

RECOMMENDED MINIMUM HEIGHT CHART	
PIPE SIZE	"H" DIMENSION (CONCRETE PIPE)
300	1420
375	1510
450	1590
525	1670
600	1750
675	1840
750	2000
825	2080
900	2160
1050	2330
1200	2490

NOTES:

SEE GENERAL NOTES - PRECAST FOR ADDITIONAL DETAILS.

CONCRETE TO BE 30 MPA MINIMUM.

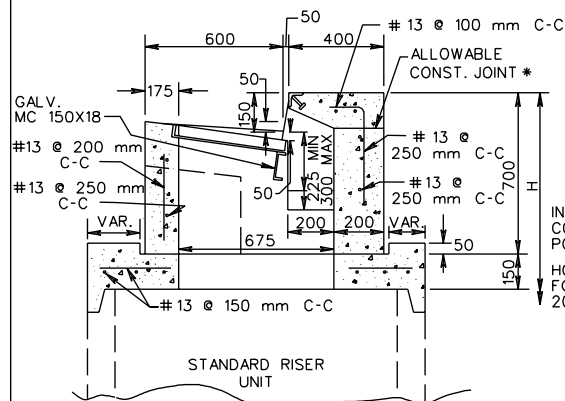
REINFORCING STEEL IN ACCORDANCE WITH ASTM-615M

DIMENSIONS SHOWN ARE MINIMUM. ACTUAL DIMENSIONS MAY VARY WITH MANUFACTURER.

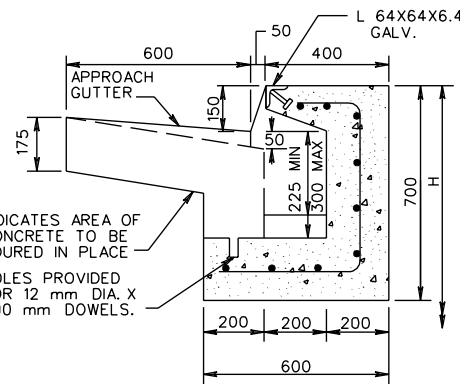
FOR DETAILS OF FRAME AND GRATE SEE STANDARD DI-2A,B,C.

\* VERTICAL REINFORCING BARS TO BE CONTINUOUS THROUGH JOINT.

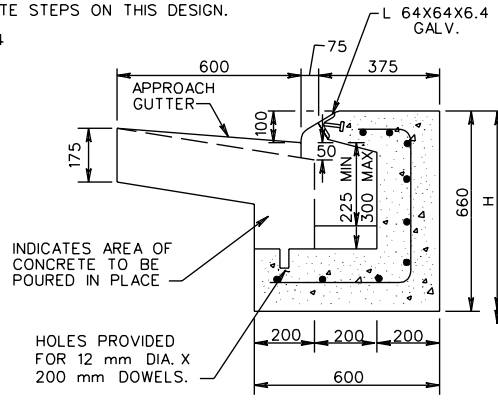
ELIMINATE STEPS ON THIS DESIGN.



SECTION A-A



SECTION B-B  
(CG-6 CURB AND GUTTER)



ALTERNATE SECTION B-B  
(FOR USE WITH CG-7 CURB AND GUTTER)

SPECIFICATION REFERENCE
105
233
302

STANDARD PRECAST TOP UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION

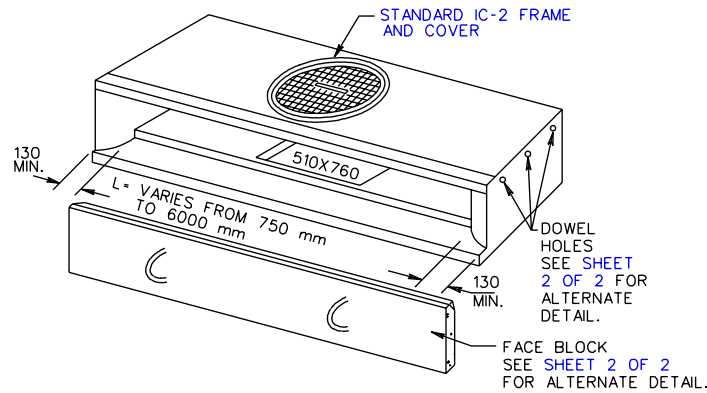
REV. 3/03

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

103.04

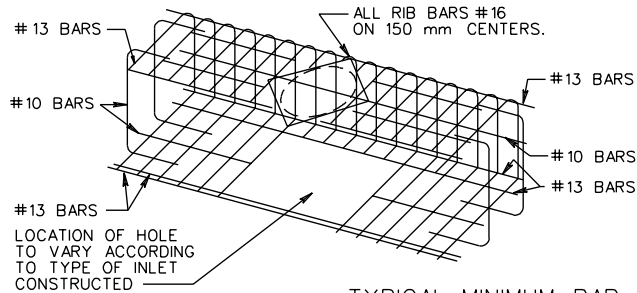
INSERTABLE SHEET MA148

T-DI-3,4

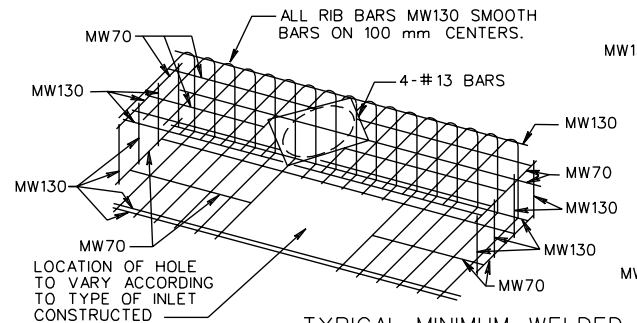
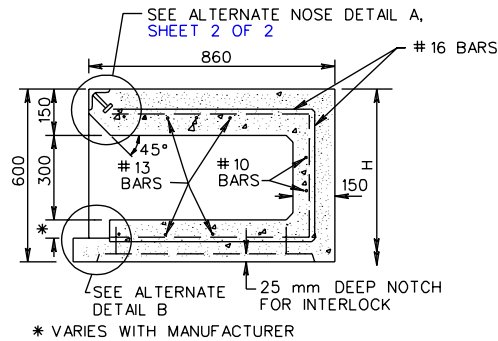


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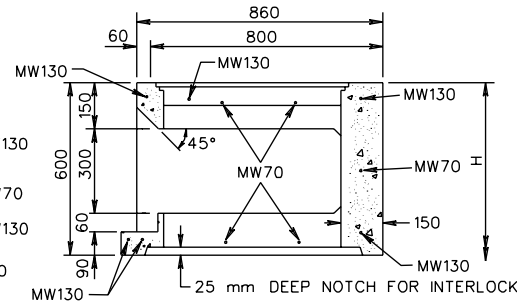
1. SEE GENERAL NOTES-PRECAST FOR ADDITIONAL DETAILS.
2. CONCRETE TO BE 30 MPA MINIMUM COMPRESSIVE STRENGTH.
3. REINFORCING STEEL IN ACCORDANCE WITH ASTM A-615M (REINFORCING BARS).
4. REINFORCING IN ACCORDANCE WITH ASTM A-185M FOR WELDED WIRE MESH.
5. DIMENSIONS SHOWN ARE MINIMUM. ACTUAL DIMENSIONS MAY VARY WITH MANUFACTURER.
6. THIS UNIT MAY BE USED WITH ALL STANDARD DI-3 & DI-4 CURB DROP INLETS.
7. EACH FACE BLOCK SHALL HAVE 2 OR MORE LOOPS (#10 BARS) CAST IN FACE AS SHOWN. THESE LOOPS MAY BE USED FOR LIFTING, AND FOR TIEING IN THE POURED IN PLACE GUTTER SECTION. FACE BLOCKS ARE TO BE SEALED WITH GROUT OR POLYSULFIDE SEALER.



TYPICAL MINIMUM BAR REINFORCEMENT



TYPICAL MINIMUM WELDED WIRE REINFORCEMENT



DI-3A,B,C FOR 900 mm BASE UNIT	PIPE SIZE	"H" DIMENSION CONCRETE
	150	890
200	950	
250	1000	
300	1070	
375	1150	
450	1240	
525	1320	
DI-3A,B,C,D,E, & F FOR 1200 mm I.D. BASE UNIT	150	1150
	200	1200
	250	1250
	300	1320
	375	1410
	450	1490
	525	1570
	600	1650
DI-3A,B,C,D,E & F FOR 1500 mm OR 1800 mm BASE UNIT AND DI-4A,B,C,D,E & F	300	1320
	375	1410
	450	1490
	525	1570
	600	1650
	675	1740
	750	1900
	825	1980
	900	2060
	1050	2230
1200	2390	

SHEET 1 OF 2

STANDARD PRECAST TOP UNITS

VIRGINIA DEPARTMENT OF TRANSPORTATION

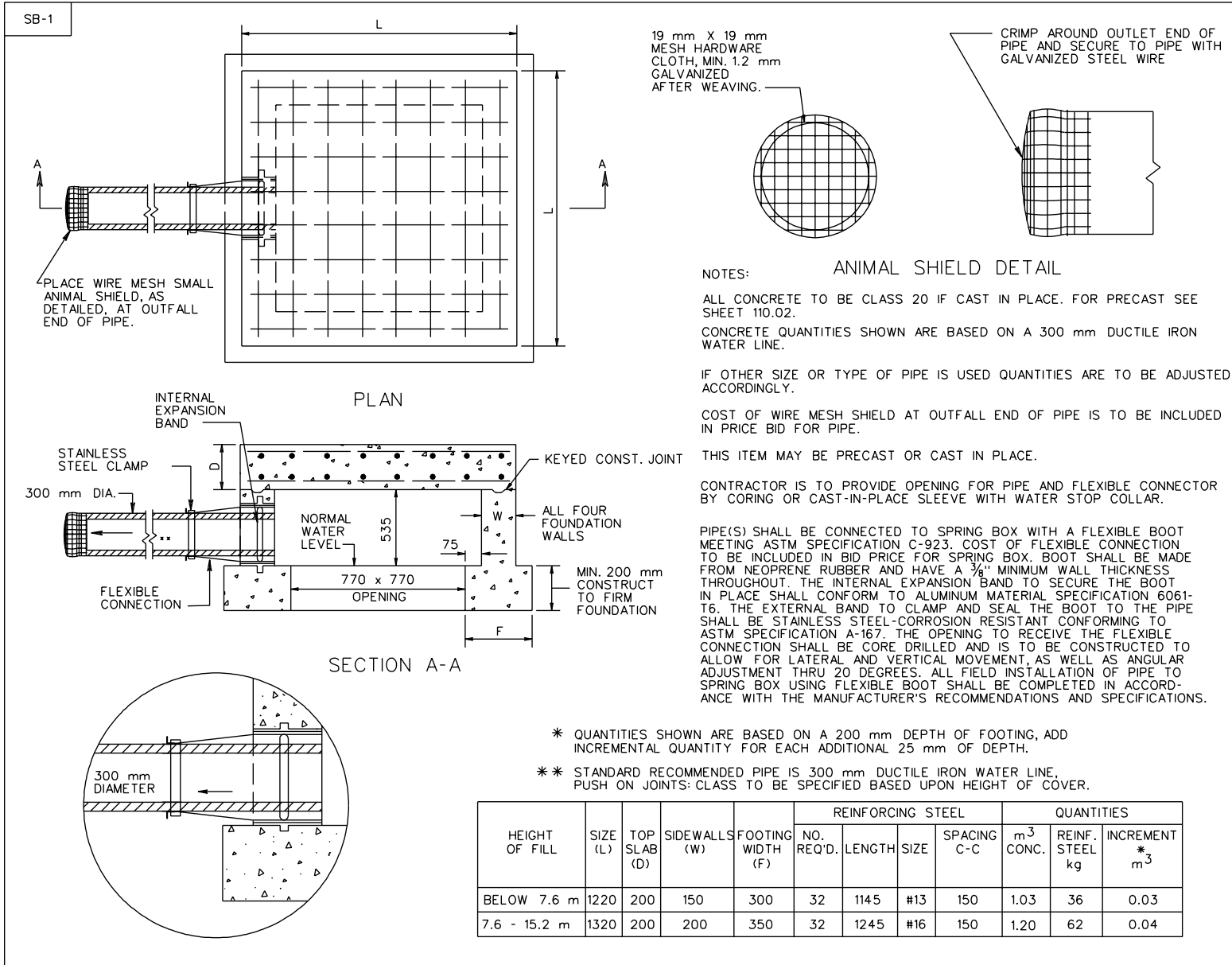
REV. 3/03

103.05

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SPECIFICATION REFERENCE

105  
233  
302



REV. 3/03

110.01

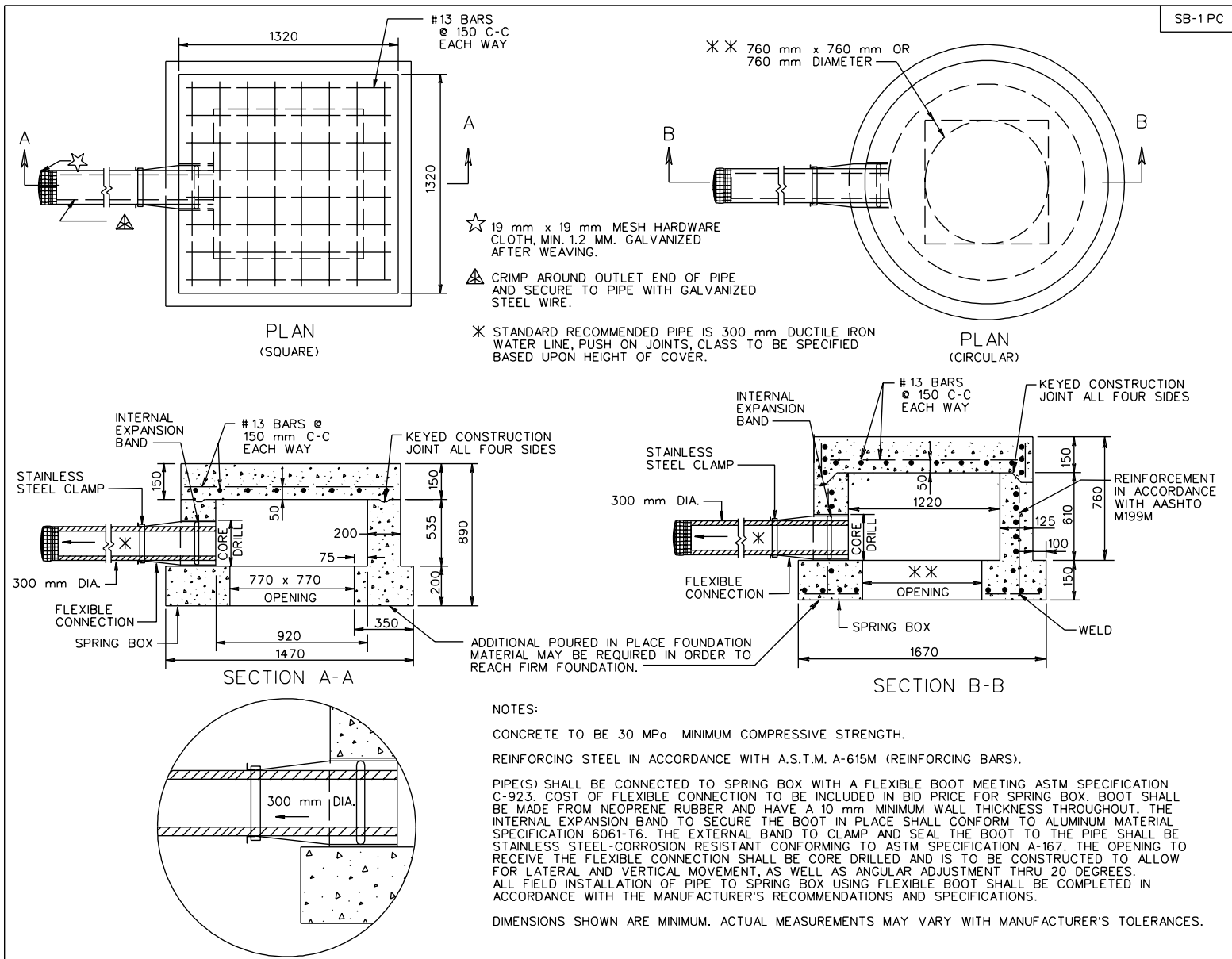
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

