



# COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION  
1401 EAST BROAD STREET  
RICHMOND, VIRGINIA 23219-2000

GREGORY A. WHIRLEY  
ACTING COMMISSIONER

July 29, 2005

## MEMORANDUM

To: All Holders of the Virginia Department of Transportation's 2001 Road and Bridge Standards

The following is a list of standards contained in the 2001 Road and Bridge Standards that have been revised. Please add these pages to your copy of the standards. An insertable sheet will not be required in plan assemblies for the following eight (8) sheets only. Changes to these sheets will not affect the basis of payment or estimates.

PAGE	STANDARD	REVISION
103.02	N/A	Revised note concerning safety slabs.
103.07	T-DI-5	Added note stating DI-5 is not to be placed in areas subject to traffic.
103.08	T-DI-7	Revised note differentiating between grate A and grate B.
104.21	DI-5	Added note stating DI-5 is not to be placed in areas subject to traffic.
104.23	DI-7	Revised note differentiating between grate A and grate B.
602.02	PE-1	Corrected dimension line and reorganized notes.
802.21	TC-5	Updated superelevation table for urban low speed.
802.24	TC-5	Updated superelevation table for urban low speed.

The following is a list of revised standards to the 2001 Road and Bridge Standards that do require an insertable sheet to be included in your plan assembly until the next edition of the imperial standards is published. Please add these pages to your copy of the standards. The respective insertable sheet number has been placed with the revised standard. An insertable sheet is available for each of these revised standards. The insertable sheets are available on VDOT's web site on the FTP server and in Falcon DMS for VDOT personnel. These insertable sheets will be required in plan assemblies for projects utilizing the standard items listed below that have not been to advertisement prior to February 1, 2006.

<b>PAGE</b>	<b>INSERT</b>	<b>STANDARD</b>	<b>REVISION</b>
104.03	a153	DI-2A, 2B, 2C	Revised angle of galvanized plate.
104.06	a153	DI-2D, 2E, 2F	Revised angle of galvanized plate.
104.31	a163	DI-12, 12A	Replaced curved grate with a flat grate.
104.33	a164	DI-12B, 12C	Replaced curved grate with a flat grate.
104.34	a164	DI-12B, 12C	Replaced curved grate with a flat grate.
104.36	a165	DI-13	Added note to require face of guardrail to be flush with face of curb.
106.14	a62	SL-1	Revised notes to remove language that no additional compensation will be provided for additional safety slabs needed for precast structures.
107.01	a86	PB-1	Added note referencing general notes.
107.02	a86	PB-1	Added note referencing general notes sheet.
107.03	a120	PB-1	Added note referencing general notes sheet.
107.05	a166_1	PC-1	Update tables to match drainage manual.
107.06	a166_1	PC-1	Update tables to match drainage manual.
107.07	a166_2	PC-1	Update tables to match drainage manual.

<b>PAGE</b>	<b>INSERT</b>	<b>STANDARD</b>	<b>REVISION</b>
107.08	a166_2	PC-1	Update tables to match drainage manual.
107.09	a166_3	PC-1	Update tables to match drainage manual.
107.10	a166_3	PC-1	Update tables to match drainage manual.
107.11	a166_4	PC-1	Update tables to match drainage manual.
107.12	a166_4	PC-1	Update tables to match drainage manual.
107.13	a166_5	PC-1	Update tables to match drainage manual.
107.14	a166_5	PC-1	Update tables to match drainage manual.
107.15	a166_6	PC-1	Update tables to match drainage manual.
107.16	a166_6	PC-1	Update tables to match drainage manual.
107.17	a166_7	PC-1	Update tables to match drainage manual.
107.18	a166_7	PC-1	Update tables to match drainage manual.
107.19	a166_8	PC-1	Update tables to match drainage manual.
107.20	a166_8	PC-1	Update tables to match drainage manual.
107.20A	a166_9	PC-1	Update tables to match drainage manual.
107.21	a166_9	PC-1	Update tables to match drainage manual.
114.03	a70	EC-3	Revised note on use of soil stabilization mat by changing “shall” to “may” and corrected dimension on terminal diagram.
203.05	a59	CG-12	Update detectable warning (truncated domes) to meet new ADA guidelines.
203.05A	a59	CG-12	Update detectable warning (truncated domes) to meet new ADA guidelines.

<b>PAGE</b>	<b>INSERT</b>	<b>STANDARD</b>	<b>REVISION</b>
203.06	a59	CG-12	Update detectable warning (truncated domes) to meet new ADA guidelines.
203.07	a59	CG-12	Update detectable warning (truncated domes) to meet new ADA guidelines.
501.04	a87	GR-2, 2A	Modified guardrail height tolerance.
501.21	a145	GR-11	Corrected detail names for anchor cable and anchor bolt.
501.38	a92	GR-INS	20' minimum radius changed to 5' minimum. Added note stating radial not to be used in place of GR-6, 7, or 9.
501.42	a95	MB-5	Removed structure mounted barrier.
501.44	a98	MB-7D, 7E, 7F	Move delineators to the top of barrier.
501.45	a103	MB-7D PC	Move delineators to the top of barrier.
501.46	a103	MB-7D PC	Move delineators to the top of barrier.
501.59	a105_2	MB-INS	Added note concerning dynamic deflection of barrier connections.
501.60	a105_1	MB-INS	Added note concerning dynamic deflection of barrier connections.
501.61	a105_1	MB-INS	Added note concerning dynamic deflection of barrier connections.
1301.11	a167	PF-1	Revised the anchor bolts.
1301.28	a169	SP-5, 6, 7, 8, 9	Deleted SP 1 – 4. All new pedestrian signals SP 5 - 9.
1301.63	a156	SSP-VA	Revised the sign panel fastening method.

<b>PAGE</b>	<b>INSERT</b>	<b>STANDARD</b>	<b>REVISION</b>
1301.67	a156	SSP-V1 A	Revised the sign panel fastening method.
1301.72	a154	OSS-1	Revised the anchor bolts.
1301.73	a154	OSS-1	Revised the conduit.
1301.76	a157	OSS-1	Revised the anchor bolts.
1301.78	a167	BSS-1	Revised the anchor bolts.
1301.79	a157	SPD-1	Revised the sign panel fastening methods.
1301.86	a168	PM-1	Revised the skip line spacing.
1301.91	a168	PM-6	Revised the pavement message marking.
1411.02	a162	SMH-1	Revised notes.

If you have any questions or comments regarding the listed revisions to this publication, please contact Mr. Steve Van Cleef of the Standards and Special Design Section at (804) 786-2543.

Sincerely,

Mohammad Mirshahi, P.E.  
State Location and Design Engineer

## LEGEND

## PAGE

A - FLAT SLAB TOP WITH FRAME AND GRATE (T-DI-1) _____	103.03
B - DROP INLET TOP UNIT (T-DI-2) _____	103.04
C - THROAT FACE BLOCK (T-DI-3,4) _____	103.05, 103.06
D - CURB DROP INLET THROAT SECTION (T-DI-3,4) _____	103.05, 103.06
E - SPACER UNIT (T-MH-2) _____	103.09
F - FLAT SLAB TOP WITH HOLE (T-MH-2) _____	103.09
G - DROP INLET TOP UNIT (T-DI-5) _____	103.07
I - DROP INLET TOP UNIT (T-DI-7) _____	103.08
J - FLAT SLAB TOP UNIT (T-MH-2) _____	103.09
K - MANHOLE FRAME AND COVER (T-MH-1) _____	106.02 THRU 106.06
L - SPACER UNIT (T-MH-2) _____	103.09
M - CONCENTRIC TAPER UNIT (T-MH-2) _____	103.09
N - ECCENTRIC TAPER UNIT (T-MH-2) _____	103.09
O - RISER UNIT (R-1) _____	103.10
P - FLAT SLAB REDUCER (R-2) _____	103.10
Q - TAPER REDUCER (R-3) _____	103.10
R - MONOLITHIC BASE UNIT - OVER 4' DIA. (B-1) _____	103.11
S - DOGHOUSE BASE UNIT - OVER 4' DIA. (B-2) _____	103.11
T - FOOTING (B-2) _____	103.11
U - TEE SECTION BASE UNIT (B-3) _____	103.12
V - MONOLITHIC BASE UNIT - OVER 4' DIA. (B-1) _____	103.11
W - DOGHOUSE BASE UNIT - OVER 4' DIA. (B-2) _____	103.11
X - FOOTING (B-2) _____	103.11
ALTERNATE JOINT DETAIL _____	103.03

## GENERAL NOTES - PRECAST

PRECAST STRUCTURES WILL CONFORM TO SECTION 105.04 OF THE SPECIFICATIONS. THE MANUFACTURER WILL HAVE THE OPTION OF SELECTING THE COMBINATION OF PRECAST UNITS TO COMPLETE A STRUCTURE UNLESS OTHERWISE NOTED ON THE PLANS.

THE "H" (LINEAR FEET FOR MANHOLES) DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE MASONARY STRUCTURE. PLAN "H" DIMENSIONS ARE APPROXIMATE ONLY FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS.

IN THE EVENT THE INVERT OF THE OUTFALL PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE. THIS WILL APPLY TO ALL STRUCTURES MEETING THIS CONDITION AND IS NOT TO BE CONFUSED WITH STANDARD IS-1 THE COST FOR INVERT SHAPING SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

WHEN SPECIFIED ON THE PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

ALL PRECAST STRUCTURES TO BE CONSTRUCTED WITH 4000 PSI MINIMUM CONCRETE.

STEPS IN ACCORDANCE WITH STANDARD ST-1 ARE TO BE PROVIDED IN ALL MANHOLES AND IN ALL DROP INLETS WITH AN "H" DIMENSION OF 4'-0" OR GREATER.

3" DIAMETER WEEP HOLES WILL BE REQUIRED IN PRECAST STRUCTURE LOCATED ADJACENT TO THE PAVEMENT TO DRAIN SUBBASE. PLACEMENT OF WEEP HOLES IN THE PRECAST UNIT WILL BE DETERMINED BY THE PROXIMITY OF THE STRUCTURE TO THE SUBBASE. WEEP HOLES MAY ALSO BE REQUIRED IN OTHER STRUCTURES WHEN CALLED FOR ON THE PLANS OR DIRECTED BY THE ENGINEER.

WEEP HOLES WILL HAVE 12" X 12" PLASTIC HARDWARE CLOTH, 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO OURSIDE OF STRUCTURE.

PRECAST UNITS LOCATED ADJACENT TO CAST-IN-PLACE CONCRETE ITEMS, SUCH AS FLUMES, DITCHES, GUTTERS, AND SIDEWALKS SHALL BE CONNECTED TO THE ADJACENT UNIT BY MEANS OF NO. 4 SMOOTH STEEL DOWELS SPACED ON APPROXIMATELY 12" CENTERS THROUGHOUT THE CONTACT LENGTH AND EXTENDING AT LEAST 4" INTO BOTH THE PRECAST UNIT TO RECEIVE THE DOWELS, THEY SHALL NOT EXCEED 5/8" DIAMETER.

THE STANDARD SAFETY SLAB (SL-1) IS TO BE USED WHEN SPECIFIED IN THE PLANS ON THE DRAINAGE SUMMARY SHEET AND/OR THE DRAINAGE DESCRIPTION. REFER TO STANDARD SL-1 FOR SAFETY SLAB INFORMATION.

3/4" CHAMFER MAY BE PROVIDED ON ALL EDGES AT MANUFACTURER'S OPTION.

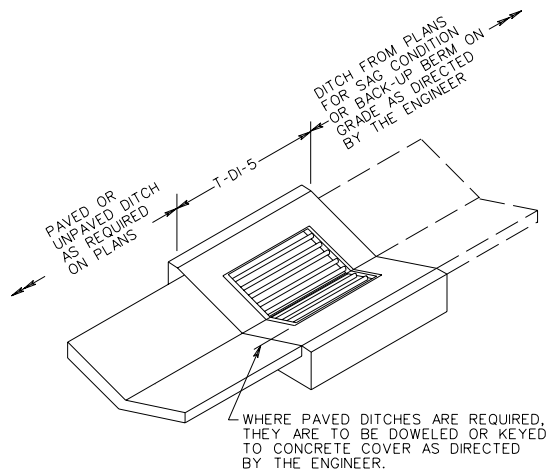
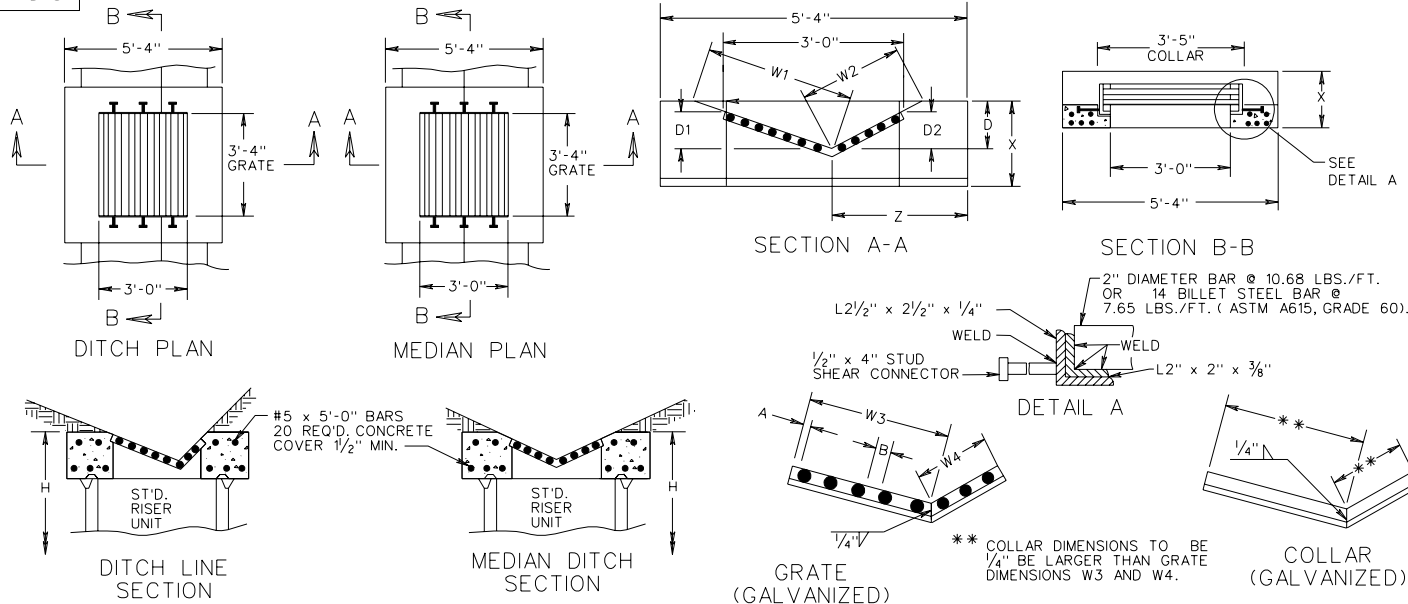
## GENERAL NOTES - PRECAST

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

103.02

T-D1-5



GRATE BAR SPACING CHART	
GRATE TYPE	MAXIMUM DIMENSION
	a      b
A I	1 1/2"    3"
A III	1"        1"

ST'D PG-2 TYPE	COVER DIMENSIONS AND QUANTITIES								
	W1	W2	W3	W4	D*	D1	D2	X	Z
A1,A2,A3	3'-0 1/2"	2'-0 1/16"	2'-0 9/16"	1'-0 3/8"	6"	4"	3"	14"	2'-2"
B1,B2,B3,B4, C1,C2,C3	2'-9"	2'-9"	1'-6 3/16"	1'-6 3/16"	8"	4 1/2"	4 1/2"	16"	2'-8"
E	2'-3"	2'-3"	1'-8 1/16"	1'-8 1/16"	12"	9"	9"	19"	2'-8"

NOTES:

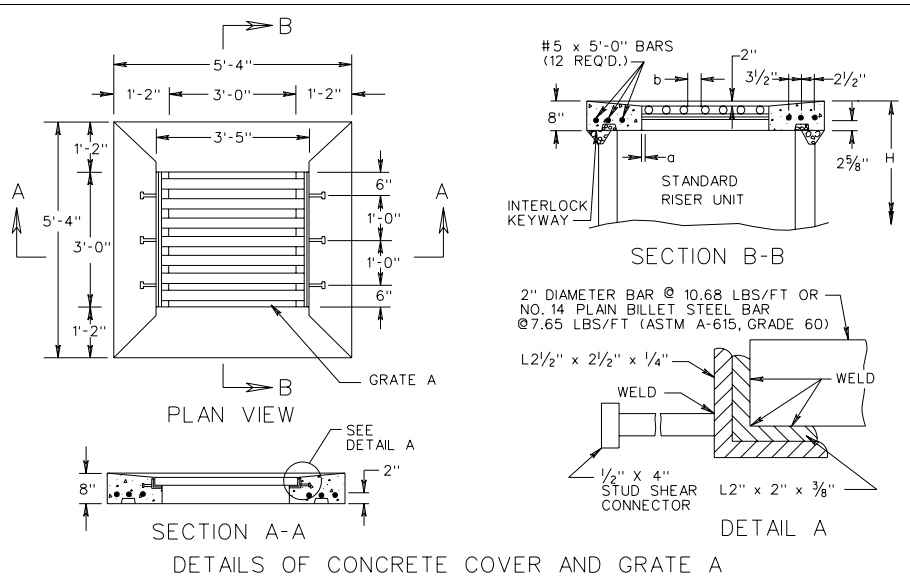
1. SEE GENERAL NOTES-PRECAST FOR ADDITIONAL DETAILS.
2. CONCRETE SHALL BE 4000 PSIMINIMUM.
3. REINFORCING STEEL SHALL BE IN ACCORDANCE WITH ASTM-A 615.
4. CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT.
5. DIMENSIONS SHOWN ARE MINIMUM. ACTUAL DIMENSIONS MAY VARY WITH MANUFACTURER.
6. GRATE BARS ARE TO BE INSTALLED SO THEY WILL BE ALIGNED PARALLEL TO THE DITCH FLOW.
7. WHERE DITCH SLOPES DO NOT MATCH THOSE OF INLET COVER, THE AREA ADJACENT TO THE INLET IS TO BE GRADED TO PROVIDE A SMOOTH TRANSITION.
8. DI-5 IS TO BE UTILIZED IN LOCATIONS NOT NORMALLY SUBJECT TO TRAFFIC.

REV. 7/05  
103.07

STANDARD PRECAST TOP UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION

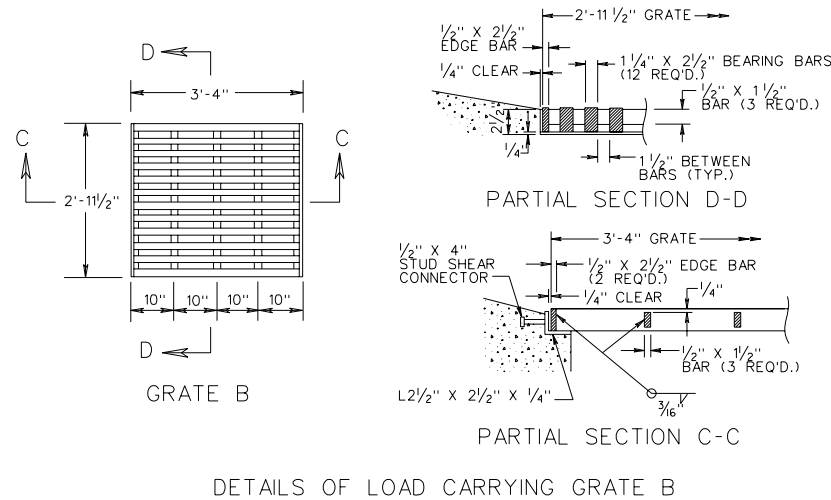
SPECIFICATION REFERENCE
105
233
302



GRATE A BAR SPACING CHART		
GRATE TYPE	MAXIMUM DIMENSION	
	a	b
A I	1 1/2"	3"
A III	1"	1"

NOTES:

- SEE GENERAL NOTES-PRECAST FOR ADDITIONAL DETAILS.
- CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT. OUTSIDE DIMENSIONS OF GRATE ARE TO BE 3'-4" X 2'-11 1/4" (GRATE A) OR 3'-4" X 2'-11 1/2" (GRATE B).
- DIMENSIONS SHOWN ARE MINIMUM. ACTUAL DIMENSIONS MAY VARY WITH MANUFACTURER.
- GRATE A IS TO BE UTILIZED IN LOCATIONS NOT NORMALLY SUBJECT TO TRAFFIC.
- GRATE B IS TO BE UTILIZED IN LOCATIONS NORMALLY SUBJECT TO TRAFFIC.
- ALTERNATE METHODS OF ANCHORING ANGLE IRON WILL BE ACCEPTABLE IF APPROVED BY THE ENGINEER.
- GRATE AND COLLAR ARE TO BE GALVANIZED AFTER FABRICATION.
- JOINTS BETWEEN CONCRETE COVER AND GUTTERS (WHEN REQUIRED) ARE TO BE DOWELED, KEYED, OR OTHER VDOT APPROVED METHODS.
- CONCRETE SHALL BE 4000 PSI MINIMUM.
- REINFORCING STEEL SHALL BE IN ACCORDANCE WITH ASTM A-615.
- GRATE BARS ARE TO BE INSTALLED SO THEY WILL BE ALIGNED PARALLEL TO THE DITCH FLOW.
- SEE STANDARD DI-7, 7A, 7B FOR DETAILS OF GUTTER, METHOD OF PLACEMENT, ALTERNATE METHODS OF CONSTRUCTION.

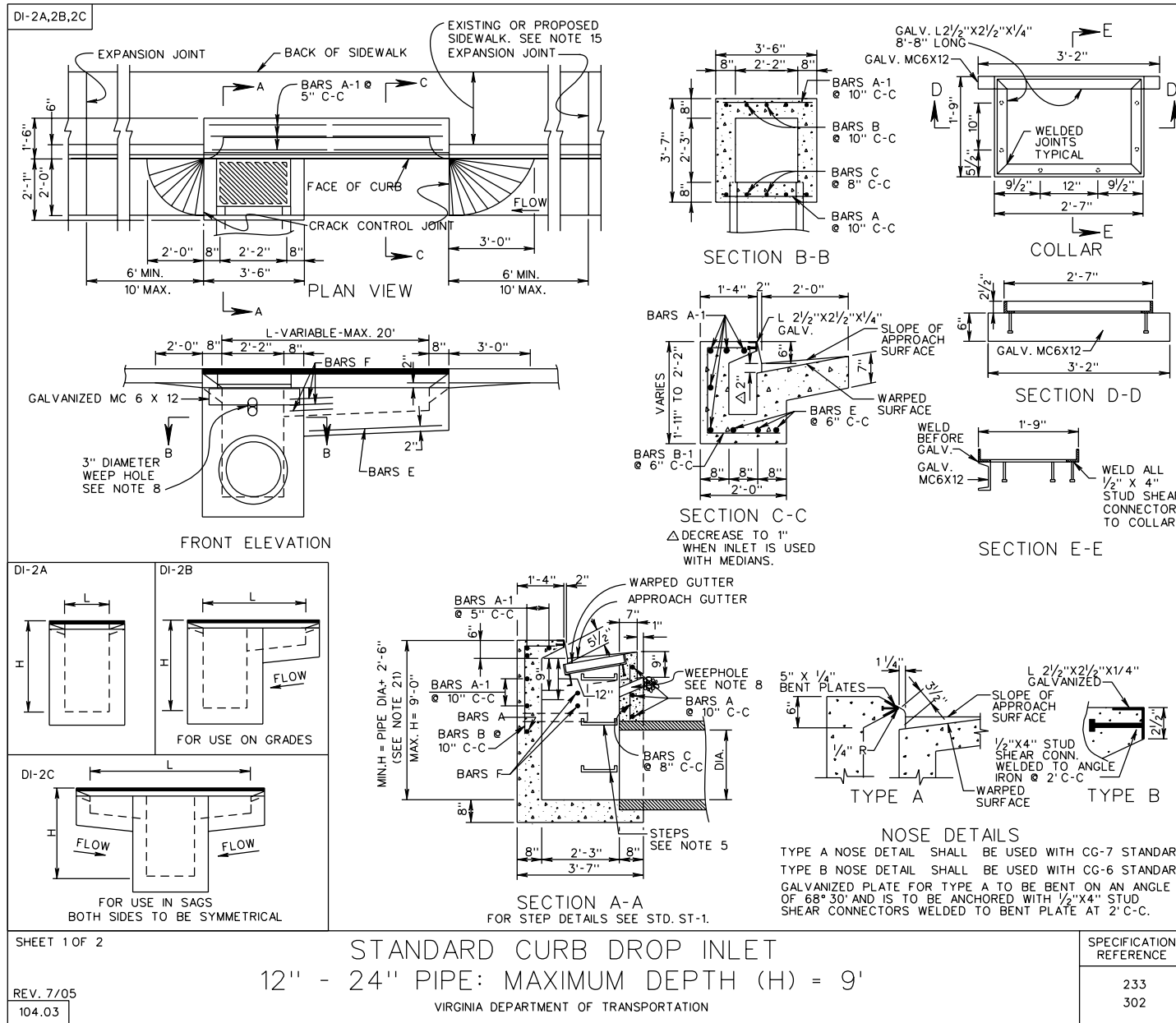


SPECIFICATION REFERENCE
105
233
302

STANDARD PRECAST TOP UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION





SHEET 1 OF 2

STANDARD CURB DROP INLET  
 12" - 24" PIPE: MAXIMUM DEPTH (H) = 9'

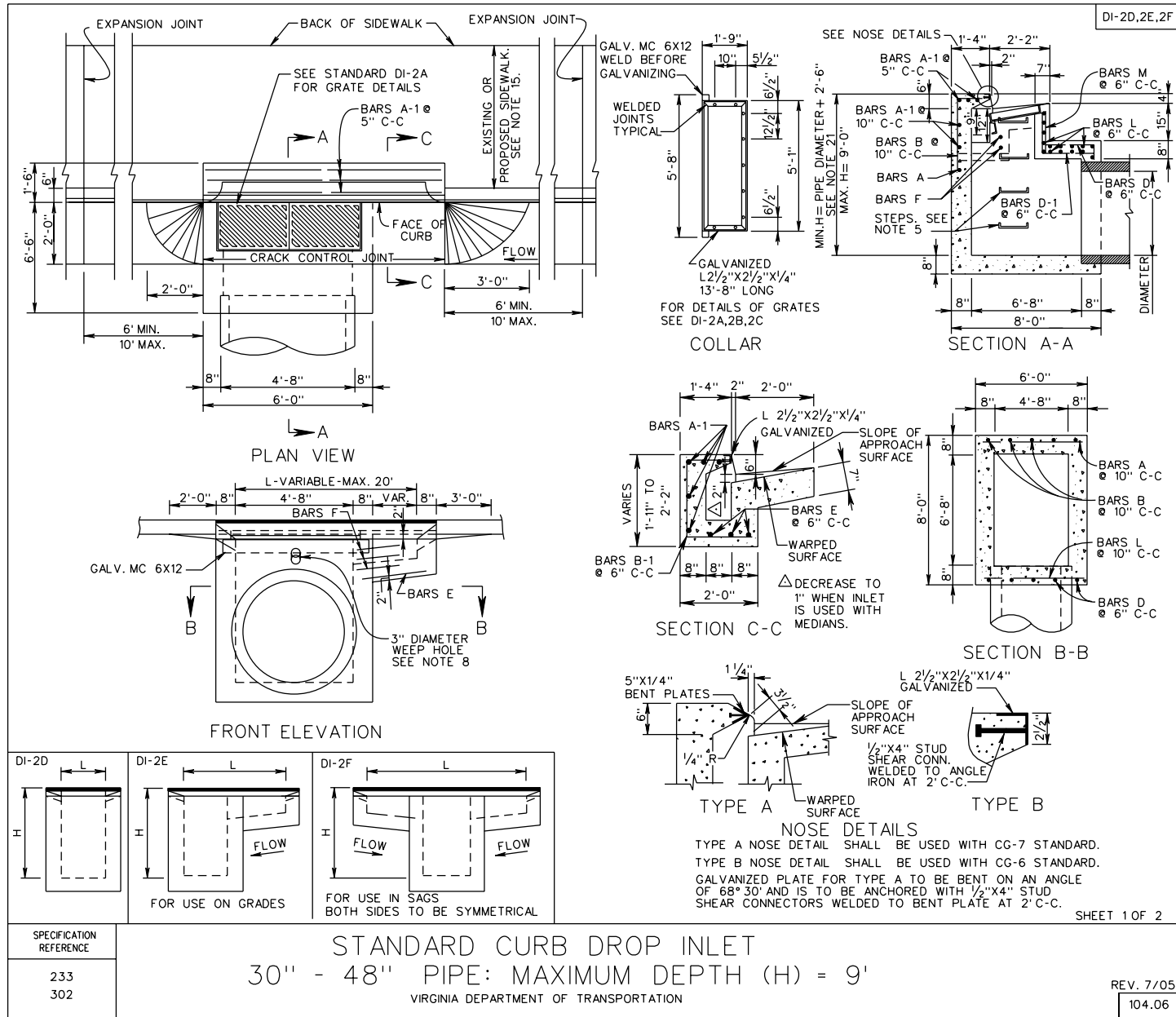
VIRGINIA DEPARTMENT OF TRANSPORTATION

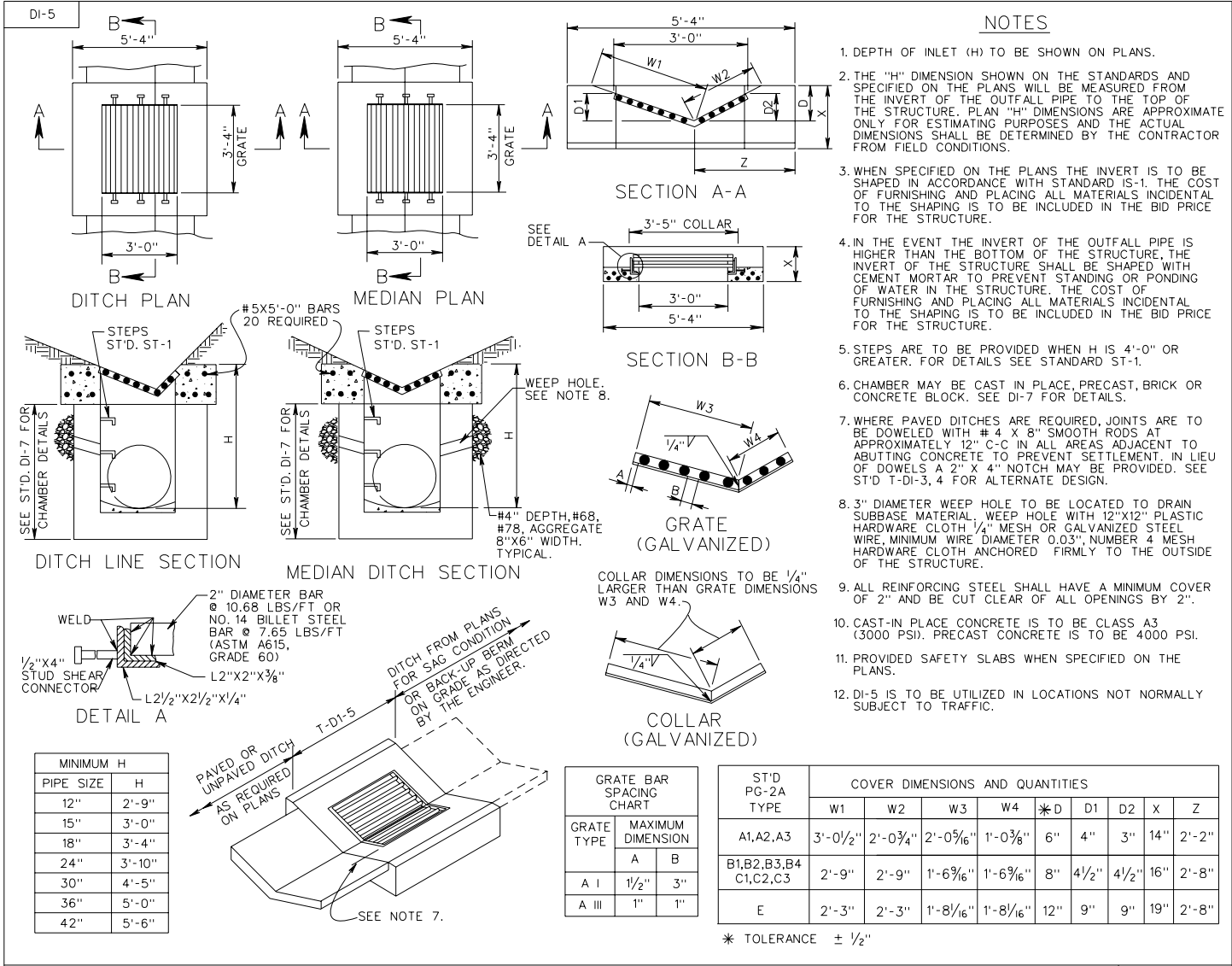
SPECIFICATION REFERENCE

233  
 302

REV. 7/05  
 104.03

INSERTABLE SHEET A153





STANDARD DITCH DROP INLET

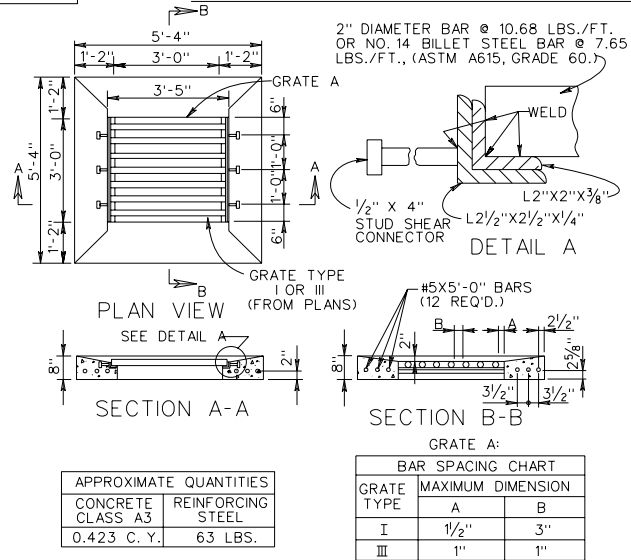
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05  
104.21

