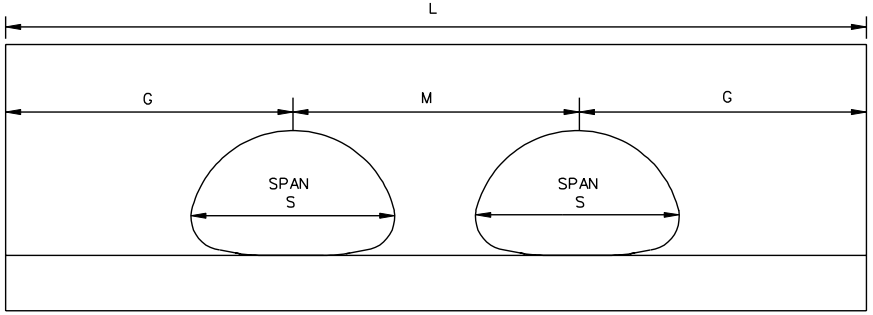
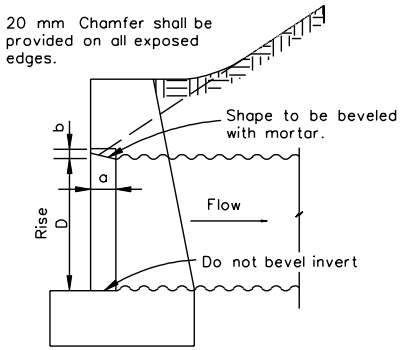
EW-10



FRONT ELEVATION



SIDE ELEVATION

Notes:

On shallow fills, where endwalls are 300 mm or less below shoulder line, the top of the endwall shall be constructed parallel to the grade of the road.

CORRUGATED METAL PIPE								
NOMINAL DIMENSIONS OF PIPE ARCH		DIMENSIONS FOR ONE DOUBLE ENDWALL			CUBIC METERS CONCRETE		a	b
Span S	Rise D	M	G	L	One Double Endwall	Increase For Each Additional Pipe Arch		
430	330	760	660	2080	0.31	0.11	50	30
530	380	860	780	2420	0.37	0.12	65	40
610	460	940	940	2820	0.70	0.21	75	50
710	510	1040	1060	3160	0.90	0.27	75	50
885	610	1220	1290	3800	1.45	0.40	100	65
1060	740	1470	1570	4610	2.18	0.60	115	75
* 1010	790	1470	1570	4610	2.18	0.60	115	75
1240	840	1700	1820	5340	2.64	0.71	140	90
* 1160	920	1700	1820	5340	2.64	0.71	140	90
1440	970	1980	2100	6180	3.57	0.95	150	100
* 1340	1050	1980	2100	6180	3.57	0.95	150	100

* 75 mm x 25 mm and 125 x 25 mm corrugation dimensions.

Notes:

This item may be precast or cast in place.

All dimensions not given in table are same as those for single endwalls for the same size pipe arch.

All cast in place concrete to be Class 20.
For precast See Sheet 101.25.

In no case shall top of endwall project above fill slope, ditch slope, or shoulder.

Headwall to be beveled in all areas except where a conflict with invert or wingwalls occur.

Bevel edge is required on the headwall at the inlet end of the culvert (where the flow enters the culvert).

Headwall at the outlet end of the culvert may be either square edge or bevel edge.

STANDARD ENDWALLS FOR MULTIPLE PIPE ARCHES
330 mm - 1050 mm RISE

REV. 8/97

101.24

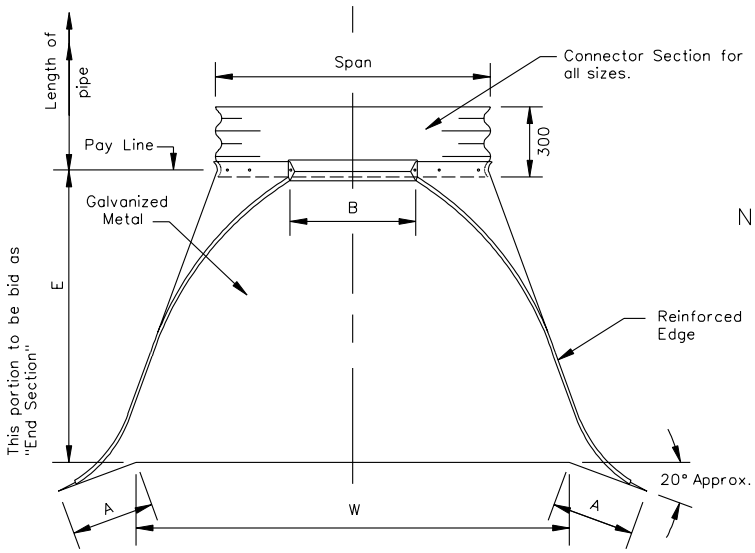
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

105
302

ES-3

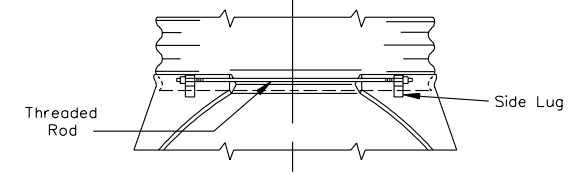


PLAN

Where Flared End - Sections are to be used with asphalt coated and paved metal pipe, end sections do not need to be coated or paved.

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

ALTERNATE CONNECTION



Notes: Toe plate to be punched to match holes in skirt lip.

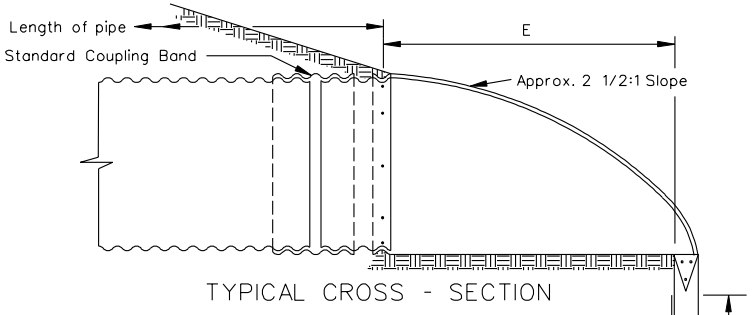
M10 galvanized bolts to be furnished. Length of toe plate is W + 250 mm with rise of 340 mm to 740 mm included and W + 450 mm min. with rise of 840 mm to 1200 mm included.

Skirt Section with Rise of 340 mm to 610 mm included to be made in one piece.

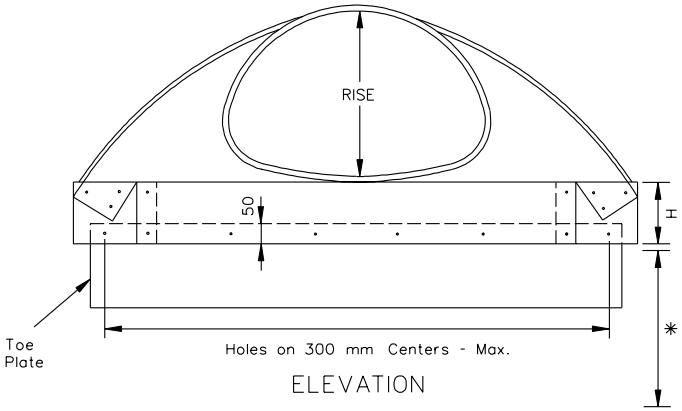
Skirt Section with Rise of 740 mm to 970 mm included may be made from two sheets joined by riveting or bolting on center line.

Skirt Section with Rise of 1100 mm to 1200 mm included may be made from three sheets joined by riveting or bolting at equal distances from center line.

Connector Section, Corner Plate and Toe Plate to be same sheet thickness as skirt and same type of material as culvert.



TYPICAL CROSS - SECTION



ELEVATION

PIPE-ARCH DIMENSIONS												
75x25 and 125x25 CORRUGATIONS			68 x 12 CORRUGATIONS				DIMENSIONS				
							A	B	H	E	W
SPAN	RISE	SHEET THICK-NESS	SPAN	RISE	SHEET THICKNESS STEEL	SHEET THICKNESS ALUM.	25mm TOL.	MAX.	25mm TOL.	40mm TOL.	50mm TOL.
			430	330	1.63	1.52	100	225	150	475	750
			530	380	1.63	1.52	125	250	150	575	900
			610	460	1.63	1.52	150	275	150	700	1050
			710	510	1.63	1.52	175	350	150	800	1200
			885	610	1.63	1.91	225	400	150	975	1500
1010	790	2.01	1060	740	1.63	2.67	275	425	175	1175	1900
1160	920	2.01	1240	840	2.77	2.67	300	500	225	1350	2150
1340	1050	2.01	1440	970	2.77	2.67	350	550	250	1600	2400
1520	1170	2.01	1620	1100	2.77	2.67	400	575	250	1775	2800
1670	1300	2.01	1800	1200	3.50	3.43	425	600	300	1950	3250

SPECIFICATION REFERENCE

302

FLARED END-SECTION FOR METAL PIPE-ARCHES
340 mm - 1200 mm RISE

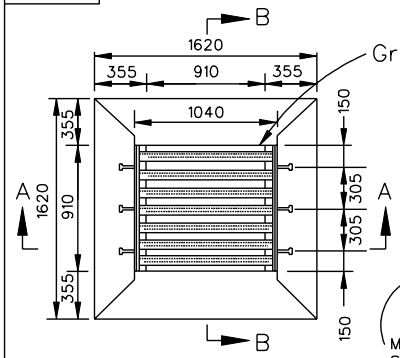
Rev. 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

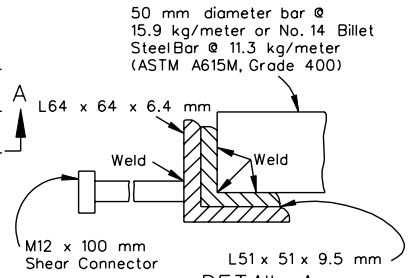
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

102.03

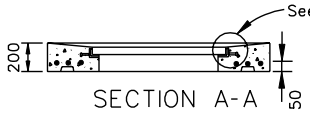
T-DI-7



PLAN VIEW

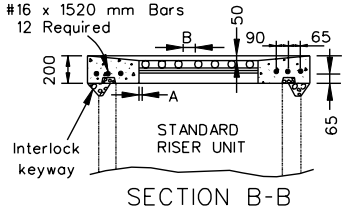


DETAIL A



SECTION A-A

BAR SPACING CHART		
GRATE TYPE	MAXIMUM DIMENSION	
	A	B
I	40	75
III	25	25



SECTION B-B

See General Notes-Precast for additional details.

Concrete cover and grate are to be furnished as a single unit. Outside dimensions of grate to be 1010 mm x 900 mm.

Dimensions shown are minimum. Actual dimensions may vary with manufacturer.

Alternate methods of anchoring angle iron will be acceptable if approved by the Engineer.

Grate and collar are to be galvanized.

Joints between concrete cover and gutters (when required) are to be doweled or keyed.

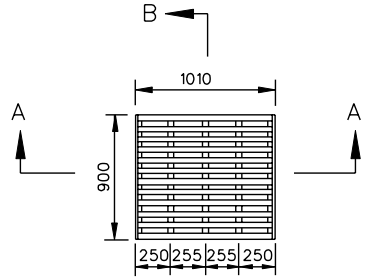
Concrete to be 30 MPa minimum.

Reinforcing steel to be in accordance with ASTM A615M.

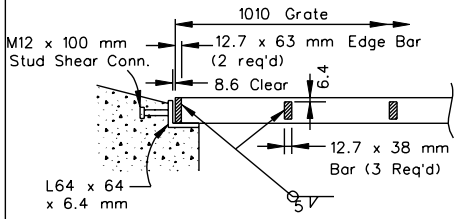
Grate bars to be installed so they will be aligned parrallel to the ditch flow.

See Standard DI-7,7A,7B for:
- Details of Gutter
- Method of Placement
- Alternate Methods of Construction

DETAILS OF CONCRETE COVER AND GRATE



GRATE B

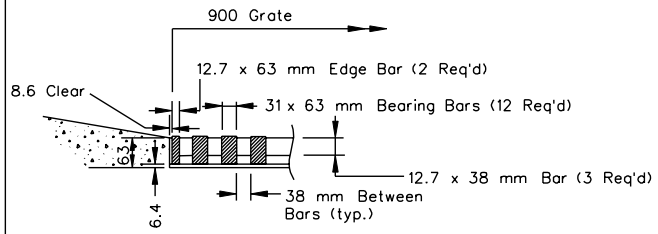


PARTIAL SECTION A-A

Grate A is to be used when inlet is located in median or other areas not normally subject to traffic.

Grate B is to be used when inlet is located on shoulders or other areas subject to traffic.

Grate to be galvanized after fabrication.



PARTIAL SECTION B-B

LOAD CARRYING GRATE

STANDARD PRECAST TOP UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

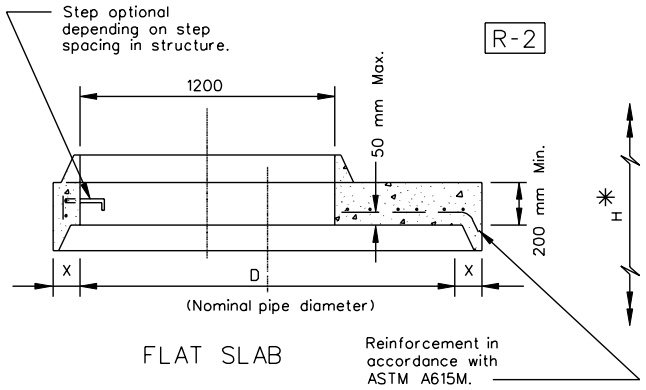
103.07 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

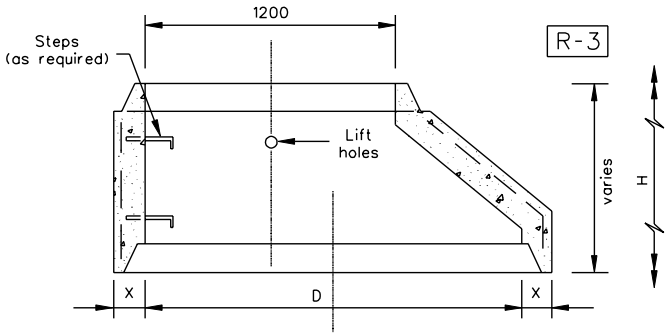
105
233
302

R-1,2,3

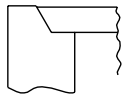
DIMENSIONS	
D	MIN. X
1500	125
1800	150
2100	175
2400	200



FLAT SLAB



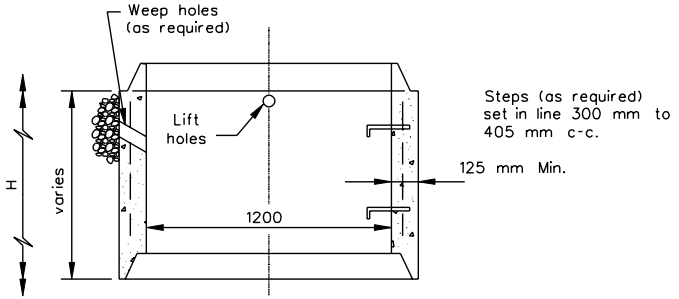
TAPER REDUCER



Tongue and groove joint to be of fabricator's design meeting the approval of the Engineer. Joints are to be sealed with mortar or O-ring gaskets.

ALTERNATE JOINT DETAIL

R-1



RISER

Notes:

See General Notes for additional information on weep holes, step requirements, "H" dimension, etc.

All reducer and riser units are to be in accordance with the requirements of AASHTO M199M.

Concrete to be 30 MPa.

Two 50 mm diameter lift holes to be provided in each riser and taper unit. Holes are to be located above the center of gravity of each unit with centers 180° apart.

Where openings are required for pipe, they shall be formed, drilled or neatly cut as approved by the engineer. The contractor will furnish the fabricator with the angles between center lines, the invert elevations, and the size of all pipes to enter the manhole.

For step details see standard ST-1.

Three lift eyes of manufacturer's design per unit may be substituted for lift holes shown hereon.

Dimensions shown are minimum. Actual dimensions may vary with manufacturer.

"D" is nominal pipe diameter.

✳ When using R-2 Flat Slab height of structure (H) is limited to a maximum of 7.6 m.

STANDARD PRECAST REDUCER AND RISER UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

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

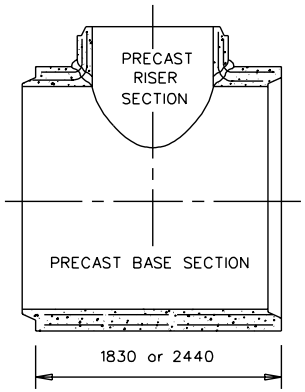
SPECIFICATION REFERENCE

105
302

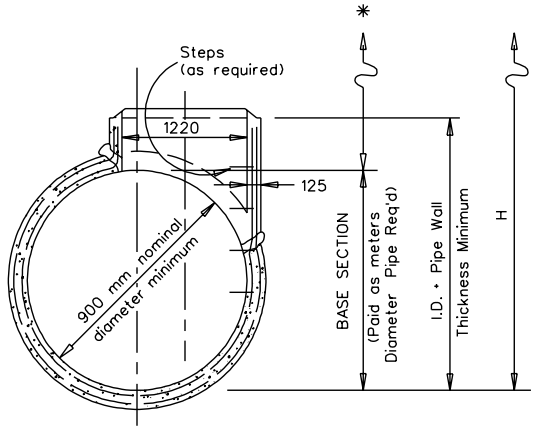
B-3

Weld and splice longitudinal and circumferential steel of riser and base sections to maintain continuity of reinforcement.

Hand or pneumatically place mortar and shape into collar.



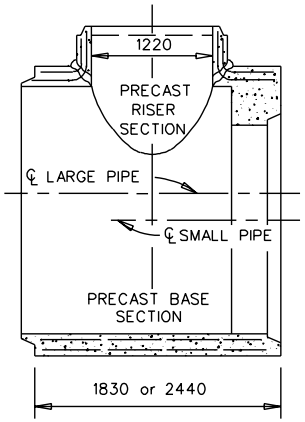
LONGITUDINAL SECTION



TRANSVERSE SECTION

* RISER SECTION

(Paid as Standard Drop Inlet or Meters Manhole depending on use of structure)



REDUCER SECTION

Notes:

See General Notes for additional information on Weep holes, step requirements, "H" dimension, etc.

The Tee Unit is to be precast for delivery to the construction site as a complete unit. Alternate designs meeting the approval of the Engineer may be substituted for that shown hereon.

The precast base section is to conform to the requirements of AASHTO M170M.

The precast riser section is to conform to the requirements of AASHTO M199M, except that minimum wall thickness is to be 125 mm.

The Base Section is to be the same class and strength as the adjoining pipe culvert and the tongue and groove joints are to be of an identical design.

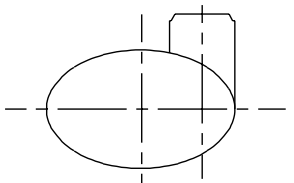
Concentric riser section may be substituted when approved by the Engineer.

Other manufacturer's designs for Reducer Sections may be substituted when approved by the Engineer.

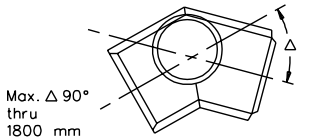
Reducer Sections with pipe crowns or center lines matched are available in addition to the matched inverts shown hereon.

TEE SECTION

OPTIONAL VARIATIONS AVAILABLE
WHEN SPECIFIED AS A MODIFIED B-3



SECTION
ELLIPTICAL TEE MANHOLE



PLAN
MANHOLE TEE BEND

Sheet 2 of 2

STANDARD PRECAST BASE UNITS
MAX. DEPTH (H) 7.6 m

VIRGINIA DEPARTMENT OF TRANSPORTATION

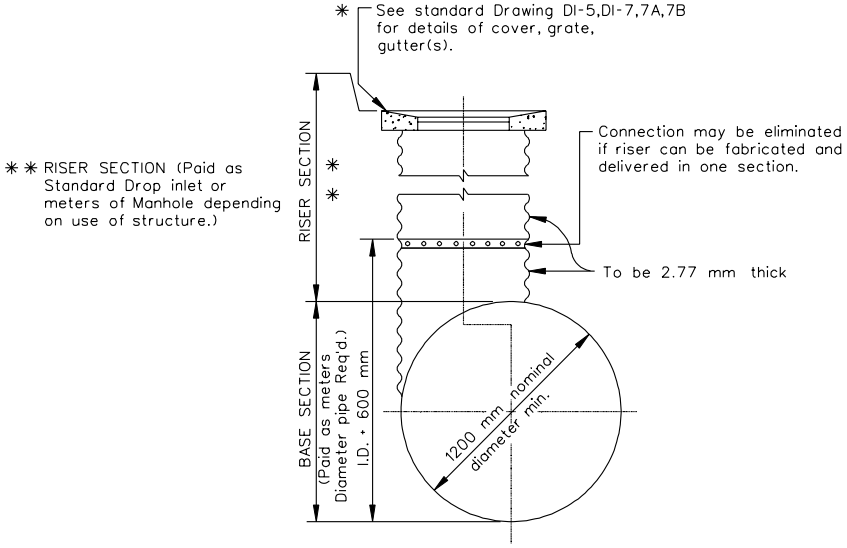
Rev. 8/97

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

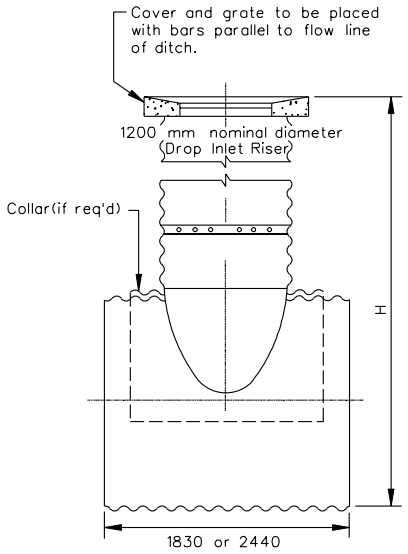
SPECIFICATION REFERENCE

105
302

✳ Other Standard grates or drop inlet throat sections may be substituted when specified on the plans.



TRANSVERSE SECTION



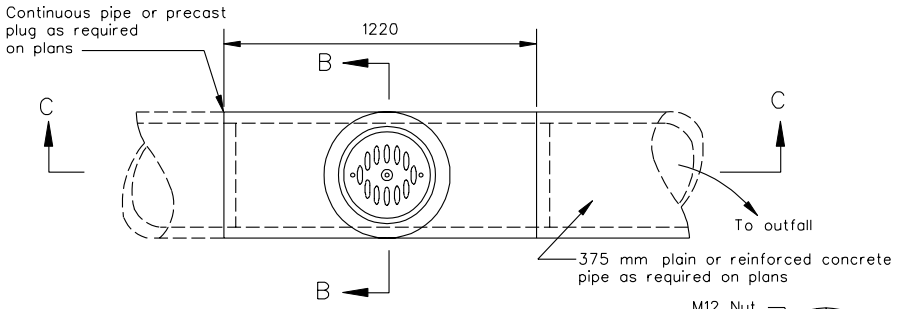
LONGITUDINAL SECTION

Notes:

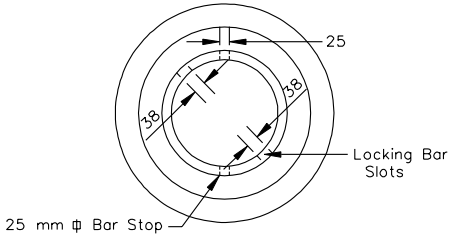
The Tee Unit to be fabricated for delivery to the construction site as a complete unit. Actual design details and methods of construction will be at the option of the fabricator and meeting the approval of the Engineer, except the sheet thickness, corrugation, and Specifications to be met will be the same as those required for the adjoining pipe culvert. If asphalt coating is specified for the culvert, the Tee Unit shall also be coated.

When required, connection between drop inlet Riser and Tee Unit may be bolted or riveted.

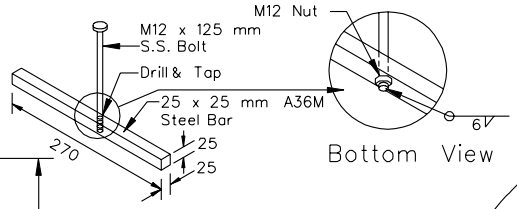
SPECIFICATION REFERENCE	CORRUGATED METAL TEE SECTION MAX. DEPTH (H) 7.6 m VIRGINIA DEPARTMENT OF TRANSPORTATION	Rev. 8/97
233 302	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	103.12



PLAN

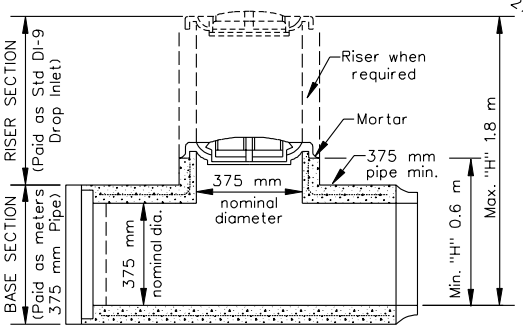


FRAME PLAN

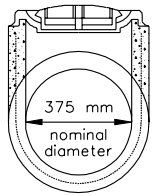


Bottom View

LOCKING BAR

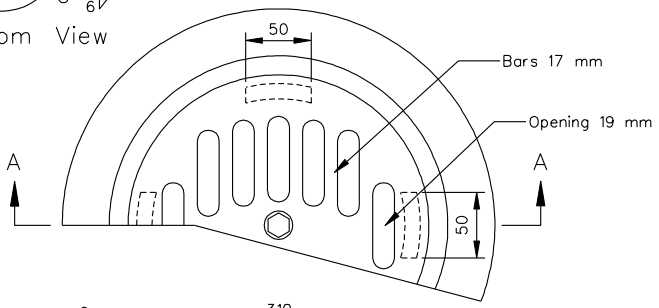


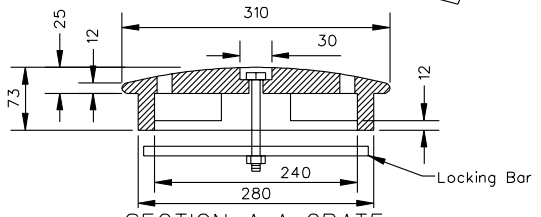
SECTION C-C



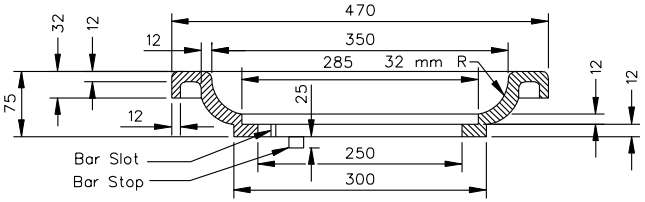
SECTION B-B

HALF PLAN FRAME & GRATE





SECTION A-A GRATE



SECTION A-A FRAME

Precast pipe plug shall be set in fresh mortar.

Precast plug shall conform to pipe manufacturer's joint design and shall have a min. thickness not less than pipe wall thickness.

This inlet is to be used only in locations not subject to traffic.

Frame is to be securely mortared to Tee Section.

Frame and grate to be Gray Iron, ASTM A48, Class 30S.

The precast Tee Unit is to conform to the requirements of AASHTO M170M for 375 mm Class III reinforced concrete pipe.

If needed the cost of the precast plug shall be included in the price bid for the DI-9.

REV. 9/1/97

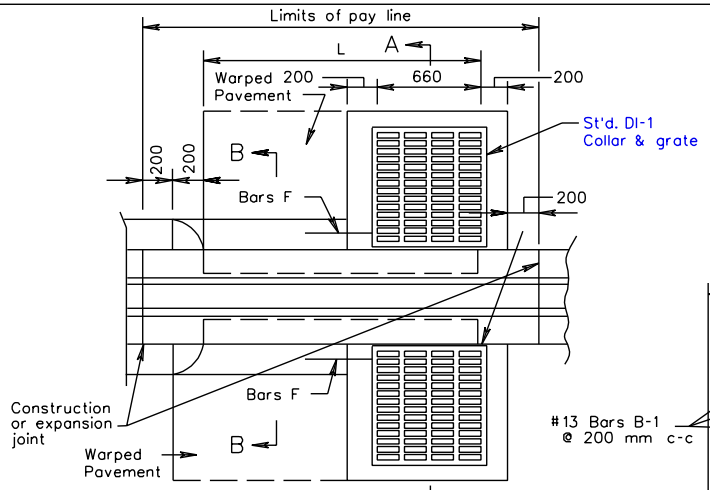
SPECIFICATION REFERENCE
233 302

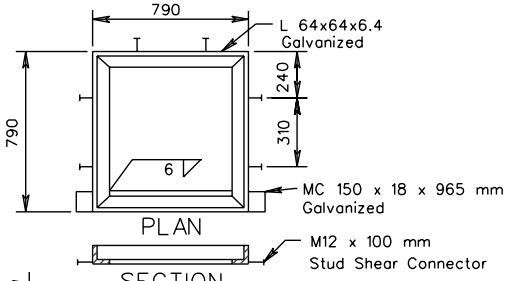
375 mm PIPE TEE SECTION DROP INLET

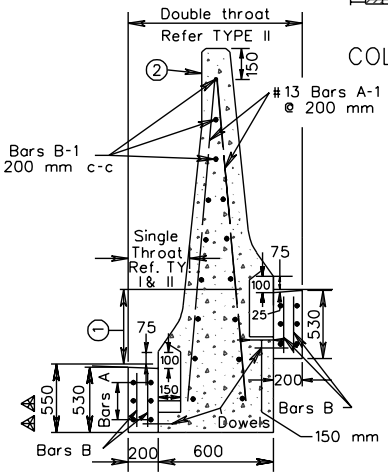
VIRGINIA DEPARTMENT OF TRANSPORTATION

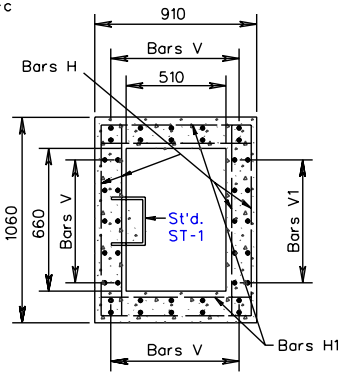
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

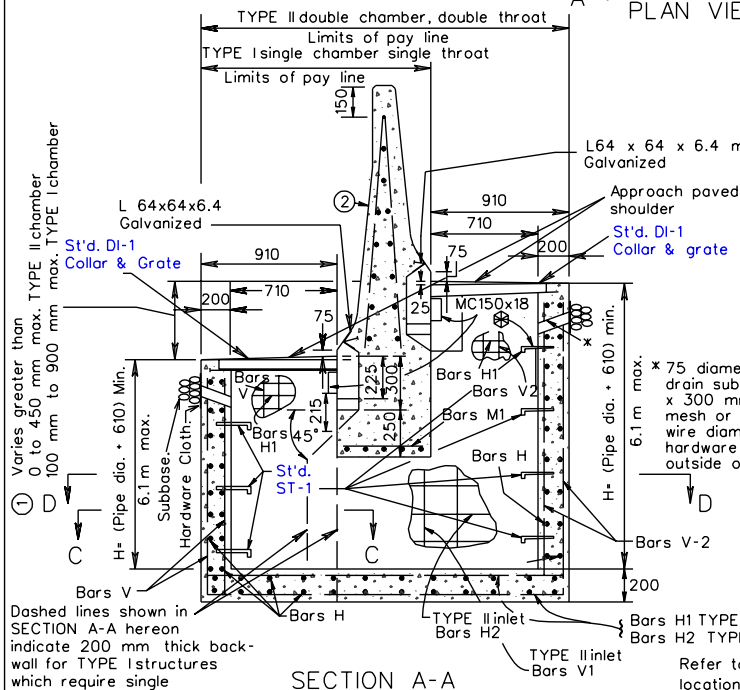
DI-14D,14E,14F







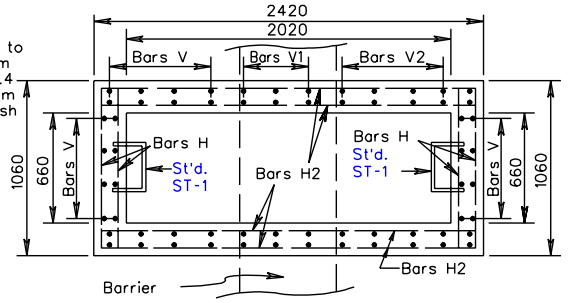




▲▲ A minimum 500 mm footing depth is required for forming the inlet slot, see plans for length "L".

* 75 diameter weep hole to be located to drain subbase. Weep hole with 300 mm x 300 mm plastic hardware cloth , 6.4 mesh or galvanized steel wire , minimum wire diameter 0.76 mm, number 4 mesh hardware cloth anchored firmly to outside of structure.

Refer to plans for structure locations, data & dimensions



Note:
Refer to plans for location of pipes and inverts.

Sheet 1 of 2

CONCRETE MEDIAN BARRIER DROP INLET (TALL WALL)

SPECIFICATION REFERENCE
233
302

REV. 8/97

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

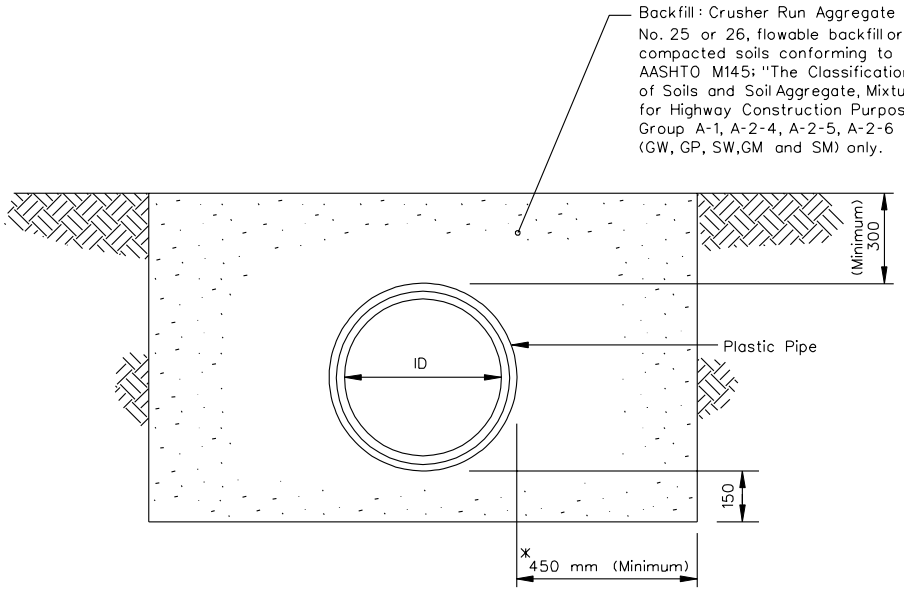
VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED ON 10/99 **REVISED ON 5/00** **REVISED ON 2/01**

PB-1

Notes:

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



* Minimum applies to pipe sizes up to and inclusive of 900 mm diameter. For pipes with diameters larger than 900 mm, the minimum dimension will be same as the outside diameter of the pipe.