STANDARD SPRING BOX

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

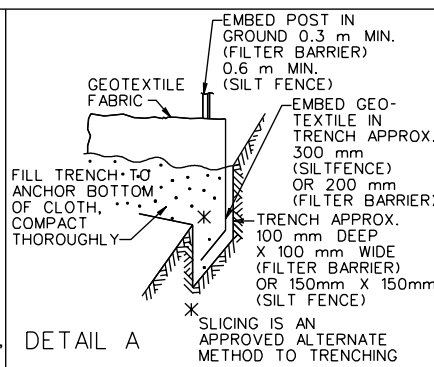
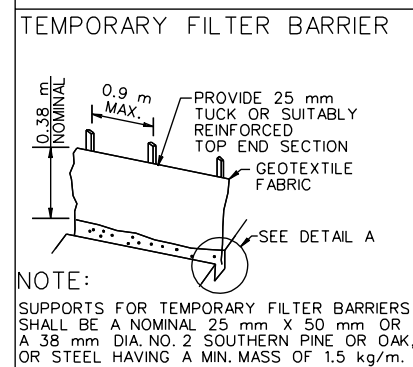
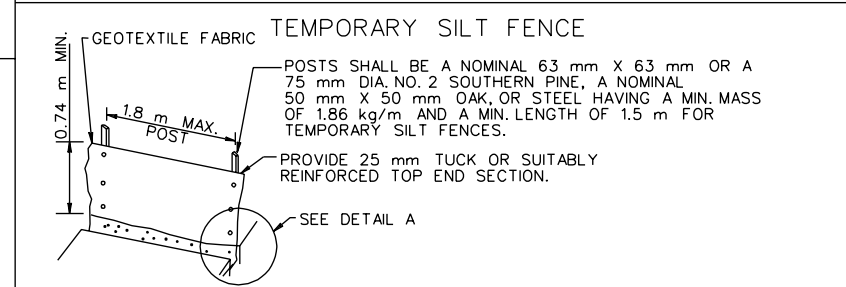
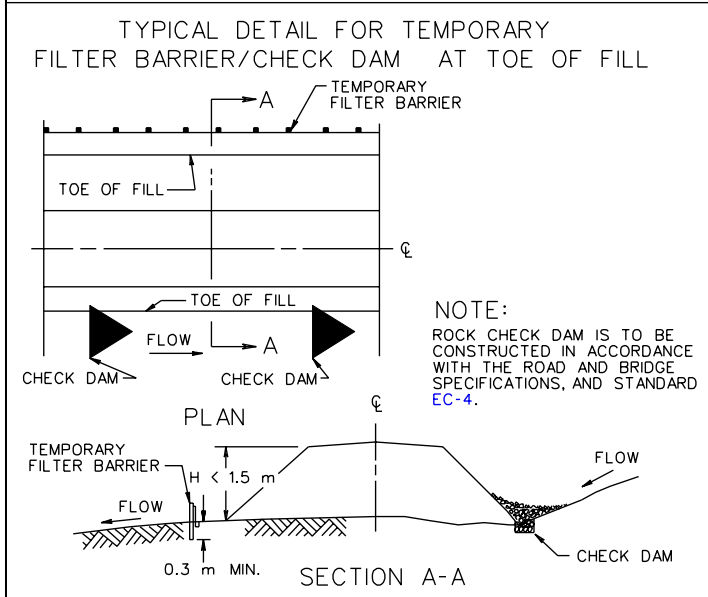
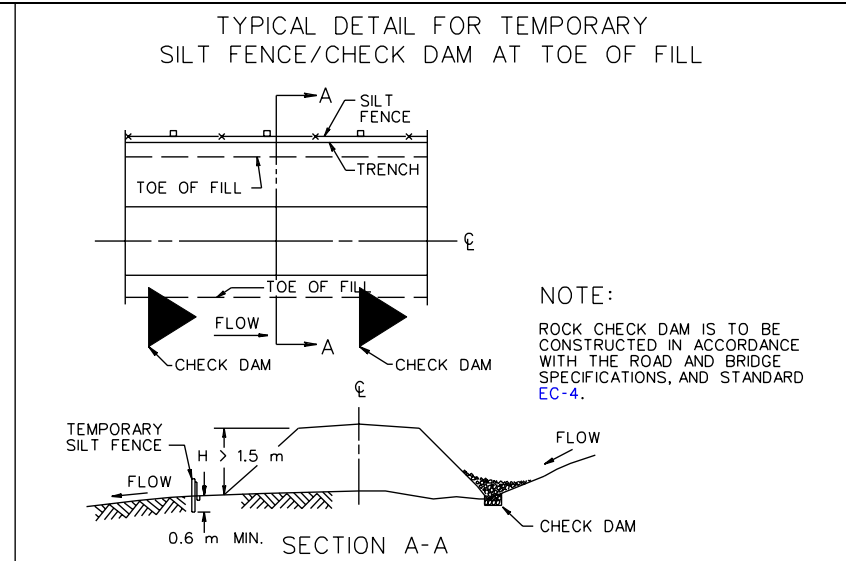
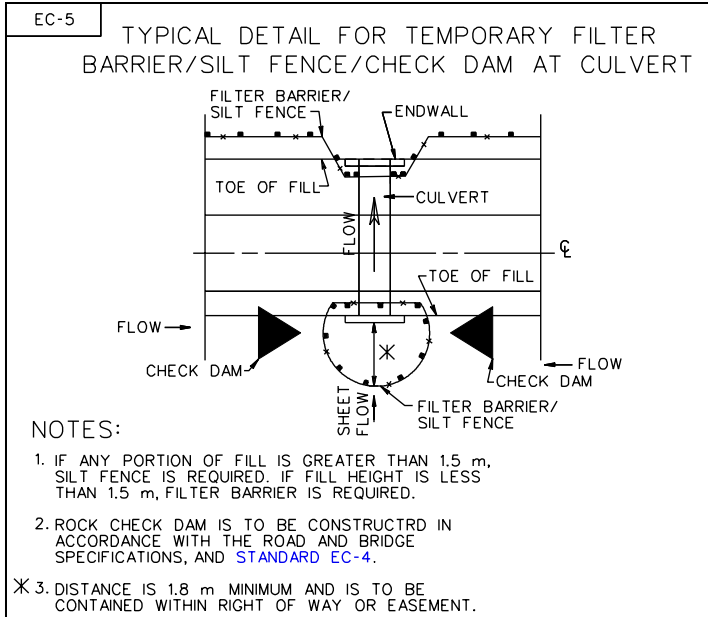
105  
232  
302



SPECIFICATION REFERENCE
105

PRECAST SPRING BOX  
 VIRGINIA DEPARTMENT OF TRANSPORTATION

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TEMPORARY SILT FENCE AND FILTER BARRIER

REV. 3/03

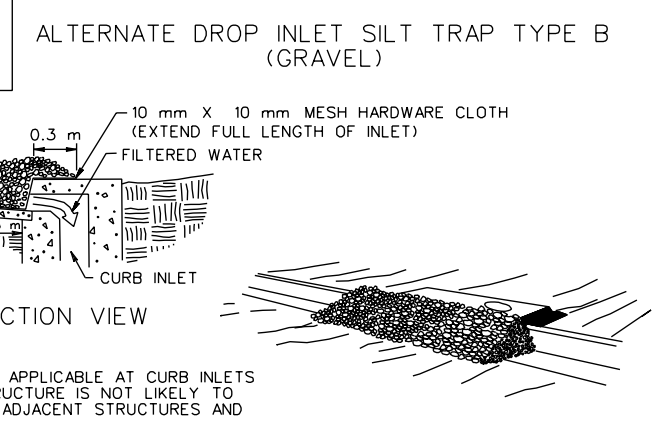
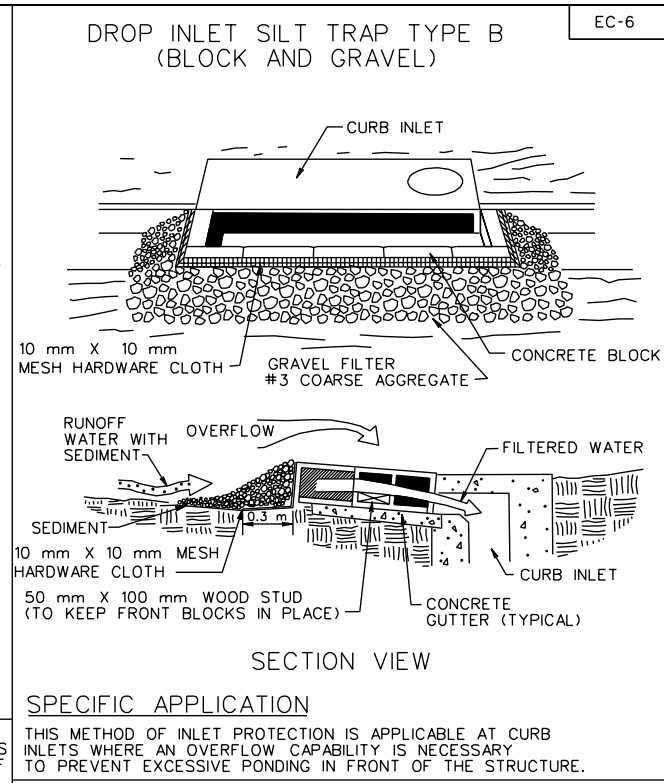
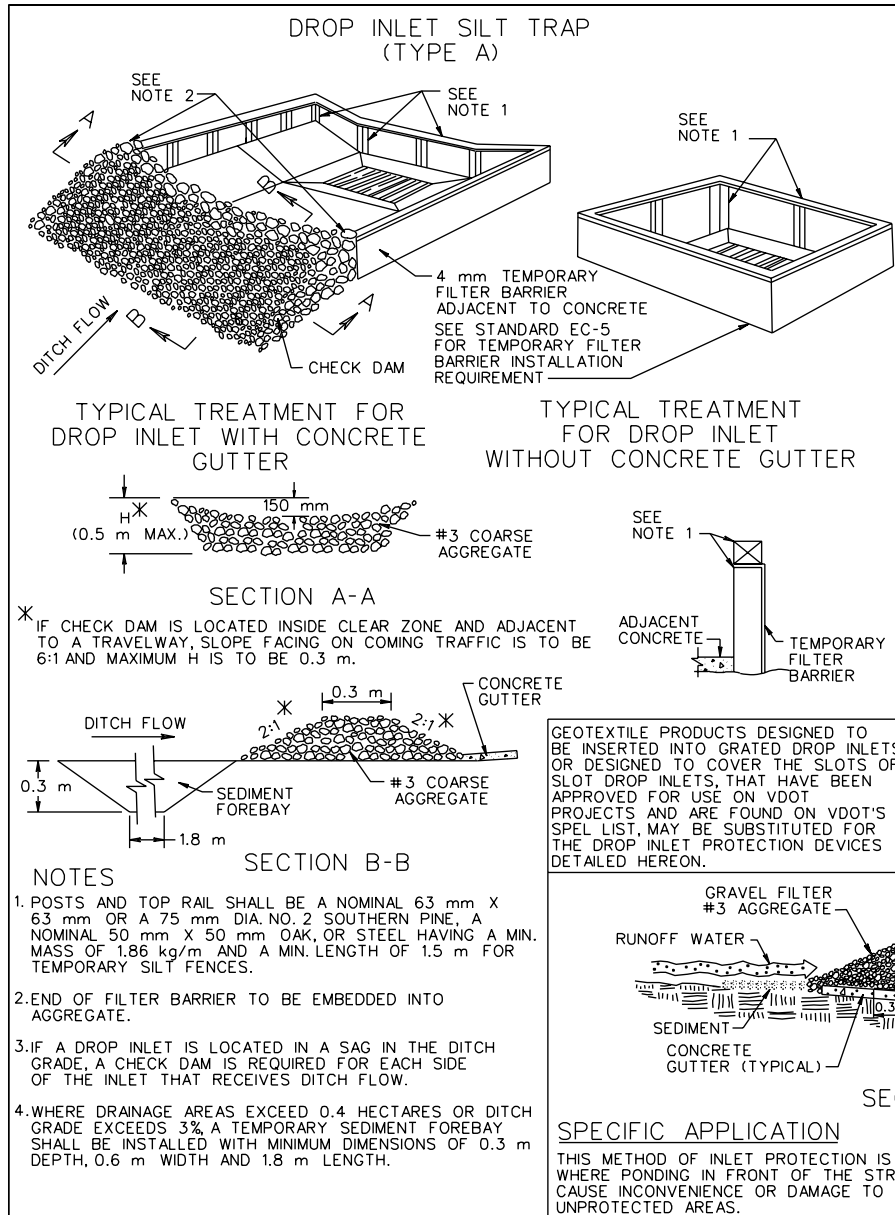
114.06

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

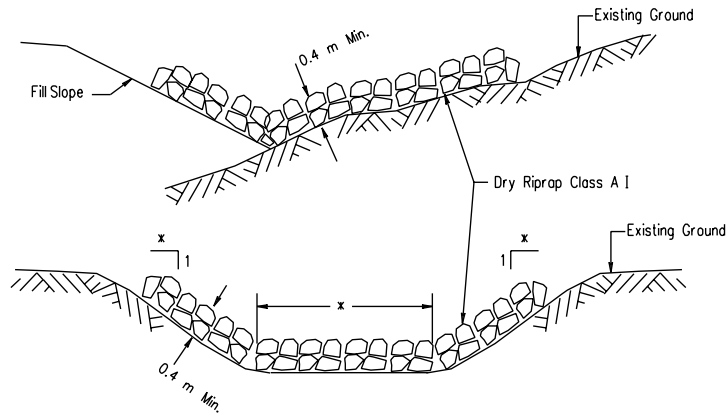
SPECIFICATION REFERENCE

107  
242  
303



<p>SPECIFICATION REFERENCE</p> <p>107 242 303</p>	<h2 style="margin: 0;">DROP INLET SILT TRAP (TYPE A AND B)</h2> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>REV. 3/03</p> <p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>114.07</p>
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SUGGESTED METHOD OF TEMPORARILY PLACING RIPRAP FOR EROSION CONTROL IN CHANNELS, DITCHES, & AT TOE OF FILL SLOPES

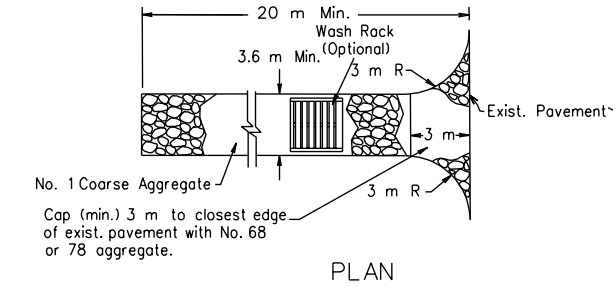


NOTES:

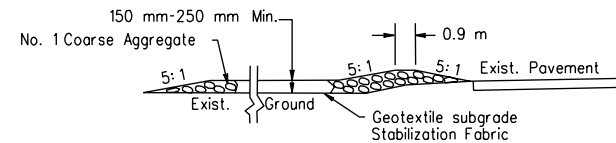
The depth of protection will depend on whatever depth is attainable, with the riprap being evenly spread with the quantity shown on these plans. Riprap may be added or deleted as found necessary by the Engineer.