SPECIFICATION REFERENCE	
233	302

DI-7,7A,7B

DETAILS OF CONCRETE COVER AND GRATE



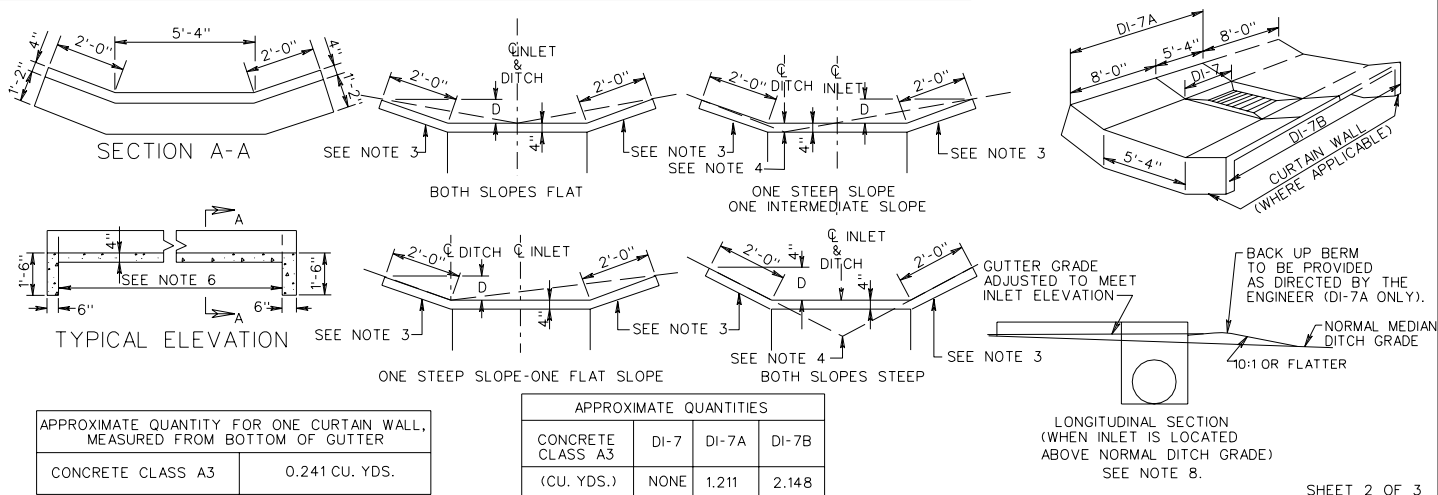
NOTES

1. GRATE A IS TO BE UTILIZED IN LOCATIONS NOT NORMALLY SUBJECT TO TRAFFIC.
2. GRATE B IS TO BE UTILIZED IN LOCATIONS NORMALLY SUBJECT TO TRAFFIC.
3. FOR DETAILS OF LOAD CARRYING GRATE (GRATE B), SEE T-DI-7, SHEET 103.08.
4. CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT. OUTSIDE DIMENSIONS OF GRATE TO BE 3'-4" X 2'-11 1/4" (GRATE A) OR 3'-4" X 2'-11 1/2" (GRATE B).
5. ALTERNATE METHODS OF ANCHORING ANGLE IRON WILL BE ACCEPTABLE IF APPROVED BY THE ENGINEER.
6. GRATE AND COLLAR ARE TO BE GALVANIZED.
7. CONCRETE COVER MAY BE PRECAST OR CAST IN PLACE.
8. CONCRETE TO BE CLASS A3 IF CAST IN PLACE. 4000 PSI IF PRECAST.
9. GRATE BARS TO BE PARALLEL TO DITCH FLOW.

DETAILS OF GUTTER AND METHOD OF PLACEMENT

NOTES

1. DI-7 NO GUTTERS.  
DI-7A NO GUTTER IN ONE DIRECTION.  
DI-7B GUTTER IN BOTH DIRECTIONS.
2. JOINTS BETWEEN GUTTERS AND CONCRETE COVER ARE TO BE DOWELED WITH #4 X 8" SMOOTH RODS @ APPROX. 12" C-C TO PREVENT SETTLEMENT IN LIEU OF DOWELS A 2" X 4" NOTCH MAY BE PROVIDED. SEE STANDARD T-DI-3, 4 ALTERNATE DESIGN.
3. VARIABLE 2:1 OR FLATTER.
4. DITCH GRADE MUST BE ADJUSTED TO MEET DIFFERENCE IN ELEVATION. SEE LONGITUDINAL SECTION.
5. IF DEPTH (D) BECOMES LESS THEN 4", LENGTH OF WINGS ARE TO BE EXTENDED AS DIRECTED BY THE ENGINEER.
6. CURTAIN WALL TO BE LOCATED AT THE END OF THE PAVED DITCH SECTIONS OF THE DI-7A & DI-7B THAT ARE NOT ABUTTED BY OTHER DRAINAGE.
7. IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET, A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.



SHEET 2 OF 3

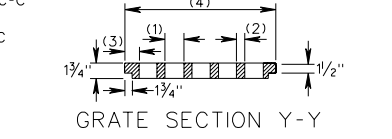
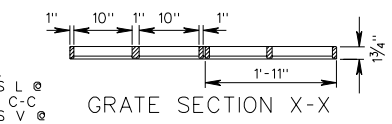
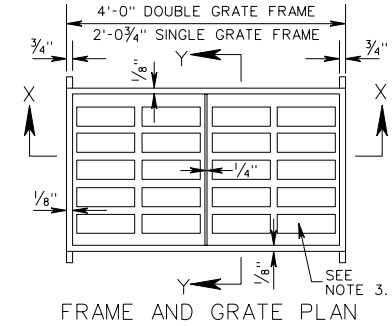
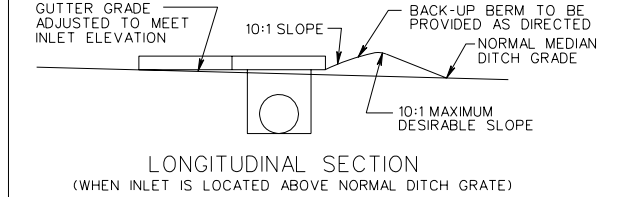
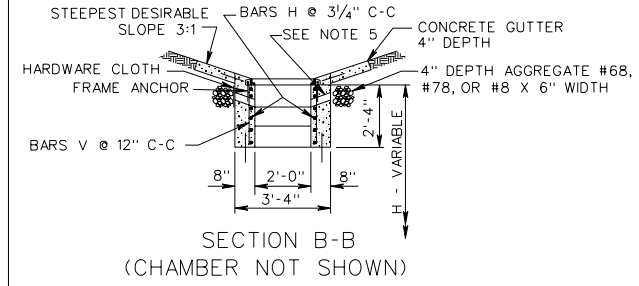
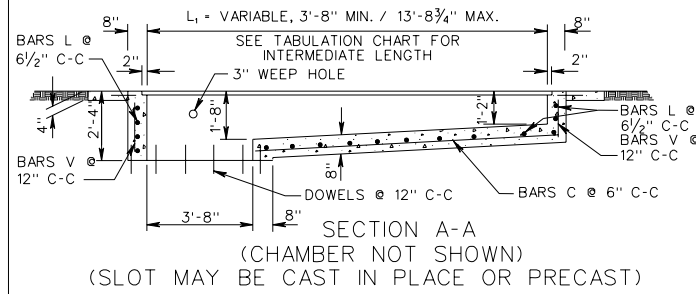
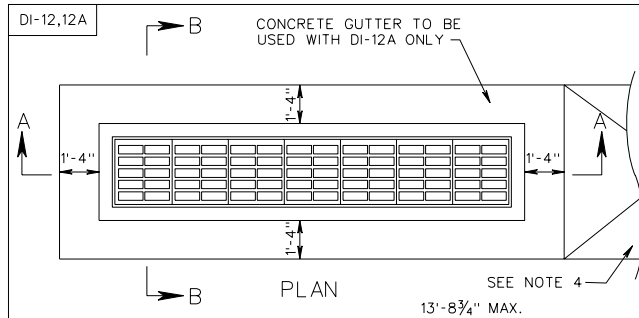
STANDARD MEDIAN DROP INLET  
12" TO 42" PIPE

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

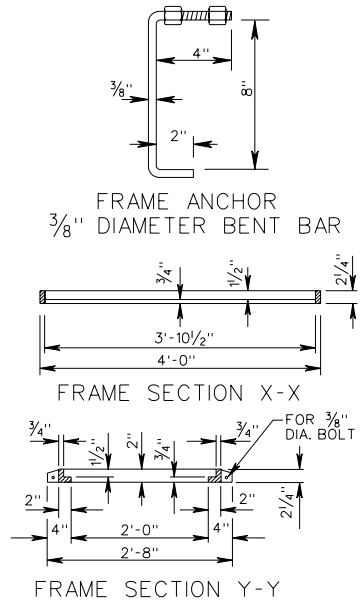
241  
503

REV. 7/05  
104.23



NOTE: SEE GRATE DIMENSION TABLE FOR GRATE TYPE I & II DIMENSIONS

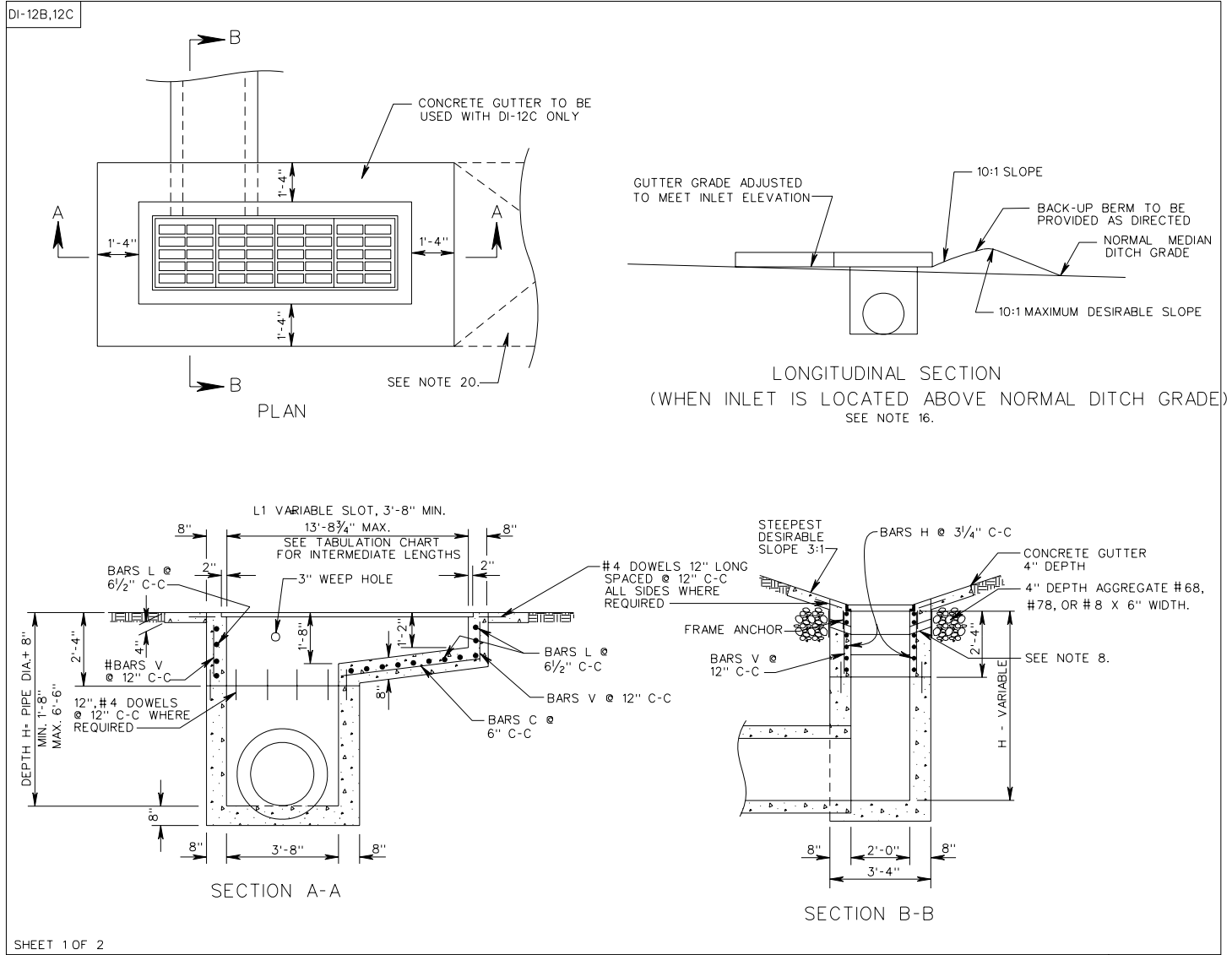
LEGEND  
(1) - OPENING WIDTH  
(2) - BAR THICKNESS  
(3) - END SECTION WIDTH  
(4) - TOTAL WIDTH



GRATE TYPE	GRATE DIMENSIONS			
	OPENING WIDTH	BAR THICKNESS	END SECTION WIDTH	TOTAL WIDTH
TYPE I	3 1/4"	1 3/8"	2 1/4"	26 1/4"
TYPE II	1 1/2"	1 3/8"	2 5/8"	26 1/4"

- NOTES:
- TYPE I GRATE: LIMITED ACCESS AND RURAL UNLIMITED ACCESS: PEDESTRIAN ACCESS UNLIKELY
  - TYPE II GRATE: URBAN AREAS: PEDESTRIAN ACCESSIBLE AREAS.
  - SEE GRATE SECTION Y-Y FOR SIZE AND NUMBER OF GRATE OPENING REQUIRED FOR TYPE I AND TYPE II GRATE.
  - PAVED TRANSITION WHERE REQUIRED ON PLANS IS TO BE SHAPED TO CONFORM TO ROUNDED CONCRETE GUTTER OF DI-12A.
  - 3" DIAMETER WEEP HOLE WITH 12" X 12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO OUTSIDE OF STRUCTURE.
  - IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET, A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.
  - GRATE BARS TO BE PARALLEL TO DITCH FLOW.

REV. 7/05	104.31	<p>MULTIGRATE DROP INLET FOR PIPE SIZES 12" TO 72"</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	SPECIFICATION REFERENCE
			233 302



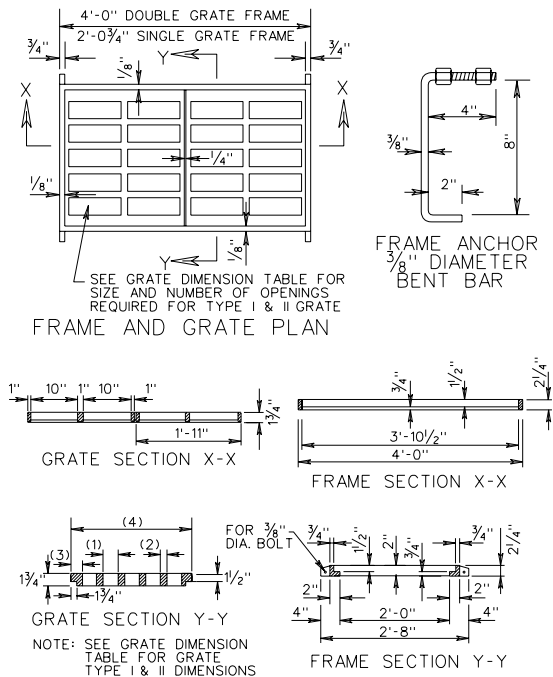
SHEET 1 OF 2

MULTIGRATE DROP INLET  
FOR PIPE SIZES 12" TO 36"

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05  
104.33

SPECIFICATION REFERENCE
241
503



LEGEND

(1) - OPENING WIDTH  
(2) - BAR THICKNESS  
(3) - END SECTION WIDTH  
(4) - TOTAL WIDTH

GRATE DIMENSIONS				
GRATE TYPE	OPENING WIDTH	BAR THICKNESS	END SECTION WIDTH	TOTAL WIDTH
TYPE I	3 1/4"	1 3/8"	2 1/4"	26 1/4"
	5 OPENINGS	4 BARS		
TYPE II	1 1/2"	1 3/8"	2 5/16"	26 1/4"
	8 OPENINGS	7 BARS		

NOTES

- DEPTH OF INLET (H) TO BE SHOWN ON PLANS. FOR DEPTH GREATER THAN 6'-6", USE ST'D. DI-12, DI-12A.
- THE "H" DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE STRUCTURE. PLAN "H" DIMENSIONS ARE APPROXIMATE ONLY FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS.
- WHEN SPECIFIED ON THE PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE STRUCTURE IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- IN THE EVENT THE INVERT OF THE OUTFALL PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- STEPS ARE TO BE PROVIDED WHEN H IS 4'-0" OR GREATER. FOR DETAILS SEE STANDARD ST-1.
- THIS ITEM MAY BE PRECAST OR CAST-IN-PLACE.
- # 4 DOWELS 12" LONG, 12" C-C TO BE PLACED IN ALL AREAS ADJACENT TO ABUTTING CONCRETE TO PREVENT SETTLEMENT.
- 3" DIAMETER WEEP HOLE 12"x12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03". NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO THE OUTSIDE OF THE STRUCTURE.
- ALL REINFORCING STEEL SHALL HAVE A MIN. COVER OF 2".
- ALL REINFORCING STEEL TO BE CUT CLEAR OF ALL OPENINGS BY 2".
- CAST-IN PLACE CONCRETE IS TO BE CLASS A3 (3000 PSI). PRECAST CONCRETE IS TO BE 4000 PSI.
- LENGTH OF SLOT (L) WILL, IN EVERY CASE, BE SHOWN ON PLANS.
- ALL REINFORCING BARS TO BE #4.
- DI-12C CONCRETE GUTTER INCREMENT: ADD 0.07 CU. YDS. CLASS A3 CONCRETE FOR EACH ADDITIONAL FOOT OF SLOT LENGTH GREATER THAN MINIMUM 3'-8".
- GRATE BARS TO BE INSTALLED SO THEY WILL BE ALIGNED PARALLEL TO THE DITCH FLOW.
- IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.
- DI-12B-----NO GUTTER.  
DI-12C----PERIPHERAL GUTTER.
- PAVED DITCHES ARE TO BE TRANSITIONED TO MEET INLET GUTTER AS SHOWN IN STANDARD PG-2A.
- QUANTITIES SHOWN ARE FOR INLETS WITHOUT PIPES. PIPE DISPLACEMENTS MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES.
- PAVED TRANSITION WHERE REQUIRED ON PLANS. TRANSITION IS TO BE SHAPED TO CONFORM TO ROUNDED CONCRETE GUTTER OF DI-12C.
- TYPE I GRATE: LIMITED ACCESS AND RURAL UNLIMITED ACCESS.  
PEDESTRIAN ACCESS UNLIKELY.
- TYPE II GRATE: URBAN AREAS; PEDESTRIAN ACCESSIBLE AREAS.
- L = LENGTH ROUNDED FOR PLAN USE.
- DI-12C: FOR APPROX. QUANTITIES FOR DI-12C, ADD 0.36 CU. YDS. OF CLASS A3 CONCRETE TO DI-12B QUANTITIES FOR CONCRETE GUTTER. QUANTITY SHOWN IS FOR A MINIMUM SLOT LENGTH OF 3'-8". FOR OTHER LENGTHS SEE CONCRETE GUTTER INCREMENT BELOW.

TABULATION CHARTS

APPROXIMATE QUANTITIES DI-12B ONLY (SEE NOTES 19 & 24)					
(MINIMUM HEIGHT) SLOT 4' TO 14' (SEE NOTE 23)					
L (SEE NOTE 23)	L1	CONCRETE CU. YDS.	REINFORCING STEEL LBS.	NUMBER GRATES	CONCRETE CHAMBER INCREMENTS PER FOOT CU. YDS.
4	3'-8"	0.99	81.27	2	.35
6	5'-8 3/4"	1.28	122.81	3	
8	7'-8"	1.48	161.90	4	
10	9'-8 3/4"	1.79	203.37	5	
12	11'-8"	2.09	242.45	6	
14	13'-8 3/4"	2.40	283.93	7	

SHEET 2 OF 2

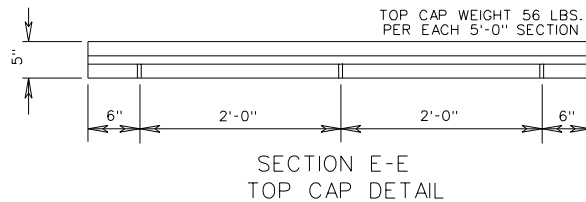
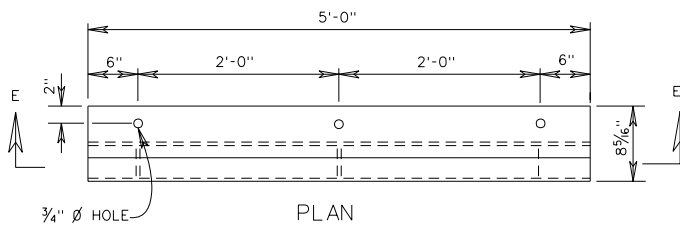
SPECIFICATION REFERENCE
241
503

MULTIGRATE DROP INLET  
FOR PIPE SIZES 12" TO 36"

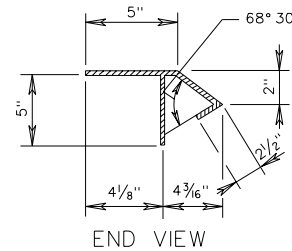
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

104.34

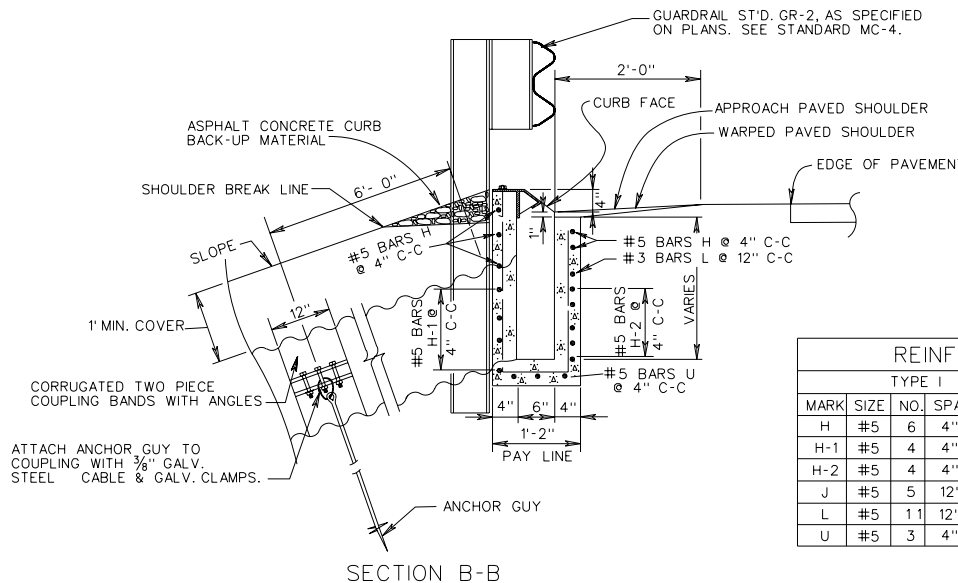


TYPICAL METHOD OF INSTALLATION FOR PIPE ON FILL SLOPE

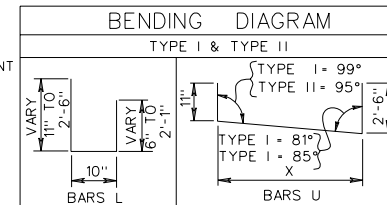


NOTES

1. SEE SHEET 1 OF 2 (104.35) OF ROAD AND BRIDGE STANDARDS FOR ADDITIONAL DESIGN AND PLACING INFORMATION.
2. TOP CAP IS TO BE FABRICATED FROM A-36 STEEL PLATE 1/4" THICK. ALL JOINTS ARE TO BE WELDED USING 1/4" FILLET WELDS AND THE COMPLETE UNIT IS TO BE GALVANIZED.
3. GUARDRAIL MUST BE FLUSH WITH THE FACE OF CURB.