Sheet 3 of 3

SPECIFICATION REFERENCE	PLASTIC CULVERT PIPE BEDDING	
302 303	VIRGINIA DEPARTMENT OF TRANSPORTATION	Rev. 8/97
	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	107.03

PC-1

MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES 150 mm X 50 mm CORRUGATIONS

PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM ALLLOWABLE COVER HEIGHT (m)	
NOMINAL SIZE		AREA	MAXIMUM "B"	Rc		MAXIMUM CORNER PRESSURE	
SPAN m	RISE m	(m^2)	(mm)	(mm)		190 MPa	* 290 MPa
1.85	1.40	2.04	533	458	2.77	4.8	7.3
1.95	1.45	2.23	521	458	2.77	4.5	7.0
2.05	1.50	2.42	559	458	2.77	4.2	6.7
2.15	1.55	2.60	544	458	2.77	4.2	6.4
2.20	1.60	2.88	528	458	2.77	3.9	6. 1
2.35	1.65	3.07	569	458	2.77	3.6	5.7
2.40	1.70	3.25	551	458	2.77	3.6	5.4
2.50	1.75	3.53	531	458	2.77	3.6	5.4
2.60	1.80	3.72	577	458	2.77	3.3	5. 1
2.70	1.85	3.99	554	458	2.77	3.3	4.8
2.85	1.90	4.27	605	458	2.77	3.0	4.8
2.90	1.95	4.55	582	458	2.77	3.0	4.5
2.95	2.00	4.83	556	458	2.77	3.0	4.5
3.10	2.05	5.11	607	458	2.77	2.7	4.2
3.25	2.10	5.39	663	458	2.77	2.7	4.2
3.30	2.15	5.67	638	458	2.77	2.7	3.9
3.45	2.20	5.95	696	458	2.77	2.4	3.9
3.50	2.25	6.22	668	458	2.77	2.4	3.6
3.60	2.30	6.60	640	458	2.77	2.4	3.6
3.75	2.35	6.87	699	458	2.77	2.4	3.6
3.80	2.40	7.25	671	458	2.77	2.4	3.6
3.85	2.45	7.52	640	458	2.77	2.1	3.3
3.90	2.50	7.90	610	458	2.77	2.1	3.3
4.10	2.55	8.27	668	458	2.77	2.1	3.3
4.25	2.60	8.64	734	458	2.77	2.1	3.0
4.30	2.65	9.01	701	458	2.77	2.1	3.0
4.35	2.70	9.38	668	458	2.77	1.8	3.0
4.50	2.75	9.75	734	458	2.77	1.8	3.0
4.65	2.80	10.13	803	458	2.77	1.8	2.7
4.70	2.85	10.50	767	458	2.77	1.8	2.7
4.75	2.90	10.96	732	458	2.77	1.8	2.7
4.80	3.00	11.33	696	458	2.77	1.8	2.7
5.00	3.00	11.71	765	458	2.77	1.8	2.7
5.05	3.05	12.17	729	458	2.77	1.8	2.7

NOTES

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

Cover heights indicated in table are for finished construction.

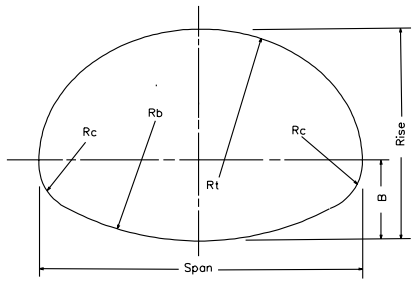
The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

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

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

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

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



Sheet 10 of 17

SPECIFICATION REFERENCE

232
302

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

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

107.13

PC-1

MINIMUM THICKNESS-STRUCTURAL PLATE STEEL PIPE ARCHES 150 mm X 50 mm CORRUGATIONS

PIPE ARCH DIMENSION					MINIMUM SHEET THICKNESS REQUIRED (mm)	MAXIMUM ALLLOWABLE COVER HEIGHT (m)	
						MAXIMUM CORNER PRESSURE	
SPAN m	RISE m	AREA (m^2)	MAXIMUM "B" (mm)	Rc (mm)		190 MPa	290 MPa ☆
4.05	2.85	9.01	978	788	2.80	3.6	5.4 *
4.10	2.90	9.48	958	788	2.80	3.6	5.1 *
4.25	2.95	9.75	1006	788	2.80	3.6	5.1 *
4.30	3.00	10.13	986	788	2.80	3.6	4.8 *
4.40	3.05	10.59	963	788	2.80	3.3	4.8 *
4.55	3.10	10.96	1011	788	2.80	3.3	4.8 *
4.65	3.15	11.43	1062	788	2.80	3.3	4.5 *
4.75	3.20	11.80	1039	788	2.80	3.3	4.5 *
4.80	3.25	12.26	1016	788	2.80	3.0	4.2 *
4.95	3.30	12.73	1069	788	2.80	3.0	4.2 *
5.00	3.35	13.19	1044	788	2.80	3.0	4.2 *
5.20	3.40	13.56	1100	788	2.80	3.0	4.2 *
5.25	3.45	14.03	1074	788	2.80	3.0	3.9 *
5.30	3.50	14.59	1049	788	2.80	2.7	3.9 *
5.45	3.55	14.96	1105	788	2.80	2.7	3.9 *
5.50	3.60	15.51	1077	788	2.80	2.7	3.9 *
5.65	3.65	15.98	1135	788	2.80	2.7	3.6 *
5.70	3.70	16.44	1107	788	2.80	2.7	3.6 *
5.85	3.75	16.91	1166	788	3.50	2.4	3.9
5.95	3.80	17.47	1138	788	3.50	2.4	3.9
6.00	3.85	18.02	1110	788	3.50	2.4	3.9
6.05	3.90	18.58	1080	788	3.50	2.4	3.6
6.20	3.95	19.04	1140	788	3.50	2.4	3.6
6.25	4.00	19.60	1110	788	3.50	2.4	3.6

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

Cover heights indicated in table are for finished construction.

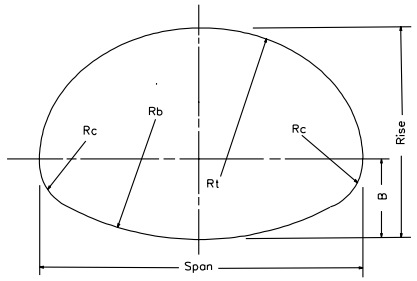
The allowable cover tables shown are based on a soil modulus of 4.8 MPa. All other design criteria are in accordance with the AASHTO Specifications and VDOT Modifications for Soil Corrugated Metal Structure Interaction Systems.

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

Minimum finished height of cover shall be $\frac{\text{Span}}{8}$ or 0.3 meter, whichever is greater.
To protect pipe during construction minimum height of cover prior to allowing construction traffic to cross installation shall be $\frac{\text{Span.}}{2}$

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

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



Sheet 11 of 17

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

Rev. 8/97

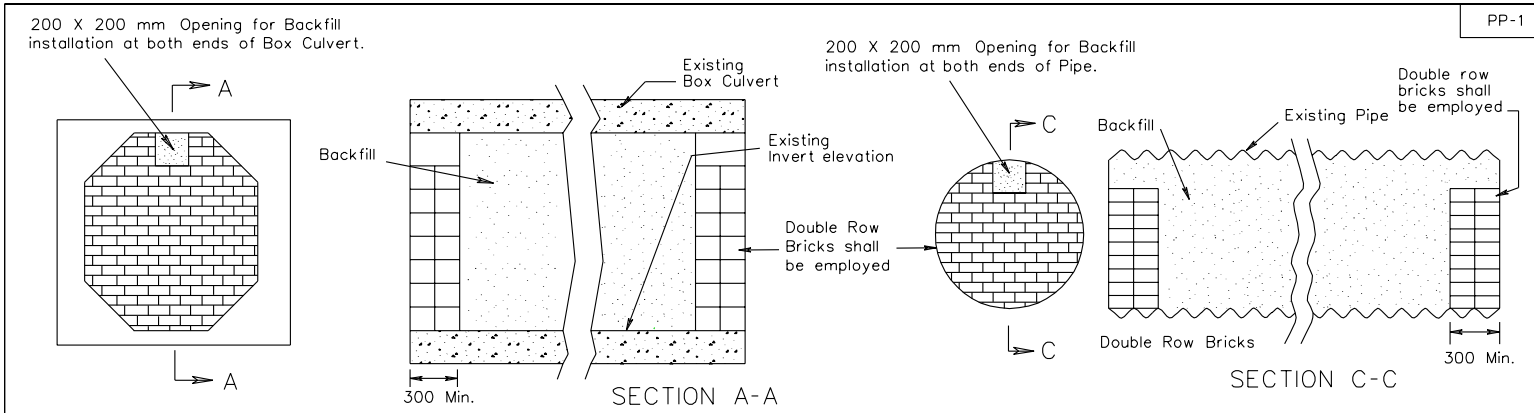
107.14 | UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS

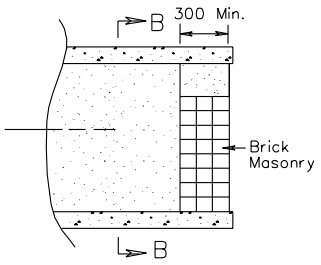
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

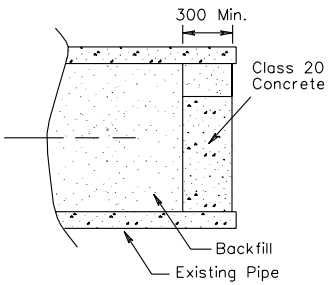
232
302

PP-1

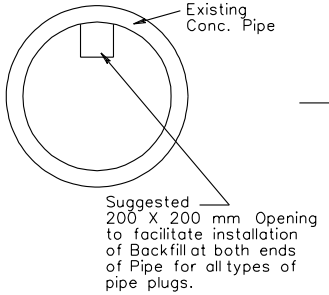




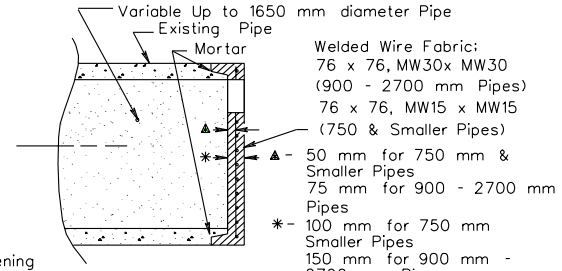
SECTION OF BRICK MASONRY PIPE PLUG



SECTION OF CONCRETE PIPE PLUG



SECTION B-B



⊛ SECTION OF PRECAST PIPE PLUG (Male End)

(Male or Female plug design to be furnished where applicable.)

QUANTITIES		
Pipe Size	m^3 Backfill per meter	m^3 Per Each Conc. Plug
300	0.07	0.01
375	0.11	0.02
450	0.16	0.04
600	0.28	0.07
750	0.44	0.12
900	0.64	0.18
1050	0.87	0.25
1200	1.13	0.33
1350	1.43	0.42
1500	1.77	0.52
1650	2.14	0.63
1800	2.54	0.75
2050	3.30	0.98
2100	3.46	1.03
2250	3.98	1.18
2400	4.52	1.35
2550	5.11	1.52
2700	5.73	1.71

NOTES:

Backfill is to be either Flowable Backfill or Fine Aggregate as per the Specifications and is to be paid as m^3 of Flowable Backfill.

For placement of structures, see roadway plan sheets.

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

⊛ Precast notes :

Concrete to be 30 MPa Minimum Compressive strength.

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

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

SPECIFICATION REFERENCE

DETAILS FOR BACKFILLING ABANDONED CULVERTS

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

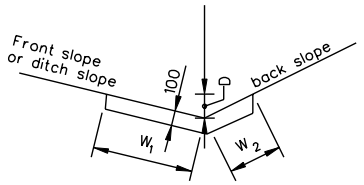
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

107.21

REVISED ON 7/02

PG-2A

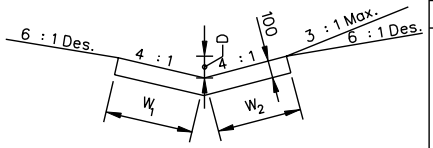
OUTSIDE ROAD DITCHES



TYPE	D mm	FRONT SLOPE	BACK SLOPE	W1 mm	W2 mm	K	SQ. METERS SURFACE AREA/METER
A1	150	6:1	4:1	910	620	48	1.53
A1	200	6:1	4:1	1215	825	104	2.04
A2	150	6:1	3:1	910	475	42	1.39
A2	200	6:1	3:1	1215	630	92	1.85
A3	150	6:1	2:1	910	335	38	1.25
A3	200	6:1	2:1	1215	445	82	1.66
B1	150	4:1	4:1	620	620	38	1.24
B1	200	4:1	4:1	825	825	82	1.65
B2	200	4:1	3:1	825	630	72	1.46
B2	250	4:1	3:1	1030	790	130	1.82
B3	200	4:1	2:1	825	445	60	1.27
B3	250	4:1	2:1	1030	560	111	1.59
B4	200	4:1	1 1/2:1	825	360	55	1.19
B4	250	4:1	1 1/2:1	1030	450	101	1.48
C1	200	3:1	2:1	630	445	50	1.08
C1	250	3:1	2:1	790	560	92	1.35
C2	250	3:1	1 1/2:1	790	450	80	1.24
C3	250	3:1	1:1	790	355	70	1.15

MEDIAN DITCH

TYPE D

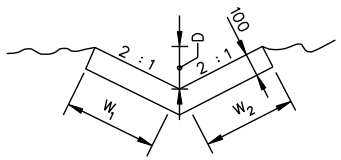


K = 82

D = Depth	W_1	W_2	Sq. m surface area per m
200	825	825	1.65

DITCH AT TOE OF FILL OR TOP OF CUT

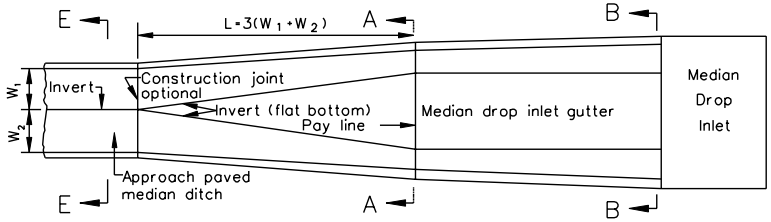
TYPE E



K = 115

300	670	670	1.34

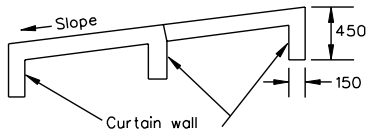
PLAN FOR TRANSITION OF PAVED MEDIAN DITCH TO MEDIAN DROP INLET GUTTER



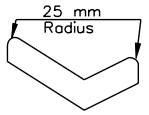
Notes:

For Section B-B see Standards DI-7, 7A and 7B.
Transitional portion of paved ditch to be paid for at the same price bid per sq. meter for approach paved median ditch.
Standard PG-2A ditches to be Class 20 Concrete.

Curtain wall to be located at beginning an end of all channels and on the lower end of each expansion joint.



ALTERNATE METHOD OF FORMING DITCHES



Note:
All ditches may be constructed with vertical sides at the option of the contractor.

SPECIFICATION REFERENCE

502

STANDARD PAVED DITCHES

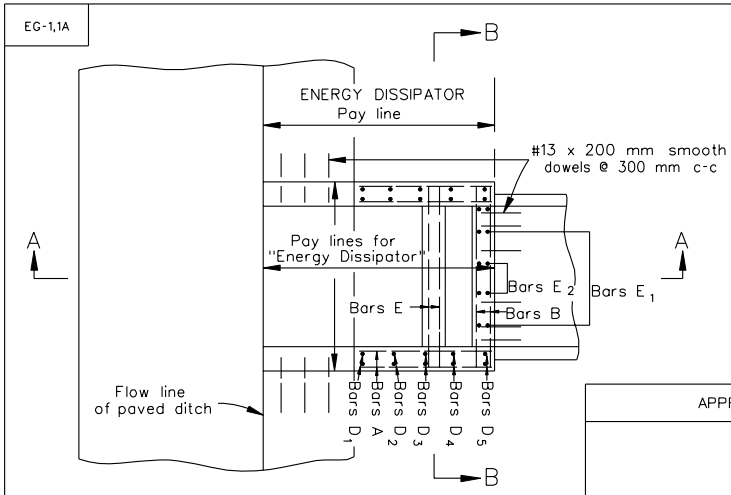
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 9/1/97

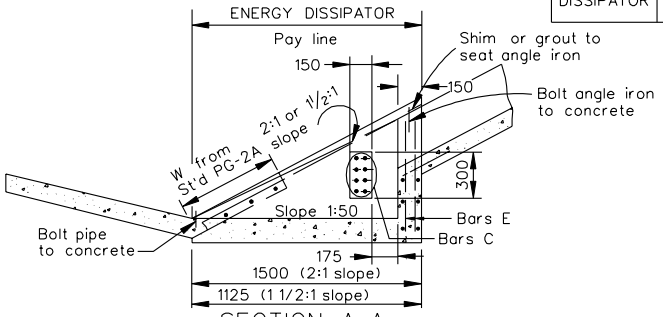
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

109.01

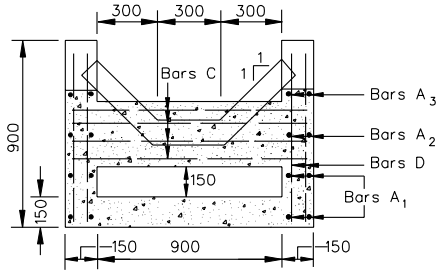
EG-1,1A



PLAN VIEW
(No grate shown)



SECTION A-A



SECTION B-B

Notes:

Amount of paved ditch replaced by "Energy Dissipator" tabulated by depths as shown in Standard PG-2A.

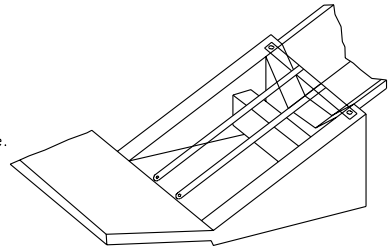
This item may be precast or cast in place.

Concrete to be Class 20 if cast in place.

For precast see sheet 111.02.

The 2:1 design may be used on either 1 1/2:1 or 2:1 slopes.

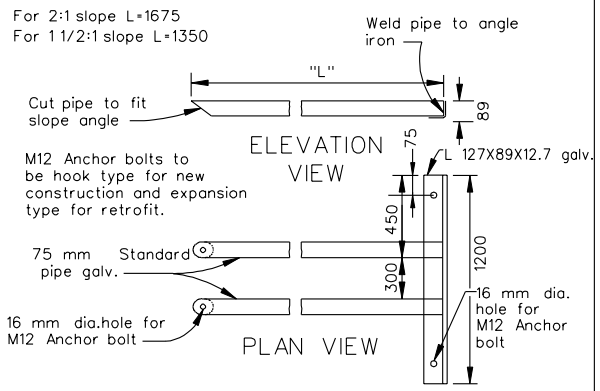
EG-1 - Energy Dissipator without grate.
EG-1A - Energy Dissipator with grate.



APPROXIMATE QUANTITIES			
		CONCRETE	REINFORCING STEEL
		m^3	kg
ENERGY DISSIPATOR	2:1	0.60	28
	1-1/2:1	0.50	26

SCHEDULE OF REINFORCING STEEL

MARK	NO.	LENGTH		SIZE	SPACING C-C	SHAPE
		2:1	1-1/2:1			
A1	8	860	860	#10	200	STRAIGHT
A2	4	760	560	#10	200	STRAIGHT
A3	4	320	250	#10	200	STRAIGHT
B	6	1140	1140	#10	200	STRAIGHT
C	8	1120	1120	#13	65	STRAIGHT
D1	4	360	200	#10	200	STRAIGHT
D2	4	470	340	#10	200	STRAIGHT
D3	4	570	480	#10	200	STRAIGHT
D4	4	670	620	#10	200	STRAIGHT
D5	4	760	760	#10	200	STRAIGHT
E1	4	600	600	#10	200	STRAIGHT
E2	4	440	440	#10	200	STRAIGHT



SAFETY GRATE DETAIL

STANDARD ENERGY DISSIPATOR FOR USE WITH PAVED FLUMED

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV./9/1/97

SPECIFICATION REFERENCE

502

111.01

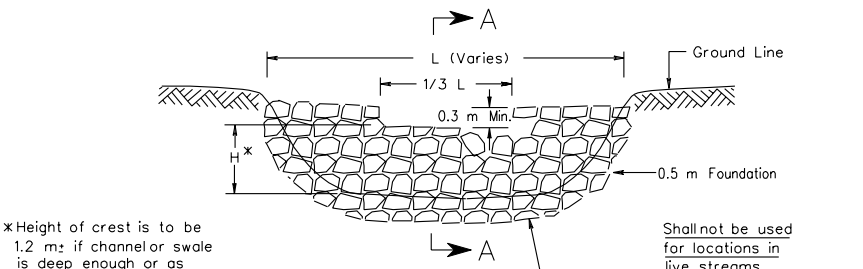
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

REVISED ON 2/01

ESC-INS

CHECK DAMS

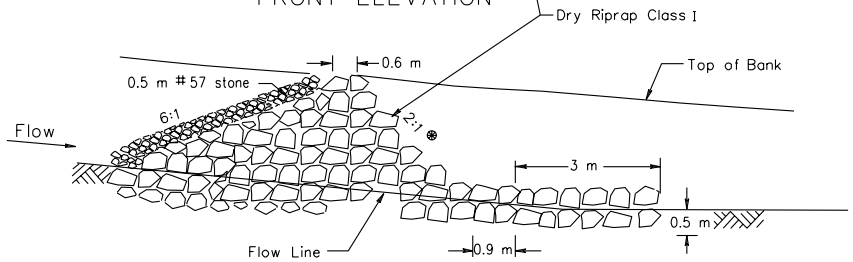
TYPICAL DETAIL FOR ROCK CHECK DAM TYPE I



*Height of crest is to be 1.2 m± if channel or swale is deep enough or as designated by designer.

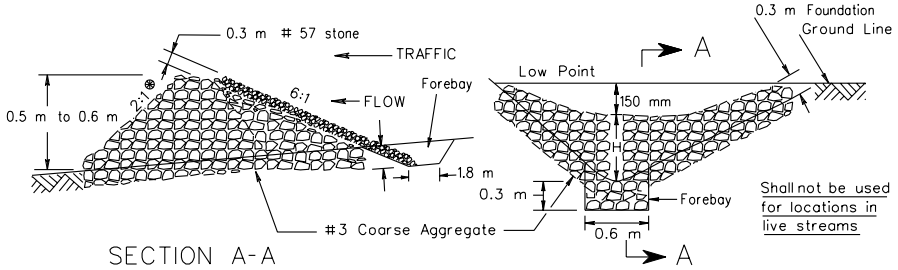
Shall not be used for locations in live streams

FRONT ELEVATION



SECTION A-A

TYPICAL DETAIL FOR ROCK CHECK DAM TYPE II



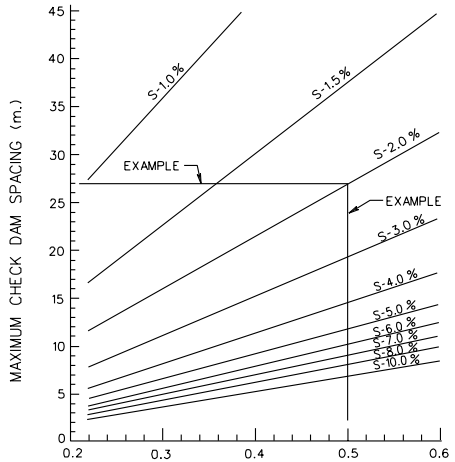
SECTION A-A

FRONT ELEVATION

Shall not be used for locations in live streams

Shall not be used in cut ditch within clear zone when H > 0.3 m

ROCK CHECK DAM SPACING



CHECK DAM HEIGHT (m)
MEASURED AT BOTTOM OF SPILLWAY

DESIGN OF STONE CHECK DAM SPACING
(n=0.030, V=0.6 m/s)

EXAMPLE : HEIGHT OF STRUCTURE 0.5 m
GRADE 2%
EXTEND PERPENDICULAR FROM 0.5 m HEIGHT TO INTERSECT 2% GRADE°
EXTEND 90 TO THE LEFT TO DETERMINE SPACING (27 m±)

NOTES:
Rock Check Dams that are designated on the plans as a Stormwater Management (SWM) item are to be left in place as a permanent installation.

H = Height of dam 0.3 m or as designated by designer.

Where drainage areas exceed 0.4 hectares or ditch grade exceeds 3%, a temporary sediment trap shall be installed with minimum dimensions of 0.3 m deep and 1.8 m in length.

⊛ If Rock Check Dams are subject to two way traffic and are located within the clear zone, they are to have 6:1 slopes on both sides.

SPECIFICATION REFERENCE
107 303

TEMPORARY EROSION & SILTATION CONTROL

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

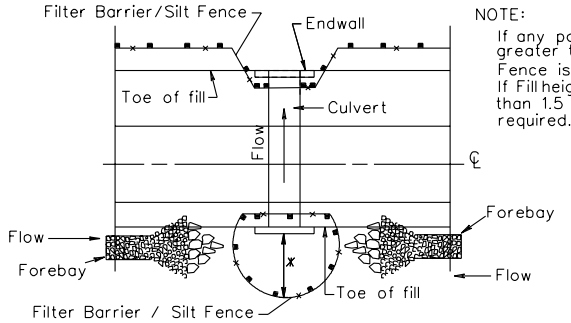
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

115.01

REVISED ON 2/01

ESC-INS

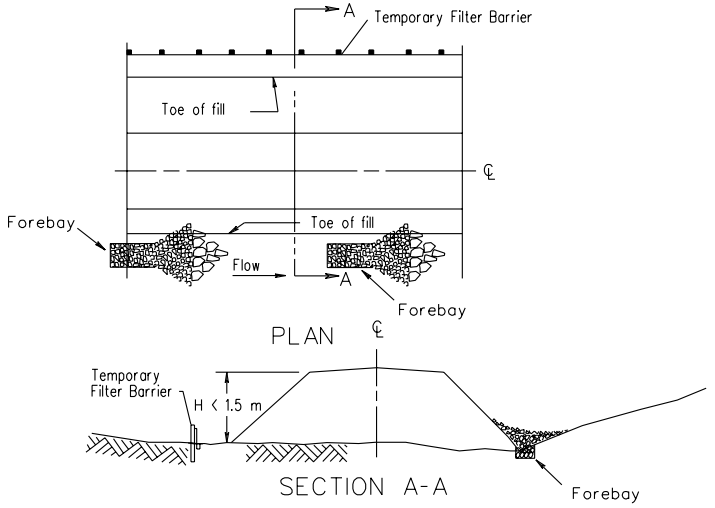
TYPICAL DETAIL FOR TEMPORARY FILTER BARRIER / SILT FENCE AT CULVERT OR PIPE



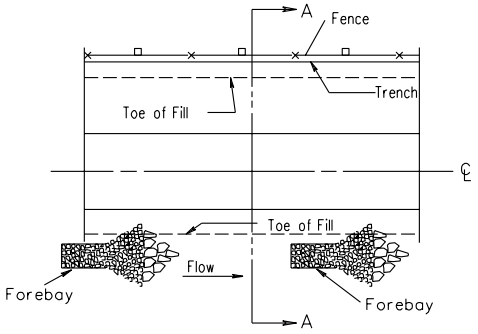
NOTE:
If any portion of Fill is greater than 1.5 m, Silt Fence is required.
If Fill height is less than 1.5 m, Filter Barrier is required.

* Distance is 1.8 m minimum if flow is toward the embankment. To be contained in right of way or easement.

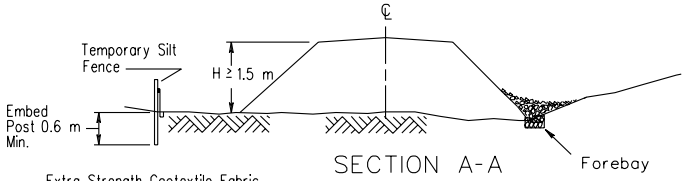
TYPICAL DETAIL FOR TEMPORARY FILTER BARRIER AT TOE OF FILL

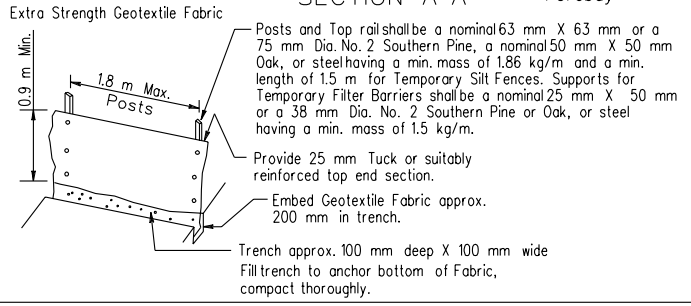


TEMPORARY SILT FENCE

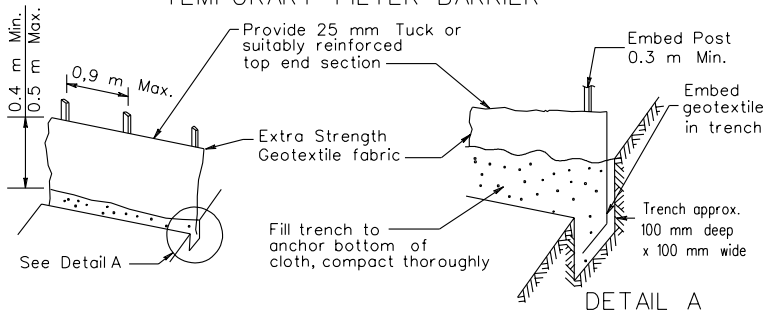


NOTE:
Rock Check Dam is to be constructed in accordance with the Road and Bridge Specifications, and Standard ESC-INS sheet 115.01.





TEMPORARY FILTER BARRIER



Sheet 4 of 8

TEMPORARY EROSION & SILTATION CONTROL

Rev. 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

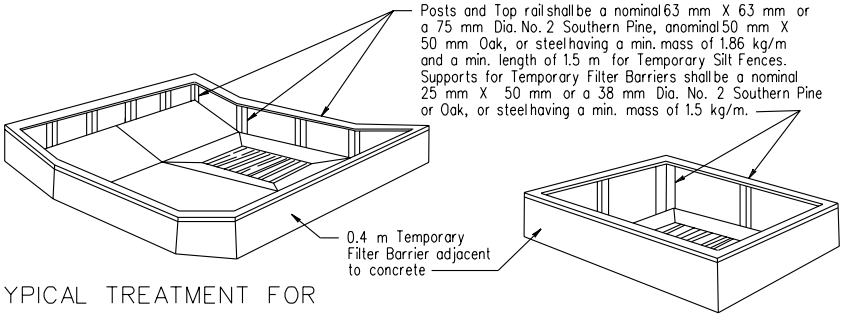
SPECIFICATION REFERENCE

107
242
303

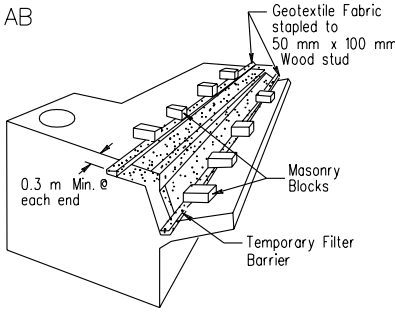
REVISED ON 2/01

ESC-INS

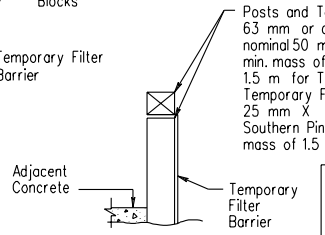
DROP INLET SILT TRAP



TYPICAL TREATMENT FOR DROP INLET WITH CONC. SLAB



TYPICAL TREATMENT CURB DROP INLET



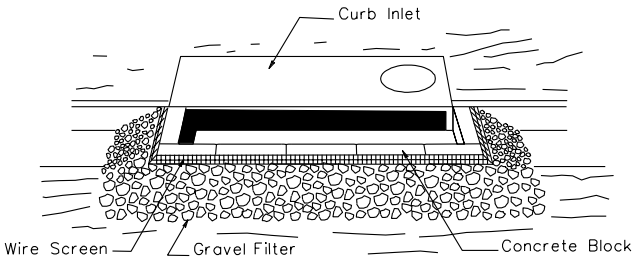
TYPICAL TREATMENT FOR DROP INLET WITHOUT CONC. SLAB

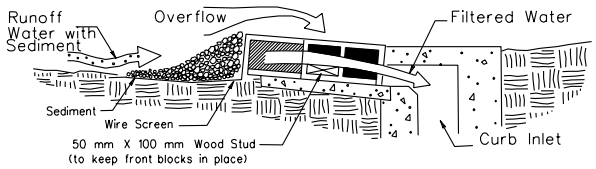
Drop inlet silt traps will be measured for payment in meters of Temporary Filter Barrier.

Curb Drop Inlet Filter Barrier will be measured in meters along the throat and paid for as Temporary Filter Barrier.

Geotextile products designed to be inserted into grated drop Inlets or designed to cover the slots of slot drop inlets that have been approved for use on VDOT projects and are found on VDOT's SPEL list may be substituted for the drop inlet protection devices.

ALTERNATE DROP INLET SILT TRAP (BLOCK AND GRAVEL TYPE)



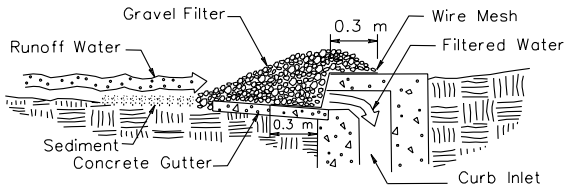


SECTIONAL VIEW

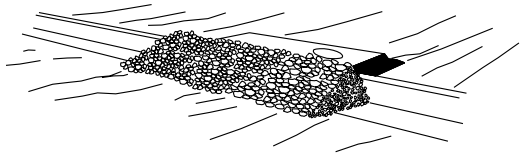
Specific Application

This method of inlet protection is applicable at curb inlets where an overflow capability is necessary to prevent excessive ponding in front of the structure.

ALTERNATE DROP INLET SILT TRAP (GRAVEL TYPE)



SECTIONAL VIEW



Specific Application

This method of inlet protection is applicable at curb inlets where ponding in front of the structure is not likely to cause inconvenience or damage to adjacent structures and unprotected areas.

Sheet 6 of 8

TEMPORARY EROSION & SILTATION CONTROL

Rev. 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

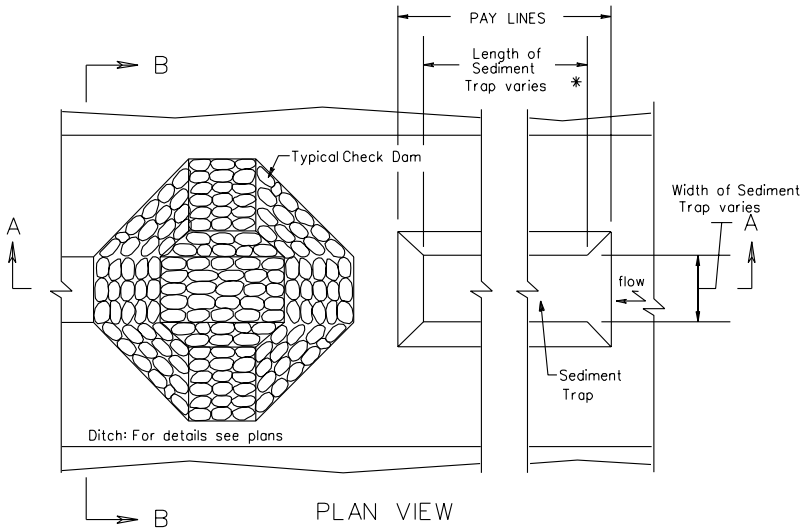
SPECIFICATION REFERENCE

107
242
303

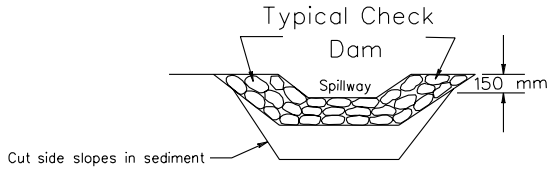
REVISED ON 2/01

ESC-INS

TYPICAL SEDIMENT TRAP



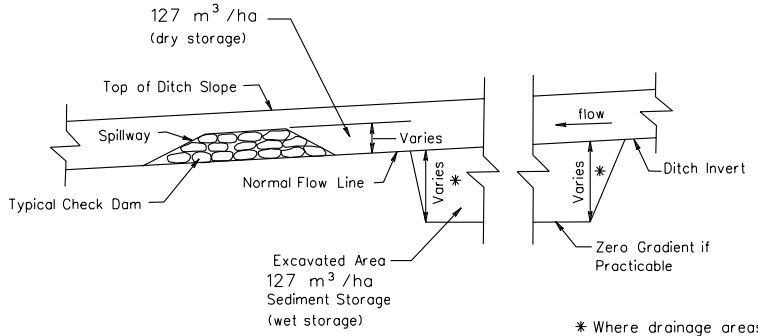
PLAN VIEW



SECTION B-B

NOTES:

Check Dam is shown for illustration only and is not included in payment for Sediment Trap.