\* Side slopes and bottom width (if trapezoidal) shown in typical section of proposed ditch or channel.

MINIMUM REQUIREMENTS FOR STABILIZED CONSTRUCTION ENTRANCE



PLAN



PROFILE

Surface water shall be piped under the construction entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.

The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed immediately.

Wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.

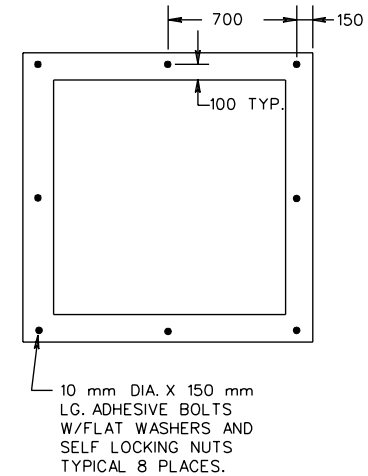
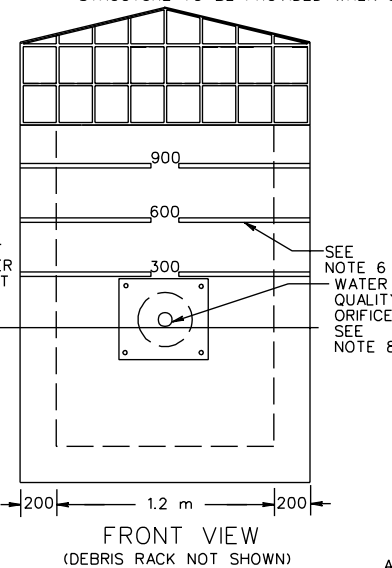
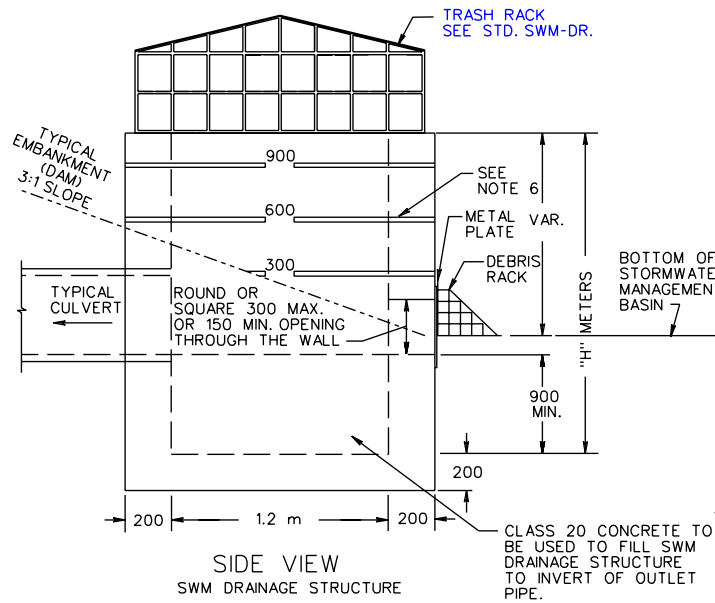
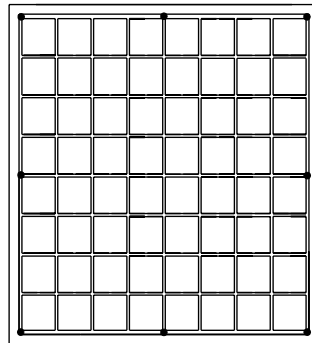
Periodic inspection and needed maintenance shall be provided after heavy use and each rain.

SPECIFICATION REFERENCE	TEMPORARY EROSION & SILTATION CONTROL		Rev. 3/03
107 303	VIRGINIA DEPARTMENT OF TRANSPORTATION		UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS
			115.03

SWM-1

NOTES:

1. COST OF TRASH RACK AND DEBRIS RACK ARE TO BE INCLUDED IN THE BID PRICE FOR THE STORMWATER MANAGEMENT DRAINAGE STRUCTURE.
2. STRUCTURE MAY BE PRECAST OR CAST IN PLACE. SEE SHEET 2 OF 2 FOR DETAILS ON PRECAST STRUCTURE.
3. WEEP HOLES SHALL NOT BE PROVIDED.
4. STEPS ARE TO BE PROVIDED WHEN HEIGHT OF STRUCTURE IS 1.2 m OR GREATER ABOVE INVERT OF OUTLET PIPE. FOR STEP DETAILS SEE STANDARD ST-1.
5. FOR DETAILS ON METAL PLATE AND DEBRIS RACK AND TRASH RACK SEE STANDARD SWM-DR.
6. MARK HEIGHT OF STRUCTURE, IN BLACK, WITH 100 mm HIGH NUMERALS AND 25 mm WIDE HORIZONTAL STRIPES AT 300 mm INTERVALS FROM INVERT OF WATER QUALITY ORIFICE (ALL VISIBLE SIDES).
7. THE PERMANENT STORMWATER MANAGEMENT DRAINAGE STRUCTURE, STANDARD SWM-1 MAY BE MODIFIED WHERE THE STORMWATER MANAGEMENT BASIN IS TO BE USED AS A TEMPORARY SEDIMENT BASIN DURING PROJECT CONSTRUCTION. SEE STANDARD SWM-DR, SHEET 1 OF 5, FOR TEMPORARY MODIFICATION DETAILS.
8. THE SIZE OF THE WATER QUALITY ORIFICE SHALL BE SPECIFIED ON THE PLANS. ADDITIONAL OPENINGS IN STORMWATER MANAGEMENT DRAINAGE STRUCTURE TO BE PROVIDED WHEN SPECIFIED ON THE PLANS.



APPROXIMATE QUANTITIES  
CAST-IN-PLACE CLASS 20 CONCRETE TO BE USED.  
MAXIMUM DEPTH (H) TO BE 4 m.

PIPE SIZE	300	375	450	600	750	900	1050
MINIMUM DEPTH H	1.5	1.61	1.69	1.86	2.02	2.19	2.35
CU. YDS. CONCRETE	1.94	2.05	2.13	2.28	2.42	2.55	2.66.

INCREMENT METER OF ADDITIONAL DEPTH 1.12 CU. METERS.

SHEET 1 OF 2

SPECIFICATION REFERENCE

302

# CAST IN PLACE STORMWATER MANAGEMENT DRAINAGE STRUCTURE

VIRGINIA DEPARTMENT OF TRANSPORTATION

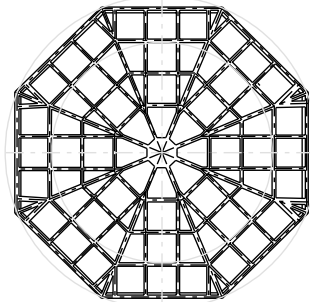
REV. 3/03

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116.01



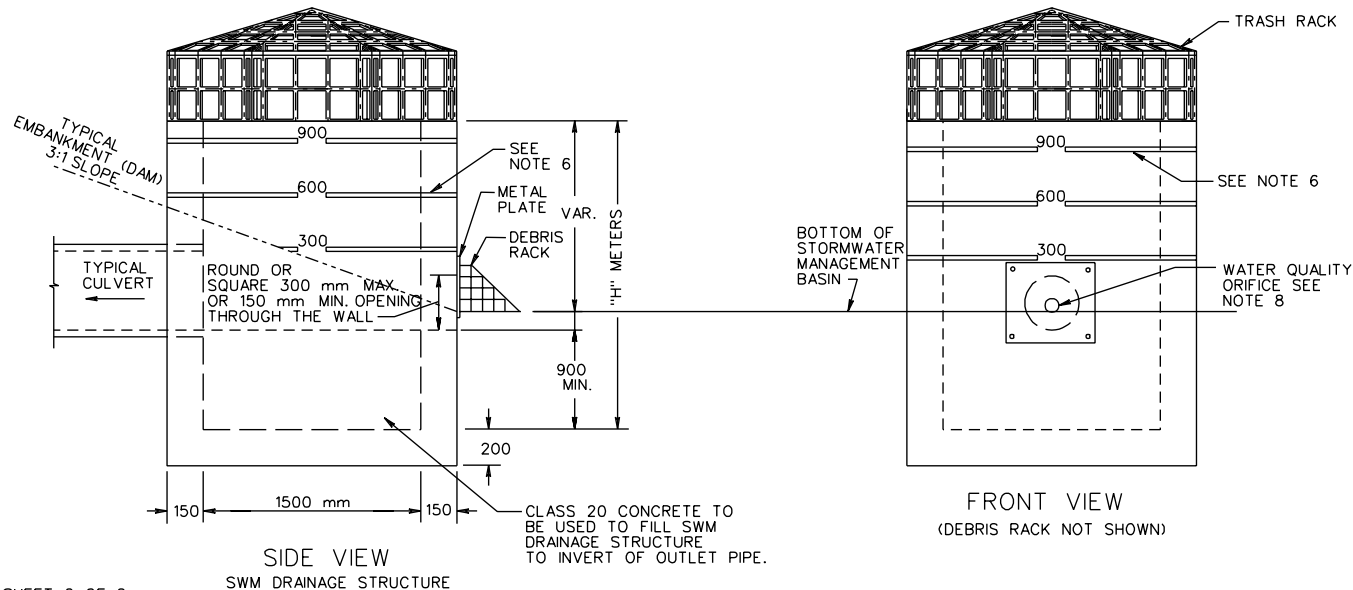
SWM-1



PLAN VIEW

NOTES:

1. COST OF TRASH RACK AND DEBRIS RACK ARE TO BE INCLUDED IN THE PRICE BID FOR STORMWATER MANAGEMENT DRAINAGE STRUCTURE.
2. STRUCTURE MAY BE PRECAST OR CAST IN PLACE. SEE SHEET 1 OF 2 FOR DETAILS ON CAST IN PLACE STRUCTURE.
3. WEEP HOLES SHALL NOT BE PROVIDED. ANY LIFT HOLES SHALL BE PLUGGED.
4. STEPS ARE TO BE PROVIDED WHEN HEIGHT OF STRUCTURE IS 1.2 m OR GREATER ABOVE INVERT OF OUTLET PIPE. FOR STEP DETAILS SEE STANDARD ST-1.
5. SEE STANDARD SWM-DR FOR DETAILS ON PLATE, DEBRIS RACK AND TRASH RACK.
6. MARK HEIGHT OF STRUCTURE, IN BLACK, WITH 100 mm HIGH NUMERALS AND 25 mm WIDE HORIZONTAL STRIPES AT 300 mm INTERVALS FROM INVERT OF WATER QUALITY ORIFICE (ALL VISIBLE SIDES).
7. THE PERMANENT STORMWATER MANAGEMENT DRAINAGE STRUCTURE, STANDARD SWM-1 MAY BE MODIFIED WHERE THE STORMWATER MANAGEMENT BASIN IS TO BE USED AS A TEMPORARY SEDIMENT BASIN DURING PROJECT CONSTRUCTION. SEE STANDARD SWM-DR, SHEET 1 OF 5 FOR TEMPORARY MODIFICATION DETAILS.
8. THE SIZE OF THE WATER QUALITY ORIFICE SHALL BE SPECIFIED ON THE PLANS. ADDITIONAL OPENINGS IN THE STORMWATER MANAGEMENT DRAINAGE STRUCTURE TO BE PROVIDED WHEN SPECIFIED ON THE PLANS.