TYPE I		TYPE II	
MARK	X	MARK	X
U	10'-5 1/2"	U	20'-4 3/4"



REINFORCING STEEL SCHEDULE									
TYPE I				TYPE II					
MARK	SIZE	NO.	SPA.	LENGTH	MARK	SIZE	NO.	SPA.	LENGTH
H	#5	6	4"	10'-4"	H	#5	6	4"	20'-4"
H-1	#5	4	4"	8'-11" TO 2'-8"	H-1	#5	4	4"	12'-8" TO 2'-8"
H-2	#5	4	4"	8'-11" TO 2'-8"	H-2	#5	4	4"	12'-8" TO 2'-8"
J	#5	5	12"	0'-10"	J	#5	5	12"	0'-10"
L	#5	11	12"	5'-5" TO 2'-3"	L	#5	21	12"	5'-5" TO 2'-3"
U	#5	3	4"	13'-10"	U	#5	3	4"	23'-10"

SHEET 2 OF 2

SPECIFICATION REFERENCE

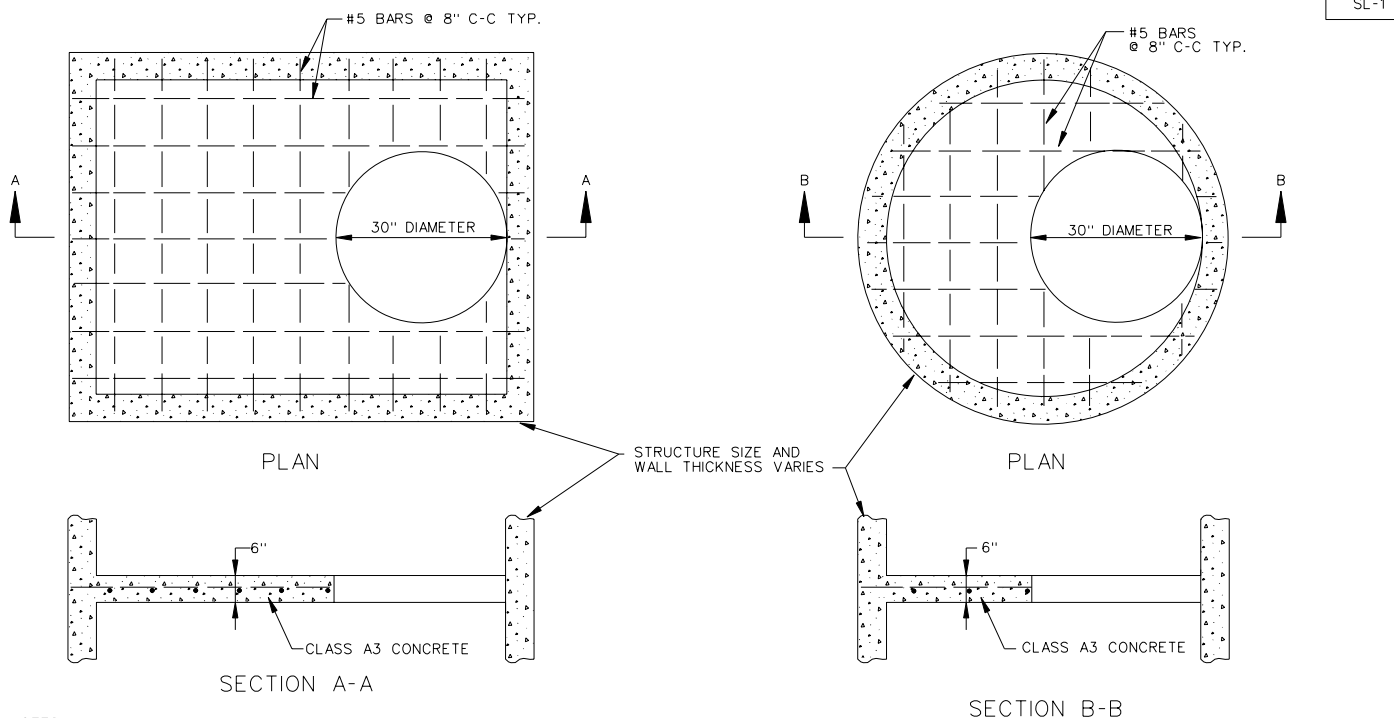
SHOULDER SLOT INLET

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

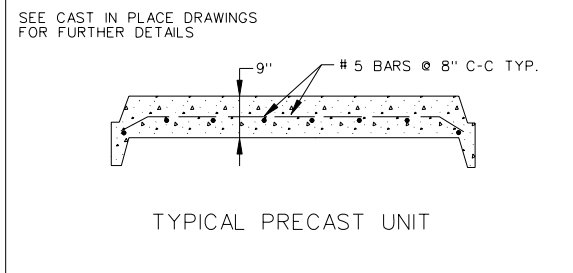
104.36





NOTES:

1. STANDARD SL-1, MANHOLE SAFETY SLAB, IS REQUIRED AS PART OF THE DRAINAGE DESIGN FOR MANHOLES, JUNCTION BOXES AND DROP INLETS WITH HEIGHTS GREATER THAN 12 FEET. THE SPACING OF ADJACENT SAFETY SLABS SHALL BE 8' TO 12' WITH NO SAFETY SLAB LOCATED WITHIN 6 FEET OF THE TOP OR BOTTOM OF THE STRUCTURE. SAFETY SLABS SHALL NOT BE LOCATED BELOW ANY INLET PIPE OF 30" DIAMETER OR GREATER.
2. THE COST OF THE SL-1 IS INCLUDED IN THE COST OF THE STRUCTURE.
3. ACCESS OPENINGS ARE TO BE STAGGERED FROM ONE SIDE OF STRUCTURE TO THE OTHER WHERE APPLICABLE. STEPS ARE TO BE STAGGERED ACCORDINGLY.
4. SAFETY SLAB MAY BE CAST-IN-PLACE OR PRECAST. CAST-IN-PLACE CONCRETE TO BE CLASS A3 (3000 PSI). PRECAST CONCRETE IS TO BE A4 (4000 PSI). REINFORCING STEEL TO BE IN ACCORDANCE WITH AASHTO M31.
5. ACCESS OPENINGS MAY BE 30" DIAMETER OR 30" SQUARE. WHEN STRUCTURE WIDTH IS LESS THAN 30" THE ACCESS OPENING SHALL BE RECTANGULAR (STRUCTURE WIDTH BY 30" LONG).



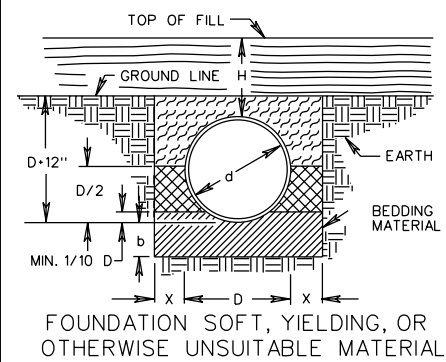
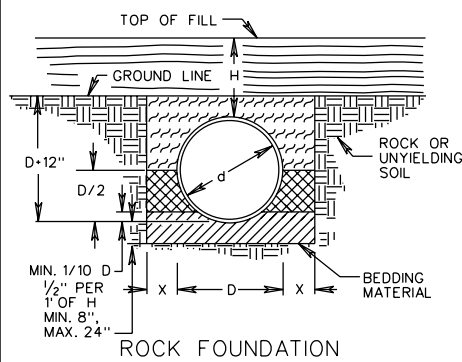
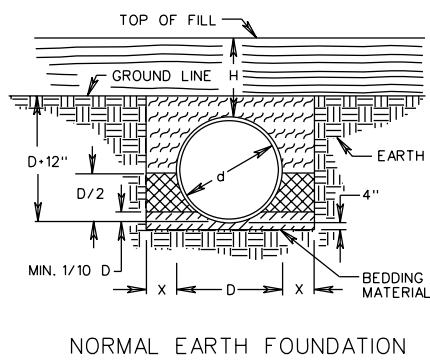
SPECIFICATION REFERENCE
302

TYPICAL CONCRETE SAFETY SLAB  
FOR DROP INLETS, MANHOLES AND JUNCTION BOXES

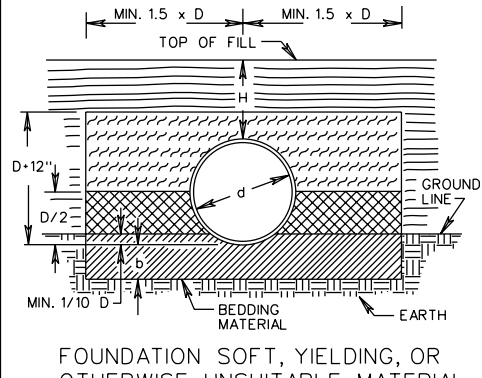
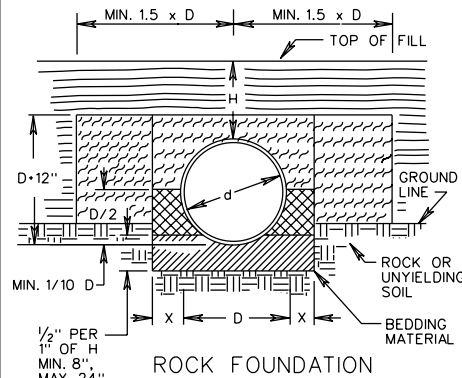
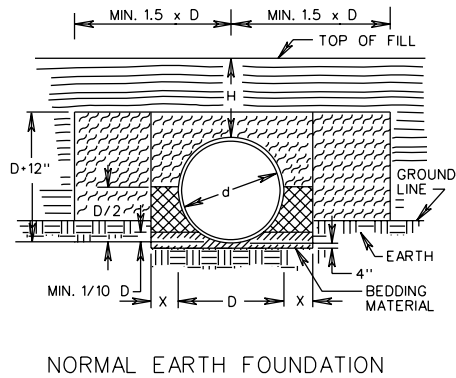
VIRGINIA DEPARTMENT OF TRANSPORTATION





REV. 7/05  
106.14

NO PROJECTION OF PIPE ABOVE GROUND LINE



PIPE PROJECTION ABOVE GROUND LINE



-  BEDDING MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.
-  CLASS I BACKFILL MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.
-  REGULAR BACKFILL MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.
-  EMBANKMENT

NOTES:

FOR PLASTIC PIPE, THE LIMITS OF THE CLASS I BACKFILL MATERIAL SHALL BE EXTENDED TO 12" ABOVE THE TOP OF THE PIPE.

FOR GENERAL NOTES ON PIPE BEDDING, SEE INSTALLATION OF PIPE CULVERTS AND STORM SEWERS GENERAL NOTES ON SHEET 107.00.

SPECIFICATION REFERENCE

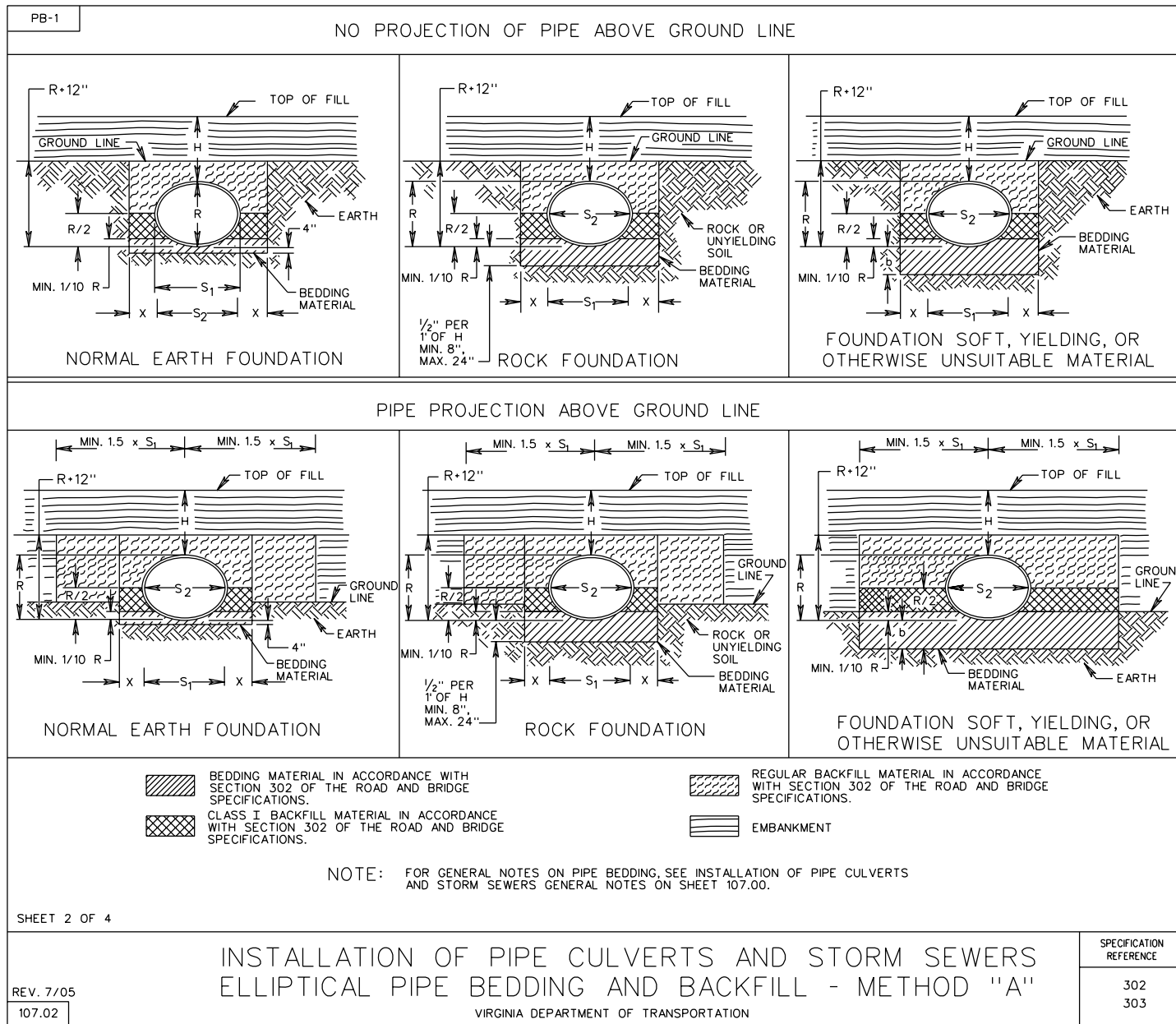
302  
303

INSTALLATION OF PIPE CULVERTS AND STORM SEWERS  
CIRCULAR PIPE BEDDING AND BACKFILL - METHOD "A"

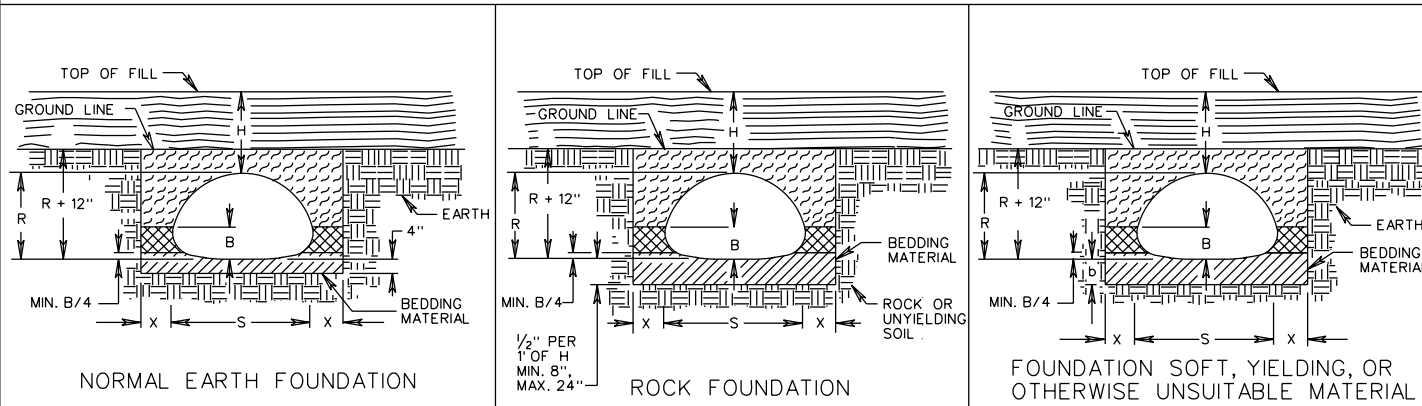
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

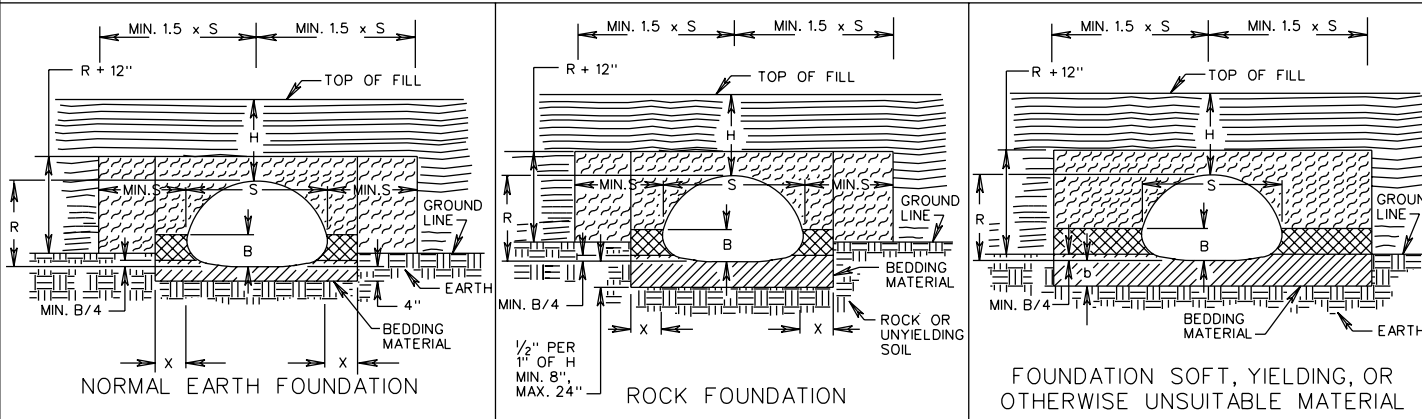
107.01







NO PROJECTION OF PIPE ARCH ABOVE GROUND LINE



PIPE ARCH PROJECTION ABOVE GROUND LINE



-  BEDDING MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.
-  CLASS I BACKFILL MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.

-  REGULAR BACKFILL MATERIAL IN ACCORDANCE WITH SECTION 302 OF THE ROAD AND BRIDGE SPECIFICATIONS.
-  EMBANKMENT

NOTE: FOR GENERAL NOTES ON PIPE BEDDING, SEE INSTALLATION OF PIPE CULVERTS AND STORM SEWERS GENERAL NOTES ON SHEET 107.00.

SPECIFICATION REFERENCE	<p>INSTALLATION OF PIPE CULVERTS AND STORM SEWERS PIPE ARCH BEDDING AND BACKFILL</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>REV. 7/05 107.03</p>
302 303		


DIAMETER  INCHES	AREA  SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET				DIAMETER  INCHES
		NONREINFORCED CONCRETE (STRENGTH) (SEE NOTE 4)	REINFORCED CONCRETE CLASS			
			III	IV	V	
12	0.8	14' (1800)	14'	19'	29'	12
15	1.2	14' (2125)	14'	19'	29'	15
18	1.8	14' (2400)	14'	20'	29'	18
21	2.4	13' (2700)	14'	20'	29'	21
24	3.1	13' (3000)	14'	20'	29'	24
27	4.0		14'	20'	29'	27
30	4.9		14'	20'	29'	30
33	5.9		14'	20'	29'	33
36	7.1		14'	20'	30'	36
42	9.6		14'	21'	30'	42
48	12.6		14'	21'	30'	48
54	15.9		14'	21'	30'	54
60	19.6		14'	21'	30'	60
66	23.8		14'	21'	30'	66
72	28.3		14'	21'	30'	72
78	33.2		14'	21'	30'	78
84	38.5		14'	21'	30'	84
90	44.4		14'	21'	30'	90
96	50.3		14'	21'	30'	96
102	56.7		14'	21'	30'	102
108	63.6		14'	21'	30'	108

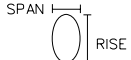
NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHTS OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION ARE TO BE 1/2 DIAMETER OR 3'0", WHICHEVER IS GREATER. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(DIAMETER + 36") ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2.0' OR 1/2 DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9".
- CRUSHING STRENGTH (POUNDS PER LINEAR FOOT ULTIMATE STRENGTH)
- FOR HEIGHT OF COVER GREATER THAN THAT SHOWN FOR CLASS V, A SPECIAL DESIGN CONCRETE PIPE IS REQUIRED.
- NONREINFORCED PIPE TO BE USED ONLY UNDER ENTRANCES AND LOWER FUNCTIONAL CLASSIFICATION (LFC) ROADWAYS (SEE SHEET 17 OF 18).
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- PIPE WITH LESS THAN THE STANDARD MINIMUM COVER IS TO BE MINIMUM CLASS III REINFORCED.

SPECIFICATION REFERENCE	<p>CONCRETE PIPE HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>REV. 7/05 107.05</p>
302 232		

PC-1

HORIZONTAL INSTALLATION			
EQUIVALENT ROUND SIZE INCHES	SPAN X RISE INCHES	MAX. HEIGHT OF COVER IN FEET	
		CLASS	
		HE - III	HE - IV
18	23 x 14	13'	21'
24	30 x 19	13'	21'
27	34 x 22	13'	21'
30	38 x 24	13'	21'
33	42 x 27	13'	21'
36	45 x 29	13'	21'
39	49 x 32	13'	21'
42	53 x 34	13'	21'
48	60 x 38	13'	21'
54	68 x 43	13'	21'
60	76 x 48	13'	21'
66	83 x 53	13'	21'
72	91 x 58	13'	21'
78	98 x 63	13'	21'
84	106 x 68	13'	21'

VERTICAL INSTALLATION				
SPAN X RISE INCHES	MAX. HEIGHT OF COVER IN FEET			
	CLASS			
	VE - III	VE - IV	VE - V	
29 x 45	13	21	29	
32 x 49	13	21	29	
34 x 53	13	21	29	
38 x 60	13	21	29	
43 x 68	13	21	29	
48 x 76	13	21	29	
53 x 83	13	21	29	
58 x 91	13	21	29	
63 x 98	13	21	29	
68 x 106	13	21	29	

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHTS OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION ARE TO BE 1/2 SPAN OR 3', WHICHEVER IS GREATER. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(SPAN + 36") ON EACH SIDE OF THE PIPE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2.0' OR 1/2 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. MINIMUM FINISHED HEIGHT OF COVER FOR PIPE UNDER ENTRANCES IS 9".
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.

SHEET 2 OF 18

REINFORCED ELLIPTICAL CONCRETE PIPE  
 HEIGHT OF COVER TABLES FOR H-20 LIVE LOAD  
 VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05  
 107.06

SPECIFICATION REFERENCE
302
232

CORRUGATED STEEL PIPE 2 2/3" x 1/2" CORRUGATIONS							
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET					MINIMUM SHEET THICKNESS FOR ENTRANCE PIPES WITH LESS THAN 1 FT COVER INCHES (GAUGE)
		SHEET THICKNESS IN INCHES (GAUGE)					
		0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	
12	0.79	18	100				0.064 (16)
15	1.23	18	80	100	100		0.064 (16)
18	1.77	18	55	71	89	94	0.064 (16)
21	2.40	18	41	51	62	74	0.079 (14)
24	3.14	17	33	40	47	55	0.109 (12)
27	3.98	17	28	33	38	44	
30	4.91	17	25	28	32	36	
33	5.94	17	23	25	28	31	
36	7.1	16	21	23	26	28	
42	9.6	16	20	21	22	24	
48	12.6	15	19	19	20	21	
54	16.0		18	19	19	20	
60	19.6			18	19	19	
66	23.8				18	18	
72	28.3				18	18	
78	33.2					18	
84	38.5					17	

CORRUGATED STEEL PIPE 3" x 1" AND 5" x 1" CORRUGATIONS							
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET					MINIMUM SHEET THICKNESS FOR ENTRANCE PIPES WITH LESS THAN 1 FT COVER INCHES (GAUGE)
		SHEET THICKNESS IN INCHES (GAUGE)					
		0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	
36	7.1	16	38	47	57	66	
42	9.6	16	30	36	42	48	
48	12.6	15	26	30	34	38	
54	16.0	15	23	26	28	31	
60	19.6	14	21	23	25	27	
66	23.8	14	20	22	23	25	
72	28.3	13	19	20	22	23	
78	33.2	13	19	20	21	21	
84	38.5	12	18	19	20	21	
90	44.2	12	18	19	19	20	
96	50.3		18	18	19	19	
102	56.7		18	18	18	19	
108	63.6			18	18	18	
114	70.9			18	18	18	
120	78.5			17	18	18	
132	95.0				17	18	
144	113.0					17	

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 15 DIAMETERS ON EACH SIDE OF THE PIPE OR THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT UNDER ENTRANCES, SHALL BE 2.0' OR 1/2 DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9" FOR PIPE DIAMETERS LESS THAN OR EQUAL TO 24" AND 12" OR 1/8 DIAMETER, WHICHEVER IS GREATER. FOR PIPE DIAMETERS GREATER THAN 24", WHERE A POLYMER COATED PIPE WILL BE USED AND THE SURFACE OVER THE TOP OF THE PIPE WILL BE ASPHALT, CLASS 1 BACKFILL MATERIAL IS TO BE PLACED UP TO A MINIMUM OF 6" ABOVE THE TOP OF THE PIPE.
- 16 GAUGE PIPE LIMITED TO THOSE LOCATIONS WHERE PIPE DIAMETER PLUS COVER IS LESS THAN 20'.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE COVER TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
12" TO 30"	18"
36" AND ABOVE	1/2 DIAMETER

CONCRETE- LINED CORRUGATED STEEL PIPE

MAXIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH THE TABLES BUT SHALL NOT EXCEED 30'.

SPECIFICATION REFERENCE
302 232

CORRUGATED STEEL PIPE  
HEIGHT OF COVER TABLES FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

PC-1

CORRUGATED ALUMINUM ALLOY PIPE - 2 2/3" x 1/2" CORRUGATIONS							
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET					MINIMUM SHEET THICKNESS FOR ENTRANCE PIPES WITH LESS THAN 1 FT. COVER
		SHEET THICKNESS IN INCHES (GAUGE)					
		0.060 (16)	0.075 (14)	0.105 (12)	0.135 (10)	0.164 (8)	
12	0.8	18	50	80	90	93	0.060
15	1.2	18	39	49	60	71	0.105
18	1.8	18	30	35	41	48	0.135
21	2.4	18	25	28	32	36	
24	3.1	17	22	25	27	30	
27	4.0	17	20	22	24	26	
30	4.9	17	19	21	22	23	
33	5.9	17	18	20	21	22	
36	7.1	16	16	19	20	21	
42	9.6	16	18	18	19	19	
48	12.6			18	18	18	
54	15.9			16	18	18	
60	19.6				15	17	
66	23.8					14	
72	28.3					11	

CORRUGATED ALUMINUM ALLOY PIPE - 3" x 1" CORRUGATIONS							
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET					
		SHEET THICKNESS IN INCHES (GAUGE)					
		0.60 (16)	0.75 (14)	0.105 (12)	0.35 (10)	0.164 (8)	
36	7.1	16	24	27	30	34	
42	9.6	16	21	23	25	27	
48	12.6	15	20	21	22	24	
54	16.0	15	19	20	21	22	
60	19.6	14	18	19	20	20	
66	23.8		18	18	19	19	
72	28.3		18	18	18	19	
78	33.2		17	18	18	18	
84	38.5			17	18	18	
90	44.2			15	17	18	
96	50.3			12	16	17	
102	56.7				14	17	
108	63.6				11	14	
114	70.9					12	
120	78.5					10	

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 20 DIAMETERS ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2.0' OR 1/2 DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9" FOR PIPE DIAMETERS EQUAL TO OR LESS THAN 18" AND 12" OR 1/8 DIAMETER, WHICHEVER IS GREATER, FOR PIPE DIAMETERS GREATER THAN 18".
- 16 GAUGE PIPE LIMITED TO THOSE LOCATIONS WHERE PIPE DIAMETER PLUS COVER IS LESS THAN 20'.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
12" TO 24"	18"
30" AND OVER	EQUAL TO DIAMETER

SHEET 4 OF 18

CORRUGATED ALUMINUM ALLOY PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

SPECIFICATION  
REFERENCE

302  
232

REV. 7/05  
107.08

VIRGINIA DEPARTMENT OF TRANSPORTATION



CORRUGATED ALUMINUM ALLOY PIPE - 6" x 1" CORRUGATIONS						
PIPE DIAMETER  INCHES	AREA  SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET				
		SHEET THICKNESS IN INCHES (GAUGE)				
		0.060 (16)	0.075 (14)	0.105 (12)	0.135 (10)	0.164 (8)
36	7.1	16	24	26	30	33
42	9.6	16	21	23	25	27
48	12.6	15	20	21	22	23
54	16.0	15	19	20	21	21
60	19.6	14	18	19	19	20
66	23.8	14	18	18	19	19
72	28.3		18	18	18	19
78	33.2		16	18	18	18
84	38.5			17	18	18
90	44.2			15	17	18
96	50.3				16	17
102	56.7				13	16
108	63.6					14
114	70.9					11
120	78.5					

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A AS FOLLOWS PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 20' DIAMETERS ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2.0' OR 1/2 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- 16 GAUGE PIPE LIMITED TO THOSE LOCATIONS WHERE PIPE DIAMETER PLUS COVER IS LESS THAN 20'.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
30" AND OVER	EQUAL TO DIAMETER

SPECIFICATION  
REFERENCE

232  
302

CORRUGATED ALUMINUM ALLOY PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV.7/05

107.09

INSERTABLE SHEET A166-3

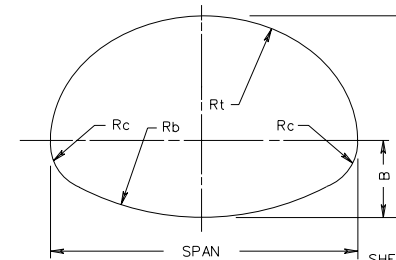
MINIMUM SHEET THICKNESS AND DESIGN DATA							
PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED INCHES (GAUGE)	MAXIMUM COVER HEIGHT IN FEET	
NOMINAL SIZE SPAN - RISE INCHES	EQUIVALENT PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM "B" INCHES (SEE NOTE 7)	Rc INCHES		MAXIMUM CORNER PRESSURE	
						4000 LBS./SQ. FT. (SEE NOTE 4)	6000 LBS./SQ. FT. (SEE NOTE 6)
2 2/3" x 1 1/2" CORRUGATIONS							
17 x 13	15	1.1	5 1/4"	3	0.064 (16)	11	17
21 x 15	18	1.6	6"	3	0.064 (16)	9	14
24 x 18	21	2.2	7 1/4"	3	0.064 (16)	8	12
28 x 20	24	2.8	8"	3	0.064 (16)	7	10
35 x 24	30	4.4	9 1/2"	3	0.064 (16)	5	8
42 x 29	36	6.4	10 1/2"	3 1/2	0.064 (16)	5	8
49 x 33	42	8.7	11 1/2"	4	0.079 (14)	5	8
57 x 38	48	11.4	13 1/2"	5	0.109 (12)	5	8
64 x 43	54	14.3	15"	6	0.109 (12)	6	9
71 x 47	60	17.6	16 1/2"	7	0.138 (10)	6	9
77 x 52	66	21.3	18"	8	0.168 (8)	6	10
83 x 57	72	25.3	20"	9	0.168 (8)	7	10
3" x 1" AND 5" x 1" CORRUGATIONS							
40 x 31	36	6.4	9 3/4"	5	0.109 (12)	8	12
46 x 36	42	8.7	11 1/2"	6	0.109 (12)	8	12
53 x 41	48	11.4	13"	7	0.109 (12)	8	13
60 x 46	54	14.3	14 3/4"	8	0.109 (12)	8	13
66 x 51	60	17.6	16 1/2"	9	0.109 (12)	9	13
73 x 55	66	22.0	21 1/2"	12	0.109 (12)	11	16
81 x 59	72	26.0	23"	14	0.109 (12)	11	17
87 x 63	78	31.0	24 1/2"	14	0.109 (12)	10	16
95 x 67	84	35.0	26 1/2"	16	0.109 (12)	11	16
103 x 71	90	40.0	27"	16	0.109 (12)	10	15
112 x 75	96	46.0	29"	18	0.109 (12)	10	16
117 x 79	102	52.0	30 3/4"	18	0.109 (12)	10	15
128 x 83	108	58.0	29 1/2"	18	0.138 (10)	9	14
137 x 87	114	64.0	30 3/4"	18	0.138 (10)	8	13
142 x 91	120	71.0	32 1/2"	18	0.168 (8)	8	12

⊗ INDICATES PIPE ARCHES FOR WHICH DIMENSIONS FOR EITHER CORRUGATION MAY BE USED WITHIN HEIGHT OF COVER LIMITATIONS.