SECTION A-A

* Where drainage areas exceed 0.4 ha or ditch grade exceeds 3%, a Sediment Trap shall be installed with each Check Dam with minimum dimensions of 0.3 m deep and 1.8 m in length.

Note: The sediment storage volume shall be 254 m³/ha of total contributing drainage area and shall consist of half in the form of wet storage and half in the form of dry storage.

SPECIFICATION REFERENCE
107 303

TEMPORARY EROSION & SILTATION CONTROL

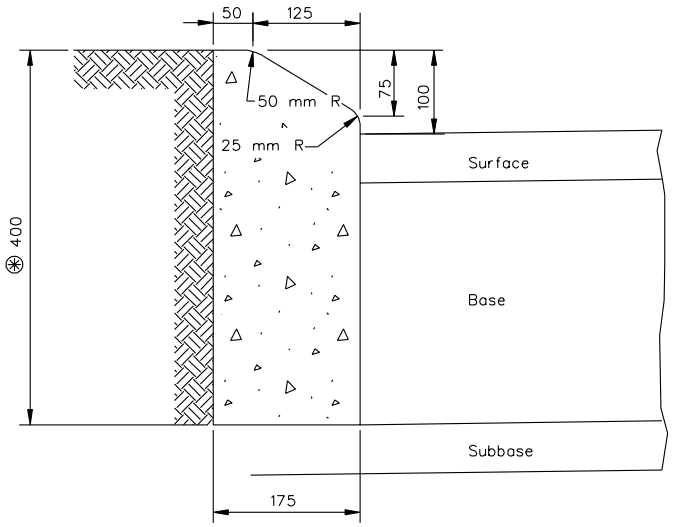
VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

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

115.07

CG-3



Notes:

This item may be precast or cast in place.

Concrete to be Class 20 if cast in place, 30 MPa if precast.

Curb having a radius of 90 m or less (along face of curb) will be paid for as radial curb.

⊛ The depth of curb may be reduced as much as 75 mm (325 mm depth) or increased as much as 75 mm (475 mm depth) in order that the bottom of curb will coincide with the top of a course of the pavement substructure. Otherwise the depth is to be 450 mm as shown. No adjustment in the price bid is to be made for a decrease or an increase in depth.

When this standard is to be tied into existing barrier curb, the transition is to be made within 3.0 m or the change in standards made at regular openings.

This curb may be used with any design speed but is required when design speed is greater than 60 km/h on Rural highways and 70 km/h in developed urban & suburban areas.

STANDARD 100 mm CURB

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 9/1/97

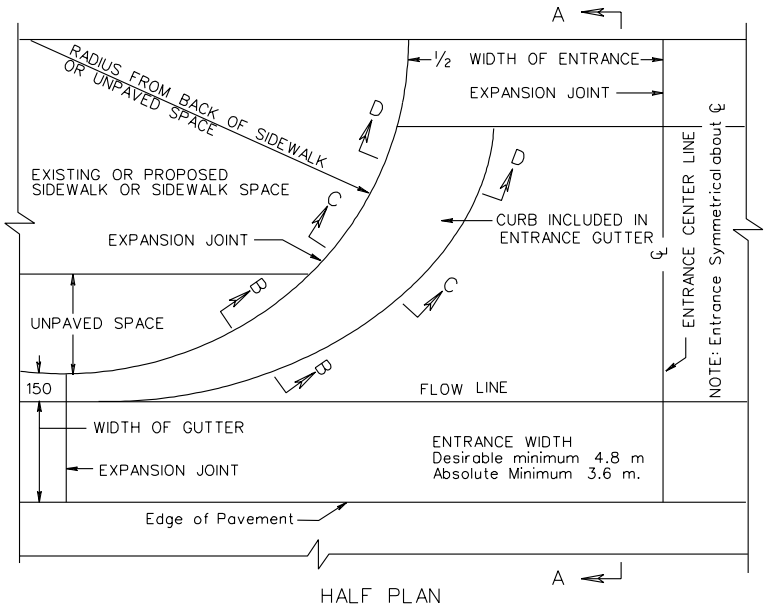
201.02

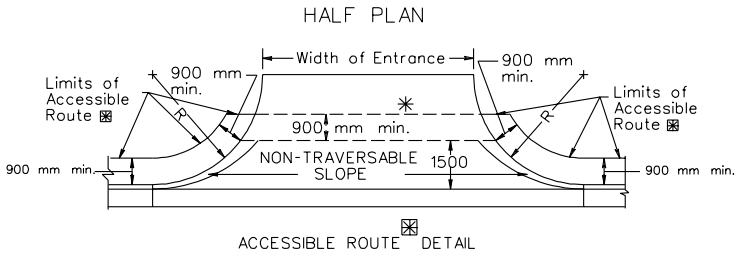
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

105
502

CG-9D



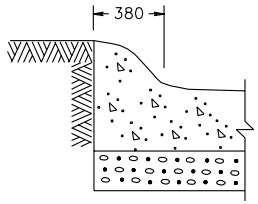


Additional right-of-way is required if the limits of Accessible Route ⊠ extend beyond existing or proposed VDOT Right-Of Way.

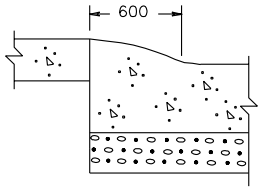
Detail to be used when the combined width of unpaved space and sidewalk space is less than 2.1 m.

⊠ Accessible route is defined as a continuous unobstructed, stable, firm and slip resistant path connecting all accessible elements of a facility that can be approached, entered and used by persons with mobility impairments.

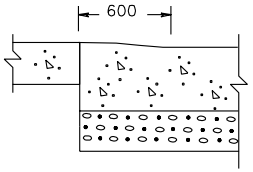
✳ If accessible routes are being provided, a minimum 900 mm traversable width is required.



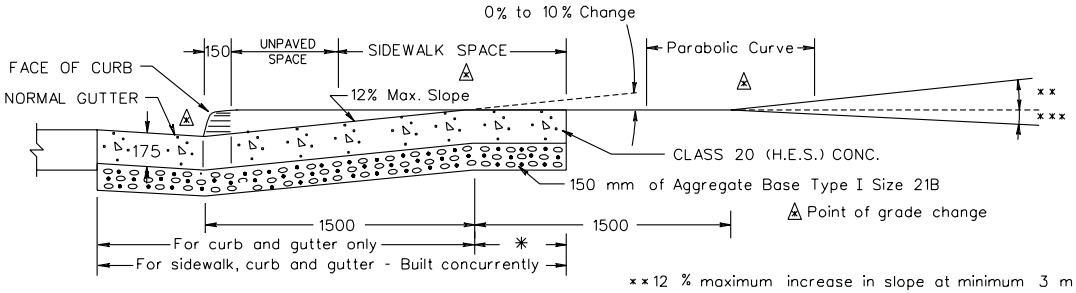
SECTION B-B



SECTION C-C



SECTION D-D

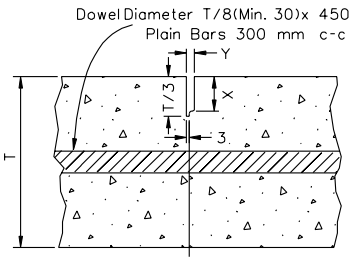


SECTION A-A

** 12 % maximum increase in slope at minimum 3 m intervals
*** 3 % maximum decrease in slope for first 3 m interval and
8 % maximum decrease for succeeding minimum 3 m intervals

When used in conjunction with Standard CG-3 or CG-7, the curb face on this Standard is to be adjusted to match the mountable curb configuration.

SPECIFICATION REFERENCE	STANDARD ENTRANCE GUTTER	Rev. 8/97
502	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS — 203.03



DETAIL OF TRANSVERSE CONTRACTION JOINT (BEFORE INSTALLATION OF SEAL)

General Notes

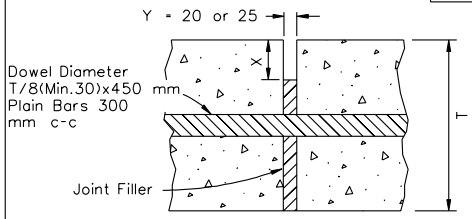
Alternate preformed sealants having a cross-sectional area comparable to type A (Contraction Joints) and type D (Expansion Joints) and meeting the approval of the Engineer may be substituted.

Other types of joint material are to be in accordance with the Specifications.

All details not shown hereon to be in accordance with Standards PR-2, Sheet 2 of 3.

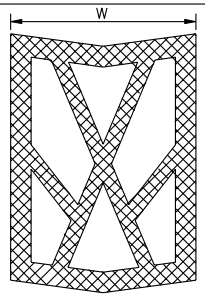
All Contraction Joints to be sawed in conformance with detail to the left, except that where gravel aggregate is used in the concrete, the joint may be prepared by forming 6 mm or less of the width, for the depth shown with non-metallic or removable material, followed by sawing to complete the joint to the required width and depth.

For details of Transverse Construction Joint, see below.



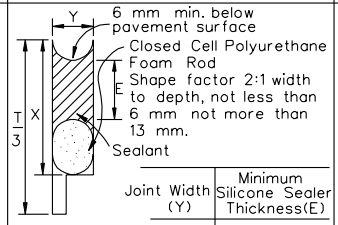
DETAIL OF TRANSVERSE EXPANSION JOINT (BEFORE INSTALLATION OF SEAL)

PREFORMED CHLOROPRENE ELASTOMERIC JOINT SEALANT



Type A

SILICONE JOINT SEALANT

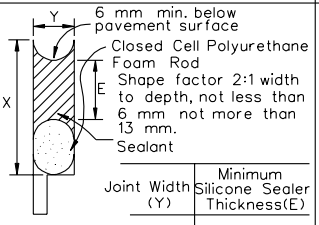


Joint Width (Y)	Minimum Silicone Sealer Thickness(E)
6	6
10	6
13	6

Back-up Material shall be 25% greater diameter than Y dimension.

Type B

SILICONE JOINT SEALANT

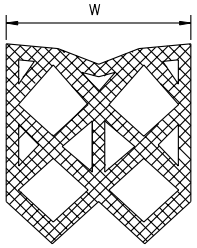


Joint Width (Y)	Minimum Silicone Sealer Thickness(E)
20	10
25	13

Back-up Material shall be 25% greater diameter than Y dimension.

Type C

PREFORMED CHLOROPRENE ELASTOMERIC JOINT SEALANT



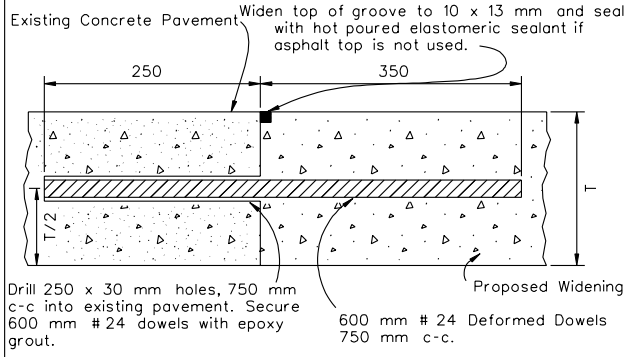
When Y = 20
W = 30
X = 50

When Y = 25
W = 40
X = 50

Type D

SEALANTS FOR TRANSVERSE CONTRACTION JOINTS

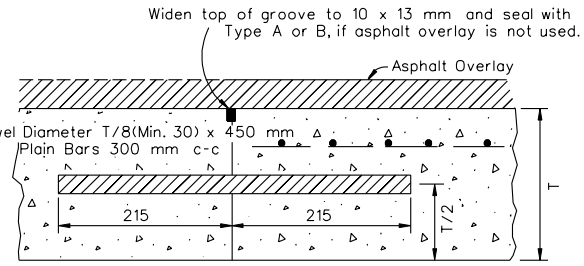
SEALANTS FOR TRANSVERSE EXPANSION JOINTS



METHODS OF WIDENING CONCRETE PAVEMENT
(PLAIN AND REINFORCED)

FOR 4.5 m SLAB LENGTHS (PLAIN)				
Dimension	Sealant Type			
	A	B	C	D
X	45	30	45-50	50
Y	6	6	20	20
W	16±2	-	-	-

FOR 9.1 m SLAB LENGTHS (REINFORCED)				
Dimension	Sealant Type			
	A	B	C	D
X	45	30	45-50	50
Y	10	10	20	20
W	30±2	-	-	-



■ If joint coincides with specified joint, construct in accordance with detail on sheet 2 (Contraction or Expansion Joint).

DETAIL OF TRANSVERSE CONSTRUCTION (BUTT) JOINT
(FOR USE WITH PLAIN, REINFORCED, AND PLAIN BASE WITH ASPHALT TOP)

SPECIFICATION REFERENCE

316

PLAIN AND REINFORCED CONCRETE PAVEMENT SHOWING REINFORCEMENT, LONGITUDINAL AND TRANSVERSE JOINTS

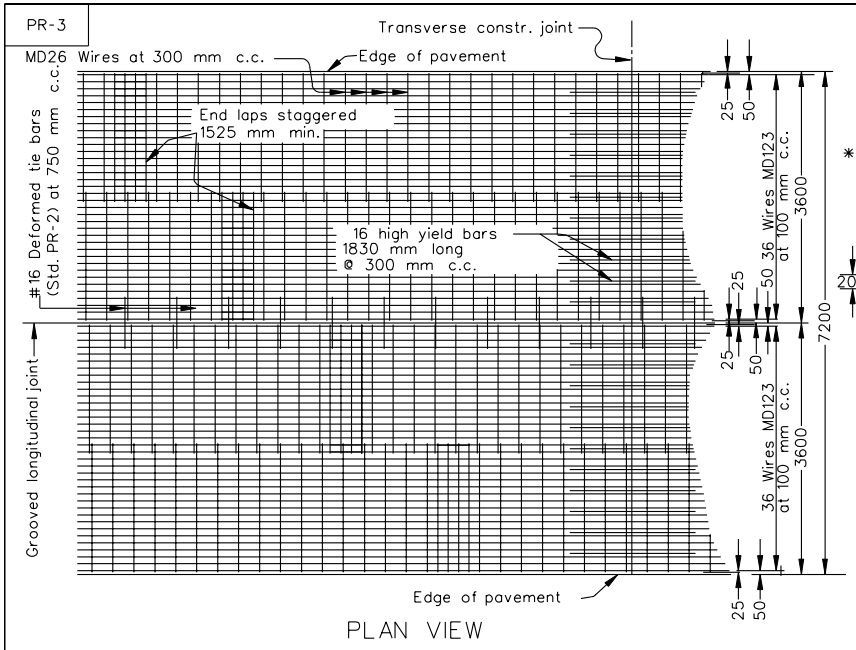
Rev. 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

301.03

PR-3



PLAN VIEW

Notes:

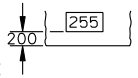
For 10.8 meter pavement, use single 3.6 meter lanes with 2 construction joints, or 3.6 meter and 7.2 meter lanes with one groove and one construction joint.

Transverse wires do not extend through longitudinal joints.

Tie bars and dowelbars are to be as near midpoint of pavement depth as feasible.

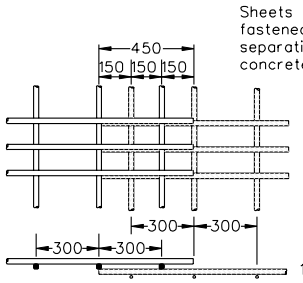
* The double lap requirement (900 mm) and or extra bar method applies only to laps falling within an area 3100 mm beyond the construction joint.

*16 x 760 mm deformed tie bars at 750 mm o.c. may be used in lieu of hook bolts where shown hereon.

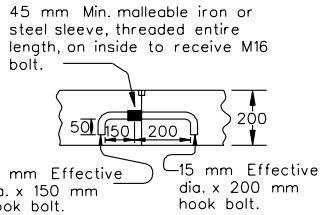


pavement every 500 meters, and station number stamped into it. The date is to be shown in a similar manner at the beginning of each days pour.

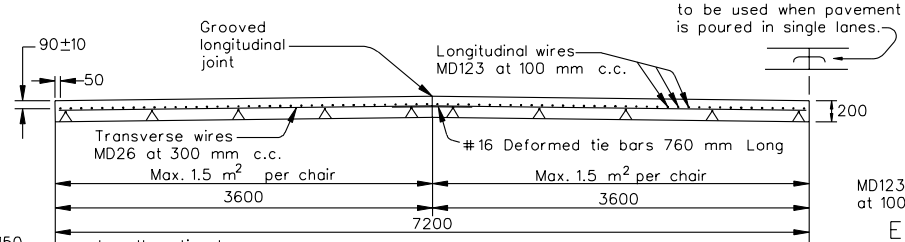
Both outside edges of divided highway to be stamped. One edge of undivided highways where feasible. (Travel Lane)



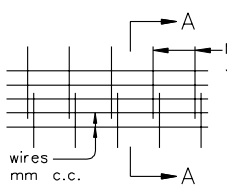
END LAP DETAIL



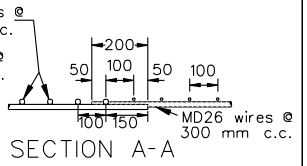
HOOK BOLT DETAIL



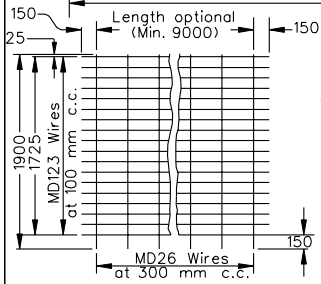
TRANSVERSE SECTION



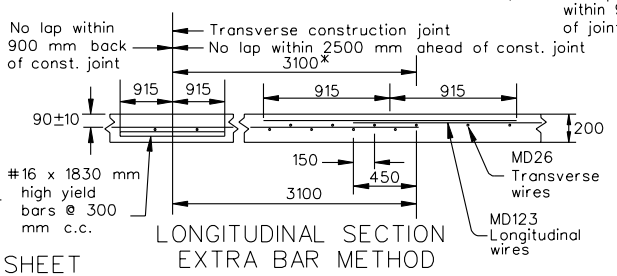
EDGE LAP DETAIL



SECTION A-A

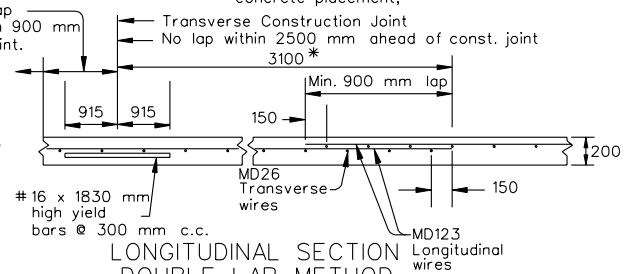


TYPICAL WIRE FABRIC SHEET



LONGITUDINAL SECTION EXTRA BAR METHOD

Sheets to be securely fastened to prevent separation during concrete placement,



LONGITUDINAL SECTION DOUBLE LAP METHOD

200 mm THICK CONTINUOUSLY REINFORCED CONCRETE PAVEMENT (WIRE MESH REINFORCEMENT)

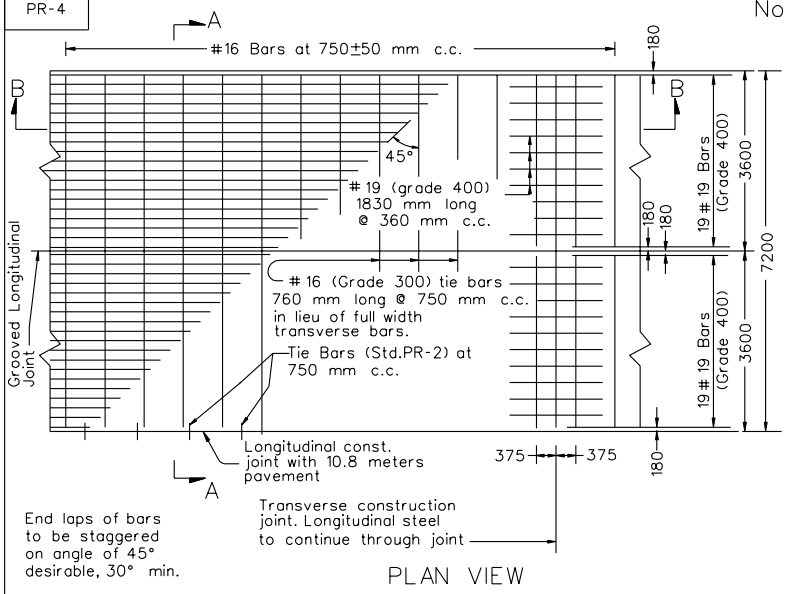
SPECIFICATION REFERENCE 316

Rev. 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

PR-4



PLAN VIEW

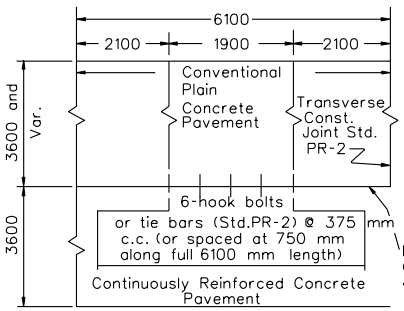
Notes:

Hook bolts or tie bars are to be placed in the same horizontal plane as #16 Transverse bars. Where necessary adjust the location of hook bolts or tie bars to a 70 mm minimum clearance between hook bolts or tie bars and transverse bars.

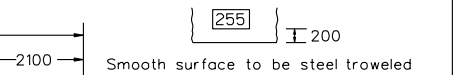
Transverse construction joint bars are to be placed in the same horizontal plane as #19 longitudinal bars.

19 longitudinal bars are to be lapped and tied in the same horizontal plane.

For 10.8 meter width pavement use single 3.6 meter lanes with 2 longitudinal construction joints or 3.6 meter and 7.2 meter lanes with one longitudinal construction joint and one grooved longitudinal joint. Transverse bars shall not extend through longitudinal construction joints, but shall extend full length (7.12 meter) for grooved longitudinal joints.



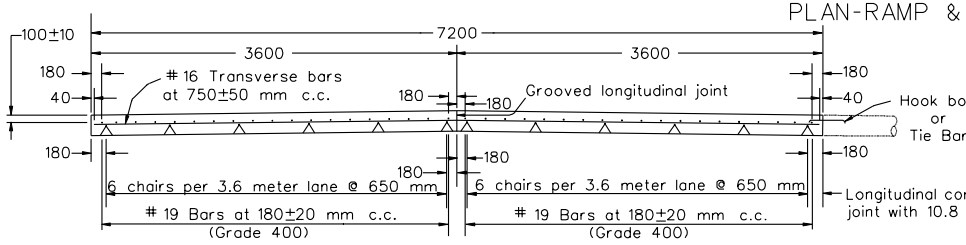
PLAN-RAMP & MAIN LINE CONNECTION



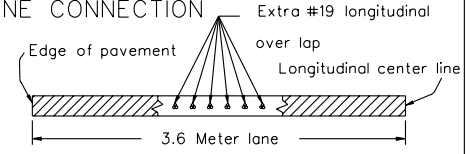
Smooth surface to be steel troweled every 500 meters, and station number stamped into it.

The date is to be shown in a similiar manner at the beginning of each days pour.

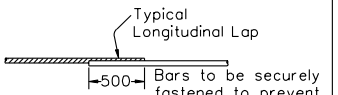
Both outside edges of divided highway to be stamped. One edge of undivided highways where feasible.(Travel Lane)

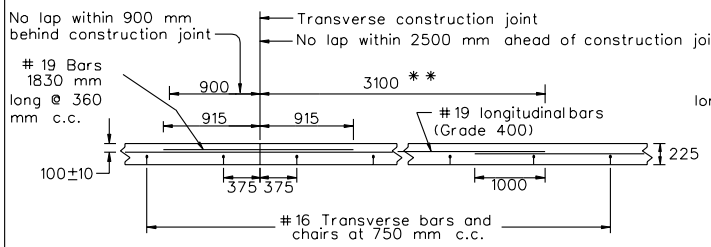


SECTION A-A

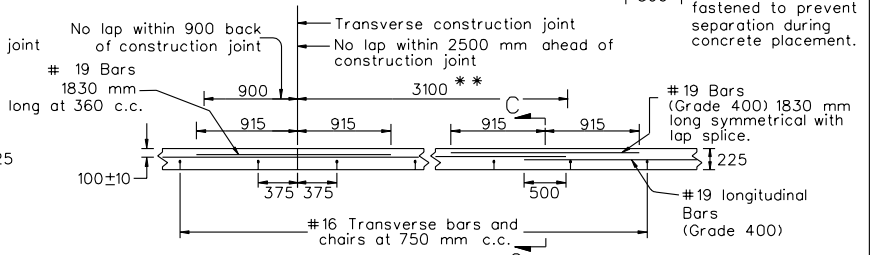


SECTION C-C





SECTION B-B
DOUBLE LAP METHOD



SECTION B-B C
EXTRA BAR METHOD

** Double lap requirement (1000 mm) and the extra bar method apply only to laps falling within an area of 3.10 meters beyond the construction joint.

Sheet 1 of 3

225 mm THICK CONTINUOUSLY REINFORCED CONCRETE PAVEMENT (STEEL BAR REINFORCEMENT)

SPECIFICATION REFERENCE
316

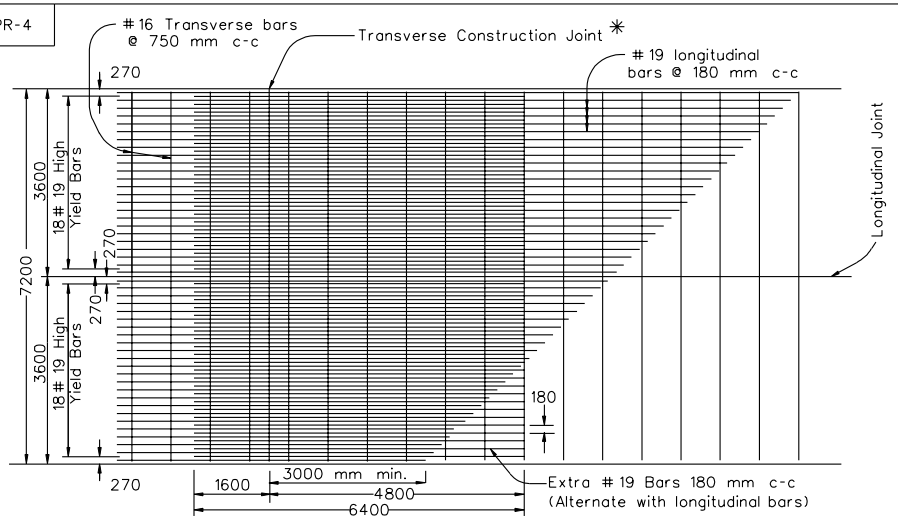
REV. 9/97

301.08

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

PR-4



LEAVE OUT JOINT
STEEL BAR REINFORCEMENT ONLY

✳ Longitudinal steel to continue through joint.

Extra #19 (Grade 400) bars (6.4 meters long) shall be spaced at 180 mm c-c

Sheet 3 of 3

225 mm THICK CONTINUOUSLY REINFORCED CONCRETE PAVEMENT (LEAVE OUT JOINT DETAIL)

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

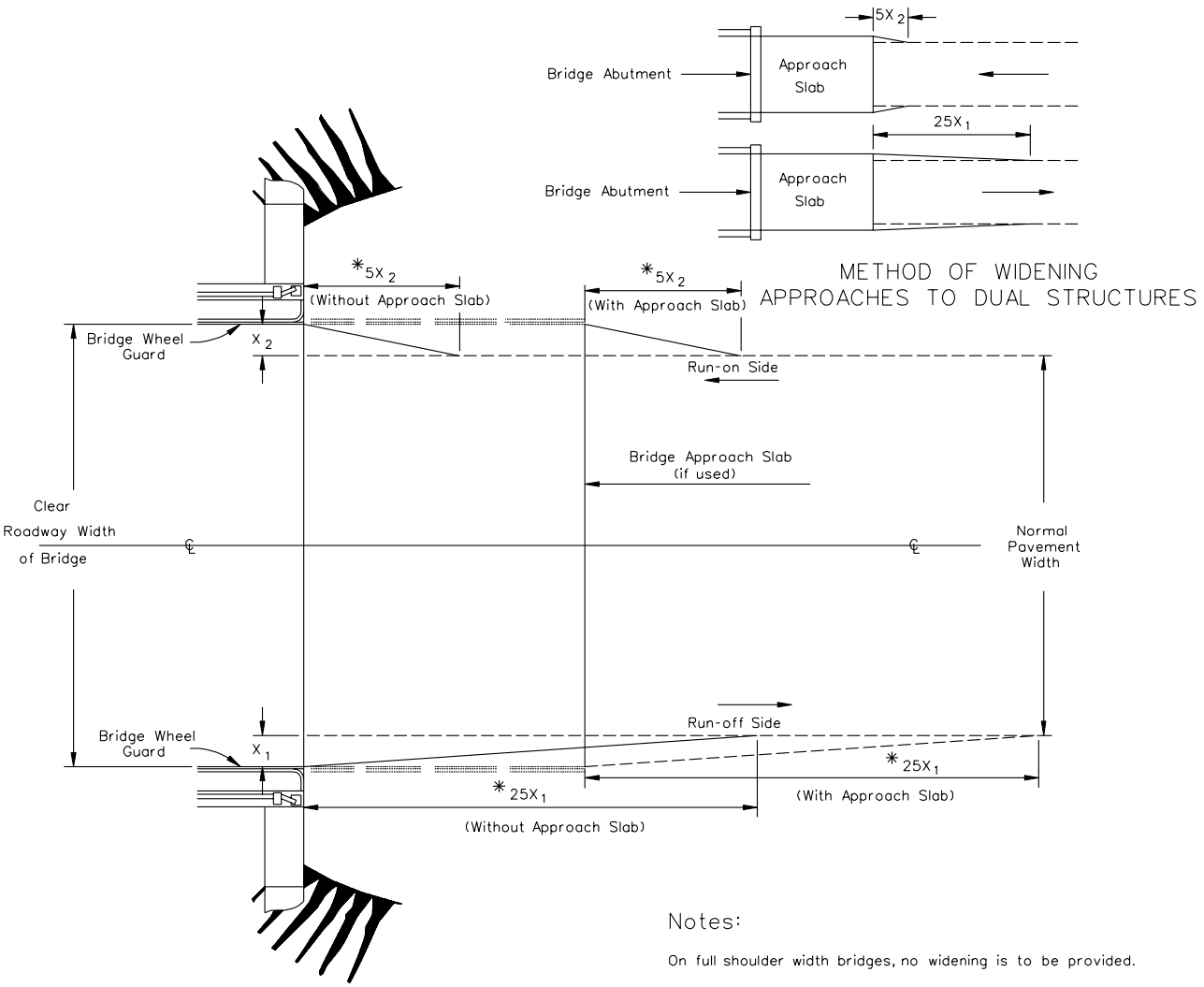
316

REV. 9/97

301.10

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

WP-1



METHOD OF WIDENING APPROACHES TO DUAL STRUCTURES

Notes:

On full shoulder width bridges, no widening is to be provided.

X_1 and X_2 = Amount of bridge widening per side (3 meters Maximum).

* If Bridge Drainage Aprons are required the pavement widening is to be applied at the end of the drainage apron farthest from the abutment backwall.

METHOD OF WIDENING BRIDGE APPROACH PAVEMENT

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

NONE

REV. 9/97

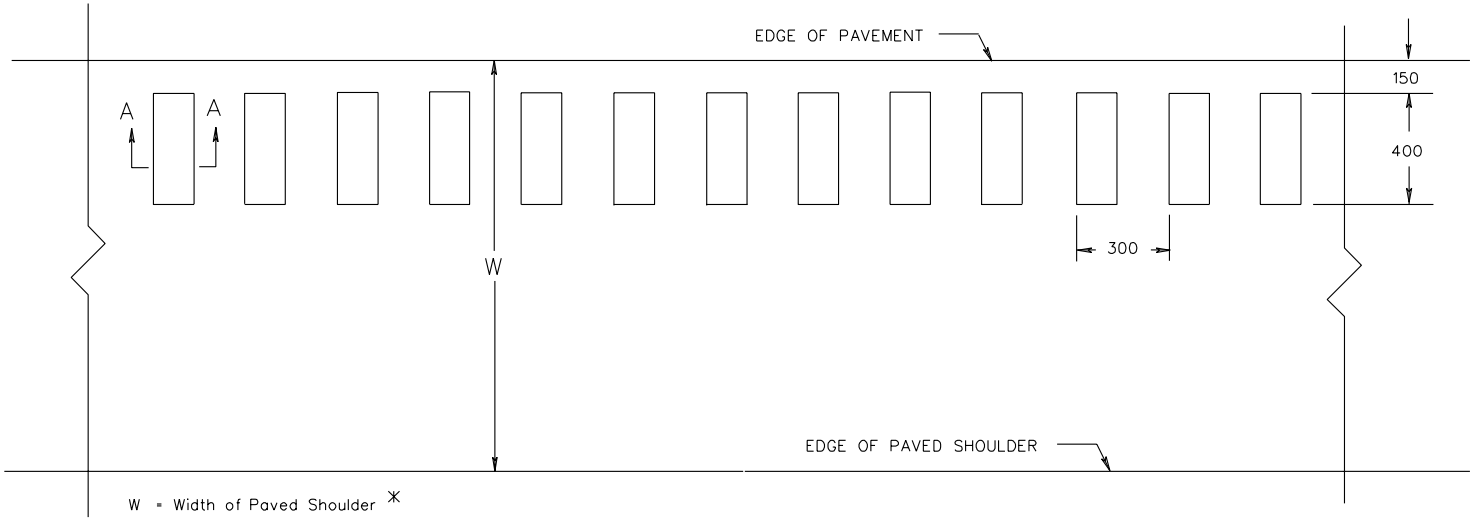
303.01

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

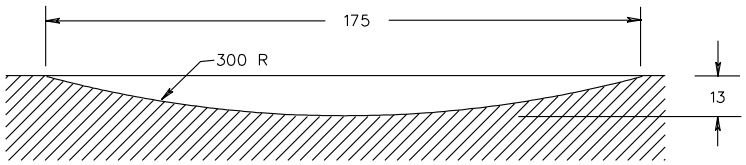
REVISED ON 12/99

REVISED ON 11/02

RS-1



PLAN VIEW



SECTION A-A

NOTES

Rumble Strips shall be placed continuously as directed by the Engineer.

Rumble Strips shall not be placed within limits of Bridge Drainage Aprons or Special Design Shoulder Slot Inlets.

Rumble Strips shall be placed on mainline shoulders only.

* Where bicycles are not prohibited, the minimum width of the outside paved shoulder shall be 2.4 m.

Depressed areas of milled rumble strips (including sides) shall be fully coated with Asphalt Material CRS-1, 2, 1h, or CSS-1h, using a brush or pressure distributor. Application shall be limited to the depressed area and shall not result in pooling of asphalt material in the depression.

