text{Dia.}}{2}$

Minimum finished height of cover to be $\frac{\text{Dia.}}{4}$ or 300 mm, whichever is greater except pipe under entrances and median crossovers where a 230 mm minimum will be permitted for pipe up to 600 mm diameter in which case the tabulated minimum sheet thickness for entrances with less than 300 mm cover shall be used.

*The cover shall extend the full length of the pipe. The approach fill is to extend a minimum of (15)Diameter on each side of the structure, or to the intersection with a cut.

Allowable cover heights, as indicated in the table to the left, in excess of 30 meters are to be considered as special design installations and will require detailed foundation determination.

For details of elongated pipe see sheet 17 of 17.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

Note:

A Maximum Height of Cover Table for Steel Spiral Rib Pipe with 19 mm wide X 25 mm deep ribs spaced at 292 mm is available upon request.

SPECIFICATION REFERENCE	<p>STEEL SPIRAL RIB PIPE HEIGHT OF COVER TABLE FOR H-18 LIVE LOAD</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS</p>	<p>107.17</p>
232 302			

CAST IRON PIPE CULVERT DESIGNATION⁽⁵⁾

Diameter (mm)	Area (m ²)	MAXIMUM HEIGHT OF COVER IN METERS				
		0.30 - 3.9	4.0 - 6.4	6.5 - 10.6	10.2 - 18.2	18.3 - 25.9
300	0.07	Standard Pipe Method "A" Bedding	Heavy Pipe Method "A" Bedding	Extra Heavy Pipe Method "A" Bedding	Extra Heavy Pipe Method "B1" Bedding	Extra Heavy Pipe Method "B2" Bedding
375	0.11					
410	0.13					
450	0.17					
600	0.29					
750	0.46					
900	0.66					
1050	0.89					
1200	1.17					

Notes:

- (1) Pipe may be smooth cast iron, corrugated cast iron, or ribbed cast iron.
- (2) Pipe to be smooth cast iron only.
- (3) Pipe to be corrugated cast iron or ribbed cast iron.
- (4) May be substituted for 375 mm pipe culvert at no increase in price bid for 375 mm pipe, where approved by the Engineer.
- (5) Crushing strength (kN/m)

Standard pipe	29.2 kN/m
Heavy pipe	43.8 kN/m
Extra heavy pipe	58.4 kN/m

Maximum height of cover shown in table is for finished construction. To protect pipe during construction, minimum height of cover prior to allowing construction traffic to cross installation is to be 600 mm. This cover is to extend the full length of the pipe culvert. The approach fillramp is to extend a minimum of 10 (Diameter + 900 mm) on each side of the culvert, or to the intersection with a cut. Minimum finished height of cover to be 600 mm, except pipe under entrances and median crossovers where a 230 mm minimum will be permitted.

CAST IRON PIPE
STRENGTH TABLE FOR H-18 LIVE LOAD

SPECIFICATION
REFERENCE

232
302

EXTRA STRENGTH CLAY PIPE		
Diameter (mm)	Area (m ²)	Allowable Maximum Cover (m)
300	0.07	4.57
375	0.11	4.57
450	0.17	4.57
525	0.22	4.57
600	0.29	4.57
750	0.46	3.96
900	0.66	3.96

Notes:

All Vitrified Clay Pipe is to be Extra Strength.

Maximum heights of cover shown in table are for finished construction.

To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation is to be 900 mm. This cover is to extend the full length of the pipe culvert. The approach fill ramp is to extend a minimum of 10 (Dia. • 900 mm) on each side of the culvert, or to the intersection with a cut.

Minimum finished height of cover to be 600 mm, except pipe under entrances and median crossovers where a 230 mm minimum will be permitted.

Method "A" bedding is to be used for all installations unless otherwise designated on plans.

VITRIFIED CLAY

POLYETHYLENE DOUBLE WALL CORRUGATED PIPE CULVERT		
Diameter (mm)	Area (m ²)	Allowable Maximum Cover (m)
300	0.07	6.3
375	0.11	6.3
450	0.17	6.0
600	0.22	6.0
750	0.45	5.7
900	0.65	5.4

Note: For details of bedding for Polyethylene Pipe Culvert see Standard PB-1.