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE ARCH. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(HHEIGHT + 1/2 SPAN) ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2'-0" OR 1/2 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1'-0" OR 1/4 SPAN, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. WHERE POLYMER COATED PIPE WILL BE USED AND THE SURFACE OVER THE TOP OF THE PIPE WILL BE ASPHALT, CLASS I BACKFILL MATERIAL IS TO BE PLACED UP TO A MINIMUM OF 6" ABOVE THE TOP OF THE PIPE.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- WHEN DESIGN HEIGHT OF COVER REQUIRES THE USE OF THIS CATEGORY OF PIPE, FOUNDATION AND BACKFILL MUST BE APPROVED BY THE ENGINEER.
- SPAN OF PIPE ARCHES IS MEASURED "B" INCHES ABOVE THE INVERT. SEE DIAGRAM BELOW FOR ILLUSTRATION OF "B" DIMENSION.

PIPE ARCH SPAN	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
17" TO 35"	18"
42" AND ABOVE	1/2 SPAN



SHEET 6 OF 18

CORRUGATED STEEL PIPE ARCH  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

232  
302

REV. 7/05  
107.10

MINIMUM SHEET THICKNESS AND DESIGN DATA

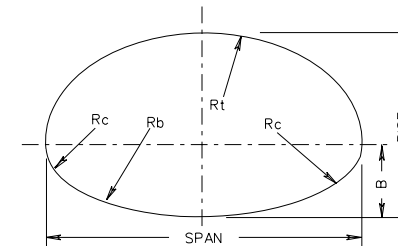
PIPE ARCH DIMENSION				MINIMUM SHEET THICKNESS REQUIRED INCHES (GAUGE)	MAXIMUM COVER HEIGHT IN FEET	
NOMINAL SIZE SPAN-RISE INCHES	EQUIVALENT PIPE DIAMETER INCHES	AREA SQ. FT.	Rc INCHES		MAXIMUM CORNER PRESSURE	
					4000 LBS./SQ. FT. (SEE NOTE 4)	6000 LBS./SQ. FT. (SEE NOTE 6)
2 2/3" x 1/2" CORRUGATIONS						
17 x 13	15	1.1	3"	0.060 (16)	11	17
21 x 15	18	1.6	3"	0.060 (16)	9	14
24 x 18	21	2.2	3"	0.060 (16)	8	12
28 x 20	24	2.8	3"	0.075 (14)	7	10
35 x 24	30	4.4	3"	0.075 (14)	5	8
42 x 29 ⊗	36	6.4	3 1/2"	0.105 (12)	5	8
49 x 33 ⊗	42	8.7	4"	0.105 (12)	5	8
57 x 38 ⊗	48	11.4	5"	0.135 (10)	5	8
64 x 43 ⊗	54	14.3	6"	0.135 (10)	6	9
71 x 47 ⊗	60	17.6	7"	0.164 (8)	6	9
3" x 1" CORRUGATIONS						
40 x 31 ⊗	36	6.4	5"	0.060 (16)	8	12
46 x 36 ⊗	42	8.7	6"	0.060 (16)	8	12
53 x 41 ⊗	48	11.4	7"	0.060 (16)	8	13
60 x 46 ⊗	54	14.3	8"	0.075 (14)	8	13
66 x 51 ⊗	60	17.6	9"	0.075 (14)	9	13
73 x 55	66	22.0	12"	0.105 (12)	11	16
81 x 59	72	26.0	14"	0.105 (12)	11	17
87 x 63	78	31.0	14"	0.135 (10)	10	16
95 x 67	84	35.0	16"	0.135 (10)	11	16
103 x 71	90	40.0	16"	0.164 (8)	10	15
112 x 75	96	46.0	18"	0.164 (8)	10	13
117 x 79	102	52.0	18"	0.164 (8)	10	11

⊗ INDICATES PIPE ARCHES FOR WHICH DIMENSIONS FOR EITHER CORRUGATION MAY BE USED WITHIN HEIGHT OF COVER LIMITATIONS.

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE ARCH. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(HHEIGHT + 1/2 SPAN) ON EACH SIDE OF THE STRUCTURE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2'0" OR 1/8 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 SPAN, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- WHEN DESIGN HEIGHT OF COVER REQUIRES THE USE OF THIS CATEGORY OF PIPE BEDDING FOUNDATION AND BACKFILL MUST BE APPROVED BY THE ENGINEER.
- 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, 1" IS PERMISSIBLE FOR DIMENSIONS OF SPAN, RISE, AND CORNER RADIUS.

PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
17" TO 35"	18"
42" AND ABOVE	1/2 SPAN



SHEET 7 OF 18

SPECIFICATION REFERENCE

232  
302

CORRUGATED ALUMINUM ALLOY PIPE ARCH  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

107.11

PC-1

STRUCTURAL PLATE STEEL PIPE - 6" x 2" CORRUGATIONS								
PIPE DIAMETER  INCHES	AREA  SQ. FT.	MINIMUM HEIGHT OF COVER IN FEET						
		SHEET THICKNESS IN INCHES (GAUGE)						
		0.109 (12)	0.138 (10)	0.168 (8)	0.188 (7)	0.218 (5)	0.249 (3)	0.280 (1)
60	20	43	50	58	63	71	79	88
66	24	36	42	48	51	58	64	70
72	28	32	36	40	43	48	53	58
78	33	28	32	35	38	41	45	49
84	38	26	29	32	33	36	39	43
90	44	24	27	29	30	33	35	38
96	50	23	25	27	28	30	32	34
102	57	22	23	25	26	28	29	31
108	64	21	22	24	25	26	27	29
114	71	20	21	23	23	25	26	27
120	78	20	21	22	22	23	24	25
132	95	19	20	20	21	22	22	23
144	113	18	19	20	20	21	21	22
156	133	18	18	19	19	20	20	21
168	154	17	18	18	19	19	19	20
180	177	15	18	18	18	19	19	19
192	201		18	18	18	18	19	19
204	227		17	18	18	18	18	18
216	254			17	18	18	18	18
228	284			17	17	18	18	18
240	314				16	17	18	18

NOTES:

- COVER HEIGHTS INDICATED 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 1/2 DIAMETER. THIS COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(DIAMETER + 36") ON EACH SIDE OF THE PIPE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2.0' OR 1/2 DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERSECTION SYSTEMS.
- STRUCTURAL PLATE PIPE DIMENSIONS ARE TO INSIDE CREST AND ARE SUBJECT TO MANUFACTURING TOLERANCES.
- SEE STANDARD PB-1 FOR BEDDING AND BACKFILL REQUIREMENTS.

SHEET 8 OF 18

STRUCTURAL PLATE STEEL PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

SPECIFICATION  
REFERENCE

232  
302

REV. 7/05  
107.12

VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURAL PLATE ALUMINUM ALLOY PIPE 9" x 2 1/2" CORRUGATIONS								
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET						
		SHEET THICKNESS IN INCHES						
		0.10	0.125	0.15	0.175	0.20	0.225	0.25
60	20	29	32	35	38	41	45	48
66	24	26	28	31	33	35	38	40
72	28	24	25	27	29	31	33	35
78	33	22	24	25	26	28	29	31
84	38	21	22	23	25	26	27	28
90	44	20	21	22	23	24	25	26
96	50	19	20	21	22	23	23	24
102	57	18	20	20	21	22	22	23
108	64	17	19	20	20	21	21	22
114	71	16	19	19	20	20	21	21
120	78	15	18	19	19	20	20	20
132	95	14	18	18	19	19	19	19
144	113	12	18	18	18	18	19	19
156	133		17	18	18	18	18	18
168	154			17	18	18	18	18
180	177				17	18	18	18
192	201					17	17	17
204	227					14	16	17
216	254						13	15
228	284							13

NOTES:

- COVER HEIGHTS INDICATED IN TABLE ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION SHALL BE 1/2 DIAMETER. THIS COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(DIAMETER + 36") ON EACH SIDE OF THE PIPE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2.0' OR 1/2 DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AND ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- STEEL BOLTS ONLY TO BE USED. BOLTS ARE 3/4" DIAMETER HIGH STRENGTH TO MEET CURRENT AASHTO DESIGNATION M-164 AND GALVANIZED TO MEET CURRENT ASTM DESIGNATION A-394. BOLTS ARE TO BE LOCATED IN THE VALLEY AND CREST OF EACH CORRUGATION IN DOUBLE ROWS SPACED 1 1/4" APART.

SPECIFICATION REFERENCE
232 302

STRUCTURAL PLATE ALUMINUM ALLOY PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

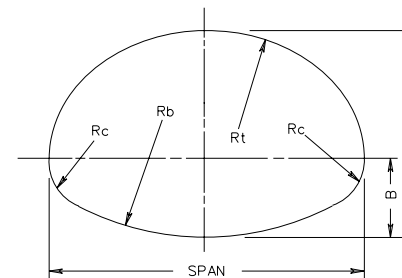
PC-1

MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES  
6" x 2" CORRUGATIONS

PIPE ARCH DIMENSION				MINIMUM SHEET THICKNESS REQUIRED GAUGE	MAXIMUM ALLOWABLE COVER HEIGHT IN FEET	
NOMINAL SIZE		AREA SQ. FT.	Rc INCHES		MAXIMUM CORNER PRESSURE	
SPAN	RISE				4000 LBS./SQ.FT. (SEE NOTE 4)	6000 LBS./SQ.FT. (SEE NOTE 6)
6'-1"	4'-7"	22	18	12	16	24
6'-4"	4'-9"	24	18	12	15	23
6'-9"	4'-11"	26	18	12	14	22
7'-0"	5'-1"	28	18	12	14	21
7'-3"	5'-3"	31	18	12	13	20
7'-8"	5'-5"	33	18	12	12	19
7'-11"	5'-7"	35	18	12	12	18
8'-2"	5'-9"	38	18	12	12	18
8'-7"	5'-11"	40	18	12	11	17
8'-10"	6'-1"	43	18	12	11	16
9'-4"	6'-3"	46	18	12	10	16
9'-6"	6'-5"	49	18	12	10	15
9'-9"	6'-7"	52	18	12	10	15
10'-3"	6'-9"	55	18	12	9	14
10'-8"	6'-11"	58	18	12	9	14
10'-11"	7'-1"	61	18	12	9	13
11'-5"	7'-3"	64	18	12	8	13
11'-7"	7'-5"	67	18	12	8	12
11'-10"	7'-7"	71	18	12	8	12
12'-4"	7'-9"	74	18	12	8	12
12'-6"	7'-11"	78	18	12	8	12
12'-8"	8'-1"	81	18	12	7	11
12'-10"	8'-4"	85	18	12	7	11
13'-5"	8'-5"	89	18	12	7	11
13'-11"	8'-7"	93	18	12	7	10
14'-1"	8'-9"	97	18	12	7	10
14'-3"	8'-11"	101	18	12	6	10
14'-10"	9'-1"	105	18	12	6	10
15'-4"	9'-3"	109	18	12	6	9
15'-6"	9'-5"	113	18	12	6	9
15'-8"	9'-7"	118	18	12	6	9
15'-10"	9'-10"	122	18	12	6	9
16'-5"	9'-11"	126	18	12	6	9
16'-7"	10'-1"	131	18	12	6	9

NOTES

- COVER HEIGHTS INDICATED IN TABLE ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION SHALL BE 1/2 SPAN. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE ARCH. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(HHEIGHT + 1/2 SPAN) ON EACH SIDE OF THE STRUCTURE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2.0' OR 1/2 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 SPAN, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- WHEN DESIGN HEIGHT OF COVER REQUIRES THE USE OF THIS CATEGORY OF PIPE, BEDDING AND BACKFILL MUST BE APPROVED BY THE ENGINEER.
- STRUCTURAL PLATE PIPE-ARCH DIMENSIONS ARE TO INSIDE OF CREST AND ARE SUBJECT TO MANUFACTURING TOLERANCES.



SHEET 10 OF 18

STRUCTURAL PLATE STEEL PIPE ARCH  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD  
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

232  
302

REV. 7/05  
107.14

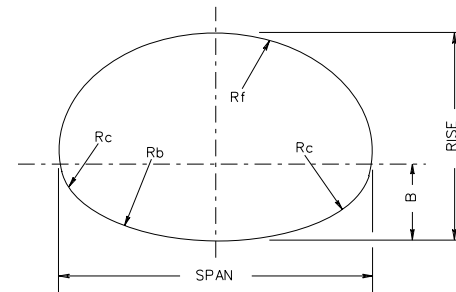
MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES  
6" x 2" CORRUGATIONS

PIPE ARCH DIMENSION				MINIMUM SHEET THICKNESS REQUIRED GAUGE	MAXIMUM ALLOWABLE COVER HEIGHT IN FEET	
SPAN	RISE	AREA SQ. FT.	Rc INCHES		MAXIMUM CORNER PRESSURE	
					4000 LBS./SQ. FT. (SEE NOTE 4)	6000 LBS./SQ. FT. (SEE NOTE 6)
13'-3"	9'-4"	97	31	12	12	18 ☉
13'-6"	9'-6"	102	31	12	12	17 ☉
14'-0"	9'-8"	105	31	12	12	17 ☉
14'-2"	9'-10"	109	31	12	12	16 ☉
14'-5"	10'-0"	114	31	12	11	16 ☉
14'-11"	10'-2"	118	31	12	11	16 ☉
15'-4"	10'-4"	123	31	12	11	15 ☉
15'-7"	10'-6"	127	31	12	11	15 ☉
15'-10"	10'-8"	132	31	12	10	14 ☉
16'-3"	10'-10"	137	31	12	10	14 ☉
16'-6"	11'-0"	142	31	12	10	14 ☉
17'-0"	11'-2"	146	31	12	10	14 ☉
17'-2"	11'-4"	151	31	12	10	13 ☉
17'-5"	11'-6"	157	31	12	9	13 ☉
17'-11"	11'-8"	161	31	12	9	13 ☉
18'-1"	11'-10"	167	31	12	9	13 ☉
18'-7"	12'-0"	172	31	12	9	12 ☉
18'-9"	12'-2"	177	31	12	9	12 ☉
19'-3"	12'-4"	182	31	10	8	13
19'-6"	12'-6"	188	31	10	8	13
19'-8"	12'-8"	194	31	10	8	13
19'-11"	12'-10"	200	31	10	8	12
20'-5"	13'-0"	205	31	10	8	12
20'-7"	13'-2"	211	31	10	8	12

☉ MAXIMUM COVER HEIGHTS SHOWN MAY BE INCREASED BY A MAXIMUM OF 12" IF A SHEET THICKNESS GREATER THAN 12 GAUGE IS USED.

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION SHALL BE 1/2 SPAN. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE ARCH. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(HHEIGHT + 1/2 SPAN) ON EACH SIDE OF THE STRUCTURE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 1/4 SPAN. IN CASES IN WHICH THIS COVER HEIGHT CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1/8 SPAN WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- STRUCTURAL PLATE PIPE-ARCH DIMENSIONS ARE TO INSIDE OF CREST AND ARE SUBJECT TO MANUFACTURING TOLERANCES.
- WHEN DESIGN HEIGHT OF COVER REQUIRES THE USE OF THIS CATEGORY OR PIPE, BEDDING AND BACKFILL MUST BE APPROVED BY THE ENGINEER.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. 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 STEEL PIPE ARCH  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

107.15

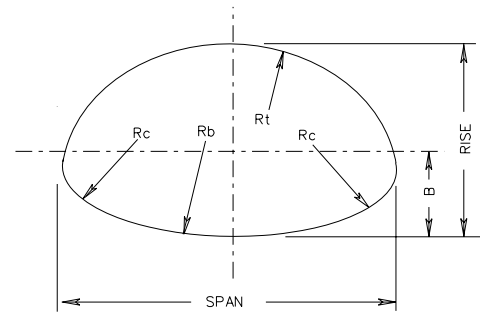
PC-1

STRUCTURAL PLATE ALUMINUM ALLOY PIPE ARCHES  
9' x 2 1/2" CORRUGATIONS

SPAN	RISE	CORNER RADIUS	MAXIMUM COVER HEIGHT IN FEET								AREA SQ.FT.
			MINIMUM SHEET THICKNESS IN INCHES								
			MAXIMUM CORNER PRESSURE IN LBS./SQ. FT.								
			0.100"		0.125"		0.150"		0.175"		
4000 (SEE NOTE 4)	4000 (SEE NOTE 4)	6000 (SEE NOTE 6)	4000 (SEE NOTE 4)	6000 (SEE NOTE 6)	4000 (SEE NOTE 6)	4000 (SEE NOTE 6)	6000 (SEE NOTE 6)	6000 (SEE NOTE 6)			
6'-2"	5'-0"	31.8	25	28	36	28	42	28	42	24.7	
6'-7"	4'-11"	31.8	23	26	34	26	40	26	40	26.6	
6'-7"	5'-8"	31.8	23	26	34	26	40	26	40	29.6	
6'-11"	5'-9"	31.8	22	25	32	25	38	25	38	31.9	
7'-3"	5'-11"	31.8	21	24	31	24	36	24	36	34.3	
7'-9"	6'-0"	31.8	20	22	29	22	34	22	34	36.8	
8'-1"	6'-1"	31.8	19	21	28	21	32	21	32	39.3	
8'-5"	6'-3"	31.8	18	20	27	20	31	20	31	41.9	
8'-10"	6'-4"	31.8	17	20	25	20	30	20	30	44.5	
9'-3"	6'-5"	31.8	16	19	24	19	28	19	28	45.1	
9'-7"	6'-6"	31.8	16	18	23	18	27	18	27	49.9	
9'-11"	6'-8"	31.8	15	17	22	17	26	17	26	52.7	
10'-3"	6'-9"	31.8	15	17	22	17	25	17	25	55.5	
10'-9"	6'-10"	31.8	14	16	21	16	24	16	24	58.4	
11'-1"	7'-0"	31.8	14	15	20	15	23	15	23	61.4	
11'-5"	7'-1"	31.8	13	15	19	15	23	15	23	64.4	
11'-9"	7'-2"	31.8	13	15	19	15	22	15	22	67.5	
12'-3"	7'-3"	31.8	12	14	18	14	21	14	21	70.5	
12'-7"	7'-5"	31.8	12	14	18	14	21	14	21	73.7	
12'-11"	7'-6"	31.8	12	13	17	13	20	13	20	77.0	
13'-1"	8'-2"	31.8	11	13	17	13	20	13	20	83.0	
13'-1"	8'-4"	31.8	11	13	17	13	20	13	20	86.8	
13'-11"	8'-5"	31.8	11	12	16	12	19	12	19	90.3	
14'-0"	8'-7"	31.8	11	12	16	12	18	12	18	94.2	
13'-11"	9'-5"	31.8	11	12	16	12	19	12	19	101.5	
14'-3"	9'-7"	31.8	10	12	15	12	18	12	18	105.7	
14'-8"	9'-8"	31.8		12	14	12	17	12	18	109.9	
14'-11"	9'-10"	31.8		11	13	11	16	11	17	114.2	
15'-4"	10'-0"	31.8		11	12	11	14	11	17	118.6	
15'-7"	10'-2"	31.8		11	11	11	14	11	16	123.1	
16'-1"	10'-4"	31.8		10		10	12	10	15	127.6	
16'-4"	10'-6"	31.8				10	12	10	14	132.3	
16'-9"	10'-8"	31.8				10	11	10	13	136.9	
17'-0"	10'-10"	31.8				10		10	12	141.8	
17'-3"	11'-0"	31.8				10		10	12		
18'-0"	11'-4"	31.8						9	10		

NOTES:

- COVER HEIGHTS INDICATED IN TABLE ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION TO BE 1/2 SPAN. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE ARCH. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(RISE + 1/2 SPAN) ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES SHALL BE 2.0' OR 1/4 SPAN, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 SPAN, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED.
- SEE STANDARD PB-1 FOR BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- WHEN DESIGN HEIGHT OF COVER REQUIRES THE USE OF THIS CATEGORY OF PIPE, BEDDING AND BACKFILL MUST BE APPROVED BY THE ENGINEER.
- BOLTS ARE 3/4" DIAMETER, HIGH STRENGTH TO MEET CURRENT A.S.T.M. DESIGNATION M-164 AND GALVANIZED TO MEET CURRENT A.S.T.M. DESIGNATION A-394. BOLTS ARE TO BE LOCATED IN THE VALLEY AND CREST OF EACH CORRUGATION IN DOUBLE ROWS SPACED 1 1/4" APART.
- STRUCTURAL PLATE PIPE-ARCH DIMENSIONS ARE TO INSIDE CREST AND ARE SUBJECT TO MANUFACTURING TOLERANCES.



SHEET 12 OF 18

STRUCTURAL PLATE ALUMINUM ALLOY PIPE ARCH  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

SPECIFICATION  
REFERENCE

REV. 7/05  
107.16

VIRGINIA DEPARTMENT OF TRANSPORTATION

232  
302



ALUMINUM SPIRAL RIB PIPE 3/4" WIDE x 3/4" DEEP RIBS SPACED @ 7 1/2"						
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET				MINIMUM SHEET THICKNESS FOR ENTRANCE PIPES WITH LESS THAN 1 FT. COVER INCHES (GAUGE)
		SHEET THICKNESS IN INCHES (GAUGE)				
		0.064 (16)	0.079 (14)	0.109 (12)	0.135 (10)	
12	0.8	18	95	100		0.064 (16)
15	1.2	18	57	78	100	0.109 (12)
18	1.8	18	40	52	65	0.135 (10)
21	2.4	18	31	39	47	
24	3.1	17	26	32	37	
27	4.0	17	24	27	31	
30	4.9	17	22	24	27	
36	7.1	16	20	21	23	
42	9.6	16	18	19	20	
48	12.6		18	18	19	
54	16.0			18	18	
60	19.6			18	18	
66	23.8				18	
72	28.3				17	

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 20 DIAMETERS ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2'0" OR 1/2" DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1'0" OR 1/4" DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9" FOR PIPE DIAMETERS LESS THAN OR EQUAL TO 18" OR 12" OR 1/4" DIAMETER, WHICHEVER IS GREATER, FOR PIPE DIAMETERS GREATER THAN 18".
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERSECTION SYSTEMS.
- 16 GAUGE PIPE LIMITED TO THOSE LOCATIONS WHERE PIPE DIAMETER PLUS COVER IS LESS THAN 20'.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 2)
12" TO 24"	18"
30" AND OVER	EQUAL TO DIAMETER

SPECIFICATION REFERENCE
232 302

ALUMINUM SPIRAL RIB PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD  
VIRGINIA DEPARTMENT OF TRANSPORTATION

PC-1

STEEL SPIRAL RIB PIPE 3/4" WIDE x 3/4" RIBS SPACED @ 7 1/2"					
PIPE DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET			MINIMUM SHEET THICKNESS FOR ENTRANCE PIPES WITH LESS THAN 1 FT. COVER INCHES (GAUGE)
		SHEET THICKNESS IN INCHES (GAUGE)			
		0.064 (16)	0.079 (14)	0.109 (12)	
12	0.8	18			0.064 (16)
15	1.2	18			0.064 (16)
18	1.8	18	92	130	0.064 (16)
21	2.4	18	64	88	0.079 (14)
24	3.1	17	48	65	0.109 (12)
27	4.0	17	39	50	
30	4.9	17	33	41	
36	7.1	16	26	31	
42	9.6	16	23	26	
48	12.6	15	21	23	
54	16.0	15	19	21	
60	19.6	14	19	20	
66	23.8		18	19	
72	28.3		18	18	
78	33.2			18	
84	38.6			18	

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. 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 PIPE OR TO THE INTERSECTION WITH THE CUT.
- MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2.0' OR 1/2' DIAMETER, WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/4' DIAMETER, WHICHEVER IS GREATER, WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9" FOR PIPE DIAMETERS LESS THAN OR EQUAL TO 24" AND 12" OR 1/4' DIAMETER, WHICHEVER IS GREATER, FOR PIPE DIAMETERS GREATER THAN 24". WHERE POLYMER COATED PIPE WILL BE USED AND THE SURFACE OVER THE TOP OF THE PIPE WILL BE ASPHALT, CLASS 1 BACKFILL MATERIAL IS TO BE PLACED UP TO A MINIMUM OF 6" ABOVE THE TOP OF THE PIPE.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- 16 GAUGE PIPE LIMITED TO THOSE LOCATIONS WHERE PIPE DIAMETER PLUS COVER IS LESS THAN 20'.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL CORRUGATED METAL STRUCTURE INTERACTION SYSTEMS.
- A MAXIMUM HEIGHT OF COVER TABLE FOR STEEL SPIRAL RIB WITH 3/4" WIDE x 1" DEEP RIBS SPACED AT 1 1/2" IS AVAILABLE UPON REQUEST.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 4)
12" TO 30"	18"
36" AND ABOVE	1/2' DIAMETER

SHEET 14 OF 18

STEEL SPIRAL RIB PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

SPECIFICATION  
REFERENCE

232  
302

REV. 7/05  
107.18

VIRGINIA DEPARTMENT OF TRANSPORTATION

CAST IRON PIPE CULVERT DESIGNATION				
DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER IN FEET		
		1-13	14-21	22-35 (2)
12 (2)	0.8	STANDARD PIPE	HEAVY PIPE	EXTRA HEAVY PIPE
15 (3)	1.2			
16 (2) (4)	1.4			
18 (1)	1.8			
24 (1)	3.1			
30 (1)	4.9			
36 (1)	7.1			
42 (2)	9.6			
48 (2)	12.6			

- (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 15" PIPE CULVERT AT NO INCREASE IN PRICE BID FOR 15" PIPE, WHERE APPROVED BY THE ENGINEER.
- (5) CRUSHING STRENGTH (LBS. PER LIN. FT. )

NOTES:

- 1. MAXIMUM HEIGHT OF COVER SHOWN IN TABLE IS FOR FINISHED CONSTRUCTION.
- 2. TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION IS TO BE 24". THIS COVER IS TO EXTEND THE FULL LENGTH OF THE PIPE CULVERT. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10 (DIAMETER + 36") ON EACH SIDE OF THE CULVERT, OR TO THE INTERSECTION WITH A CUT.
- 3. MINIMUM FINISHED HEIGHT OF COVER TO BE 24", EXCEPT PIPE UNDER ENTRANCES AND MEDIAN CROSSOVERS WHERE A 9" MINIMUM WILL BE PERMITTED.
- 4. SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.

SPECIFICATION  
REFERENCE

232  
302

CAST IRON PIPE  
HEIGHT OF COVER TABLE FOR H-20 LIVE LOAD

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

107.19

PC-1

POLYETHYLENE CORRUGATED PIPE (PE) (SEE NOTE 6)		
DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER FEET
12	0.8	21
15	1.2	21
18	1.8	20
24	3.1	20
30	4.9	19
36	7.1	18
42	7.1	18
48	7.1	17

POLYVINYLCHLORIDE RIBBED PIPE (PVC)		
DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER FEET
18	1.7	20
21	2.3	19
24	3.0	19
30	4.7	18
36	6.9	18
48	12.3	18

NOTES:

- COVER HEIGHTS INDICATED IN TABLES ARE FOR FINISHED CONSTRUCTION.
- TO PROTECT PIPE DURING CONSTRUCTION, MINIMUM HEIGHT OF COVER TO BE IN ACCORDANCE WITH TABLE A PRIOR TO ALLOWING CONSTRUCTION TRAFFIC TO CROSS INSTALLATION. THE COVER SHALL EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL IS TO EXTEND A MINIMUM OF 10(DIAMETER + 1/2 DIAMETER) ON EACH SIDE OF THE PIPE OR TO THE INTERSECTION WITH A CUT.
- STANDARD MINIMUM FINISHED HEIGHT OF COVER FOR ALL PIPES, EXCEPT THOSE UNDER ENTRANCES, SHALL BE 2.0' OR 1/2 DIAMETER WHICHEVER IS GREATER. IN CASES IN WHICH THESE COVER HEIGHTS CANNOT BE ACHIEVED, AN ABSOLUTE MINIMUM FINISHED COVER HEIGHT OF 1.0' OR 1/8 DIAMETER WHICHEVER IS GREATER WILL BE ALLOWED ONLY IF ALL POSSIBLE MEANS TO OBTAIN THE STANDARD VALUE HAVE BEEN EXHAUSTED. THE MINIMUM FINISHED HEIGHT OF COVER FOR PIPES UNDER ENTRANCES IS 9" FOR PIPE DIAMETERS LESS THAN OR EQUAL TO 24" AND 12" OR 1/8 DIAMETER, WHICHEVER IS GREATER, FOR PIPE DIAMETERS GREATER THAN 24". WHERE THE SURFACE OVER THE TOP OF THE PIPE WILL BE ASPHALT, A MINIMUM OF 6" OF CLASS 1 BACKFILL MATERIAL IS TO BE PLACED BETWEEN THE TOP OF THE PIPE AND THE BOTTOM OF THE ASPHALT.
- SEE STANDARD PB-1 FOR PIPE BEDDING AND BACKFILL REQUIREMENTS.
- THE MAXIMUM HEIGHT OF COVER SHOWN IN THE TABLES IS BASED ON A SOIL MODULUS OF 700 PSI. ALL OTHER DESIGN CRITERIA ARE IN ACCORDANCE WITH THE AASHTO SPECIFICATIONS AND VDOT MODIFICATIONS FOR SOIL THERMOPLASTIC PIPE INTERACTION SYSTEMS.
- HEIGHT OF COVER VALUES FOR 12" TO 36" DIAMETER APPLY TO TYPE C, D, OR S. HEIGHT OF COVER VALUES FOR 42" AND 48" APPLY TO TYPE D ONLY.