REV. 9/97

SPECIFICATION REFERENCE
310 315

RUMBLE STRIPS (ASPHALT SHOULDER)

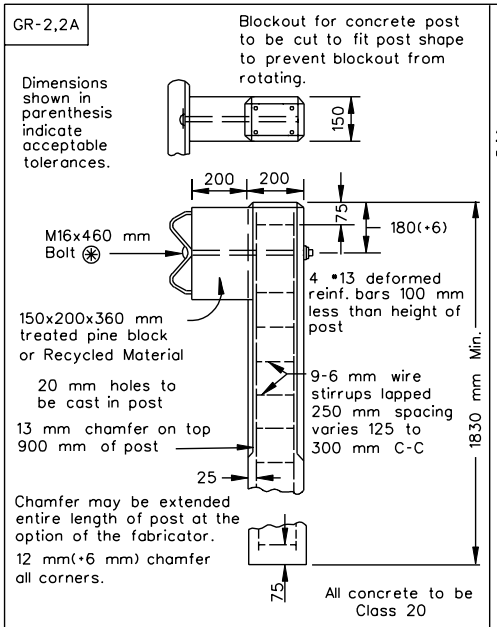
VIRGINIA DEPARTMENT OF TRANSPORTATION

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

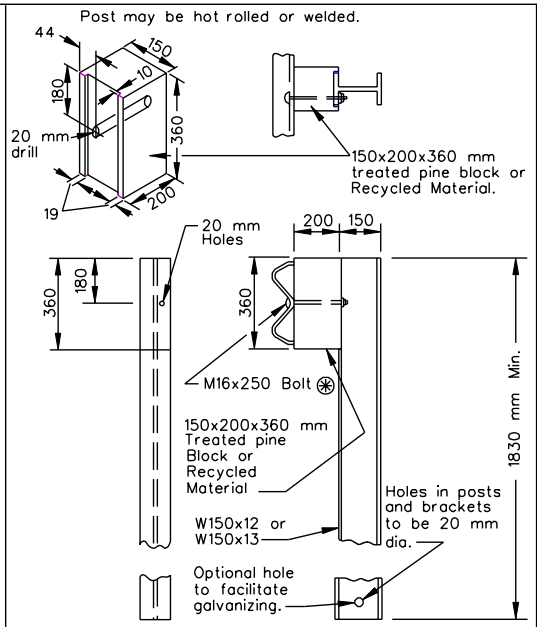
304.01

REVISED ON 7/98 **REVISED ON 2/01** **REVISED ON 7/01**

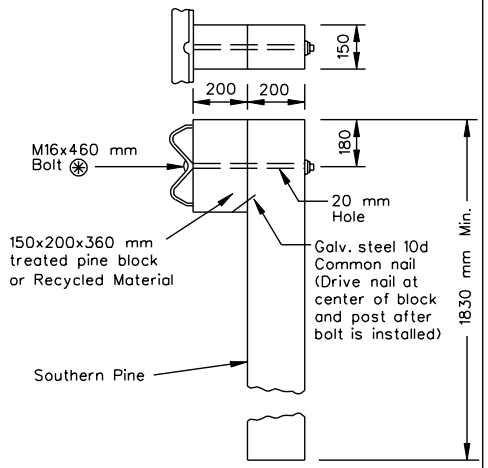
GR-2,2A



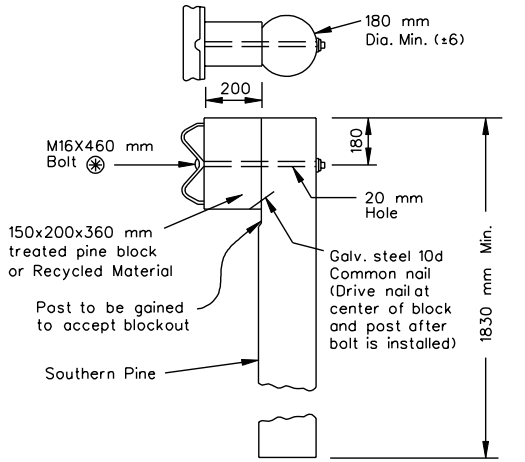
CONCRETE POST



STEEL POST



150X200 mm WOOD POST



ROUND WOOD POST

All bolts, nuts, washers, and other steel items are to be galvanized.

Alternate type posts and Blockout may be interchanged on any one project with the restriction that the same type of post and Blockout must be used in any single run of guardrail.

For details of guardrail element splice joint, hardware, etc. See sheet no's. 501.01 and 501.02

The guardrail and median barrier components depicted in AASHTO - AGC - ARTBA "A Guide to Standardized Highway Barrier Hardware" may be substituted if interchangeable with the Standards for guardrail (GR) or median barrier (MB) and approved by the Engineer.

⊛ Standard washer to be used on last 15 m of Run off end.

STANDARD BLOCKED-OUT W BEAM GUARDRAIL (STRONG POST SYSTEM) POST AND BLOCKOUT DETAILS

Rev. 8/97

501.05

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

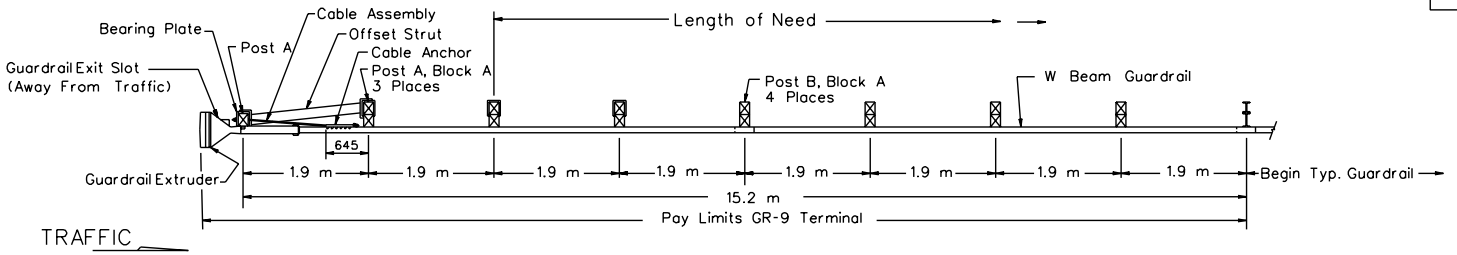
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

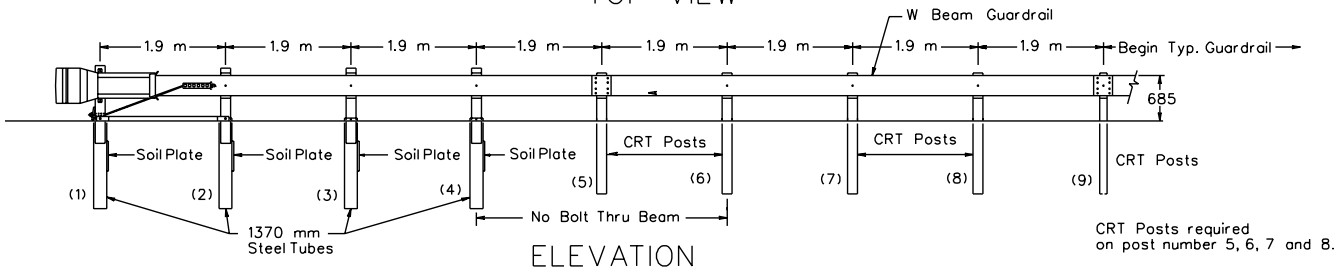
221
236
505

REVISED ON 4/98 **REVISED ON 2/01** **REVISED ON 7/02**

GR-9

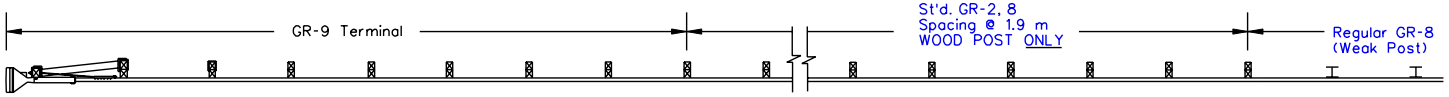


TOP VIEW



ELEVATION

CRT Posts required on post number 5, 6, 7 and 8.



TRANSITION FROM GR-9 TERMINAL TO WEAK POST GUARDRAIL

NOTES:

This design shall only be used after an analysis indicates it is more cost effective than providing the flare for a St'd. GR-7 or extending the guardrail to provide a St'd. GR-6 terminal.

Alternate Breakaway Cable Terminal (GR-9) is to be ET-2000 (as shown) manufactured by Syro Steel Company, CAT as manufactured by Syro Steel Company, BRAKEMASTER as manufactured by Energy Absorption Systems, Inc., the BEST System as manufactured by Interstate Steel Corporation, or other approved equal.

For details, dimensions, quantities and other information not shown hereon, see individual manufacturer's plans.

Direction of tape shall conform to MUTCD application for diagonal strips on object markers and bridge end panels. Color of tape shall be amber (yellow).

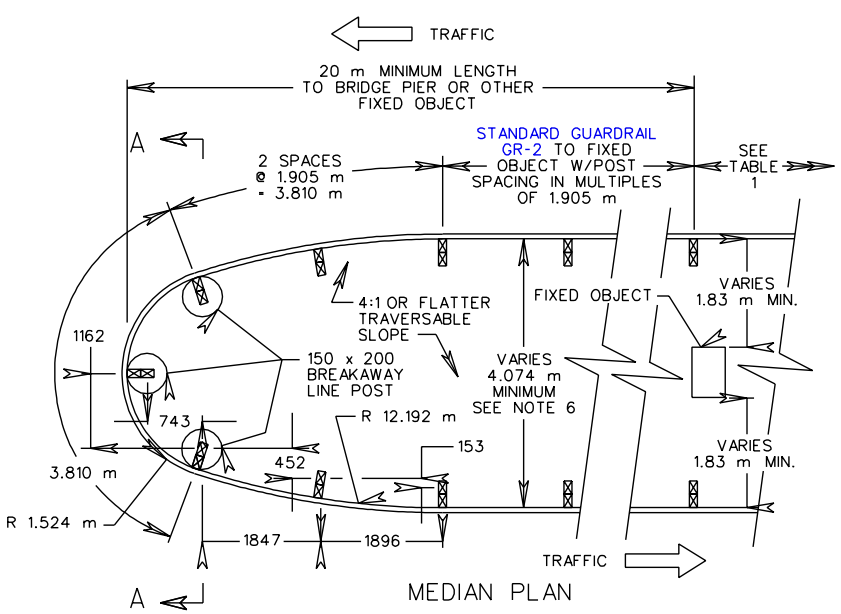
The guardrail and median barrier components depicted in A.R.T.B.A. Technical Bulletin Number 268B may be substituted if interchangeable with the Standards for guardrail (GR) or median barrier (MB) and approved by the Engineer.

CRT posts required on post number 5, 6, 7 and 8.

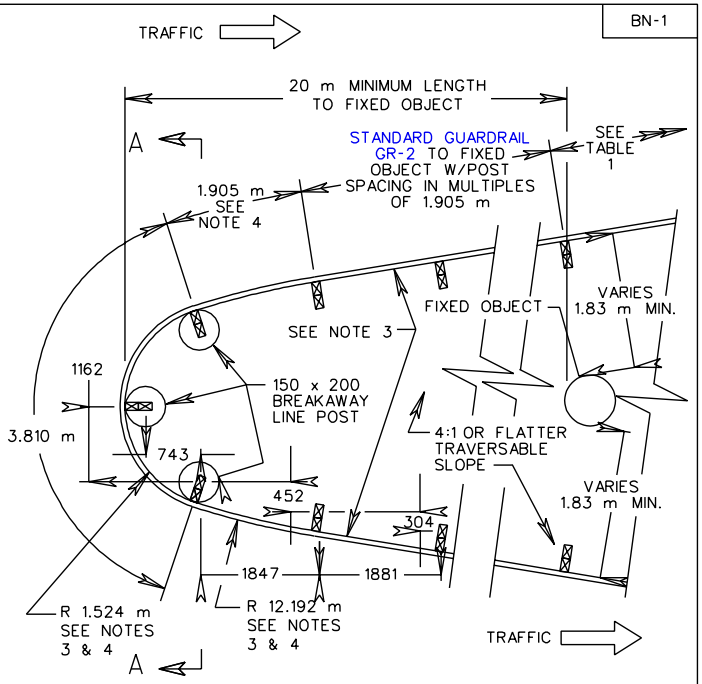
SPECIFICATION REFERENCE	ALTERNATE BREAKAWAY CABLE TERMINAL NO FLARE	
505.01	VIRGINIA DEPARTMENT OF TRANSPORTATION	Rev. 8-97
	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	501.16

VOID 10/1/98

BN-1



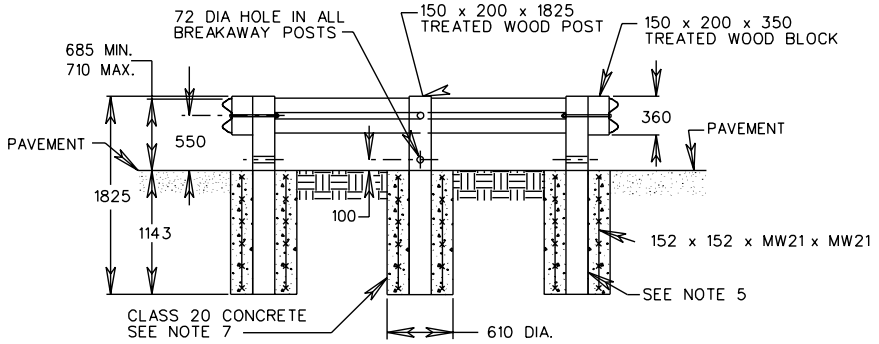
MEDIAN PLAN



GORE PLAN

TABLE 1

MINIMUM DISTANCE BARRIER MUST PASS FIXED OBJECT	
7.6 m FOR GR-2	7.6 m PLUS A TYPE II FOR GR-8
3.8 m FOR GR-2A	0.3 m FOR MB-7C



SECTION A-A

NOTES

1. ALL STEEL COMPONENTS ARE TO BE GALVANIZED IN ACCORDANCE WITH SPECIFICATIONS.
2. FOR DETAILS OF W BEAM RAIL, METHOD OF ATTACHING RAIL TO POST, SPLICES AND OTHER DIMENSIONS AND/OR PERTINENT INFORMATION NOT SHOWN, SEE SHEET NUMBERS 501.01 AND 501.05.
3. ANGLE (OFFSET) SHOWN IS FOR REPRESENTATIONAL PURPOSES ONLY. REFER TO ROADWAY PLAN SHEET(S) AND EXISTING FIELD CONDITIONS FOR DETERMINATION OF APPROPRIATE ANGLE (OFFSET). LIKEWISE THE LENGTH, ANGLE (OFFSET), AND POINT(S) OF TANGENCY FOR THE 12.192 m RADIUS MAY VARY FROM THIS ILLUSTRATION.
4. THE 1.905 m POST SPACING SHALL BE HELD REGARDLESS OF THE LENGTH, ANGLE (OFFSET), AND POINT OF TANGENCY OF THE 12.192 m RADIUS.
5. WRAP THE EMBEDDED PORTION OF THE ORIGINAL POSTS WITH 12 mm THICK POLYSTYRENE TO FACILITATE POST REPLACEMENT.
6. SPECIAL DESIGN REQUIRED FOR WIDTHS LESS THAN 4.074 m.
7. CONCRETE FOOTING MAY BE SUBSTITUTED WITH A TS 203 X 4.8 X 152 x 1525 LG. STEEL TUBE ASSEMBLY PER GR-7.

SPECIFICATION REFERENCE
221
505

1.524 m RADIUS BULL NOSE IMPACT ATTENUATOR

VIRGINIA DEPARTMENT OF TRANSPORTATION

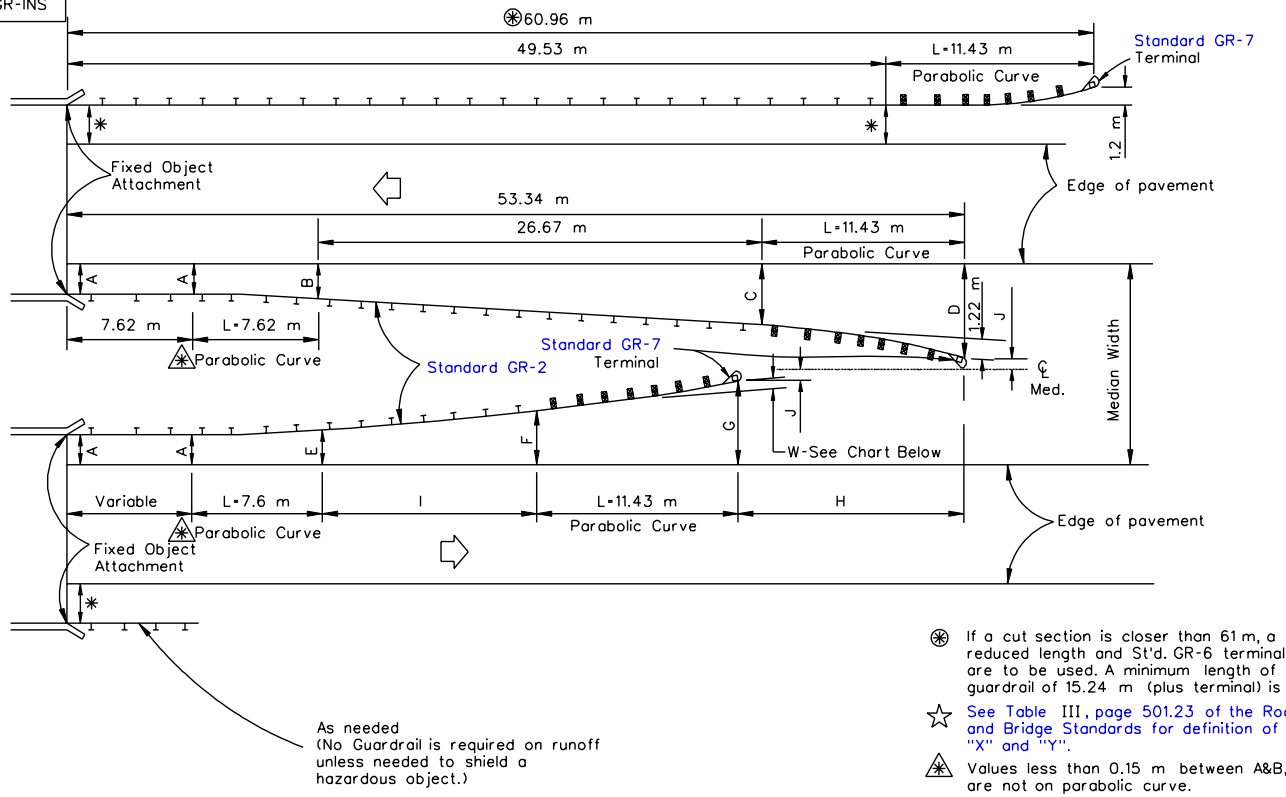
Rev. 8/97

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

501.18

REVISED ON 3/03

GR-INS



⊛ If a cut section is closer than 61 m, a reduced length and St'd. GR-6 terminal are to be used. A minimum length of guardrail of 15.24 m (plus terminal) is required.

☆ See Table III, page 501.23 of the Road and Bridge Standards for definition of "X" and "Y".

⚠ Values less than 0.15 m between A&B, A&E are not on parabolic curve.

✳ Right Bridge Offset Values are given in geometric standards for corresponding left Bridge Offset ("A" Dimensions) shown.

DIMENSIONS											
MEDIAN WIDTH	LEFT BRIDGE RAIL OFFSET	B	C	D	E	F	G	H	I	J	W
(Meters)	A m	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
9.00	1.5	1.68	2.13	3.35	1.65	1.83	2.44	16.45	10.21	1.2	6.00
12.00	1.5	1.83	3.20	4.88	1.83	3.05	4.88	13.41	13.10	1.2	7.60
12.00	2.4	2.56	3.50	5.18	2.68	3.29	5.18	14.63	11.88	.9	10.60
12.00	3.6	3.71	3.96	5.18	3.77	3.96	4.87	14.78	11.58	.9	9.10

☆ OFFSETS (Y) FOR INTRODUCED GUARDRAIL TRANSITIONS										
LENGTH L (Meters)	X		Y (mm)							
			W (mm) 150	W (mm) 225	W (mm) 300	W (mm) 600	W (mm) 750	W (mm) 900	W (mm) 1050	W (mm) 1200
7.62	X [1]	1.905	5	15	15	15	20	20	30	30
	X 2	3.810	35	55	75	65	85	100	115	130
	X 3	5.715	85	125	170	165	190	225	265	300
	X 4	7.620	150	225	300	270	335	405	475	540
11.43	X 5	9.525				420	530	630	740	845
	X 6	11.43				600	750	900	1050	1200

DETAIL OF GUARDRAIL AT DUAL BRIDGES

Sheet 2 of 8

W BEAM GUARDRAIL INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

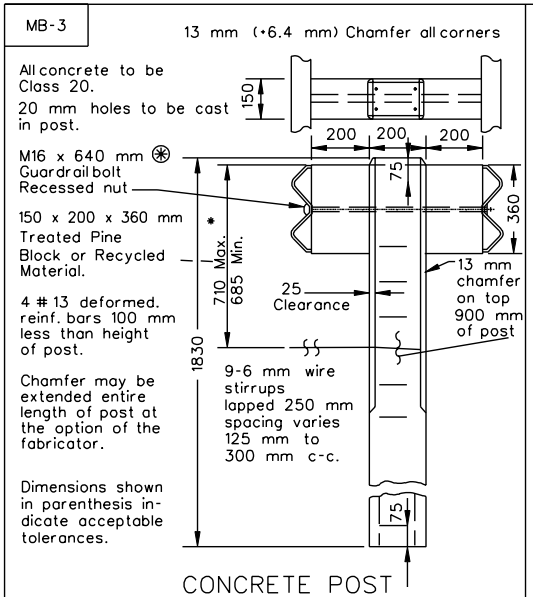
SPECIFICATION REFERENCE
221
505

REVISED 8/97

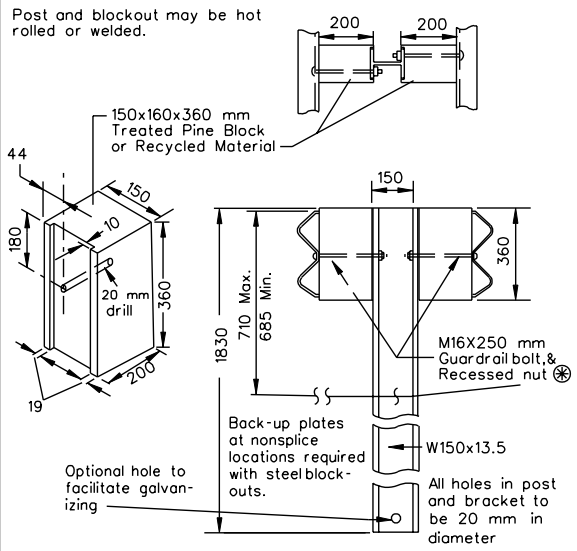
501.31 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

REVISED ON 7/98

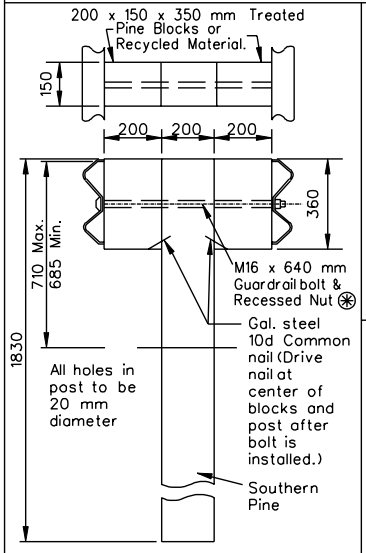
MB-3



CONCRETE POST



STEEL POST



WOOD POST

Notes:

Standard MB-3 post spacing is 1.905 m.

For details of Rail Element, Rail Splice Joint, W Beam Back up Plate, and associated hardware see Sheet no. 501.01.

Alternate type posts and blockouts may be interchanged on any one project with the restriction that the same type of post and blockout must be used in any single run of median barrier.

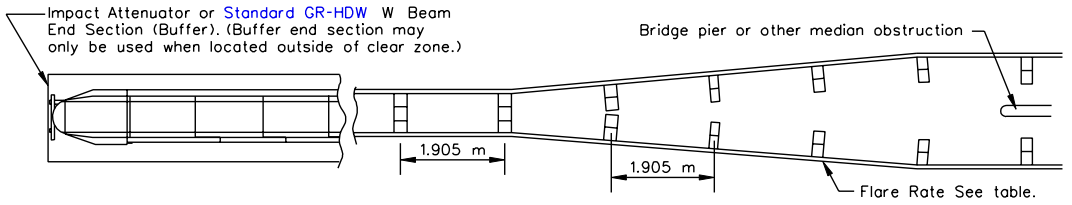
All bolts, nuts, washers, steel posts, bent plate post, and blockouts are to be galvanized.

The guardrail and median barrier components depicted in AASHTO - AGC - ARTBA "A Guide to Standardize Highway Barrier Hardware" may be substituted if interchangeable with the Standards for guardrail (GR) or median barrier (MB) and approved by the Engineer.

⊛ Standard washers are to be used on last 15.24 meters of Run off end.

FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE		BEYOND SHY LINE
km/H	SHY LINE (m)	FLARE RATE	FLARE RATE
110	2.8	30:1	15:1 *
100	2.4	26:1	14:1 *
80	2.0	21:1	11:1 *
60	1.4	16:1	8:1 *
50	1.1	13:1	7:1 *

* Suggested maximum flare rate for semi-rigid barrier systems.



METHOD OF TREATMENT AT BRIDGE PIER OR MEDIAN OBSTRUCTION

BLOCKED-OUT W BEAM MEDIAN BARRIER

Rev. 8/97

501.38

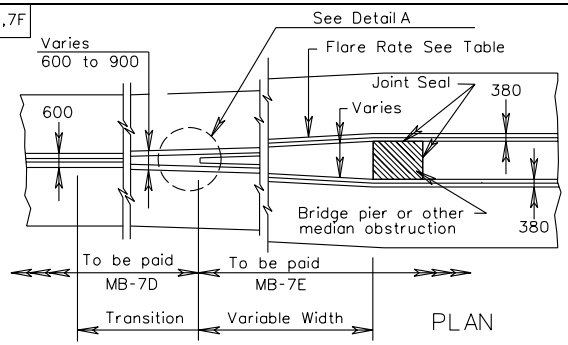
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

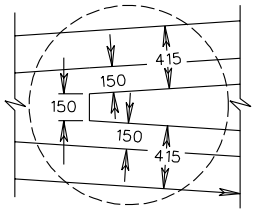
SPECIFICATION REFERENCE

221
505

MB-7D,7E,7F



PLAN

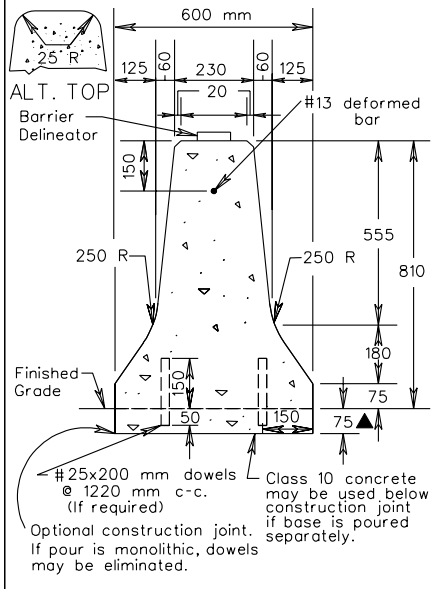


DETAIL A

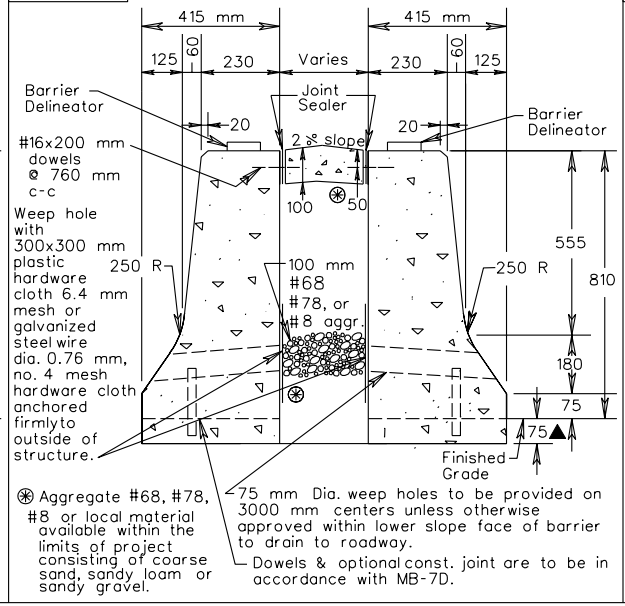
FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE		BEYOND SHY LINE
km/h	SHY LINE m	FLARE RATE	FLARE RATE
110	2.8	30:1	20:1*
100	2.4	26:1	18:1*
80	2.0	21:1	14:1*
60	1.4	16:1	11:1*
50	1.1	13:1	8:1*

* Suggested maximum flare rate for rigid barrier systems.

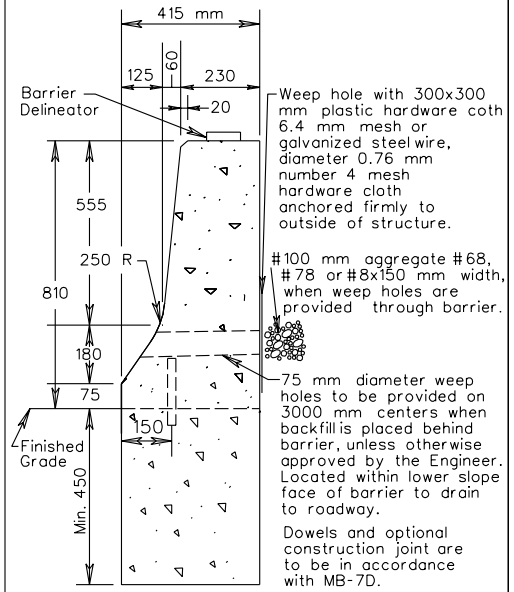
MB-7D



MB-7E



MB-7F



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 6 meters c-c.

Concrete median barrier may be precast, cast in place or slip-formed.

Horizontal reinforcing steel bars are to be separated at all expansion and contraction joints. A 50 mm 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 20 if cast in place, 30 MPa 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 meter of barrier.

CONCRETE MEDIAN BARRIER

SPECIFICATION REFERENCE

105
502

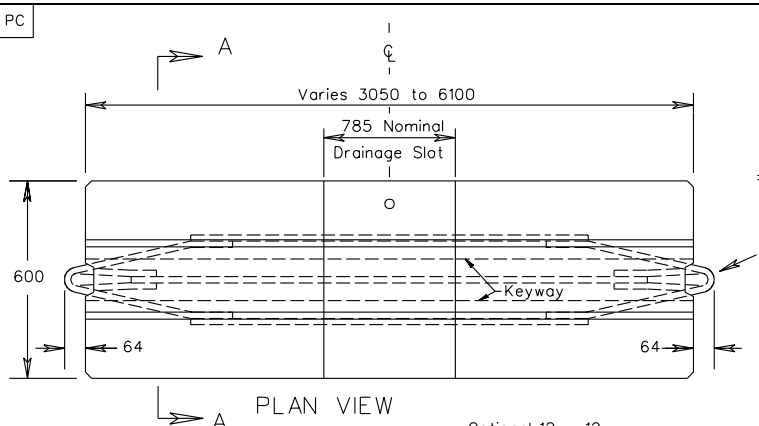
Rev. 8/97

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

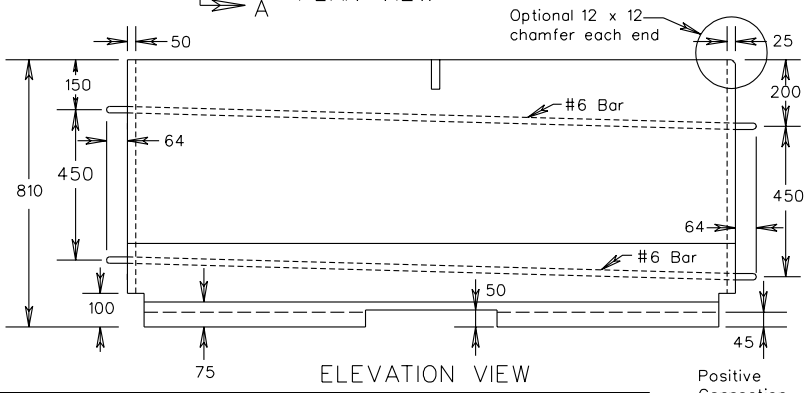
VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED ON 12/99

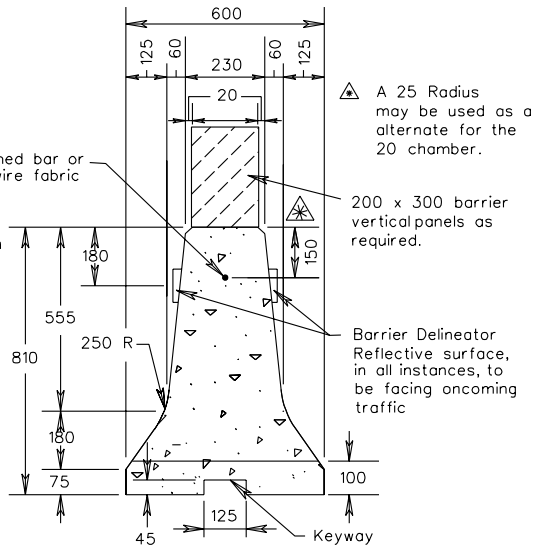
MB-7D PC



PLAN VIEW



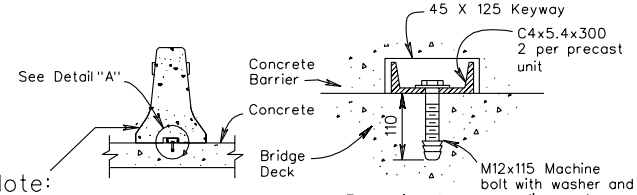
ELEVATION VIEW



SECTION A-A

*Suggested maximum flare rate for rigid barrier systems.

FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE		BEYOND SHY LINE
km/h	SHY LINE m	FLARE RATE	FLARE RATE
110	3.0	30:1	20:1
100	2.5	26:1	17:1
80	2.0	21:1	14:1
60	1.5	17:1	11:1
50	1.0	13:1	8:1



Detail "A"

Note:

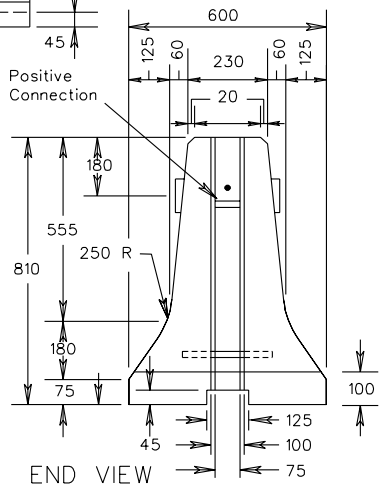
This design shall not be used on bridge decks as an exterior parapet or railing.

Detail "A" shall be used on installations separating traffic lanes in opposite directions or on surfaces superelevated at a rate greater than 20 per meter.

Note:

Machine bolts centered on channel sections are to be placed a min. of 600 from each end of the precast unit and are not to conflict with bridge expansion joints.

DETAIL FOR TEMPORARY INSTALLATION ON BRIDGE DECK



END VIEW

Notes:

For positive connection details and dimensions see Special Design Drawing No. A-105.

At the option of the manufacture, additional reinforcing may be added to the precast concrete barrier for handling.

Concrete to be 4000 P.S.I minimum.

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.

Approved alternates are an acceptbale substitution for Standard.