SHEET 2 OF 2

PRECAST STORMWATER MANAGEMENT DRAINAGE STRUCTURE

REV. 3/03

VIRGINIA DEPARTMENT OF TRANSPORTATION

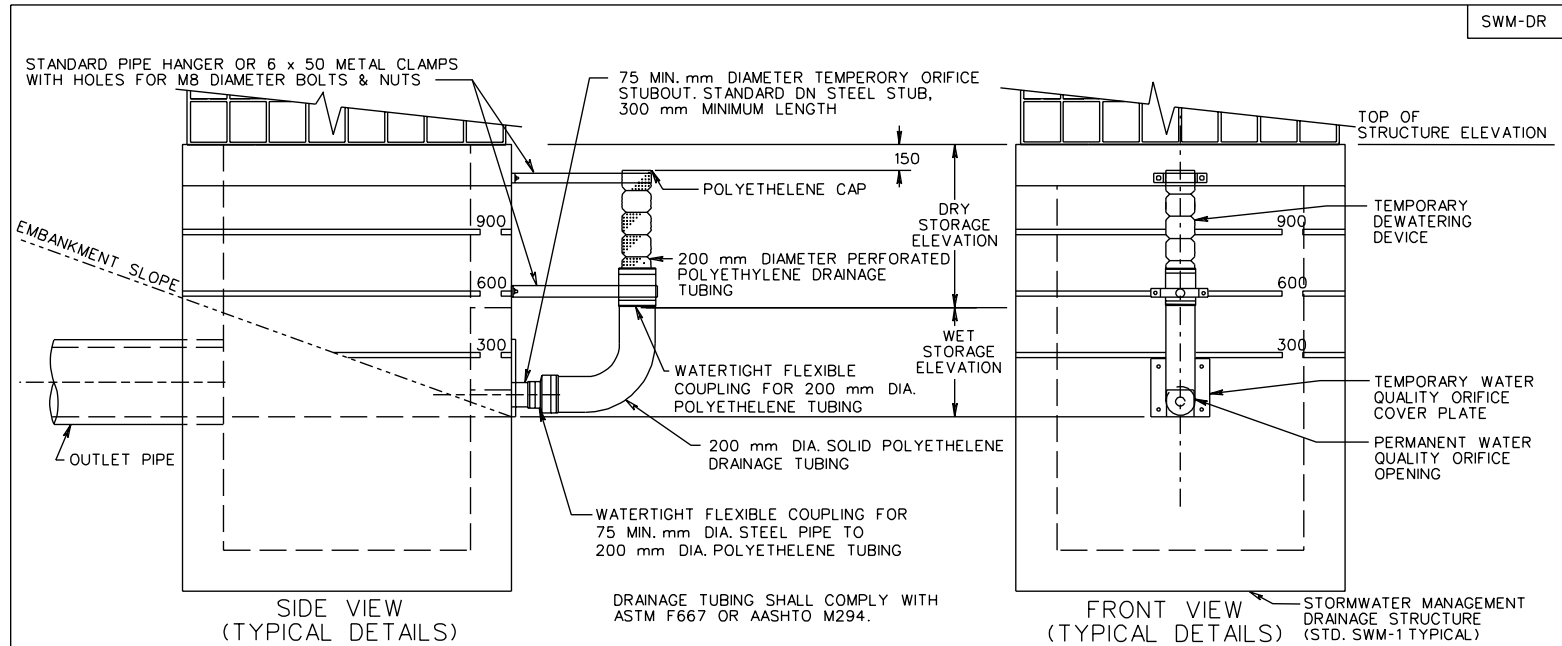
116.02

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SPECIFICATION REFERENCE

105 302

SWM-DR



NOTE:

1. THESE DETAILS ARE TO BE USED TO MODIFY THE PERMANENT STORMWATER MANAGEMENT DRAINAGE STRUCTURE WHERE THE STORMWATER MANAGEMENT BASIN IS TO BE USED FOR A TEMPORARY SEDIMENT BASIN DURING PROJECT CONSTRUCTION.
2. GRADE STORMWATER MANAGEMENT BASIN AS SHOWN IN PLANS.
3. ALL OPENINGS (IF ANY) IN SIDE OF STRUCTURE (OTHER THEN PERMANENT WATER QUALITY ORIFICE) ARE TO BE COVERED WITH SOLID METAL PLATES WHILE THE BASIN IS BEING USED FOR SEDIMENT CONTROL.
4. DEWATERING DEVICE AND COMPONENTS AND TEMPORARY METAL PLATES (IF ANY), AS SHOWN IN THE DETAIL, ARE TO BE REMOVED AND PERMANENT STEEL PLATE WITH WATER QUALITY ORIFICE IS TO BE INSTALLED WHEN BASIN IS NO LONGER NEEDED FOR SEDIMENT CONTROL.
5. SIMILAR DEVICE MAY ALSO BE USED ON OTHER STORMWATER MANAGEMENT DRAINAGE STRUCTURES.
6. COST OF TEMPORARY DEWATERING DEVICE AND TEMPORARY METAL PLATES (IF ANY) SHALL BE INCLUDED IN THE BID PRICE FOR STORMWATER MANAGEMENT DRAINAGE STRUCTURE.
7. THE TEMPORARY 200 mm DIA. POLYETHYLENE DRAINAGE TUBING IS TO BE SOLID FOR THE LENGTH BELOW WET STORAGE ELEVATION AND IS TO BE PERFORATED ABOVE THE WET STORAGE ELEVATION. THE COUPLING IS TO BE WATERTIGHT.

SHEET 1 OF 5

SPECIFICATION REFERENCE

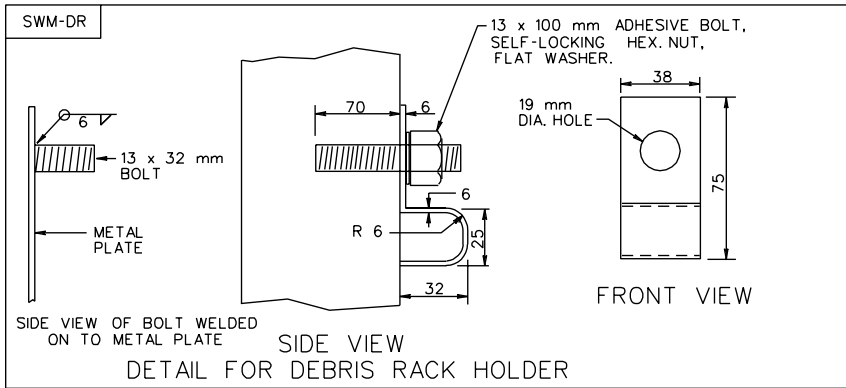
STORMWATER MANAGEMENT (SWM) DETAILS TRASH RACK

VIRGINIA DEPARTMENT OF TRANSPORTATION

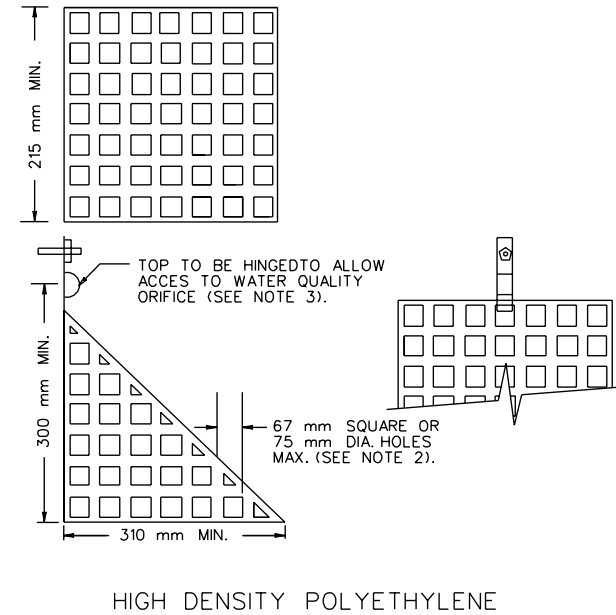
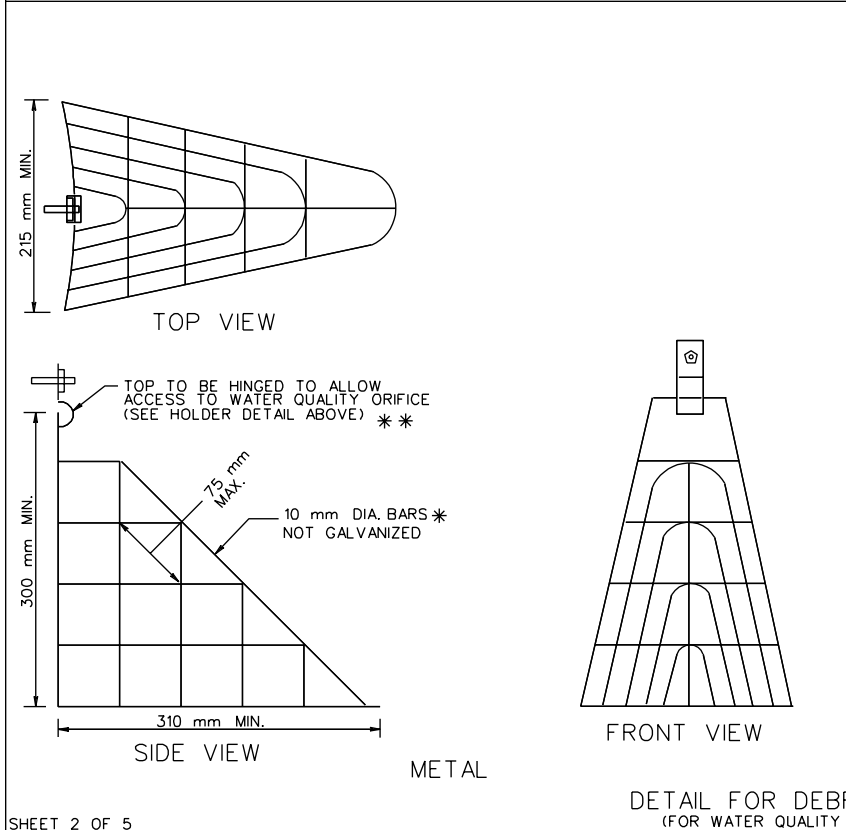
REV. 3/03

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116.03



1. COST OF DEBRIS RACK, METAL PLATE, AND DEBRIS RACK HOLDER TO BE INCLUDED IN THE BID PRICE FOR THE SWM DRAINAGE STRUCTURE.
2. DEBRIS RACK MAY BE FABRICATED FROM WELDED 10 mm DIAMETER BARS OR 13 mm THICK HIGH DENSITY POLYETHYLENE. METAL COMPONENTS OF DEBRIS RACK MUST NOT BE GALVANIZED.
3. DEBRIS RACK TO BE HINGED AS SHOWN OR CONTRACTOR MAY SUBSTITUTE A COMPARABLE DESIGN AS APPROVED BY THE ENGINEER.
4. THE LOCATION OF THE DEBRIS RACK HOLDER MAY BE ADJUSTED FOR VARIABLE CONDITIONS. WHEN HOLDER BOLT IS LOCATED ON THE METAL PLATE THE 13 mm DIA. BOLT LENGTH IS TO BE REDUCED 13 mm LG. AND WELDED TO THE PLATE. DEBRIS RACK HOLDER AND ALL HARDWARE IS TO BE GALVANIZED.



SHEET 2 OF 5

STORMWATER MANAGEMENT (SWM) DETAILS

DEBRIS RACK, METAL PLATE, WATER QUALITY ORIFICE, CONCRETE CRADLE (FOR SWM DRAINAGE STRUCTURES, SWM RISER PIPES AND SWM DAMS)

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REV. 3/03

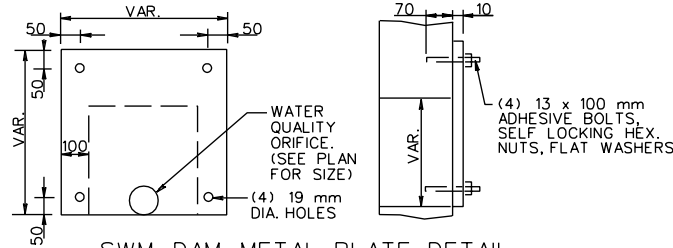
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UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

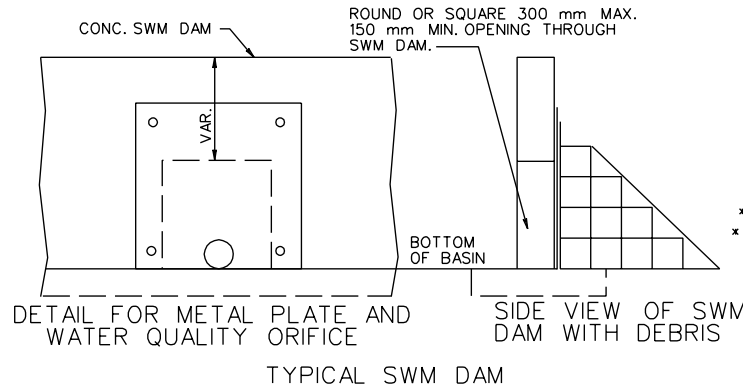
302

SWM-DR

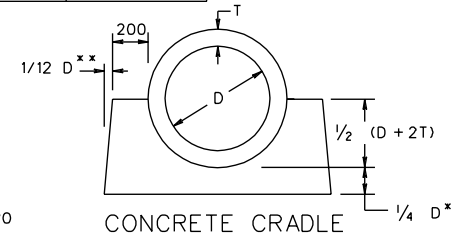


SWM DAM METAL PLATE DETAIL  
(NOT GALVANIZED)

Pipe size Millimeter (Nominal)	Cradle Bottom Width (mm)	Cradle Height (mm)	Cradle Width (mm)	Cradle Volume Cubic meters per 1m of pipe
300	860	350	810	0.23
375	960	400	900	0.28
450	1060	440	980	0.31
600	1260	530	1160	0.41
750	1470	660	1340	0.58
900	1670	790	1520	0.77
1050	1870	910	1700	0.97



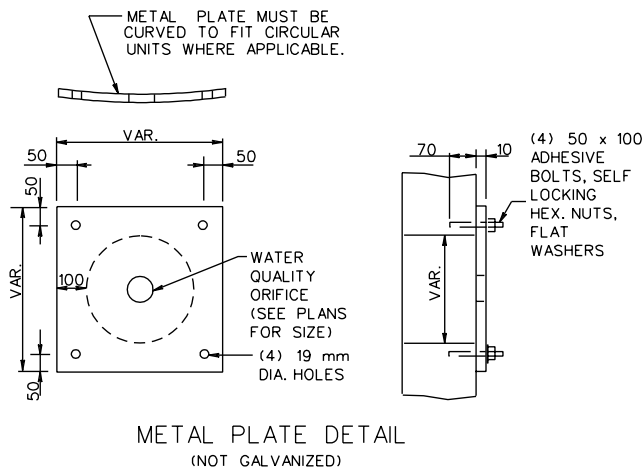
TYPICAL SWM DAM



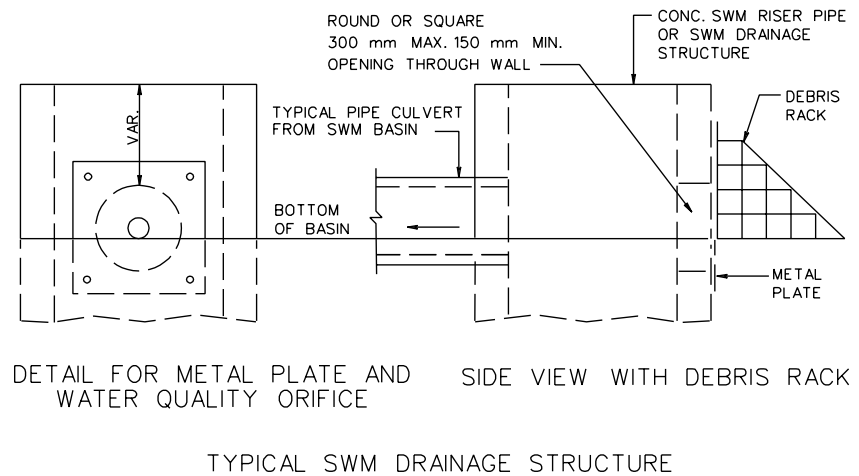
CONCRETE CRADLE

CONCRETE SHALL BE CLASS 20  
 \* BUT NOT LESS THAN 150 mm  
 \*\* IF THE PIPE IS LAID IN AN EXCAVATED TRENCH, THEN  
 THE SIDE WALLS MAY CONFORM TO THE TRENCH SHAPE  
 (IE THE TRENCH MAY BECOME THE CRADLE FORM).