TABLE A	
PIPE DIAMETER	MINIMUM COVER HEIGHT DURING CONSTRUCTION (SEE NOTE 4)
12" TO 30"	18"
36" AND ABOVE	1/2 DAMETER

PLASTIC PIPE

EXTRA STRENGTH CLAY PIPE		
DIAMETER INCHES	AREA SQ. FT.	MAXIMUM HEIGHT OF COVER FEET
12	0.8	19
15	1.2	15
18	1.8	15
21	2.4	15
24	3.1	15
30	4.9	13
36	7.1	13

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 36". THIS COVER IS TO EXTEND THE FULL LENGTH OF THE PIPE. THE APPROACH FILL RAMP IS TO EXTEND A MINIMUM OF 10(DIAMETER + 36") ON EACH SIDE OF THE PIPE, OR TO THE INTERSECTION WITH A CUT.
- MINIMUM FINISHED HEIGHT OF COVER TO BE 24", EXCEPT PIPE UNDER ENTRANCES WHERE A 9" MINIMUM WILL BE PERMITTED.
- METHOD A BEDDING IS TO BE USED FOR ALL INSTALLATIONS UNLESS OTHERWISE DESIGNATED ON THE PLANS.

VITRIFIED CLAY

SHEET 16 OF 18

VITRIFIED CLAY AND PLASTIC PIPE  
HEIGHT OF COVER TABLES FOR H-20 LIVE LOAD

SPECIFICATION  
REFERENCE

232  
302

REV. 7/05  
107.20

VIRGINIA DEPARTMENT OF TRANSPORTATION

TABLE A - ALLOWABLE TYPE OF PIPE CULVERT FOR ROADWAYS THAT ARE CONSTRUCTED, FUNDED OR WILL ULTIMATELY BE MAINTAINED BY VDOT					
FUNCTIONAL CLASSIFICATION OF ROADS SYSTEM UNDER WHICH PIPE IS TO BE INSTALLED					ENTRANCE PIPE
HIGHER FUNCTIONAL CLASS - HFC RURAL PRINCIPAL ARTERIAL, URBAN PRINCIPAL ARTERIAL, RURAL MINOR ARTERIAL, URBAN MINOR ARTERIAL, RURAL COLLECTOR ROADS, URBAN COLLECTOR STREETS, SUBDIVISION STREETS WITH AN ADT GREATER THAN 4000			LOWER FUNCTIONAL CLASS - LFC RURAL LOCAL ROADS, URBAN LOCAL STREETS, SUBDIVISION STREETS WITH AN ADT LESS THAN OR EQUAL TO 4000		
ALLOWABLE PIPE CULVERTS  NOTES 1 & 2	STATEWIDE EXCEPT LOCATIONS SHOWN IN TABLE B	LOCATION SHOWN IN TABLE B	STATEWIDE EXCEPT LOCATIONS SHOWN IN TABLE B	LOCATION SHOWN IN TABLE B	STATEWIDE
CONCRETE	✓	✓	✓	✓	✓
ALUMINUM COATED TYPE 2 CORRUGATED STEEL  NOTE 3	✓		✓		✓
POLYMER COATED (10/10) CORRUGATED STEEL  NOTE 3	✓	✓	✓	✓	✓
UNCOATED GALVANIZED CORRUGATED STEEL  NOTES 3 & 4					✓
GALVANIZED STEEL STRUCTURAL PLATE  NOTE 3			✓		✓
GALVANIZED STEEL STRUCTURAL PLATE WITH CONCRETE INVERT  NOTE 3	✓		✓	✓	✓
CORRUGATED ALUMINUM ALLOY  NOTE 3	✓	✓	✓	✓	✓
CORRUGATED ALUMINUM ALLOY STRUCTUAL PLATE  NOTE 3	✓	✓	✓	✓	✓
POLYVINYLCHLORIDE (PVC) RIBBED PIPE (SMOOTH INTERIOR)	✓	✓	✓	✓	✓
POLYETHYLENE (PE) CORRUGATED TYPE C	✓	✓	✓	✓	
POLYETHYLENE (PE) CORRUGATED TYPE S & D	✓	✓	✓	✓	✓

NOTES:

1. ALLOWABLE TYPES OF PIPES FOR A SPECIFIC AREA ARE TO CONFORM TO THE CRITERIA SHOWN IN TABLES A, A1, B, AND C. ANY DEVIATION MUST BE APPROVED BY THE STATE LOCATION AND DESIGN ENGINEER AND THE DISTRICT MATERIALS ENGINEER.
2. SEE HEIGHT OF COVER TABLES FOR MINIMUM AND MAXIMUM COVER LIMITATIONS FOR EACH TYPE OF PIPE.
3. SEE TABLE C FOR MINIMUM AND MAXIMUM pH, RESISTIVITY, AND VELOCITY LIMITATIONS FOR METAL PIPES.
4. USE ONLY UNDER ENTRANCES WHERE THE PIPE SIZE IS LESS THAN OR EQUAL TO 30" DIAMETER (OR EQUIVALENT) AND THE HEIGHT OF COVER IS LESS THAN OR EQUAL TO 15" AND AS AN OUTLET PIPE FOR STANDARD DI-13 SHOULDER SLOT INLETS.

SPECIFICATION REFERENCE
302 232

ALLOWABLE PIPE CRITERIA FOR CULVERTS AND STORM SEWERS

PC-1

TABLE A1 - ALLOWABLE TYPE OF STORM SEWER PIPE FOR ROADWAYS THAT ARE CONSTRUCTED, FUNDED OR WILL ULTIMATELY BE MAINTAINED BY VDOT			
FUNCTIONAL CLASSIFICATION OF ROADS SYSTEM UNDER WHICH PIPE IS TO BE INSTALLED			
HIGHER FUNCTIONAL CLASS - HFC RURAL PRINCIPAL ARTERIAL, URBAN PRINCIPAL ARTERIAL, RURAL MINOR ARTERIAL, URBAN MINOR ARTERIAL, RURAL COLLECTOR ROADS, URBAN COLLECTOR STREETS, SUBDIVISION STREETS WITH AN ADT GREATER THAN 4000		LOWER FUNCTIONAL CLASS - LFC RURAL LOCAL ROADS, URBAN LOCAL STREETS, SUBDIVISION STREETS WITH AN ADT LESS THAN OR EQUAL TO 4000	
ALLOWABLE PIPE CULVERTS NOTES 1 & 2	STATEWIDE	STATEWIDE EXCEPT LOCATIONS SHOWN IN TABLE B	LOCATION SHOWN IN TABLE B
CONCRETE	✓	✓	✓
CORRUGATED STEEL ALUMINUM COATED TYPE 2 FULLY CONCRETE LINED		✓	
NOTE 3			
ALUMINUM COATED TYPE 2 STEEL SPIRAL RIB		✓	
NOTE 3			
POLYMER COATED (10/10) CORRUGATED STEEL SPIRAL RIB		✓	✓
NOTE 3			
POLYMER COATED (10/10) CORRUGATED STEEL DOUBLE WALL (SMOOTH INTERIOR)		✓	✓
NOTE 3			
ALUMINUM SPIRAL RIB		✓	✓
NOTE 3			
POLYVINYLCHLORIDE (PVC) RIBBED PIPE (SMOOTH INTERIOR)		✓	✓
POLYETHYLENE (PE) CORRUGATED TYPE S AND TYPE D		✓	✓

TABLE B EXCEPTIONS TO STATEWIDE APPLICATIONS		
COUNTIES (INCLUDING TOWNS)		CITIES
ARLINGTON - EAST OF AND INCLUDING RTES. 95 & 395	SURRY - EAST OF AND INCLUDING RTE. 10	SUFFOLK - EAST OF AND INCLUDING RTE. 32
FAIRFAX - EAST OF AND INCLUDING RTES. 95 & 395	ISLE OF WIGHT - EAST OF AND INCLUDING RTE. 10	CHESAPEAKE WILLIAMSBURG VIRGINIA BEACH POQUOSON HAMPTON PORTSMOUTH
PRINCE WILLIAM - EAST OF AND INCLUDING RTES. 95 & 395		NEWPORT NEWS NORFOLK ALEXANDRIA FREDERICKSBURG
WESTMORELAND JAMES CITY	ESSEX NORTHAMPTON	
LANCASTER ACCOMACK	MIDDLESEX STAFFORD	
MATTHEWS SPOTSYLVANIA	YORK KING GEORGE	
GLOUCESTER NORTHUMBERLAND	RICHMOND	

TABLE C					
PIPE TYPE	ALLOWABLE pH RANGE		ALLOWABLE RESISTIVITY RANGE		ALLOWABLE VELOCITY (FPS) (SEE NOTE 5)
	MIN.	MAX.	MIN.	MAX.	MAXIMUM
ALUMINUM COATED TYPE 2 CORRUGATED STEEL	5.0	9.0	1500	-	5
GALVANIZED STEEL STRUCTURAL PLATE WITH CONCRETE INVERT	6.0	9.0	2000	10000	15
GALVANIZED STEEL STRUCTURAL PLATE	6.0	9.0	2000	7000	5
POLYMER COATED (10/10) CORRUGATED STEEL	4.0	9.0	750	-	15
UNCOATED GALVANIZED CORRUGATED STEEL	6.0	10.0	2000	7000	5
CORRUGATED ALUMINUM ALLOY	4.0	9.0	500	-	5
CORRUGATED ALUMINUM ALLOY STRUCTURAL PLATE	4.0	9.0	500	-	5
ALUMINUM SPIRAL RIB	4.0	9.0	500	-	5
ALUMINUM COATED TYPE 2 SPIRAL RIB	5.0	9.0	1500	-	5
CORRUGATED STEEL ALUMINUM COATED TYPE 2 FULLY CONCRETE LINED	5.0	9.0	1500	-	15
POLYMER COATED CORRUGATED STEEL SPIRAL RIB	4.0	9.0	750	-	15
POLYMER COATED CORRUGATED STEEL DOUBLE WALL	4.0	9.0	750	-	15

- NOTES:
1. ALLOWABLE TYPES OF PIPES FOR A SPECIFIC AREA ARE TO CONFORM TO THE CRITERIA SHOWN IN TABLES A, A1, B, AND C. ANY DEVIATION MUST BE APPROVED BY THE STATE LOCATION AND DESIGN ENGINEER AND THE DISTRICT MATERIALS ENGINEER.
  2. SEE HEIGHT OF COVER TABLES FOR MINIMUM AND MAXIMUM COVER LIMITATIONS FOR EACH TYPE OF PIPE.
  3. SEE TABLE C FOR MINIMUM AND MAXIMUM pH, RESISTIVITY, AND VELOCITY LIMITATIONS FOR METAL PIPES.
  4. USE ONLY UNDER ENTRANCES WHERE THE PIPE SIZE IS LESS THAN OR EQUAL TO 30" DIAMETER (OR EQUIVALENT) AND THE HEIGHT OF COVER IS LESS THAN OR EQUAL TO 15' AND AS AN OUTLET PIPE FOR STANDARD DI-13 SHOULDER SLOT INLETS.
  5. ALLOWABLE VELOCITY WHERE ABRASIVE BEDLOAD IS PRESENT OR ANTICIPATED; MAXIMUM VELOCITY BASED ON 10 YEAR DESIGN DISCHARGE (Q).

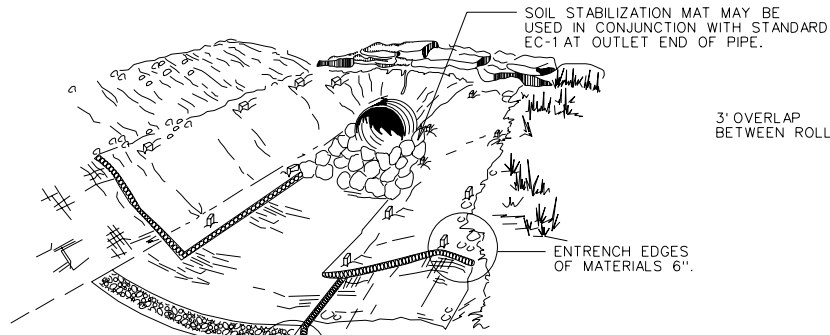
SPECIFICATION REFERENCE
302 232

ALLOWABLE PIPE CRITERIA FOR CULVERTS AND STORM SEWERS

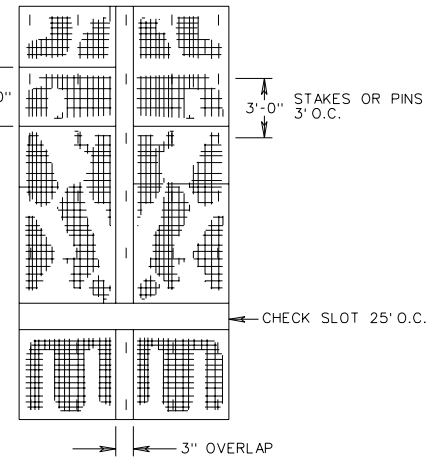
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05  
107.21

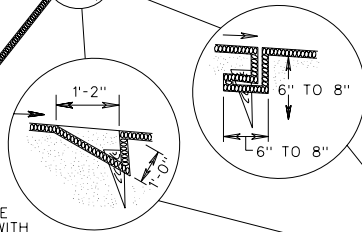
TYPICAL INSTALLATION AT END OF PIPE



STAKING DETAIL

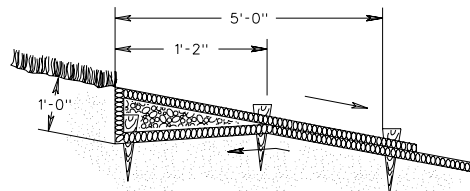


\* TRANSVERSE CLOSED CHECK SLOT



\* TRANSVERSE CHECK SLOT TO BE CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION FOR PREFERRED INSTALLATION.

\* TRANSVERSE OPEN CHECK SLOT



UPSTREAM AND DOWNSTREAM TERMINAL

NOTES:

1. STAKES SHALL BE WOOD OR METAL AS RECOMMENDED BY THE MANUFACTURER AND SHALL BE A MINIMUM OF 12" IN LENGTH. IN SANDY SOILS METAL STAKES A MINIMUM OF 18" IN LENGTH SHALL BE USED.
2. SOIL STABILIZATION MAT TYPE A AND B ARE TO BE IN ACCORDANCE WITH THE APPROVED PRODUCTS LIST.
3. SOIL STABILIZATION MAT SHOULD BE INSTALLED TO THE SHOULDER BREAK POINT OR EXISTING GROUND THEN EMBEDDED 6". MATERIAL ON BOTH SIDES OF THE DITCH SHALL BE INSTALLED TO THE SAME ELEVATIONS.
4. IF MORE THAN 3 LINES OF MATERIAL ARE REQUIRED PARALLEL TO THE  $\text{C}$  OF THE DITCH, MATERIAL SHALL BE INSTALLED PERPENDICULAR TO THE CENTER LINE OF THE DITCH, STARTING AT THE LOWEST  $\text{C}$  ELEVATION OF THE DITCH.
5. FOR SOURCES OF APPROVED MATERIALS SEE VDOT'S APPROVED PRODUCTS LIST FOR ST'D. EC-3, TYPE A OR B.

V DITCH

SPECIFICATION REFERENCE

606  
244

SOIL STABILIZATION MAT  
DITCH INSTALLATION TYPE A OR B

VIRGINIA DEPARTMENT OF TRANSPORTATION

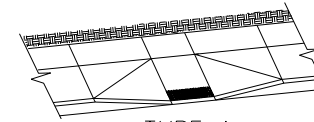
SHEET 1 OF 2

REV. 7/05

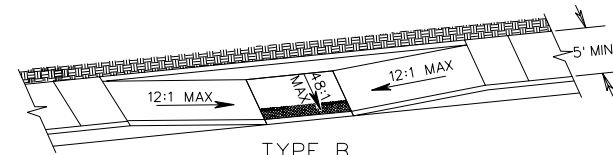
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GENERAL NOTES:

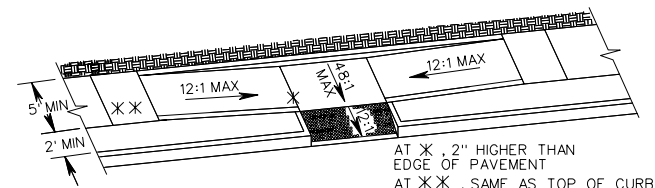
1. THE DETECTABLE WARNING SHALL BE PROVIDED BY TRUNCATED DOMES.
2. DETECTABLE WARNING TO BE CLASS A-3 CONCRETE (CLASS A-4 IF PRECAST) WITH SLIP RESISTANT INTEGRAL SURFACE COVERING THE FULL WIDTH OF THE RAMP FLOOR BY 2 FOOT IN LENGTH IN THE DIRECTION OF PEDESTRIAN TRAVEL. OTHER TYPES OF MATERIAL WITH THE TRUNCATED DOMES DETECTABLE WARNING MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
3. SLOPING SIDES OF CURB RAMP MAY BE POURED MONOLITHICALLY WITH RAMP FLOOR OR BY USING PERMISSIBLE CONSTRUCTION JOINT WITH REQUIRED BARS.
4. IF RAMP FLOOR IS PRECAST, HOLES MUST BE PROVIDED FOR DOWEL BARS SO THAT ADJOINING FLARED SIDES CAN BE CAST IN PLACE AFTER PLACEMENT OF PRECAST RAMP FLOOR. PRECAST CONCRETE SHALL BE CLASS A-4.
5. REQUIRED BARS ARE TO BE NO. 5 X 8" PLACED 1' CENTER TO CENTER ALONG BOTH SIDES OF THE RAMP FLOOR, MID-DEPTH OF RAMP FLOOR. MINIMUM CONCRETE COVER 1/2".
6. CURB / CURB AND GUTTER SLOPE TRANSITIONS ADJACENT TO CURB RAMPS ARE INCLUDED IN PAYMENT FOR CURB / CURB AND GUTTER.
7. CURB RAMPS ARE TO BE LOCATED AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THEY ARE TO BE PROVIDED AT INTERSECTIONS WHEREVER AN ACCESSIBLE ROUTE WITHIN THE RIGHT OF WAY OF A HIGHWAY FACILITY CROSSES A CURB REGARDLESS OF WHETHER SIDEWALK IS EXISTING, PROPOSED, OR NONEXISTENT. THEY MUST BE LOCATED WITHIN PEDESTRIAN CROSSWALKS AS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER, AND SHOULD NOT BE LOCATED BEHIND VEHICLE STOP LINES, EXISTING LIGHT POLES, FIRE HYDRANTS, DROP INLETS, ETC. ACCESSIBLE ROUTES PROVIDE A CONTINUOUS UNOBSTRUCTED, STABLE, FIRM AND SLIP RESISTANT PATH CONNECTING ALL ACCESSIBLE ELEMENTS OF A FACILITY THAT CAN BE APPROACHED, ENTERED AND USED BY PEDESTRIANS.
8. RAMPS MAY BE PLACED ON RADIAL OR TANGENTIAL SECTIONS PROVIDED THAT THE CURB OPENING IS PLACED WITHIN THE LIMITS OF THE CROSSWALK AND THAT THE SLOPE AT THE CONNECTION OF THE CURB OPENING IS PERPENDICULAR TO THE CURB.
9. TYPICAL CONCRETE SIDEWALK IS 4" THICK. WHEN THE ENTRANCE RADICANNOT ACCOMMODATE THE TURNING REQUIREMENTS OF ANTICIPATED HEAVY TRUCK TRAFFIC, REFER TO STANDARD CG-13, COMMERCIAL ENTRANCE (HEAVY TRUCK TRAFFIC) FOR CONCRETE DEPTH.
10. WHEN CURB RAMPS ARE USED IN CONJUNCTION WITH A SHARED USE PATH, THE MINIMUM WIDTH SHALL BE THE WIDTH OF THE SHARED USE PATH



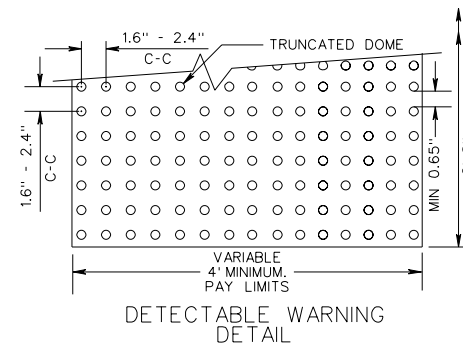
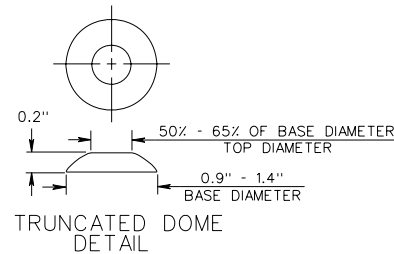
TYPE A  
PERPENDICULAR



TYPE B  
PARALLEL



TYPE C  
PARALLEL & PERPENDICULAR



SHEET 1 OF 4

CG-12 DETECTABLE WARNING SURFACE

GENERAL NOTES

VIRGINIA DEPARTMENT OF TRANSPORTATION

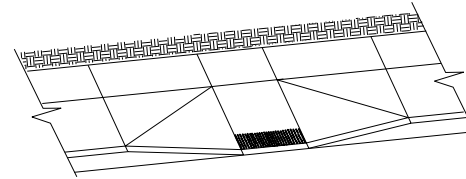
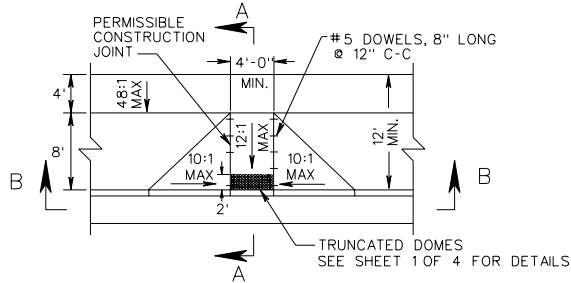
SPECIFICATION  
REFERENCE

105  
502

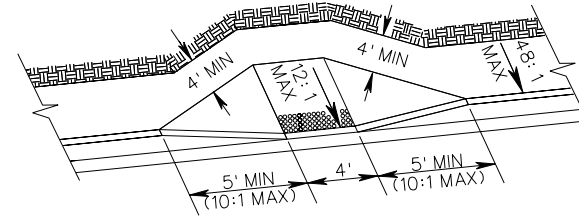
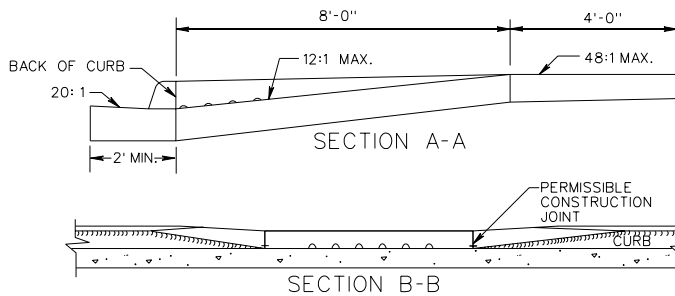
REV. 7/05  
203.05



CG-12

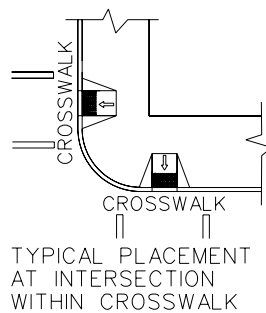


TYPICAL DESIGN

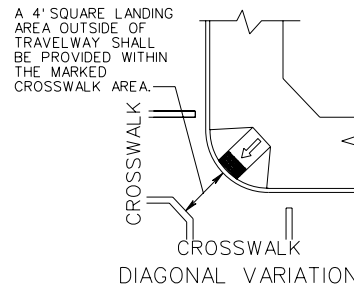


ALTERATIONS

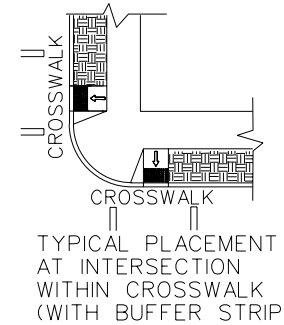
NOTE: FOR GENERAL NOTES ON THE DETECTABLE WARNING SURFACE, SEE SHEET 1 OF 4.



TYPICAL PLACEMENT AT INTERSECTION WITHIN CROSSWALK



DIAGONAL VARIATION



TYPICAL PLACEMENT AT INTERSECTION WITHIN CROSSWALK (WITH BUFFER STRIP)

THIS DESIGN TO BE USED FOR CONSTRUCTION THAT INCORPORATES WIDER SIDEWALK, LANDING (48" WIDE) REQUIRED AT TOP OF CURB RAMP. MINIMUM CURB RAMP LENGTH 8 FEET FOR NEW CONSTRUCTION, 6 FEET FOR ALTERATIONS.

SHEET 2 OF 4

SPECIFICATION REFERENCE

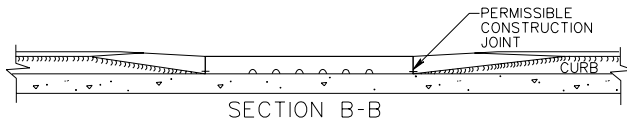
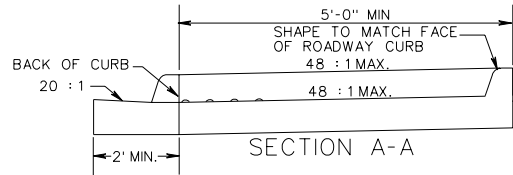
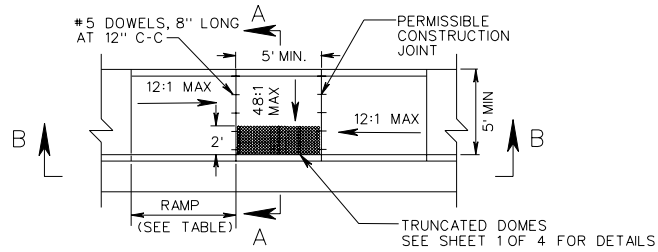
105  
502

CG-12 DETECTABLE WARNING SURFACE  
TYPE A (PERPENDICULAR) APPLICATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

NEW 7/05

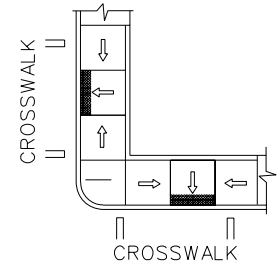
203.05A



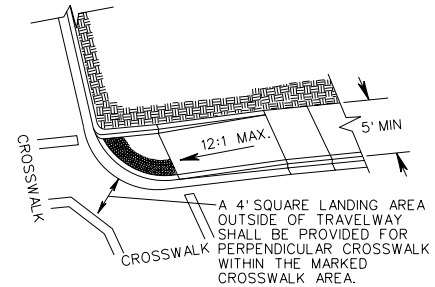
NOTE: FOR GENERAL NOTES ON THE DETECTABLE WARNING SURFACE, SEE SHEET 1 OF 4.

TYPE B PARALLEL APPLICATION		
ROADWAY GRADE IN PERCENT	MINIMUM RAMP LENGTH IN FEET	
	4" CURB	6" CURB
0	4	6
1	5	7
2	5	8
3	6	9
4	8	12
5	10	15
6	14	15

NOTE:  
THE REQUIRED LENGTH OF A PARALLEL RAMP IS LIMITED TO 15 FEET, REGARDLESS OF THE SLOPE.



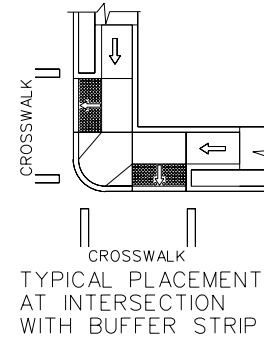
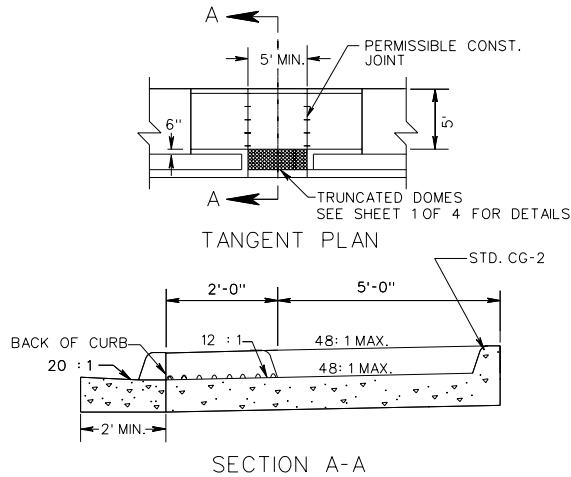
TYPICAL PLACEMENT  
AT INTERSECTION  
WITHIN CROSSWALK



SPECIFICATION REFERENCE
105 502

CG-12 DETECTABLE WARNING SURFACE  
TYPE B (PARALLEL) APPLICATION  
VIRGINIA DEPARTMENT OF TRANSPORTATION

CG-12

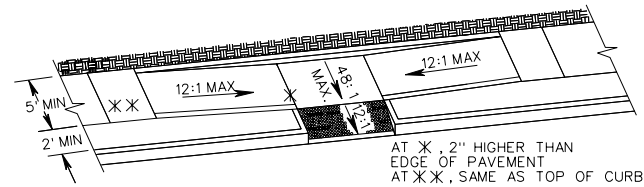


THE SELECTION OF CURB TYPE AND THE CONFIGURATION OF THE UTILITY STRIP MAY VARY TO MEET EXISTING FIELD CONDITIONS AND ROADWAY GEOMETRICS PROVIDING THE DIMENSIONS AND SLOPES ARE AS NOTED.