POLYVINYLCHLORIDE RIBBED PIPE CULVERT		
Diameter (mm)	Area (m ²)	Allowable Maximum Cover (m)
450	0.16	6.0
525	0.21	5.7
600	0.28	5.7
750	0.44	5.4
900	0.64	5.4
1200	1.14	5.4

Notes:

Cover heights indicated in tables are for finished construction.

To protect pipe during construction, minimum height of cover to be as follows prior to allowing construction traffic to cross installation.

Pipe Diameter	** Minimum cover Height During Construction
300 to 750	450 mm
900 and above	$\frac{\text{Diameter}}{2}$

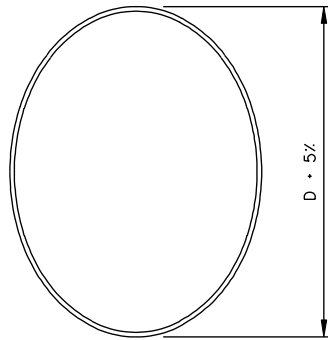
Minimum finished height of cover to be $\frac{1}{8}$ Diameter or 300 mm whichever is greater, except pipe under entrances and median crossovers where a 230 mm minimum will be permitted for pipe up to 600 mm diameter.

** The cover shall extend the full length of the pipe. The approach fill is to extend a minimum of (15)(Diameter • $\frac{1}{2}$ Diameter) on each side of the structure, or to the intersection with a cut.

The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Thermoplastic Pipe Interaction Systems.

PLASTIC PIPE

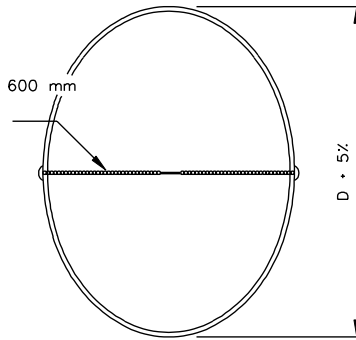
SPECIFICATION REFERENCE	VITRIFIED CLAY AND PLASTIC PIPE	
232 302	MAXIMUM COVER TABLE FOR H-18 LIVE LOAD	
	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS 107.19



ELLIPTICAL FACTORY SHAPE
(SHOP ELONGATED)

TYPE 1

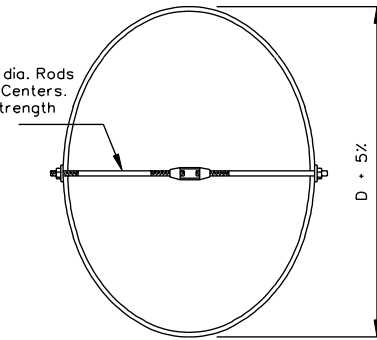
Double Line of Min.
4.2 mm dia. Wire on 600 mm
Centers Min. Tensile
Strength 551.2 kPa



ELONGATED WITH WIRE

TYPE 2

Min. 5.7 mm dia. Rods
on 600 mm Centers.
Min. Tensile Strength
551.2 kPa



ELLIPTICAL WITH ROD
AND TURNBUCKLE

TYPE 3

Note:

Wire or rod to be removed when fill reaches height specified for allowing construction traffic.

D = Diameter of round pipe

Methods shown apply to corrugated steel or corrugated aluminum alloy pipe.

Pipe size and cover height combinations requiring elongation are to be as tabulated on the applicable PC-1 tables or as shown on plans.

Any of above types of elongation may be used, unless otherwise noted on plans, special provisions, or directed by the Engineer.

Field elongation will not be permitted without the approval of the Engineer, or unless indicated on plans.

Elongation is to be performed prior to any required bituminous coating and paving of the invert.

Wire and rods to be attached to side of pipe in accordance with manufacturer's standard methods, meeting the approval of the Engineer.