Sheet 1 of 2

PRECAST TRAFFIC BARRIER SERVICE CONCRETE

SPECIFICATION REFERENCE

105
512

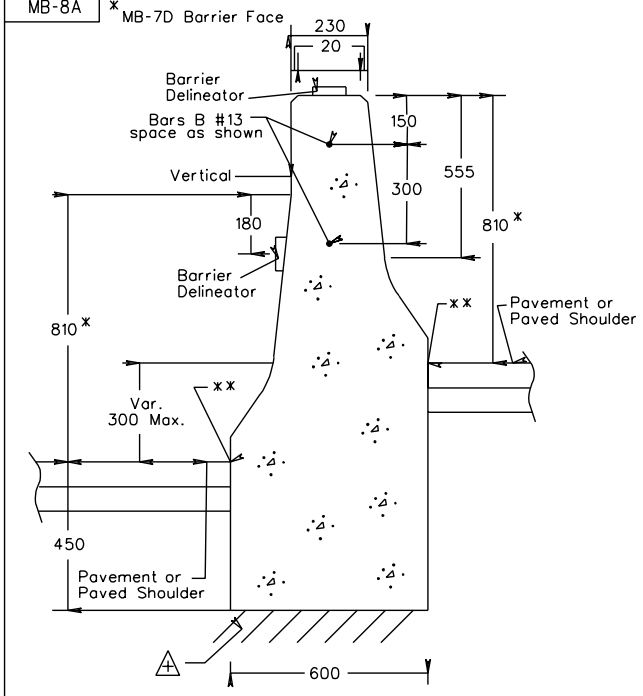
Rev. 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

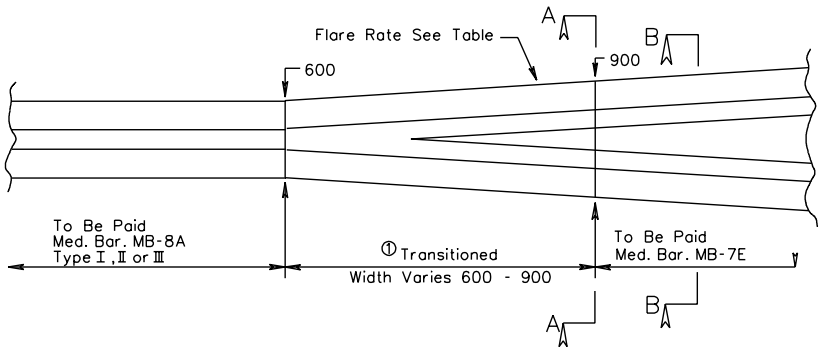
INSERTABLE SHEET MSD 1954A

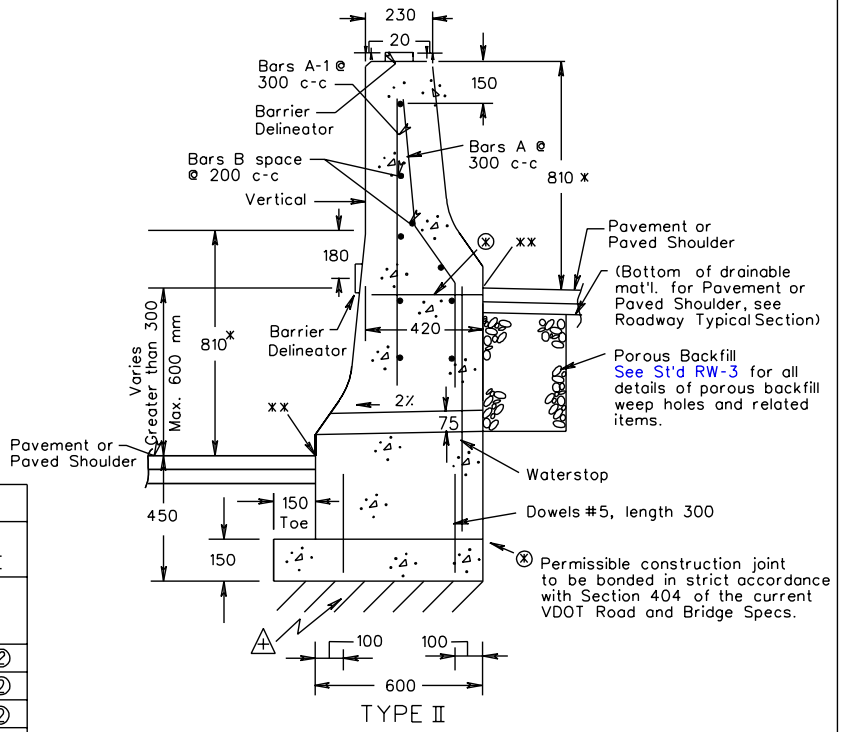
MB-8A



TYPE I

TYPE I (Greater than 0 mm ht. diff., max. 300 mm)

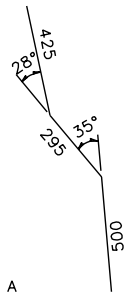




TYPE II

TYPE II (Greater than 300 diff., max. 600 mm)

BENDING DIAGRAM



BARS A

Do not use Bent Bars A within limits of Drop Inlets.

FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE		BEYOND SHY LINE
KM/M	SHY LINE M	FLARE RATE	FLARE RATE
110	2.8	28 : 1	20 : 1 ②
100	2.4	26 : 1	18 : 1 ②
80	2.0	21 : 1	14 : 1 ②
60	1.4	16 : 1	10 : 1 ②
50	1.1	13 : 1	8 : 1 ②

② maximum flare rate for rigid barrier systems.

Sheet 1 of 2

CONCRETE MEDIAN BARRIER TYPE I, II or III

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

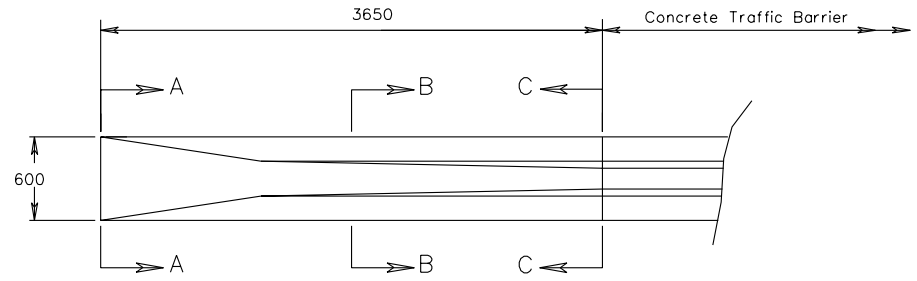
105
404
502

Rev. 8/97

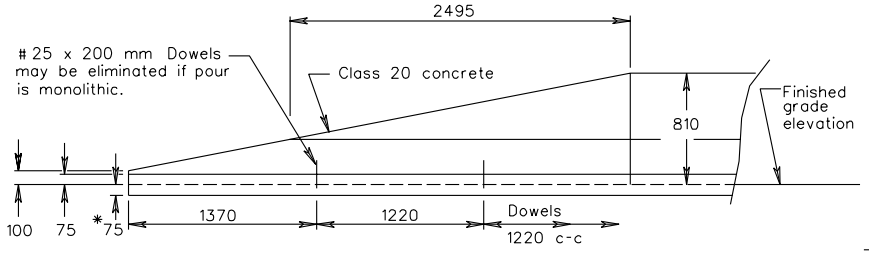
501.49 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

MB-9A

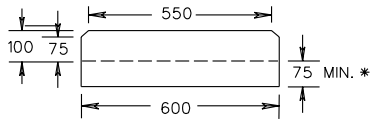
CONCRETE MEDIAN BARRIER 3.65 m TERMINAL SECTION



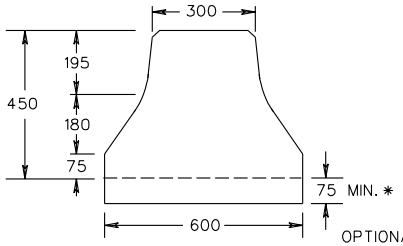
PLAN VIEW



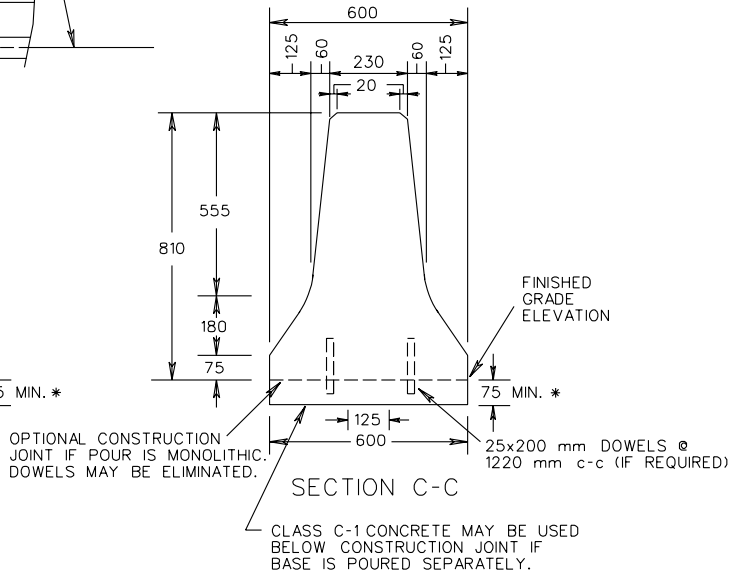
ELEVATION VIEW



SECTION A-A



SECTION B-B



SECTION C-C

Notes:

Concrete Median Barrier Terminal Sections are not to be used within the Clear Zone.

Concrete Median Barrier 3.65 m Terminal section may be precast or cast-in-place.

Concrete to be Class 20 if cast-in-place; Concrete to be 30 MPa if precast.

For use where the operating speed is 60 km/h or less.

Location of the Barrier End sections to be as noted on plans or as approved by the Engineer.

* 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 meter of barrier.

Sheet 1 Of 2

CAST IN PLACE CONCRETE MEDIAN BARRIER 3.65 m TERMINAL SECTION

SPECIFICATION REFERENCE

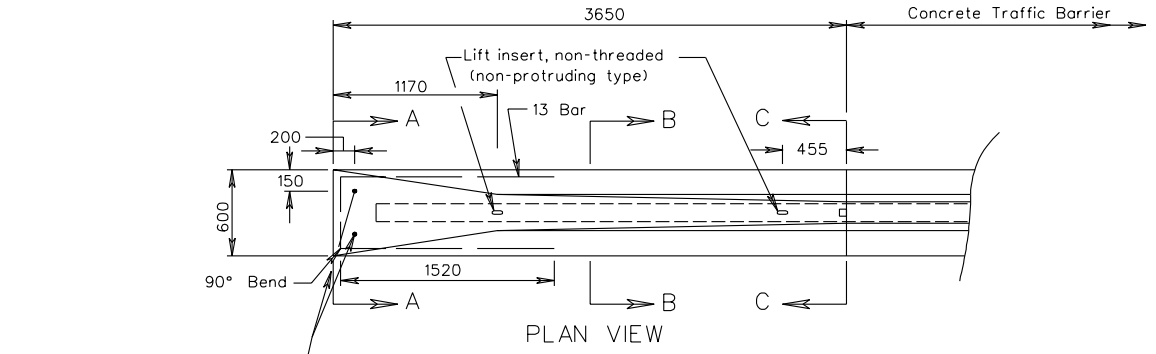
Rev. 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

MB-9A PC

CONCRETE MEDIAN BARRIER 3.65 m TERMINAL SECTION

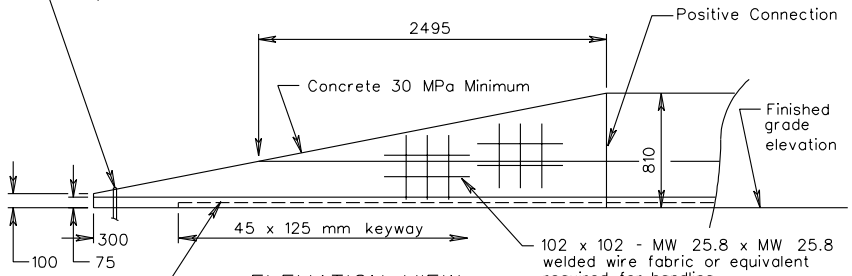


PLAN VIEW

25 mm I.D. metal sleeve (reinforcing steel shall surround 25 mm I.D. metal sleeve)

Use M20 x 225 mm Expansion Bolts for rigid pavement installation only (bolts to be removable)

Use M20 x 910 mm Drift Pins for flexible pavement installations.



ELEVATION VIEW

Manufacturer's reinforcing steel design is to be approved by Engineer.

Note:

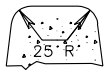
Reinforcing steel to be grade 400.

All reinforcing is to have a minimum concrete cover of 40 mm.

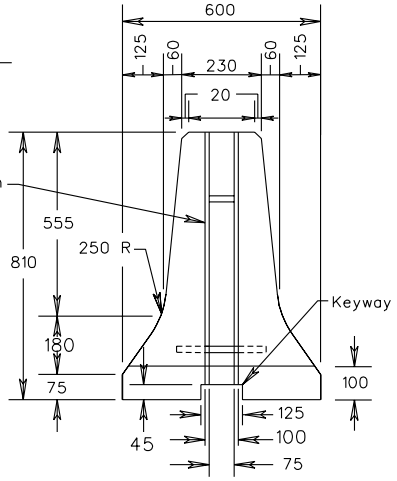
Basis of pavement, concrete median barrier 3.65 meter terminal section is to be measured and paid for in meters of St'd MB-7D or meters of traffic barrier service.

For positive connection details and dimensions see Special Design Drawing No. A-105.

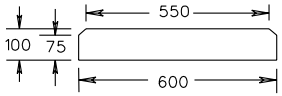
Precast Concrete Median Barrier Terminal Sections are not to be used within the Clear Zone.



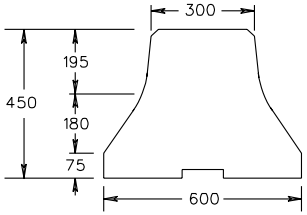
ALT. TOP



SECTION C-C



SECTION A-A



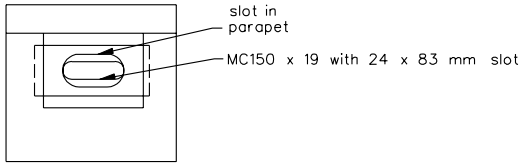
SECTION B-B

Sheet 2 Of 2

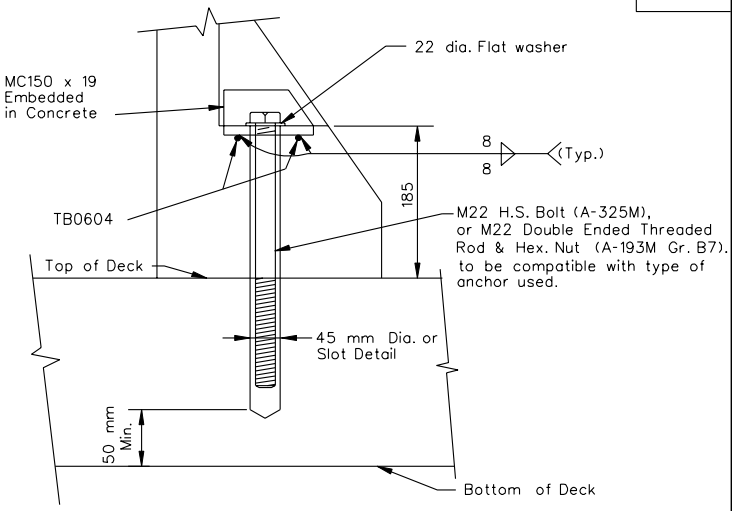
SPECIFICATION REFERENCE	PRECAST CONCRETE MEDIAN BARRIER 3.65 m TERMINAL SECTION VIRGINIA DEPARTMENT OF TRANSPORTATION	Rev. 8/97 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS 501.54

VOID 1/1/00

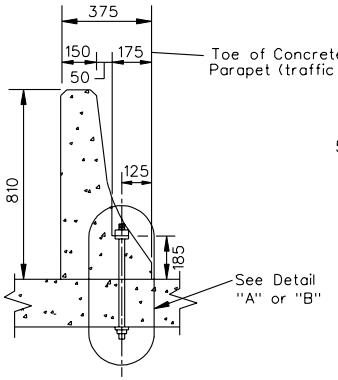
MB-10



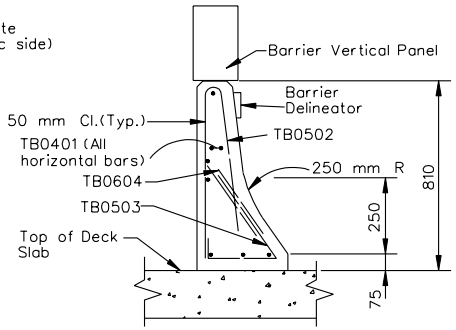
ALTERNATE SLOT DETAIL



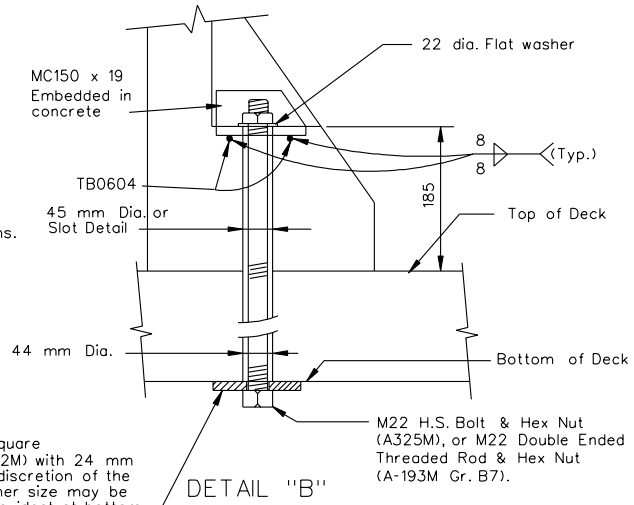
DETAIL "A"



SECTION B-B



SECTION A-A



DETAIL "B"

Notes:

Barrier delineator to be spaced in accordance with Section 702, of the Road and Bridge Specifications.

Barrier Vertical Panels to be spaced in accordance with Virginia Work Area Protection Manual.

Δ Reflective surface, in all instances, to be facing oncoming traffic.

Concrete 30 MPa (Min.) Reinforcing Steel, Grade 400.

After removing temporary barrier, cut M22 bolt or threaded rod as low as practical below roadway surface and fill recess with epoxy bonding compound EP-4 (Detail "A") or remove M22 bolts or threaded rods and fill holes with grout bonded with epoxy bonding compound EP-4 (Detail "B").

Anchor system shown in Detail "A" shall be tested to provided a minimum pullout of 142.4 kN. and installed according to manufacturer's recommendations.

Cost of Barrier Delineator and Barrier Vertical Panels to be included in price bid per meter of barrier service.

When barrier is located on vertical and/or horizontal curves, the opening at joints is not to exceed 25 mm.

Design features relating to construction or to regulation and control of traffic may be subject to change as deemed necessary by the department.

SPECIFICATION REFERENCE
105 502

TRAFFIC BARRIER SERVICE CONCRETE PARAPET (SINGLE FACE) (FOR TEMPORARY INSTALLATION ON BRIDGE DECK EXTERIOR)

Rev. 8/97

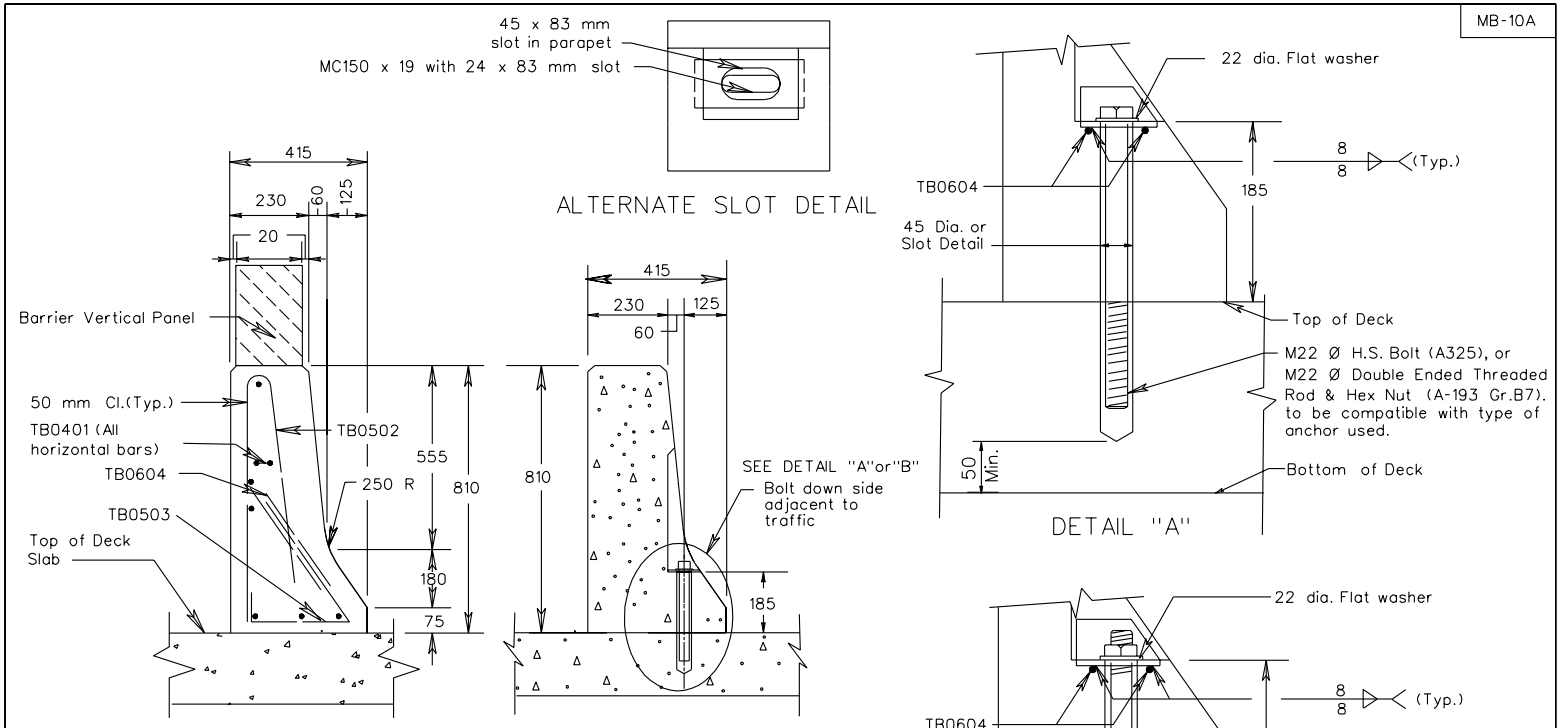
VIRGINIA DEPARTMENT OF TRANSPORTATION

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

501.56

REVISED ON 4/98 **REVISED ON 7/02**

MB-10A



Notes:

Barrier delineator to be spaced in accordance with Section 702, of the Road and Bridge Specifications.

Barrier Vertical Panels to be spaced in accordance with Virginia Work Area Protection Manual.

Δ Reflective surface, in all instances, to be facing oncoming traffic.

Concrete 30 MPa (Min.) Reinforcing Steel, Grade 400.

After removing temporary barrier, cut M22 bolt or threaded rod as low as practical below roadway surface and fill recess with epoxy bonding compound EP-4 (Detail "A") or remove M22 bolts or threaded rods and fill holes with grout bonded with epoxy bonding compound EP-4 (Detail "B").

Anchor system shown in Detail "A" shall be tested to provided a minimum pullout of 142.4 kN. and installed according to manufacturer's recommendations.

Cost of Barrier Delineator and Barrier Vertical Panels to be included in price bid per meter of barrier service.

When barrier is located on vertical and/or horizontal curves,

Design features relating to construction or to regulation and control of traffic may be subject to change as deemed necessary by the Department.

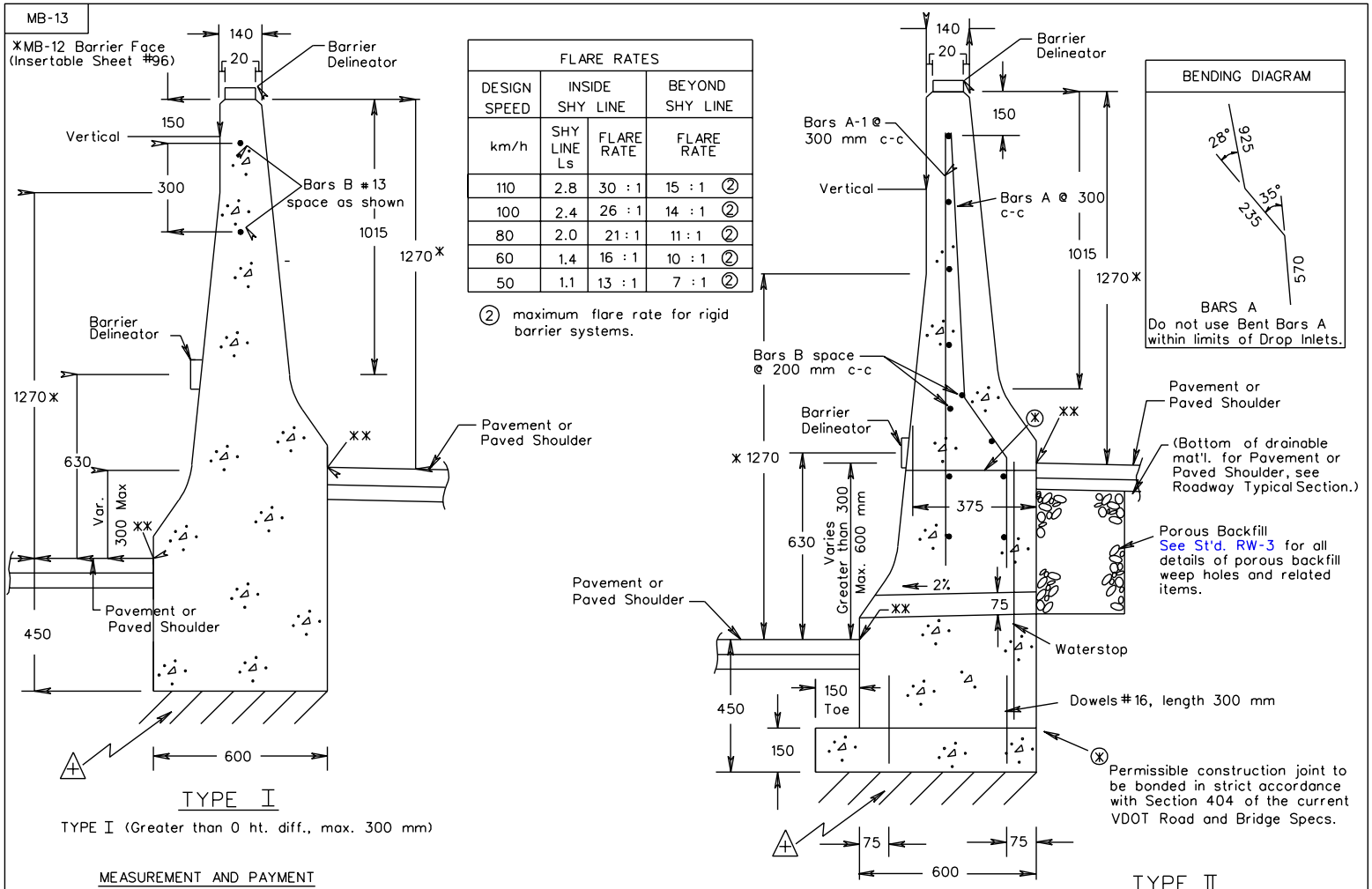
For positive connection details see and dimensions see Special Design Drawing No. 105.

Sheet 2 of 2

SPECIFICATION REFERENCE	TRAFFIC BARRIER SERVICE CONCRETE PARAPET(SINGLE FACE) (FOR TEMPORARY INSTALLATION ON BRIDGE DECK EXTERIOR)	Rev. 8/97
105 502	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS — 501.58

REVISED ON 2/01

MB-13



FLARE RATES			
DESIGN SPEED	INSIDE SHY LINE		BEYOND SHY LINE
km/h	SHY LINE Ls	FLARE RATE	FLARE RATE
110	2.8	30 : 1	15 : 1 ②
100	2.4	26 : 1	14 : 1 ②
80	2.0	21 : 1	11 : 1 ②
60	1.4	16 : 1	10 : 1 ②
50	1.1	13 : 1	7 : 1 ②

② maximum flare rate for rigid barrier systems.

BENDING DIAGRAM

BARS A
Do not use Bent Bars A within limits of Drop Inlets.

TYPE I (Greater than 0 ht. diff., max. 300 mm)

TYPE II (Greater than 300 mm, max. 600 mm)

** DENOTES FINISHED GRADE ELEVATION

FOUNDATION MATERIAL UNDER CONCRETE MEDIAN BARRIER IS TO BE COMPACTED.

MEASUREMENT AND PAYMENT

Median Barrier MB-13 Type I, II or III will be paid for at the Contract Unit Price per meter, which shall be full compensation for furnishing and installing Class 20 Conc., Reinforcing Steel, Porus Backfill and all tools, labor, equipment and incidentals necessary to complete the work. Any additional excavation, backfill with suitable material and compaction work necessary for the Concrete Median Barrier intallation is to be considered incidental in the price bid for the concrete median barrier.

REINFORCING STEEL SCHEDULE								
	Bars "A"		Bars A-1		Bars "B"		Dowels	
Panel	No.	Length	No.	Length	No.	Length	No.	Length
TYPE I					2	5900		
TYPE II	20	1730	20	1675	9	5900	40	300
TYPE III	20	1730	20	1675	9	5900	40	300

Sheet 1 of 2

Rev. 8/97

CONCRETE MEDIAN BARRIER (TALL WALL) TYPE I, II or III

MB-13

VIRGINIA DEPARTMENT OF TRANSPORTATION

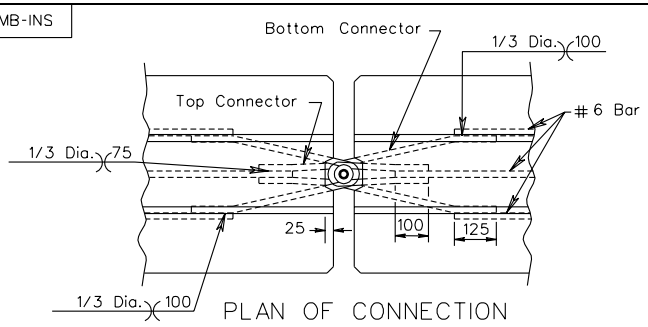
501.66 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

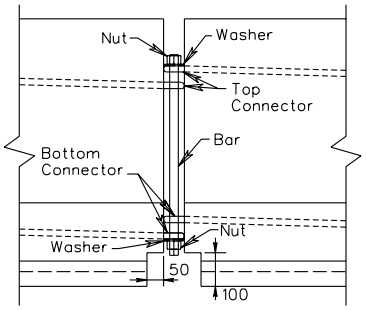
105
404
502

REVISED ON 3/98

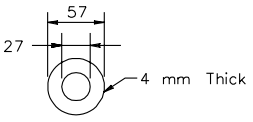
MB-INS



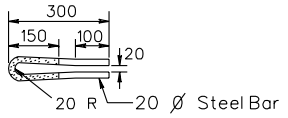
PLAN OF CONNECTION



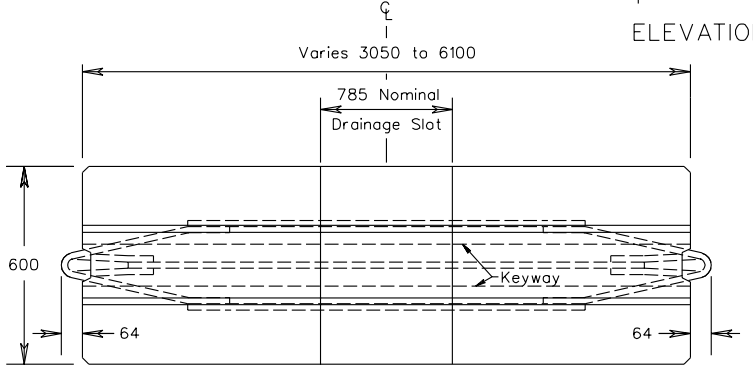
ELEVATION OF CONNECTION



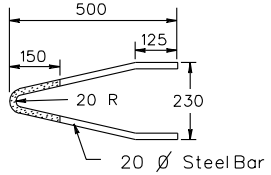
PLAIN GALVANIZED STEEL WASHER FOR 25 mm PIN



TOP CONNECTOR



PLAN VIEW



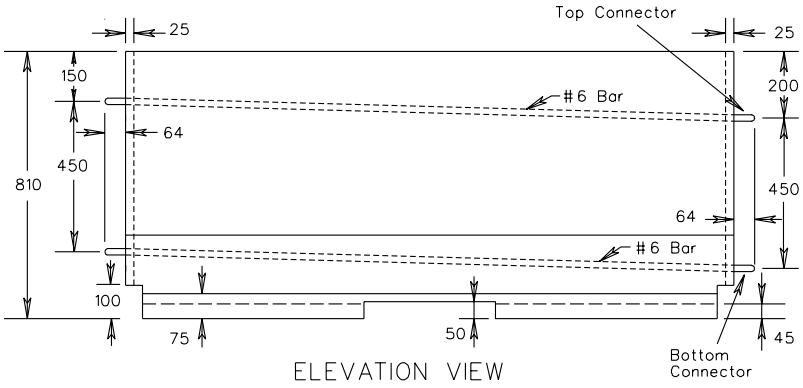
BOTTOM CONNECTOR

Galvanize After Forming
Note: Entire Connector May Be Galvanized.

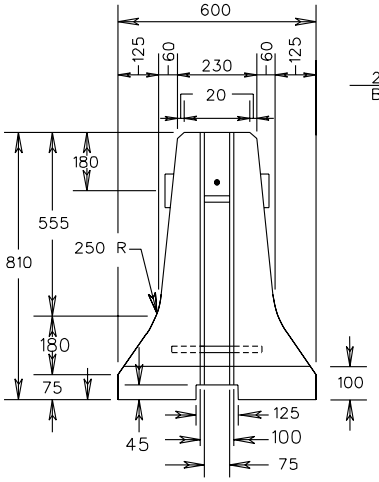
Notes:

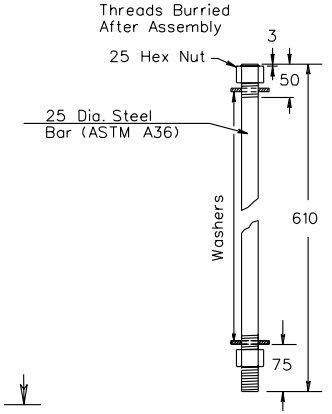
Pin and Connectors to be ASTM A-36 Reinforcing steel bars to be ASTM A 615, Grade 60 One Connector Pin Assembly with each Barrier section.

Other approved Positive Connections such as Channel Splice, Vertical I Beam, or Lapped Joint as shown in AASHTO's Roadside Design Guide may be used.



ELEVATION VIEW





CONNECTOR PIN ASSEMBLY

Galvanized after fabrication.