NOTE: FOR GENERAL NOTES ON THE DETECTABLE WARNING SURFACE, SEE SHEET 1 OF 4.

TYPE C PARALLEL & PERPENDICULAR APPLICATION		
ROADWAY GRADE IN PERCENT	MINIMUM RAMP LENGTH IN FEET	
	4" CURB	6" CURB
0	2	4
1	2	5
2	3	5
3	3	6
4	4	8
5	5	10
6	7	14
7	13	15
8	15	15

NOTE:  
THE REQUIRED LENGTH OF A PARALLEL RAMP IS LIMITED TO 15 FEET, REGARDLESS OF THE SLOPE.



THIS COMBINED (PARALLEL & PERPENDICULAR) DESIGN FOR ALTERATIONS CAN BE USED WITH ADJOINING BUFFER STRIP. LANDING AT BOTTOM OF TWO SLOPING SIDES WITH 60" X 60" MIN. DIMENSIONS. THE SHORT PERPENDICULAR RUN TO THE STREET CAN BE PROTECTED BY A LANDSCAPED SETBACK OR CONNECTED TO THE SIDEWALK WITH A WARPED SURFACE.

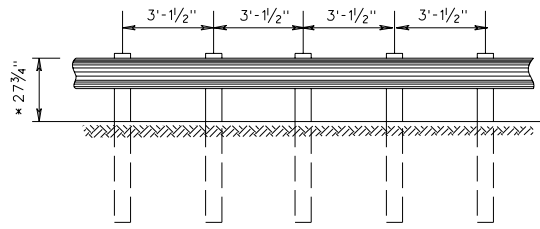
SHEET 4 OF 4

CG-12 DETECTABLE WARNING SURFACE  
TYPE C (PARALLEL & PERPENDICULAR) APPLICATION  
VIRGINIA DEPARTMENT OF TRANSPORTATION

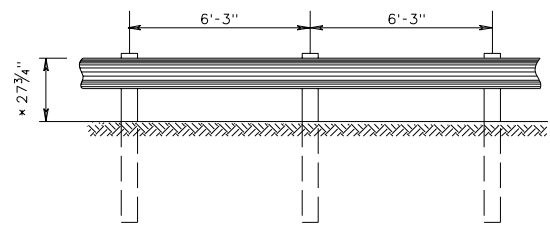
REV. 7/05  
203.07

SPECIFICATION  
REFERENCE

105  
502

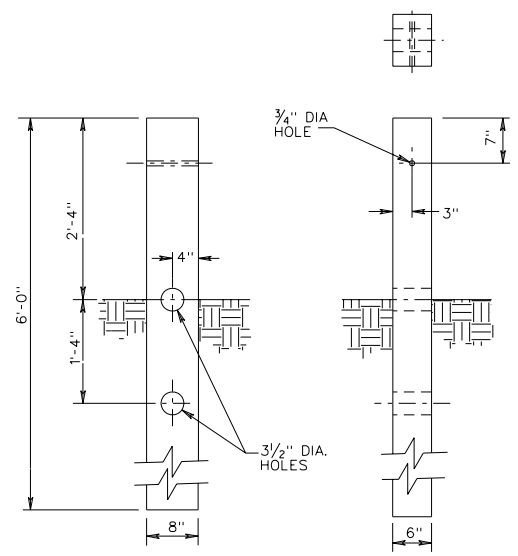


GR-2A  
(3'-1 1/2" POST SPACING)  
MAX DYNAMIC DEFLECTION = 2'



GR-2  
(6'-3" POST SPACING)  
MAX DYNAMIC DEFLECTION = 3'

\* HEIGHT TOLERANCE  $\pm 3/4"$



CRT POST

NOTES:

GUARDRAIL LOCATIONS SHOWN ON PLANS ARE APPROXIMATE ONLY AND CAN BE ADJUSTED DURING CONSTRUCTION IF AND AS DIRECTED BY THE ENGINEER.

FOR DETAILS OF POST AND BLOCKOUTS SEE SHEET NO. 501.05.

FOR DETAILS OF RAIL ELEMENT, RAIL SPLICE JOINT, W-BEAM BACK-UP PLATE, AND ASSOCIATED HARDWARE SEE SHEET NOS. 501.01 AND 501.02.

RAIL ELEMENTS ARE FURNISHED SHOP CURVED FOR RADI BETWEEN 5 FEET AND 150 FEET.

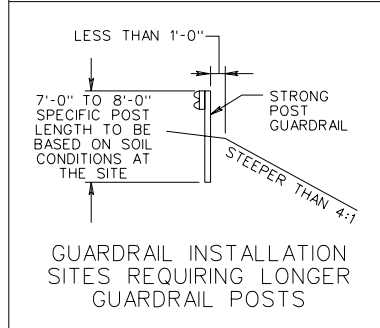
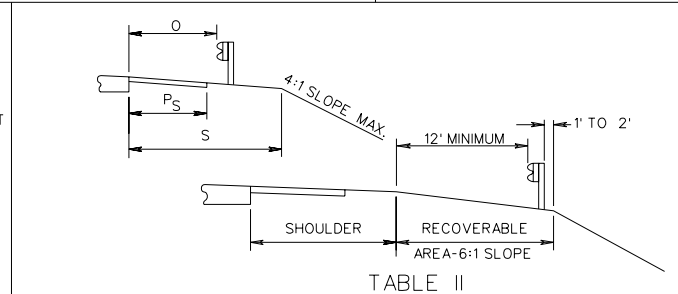
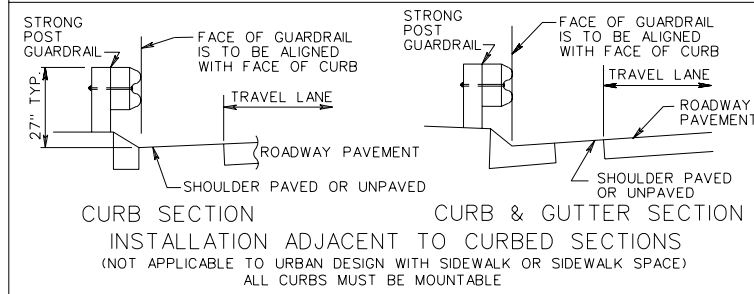
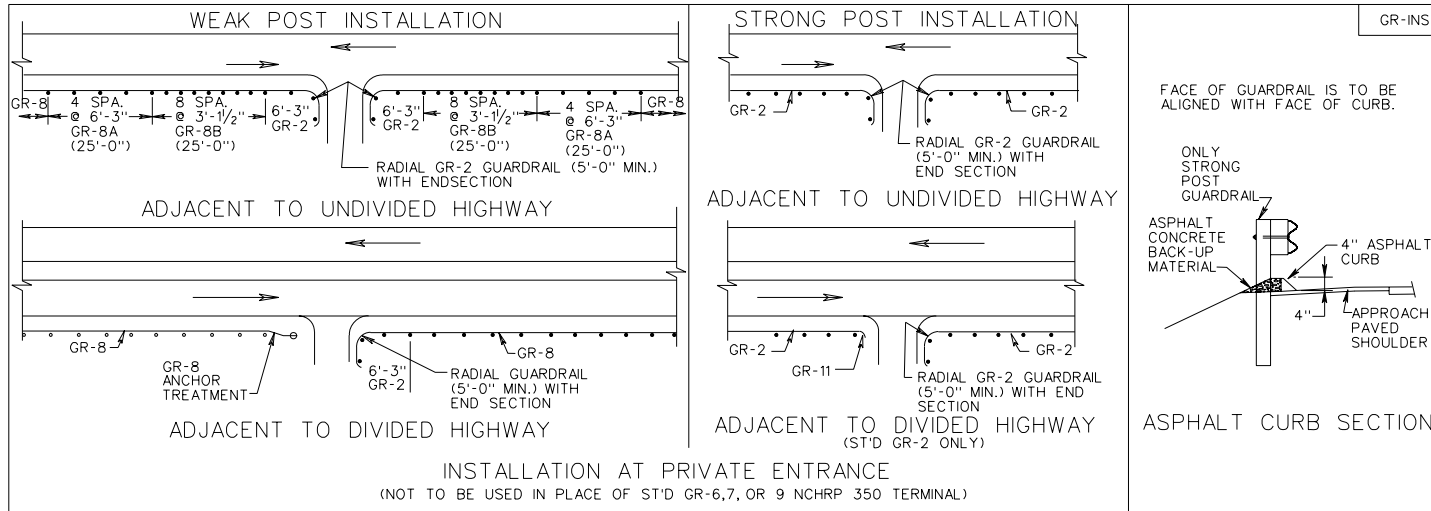
ALL GUARDRAIL POSTS SHALL BE SET PLUMB. POST SHALL NOT BE SET WITH A VARIATION OF MORE THAN 1/8" FROM VERTICAL. W-BEAM, BLOCKOUTS, AND POSTS SHALL BE SET AND ALIGNED WITHOUT ALTERATION OR FORCE, AS PER SECTION 505 OF THE SPECIFICATIONS.

ALL GR-2 AND GR-2A RAIL SHALL BE MAINTAINED AT A HEIGHT OF 27 3/4"  $\pm 3/4"$  TOLERANCE BASED OFF THE FINISHED GRADE CENTERLINE ELEVATION, PAVEMENT CROSS SLOPE, OR SHOULDER SLOPE.

ALL W-BEAM RAILS SHALL BE LAPPED IN THE DIRECTION OF VEHICULAR TRAVEL FOR THE FINISHED ROADWAY.

SPECIFICATION REFERENCE	STANDARD BLOCKED-OUT W BEAM GUARDRAIL (STRONG POST SYSTEM)
221 505	
VIRGINIA DEPARTMENT OF TRANSPORTATION	
REV. 7/05 501.04	





**TABLE I**  
NORMAL GUARDRAIL LOCATION-THROUGH TRAFFIC LANES LEFT OF TRAFFIC

SHOULDER WIDTH (S)	PAVED SHOULDER WIDTH (P <sub>S</sub> )	OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL (O)
15'	3', 4', 10' or 12'	12'
13'	3'	10'
12' (MED. 6 LANE)	10'	10'
11'	3'	8'
8' (MED.)	3' or 4'	5'

**TABLE II**  
NORMAL GUARDRAIL LOCATION-THROUGH TRAFFIC LANES RIGHT OF TRAFFIC

SHOULDER WIDTH (S)	PAVED SHOULDER WIDTH (P <sub>S</sub> )	OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL (O)
15'	6', 10' or 12'	12'
13'	8'	10'
11'	0, 3', 4' or 6'	8'
9'	0, 3' or 4'	6'
7'	0 or 3'	4'
5'	0 or 3'	2'

GUARDRAIL LOCATION ON RECOVERABLE SLOPE

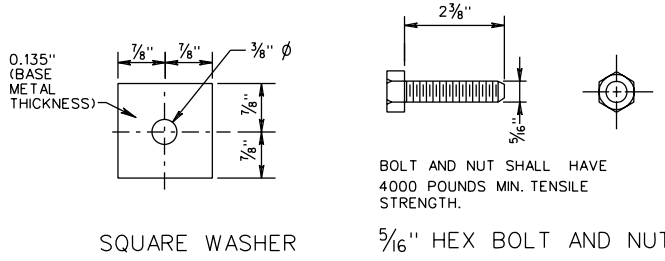
SPECIFICATION REFERENCE

221 505
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W BEAM GUARDRAIL INSTALLATION CRITERIA

INSERTABLE SHEET A95

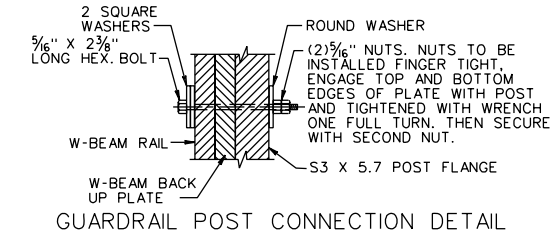
MB-5



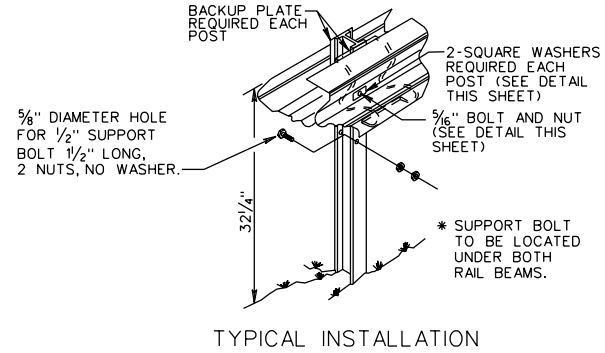
SQUARE WASHER

5/16" HEX BOLT AND NUT

⊗ THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN A.R.T.B.A. TECHNICAL BULLETIN NUMBER 268B MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.

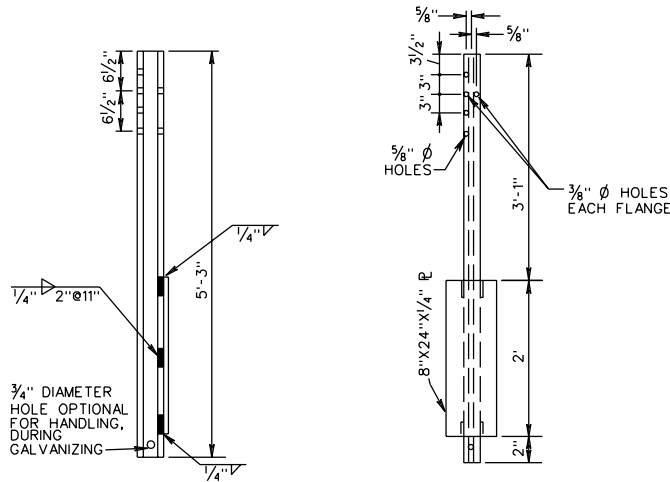


GUARDRAIL POST CONNECTION DETAIL



TYPICAL INSTALLATION

NOTES:  
 STANDARD MB-5 POST SPACING IS 12'-6"  
 STANDARD MB-5A POST SPACING IS 6'-3"  
 STANDARD MB-5B POST SPACING IS 3'-1/2"  
 STANDARD MB-5 DEFLECTION IS 7'-0"  
 ALL POSTS, BOLTS, NUTS AND WASHERS ARE TO BE GALVANIZED.  
 FOR DETAILS OF GUARDRAIL ELEMENT, HARDWARE, ETC. SEE SHEET NO. 501.01.  
 FOR DETAILS OF GUARDRAIL SPLICE JOINT, SEE STD. GR-8 DEPICTING AN NCHRP 350 TL-3 INSTALLATION.



FOR ROCK INSTALLATION, 8" X 24" X 1/4" PLATE IS TO BE ELIMINATED. DRILL OR EXCAVATE HOLE FOR POST, PLACE AND BACKFILL WITH CRUSHER RUN AGGREGATE TO LEVEL OF ROCK.

S3X5.7 STEEL POST

SHEET 1 OF 2

SPECIFICATION REFERENCE

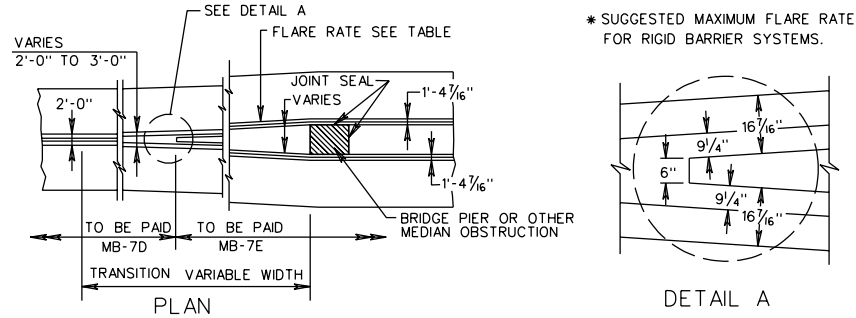
221  
505

STANDARD W BEAM MEDIAN BARRIER (WEAK POST SYSTEM)  
 TL-3 (>45 MPH)

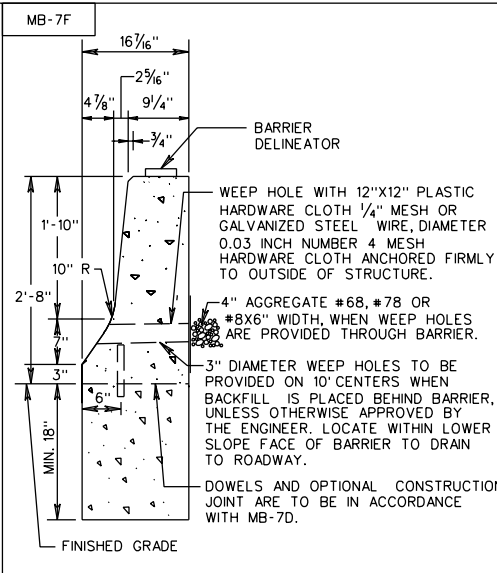
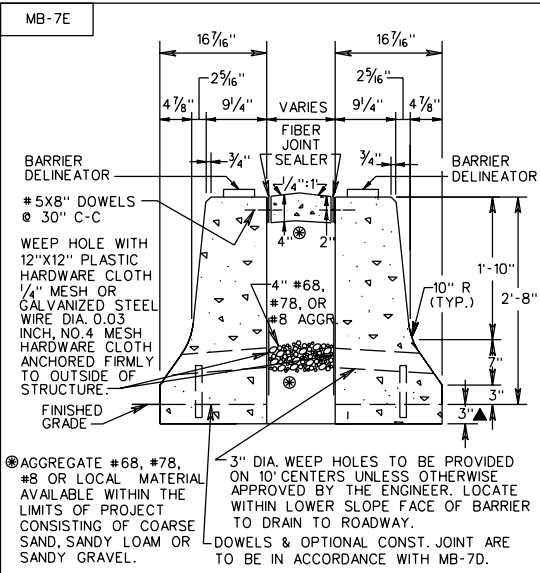
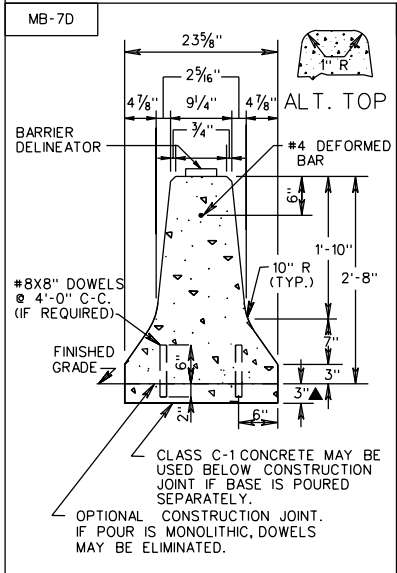
VIRGINIA DEPARTMENT OF TRANSPORTATION

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FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE	BEYOND SHY LINE	
MPH	SHY LINE LS	FLARE RATE	FLARE RATE
70	10'	30:1	20:1 *
60	8'	26:1	18:1 *
50	6.5'	21:1	14:1 *
40	5'	16:1	10:1 *
30	3.5'	13:1	8:1 *



NOTES:  
IF THE CONTRACTOR ELECTS TO USE THE OPTIONAL CONSTRUCTION JOINT, TRANSVERSE JOINTS FOR CRACK CONTROL AND EXPANSION JOINTS ARE TO BE PROVIDED IN BOTH FOOTING AND BARRIER AT THE SAME LOCATION.

TRANSVERSE JOINTS ARE TO COINCIDE WITH JOINTS IN ADJACENT PAVEMENT WITH A MAXIMUM SPACING OF 20 FEET C-C.

CONCRETE MEDIAN BARRIER MAY BE PRECAST, CAST IN PLACE OR SLIP-FORMED. FOR PRECAST DESIGN SEE STANDARD MB-7D PC.

HORIZONTAL REINFORCING STEEL BARS ARE TO BE SEPARATED AT ALL EXPANSION AND CONTRACTION JOINTS. A 2" CONCRETE COVER IS REQUIRED OVER THE ENDS OF THE REINFORCING STEEL.

BARRIER DELINEATOR SIZE, COLOR, AND SPACING TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.

COST OF DELINEATOR TO BE INCLUDED IN THE PRICE BID FOR MEDIAN BARRIER. REFLECTIVE SURFACE OF BARRIER DELINEATOR IN ALL INSTANCES, TO BE FACING ONCOMING TRAFFIC.

ALTERNATE TOP DESIGN SHOWN ON MB-7D. MAY ALSO BE APPLIED TO MB-7E AND MB-7F. CONCRETE TO BE CLASS A3 IF CAST IN PLACE, 4000 PSI IF PRECAST.

▲ DEPTH OF CONCRETE BASE MAY BE EXTENDED AT THE CONTRACTOR'S OPTION TO COINCIDE WITH BOTTOM OF PAVEMENT COURSE IN WHICH BASE TERMINATES; HOWEVER THE COST OF ADDITIONAL CONCRETE SHALL BE INCLUDED IN UNIT PRICE BID PER LINEAR FOOT OF BARRIER.

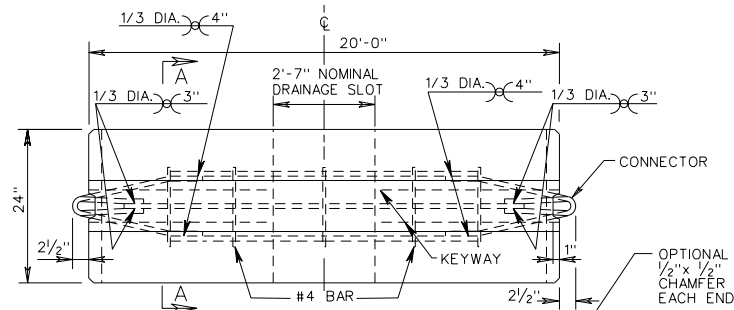
SPECIFICATION REFERENCE
105 502

CONCRETE MEDIAN BARRIER

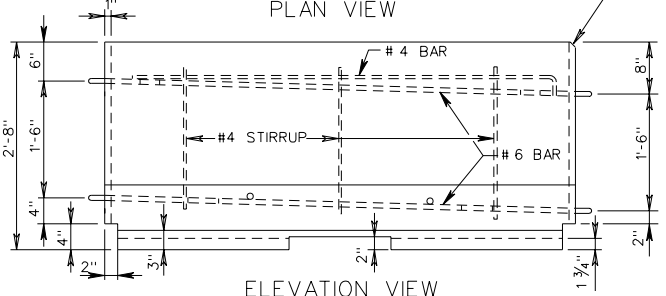
VIRGINIA DEPARTMENT OF TRANSPORTATION



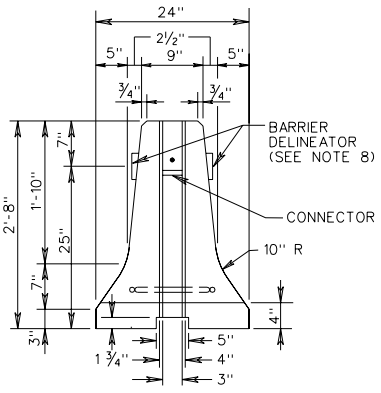
MB-7D PC



PLAN VIEW

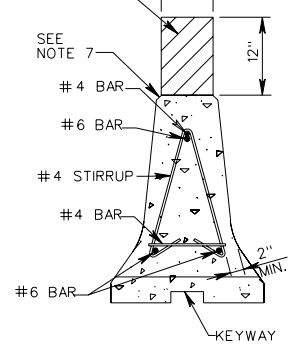


ELEVATION VIEW



END VIEW

8" X 12" BARRIER VERTICAL PANELS AS REQUIRED. SEE NOTE 9.



SECTION A-A

WHEN USING VDOT STANDARD MB-7D PC WITH THE PIN AND LOOP POSITIVE CONNECTION, ALLOW FOR A 6'-0" DYNAMIC DEFLECTION. PROVIDE MIN. 60' OF BARRIER UPSTREAM AND DOWNSTREAM OF WORK ZONE FOR ANCHORAGE. FOR APPROVED NON-VDOT DESIGNS, REFER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR DEFLECTIONS AND ANCHORAGE.

NOTES:

1. FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE SHEETS 501.59 - 501.61.
2. AT THE OPTION OF THE MANUFACTURER, ADDITIONAL REINFORCING MAY BE ADDED TO THE PRECAST CONCRETE BARRIER FOR HANDLING.
3. CONCRETE SHALL BE 4000 P.S.I. MINIMUM.
4. BARRIER DELINEATOR SIZE, COLOR AND SPACING SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.
5. COST OF DELINEATOR SHALL BE INCLUDED IN THE PRICE BID FOR TRAFFIC BARRIER SERVICE.
6. OTHER PRECAST TRAFFIC BARRIER SERVICE CONCRETE DESIGNS THAT MEET NCHRP 350 TEST REQUIREMENTS AND HAVE BEEN ACCEPTED BY VDOT AS AN ACCEPTABLE ALTERNATE TO THE STANDARD DESIGN MAY BE SUBSTITUTED.
7. A 1" RADIUS MAY BE USED AS AN ALTERNATE FOR THE 3/4" CHAMFER.
8. BARRIER DELINEATOR REFLECTIVE SURFACE IN ALL INSTANCES SHALL BE FACING ONCOMING TRAFFIC.
9. BARRIER VERTICAL PANELS SHALL BE SPACED IN ACCORDANCE WITH VIRGINIA WORK AREA PROTECTION MANUAL.

DESIGN SPEED	FLARE RATES *		
	INSIDE SHY LINE	BEYOND SHY LINE	
MPH	SHY LINE LS	FLARE RATE	FLARE RATE
70	10'	30:1	20:1
60	8'	26:1	18:1
50	6.5'	21:1	14:1
40	5'	16:1	10:1
30	3.5'	13:1	8:1

\* SUGGESTED MAXIMUM FLARED RATE FOR RIGID BARRIER SYSTEMS.