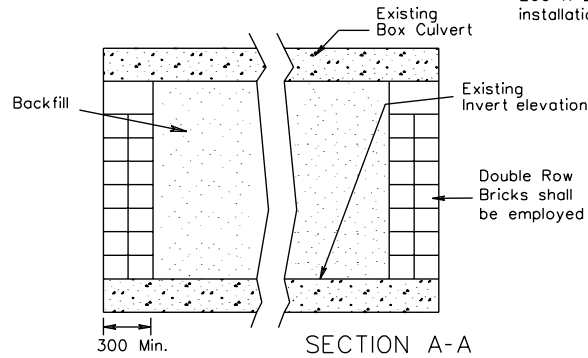
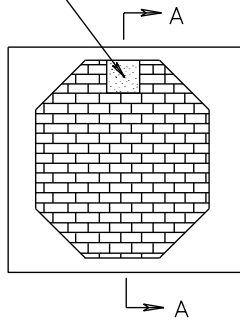
SHOP ELONGATION OF CORRUGATED
METAL PIPE AND STRUCTURAL PLATE PIPE

SPECIFICATION
REFERENCE

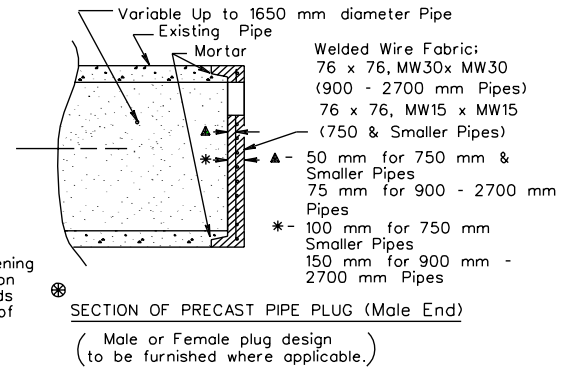
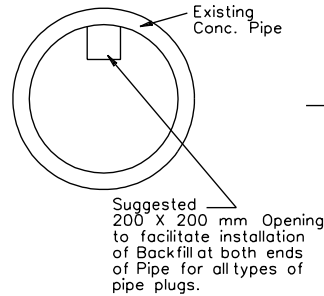
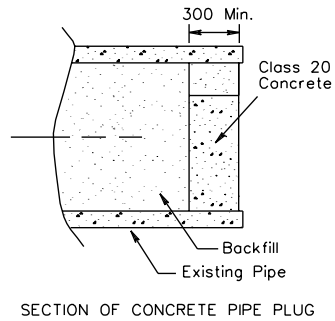
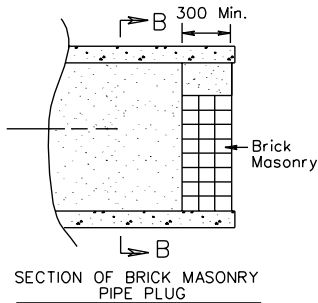
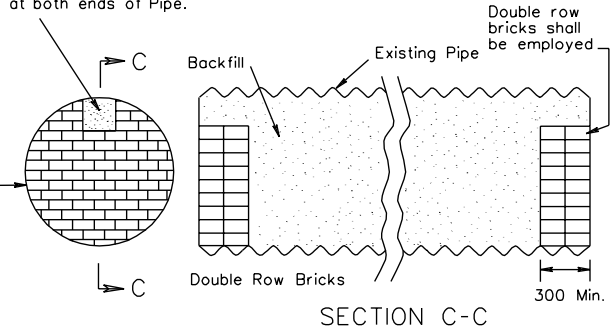
REVISED ON 8/97

PP-1

200 X 200 mm Opening for Backfill installation at both ends of Box Culvert.



200 X 200 mm Opening for Backfill installation at both ends of Pipe.



Pipe Size	QUANTITIES	
	m^3 Backfill per meter	m^3 Conc. Plug
300	0.022	.010
375	0.034	.022
450	0.050	.038
600	0.089	.077
750	0.139	.127
900	0.200	.188
1050	0.272	.260
1200	0.356	.344
1350	0.451	.439
1500	0.556	.544
1650	0.673	.661
1800	0.801	.789
2050	0.940	.928
2100	1.090	1.078
2250	1.252	1.240
2400	1.424	1.412
2550	1.608	1.596
2700	1.802	1.790

NOTES:

Backfills to be either Flowable Backfill or Fine Aggregate as per the Specifications.

For placement of structures, see roadway plan sheets.

Concrete brick may be used in lieu of clay brick. Jumbo brick will be permitted.

⊗ Precast notes :

Concrete to be 30 MPa Minimum Compressive strength.

Concrete and Reinforcing Steel shall be in accordance with AASHTO M170.

Detail shown for Precast Plug is representative only, other manufacturer's design will be acceptable upon approval by the Engineer.

SPECIFICATION REFERENCE

DETAILS FOR BACKFILLING ABANDONED CULVERTS

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

107.21