CONCRETE CRADLE IS TO BE INSTALLED UNDER THE ENTIRE  
 LENGTH OF CULVERT AT EACH STORMWATER MANAGEMENT BASIN.  
 CONCRETE CRADLE IS TO BE PAID FOR AS MISCELLANEOUS  
 CONCRETE AND SUMMARIZED IN CUBIC METERS FOR EACH PIPE  
 LOCATION



METAL PLATE DETAIL  
(NOT GALVANIZED)



DETAIL FOR METAL PLATE AND  
WATER QUALITY ORIFICE

SIDE VIEW WITH DEBRIS RACK

TYPICAL SWM DRAINAGE STRUCTURE

SHEET 3 OF 5

SPECIFICATION REFERENCE
302

STORMWATER MANAGEMENT (SWM) DETAILS

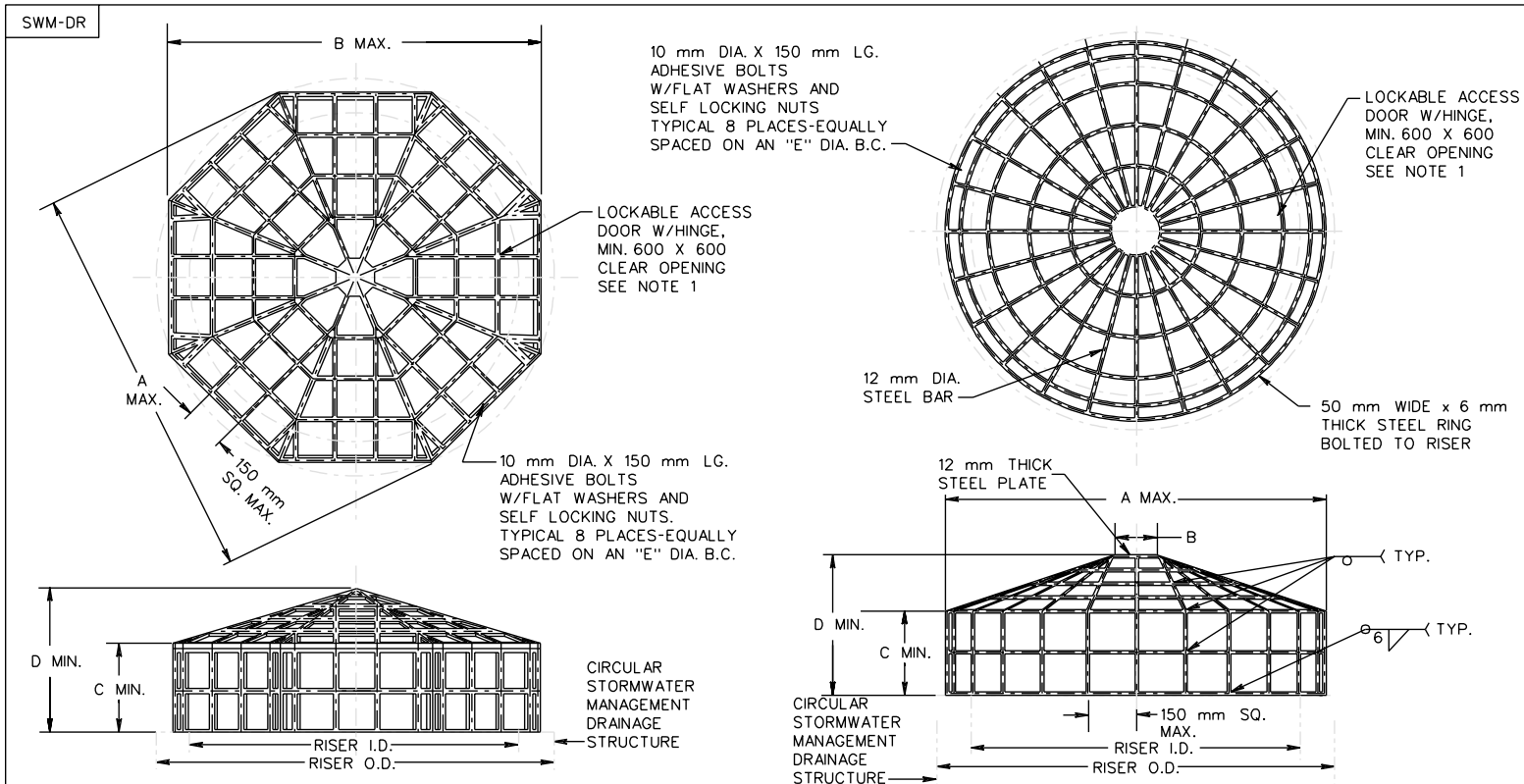
DEBRIS RACK, METAL PLATE, WATER QUALITY ORIFICE, CONCRETE CRADLE  
 (FOR SWM DRAINAGE STRUCTURES, SWM RISER PIPES AND SWM DAMS)

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ON THIS SHEET ARE IN MILLIMETERS

REV. 3/03

116.05



CIRCULAR HDPE

RISER PIPE DIMENSIONS		TRASH RACK DIMENSIONS					APPROX. WT. (Kg.)
PIPE I.D.	PIPE O.D.	A MAX.	B	C MIN.	D MIN.	E (BC)	
600	760	790	725	175	280	685	11
900	1120	1145	1055	330	480	1015	27
1200	1475	1500	1385	330	535	1345	39
1500	1830	1855	1715	430	710	1675	61
1800	2185	2210	2040	585	890	2005	93
2100	2540	2565	2370	635	990	2335	121
2400	2900	2920	2700	560	965	2670	138

CIRCULAR METAL

RISER PIPE DIMENSIONS		TRASH RACK DIMENSIONS						APPROX. WT. (Kg.)
PIPE I.D.	PIPE O.D.	A MAX.	B	C MIN.	D MIN.	E (BC)	SEGMENT	
600	760	735	150	175	250	685	15	21
900	1120	1070	150	330	460	1015	22	37
1200	1475	1400	225	330	510	1350	29	55
1500	1830	1725	225	430	660.4	1675	36	77
1800	2185	2060	225	585	860	2000	42	103
2100	2540	2930	300	635	939.8	2340	49	132
2400	2900	2720	300	560	910	2670	56	155

NOTES:

1. A HINGED, LOCKABLE ACCESS DOOR SHALL BE PROVIDED ON ALL TRASH RACKS IF THE TOTAL WEIGHT OF THE TRASH RACK IS GREATER THAN 34 Kgs, OR IF THE TRASH RACK IS TO BE PLACED ON A SWM-1 WITH AN "H" DIMENSION GREATER THAN 2.2 m.

2. ANTI-VORTEX PLATE IS TO BE USED WHEN SPECIFIED ON THE PLANS. COST OF FURNISHING AND PLACING THE ANTI-VORTEX PLATE IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.

SHEET 4 OF 5

STORMWATER MANAGEMENT (SWM) DETAILS TRASH RACK FOR STORMWATER MANAGEMENT DRAINAGE STRUCTURES

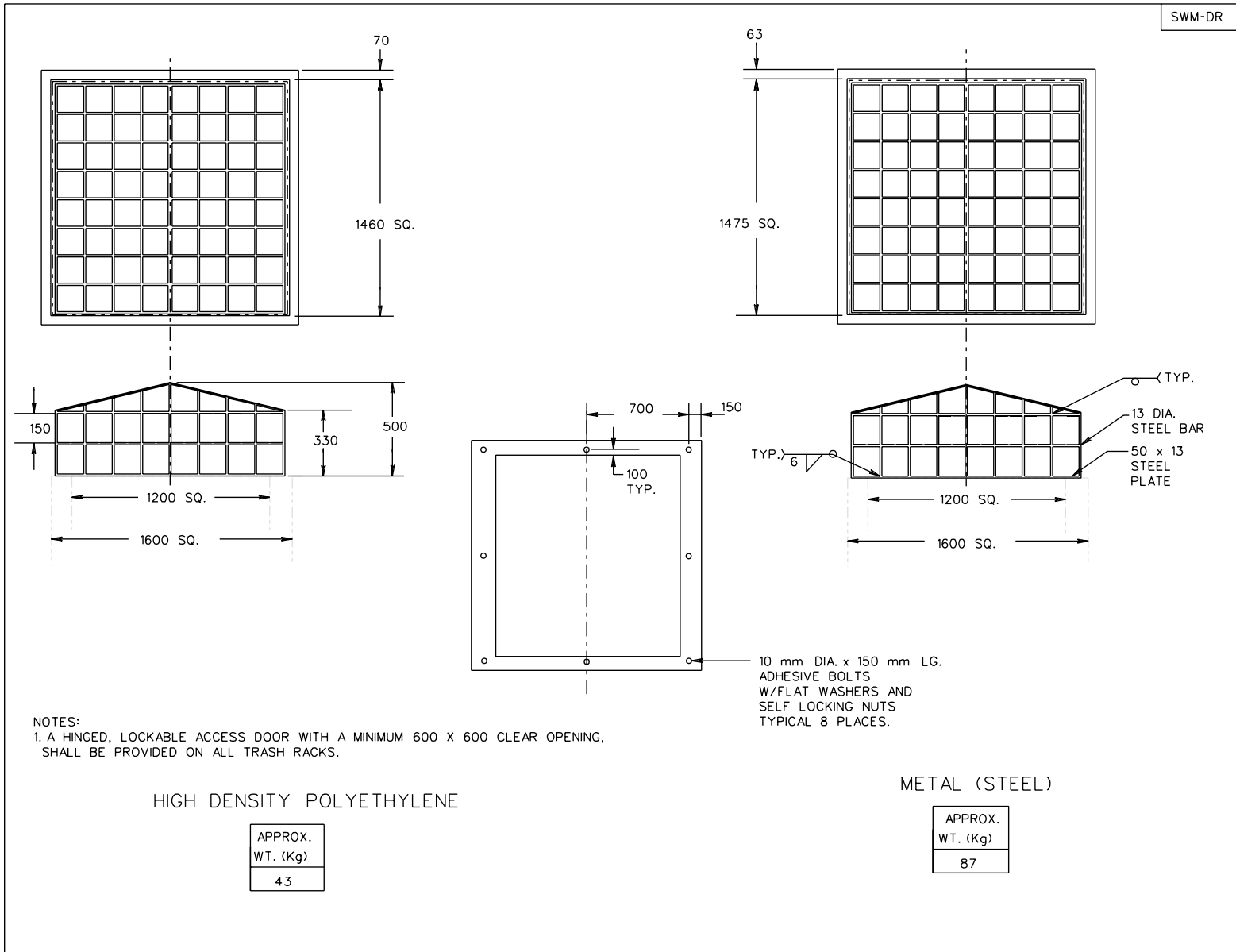
REV. 3/03

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

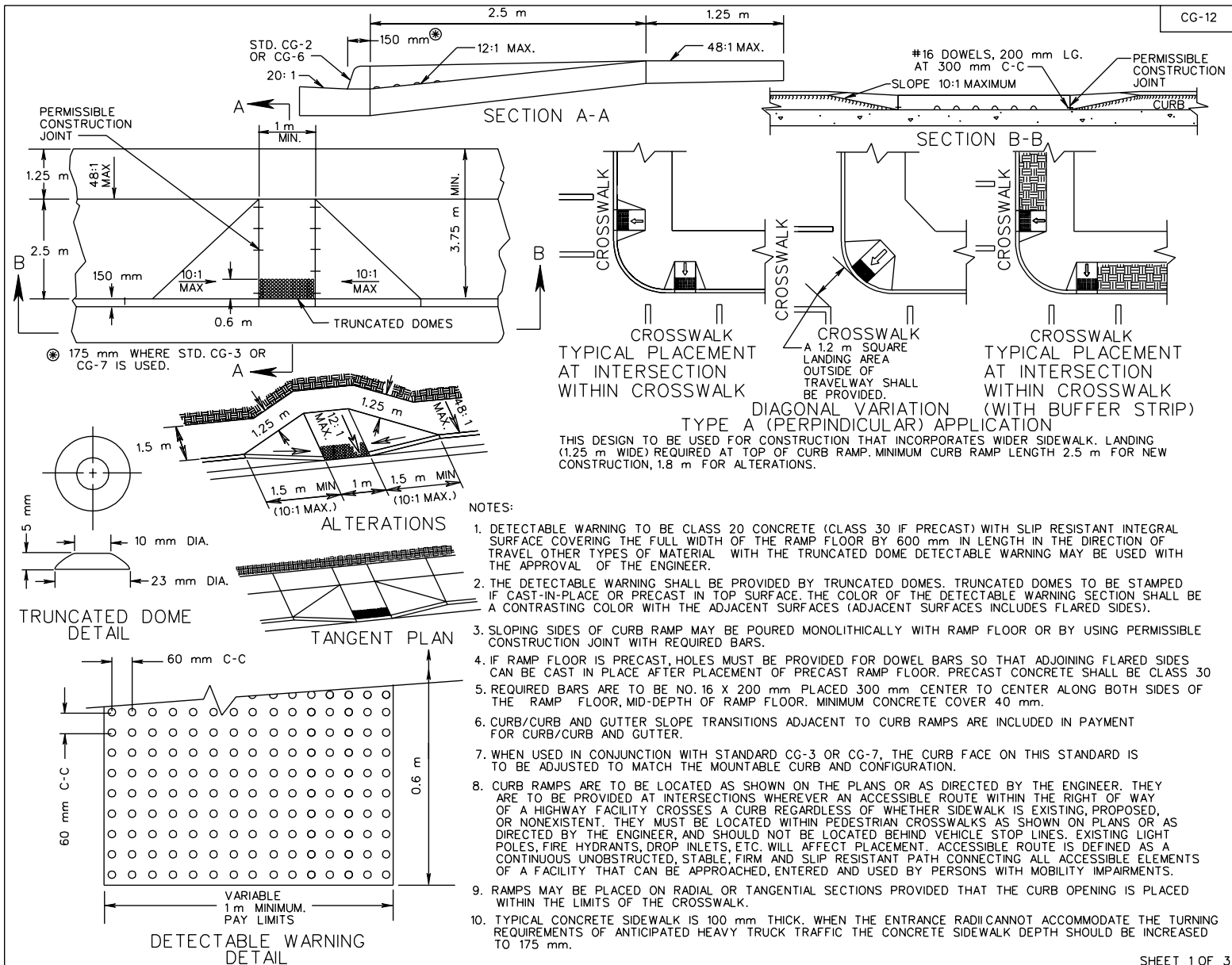
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

SWM-DR



NOTES:  
 1. A HINGED, LOCKABLE ACCESS DOOR WITH A MINIMUM 600 X 600 CLEAR OPENING, SHALL BE PROVIDED ON ALL TRASH RACKS.