SHEET 1 OF 2

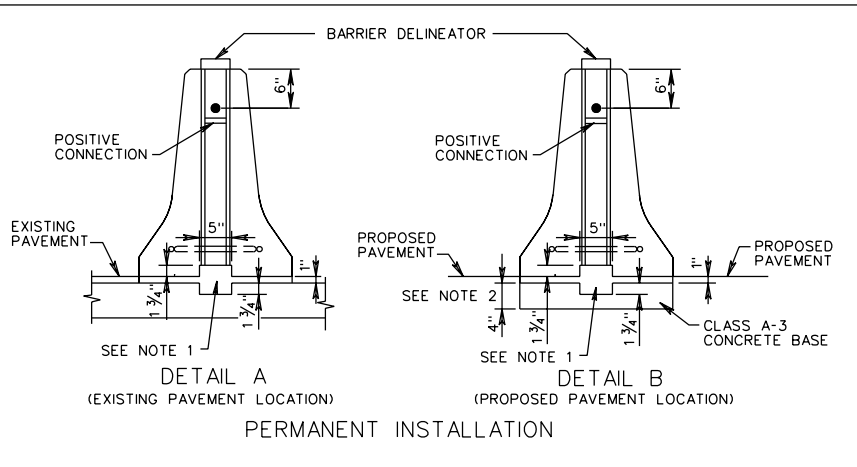
PRECAST TRAFFIC BARRIER SERVICE CONCRETE

VIRGINIA DEPARTMENT OF TRANSPORTATION

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501.45

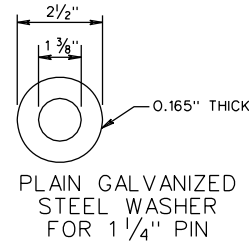
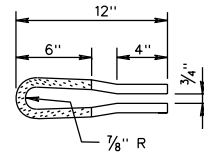
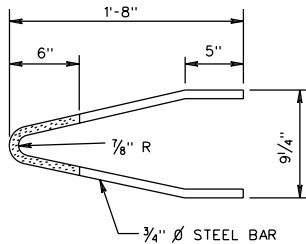
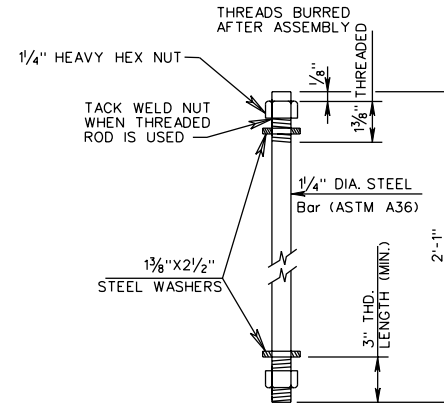
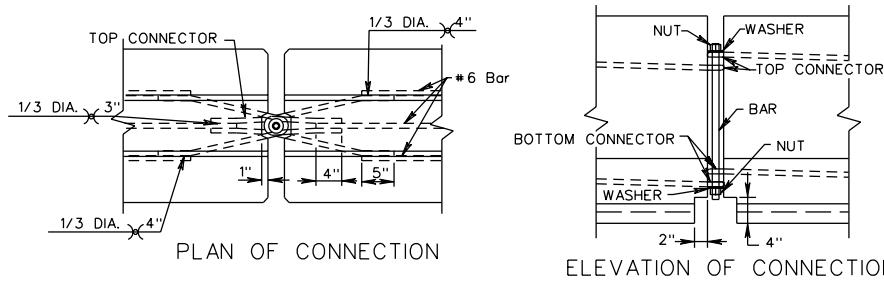
SPECIFICATION REFERENCE

105  
512



NOTES:

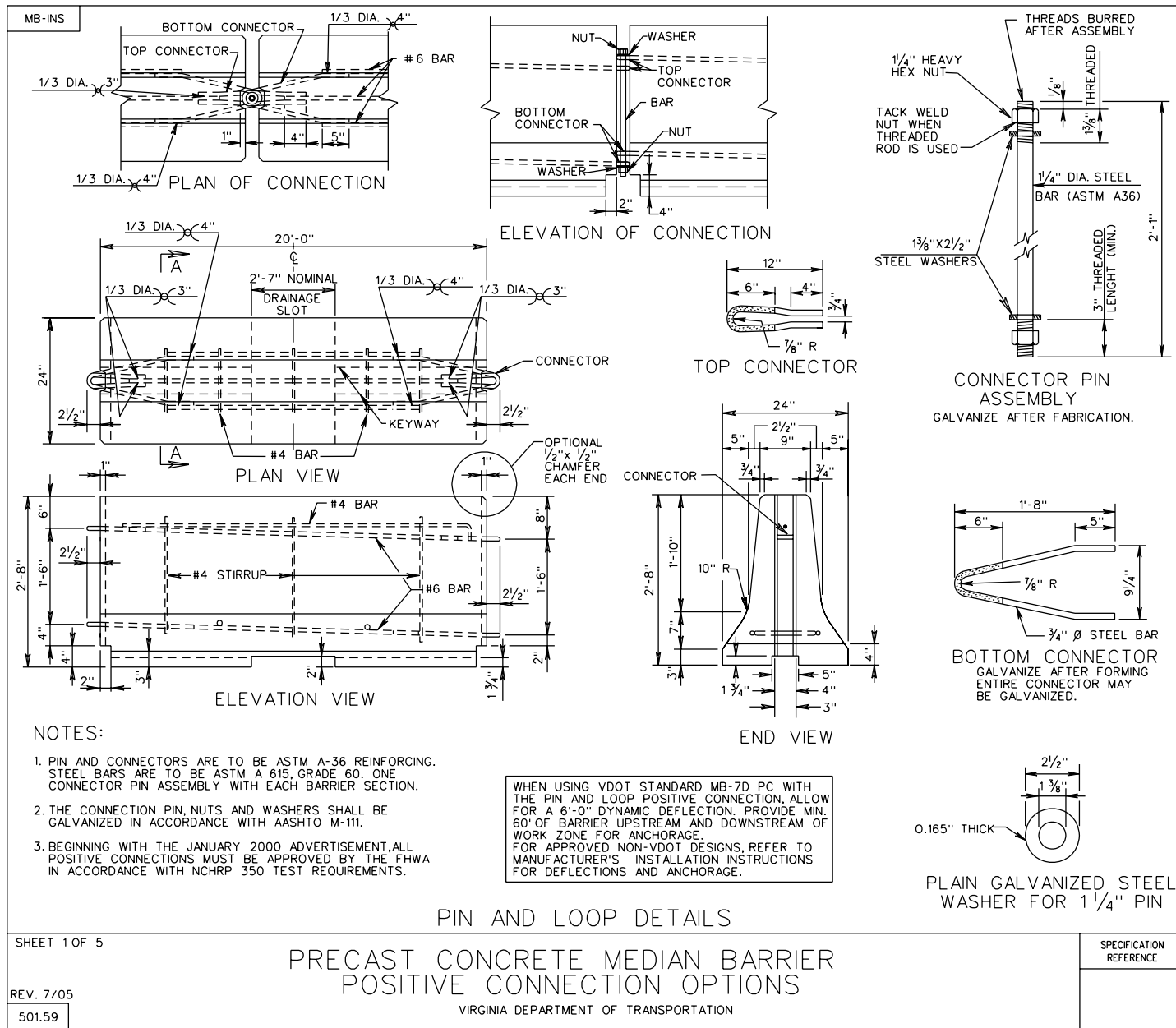
- HIGH STRENGTH GROUT OR MORTAR SHALL BE IN ACCORDANCE WITH SECTION 218 OF THE SPECIFICATIONS.
- 4" MIN. OR VARIABLE TO COINCIDE WITH SUBGRADE COURSE.
- WHEN USED AS MEDIAN BARRIER IN A PERMANENT LOCATION, DRAINAGE SLOTS WILL BE COMPLETELY FILLED AND SEALED WITH MORTAR OR GROUT UNLESS UNIT WILL BE LOCATED OVER MEDIAN DRAINAGE STRUCTURE.
- BARRIER DELINEATOR SIZE, COLOR, AND SPACING SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- COST OF DELINEATOR TO BE INCLUDED IN THE PRICE BID FOR MEDIAN BARRIER.
- REFLECTIVE SURFACE OF BARRIER DELINEATOR IN ALL INSTANCES SHALL BE FACING ONCOMING TRAFFIC.
- PIN AND CONNECTORS SHALL BE ASTM-A36. REINFORCING STEEL BARS SHALL BE ASTM A 615 GRADE 60. ONE CONNECTOR PIN ASSEMBLY WITH EACH BARRIER SECTION.

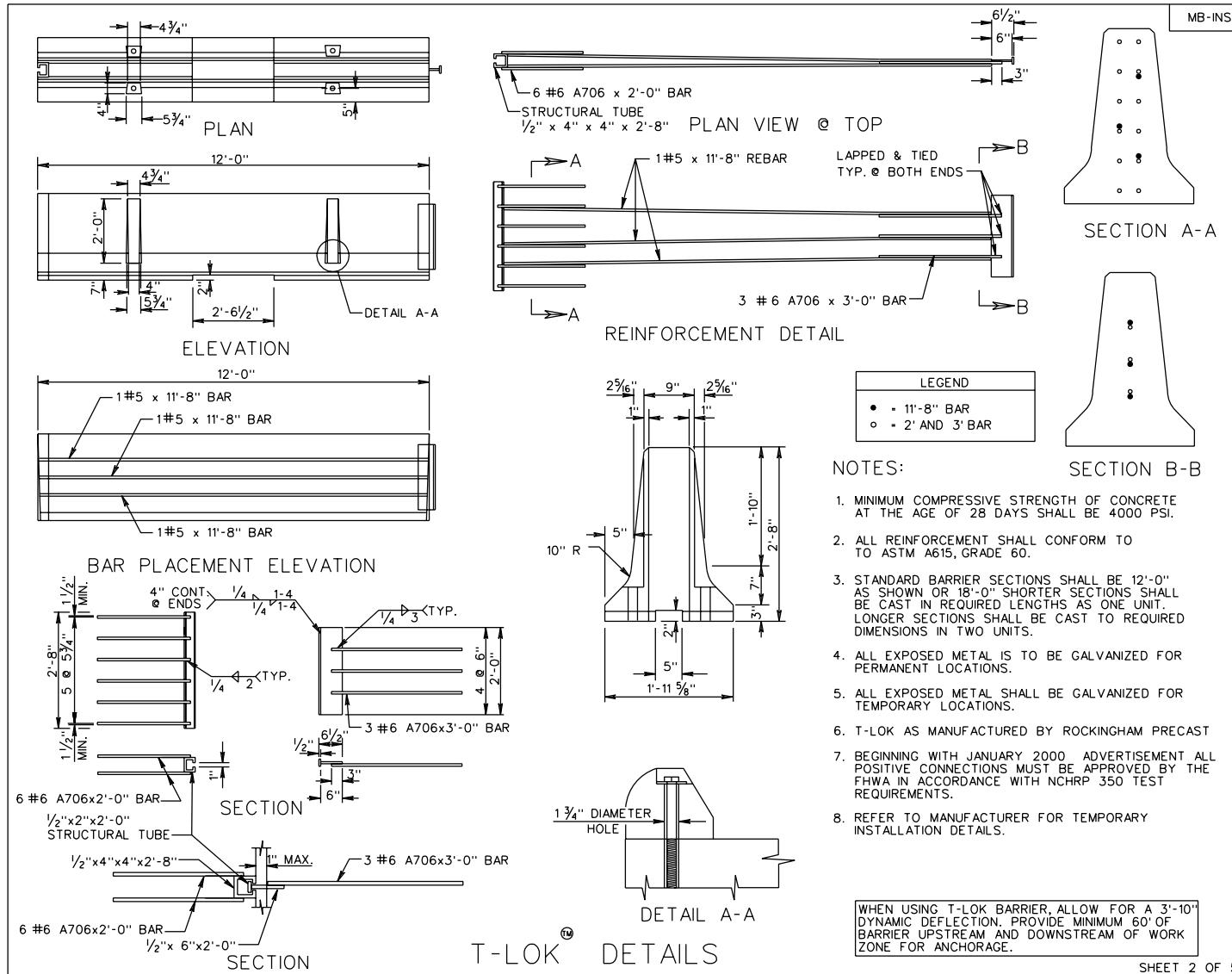


SPECIFICATION REFERENCE
105 512

PRECAST TRAFFIC BARRIER SERVICE CONCRETE

VIRGINIA DEPARTMENT OF TRANSPORTATION





SPECIFICATION REFERENCE
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PRECAST CONCRETE MEDIAN BARRIER  
POSITIVE CONNECTION OPTIONS

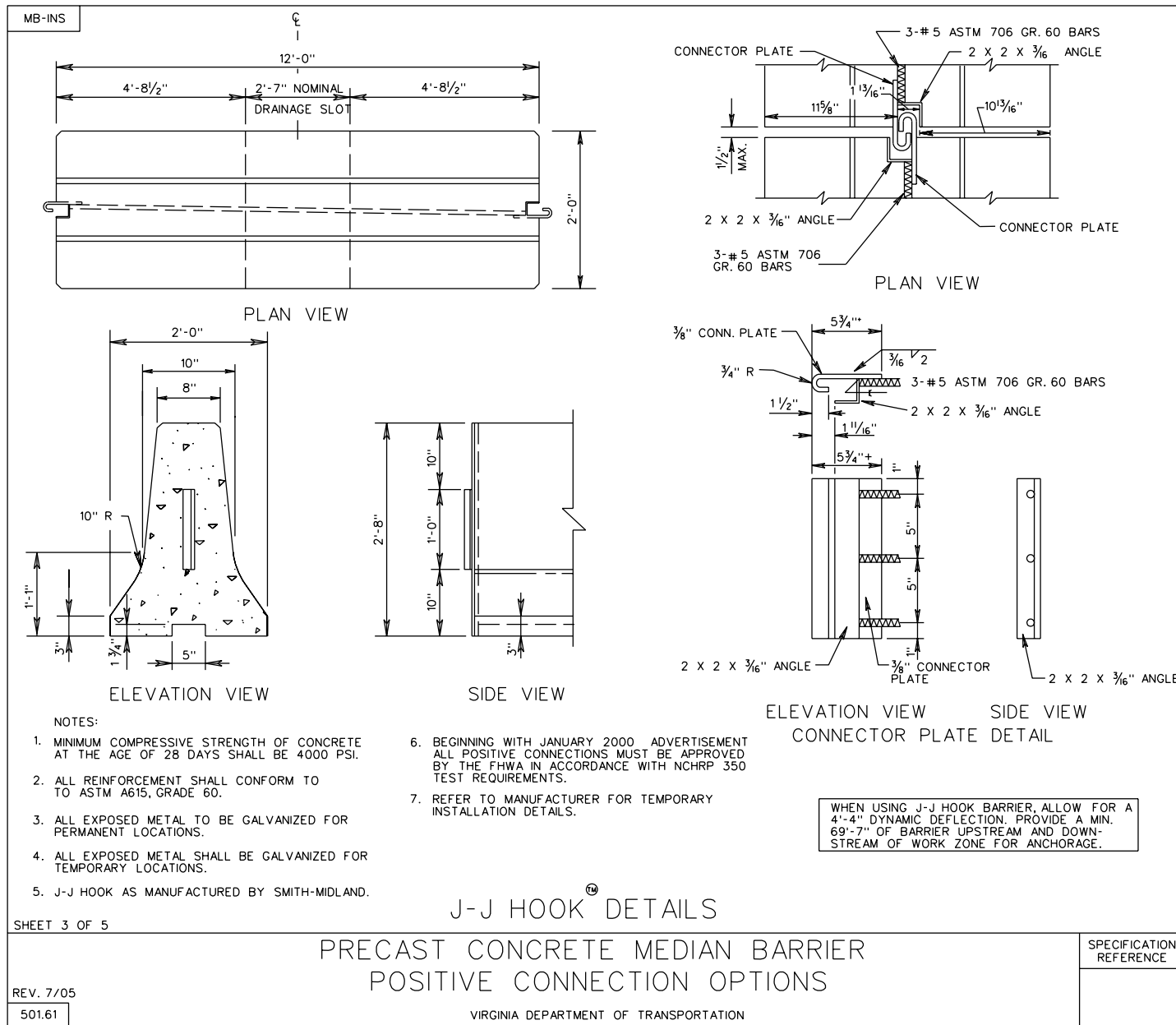
VIRGINIA DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 5

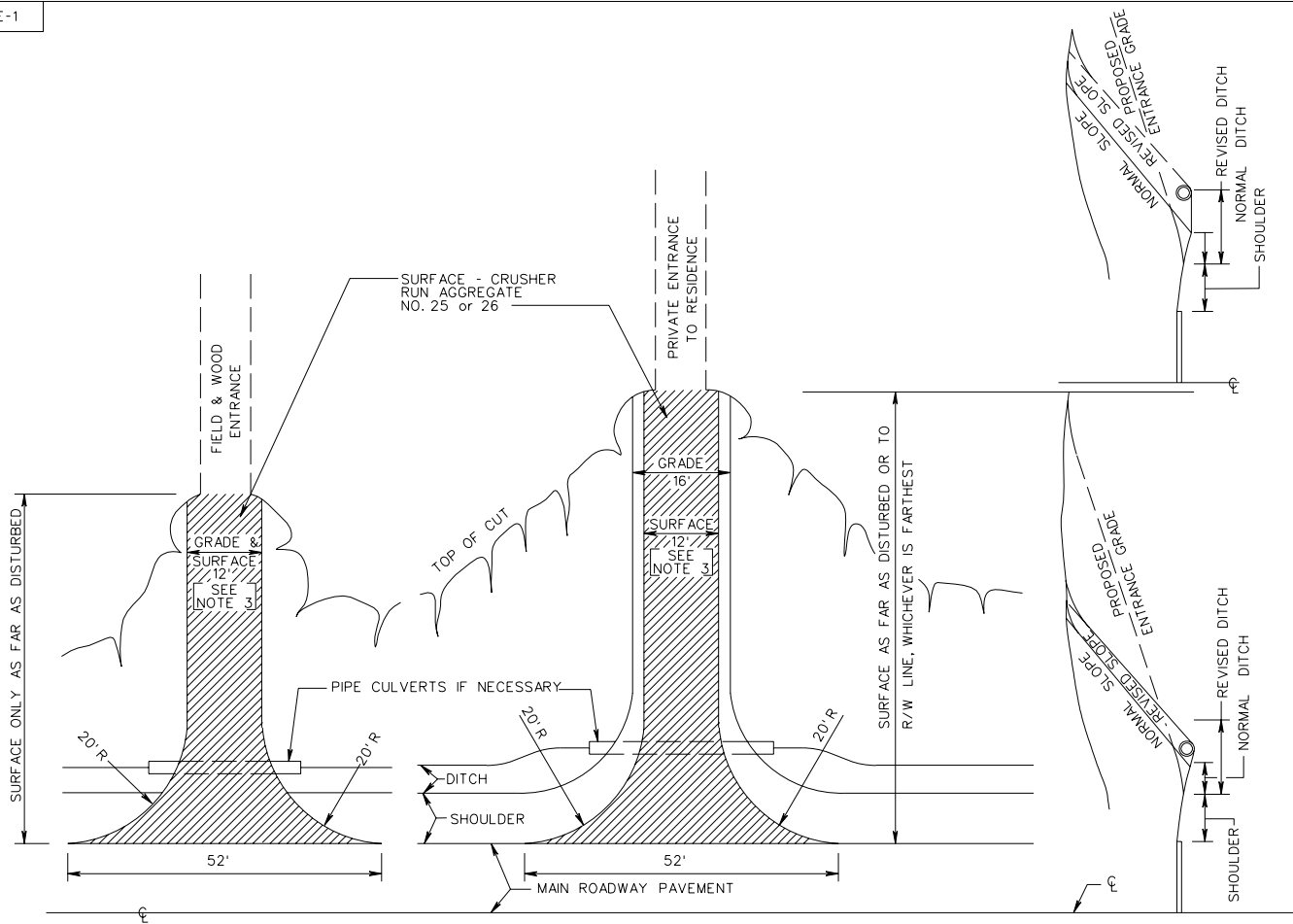
REV. 7/05

501.60

INSERTABLE SHEET A105-1



PE-1



NOTES:

1. ALL ENTRANCE GRADES SHALL START BACK OF THE SHOULDER LINE. IF DRAINAGE IS NECESSARY, THE DITCH MAY BE MOVED BACK TO PROVIDE AT LEAST 9" OF COVER OVER PIPE, AS SHOWN IN THE ALTERNATE METHODS FOR PLACING PIPE UNDER ENTRANCES DIAGRAM.
2. ENTRANCE GRADES ARE TO BE SMOOTHLY TIED INTO THE ROADWAY BY ROUNDING AS NECESSARY.
3. 12' OR EXISTING WIDTH WHICHEVER IS GREATER.
4. LENGTHS OF CULVERTS SHOWN ON ROAD PLANS FOR ENTRANCES ARE APPROXIMATE AND SHALL BE ADJUSTED TO OBTAIN ABOVE ROADWAY WIDTHS.
5. ENTRANCES IN FILL TO BE SAME AS ABOVE EXCEPT LOCATION OF CULVERT (WHEN NECESSARY).

## STANDARD PRIVATE ENTRANCES

SPECIFICATION REFERENCE

512

REV. 7/05  
602.02

VIRGINIA DEPARTMENT OF TRANSPORTATION

ALTERNATE METHODS FOR PLACING PIPES UNDER ENTRANCES

URBAN LOW SPEED DESIGN TABLE						
DV/NC (MPH)	45	40	35	30	25	20
MAX. f	0.150	0.160	0.180	0.200	0.230	0.270

FRICTION FACTORS (f) FOR ODD VELOCITIES NOT LISTED SHOULD BE DERIVED BY INTERPOLATION.

#### LEGEND

- e- SUPERELEVATION RATE.  
 f- FRICTION FACTOR.  
 R- RADIUS OF CURVE.  
 DV- DESIGN VELOCITY UTILIZING SUPERELEVATION.  
 NC- MAXIMUM VELOCITY WITH NO SUPERELEVATION (NORMAL CROWN).

#### GENERAL DESIGN CONSIDERATIONS

1. WHEN "URBAN LOW SPEED" DESIGNS UTILIZE SUPERELEVATION, THEY WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN (TYPICALLY 2.0%) AND THE APPROXIMATE MAXIMUM SAFE SPEED (DV) AFFORDED THEREBY.
2. WHEN "URBAN LOW SPEED DESIGN" WITH NO SUPERELEVATION, THE APPROXIMATE MAXIMUM SAFE SPEED (NC) IS CALCULATED USING A NEGATIVE NORMAL CROWN (TYPICALLY -2.0 %).
3. WHEN THE CURVE IS SUPERELEVATED, THE LS IS APPLIED IN THE SAME MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).
4. PLEASE NOTE THAT THE RADIUS VALUES LISTED ON PAGE 802.24 HAVE BEEN ROUNDED UP TO THE NEAREST FOOT.

#### EXAMPLES

DV = 21 mph

e = +2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

$$f = 0.270 - [1/5(0.270 - 0.230)] = 0.262$$

$$R_{min.} = DV^2 / 15(e + f)$$

$$R_{min.} = (21)^2 / 15(0.02 + 0.262) = 104.2553191 \text{ FT.}$$

NC = 37 mph

e = -2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

$$f = 0.18 - [2/5(0.18 - 0.16)] = 0.172$$

$$R_{min.} = NC^2 / 15(-e + f)$$

$$R_{min.} = (37)^2 / 15(-0.02 + 0.172) = 600.4385965 \text{ FT.}$$

## METHODOLOGIES FOR CALCULATING TC-5.01 VALUES FOR URBAN LOW-SPEED STREETS

MINIMUM RADII AND TRANSITION LENGTHS FOR 2% SUPERELEVATION

RADIUS (FEET)	E (%)	f	DV (MPH)	LENGTH OF SUPERELEVATION TRANSITION (LS) IN FEET						
				PAVEMENT WIDTH (W)						W > 72'
				24' (1@12')	36' (1.5@12')	48' (2@12')	60' (3@10')	66' (3@11')	72' (3@12')	
> 795	2.0	0.150	45	45	56	67	75	82	90	*
593	2.0	0.160	40	42	52	63	70	77	84	*
408	2.0	0.180	35	39	49	59	65	72	78	*
273	2.0	0.200	30	37	46	55	61	67	74	*
167	2.0	0.230	25	35	43	52	58	64	69	*
92	2.0	0.270	20	33	41	49	55	60	66	*

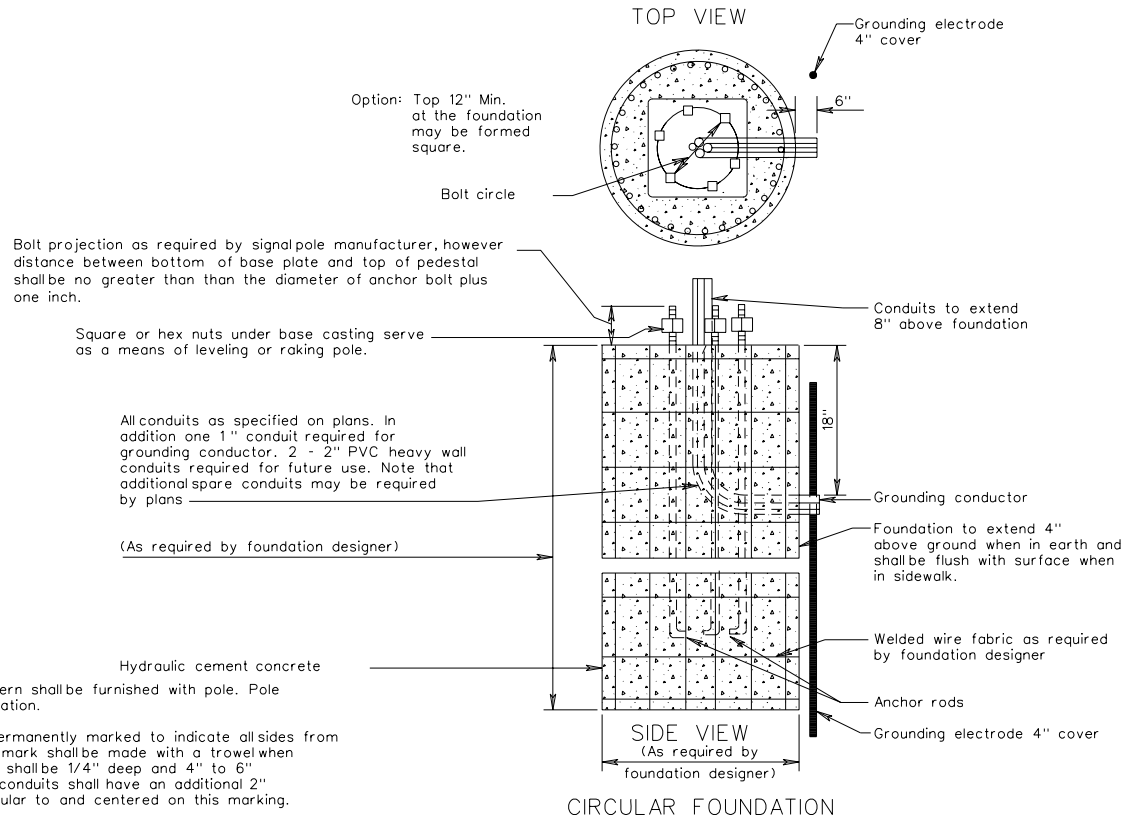
\* FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

MINIMUM RADII FOR DESIGNS  
UTILIZING NORMAL PAVEMENT CROWN

RADIUS (FEET)	f	NC (MPH)
> 1039	.150	45
762	.160	40
510	.180	35
333	.200	30
198	.230	25
107	.270	20

SUMMARY OF STD. TC-5.01 ULS (URBAN-LOW SPEED) DESIGN FACTORS





**Notes:**

Anchor bolts and bolt pattern shall be furnished with pole. Pole shall be centered on foundation.

Each foundation shall be permanently marked to indicate all sides from which conduits pass. This mark shall be made with a trowel when finishing the concrete and shall be 1/4" deep and 4" to 6" long. Locations of empty conduits shall have an additional 2" long mark made perpendicular to and centered on this marking.

When foundation extends 4" above finished grade all edges shall be chamfered 3/4".

Grounding bushings shall be installed on each end of metal conduits. Empty conduits shall be plugged to prevent moisture and rodent entry.

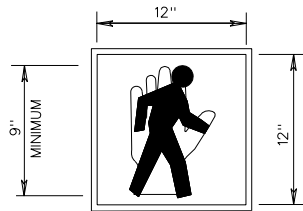
Bell ends shall be installed on each end of PVC conduits. Empty conduits shall be plugged to prevent moisture and rodent entry.

Open ends of conduits with conductors installed shall be sealed with an approved soft, pliable, and easily removable waterproof sealant. The sealant shall not have a deleterious effect on cable coverings.

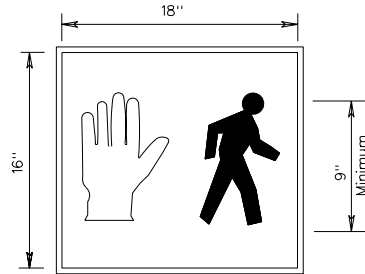
No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.

**SIGNAL POLE FOUNDATION  
INSTALLATION DETAILS**  
VIRGINIA DEPARTMENT OF TRANSPORTATION

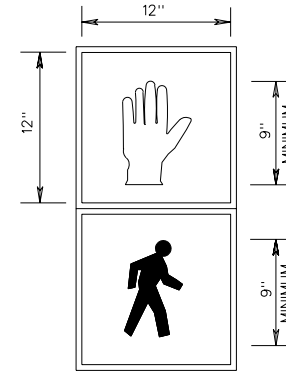
SP-5,6,7,8,9



SP-5

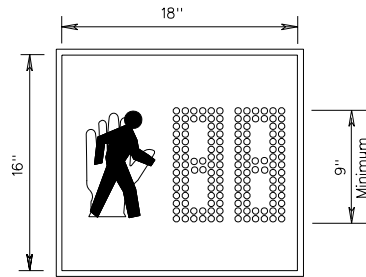


SP-6

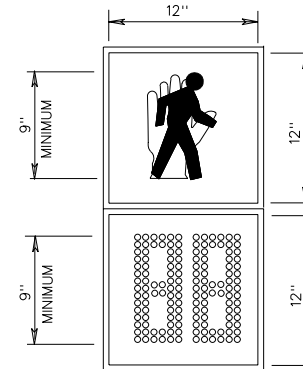


SP-7

Pedestrian Signals shall include Light Emitting Diodes conforming to Section 238 of the Specifications.



SP-8



SP-9

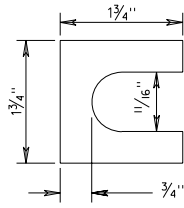
PEDESTRIAN SIGNAL INDICATION DETAILS

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VIRGINIA DEPARTMENT OF TRANSPORTATION

SHIM DETAIL

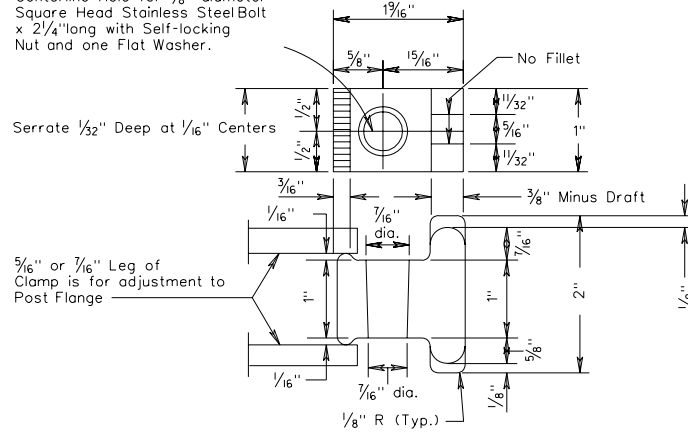


Furnish 2 @ 0.63" thick and 2 @ .032" thick shims per post. Shims shall be fabricated from brass conforming to ASTM B36M or from stainless steel with a minimum chromium content of 11.50% . No more than 2 shims shall be used per bolt with a maximum of 4 shims per post.

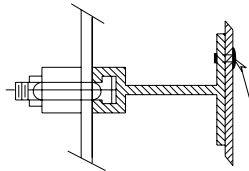
POST CLAMP DETAIL

Galvanized Gray - Iron or Aluminum Casting

Centerline Hole for 3/8" diameter Square Head Stainless Steel Bolt x 2 1/4" long with Self-locking Nut and one Flat Washer.

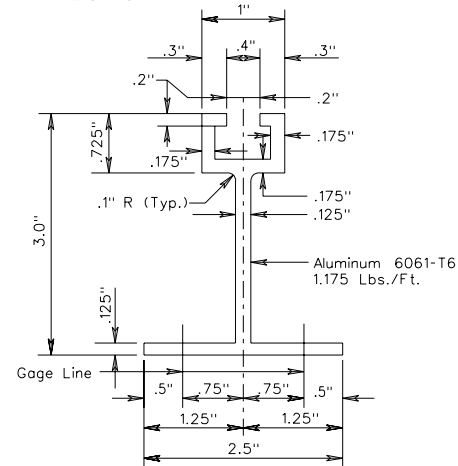


FASTENING



3/16" diameter rivet. -Rivets shall be dome head, break mandrel, blind rivets conforming to Industrial Fasteners Institute Standard IFI-114, Style 1, Grades 10 or 11 except that the minimum ultimate tensile strength shall be 360 pounds. Rivets shall have a grip range accommodating the combined thickness of the sign panel and zee bar and shall be installed in accordance with the manufacturer's recommendations.