PIN & LOOP DETAILS

Sheet 1 Of 4

PRECAST CONCRETE MEDIAN BARRIER
POSITIVE CONNECTION OPTIONS

VIRGINIA DEPARTMENT OF TRANSPORTATION

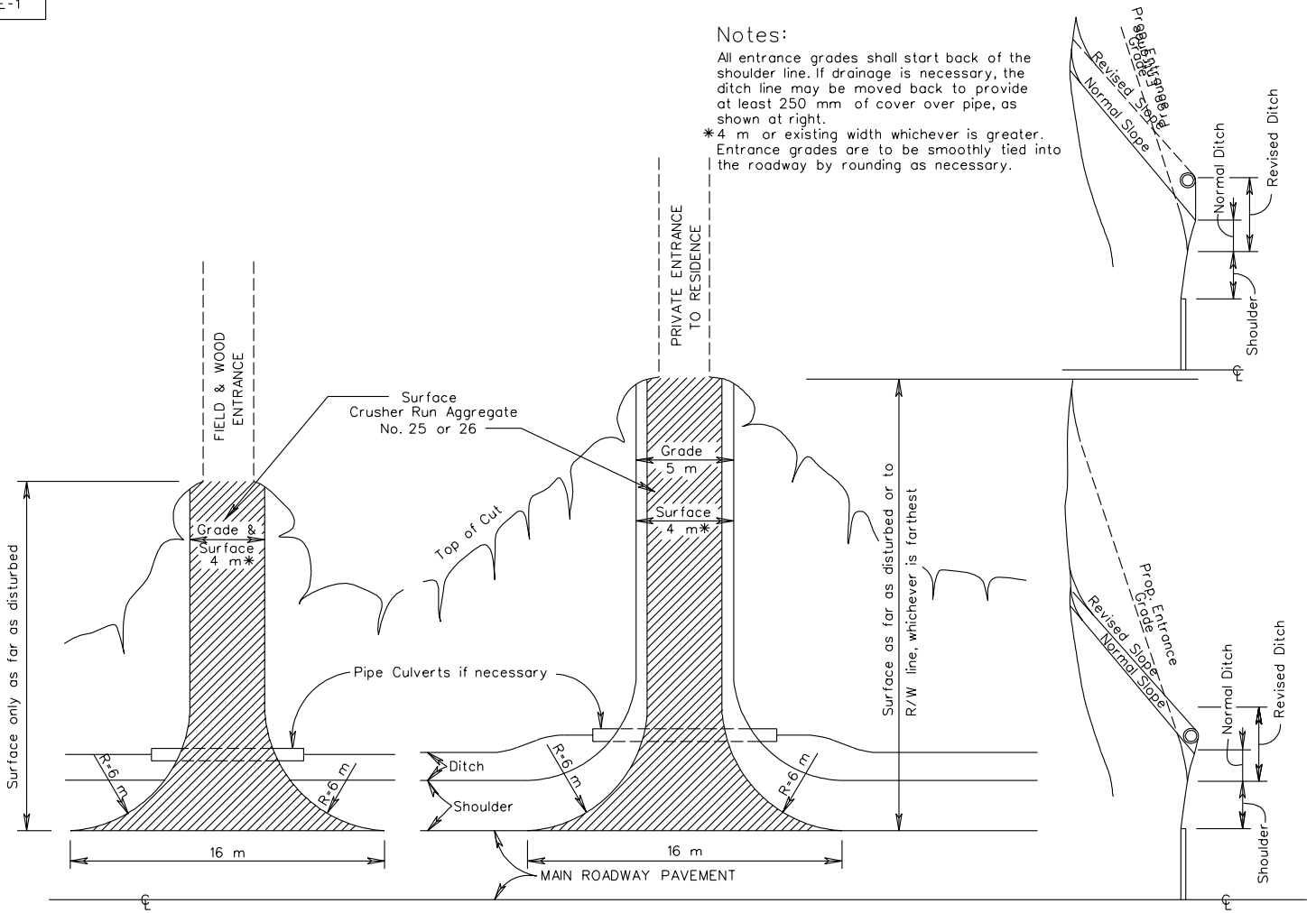
Rev. 8/97

SPECIFICATION REFERENCE

501.68

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

PE-1



Note:
Lengths of culverts shown on road plans for entrances are approximate and shall be adjusted to obtain above roadway widths.

Entrances in fill to be same as above except location of culvert (when necessary).

STANDARD PRIVATE ENTRANCES

SPECIFICATION REFERENCE

512

REV. 9/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

STANDARD SYMBOLS

Location ℄ ..... Alignment on which the proposed right-of-way and construction is based.

Standard Pavement ..... The typical pavement section to be shown on the road plans.

P.C. ..... Point of beginning of baseline circular curve.

P.T. ..... Point of ending of baseline circular curve.

P.C.C. ..... Point of baseline compound curvature.

P.R.C. ..... Point of baseline reverse curvature.

T.S. ..... Point of change from tangent to transition curve. (Tangent to Spiral)

S.C. ..... Point of change from transition curve to circular curve. (Spiral to Circular)

C.S. ..... Point of change from circular curve to transition curve. (Circular to Spiral)

S.T. ..... Point of change from transition curve to tangent. (Spiral to Tangent)

Radius ..... Radius of baseline circular curve.

DV ..... Approximate maximum safe speed in kilometers per hour using standard rate of superelevation.

NC ..... Approximate maximum safe speed in kilometers per hour with no superelevation. Factors apply only to Urban Low Speed Conditions.

LS ..... Length of transition curve measured along baseline. Where no transition curve is applied LS is length of superelevation transition.

W or PW ..... Width of standard pavement.

ZT ..... Distance from transitioned baseline to edges of transitioned pavement. $(\frac{W}{2} + \frac{w}{2})$

w ..... Maximum pavement widening (2ZT-W).

E ..... Rate of superelevation in meters per meter of pavement width.

F ..... Safe side friction factor.

S ..... Amount of superelevation to be applied to the baseline grade to obtain the elevations of the edges of transitioned pavement.

C ..... Standard pavement crown (difference in elevation between center and edges).

CR ..... Standard pavement crown transition or crown runoff length.

CP ..... Chord point (1/10 increments of transition curve).

All distances (horizontal and vertical) are measured in meters.

TRANSITION CURVES

FOR RURAL AND URBAN HIGHWAYS AND STREET CONDITIONS

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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TC-5

URBAN CONDITION

Urban conditions apply to Urban street systems and any other road with present or future Urban street operating conditions.

These tables contain superelevation rates and transition lengths for standard urban pavement widths though a range of curves and design velocities considered most likely to be used in urban road design.

On Sheet 801.01 are found the standard symbols used throughout these tables.

A table for "Low Speed Urban" designs is on Sheet 801.18 with a range of standard pavement widths (W), transition lengths (LS), and radii of curve when superelevated by an amount equal to the normal crown and the approximate maximum safe speeds (DV) afforded thereby. Values in this table can be used on streets with operating speeds less than or equal to 70 km/h. Also shown are the approximate maximum safe speeds (NC) with no superelevation. Values for (NC) can be used on Urban Arterial, Collector, and Local streets.

For minimum design factors for various design speeds for Urban conditions see Sheets 801.19 thru 801.25

When Urban conditions apply there will be no baseline transition or pavement widening. The length of transition (LS) determines the length of superelevation transition through which the outer edge of pavement is raised above the Base Line Grade to a maximum of E ($\frac{W}{2}$). See Sheet 801.07 for a graphical illustration of the application of this correction.

For odd radii curves use the corrections for the nearest smaller radii curve found in these tables.

For curves sharper than 35 m the tabulated values for 35 m curves shall be used.

LS should be shown on the plans for all curves.

E should be shown on the plans for all curves with Urban street conditions.

For graphical illustration of Design Superelevation Rates for Urban conditions see Sheet 801.16.

For additional general instructions (both Urban and Rural) see Sheet 801.04.

RURAL CONDITION

TC-5

Rural conditions apply to Interstate, Arterial, Primary and Secondary Systems or to any other road with rural type design and operating conditions.

These tables contain superelevation and widening corrections for standard rural pavement widths through a range of radii and design velocities considered most likely to be used in rural highway design.

On Sheet 801.01 are found standard symbols used throughout these tables.

For minimum design factors for various design speeds for Rural Conditions see Sheets 801.26 Thru 801.34.

On curves with greater than 850 m radius there will be no spiral transition or pavement widening. Pavement will be superelevated by an amount equal to the rate shown in the tables. See Sheet 801.06 for a graphical illustration of the application of this correction.

For odd radius curves use the transitions and corrections for the next smaller radius curve found in the tables.

For curves sharper than 35 m the tabulated values for 35 m curves shall be used.

It should be noted that no transition can be longer than the curve to which it is applied. The standard shift (ZT) should be considered for its effect on horizontal clearance.

LS and E should be shown on the plans for all curves when other than maximum values are used.

For graphical illustration of Design Superelevation Rates for Rural conditions see Sheet 801.17.

For additional general instructions (both Urban and Rural) see Sheet 801.04.

TC-5

GENERAL CONDITION

All original cross sections shall be taken from the baseline at stations, 20 meter interval for rural projects, and 10 meter interval for urban projects, and unusual breaks in the ground as on tangent alignment.

Where a part or all of a superelevation transition curve falls on a vertical curve, elevations on the vertical curve should be computed for the positions given on Sheet 801.14 for Urban projects and Sheet 801.15 for Rural projects. These elevations and pluses should be shown on the plans for the convenience of the survey party in staking out the project. Throughout these sections of the grade, elevations at even stations and 10 or 20 meter intervals should be omitted.

Slope stakes should be set at the positions on the transition given on Sheet 801.14 and 801.15 and ground cross sections taken at these positions omitting the stations and 10 or 20 meter intervals throughout the transition. If unusual breaks in the ground occur, additional sections should, of course, be taken. Additional sections should also be taken where location is through rock cut in anticipation of unusual breakage which may occur during construction.

After rough grading has been done, fine grading (blue top) and form stakes should be set at the positions given on Sheet 801.14 for Urban projects or as given on Sheet 801.15 for Rural projects.

Final cross sections should, of course, be taken at those positions at which the slope stake sections were taken. Where unusual breakage in rock occurs and this was not anticipated, additional final sections should be taken and original ground sections interpolated.

Baseline stakes should be set at all P.C.'s, P.T.'s, T.S.'s, S.T.'s,S.C.'s, and C.S.'s in staking out alignment but slope stakes need not be set nor cross sections taken at P.C.'s or P.T.'s except where called for in the accompanying tables. The transition will take its form from the positions given on Sheet 801.14 and 801.15.

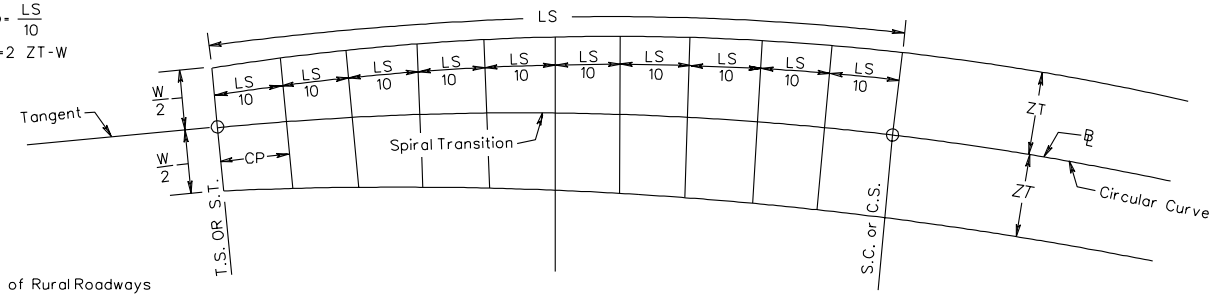
The right of way shall, in all cases, be referenced from the baseline.

The designer should avoid situations necessitating reverse curves and curves with overlapping transitions where possible.

A design exception is not required when using values from Sheets 801.19 thru 801.34 since these tables were derived within AASHTO guidelines.

Chord Points (CP)= $\frac{LS}{10}$

Total widening (W)=2 ZT-W

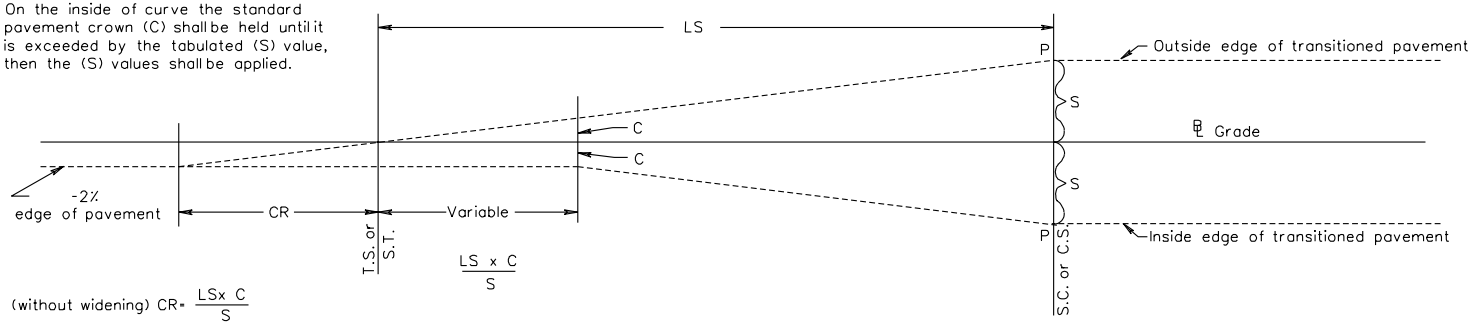


NOTE:
Pavement widening of Rural Roadways will be achieved by equal widening of both edges of pavement over the LS (length of spiral) transition.

PLAN OF TRANSITION

$ZT = \frac{W+w}{2}$

NOTE:
On the inside of curve the standard pavement crown (C) shall be held until it is exceeded by the tabulated (S) value, then the (S) values shall be applied.

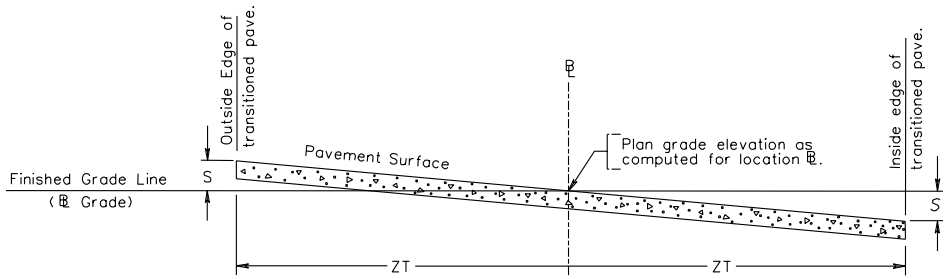


(without widening) CR= $\frac{LS \times C}{S}$

(with widening) CR= LS x $\frac{\text{normal E}}{\text{max. E}}$ x $\frac{W}{W + w}$

PROFILE OF TRANSITION

NOTE: Short vertical curves should be inserted by eye at points (P) if considered necessary.



CROSS SECTION THRU TRANSITION

DETAILS FOR TRANSITIONED ℄ (RURAL CONDITION ONLY) (R < 850 m)

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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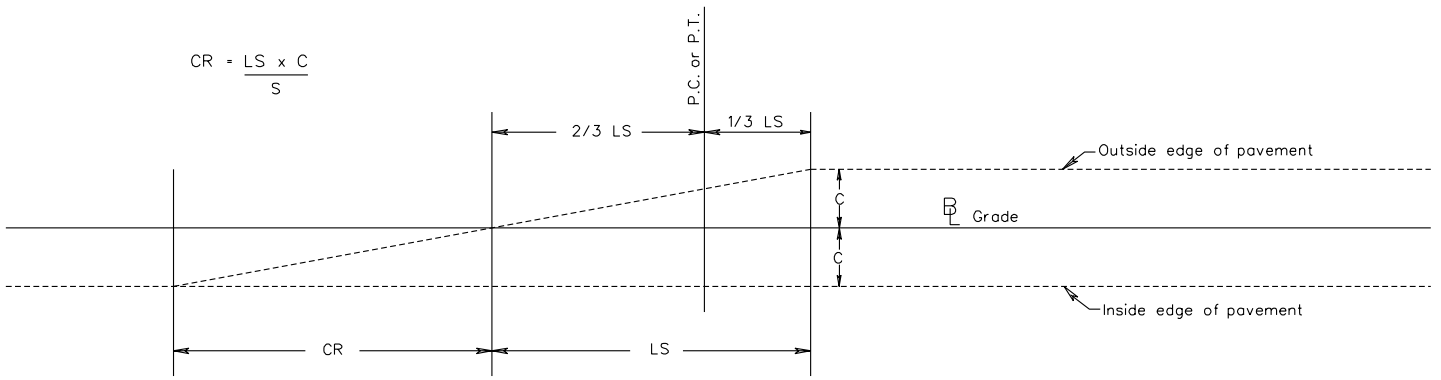
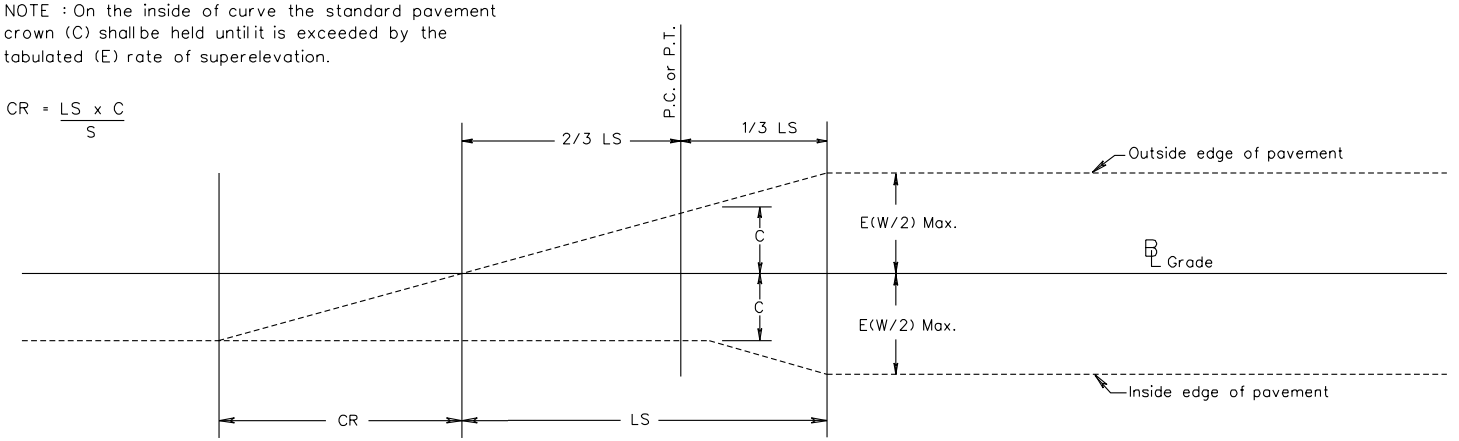
801.05

TC-5



SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN

NOTE : On the inside of curve the standard pavement crown (C) shall be held until it is exceeded by the tabulated (E) rate of superelevation.



SUPERELEVATED BY AN AMOUNT EXCEEDING THE STANDARD PAVEMENT CROWN

PROFILE OF TRANSITION
FOR NON-TRANSITIONED ℄ (RURAL CONDITION ONLY) (R>850 m)

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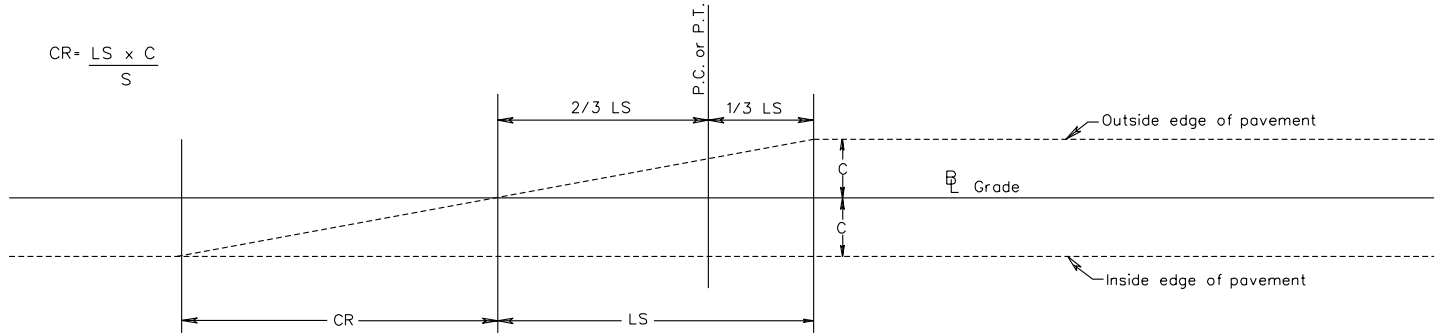
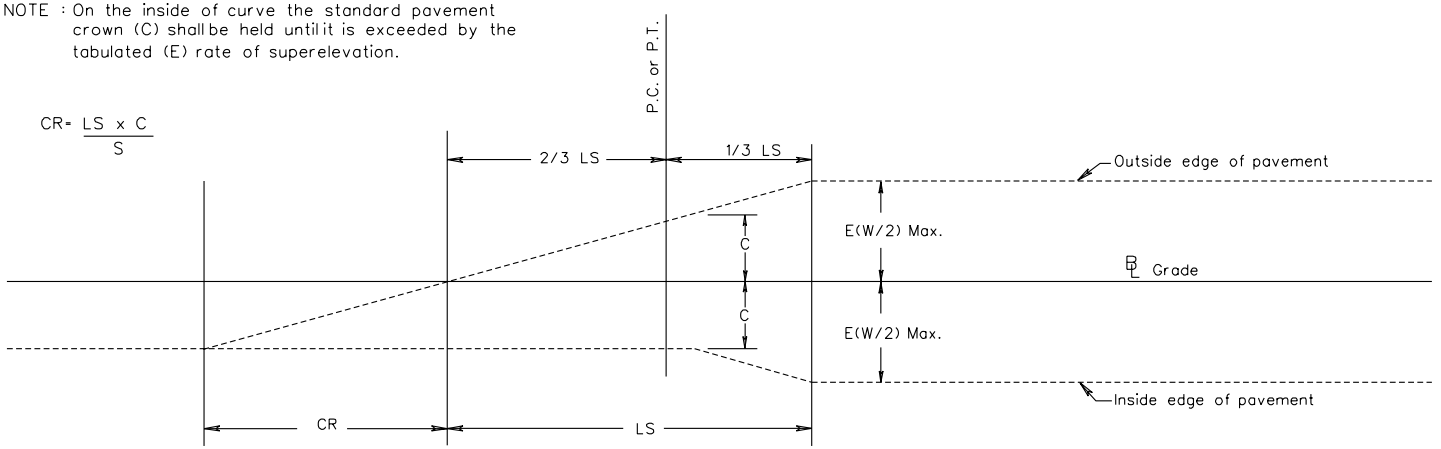
801.06 | UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION



SUPERELEVATED BY AN AMOUNT EQUAL TO THE STANDARD PAVEMENT CROWN

NOTE : On the inside of curve the standard pavement crown (C) shall be held until it is exceeded by the tabulated (E) rate of superelevation.



SUPERELEVATED BY AN AMOUNT EXCEEDING THE STANDARD PAVEMENT CROWN

PROFILE OF TRANSITION FOR NON-TRANSITIONED ℄ (URBAN CONDITIONS ONLY)

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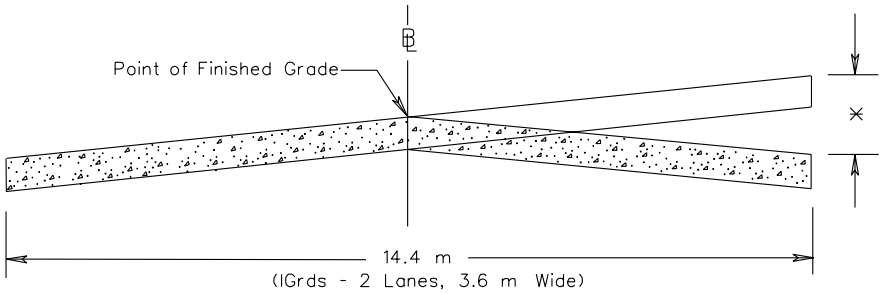
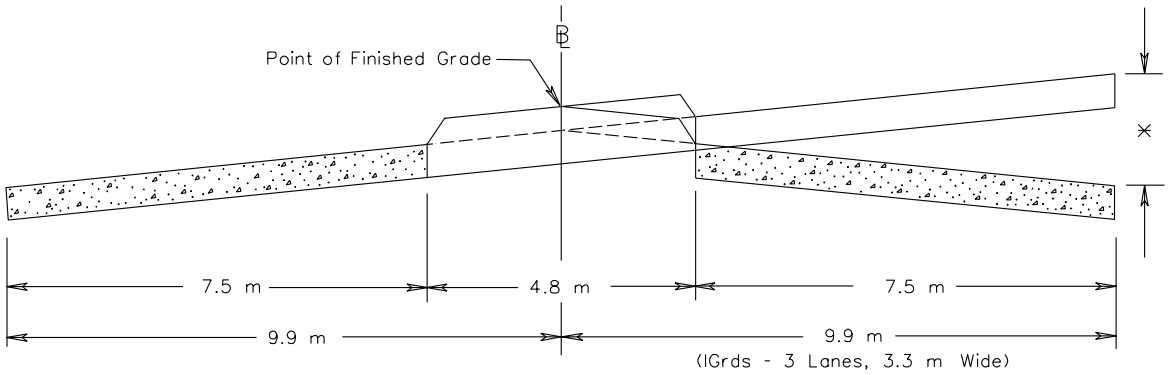
801.07

TC-5





✕ The elevation differential between normal crown and maximum superelevation, relative to the baseline profile.

Additional information may be obtained from A Policy on Geometric Design of Highways and Streets (AASHTO) Book, Chapter III - Elements of Design (Superelevation Runoff).

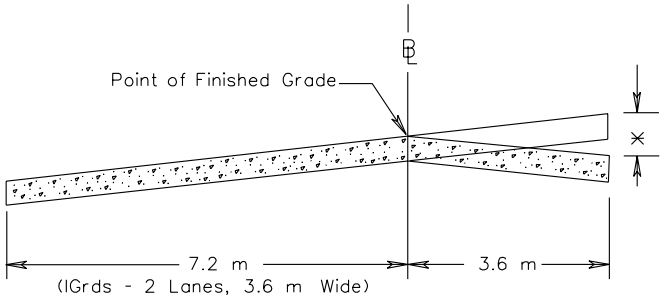
On Standard TC-5ULS (Metric), TC-5U (Metric), and TC-5R (Metric) (R > 850 m) superelevated curves, position the LS two thirds (2/3) on the tangent and one third (1/3) into the curve. Stations and elevations for these transitions will need to be computed for all chord points and shown on the profiles.

DETAILS OF SUPERELEVATION ABOUT BASELINE

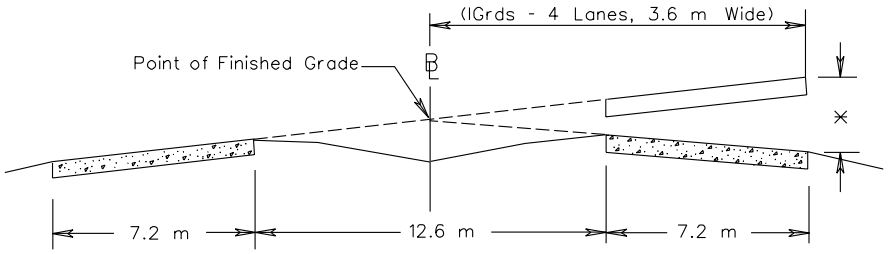
REVISED 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION



The Pavement Widths shown in the Standard TC-5 (Metric) Tables on Sheet 801.18 through 801.34 represent twice the distance from the crownline to the edge of pavement on the high side.



* The elevation differential between normal crown and maximum superelevation, relative to the baseline profile.

Additional information may be obtained from A Policy on Geometric Design of Highways and Streets (AASHTO) Book, Chapter III - Elements of Design (Superelevation Runoff).

Projects in which lanes may be added in the future in the median area should be designed with the construction baseline and point of finished grade located in the middle of the median. Superelevation is to be rotated from this baseline point. This will prevent uneven pavement problems (when additional lanes are added in the median area) such as crossover grades as well as the need for retaining walls, median barriers and special design drainage structures. Additional right of way or easements, in most situations, will not be required.

DETAILS OF SUPERELEVATION ABOUT BASELINE

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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DESIGN FACTORS FOR A DESIGN SPEED OF 30 KM/H (URBAN) USING E= 4% MAX.

TC-5

RADIUS (Meters)	E (%)	PAVEMENT WIDTH					
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)					
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6
		LS (Meters)					
7000	2.0	30	30	30	30	30	30
5000	2.0	30	30	30	30	30	30
3000	2.0	30	30	30	30	30	30
2000	2.0	30	30	30	30	30	30
1500	2.0	30	30	30	30	30	30
1250	2.0	30	30	30	30	30	30
1000	2.0	30	30	30	30	30	30
850	2.0	30	30	30	30	30	30
700	2.0	30	30	30	30	30	30
600	2.0	30	30	30	30	30	30
550	2.0	30	30	30	30	30	30
500	2.0	30	30	30	30	30	30
450	2.0	30	30	30	30	30	30
400	2.0	30	30	30	30	30	30
350	2.0	30	30	30	30	30	30
325	2.0	30	30	30	30	30	30
300	2.0	30	30	30	30	30	30
275	2.0	30	30	30	30	30	30
250	2.1	30	30	30	30	30	30
230	2.2	30	30	30	30	30	30
215	2.2	30	30	30	30	30	30
200	2.3	30	30	30	30	30	30
190	2.4	30	30	30	30	30	30
180	2.4	30	30	30	30	30	30
170	2.5	30	30	30	30	30	30
160	2.5	30	30	30	30	30	30
150	2.6	30	30	30	30	30	30
140	2.6	30	30	30	30	30	30
130	2.7	30	30	30	30	30	30
120	2.8	30	30	30	30	30	30
110	2.9	30	30	30	30	30	30
100	3.0	30	30	30	30	30	30
95	3.0	30	30	30	30	30	30
90	3.1	30	30	30	30	30	30
85	3.2	30	30	30	30	30	35
80	3.2	30	30	30	30	30	35
75	3.3	30	30	30	30	30	35
70	3.4	30	30	30	30	30	35
65	3.5	30	30	30	30	35	35
60	3.6	30	30	30	30	35	35
55	3.7	30	30	30	30	35	40
50	3.8	30	30	30	35	35	40
45	3.9	30	30	30	35	35	40
40	4.0	30	30	30	35	40	40
35	4.0	30	30	30	35	40	40

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 30 meters.

REVISED 8/97

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 40 KM/H (URBAN) USING E= 4% MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH						
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6	
		LS (Meters)						
7000	2.0	30	30	30	30	30	30	
5000	2.0	30	30	30	30	30	30	
3000	2.0	30	30	30	30	30	30	Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 30 meters.
2000	2.0	30	30	30	30	30	30	
1500	2.0	30	30	30	30	30	30	
1250	2.0	30	30	30	30	30	30	
1000	2.0	30	30	30	30	30	30	
850	2.0	30	30	30	30	30	30	
700	2.0	30	30	30	30	30	30	
600	2.0	30	30	30	30	30	30	
550	2.0	30	30	30	30	30	30	
500	2.0	30	30	30	30	30	30	
450	2.1	30	30	30	30	30	30	
400	2.2	30	30	30	30	30	30	
350	2.3	30	30	30	30	30	30	
325	2.4	30	30	30	30	30	30	
300	2.5	30	30	30	30	30	30	
275	2.5	30	30	30	30	30	30	
250	2.6	30	30	30	30	30	30	
230	2.7	30	30	30	30	30	30	
215	2.8	30	30	30	30	30	30	
200	2.8	30	30	30	30	30	30	
190	2.9	30	30	30	30	30	30	
180	3.0	30	30	30	30	30	35	
170	3.0	30	30	30	30	30	35	
160	3.1	30	30	30	30	30	35	
150	3.2	30	30	30	30	35	35	
140	3.2	30	30	30	30	35	35	
130	3.3	30	30	30	30	35	35	
120	3.4	30	30	30	30	35	35	
110	3.5	30	30	30	35	35	40	
100	3.7	30	30	30	35	35	40	
95	3.7	30	30	30	35	35	40	
90	3.8	30	30	30	35	40	40	
85	3.8	30	30	30	35	40	40	
80	3.9	30	30	35	35	40	45	
75	4.0	30	30	35	35	40	45	
70	4.0	30	30	35	35	40	45	
65	4.0	30	30	35	35	40	45	
60	4.0	30	30	35	35	40	45	

VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED 8/97

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

DESIGN FACTORS FOR A DESIGN SPEED OF 50 KM/H (URBAN) USING E=4% MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH						
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6	
		LS (Meters)						
7000	2.0	30	30	30	30	30	30	
5000	2.0	30	30	30	30	30	30	
3000	2.0	30	30	30	30	30	30	Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 30 meters.
2000	2.0	30	30	30	30	30	30	
1500	2.0	30	30	30	30	30	30	
1250	2.0	30	30	30	30	30	30	
1000	2.0	60	60	60	60	30	30	
850	2.0	30	30	30	30	30	30	
700	2.0	30	30	30	30	30	30	
600	2.1	30	30	30	30	30	30	
550	2.2	30	30	30	30	30	30	
500	2.4	30	30	30	30	30	30	
450	2.5	30	30	30	30	30	30	
400	2.6	30	30	30	30	30	30	
350	2.7	30	30	30	30	30	30	
325	2.8	30	30	30	30	30	35	
300	2.9	30	30	30	30	30	35	
275	3.0	30	30	30	30	35	35	
250	3.1	30	30	30	30	35	35	
230	3.2	30	30	30	30	35	40	
215	3.3	30	30	30	35	35	40	
200	3.4	30	30	30	35	35	40	
190	3.4	30	30	30	35	35	40	
180	3.5	30	30	30	35	40	40	
170	3.6	30	30	30	35	40	40	
160	3.7	30	30	35	35	40	45	
150	3.7	30	30	35	35	40	45	
140	3.8	30	30	35	40	40	45	
130	3.9	30	30	35	40	40	45	
120	4.0	30	30	35	40	45	45	
110	4.0	30	30	35	40	45	45	
100	4.0	30	30	35	40	45	45	

VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED 8/97

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

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 60 KM/H (URBAN) USING E= 4% MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH						
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6	
		LS (Meters)						
7000	2.0	35	35	35	35	35	35	
5000	2.0	35	35	35	35	35	35	
3000	2.0	35	35	35	35	35	35	
2000	2.0	35	35	35	35	35	35	
1500	2.0	35	35	35	35	35	35	
1250	2.0	35	35	35	35	35	35	
1000	2.0	35	35	35	35	35	35	
850	2.1	35	35	35	35	35	35	
700	2.4	35	35	35	35	35	35	
600	2.5	35	35	35	35	35	35	
550	2.6	35	35	35	35	35	35	
500	2.7	35	35	35	35	35	35	
450	2.9	35	35	35	35	35	35	
400	3.0	35	35	35	35	35	40	
350	3.2	35	35	35	35	40	40	
325	3.3	35	35	35	35	40	40	
300	3.4	35	35	35	35	40	45	
275	3.5	35	35	35	40	40	45	
250	3.6	35	35	35	40	40	45	
230	3.7	35	35	35	40	45	45	
215	3.8	35	35	35	40	45	50	
200	3.9	35	35	40	40	45	50	
190	3.9	35	35	40	40	45	50	
180	4.0	35	35	40	40	45	50	
170	4.0	35	35	40	40	45	50	
160	4.0	35	35	40	40	45	50	
150	4.0	35	35	40	40	45	50	

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 35 meters.

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

DESIGN FACTORS FOR A DESIGN SPEED OF 70 KM/H (URBAN) USING E= 4 % MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH						
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6	
		LS (Meters)						
7000	2.0	40	40	40	40	40	40	
5000	2.0	40	40	40	40	40	40	
3000	2.0	40	40	40	40	40	40	
2000	2.0	40	40	40	40	40	40	
1500	2.0	40	40	40	40	40	40	
1250	2.0	40	40	40	40	40	40	
1000	2.3	40	40	40	40	40	40	
850	2.5	40	40	40	40	40	40	
700	2.7	40	40	40	40	40	40	
600	2.9	40	40	40	40	40	40	
550	3.0	40	40	40	40	40	40	
500	3.1	40	40	40	40	40	45	
450	3.3	40	40	40	40	40	45	
400	3.5	40	40	40	40	45	50	
350	3.6	40	40	40	40	45	50	
325	3.7	40	40	40	45	45	50	
300	3.8	40	40	40	45	50	50	
275	3.9	40	40	40	45	50	55	
250	4.0	40	40	40	45	50	55	
230	4.0	40	40	40	45	50	55	
215	4.0	40	40	40	45	50	55	

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 40 meters.