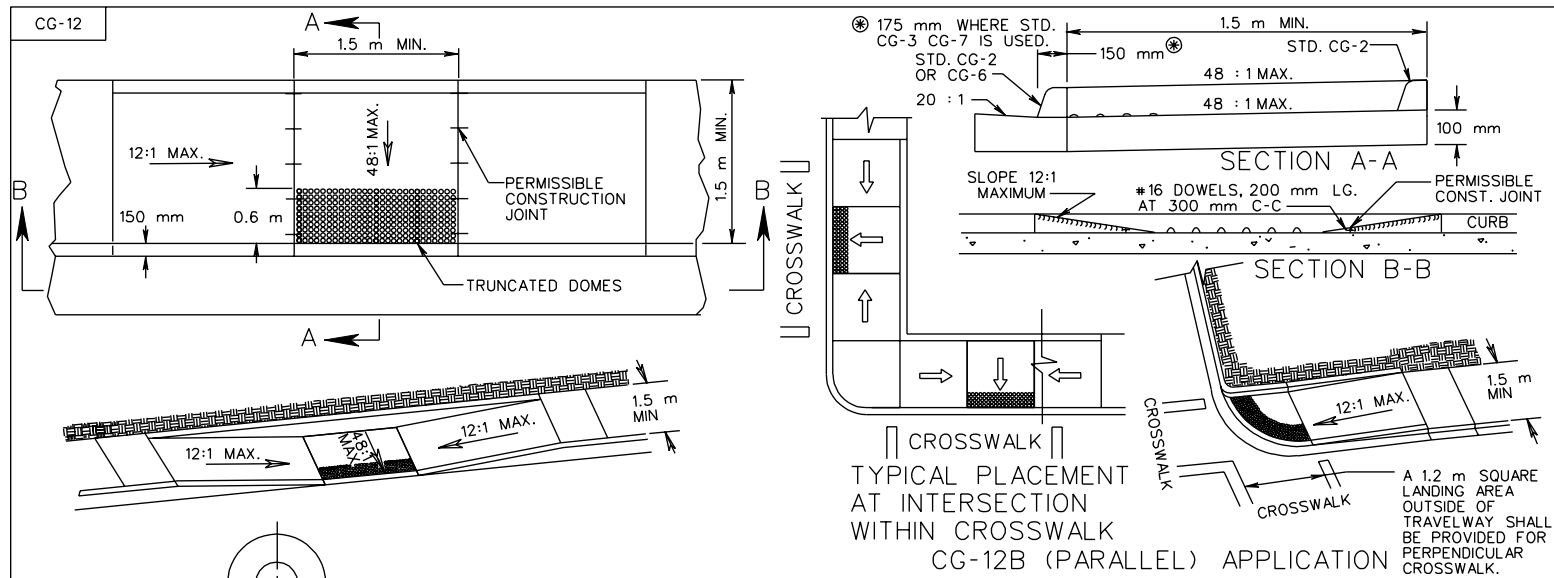
SPECIFICATION REFERENCE
105 502

CG-12 DETECTABLE WARNING SURFACE  
TYPE A (PERPENDICULAR)

VIRGINIA DEPARTMENT OF TRANSPORTATION

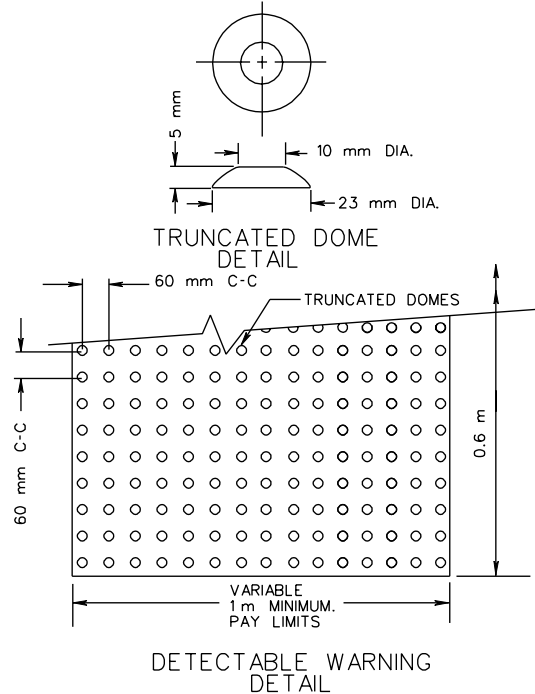
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS. 203.05

REV. 3/03



NOTES:

1. DETECTABLE WARNING TO BE CLASS 20 CONCRETE (CLASS 30 IF PRECAST) WITH SLIP RESISTANT INTEGRAL SURFACE COVERING THE FULL WIDTH OF THE RAMP FLOOR BY 600 mm IN LENGTH IN THE DIRECTION OF TRAVEL OTHER TYPES OF MATERIAL WITH THE TRUNCATED DOME DETECTABLE WARNING MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
2. THE DETECTABLE WARNING SHALL BE PROVIDED BY TRUNCATED DOMES. TRUNCATED DOMES TO BE STAMPED IF CAST-IN-PLACE OR PRECAST IN TOP SURFACE. THE COLOR OF THE DETECTABLE WARNING SECTION SHALL BE A CONTRASTING COLOR WITH THE ADJACENT SURFACES (ADJACENT SURFACES INCLUDES FLARED SIDES).
3. SLOPING SIDES OF CURB RAMP MAY BE POURED MONOLITHICALLY WITH RAMP FLOOR OR BY USING PERMISSIBLE CONSTRUCTION JOINT WITH REQUIRED BARS.
4. IF RAMP FLOOR IS PRECAST, HOLES MUST BE PROVIDED FOR DOWEL BARS SO THAT ADJOINING FLARED SIDES CAN BE CAST IN PLACE AFTER PLACEMENT OF PRECAST RAMP FLOOR. PRECAST CONCRETE SHALL BE CLASS 30
5. REQUIRED BARS ARE TO BE NO. 16 X 200 mm PLACED 300 mm CENTER TO CENTER ALONG BOTH SIDES OF THE RAMP FLOOR, MID-DEPTH OF RAMP FLOOR. MINIMUM CONCRETE COVER 40 mm.
6. CURB/CURB AND GUTTER SLOPE TRANSITIONS ADJACENT TO CURB RAMPS ARE INCLUDED IN PAYMENT FOR CURB/CURB AND GUTTER.
7. 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 AND CONFIGURATION.
8. CURB RAMPS ARE TO BE LOCATED AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THEY ARE TO BE PROVIDED AT INTERSECTIONS WHEREVER AN ACCESSIBLE ROUTE WITHIN THE RIGHT OF WAY OF A HIGHWAY FACILITY CROSSES A CURB REGARDLESS OF WHETHER SIDEWALK IS EXISTING, PROPOSED, OR NONEXISTENT. THEY MUST BE LOCATED WITHIN PEDESTRIAN CROSSWALKS AS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER, AND SHOULD NOT BE LOCATED BEHIND VEHICLE STOP LINES. EXISTING LIGHT POLES, FIRE HYDRANTS, DROP INLETS, ETC. WILL AFFECT PLACEMENT. 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.
9. RAMPS MAY BE PLACED ON RADIAL OR TANGENTIAL SECTIONS PROVIDED THAT THE CURB OPENING IS PLACED WITHIN THE LIMITS OF THE CROSSWALK.
10. TYPICAL CONCRETE SIDEWALK IS 100 mm THICK. WHEN THE ENTRANCE RADII CANNOT ACCOMMODATE THE TURNING REQUIREMENTS OF ANTICIPATED HEAVY TRUCK TRAFFIC THE CONCRETE SIDEWALK DEPTH SHOULD BE INCREASED TO 175 mm.



CG-12 DETECTABLE WARNING SURFACE  
TYPE B (PARALLEL) APPLICATION

REV. 3/03

203.05A UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS.

VIRGINIA DEPARTMENT OF TRANSPORTATION

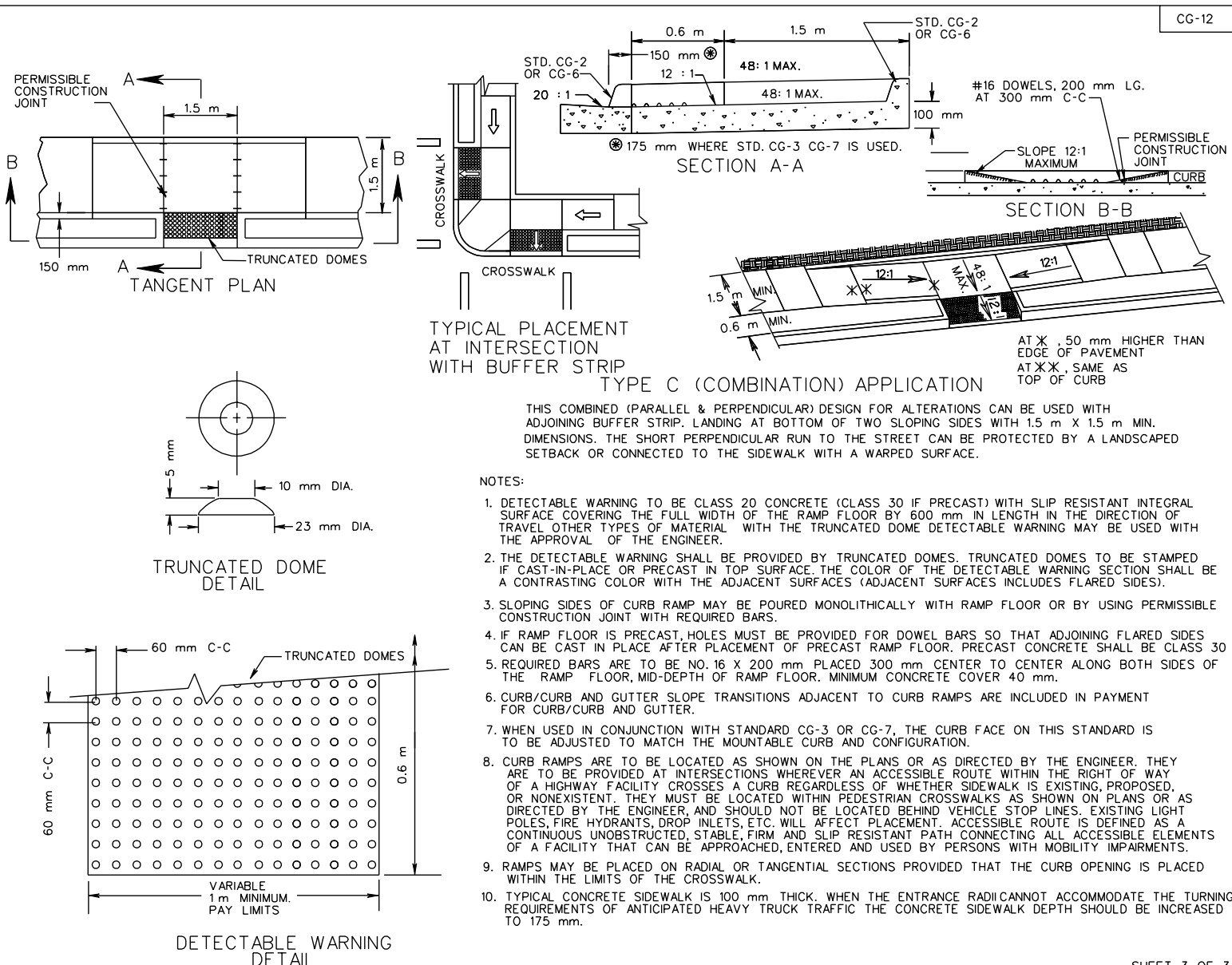
SHEET 2 OF 3

SPECIFICATION REFERENCE

105  
502



CG-12



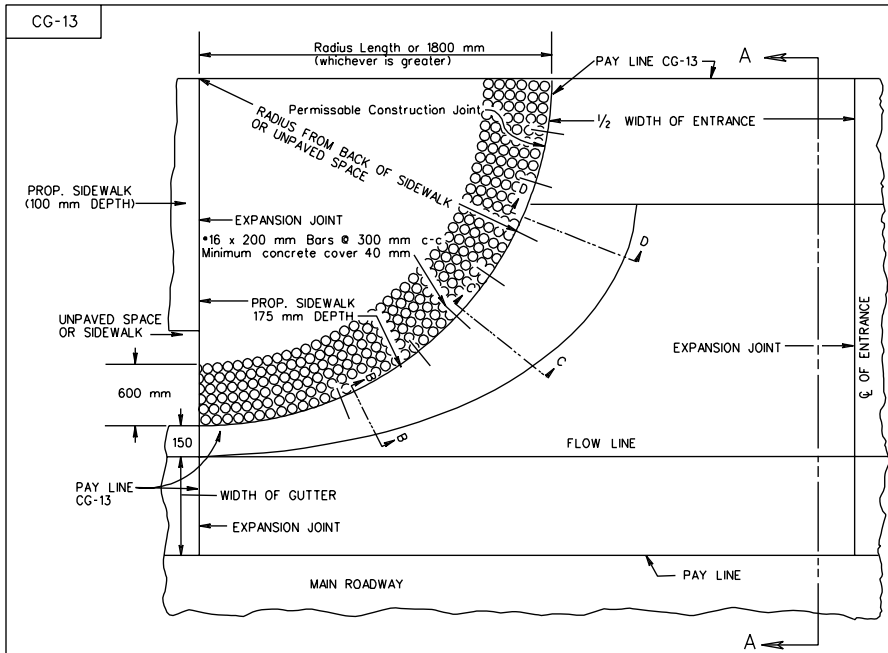
**TYPE C (COMBINATION) APPLICATION**

THIS COMBINED (PARALLEL & PERPENDICULAR) DESIGN FOR ALTERATIONS CAN BE USED WITH ADJOINING BUFFER STRIP. LANDING AT BOTTOM OF TWO SLOPING SIDES WITH 1.5 m X 1.5 m MIN. DIMENSIONS. THE SHORT PERPENDICULAR RUN TO THE STREET CAN BE PROTECTED BY A LANDSCAPED SETBACK OR CONNECTED TO THE SIDEWALK WITH A WARPED SURFACE.