TEE CROSS SECTION

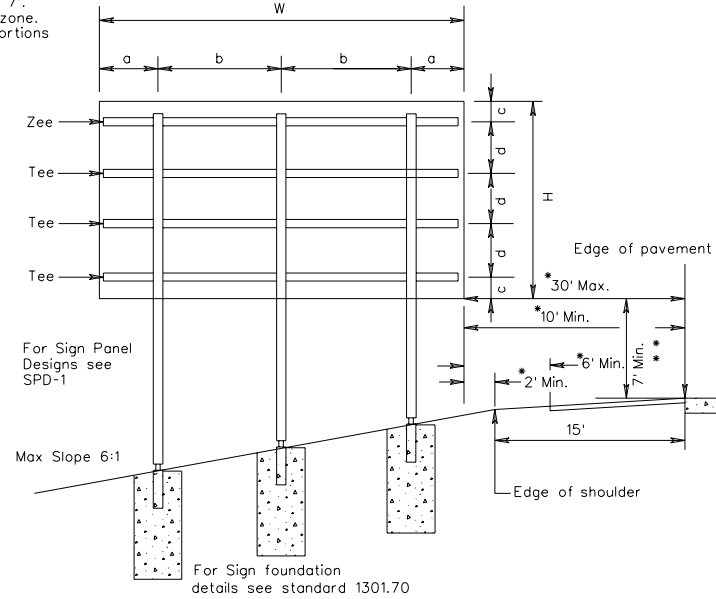
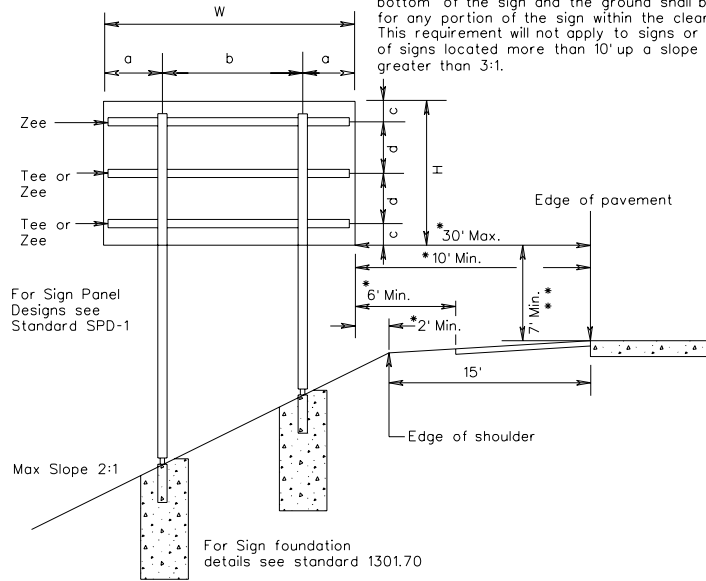


TYPICAL DETAILS FOR TYPE VA SIGN STRUCTURES

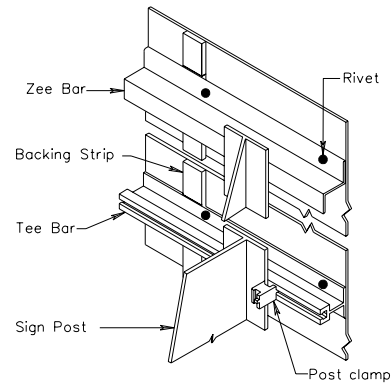
The spacing between sign posts shall be a minimum of 8' center to center.

\* Signs shall be located to provide optimum viewing and safety within the indicated view limits for lateral placement.

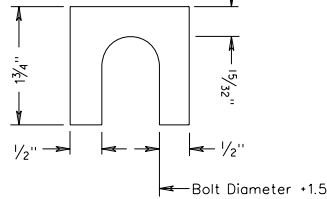
\*\* In cut slopes, the minimum clearance between the bottom of the sign and the ground shall be 7' for any portion of the sign within the clear zone. This requirement will not apply to signs or portions of signs located more than 10' up a slope greater than 3:1.



ISOMETRIC VIEW

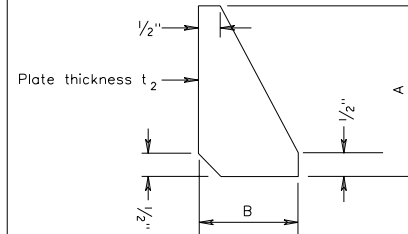


SHIM DETAIL



Furnish 2 each .063"± and 2 each .032± mm thick shims per pole. Shims shall be fabricated from brass conforming to ASTM B36 or from stainless steel with a minimum chromium content of 11.50%. No more than 2 shims shall be used per bolt with a maximum of 4 shims per pole.

STIFFENER PLATE DETAIL



TYPICAL DETAILS FOR TYPE VIA INTERSTATE SIGN STRUCTURE

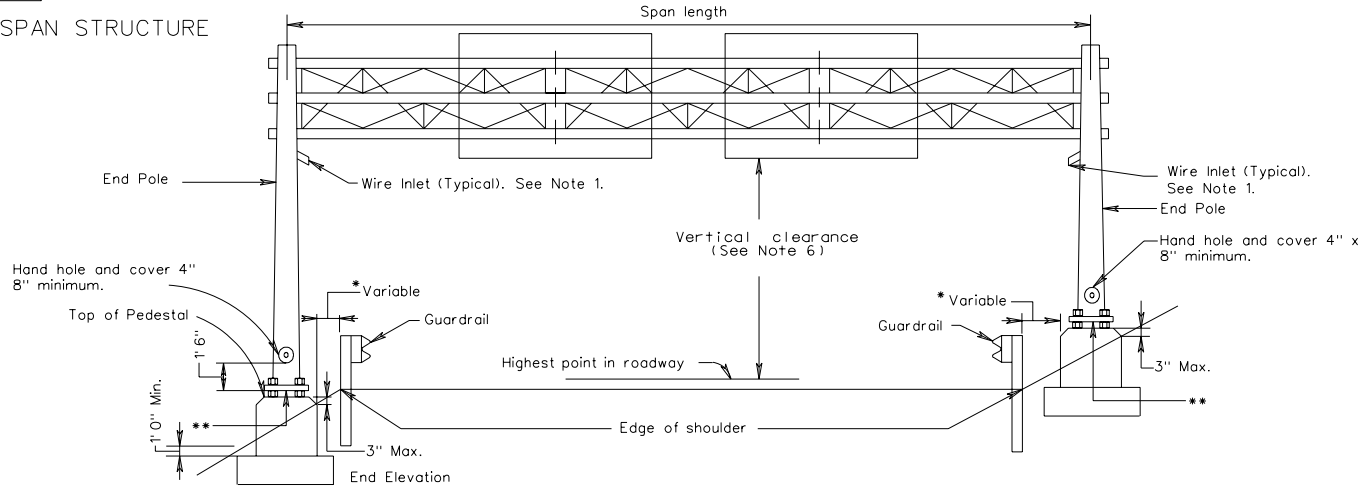
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REV. 7/05  
REV. 4/04

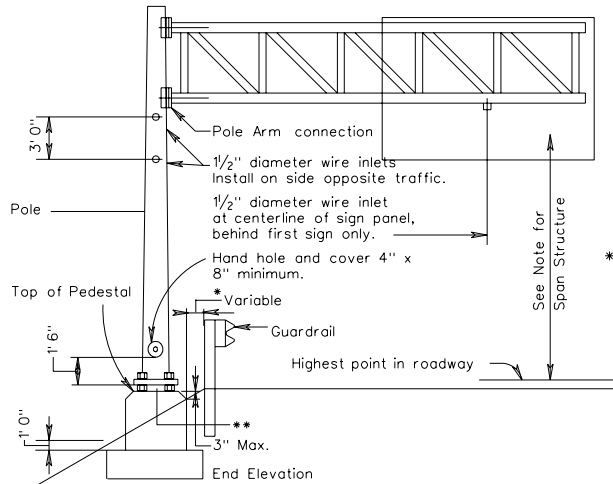
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OSS-1

SPAN STRUCTURE



CANTILEVER STRUCTURE



NOTES:

1. 1/2" diameter wire inlets shall be provided at the following locations:
  - A. On span structures on the front leg of end pole 12" below bottom chord.
  - B. On cantilever structures on pole 12" below bottom chord.
  - C. On span structures below bottom chord at centerline behind first sign panel from each end pole.
  - D. On cantilever structures below bottom chord at centerline behind first sign panel from pole.
2. All unused wire inlets shall be capped water tight.
- \*3. Distance shall be no less than the minimum indicated in Standard GR-INS.
4. No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.
- \*\*5. The maximum space between the bottom of the base plate and the top of the foundation shall be no more than the diameter of the anchor bolt plus one inch.
6. Vertical clearance for overhead and bridge mounted sign structures shall be no less than 19 feet 0 inch and no more than 21 feet 0 inch from the bottom of the lowest mounted sign panel to the crown of the roadway, unless otherwise specified on the plans. Luminaire assemblies shall a vertical clearance of no less than 17 feet six inches from the bottom of the assembly to the crown of the roadway.
7. All poles/uprights of overhead sign structures including "butterfly" structures shall have a minimum of six anchor bolts, each having a minimum diameter of 1/2".

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REV. 4/04  
REV. 1/04

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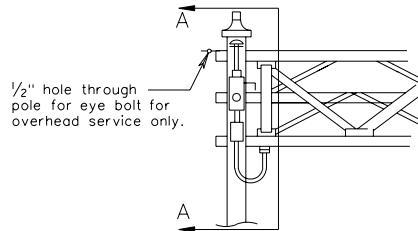
TYPICAL DETAILS FOR OVERHEAD  
SIGN STRUCTURES

VIRGINIA DEPARTMENT OF TRANSPORTATION

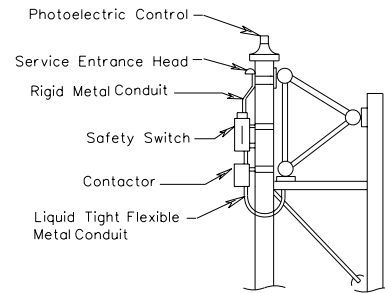
ELECTRIC DETAILS FOR SIGN LIGHTING

SPAN SIGN STRUCTURE

FRONT VIEW

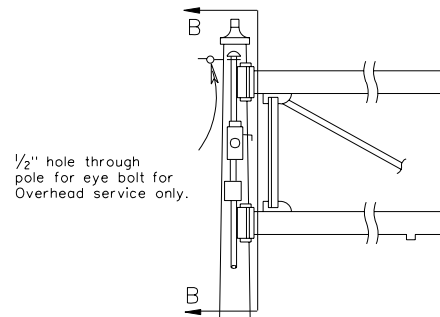


SECTION A-A

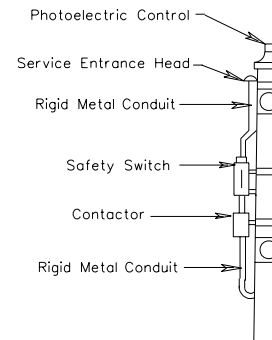


CANTILEVER SIGN STRUCTURE

FRONT VIEW



SECTION B-B



Note:

A safety switch shall be installed on all sign structures requiring electrical power. Electrical service for sign structures not controlled by a control center shall have a photocell and a photocell controlled contactor to control the electrical power to luminaires. The contactor shall be in a NEMA 3R enclosure within 24 inches of the safety switch.

All conduit located in or on overhead sign structure shall be 3/4" minimum.

TYPICAL DETAILS FOR OVERHEAD  
SIGN STRUCTURES

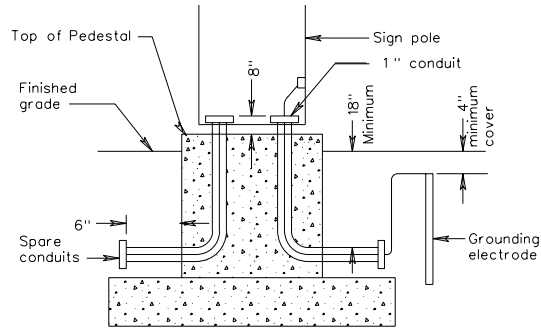
VIRGINIA DEPARTMENT OF TRANSPORTATION

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REV. 4/04  
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OSS-1

TYPICAL SIGN FOOTING DETAIL WITH CONDUIT



NOTES:

The type, size, number and orientation of conduits entering and exiting footings may vary per sign location.

In addition to the conduits specified on the plans, one - 1" conduit required for ground wire and two - 2" pvc heavy wall conduits required for future use. Future use conduits shall be stubbed out and capped. Future use conduits shall be oriented to run parallel to the roadway. For location of future use conduits in foundations for double end pole structures, see drawing at right.

Each foundation shall be permanently marked to indicate all sides from which conduits pass. This mark shall be made with a trowel when finishing the concrete and shall be 1/4" deep and 4" to 6" long. Locations of empty conduits shall have an additional 2" long mark made perpendicular to and centered on this mark.

Foundations above finished grade shall be chamfered 3/4" on all edges.

Grounding bushings shall be installed on each end of metal conduits.

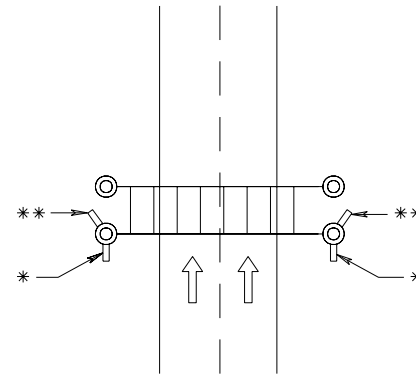
Bellends shall be installed on each end of PVC conduits.

Bellends & bushings of empty conduits shall be plugged to prevent moisture and rodent entry.

Voids remaining after conductors exit or enter bellends or bushings of conduits shall be sealed with silicone to prevent moisture and rodent entry.

No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.

LOCATION OF FUTURE USE CONDUITS FOR DOUBLE END POLE STRUCTURES



\* Future use conduits placed parallel to the roadway

\*\* Future use conduits placed at an angle to miss the back foundation or anchor bolts in a spread footing foundation.

The maximum space between the bottom of the base plate and the top of the foundation shall be no greater than the diameter of the anchor bolt plus one inch.

Overhead sign structures including "butterfly" structures shall have a minimum of six anchor bolts, each having a minimum diameter of 1/2".

TYPICAL DETAILS FOR OVERHEAD SIGN STRUCTURES

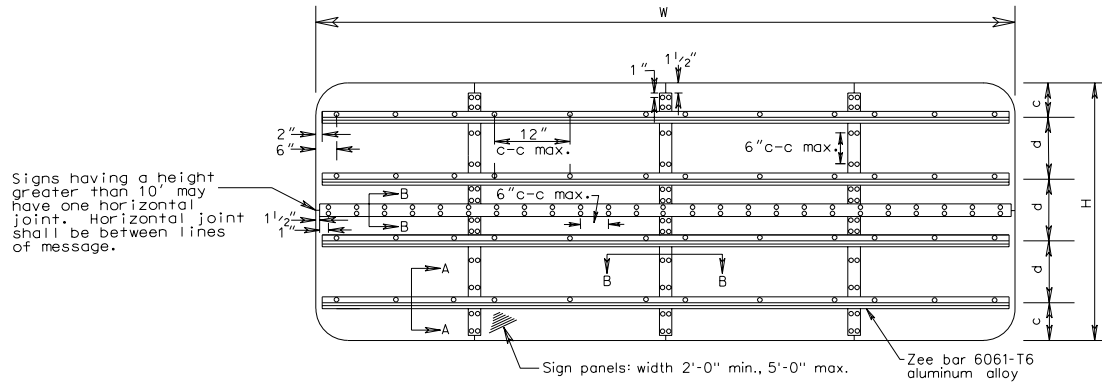
VIRGINIA DEPARTMENT OF TRANSPORTATION

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<p>BSS-1</p> <p>TYPICAL FOR PRESTRESSED CONCRETE</p> <p>This parapet is typical for bridges with a sidewalk.</p>	<p>TYPICAL FOR STEEL BEAM</p>	
<p>NOTES:</p> <ul style="list-style-type: none"> <li>The size of members shall be designed by the contractor for the sign to be supported.</li> <li>Minimum clearances are as specified by AASHTO or approved by the Virginia Department of Transportation.</li> <li>The supporting frames may be either aluminum or galvanized steel.</li> <li>The spacing of zeos and supports shall be as shown on the plans.</li> <li>Sign supports shall be braced for lateral forces.</li> <li>Bolts shall be High-Strength ASTM A325, galvanized.</li> <li>Anchors shall be cast-in-place. Thru-bolting may also be used for attachments to parapets. When cast-in-place anchors are used, they shall develop the strength of the bolts. When thru-bolting is used, anchorage on the traffic side of the parapet shall be flush with the parapet face.</li> </ul>	<p>When required by the plans bridge mounted sign structure luminaires shall be installed on a luminaire retrieval system with supports and electrical system designed for track mounted luminaires. Retrieval system including the electrical system shall be equal to "LUMI-TRAK" and designed for the number of luminaires as indicated on the plans. Spacing of hangers used to support the retrieval system shall be increased to a maximum 7-foot distance only where hangers do not support sign panels. Turntable end of retrieval system shall be of sufficient length to align with the vertical edge of the outside paved shoulder (<math>\pm 6"</math>) or shall extend five feet beyond the vertical edge (<math>\pm 6"</math>) of outermost sign luminaire whichever is greater. The opposite end of retrieval system shall extend a minimum of 6 inches past the outermost vertical edge of the sign hanger arm. Luminaire support channels and associated equipment will not be required with the luminaire retrieval system.</p>	
<p>TYPICAL BRIDGE PARAPET SIGN MOUNTING DETAILS</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		
<p>REV 7/05</p> <p>1301.78</p>		





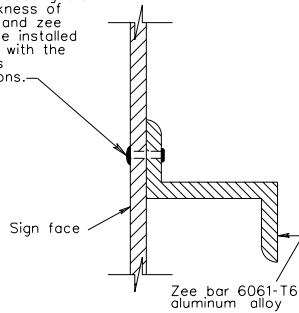
SECTION A-A

SECTION B-B

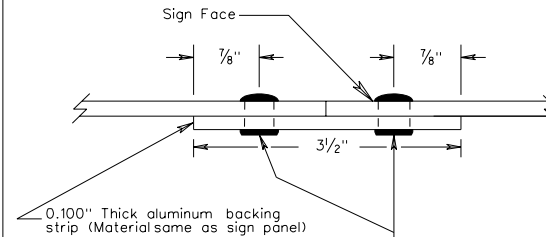
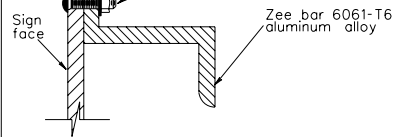
ALL INSTALLATIONS EXCEPT TOP AND BOTTOM ZEE BARS ON OVERHEAD SIGNS

TOP AND BOTTOM ZEE BAR INSTALLATION ON OVERHEAD SIGNS

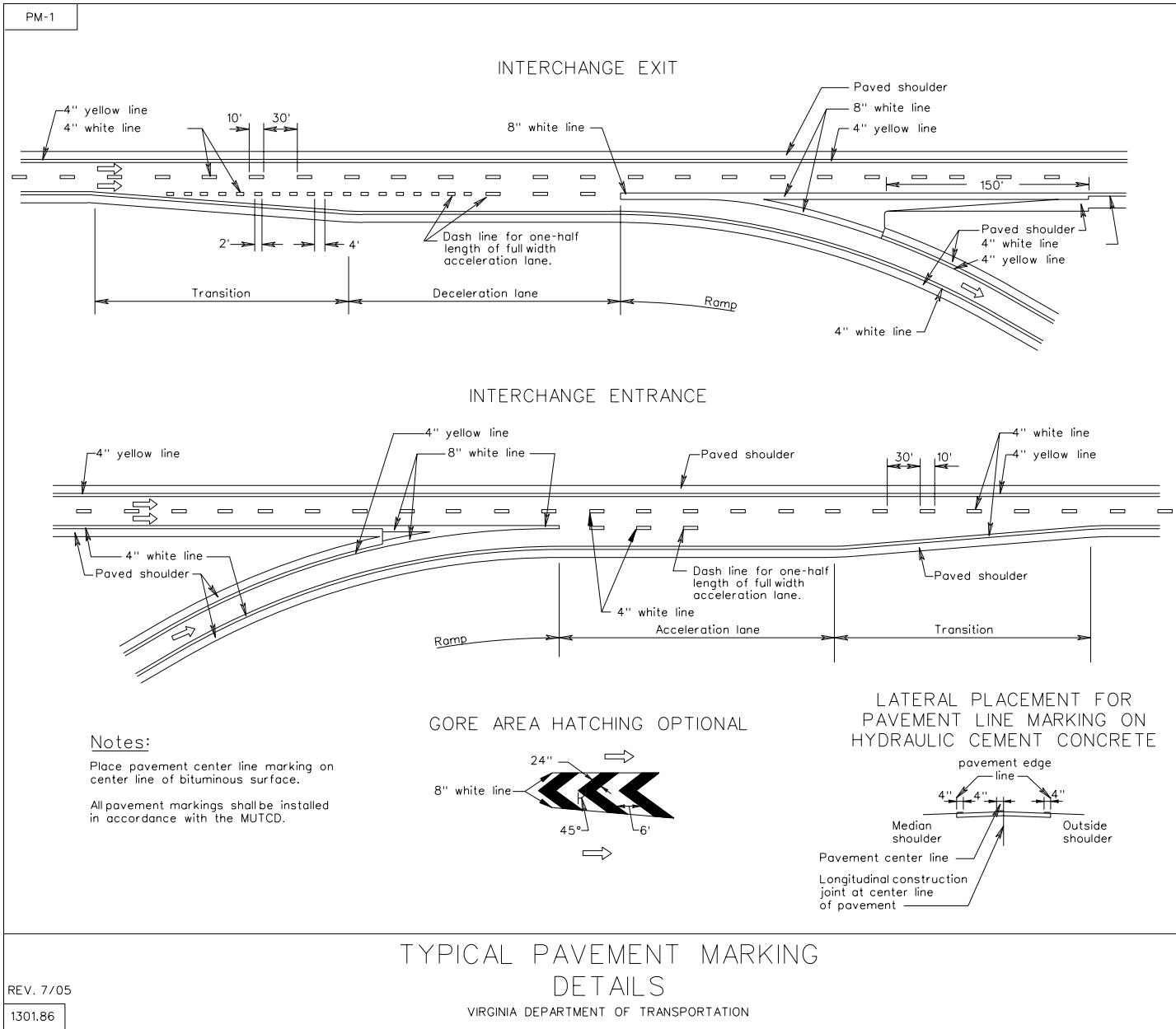
3/16" diameter rivet - Rivets shall be dome head, break mandrel, blind rivets conforming to Industrial Fasteners Institute Standard IFI-114, Style 1, Grades 10 or 11 except that the minimum ultimate tensile strength shall be 360 pounds. Rivets shall have a grip range accommodating the combined thickness of the sign panel and zee bar and shall be installed in accordance with the manufacturer's recommendations.



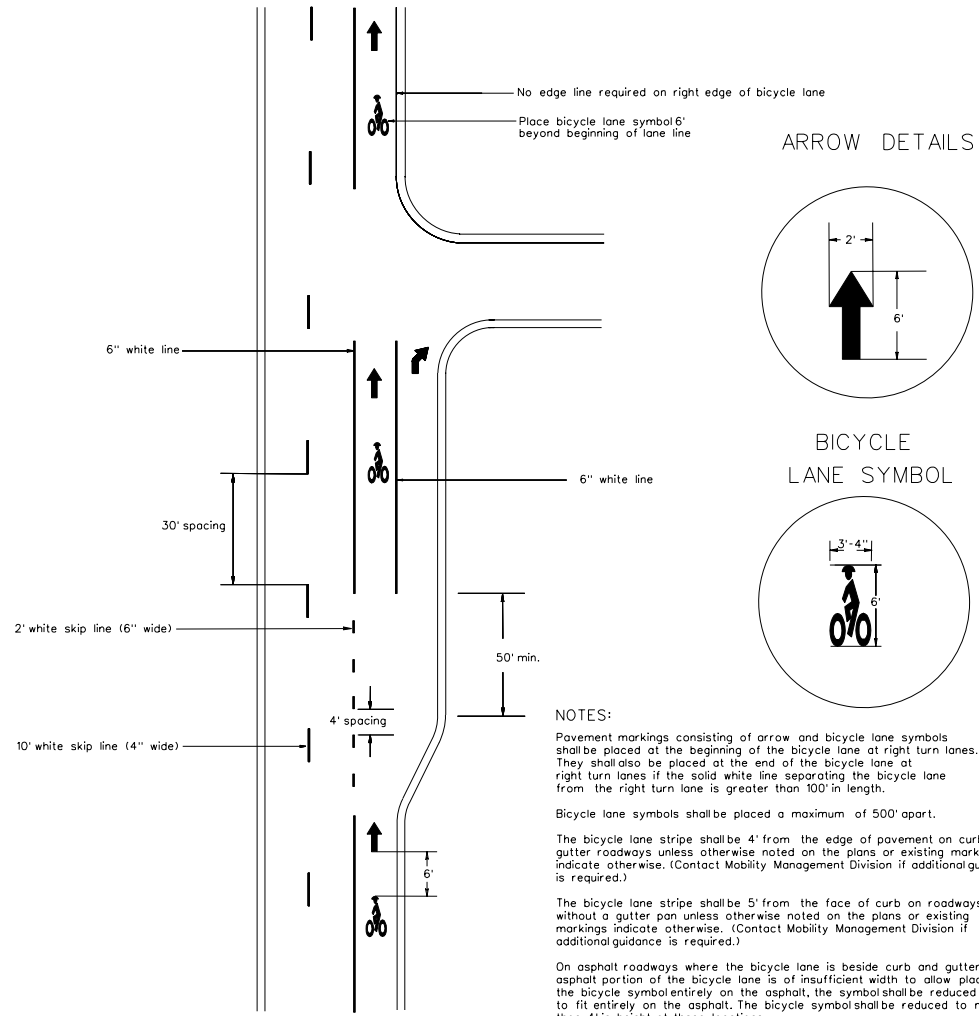
ASTM F593, Alloy 304 stainless steel - 3/8" diameter - 16 x 3/4" length carriage bolt with stainless steel nut and flat washer



SIGN PANEL DESIGN



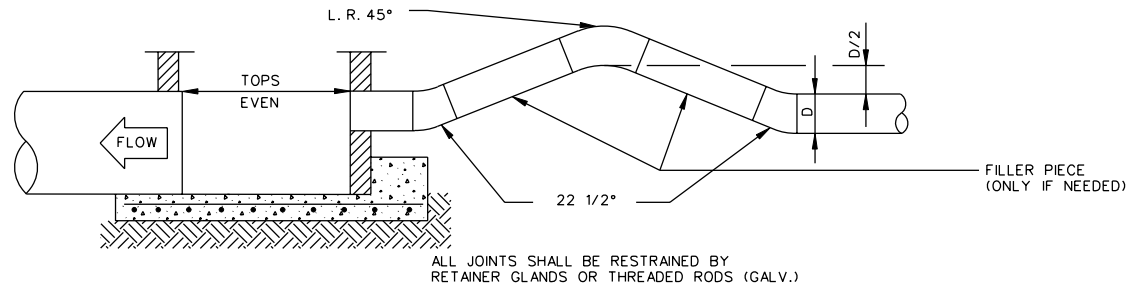
PM-6



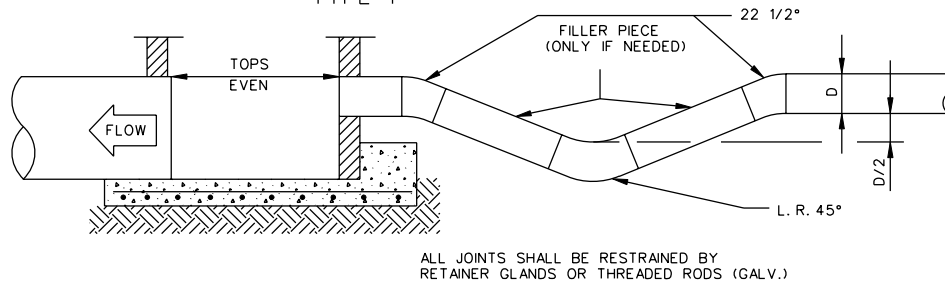
TYPICAL PAVEMENT MARKINGS FOR  
BICYCLE LANE  
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/05

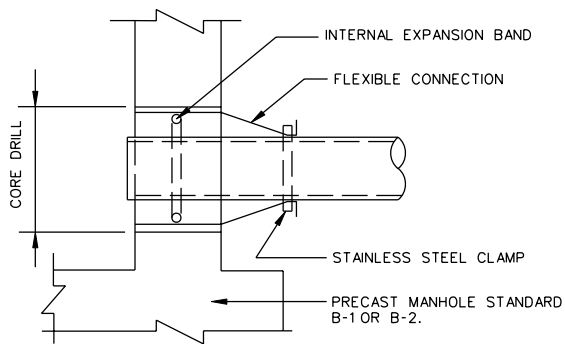
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FORCE MAIN DISCHARGE  
TYPE 1



FORCE MAIN DISCHARGE  
TYPE 2



FLEXIBLE CONNECTION

PIPE TO PRECAST MANHOLE CONNECTIONS SHALL BE MADE WITH A FLEXIBLE BOOT. THE BOOT SHALL MEET ASTM SPECIFICATION C-923 AND CONSIST OF NEOPRENE RUBBER, EPDM RUBBER, OR POLYISOPRENE RUBBER, WHERE PREFERENCE MAY BE GIVEN TO A CERTAIN MATERIAL IN PROJECT SPECIFIC INSTANCES. THE INTERNAL EXPANSION BAND TO SECURE THE BOOT IN PLACE SHALL BE COMPOSED OF STAINLESS STEEL OR A NON-METALLIC MATERIAL. THE EXTERNAL BAND TO CLAMP AND SEAL THE BOOT TO THE PIPE SHALL BE CORROSION RESISTANT STAINLESS STEEL CONFORMING TO ASTM SPECIFICATION A-167. THE PORT TO RECEIVE THE BOOT SHALL BE CORE DRILLED AND SHOULD BE MANUFACTURED TO ALLOW FOR LATERAL AND VERTICAL MOVEMENT. ALL FIELD INSTALLATION OF PIPE THRU MANHOLE SEAL SHALL BE DONE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATIONS.

SANITARY SEWER MANHOLE  
WATER AND SANITARY SEWER FACILITIES

VIRGINIA DEPARTMENT OF TRANSPORTATION