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 80 KM/H (URBAN) USING E= 4% MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH					
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)					
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6
		LS (Meters)					
7000	2.0	45	45	45	45	45	45
5000	2.0	45	45	45	45	45	45
3000	2.0	45	45	45	45	45	45
2000	2.0	45	45	45	45	45	45
1500	2.0	45	45	45	45	45	45
1250	2.3	45	45	45	45	45	45
1000	2.6	45	45	45	45	45	45
850	2.8	45	45	45	45	45	45
700	3.0	45	45	45	45	45	45
600	3.2	45	45	45	45	45	50
550	3.4	45	45	45	45	45	50
500	3.5	45	45	45	45	50	55
450	3.6	45	45	45	45	50	55
400	3.8	45	45	45	50	55	55
350	3.9	45	45	45	50	55	60
325	4.0	45	45	45	50	55	60
300	4.0	45	45	45	50	55	60

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 45 meters.

REVISED 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 90 KM/H (URBAN) USING E= 4 % MAX.

RADIUS (Meters)	E (%)	PAVEMENT WIDTH					
		7.6 m	10.8 m	14.4 m	18.0 m	19.8 m	21.6 m
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)					
		1 @ 3.8	1.5 @ 3.6	2 @ 3.6	3 @ 3.0	3 @ 3.3	3 @ 3.6
		LS (Meters)					
7000	2.0	50	50	50	50	50	50
5000	2.0	50	50	50	50	50	50
3000	2.0	50	50	50	50	50	50
2000	2.0	50	50	50	50	50	50
1500	2.3	50	50	50	50	50	50
1250	2.6	50	50	50	50	50	50
1000	2.9	50	50	50	50	50	50
850	3.1	50	50	50	50	50	50
700	3.4	50	50	50	50	50	55
600	3.6	50	50	50	50	50	55
550	3.8	50	50	50	50	55	60
500	3.9	50	50	50	50	55	60
450	4.0	50	50	50	50	60	65
400	4.0	50	50	50	50	60	65
375	4.0	50	50	50	50	60	65

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS with an absolute minimum of 50 meters.

TC-5	DESIGN FACTORS FOR A DESIGN SPEED OF 30 KM/H (RURAL) USING E= 8% MAX.													
DESIGN VELOCITY=30		WIDTH=4.8 m		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 2.4		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	
7000	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
5000	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
3000	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
2000	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
1500	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
1250	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
1000	2.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	20	0.0	
850	2.0	20	1.2	20	0.9	20	0.6	20	0.0	20	0.0	20	0.0	
700	2.0	20	1.2	20	0.9	20	0.6	20	0.0	20	0.0	20	0.0	
600	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
550	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
500	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
450	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
400	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
350	2.0	20	1.3	20	1.0	20	0.7	20	0.0	20	0.0	20	0.0	
325	2.0	20	1.4	20	1.1	20	0.8	20	0.0	20	0.0	20	0.0	
300	2.2	20	1.4	20	1.1	20	0.8	20	0.0	20	0.0	20	0.0	
275	2.3	20	1.4	20	1.1	20	0.8	20	0.0	20	0.0	20	0.0	
250	2.5	20	1.4	20	1.1	20	0.8	20	0.0	20	0.0	20	0.0	
230	2.7	20	1.5	20	1.2	20	0.9	20	0.6	20	0.0	25	0.6	
215	2.9	20	1.5	20	1.2	20	0.9	20	0.6	20	0.0	25	0.6	
200	3.1	20	1.5	20	1.2	20	0.9	20	0.6	20	0.0	25	0.6	
190	3.2	20	1.5	20	1.2	20	0.9	20	0.6	20	0.0	25	0.6	
180	3.3	20	1.5	20	1.2	20	0.9	20	0.6	20	0.0	25	0.6	
170	3.5	20	1.6	20	1.3	20	1.0	20	0.7	20	0.0	30	0.8	
160	3.6	20	1.6	20	1.3	20	1.0	20	0.7	20	0.0	30	0.8	
150	3.8	20	1.6	20	1.3	20	1.0	20	0.7	20	0.0	30	0.8	
140	4.0	20	1.6	20	1.3	20	1.0	20	0.7	20	0.0	35	0.8	
130	4.2	20	1.7	20	1.4	20	1.1	25	0.8	25	0.0	35	1.0	
120	4.5	20	1.7	25	1.4	25	1.1	25	0.8	25	0.0	35	1.0	
110	4.7	25	1.8	25	1.5	25	1.2	25	0.9	25	0.6	40	1.2	
100	5.0	25	1.8	25	1.5	25	1.2	25	0.9	30	0.6	40	1.2	
95	5.1	25	1.8	25	1.5	25	1.2	30	0.9	30	0.6	40	1.2	
90	5.3	25	1.9	25	1.6	30	1.3	30	1.0	30	0.7	45	1.4	
85	5.4	25	1.9	30	1.6	30	1.3	30	1.0	30	0.7	45	1.4	
80	5.6	30	2.0	30	1.7	30	1.4	30	1.1	30	0.8	45	1.6	
75	5.8	30	2.0	30	1.7	30	1.4	30	1.1	35	0.8	50	1.6	
70	6.0	30	2.1	30	1.8	30	1.5	35	1.2	35	0.9	50	1.8	
65	6.2	30	2.1	30	1.8	35	1.5	35	1.2	35	0.9	55	1.8	
60	6.4	30	2.2	35	1.9	35	1.6	35	1.3	35	1.0	55	2.0	
55	6.7	35	2.3	35	2.0	35	1.7	40	1.4	40	1.1	60	2.2	
50	6.9	35	2.4	35	2.1	40	1.8	40	1.5	40	1.2	60	2.4	
45	7.2	40	2.5	40	2.2	40	1.9	40	1.6	45	1.3	65	2.6	
40	7.5	40	2.7	40	2.4	45	2.1	45	1.8	45	1.5	70	3.0	
35	7.8	45	2.9	45	2.6	45	2.3	45	2.0	50	1.7	70	3.4	
30	8.0	45	3.1	45	2.8	50	2.5	50	2.2	50	1.9	75	3.8	REVISED 8/97

801.26	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN METERS	VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 40 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=40		WIDTH=4.8 m		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 2.4		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6	
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)
7000	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
5000	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
3000	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
2000	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
1500	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
1250	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
1000	2.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0	25	0.0
850	2.0	25	1.2	25	0.9	25	0.6	25	0.0	25	0.0	25	0.0
700	2.0	25	1.3	25	1.0	25	0.7	25	0.0	25	0.0	25	0.0
600	2.0	25	1.3	25	1.0	25	0.7	25	0.0	25	0.0	25	0.0
550	2.1	25	1.3	25	1.0	25	0.7	25	0.0	25	0.0	25	0.0
500	2.3	25	1.3	25	1.0	25	0.7	25	0.0	25	0.0	25	0.0
450	2.5	25	1.3	25	1.0	25	0.7	25	0.0	25	0.0	25	0.0
400	2.8	25	1.4	25	1.1	25	0.8	25	0.0	25	0.0	25	0.0
350	3.1	25	1.4	25	1.1	25	0.8	25	0.0	25	0.0	25	0.0
325	3.3	25	1.4	25	1.1	25	0.8	25	0.0	25	0.0	25	0.0
300	3.5	25	1.4	25	1.1	25	0.8	25	0.0	25	0.0	30	0.0
275	3.7	25	1.5	25	1.2	25	0.9	25	0.6	25	0.0	30	0.0
250	4.0	25	1.5	25	1.2	25	0.9	25	0.6	25	0.0	35	0.6
230	4.3	25	1.5	25	1.2	25	0.9	25	0.6	25	0.0	35	0.6
215	4.4	25	1.5	25	1.2	25	0.9	25	0.6	25	0.0	40	0.6
200	4.7	25	1.6	25	1.3	25	1.0	25	0.7	25	0.0	40	0.8
190	4.8	25	1.6	25	1.3	25	1.0	30	0.7	25	0.0	40	0.8
180	5.0	25	1.6	25	1.3	25	1.0	30	0.7	30	0.0	45	0.8
170	5.1	25	1.6	25	1.3	30	1.0	30	0.7	30	0.0	45	0.8
160	5.3	25	1.7	30	1.4	30	1.1	30	0.8	30	0.0	45	1.0
150	5.5	30	1.7	30	1.4	30	1.1	30	0.8	30	0.0	50	1.0
140	5.6	30	1.7	30	1.4	30	1.1	30	0.8	30	0.0	50	1.0
130	5.8	30	1.8	30	1.5	30	1.2	35	0.9	35	0.6	50	1.2
120	6.1	30	1.8	35	1.5	35	1.2	35	0.9	35	0.6	55	1.2
110	6.3	35	1.9	35	1.6	35	1.3	35	1.0	40	0.7	55	1.4
100	6.6	35	1.9	35	1.6	35	1.3	40	1.0	40	0.7	60	1.4
95	6.8	35	2.0	35	1.7	40	1.4	40	1.1	40	0.8	60	1.6
90	6.9	35	2.0	35	1.7	40	1.4	40	1.1	40	0.8	60	1.6
85	7.1	35	2.0	40	1.7	40	1.4	40	1.1	45	0.8	65	1.6
80	7.2	40	2.1	40	1.8	40	1.5	45	1.2	45	0.9	65	1.8
75	7.4	40	2.1	40	1.8	40	1.5	45	1.2	45	0.9	65	1.8
70	7.6	40	2.2	40	1.9	45	1.6	45	1.3	45	1.0	70	2.0
65	7.8	40	2.3	45	2.0	45	1.7	45	1.4	50	1.1	70	2.2
60	7.9	45	2.3	45	2.0	45	1.7	50	1.4	50	1.1	75	2.2
55	8.0	45	2.4	45	2.1	45	1.8	50	1.5	50	1.2	75	2.4
50	8.0	45	2.6	45	2.3	50	2.0	50	1.7	50	1.4	75	2.8

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 50 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=50		WIDTH=4.8 m		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1@ 2.4		1@ 2.7		1@ 3.0		1@ 3.3		1@ 3.6		2 @ 3.6	
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)
7000	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
5000	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
3000	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
2000	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
1500	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
1250	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
1000	2.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0	30	0.0
850	2.0	30	1.3	30	1.0	30	0.7	30	0.0	30	0.0	30	0.0
700	2.3	30	1.3	30	1.0	30	0.7	30	0.0	30	0.0	30	0.0
600	2.6	30	1.3	30	1.0	30	0.7	30	0.0	30	0.0	30	0.0
550	2.8	30	1.4	30	1.1	30	0.8	30	0.0	30	0.0	30	0.0
500	3.1	30	1.4	30	1.1	30	0.8	30	0.0	30	0.0	30	0.0
450	3.3	30	1.4	30	1.1	30	0.8	30	0.0	30	0.0	30	0.0
400	3.7	30	1.4	30	1.1	30	0.8	30	0.0	30	0.0	35	0.0
350	4.1	30	1.5	30	1.2	30	0.9	30	0.6	30	0.0	35	0.0
325	4.3	30	1.5	30	1.2	30	0.9	30	0.6	30	0.0	40	0.0
300	4.5	30	1.5	30	1.2	30	0.9	30	0.6	30	0.0	40	0.0
275	4.8	30	1.5	30	1.2	30	0.9	30	0.6	30	0.0	40	0.0
250	5.1	30	1.5	30	1.3	30	1.0	30	0.7	30	0.0	45	0.8
230	5.4	30	1.6	30	1.3	30	1.0	35	0.7	30	0.0	50	0.8
215	5.6	30	1.6	30	1.3	35	1.0	35	0.7	35	0.0	50	0.8
200	5.8	30	1.6	30	1.3	35	1.0	35	0.7	35	0.0	55	0.8
190	6.0	30	1.6	35	1.4	35	1.1	35	0.8	35	0.0	55	1.0
180	6.1	35	1.7	35	1.4	35	1.1	35	0.8	35	0.0	55	1.0
170	6.3	35	1.7	35	1.4	35	1.1	40	0.8	35	0.0	60	1.0
160	6.5	35	1.7	35	1.4	40	1.1	40	0.8	40	0.0	60	1.0
150	6.7	35	1.8	40	1.5	40	1.2	40	0.9	45	0.6	65	1.2
140	6.9	40	1.8	40	1.5	40	1.2	40	0.9	45	0.6	65	1.2
130	7.2	40	1.9	40	1.6	40	1.2	45	1.0	45	0.7	70	1.4
120	7.4	40	1.9	40	1.6	45	1.3	45	1.0	45	0.7	70	1.4
110	7.6	40	2.0	45	1.7	45	1.4	50	1.1	50	0.8	75	1.6
100	7.8	45	2.0	45	1.7	45	1.4	50	1.1	50	0.8	75	1.6
95	7.9	45	2.1	45	1.8	50	1.5	50	1.2	50	0.9	75	1.8
90	8.0	45	2.1	45	1.8	50	1.5	50	1.2	50	0.9	75	1.8
85	8.0	45	2.2	45	1.9	50	1.6	50	1.3	55	1.0	80	2.0
80	8.0	45	2.2	45	1.9	50	1.6	50	1.3	55	1.0	80	2.0

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

DESIGN FACTORS FOR A DESIGN SPEED OF 60 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=60		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6		
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	
7000	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
5000	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
3000	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
2000	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
1500	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
1250	2.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
1000	2.2	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	35	0.0	
850	2.6	35	1.0	35	0.7	35	0.0	35	0.0	35	0.0	35	0.0	
700	3.0	35	1.1	35	0.8	35	0.0	35	0.0	35	0.0	40	0.0	
600	3.4	35	1.1	35	0.8	35	0.0	35	0.0	35	0.0	45	0.0	
550	3.7	35	1.1	35	0.8	35	0.0	35	0.0	35	0.0	45	0.0	
500	4.0	35	1.1	35	0.8	35	0.0	35	0.0	40	0.0	50	0.0	
450	4.3	35	1.1	35	0.8	35	0.0	35	0.0	40	0.0	55	0.0	
400	4.7	35	1.2	35	0.9	35	0.6	35	0.0	45	0.0	60	0.0	
350	5.2	35	1.2	35	0.9	35	0.6	35	0.0	50	0.0	65	0.0	
325	5.4	35	1.2	35	0.9	35	0.6	35	0.0	50	0.0	65	0.0	
300	5.7	35	1.3	35	1.0	35	0.7	35	0.0	55	0.0	70	0.0	
275	6.0	35	1.3	35	1.0	40	0.7	40	0.0	55	0.0	75	0.0	
250	6.3	40	1.3	40	1.0	40	0.7	40	0.0	60	0.8	80	1.2	
230	6.6	40	1.4	40	1.1	45	0.8	40	0.0	65	1.0	85	1.5	
215	6.8	40	1.4	45	1.1	45	0.8	45	0.0	70	1.0	90	1.5	
200	7.0	40	1.4	45	1.1	45	0.8	45	0.0	70	1.0	90	1.5	
190	7.2	45	1.4	45	1.1	45	0.8	45	0.0	70	1.0	95	1.5	
180	7.4	45	1.5	45	1.2	50	0.9	50	0.6	75	1.2	100	1.8	
170	7.5	45	1.5	45	1.2	50	0.9	50	0.6	75	1.2	100	1.8	
160	7.7	45	1.5	50	1.2	50	0.9	50	0.6	80	1.2	105	1.8	
150	7.8	50	1.6	50	1.3	50	1.0	55	0.7	80	1.4	105	2.1	
140	8.0	50	1.6	50	1.3	55	1.0	55	0.7	80	1.4	110	2.1	
130	8.0	50	1.7	50	1.4	55	1.1	55	0.8	80	1.6	110	2.4	

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS.

REVISED 8/97

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 70 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=70		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6	
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)
7000	2.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
5000	2.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
3000	2.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
2000	2.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
1500	2.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
1250	2.3	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
1000	2.8	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0	40	0.0
850	3.3	40	1.1	40	0.8	40	0.0	40	0.0	40	0.0	45	0.0
700	3.8	40	1.1	40	0.8	40	0.0	40	0.0	40	0.0	50	0.0
600	4.3	40	1.1	40	0.8	40	0.0	40	0.0	45	0.0	60	0.0
550	4.6	40	1.1	40	0.8	40	0.0	40	0.0	50	0.0	65	0.0
500	5.0	40	1.2	40	0.9	40	0.6	40	0.0	50	0.0	70	0.0
450	5.3	40	1.2	40	0.9	40	0.6	40	0.0	55	0.0	70	0.0
400	5.8	40	1.2	40	0.9	40	0.6	40	0.0	60	0.0	80	0.0
350	6.2	40	1.3	40	1.0	45	0.7	45	0.0	65	0.0	85	0.0
325	6.5	40	1.3	45	1.0	45	0.7	45	0.0	65	0.0	90	0.0
300	6.8	45	1.3	45	1.0	50	0.7	45	0.0	70	0.0	90	0.0
275	7.1	45	1.4	50	1.1	50	0.8	50	0.0	70	0.0	95	0.0
250	7.4	50	1.4	50	1.1	50	0.8	50	0.0	80	1.0	105	1.5
230	7.6	50	1.4	50	1.1	55	0.8	50	0.0	80	1.0	110	1.5
215	7.8	50	1.5	55	1.2	55	0.9	60	0.6	85	1.2	115	1.8
200	7.9	50	1.5	55	1.2	55	0.9	60	0.6	85	1.2	115	1.8
190	8.0	55	1.5	55	1.2	55	0.9	60	0.6	90	1.2	115	1.8
180	8.0	55	1.5	55	1.2	55	0.9	60	0.6	90	1.2	115	1.8

Note: For pavement widths greater than 21.6 meters use LS values developed by IGRDS.

REVISED 8/97

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

DESIGN FACTORS FOR A DESIGN SPEED OF 80 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=80		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6		
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	
7000	2.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS.
5000	2.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	
3000	2.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	
2000	2.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	
1500	2.4	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	
1250	2.8	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	
1000	3.4	45	0.0	45	0.0	45	0.0	45	0.0	45	0.0	50	0.0	
850	3.9	45	1.1	45	0.8	45	0.0	45	0.0	45	0.0	60	0.0	
700	4.6	45	1.1	45	0.8	45	0.0	45	0.0	50	0.0	70	0.0	
600	5.1	45	1.2	45	0.9	45	0.6	45	0.0	60	0.0	75	0.0	
550	5.4	45	1.2	45	0.9	45	0.6	45	0.0	60	0.0	80	0.0	
500	5.8	45	1.2	45	0.9	45	0.6	45	0.0	65	0.0	85	0.0	
450	6.2	45	1.2	45	0.9	45	0.6	45	0.0	70	0.0	90	0.0	
400	6.7	45	1.3	50	1.0	50	0.7	50	0.0	75	0.0	100	0.0	
350	7.1	50	1.3	50	1.0	55	0.7	55	0.0	80	0.0	105	0.0	
325	7.4	55	1.4	55	1.1	55	0.8	55	0.0	80	0.0	110	0.0	
300	7.6	55	1.4	55	1.1	60	0.8	55	0.0	85	0.0	110	0.0	
275	7.8	55	1.4	60	1.1	60	0.8	60	0.0	85	0.0	115	0.0	
250	8.0	60	1.4	60	1.2	60	0.9	65	0.6	95	1.2	125	1.8	
230	8.0	60	1.5	60	1.2	60	0.9	65	0.6	95	1.2	125	1.8	

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 90 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=90		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6	
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)
7000	2.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0
5000	2.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0
3000	2.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0
2000	2.2	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0
1500	2.9	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0
1250	3.4	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	55	0.0
1000	4.1	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	65	0.0
850	4.6	50	1.1	50	0.8	50	0.0	50	0.0	55	0.0	70	0.0
700	5.4	50	1.2	50	0.9	50	0.6	50	0.0	65	0.0	85	0.0
600	6.0	50	1.2	50	0.9	50	0.6	50	0.0	70	0.0	95	0.0
550	6.4	50	1.2	50	0.9	50	0.6	50	0.0	75	0.0	100	0.0
500	6.8	50	1.2	50	1.0	55	0.7	55	0.0	80	0.0	105	0.0
450	7.2	55	1.3	55	1.0	55	0.7	55	0.0	85	0.0	110	0.0
400	7.6	55	1.3	60	1.0	60	0.7	60	0.0	90	0.0	115	0.0
350	7.9	60	1.4	60	1.1	65	0.8	60	0.0	90	0.0	120	0.0
325	8.0	60	1.4	60	1.1	65	0.8	65	0.0	95	0.0	125	0.0

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS.

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

DESIGN FACTORS FOR A DESIGN SPEED OF 100 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=100		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m		
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6		
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	
7000	2.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	
5000	2.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS.
3000	2.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	
2000	2.7	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	
1500	3.4	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	
1250	4.0	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	65	0.0	
1000	4.8	60	0.0	60	0.0	60	0.0	60	0.0	60	0.0	80	0.0	
850	5.5	60	1.2	60	0.9	60	0.6	60	0.0	70	0.0	90	0.0	
700	6.3	60	1.2	60	0.9	60	0.6	60	0.0	80	0.0	105	0.0	
600	7.0	60	1.3	60	1.0	60	0.7	60	0.0	85	0.0	115	0.0	
550	7.3	60	1.3	60	1.0	60	0.7	60	0.0	90	0.0	120	0.0	
500	7.6	60	1.3	60	1.0	65	0.7	65	0.0	95	0.0	125	0.0	
450	7.9	60	1.3	65	1.0	65	0.7	65	0.0	95	0.0	130	0.0	
400	8.0	65	1.4	65	1.1	70	0.7	65	0.0	100	0.0	130	0.0	

TC-5

DESIGN FACTORS FOR A DESIGN SPEED OF 110 KM/H (RURAL) USING E= 8% MAX.

DESIGN VELOCITY=110		WIDTH=5.4 m		WIDTH=6.0 m		WIDTH=6.6 m		WIDTH=7.2 m		WIDTH=14.4 m		WIDTH=21.6 m	
		IGRDS EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)											
		1 @ 2.7		1 @ 3.0		1 @ 3.3		1 @ 3.6		2 @ 3.6		3 @ 3.6	
RADIUS(m)	E(%)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)	LS(m)	W(m)
7000	2.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0
5000	2.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0
3000	2.1	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0
2000	3.1	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0
1500	3.9	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	70	0.0
1250	4.6	65	0.0	65	0.0	65	0.0	65	0.0	65	0.0	80	0.0
1000	5.5	65	0.0	65	0.0	65	0.0	65	0.0	75	0.0	95	0.0
850	6.3	65	1.2	65	0.9	65	0.6	65	0.0	85	0.0	110	0.0
700	7.2	65	1.3	65	1.0	65	0.7	65	0.0	95	0.0	125	0.0
600	7.8	65	1.3	65	1.0	70	0.7	70	0.0	105	0.0	135	0.0
550	8.0	65	1.3	70	1.0	70	0.7	70	0.0	105	0.0	140	0.0
500	8.0	65	1.4	70	1.1	75	0.8	70	0.0	105	0.0	140	0.0

Note: For pavements widths greater than 21.6 meters use LS values developed by IGRDS.

REVISED 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

CURVE WIDENING TABLES

SU DESIGN VEHICLE

COMPONENT	SIZE
OVERALL WIDTH (u)	2.60 m
WHEELBASE (L)	6.10 m
FRONT OVERHANG (A)	1.20 m
FACTOR (f)	0.105

LATERAL CLEARANCE

LANE WIDTH	CLEARANCE (C)
2.4 m	0.30 m
2.7 m	0.45 m
3.0 m	0.60 m
3.3 m	0.75 m
3.6 m	0.90 m
4.8 m	1.5 m

IGRDS HA.TBL TABLES

EFFECTIVE WIDTHS

NUMBER OF LANES	EFFECTIVE WIDTHS (w)						EFFECTIVE WIDTH FACTOR
	2.4 m LANES	2.7 m LANES	3.0 m LANES	3.3 m LANES	3.6 m LANES	4.8 m LANES	
1	2.4	2.7	3.0	3.3	3.6	4.8	1
1.5	2.9	3.2	3.6	4.0	4.3	5.8	1.2
2	3.6	4.1	4.5	5.0	5.4	7.2	1.5
3	4.8	5.4	6.0	6.6	7.2	9.6	2
4	9.6	10.8	12.0	13.2	14.4	19.2	4
5	12.0	13.5	15.0	16.5	18.0	24.0	5
6	14.4	16.2	18.0	19.8	21.6	28.8	6
7	16.8	18.9	21.0	23.1	25.2	33.6	7
8	19.2	21.6	24.0	26.4	28.8	38.4	8

RELATIVE GRADIENTS

DESIGN SPEED V_D km/h	RELATIVE GRADIENT (rg)		MIN. TRANSITION LENGTH IN METERS 2 SECOND RULE	
	UP TO 3 LANES	4 OR MORE LANES	URBAN	RURAL
30	0.75	1.11	30	20
40	0.70	1.05	30	25
50	0.65	1.00	30	30
60	0.60	0.90	35	35
70	0.55	0.80	40	40
80	0.50	0.75	45	45
90	0.48	0.71	50	50
100	0.45	0.67	60	60
110	0.42	0.63	65	65

DEFINITIONS

A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.

C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.

e - SUPERELEVATION RATE IN DECIMAL FROM APPROPRIATE TABLE OR CALCULATED PER AASHTO METHOD 5.

f - FACTOR FROM APPROPRIATE TABLE.

F_A - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.

L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.

LS - LENGTH OF SPIRAL OR SUPERELEVATION TRANSITION LENGTH.

R - RADIUS OF CURVE.

rg - RELATIVE GRADIENT FROM APPROPRIATE TABLE.

U - CALCULATED TRACK WIDTH OF DESIGN VEHICLE.

u - TRACK WIDTH OF DESIGN VEHICLE FROM APPROPRIATE TABLE.

V_D - DESIGN VELOCITY

W - CALCULATED WIDENING

w - EFFECTIVE WIDTH FROM APPROPRIATE TABLE.

W_C - CALCULATED TOTAL CURVE WIDTH

Z - CALCULATED EXTRA WIDTH ALLOWANCE.

GENERAL DESIGN CONSIDERATIONS

1. WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE TRANSITION LENGTH (LS).
2. THE COMPUTED TRANSITION LENGTH (LS) IS ROUNDED UP TO THE NEAREST FIVE METER INCREMENT. COMPUTED LENGTHS THAT FALL ON THE FIVE METER INCREMENT ARE NOT ROUNDED.
3. WHEN THE TRANSITION LENGTH (LS) IS CALCULATED, IT MUST BE COMPARED WITH THE MINIMUM VALUE LISTED IN THE APPROPRIATE COLUMN ON THE RELATIVE GRADIENT TABLE.
4. CROWN RUNOFF IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION.
5. NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.
6. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH A CURVE RADIUS GREATER THAN 850 METERS.
7. NO PAVEMENT WIDENING IS REQUIRED FOR 3.6 METER WIDE LANES WITH A CURVE RADIUS GREATER THAN 230 METERS.
8. PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (W) IS EQUAL TO OR GREATER THAN 0.6 METER.
9. CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 METER.
10. WHEN CALCULATING WIDENING (W) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "w" AND THE ANSWER (W) IS THEN MUTIPLIED BY THE NUMBER OF LANES.

FORMULAE USED TO CALCULATE TRANSITION LENGTH (LS) AND WIDENING (W)

$LS = (100we) / rg$ (NO WIDENING REQUIRED)

$LS = [100 (w + W/2) e] / rg$ (WIDENING REQUIRED)

$U = u + R - \sqrt{R^2 - L^2}$

$F = \sqrt{R + A (2L + A)} - R$

$Z = f (V_D / \sqrt{R})$

$W_C = 2 (U + C) + F_A + Z$

$W = W_C - 2w$

FOR SOLVED PROBLEMS USING THIS METHODOLOGY, SEE THE EXAMPLES ON PAGE 801.36.

IGRDS METHODOLOGIES FOR CALCULATING TC-5 VALUES

TC-5

RURAL EXAMPLE

6.0 m PAVEMENT WIDTH
(IGRDS - 1 LANE AT 3.0 m)

V_D = 80 km/h R = 375 m
w = 3.0 m rg = 0.50
e = 0.069 (6.9% CALCULATED PER AASHTO METHOD 5)

$U = u + R - \sqrt{R^2 - L^2}$
$U = 2.6 + 375 - \sqrt{(375)^2 - (6.1)^2}$
$U = 2.6496$

$F_A = \sqrt{R^2 + A\,(2L + A)} - R$
$F_A = \sqrt{(375)^2 + 1.2[\,2(6.1) + 1.2\,]} - 375$
$F_A = 0.0214$

$Z = f\,(V_D / \sqrt{R}\,)$
$Z = 0.105\,(80 / \sqrt{375}\,)$
$Z = 0.4338$

$W_C = 2\,(U + C) + F_A + Z$
$W_C = 2(2.6496 + 0.6) + 0.0214 + 0.4338$
$W_C = 6.9544$

$W = W_C - 2w = 6.9544 - 2(3.0) = 0.9544$ (1.0 ROUNDED)

LS = [100 (w + W/2) e] / rg (WIDENING REQUIRED)
LS = [100 (6.0 + 1.0/2) .069] / 0.50
LS = 48.3 (50 ROUNDED)

RURAL EXAMPLE

14.4 m PAVEMENT WIDTH
(IGRDS - 2 LANES AT 3.6 m)

V_D = 60 km/h R = 175 m
w = 5.4 m rg = 0.60
e = 0.075 (7.5% CALCULATED PER AASHTO METHOD 5)

$U = u + R - \sqrt{R^2 - L^2}$
$U = 2.6 + 175 - \sqrt{(175)^2 - (6.1)^2}$
$U = 2.7063$

$F_A = \sqrt{R^2 + A\,(2L + A)} - R$
$F_A = \sqrt{(175)^2 + 1.2[\,2(6.1) + 1.2\,]} - 175$
$F_A = 0.0459$

$Z = f\,(V_D / \sqrt{R}\,)$
$Z = 0.105\,(60 / \sqrt{175}\,)$
$Z = 0.4762$

$W_C = 2\,(U + C) + F_A + Z$
$W_C = 2(2.7063 + 0.9) + 0.0459 + 0.4762$
$W_C = 7.7347$

$W = W_C - 2w = 7.7347 - 2(3.6) = 0.5347$ (0.6 ROUNDED)
2 LANES THEREFORE W = 2W = 1.2

LS = [100 (w + W/2) e] / rg (WIDENING REQUIRED)
LS = [100 (5.4 + 1.2/2) .075] / 0.60
LS = 75.0

URBAN EXAMPLES

7.6 m PAVEMENT WIDTH
(IGRDS - 1 LANE AT 3.8 m)

V_D = 60 km/h R = 175 m
w = 3.8 m rg = 0.60
e = 0.04 (4% PER PAGE 801.22)

LS = (100we) / rg (NO WIDENING REQUIRED)
LS = [100(3.8)(0.04)] / 0.60
LS = 25.3333 < 35 (MIN. LS) THEREFORE
LS = 35

19.8 m PAVEMENT WIDTH
(IGRDS - 3 LANES AT 3.3 m)

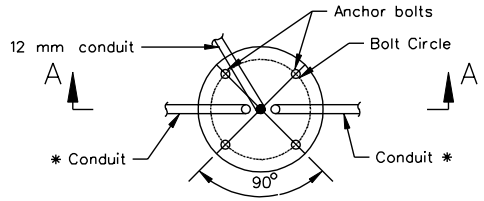
V_D = 60 km/h R = 175 m
w = 6.6 m rg = 0.60
e = 0.04 (4% PER PAGE 801.22)

LS = (100we) / rg (NO WIDENING REQUIRED)
LS = [100(6.6)(0.04)] / 0.60
LS = 44 (ROUND TO 45) > 35 (MIN. LS)
LS = 45

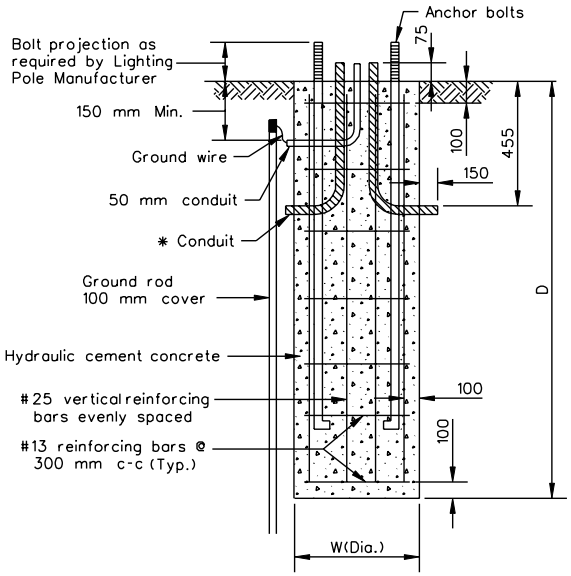
CALCULATED TC-5 EXAMPLES USING IGRDS METHODOLOGY

NEW 8/97

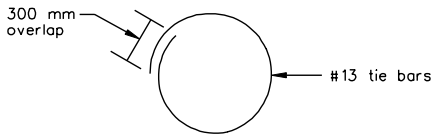
LF-1



PLAN VIEW
TYPE A AND B



SECTION A-A



PLAN VIEW

Type	W	D	Vertical Bars
A	800	1800	8 - #25
B	800	2400	8 - #25

Notes:

Conduit elbows shall have a 90° bend. The bend radius shall be in accordance with the N.E.C.

The bolt circle template shall be furnished by the lighting pole manufacturer.

* The number, orientation and size of conduits entering and exiting foundations shall be as shown on plans.

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

LIGHTING POLE FOUNDATION INSTALLATION DETAILS

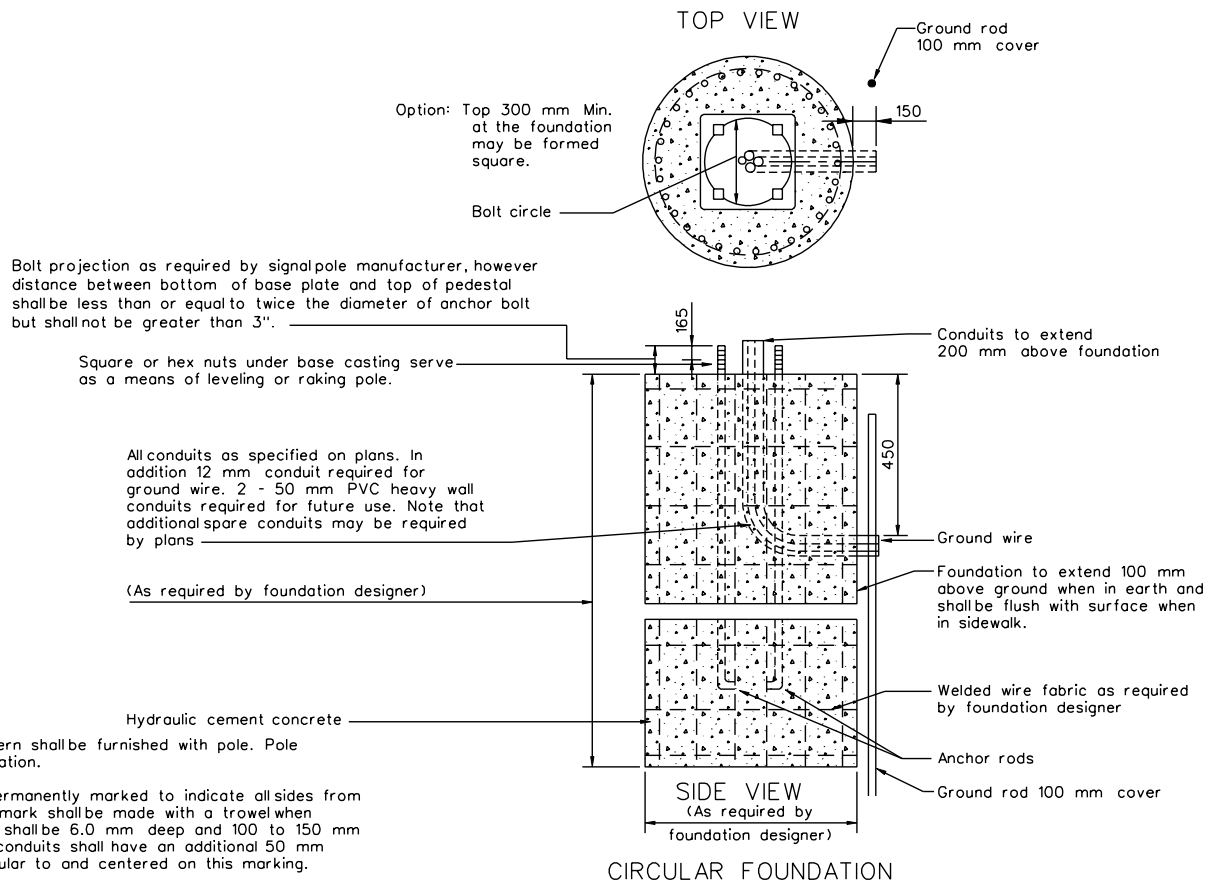
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

REV. 8/97

1301.09 | UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

PF-1



CIRCULAR FOUNDATION

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 6.0 mm deep and 100 to 150 mm long. Locations of empty conduits shall have an additional 50 mm long mark made perpendicular to and centered on this marking.