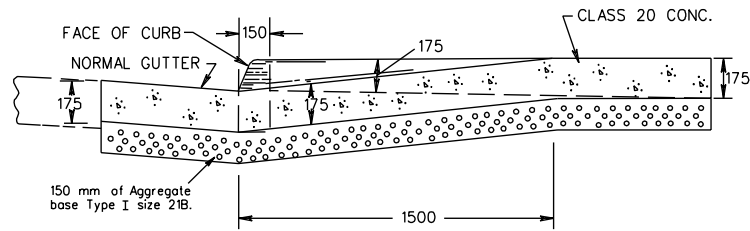
**NOTES:**

1. DETECTABLE WARNING TO BE CLASS 20 CONCRETE (CLASS 30 IF PRECAST) WITH SLIP RESISTANT INTEGRAL SURFACE COVERING THE FULL WIDTH OF THE RAMP FLOOR BY 600 mm IN LENGTH IN THE DIRECTION OF TRAVEL OTHER TYPES OF MATERIAL WITH THE TRUNCATED DOME DETECTABLE WARNING MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
2. THE DETECTABLE WARNING SHALL BE PROVIDED BY TRUNCATED DOMES. TRUNCATED DOMES TO BE STAMPED IF CAST-IN-PLACE OR PRECAST IN TOP SURFACE. THE COLOR OF THE DETECTABLE WARNING SECTION SHALL BE A CONTRASTING COLOR WITH THE ADJACENT SURFACES (ADJACENT SURFACES INCLUDES FLARED SIDES).
3. SLOPING SIDES OF CURB RAMP MAY BE POURED MONOLITHICALLY WITH RAMP FLOOR OR BY USING PERMISSIBLE CONSTRUCTION JOINT WITH REQUIRED BARS.
4. IF RAMP FLOOR IS PRECAST, HOLES MUST BE PROVIDED FOR DOWEL BARS SO THAT ADJOINING FLARED SIDES CAN BE CAST IN PLACE AFTER PLACEMENT OF PRECAST RAMP FLOOR. PRECAST CONCRETE SHALL BE CLASS 30
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6. CURB/CURB AND GUTTER SLOPE TRANSITIONS ADJACENT TO CURB RAMPS ARE INCLUDED IN PAYMENT FOR CURB/CURB AND GUTTER.
7. 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 AND CONFIGURATION.
8. CURB RAMPS ARE TO BE LOCATED AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THEY ARE TO BE PROVIDED AT INTERSECTIONS WHEREVER AN ACCESSIBLE ROUTE WITHIN THE RIGHT OF WAY OF A HIGHWAY FACILITY CROSSES A CURB REGARDLESS OF WHETHER SIDEWALK IS EXISTING, PROPOSED, OR NONEXISTENT. THEY MUST BE LOCATED WITHIN PEDESTRIAN CROSSWALKS AS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER, AND SHOULD NOT BE LOCATED BEHIND VEHICLE STOP LINES, EXISTING LIGHT POLES, FIRE HYDRANTS, DROP INLETS, ETC. WILL AFFECT PLACEMENT. 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.
9. RAMPS MAY BE PLACED ON RADIAL OR TANGENTIAL SECTIONS PROVIDED THAT THE CURB OPENING IS PLACED WITHIN THE LIMITS OF THE CROSSWALK.
10. TYPICAL CONCRETE SIDEWALK IS 100 mm THICK. WHEN THE ENTRANCE RADII CANNOT ACCOMMODATE THE TURNING REQUIREMENTS OF ANTICIPATED HEAVY TRUCK TRAFFIC THE CONCRETE SIDEWALK DEPTH SHOULD BE INCREASED TO 175 mm.

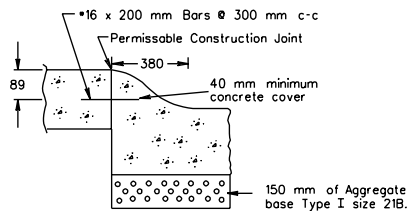
<p>SPECIFICATION REFERENCE</p> <p>105 502</p>	<p><b>CG-12 DETECTABLE WARNING SURFACE</b> <b>TYPE C (PARALLEL AND PERPENDICULAR) APPLICATION</b></p>	<p>REV. 3/03</p> <p>203.05B</p>
<p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		
<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS.</p>		



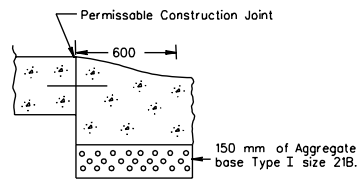
HALF PLAN



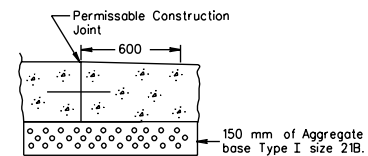
SECTION A-A



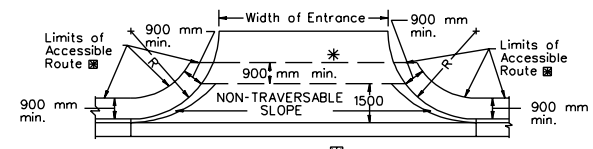
SECTION B-B



SECTION C-C



SECTION D-D



ACCESSIBLE ROUTE DETAIL

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.

NOTES

Prop. 175 mm Sidewalk is to be poured monolithically with Entrance or by using permissible construction joint with required bars.

Proposed 175 mm sidewalk to be class A-3 concrete.

Required bars are to be No. 16 x 200 mm placed 300 mm center to center along back of curb, mid-depth of sidewalk. Minimum Concrete cover 20 mm.

All details and dimensions not shown are the same as Standard CG-9D.

This design may also be applied to other Entrance Standards as the need arises.

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.

See insertable sheet MA 59 for Standard CG-12 detectable warning details.

COMMERCIAL ENTRANCE

(HEAVY TRUCK TRAFFIC ANTICIPATED)

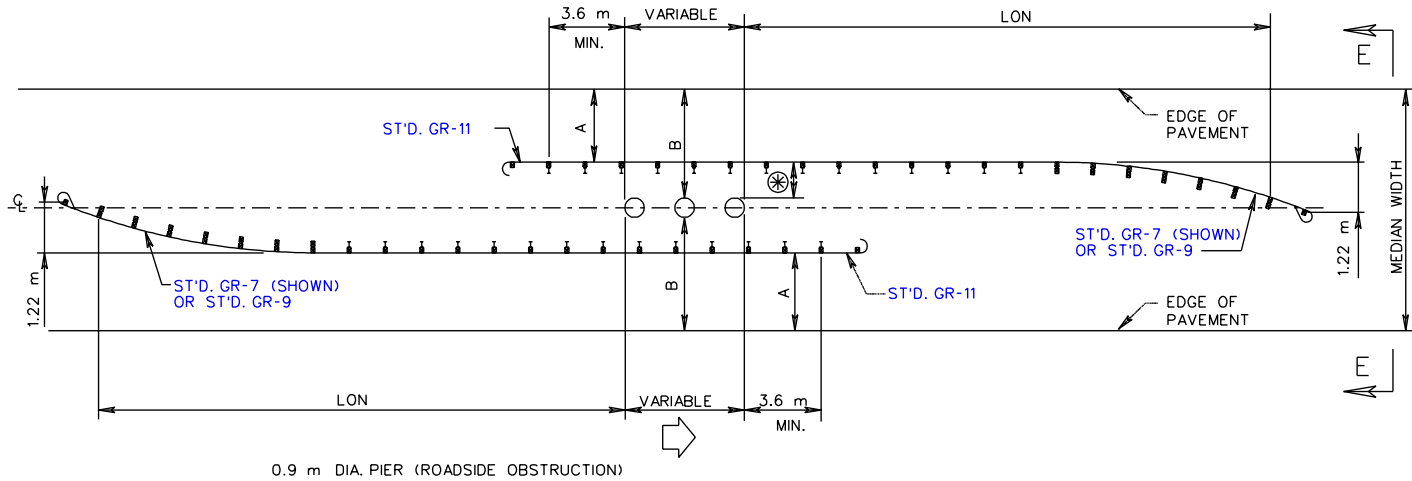
VIRGINIA DEPARTMENT OF TRANSPORTATION

Rev. 3/03

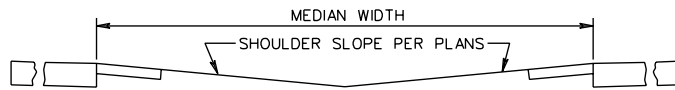
203.06 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

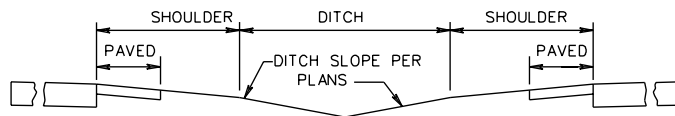
502



0.9 m DIA. PIER (ROADSIDE OBSTRUCTION)



SECTION E-E



TYPICAL SECTION

MEDIAN WIDTH	DIMENSIONS *		LENGTH OF NEED (LON) INCLUDING GR-7 OR GR-9 TERMINAL
	A (m)	B (m)	
9 m	2.20	4.05	104.4
12 m	3.70	5.55	86.4
15 m	5.20	7.05	72.0
18 m	6.70	8.55	64.8

\* THE DIMENSIONS AS SHOWN HERE ARE FOR A 0.9 m DIAMETER PIER. THESE DIMENSIONS WILL VARY AS ROADSIDE OBSTRUCTION DIMENSIONS DIFFER.

SEE TABLE III, PAGE 501.33 OF THE ROAD AND BRIDGE STANDARDS FOR DEFINITION OF "X" AND "Y".

⊗ FACE OF GUARDRAIL IS TO BE 1.83 m FROM FACE OF OBJECT.

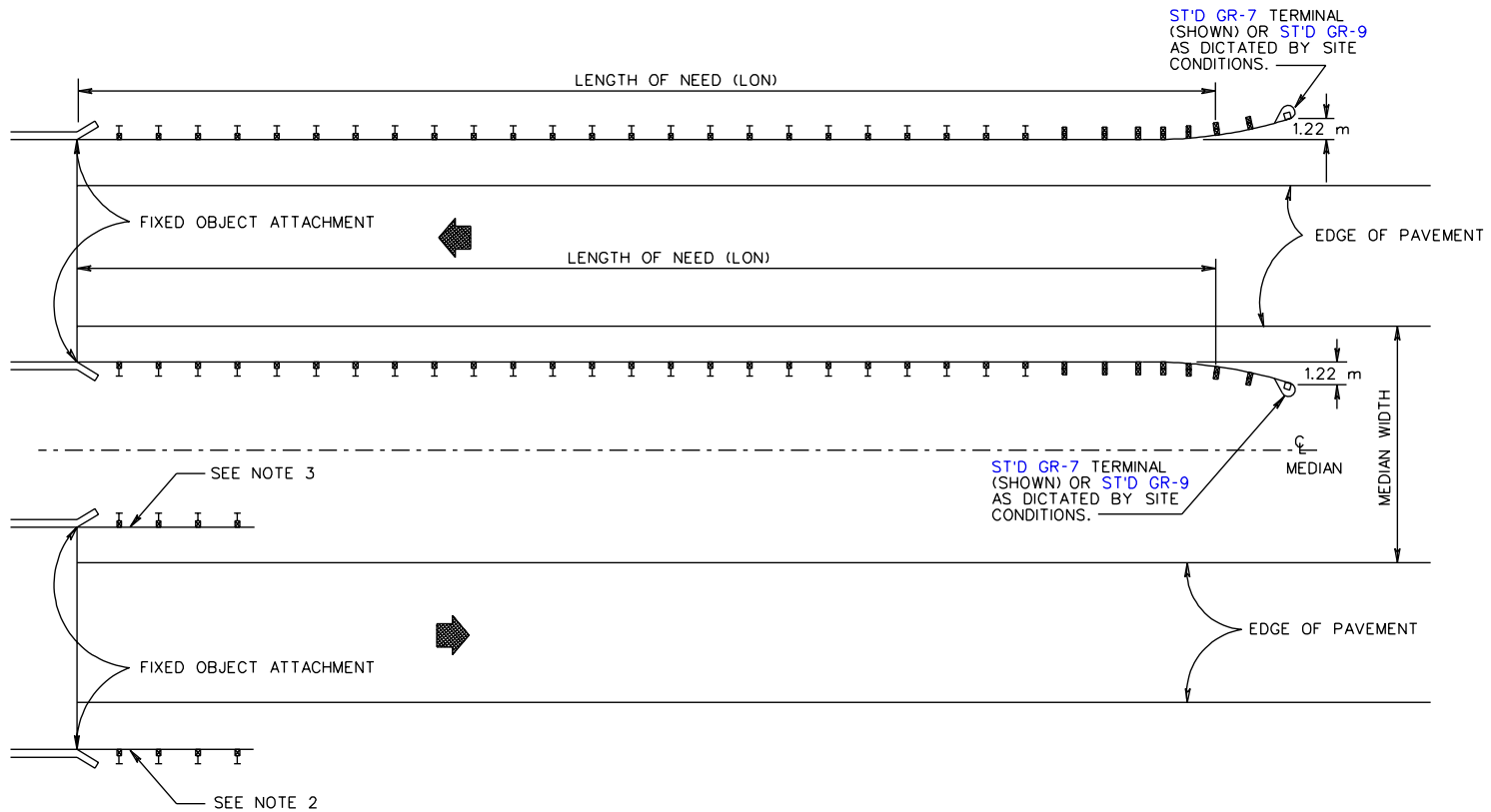
FOR MEDIAN WIDTHS LESS THAN 8.2 m SEE SHEET 501.32 OF THE ROAD AND BRIDGE STANDARDS.

THE GUARDRAIL DESIGN AND PLACEMENT SHOWN ABOVE MAY ALSO BE USED FOR SHIELDING AN OVERHEAD SIGN SUPPORT, FIXED OBJECTS OR OTHER TYPES OF ROADSIDE OBSTRUCTIONS.

DETAIL OF GUARDRAIL AT BRIDGE PIERS USING STANDARD GR-2

SPECIFICATION REFERENCE	W BEAM GUARDRAIL INSTALLATION CRITERIA		REV. 3/03
221 505	VIRGINIA DEPARTMENT OF TRANSPORTATION		501.30
			UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

GR-INS



NOTES:

1. IF A CUT SECTION IS CLOSER THAN 61 m, A STANDARD GR-6 TERMINAL IS PREFERRED.
2. NO GUARDRAIL IS REQUIRED ON RUN-OFF UNLESS NEEDED TO SHIELD A HAZARD WITHIN THE REQUIRED CLEAR ZONE.
3. NO GUARDRAIL IS REQUIRED ON RUN-OFF UNLESS NEEDED TO SHIELD A HAZARD WITHIN THE REQUIRED CLEAR ZONE. REFER TO SHEET 501.30 IF BACK OF GUARDRAIL FROM THE OPPOSING LANES IS WITHIN THE REQUIRED CLEAR ZONE.