When foundation extends 100 mm above finished grade all edges shall be chamfered 20 mm.

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

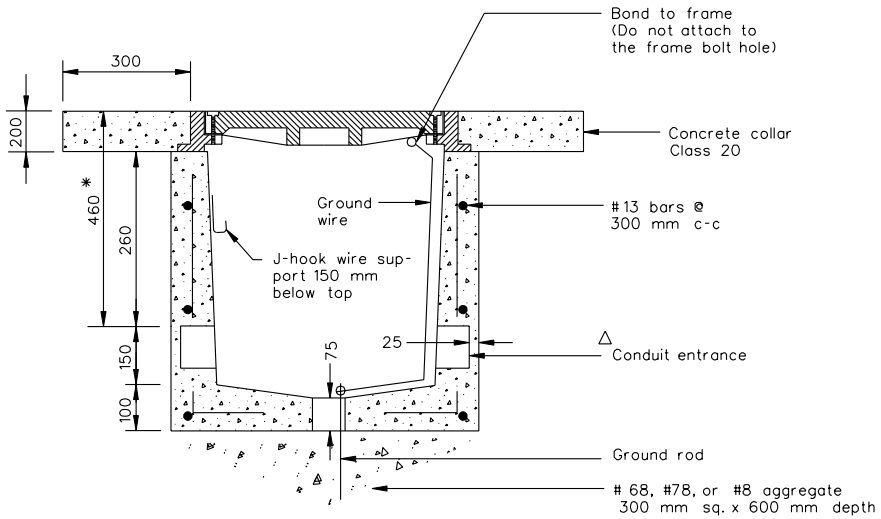
Bell ends shall be installed on each end of PVC conduits. Empty conduits shall be plugged to prevent moisture and rodent entry.

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

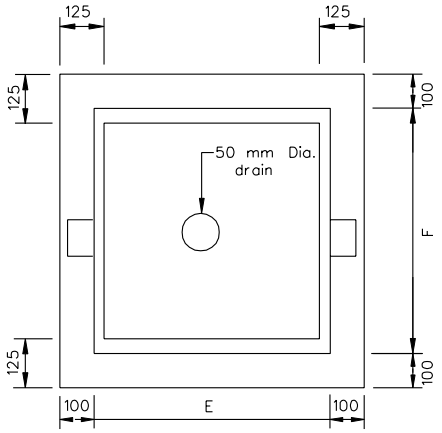
No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.

SPECIFICATION REFERENCE	SIGNAL POLE FOUNDATION INSTALLATION DETAILS	REV. 8/97
	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS — 1301.10

JB-1A,2A,3A,4A,&5A



STANDARD	DIMENSIONS	
	E	F
JB-1A	356	356
JB-2A	356	508
JB-3A	508	508
JB-4A	508	685
JB-5A	685	685



PLAN VIEW

(FRAME AND COVER REMOVED)

Notes:

Conduit entrances shall be located as shown on the plans. Conduits shall extend 50 mm min. to 75 mm max. beyond the inside wall of the junction box.

Bell ends shall be installed on the ends of PVC conduits. Grounding bushings shall be installed on the ends of metal conduits. Bell ends & bushings shall be plugged to prevent moisture & rodent entry.

* Depth of conduit entrances for magnetic detectors shall be in accordance with St'd TD-2.

All reinforcing steel shall have a minimum 40 mm concrete cover. Any reinforcing steel in conflict with conduit shall be cut a minimum of 40 mm from conduit.

The junction box may be precast or cast in place concrete.

△ A minimum 50 mm diameter conduit entrance is required unless otherwise specified on plans.

A concrete collar is required only when junction box is installed in earth areas.

High strength grout conforming to the Road & Bridge Specifications shall be used to secure the frame to the junction box.

All junction boxes shall be installed with a ground rod unless box houses only communication/interconnect cable.

Voids resulting from entrance of conduits into junction box shall be completely filled with hydraulic cement grout conforming to the Road & Bridge Specifications.

JUNCTION BOX

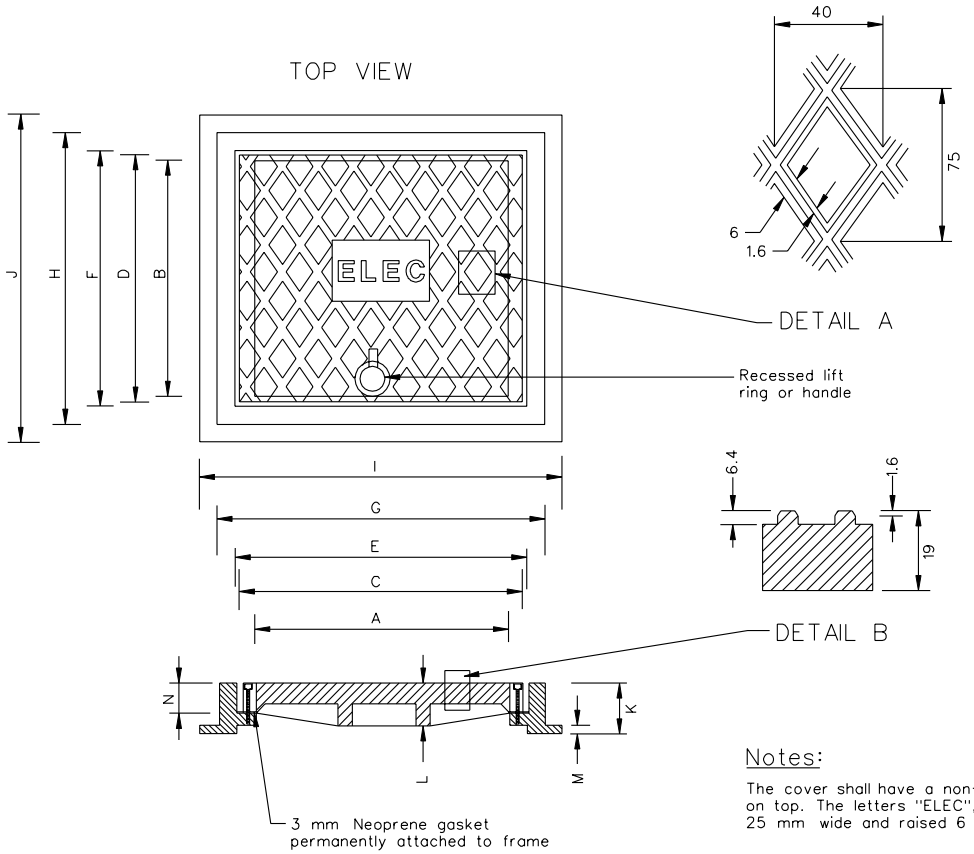
SPECIFICATION REFERENCE

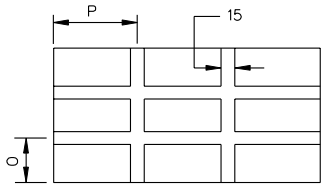
Rev. 8/97

1301.45 | UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

JB-1A,2A,3A,4A,& 5A





Notes:

The cover shall have a non-skid surface with letters cast in the depression on top. The letters "ELEC", "TRAF" or "UTILITY" (as applicable) are to be 25 mm wide and raised 6 mm high.

Four recessed M10 hex head bolts are required for each cover. Bolts shall be located at each corner or center of each side of cover.

STANDARD	DIMENSIONS															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
JB-1A	305	305	350	350	356	356	381	381	457	457	102	38	13	38	114^{+13}_{-}	114^{+13}_{-}
JB-2A	305	457	350	502	356	508	387	539	457	609	102	38	16	38	165^{+13}_{-}	114^{+13}_{-}
JB-3A	457	457	502	502	508	508	539	539	609	609	102	44	16	38	165^{+13}_{-}	165^{+13}_{-}
JB-4A	457	609	502	679	508	685	546	723	609	850	102	44	19	38	228^{+13}_{-}	165^{+13}_{-}
JB-5A	609	609	679	679	685	685	723	723	850	850	102	44	19	38	228^{+13}_{-}	228^{+13}_{-}

SPECIFICATION REFERENCE

JUNCTION BOX

VIRGINIA DEPARTMENT OF TRANSPORTATION

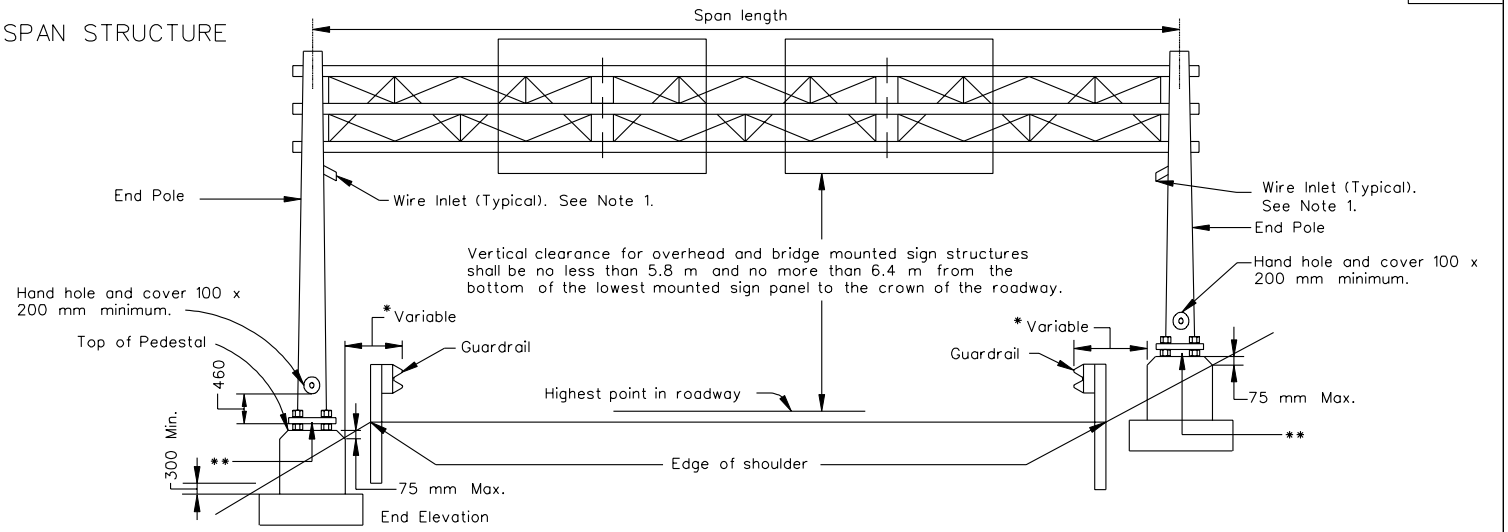
Rev. 8/97

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

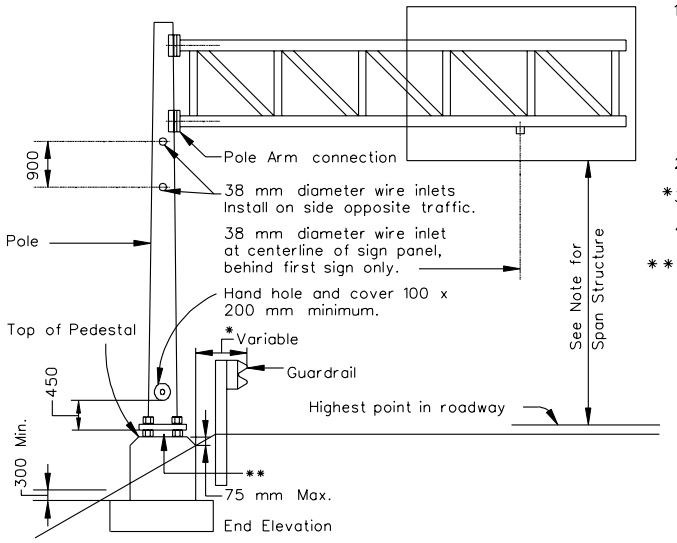
1301.46

OSS-1

SPAN STRUCTURE



CANTILEVER STRUCTURE



NOTES:

1. 38 mm diameter wire inlets shall be provided at the following locations:
   - A. On span structures on the front leg of end pole 300 mm below bottom chord.
   - B. On cantilever structures on pole 300 mm 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. Distance between bottom of base plate and top of pedestal shall be less than or equal to twice the diameter of anchor bolt but shall not be greater than 3".

SPECIFICATION REFERENCE

TYPICAL DETAILS FOR OVERHEAD SIGN STRUCTURES

VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 8/97

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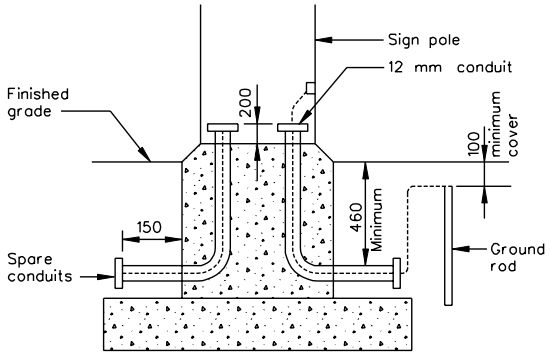
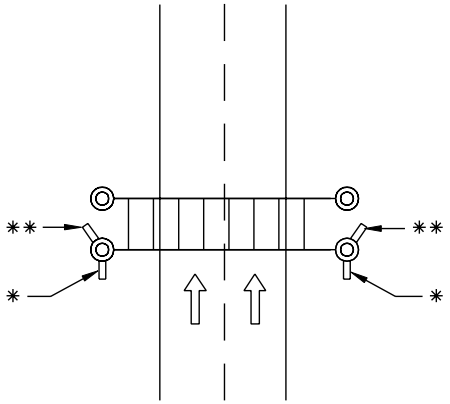
1301.68

TYPICAL SIGN FOOTING DETAIL WITH CONDUIT



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.

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 - 12 mm conduit required for ground wire and two - 50 mm 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 6 mm deep and 100 to 150 mm long. Locations of empty conduits shall have an additional 50 mm long mark made perpendicular to and centered on this mark.

Foundations above finished grade shall be chamfered 19 mm on all edges.

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

Bell ends shall be installed on each end of PVC conduits.

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

Voids remaining after conductors exit or enter bell ends 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.

SPECIFICATION REFERENCE

TYPICAL DETAILS FOR OVERHEAD SIGN STRUCTURES

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 8/97

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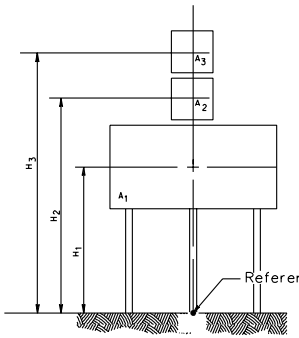
1301.72

REVISED ON 12/97

CSI-1



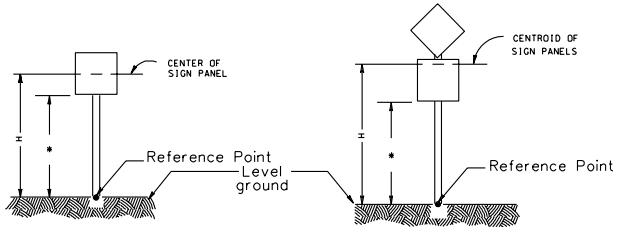
A_1 = Area of Sign Panel 1
A_2 = Area of Sign Panel 2
A_3 = Area of Sign Panel 3
H_1 = Centroidal Distance From Sign Panel 1 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_3 = Centroidal Distance from Sign Panel 3 to Ground Line.
H = Centroidal Distance for Sign Group.

$$H = \frac{(A_1 X H_1) + (A_2 X H_2) + (A_3 X H_3)}{(A_1 + A_2 + A_3)}$$

NOTE:
Measure "H" distances from Reference point which is located half-way between outer posts (for 2 or 3 posts) and intersection with ground line.

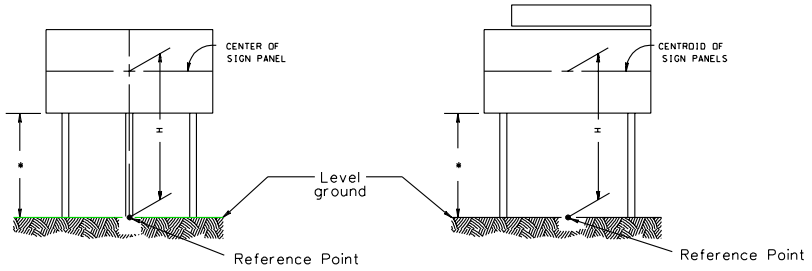
PROCEDURE FOR DETERMINING CENTROID WITH MULTIPLE SIGN PANELS

SINGLE POST



SINGLE SIGN PANEL MULTIPLE SIGN PANELS

TWO OR THREE POSTS



SINGLE SIGN PANEL MULTIPLE SIGN PANEL

DESIGN TABLE FOR WOODEN SUPPORTS				
Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
100x100	2300	0.66	1.32	1.98
	2400	0.63	1.27	1.90
	2500	0.61	1.21	1.82
	2600	0.58	1.17	1.75
	2700	0.56	1.12	1.69
	2800	0.54	1.08	1.63
	2900	0.52	1.05	1.57
	3000	0.51	1.01	1.52
	3100	0.49	0.98	1.47
	3200	0.47	0.95	1.42
	3300	0.46	0.92	1.38
	3400	0.45	0.89	1.34
	3500	0.43	0.87	---
	3600	0.42	0.84	---
	3700	0.41	0.82	---

Dimension "H" is defined as follows (for level ground):

Single sign panel: Vertical distance from center of sign panel to the ground line.

Multiple sign panels: Vertical distance from centroid of sign panel group to the ground line.

Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

* Wood post sign structures shall be installed in accordance with WSP-1 except that notes under installation details are replaced with the following:

Single post sign structures shall have a minimum distance between top of sign panel and groundline of 2700 mm.

Single and multipost sign structures shall have a minimum distance between top of pavement (at edge of pavement) and bottom of sign panel, and between groundline and bottom of sign panel of 2100 mm.

If a secondary sign panel is mounted below primary sign panel the above distances (between bottom of sign panel and either groundline or top of pavement) may be reduced to 1800 mm.

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS LEVEL GROUND

SPECIFICATION REFERENCE

Rev. 8/97

1301.93 | UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

CSI-1

DESIGN TABLE FOR WOODEN SUPPORTS				
Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
125x125	2300	1.51	3.01	---
	2400	1.44	2.89	---
	2500	1.39	2.77	---
	2600	1.33	2.67	---
	2700	1.28	2.57	---
	2800	1.24	---	---
	2900	1.19	---	---
	3000	1.16	---	---
	3100	1.12	---	---
	3200	1.08	---	---
	3300	1.05	---	---
	3400	1.02	---	---
	3500	0.99	---	---
	3600	0.96	---	---
	3700	0.94	---	---
100x150 (*)	2300	1.81	3.62	---
	2400	1.74	3.47	---
	2500	1.67	3.33	---
	2600	1.60	3.21	---
	2700	1.54	3.09	---
	2800	1.49	2.98	---
	2900	1.44	2.87	---
	3000	1.39	2.78	---
	3100	1.34	2.69	---
	3200	1.30	2.60	---
	3300	1.26	2.52	---
	3400	1.23	---	---
	3500	1.19	---	---
	3600	1.16	---	---
	3700	1.13	---	---

DESIGN TABLE FOR WOODEN SUPPORTS				
Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
150x150	2300	2.85	5.69	8.54
	2400	2.73	5.46	8.18
	2500	2.62	5.24	7.86
	2600	2.52	5.04	7.56
	2700	2.43	4.85	7.28
	2800	2.34	4.68	7.02
	2900	2.26	4.52	6.77
	3000	2.18	4.37	6.55
	3100	2.11	4.22	6.34
	3200	2.05	4.09	---
	3300	1.98	3.97	---
	3400	1.93	3.85	---
	3500	1.87	3.74	---
	3600	1.82	3.64	---
	3700	1.77	3.54	---
150x200 (*)	2300	5.09	10.18	15.27
	2400	4.88	9.76	14.63
	2500	4.68	9.37	14.05
	2600	4.50	9.01	13.51
	2700	4.34	8.67	13.01
	2800	4.18	8.36	12.54
	2900	4.04	8.07	12.11
	3000	3.90	7.81	11.71
	3100	3.78	7.55	11.33
	3200	3.66	7.32	10.98
	3300	3.55	7.10	10.64
	3400	3.44	6.89	10.33
	3500	3.35	6.69	10.04
	3600	3.25	6.50	9.76
	3700	3.16	6.33	9.49

(*) Larger dimension in direction of (parallel to) traffic.

Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

SPECIFICATION REFERENCE

XXX

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS LEVEL GROUND

VIRGINIA DEPARTMENT OF TRANSPORTATION

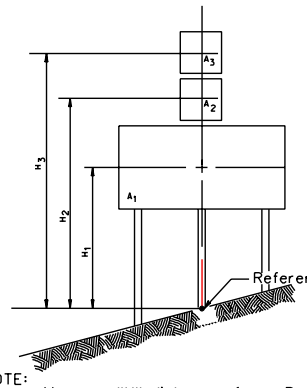
Rev. 8/97

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

1301.94

REVISED ON 12/97

CSI-1



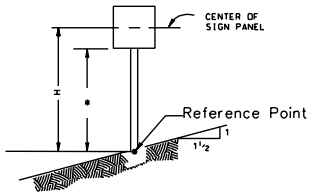
A_1 = Area of Sign Panel 1
A_2 = Area of Sign Panel 2
A_3 = Area of Sign Panel 3
H_1 = Centroidal Distance From Sign Panel 1 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_3 = Centroidal Distance from Sign Panel 3 to Ground Line.
H = Centroidal Distance for Sign Group.

$$H = \frac{(A_1 X\ H_1) + (A_2\ X\ H_2) + (A_3 X\ H_3)}{(A_1 + A_2 + A_3)}$$

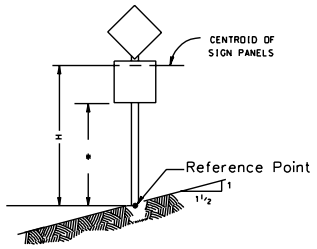
NOTE:
Measure "H" distances from Reference point which is located half-way between outer posts (for 2 or 3 posts) and intersection with ground line.

PROCEDURE FOR DETERMINING CENTROID WITH MULTIPLE SIGN PANELS

SINGLE POST

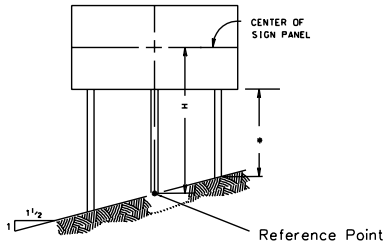


SINGLE SIGN PANEL

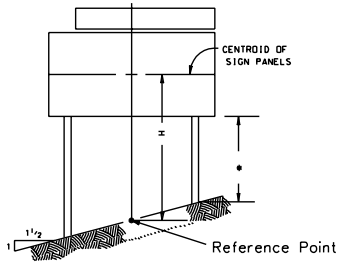


MULTIPLE SIGN PANELS

TWO OR THREE POSTS



SINGLE SIGN PANEL



MULTIPLE SIGN PANEL

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
100x100	2300	0.66	---	---
	2400	0.63	---	---
	2500	0.61	---	---
	2600	0.58	---	---
	2700	0.56	---	---
	2800	0.54	---	---
	2900	0.52	---	---
	3000	0.51	---	---
	3100	0.49	---	---
	3200	0.47	---	---
	3300	0.46	---	---
	3400	0.45	---	---
	3500	0.43	---	---
	3600	0.42	---	---
	3700	0.41	---	---

Dimension "H" is defined as follows (for 1 1/2: 1 Slope):

Single sign panel: Vertical distance from center of sign panel to the ground line.

Multiple sign panels: Vertical distance from centroid of sign panel group to the ground line.

Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

- Wood post sign structures shall be installed in accordance with WSP-1 except that notes under installation details are replaced with the following:

Single post sign structures shall have a minimum distance between top of sign panel and groundline of 2700 mm.

Single and multipost sign structures shall have a minimum distance between top of pavement (at edge of pavement) and bottom of sign panel, and between groundline and bottom of sign panel of 2100 mm.

If a secondary sign panel is mounted below primary sign panel the above distances (between bottom of sign panel and either groundline or top of pavement) may be reduced to 1800 mm.

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS 1 1/2 : 1 SLOPE

SPECIFICATION REFERENCE

REV. 8/97

1301.95

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED ON 12/97

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
125x125	2300	1.51	---	---
	2400	1.44	---	---
	2500	1.39	---	---
	2600	1.33	---	---
	2700	1.28	---	---
	2800	1.24	---	---
	2900	1.19	---	---
	3000	1.16	---	---
	3100	1.12	---	---
	3200	1.08	---	---
	3300	1.05	---	---
	3400	1.02	---	---
	3500	0.99	---	---
	3600	0.96	---	---
	3700	0.94	---	---
	3800	---	---	---
	3900	---	---	---
	4000	---	---	---
	4100	---	---	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---
	5000	---	---	---
	5100	---	---	---
	5200	---	---	---

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
100x150 (*)	2300	1.81	---	---
	2400	1.74	---	---
	2500	1.67	---	---
	2600	1.60	---	---
	2700	1.54	---	---
	2800	1.49	---	---
	2900	1.44	---	---
	3000	1.39	2.60	---
	3100	1.34	2.52	---
	3200	1.30	---	---
	3300	1.26	---	---
	3400	1.23	---	---
	3500	1.19	---	---
	3600	1.16	---	---
	3700	1.13	---	---
	3800	---	---	---
	3900	---	---	---
	4000	---	---	---
	4100	---	---	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4500	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---
	5000	---	---	---
	5100	---	---	---
	5200	---	---	---

(*) Larger dimension in direction of (parallel to) traffic.

Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

SPECIFICATION REFERENCE	DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS $1\frac{1}{2}$: 1 SLOPE	REV. 8/97
XXX	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS — 1301.96

REVISED ON 12/97

CSI-1

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
150x150	2300	2.85	---	---
	2400	2.73	---	---
	2500	2.62	---	---
	2600	2.52	---	---
	2700	2.43	---	---
	2800	2.34	---	---
	2900	2.26	---	---
	3000	2.18	4.09	---
	3100	2.11	3.96	---
	3200	2.05	3.84	---
	3300	1.98	3.72	---
	3400	1.93	3.61	---
	3500	1.87	3.51	---
	3600	1.82	3.41	---
	3700	1.77	3.32	---
	3800	---	3.23	---
	3900	---	3.15	---
	4000	---	3.07	---
	4100	---	2.99	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---
	5000	---	---	---
	5100	---	---	---
	5200	---	---	---

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
150x200 (*)	2300	5.09	---	---
	2400	4.88	---	---
	2500	4.68	---	---
	2600	4.50	---	---
	2700	4.34	---	---
	2800	4.18	---	---
	2900	4.04	---	---
	3000	3.90	7.53	---
	3100	3.78	7.29	---
	3200	3.66	7.06	---
	3300	3.55	6.85	---
	3400	3.44	6.65	---
	3500	3.35	6.46	---
	3600	3.25	6.28	---
	3700	3.16	6.11	---
	3800	---	5.95	8.49
	3900	---	5.79	8.28
	4000	---	5.65	8.07
	4100	---	5.51	7.87
	4200	---	3.93	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---
	5000	---	---	---
	5100	---	---	---
	5200	---	---	---

(*) Larger dimension in direction of (parallel to) traffic.
Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS $1\frac{1}{2}$: 1 SLOPE

SPECIFICATION REFERENCE

XXX

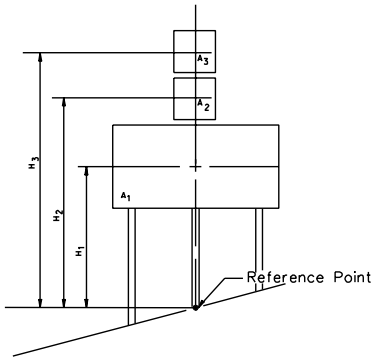
REV. 8/97

1301.97 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

REVISED ON 12/97

CSI-1



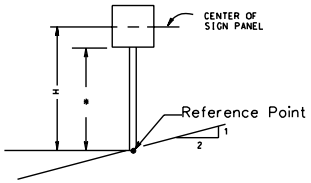
A_1 = Area of Sign Panel 1
A_2 = Area of Sign Panel 2
A_3 = Area of Sign Panel 3
H_1 = Centroidal Distance From Sign Panel 1 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_2 = Centroidal Distance From Sign Panel 2 to Ground Line
H_3 = Centroidal Distance from Sign Panel 3 to Ground Line.
H = Centroidal Distance for Sign Group.

$$H = \frac{(A_1 X\ H_1) + (A_2\ X\ H_2) + (A_3 X\ H_3)}{(A_1 + A_2 + A_3)}$$

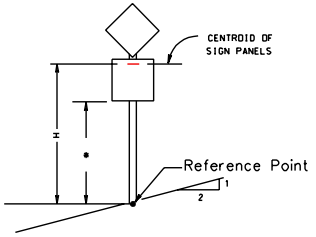
NOTE:
Measure "H" distances from Reference point which is located half-way between outer posts (for 2 or 3 posts) and intersection with ground line.

PROCEDURE FOR DETERMINING CENTROID WITH MULTIPLE SIGN PANELS

SINGLE POST

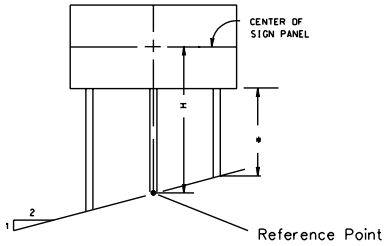


SINGLE SIGN PANEL

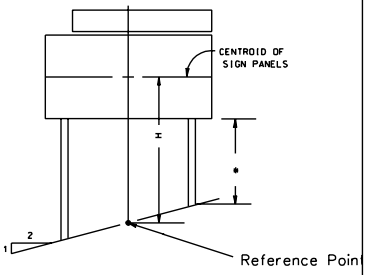


MULTIPLE SIGN PANELS

TWO OR THREE POSTS



SINGLE SIGN PANEL



MULTIPLE SIGN PANEL

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
100x100	2300	0.66	---	---
	2400	0.63	---	---
	2500	0.61	---	---
	2600	0.58	---	---
	2700	0.56	1.06	---
	2800	0.54	1.02	---
	2900	0.52	0.99	---
	3000	0.51	0.95	1.33
	3100	0.49	0.92	---
	3200	0.47	0.90	---
	3300	0.46	0.87	---
	3400	0.45	0.84	---
	3500	0.43	0.82	---
	3600	0.42	0.80	---
	3700	0.41	0.77	---

Dimension "H" is defined as follows (for 2:1 Slope):

Single sign panel: Vertical distance from center of sign panel to the ground line.

Multiple sign panels: Vertical distance from centroid of sign panel group to the ground line.

Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

- Wood post sign structures shall be installed in accordance with WSP-1 except that notes under installation details are replaced with the following:

  Single post sign structures shall have a minimum distance between top of sign panel and groundline of 2700 mm.

  Single and multipost sign structures shall have a minimum distance between top of pavement (at edge of pavement) and bottom of sign panel, and between groundline and bottom of sign panel of 2100 mm.

  If a secondary sign panel is mounted below primary sign panel the above distances (between bottom of sign panel and either groundline or top of pavement) may be reduced to 1800 mm.

SPECIFICATION REFERENCE
XXX

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS 2 : 1 SLOPE

REV. 8/97

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

1301.99

REVISED ON 12/97

DESIGN TABLE FOR WOODEN SUPPORTS				
Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
125x125	2300	1.51	---	---
	2400	1.44	---	---
	2500	1.39	---	---
	2600	1.33	---	---
	2700	1.28	---	---
	2800	1.24	---	---
	2900	1.19	---	---
	3000	1.16	---	---
	3100	1.12	---	---
	3200	1.08	---	---
	3300	1.05	---	---
	3400	1.02	---	---
	3500	0.99	---	---
	3600	0.96	---	---
	3700	0.94	---	---
	3800	---	---	---
	3900	---	---	---
	4000	---	---	---
	4100	---	---	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---

DESIGN TABLE FOR WOODEN SUPPORTS				
Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
100x150 (*)	2300	1.81	---	---
	2400	1.74	---	---
	2500	1.67	---	---
	2600	1.60	---	---
	2700	1.54	---	---
	2800	1.49	---	---
	2900	1.44	---	---
	3000	1.39	2.65	---
	3100	1.34	2.57	---
	3200	1.30	---	---
	3300	1.26	---	---
	3400	1.23	---	---
	3500	1.19	---	---
	3600	1.16	---	---
	3700	1.13	---	---
	3800	---	---	---
	3900	---	---	---
	4000	---	---	---
	4100	---	---	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---

(*) Larger dimension in direction of (parallel to) traffic.
Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

SPECIFICATION REFERENCE	DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS 2 : 1 SLOPE	REV. 8/97
XXX	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS — 1301.100

REVISED ON 12/97

CSI-1

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
150x150	2300	2.85	---	---
	2400	2.73	---	---
	2500	2.62	---	---
	2600	2.52	---	---
	2700	2.43	---	---
	2800	2.34	---	---
	2900	2.26	---	---
	3000	2.18	4.17	---
	3100	2.11	4.03	---
	3200	2.05	3.91	---
	3300	1.98	3.79	---
	3400	1.93	3.68	---
	3500	1.87	3.57	---
	3600	1.82	3.47	---
	3700	1.77	3.38	---
	3800	---	3.29	---
	3900	---	3.21	---
	4000	---	3.13	---
	4100	---	3.05	---
	4200	---	---	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---

DESIGN TABLE FOR WOODEN SUPPORTS

Size of post	H (mm)	Maximum area (Total of sign panels) (m^2)		
		Single-post	Two-posts	Three-posts
150x200 (*)	2300	5.09	---	---
	2400	4.88	---	---
	2500	4.68	---	---
	2600	4.50	---	---
	2700	4.34	---	---
	2800	4.18	---	---
	2900	4.04	---	---
	3000	3.90	7.61	---
	3100	3.78	7.36	---
	3200	3.66	7.13	---
	3300	3.55	6.92	---
	3400	3.44	6.71	---
	3500	3.35	6.52	---
	3600	3.25	6.34	9.20
	3700	3.16	6.17	8.96
	3800	---	6.01	8.72
	3900	---	5.85	8.50
	4000	---	5.71	8.28
	4100	---	5.57	8.08
	4200	---	3.99	---
	4300	---	---	---
	4400	---	---	---
	4500	---	---	---
	4600	---	---	---
	4700	---	---	---
	4800	---	---	---
	4900	---	---	---

(*) Larger dimension in directionof (parallel to) traffic.
Minimum spacing between posts:

100 X 100 posts: 900mm
All other posts: 2400mm

DETAILS FOR CALCULATING NUMBER AND SIZE OF WOOD POSTS FOR CONSTRUCTION SIGN INSTALLATIONS 2 : 1 SLOPE

SPECIFICATION REFERENCE

REV. 8/97

1301.101

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

VIRGINIA DEPARTMENT OF TRANSPORTATION