DETAIL OF GUARDRAIL AT DUAL BRIDGES

Sheet 2 of 8

W BEAM GUARDRAIL INSTALLATION CRITERIA

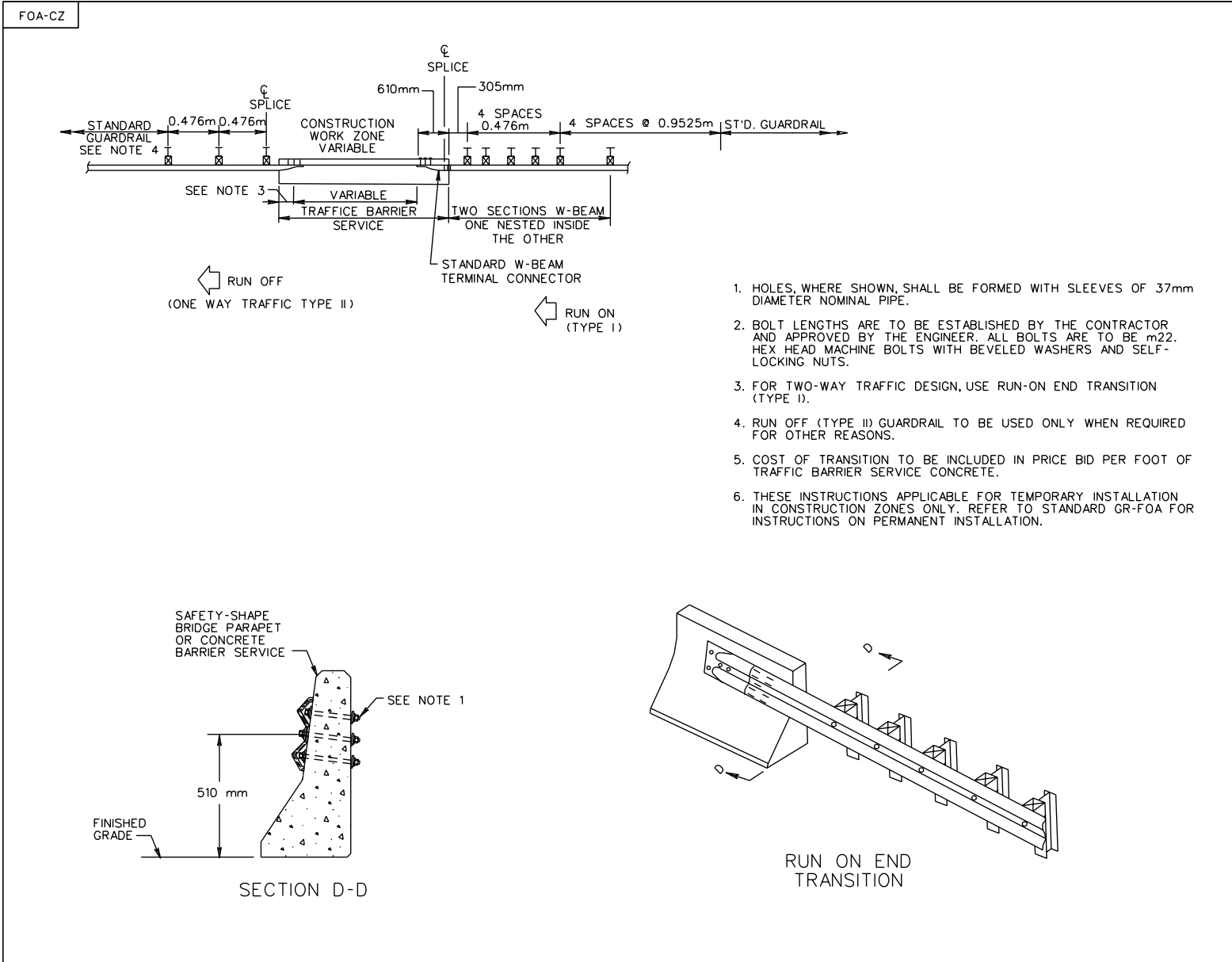
REVISED 3/03

VIRGINIA DEPARTMENT OF TRANSPORTATION

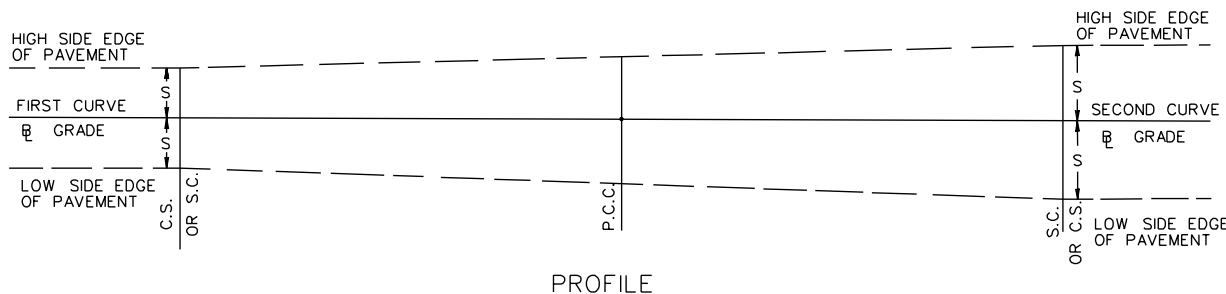
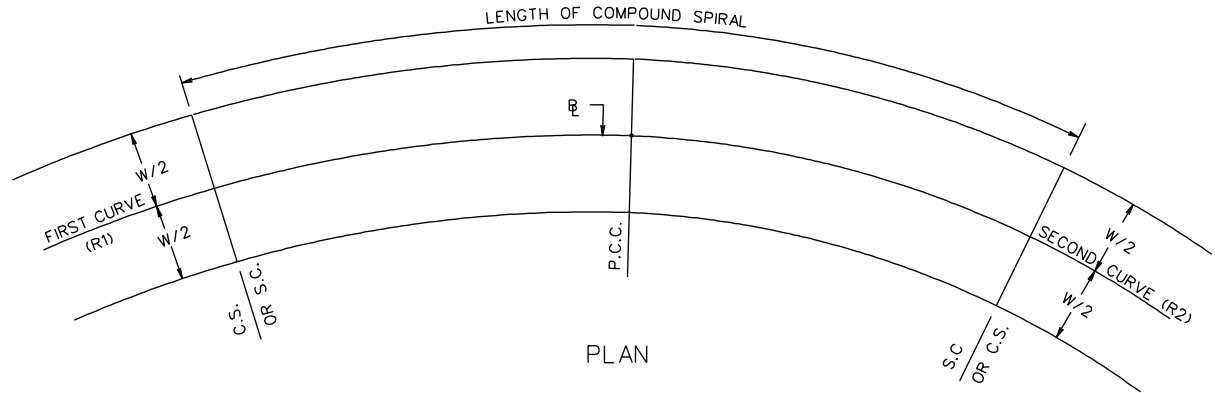
501.31 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE

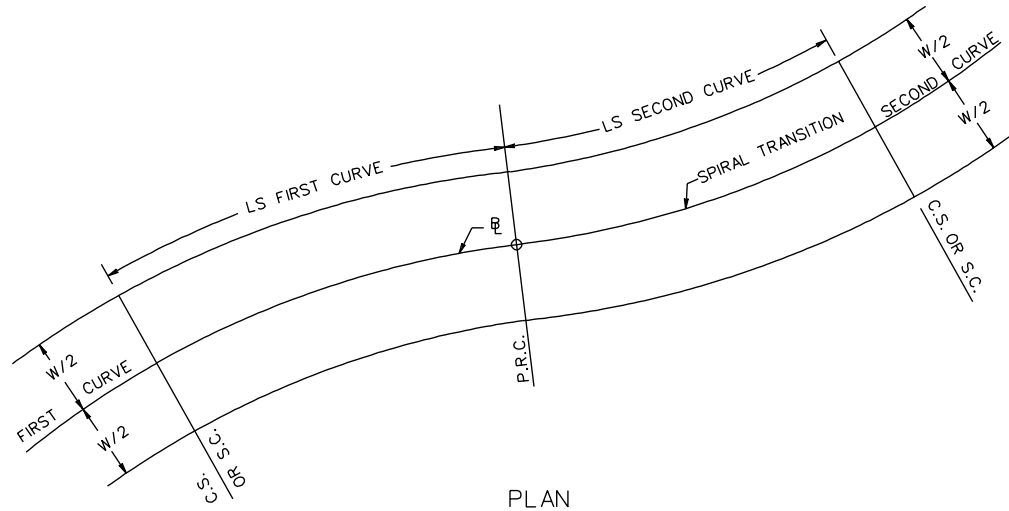
221  
505



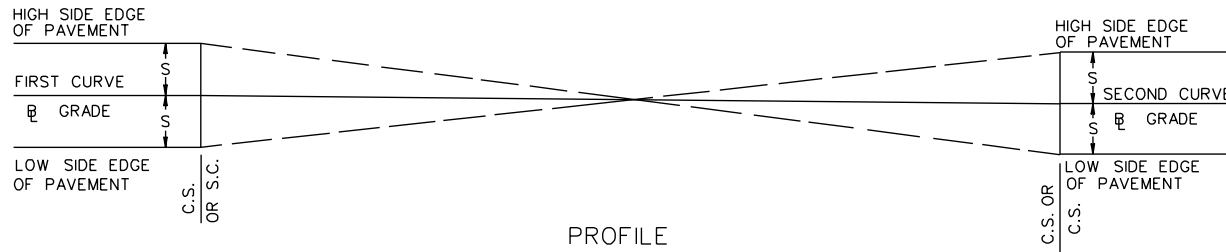
<p>W BEAM GUARDRAIL INSTALLATION CRITERIA FIXED OBJECT ATTACHMENT METHODS FOR CONSTRUCTION ZONES</p>		<p>SPECIFICATION REFERENCE</p>
<p>New. 3/03</p>	<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>505</p>
<p>501.72</p>		<p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>



- NOTE:
1. FOR COMPOUND CURVES ON ROADWAYS, THE RATIO OF FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 1.5:1 WHERE PRACTICAL, A DESIRABLE MAXIMUM RATIO OF 1.75:1 SHOULD BE USED. FOR COMPOUND CURVES ON RAMP, THE RATIO OF THE FLATTER RADIUS (R1) TO THE SHARPER RADIUS (R2) SHALL NOT EXCEED 2:1.
  2. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF COMPOUND SPIRAL COMPUTED PER PAGE 802.22.
  3. REFER TO OF THE ROAD DESIGN MANUAL FOR ADDITIONAL COMPOUND CURVE INFORMATION.



PLAN



PROFILE

NOTE:

1. COMPUTE SUPERELEVATION TRANSITION FROM MAXIMUM OF FIRST CURVE TO MAXIMUM OF SECOND CURVE. LENGTH OF LS (SPIRAL TRANSITIONS) COMPUTED PER PAGE 802.22.
2. REFER TO THE ROAD DESIGN MANUAL FOR ADDITIONAL REVERSE CURVE DESIGN INFORMATION.

METHOD OF APPLYING TC-5.01 ON REVERSE CURVES  
 URBAN CONDITIONS & RURAL CONDITIONS WITHOUT PAVEMENT WIDENING

SPECIFICATION  
 REFERENCE

TC-5.01	<p style="text-align: center;"><b>CURVE WIDENING TABLES</b></p> <p style="text-align: center;"><b>SU DESIGN VEHICLE</b></p> <table border="1" style="margin: auto; border-collapse: collapse; text-align: center;"> <tr><th>COMPONENT</th><th>SIZE</th></tr> <tr><td>OVERALL WIDTH (u)</td><td>2.4 m</td></tr> <tr><td>WHEELBASE (L)</td><td>6.1 m</td></tr> <tr><td>FRONT OVERHANG (A)</td><td>1.2 m</td></tr> </table> <p style="text-align: center;"><b>LATERAL CLEARANCE</b></p> <table border="1" style="margin: auto; border-collapse: collapse; text-align: center;"> <tr><th>LANE WIDTH</th><th>CLEARANCE (C)</th></tr> <tr><td>2.7 m</td><td>.45 m</td></tr> <tr><td>3.0 m</td><td>.60 m</td></tr> <tr><td>3.3 m</td><td>.75 m</td></tr> <tr><td>3.6 m</td><td>.90 m</td></tr> <tr><td>4.8 m</td><td>1.5 m</td></tr> </table>	COMPONENT	SIZE	OVERALL WIDTH (u)	2.4 m	WHEELBASE (L)	6.1 m	FRONT OVERHANG (A)	1.2 m	LANE WIDTH	CLEARANCE (C)	2.7 m	.45 m	3.0 m	.60 m	3.3 m	.75 m	3.6 m	.90 m	4.8 m	1.5 m	<p style="text-align: center;"><b>ADJUSTMENT FACTORS</b></p> <table border="1" style="margin: auto; border-collapse: collapse; text-align: center;"> <tr><th>NUMBER OF LANES ROTATED <math>n_1</math></th><th>ADJUSTMENT FACTOR (<math>b_w</math>)</th></tr> <tr><td>1</td><td>1.00</td></tr> <tr><td>1.5</td><td>0.8333</td></tr> <tr><td>2</td><td>0.75</td></tr> <tr><td>2.5</td><td>0.70</td></tr> <tr><td>3</td><td>0.6667</td></tr> <tr><td>3.5</td><td>0.6425</td></tr> </table>	NUMBER OF LANES ROTATED $n_1$	ADJUSTMENT FACTOR ( $b_w$ )	1	1.00	1.5	0.8333	2	0.75	2.5	0.70	3	0.6667	3.5	0.6425	<p style="text-align: center;"><b>RELATIVE GRADIENTS</b></p> <table border="1" style="margin: auto; border-collapse: collapse; text-align: center;"> <tr><th>DESIGN SPEED <math>V_D</math> MPH</th><th>MAXIMUM RELATIVE GRADIENT (rg)</th><th>MIN. TRANSITION LENGTH IN METERS 2 SECOND RULE RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE &amp; COMPOUND CURVES FOR ALL CONDITIONS</th></tr> <tr><td>30</td><td>0.75</td><td>17</td></tr> <tr><td>40</td><td>0.70</td><td>22</td></tr> <tr><td>50</td><td>0.65</td><td>28</td></tr> <tr><td>60</td><td>0.60</td><td>33</td></tr> <tr><td>70</td><td>0.55</td><td>39</td></tr> <tr><td>80</td><td>0.50</td><td>44</td></tr> <tr><td>90</td><td>0.47</td><td>50</td></tr> <tr><td>100</td><td>0.44</td><td>56</td></tr> <tr><td>110</td><td>0.41</td><td>61</td></tr> </table>	DESIGN SPEED $V_D$ MPH	MAXIMUM RELATIVE GRADIENT (rg)	MIN. TRANSITION LENGTH IN METERS 2 SECOND RULE RURAL CONDITIONS WITH PAVEMENT WIDENING AND REVERSE & COMPOUND CURVES FOR ALL CONDITIONS	30	0.75	17	40	0.70	22	50	0.65	28	60	0.60	33	70	0.55	39	80	0.50	44	90	0.47	50	100	0.44	56	110	0.41	61
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100	0.44	56																																																																	
110	0.41	61																																																																	
<b>DEFINITIONS</b>																																																																			
<p>A - FRONT OVERHANG OF DESIGN VEHICLE FROM APPROPRIATE TABLE.</p> <p><math>b_w</math> - ADJUSTMENT FACTOR FROM TABLE.</p> <p>C - LATERAL CLEARANCE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.</p> <p>E - SUPERELEVATION RATE FROM APPROPRIATE TABLE OR CALCULATED PER AASHTO METHOD 5.</p> <p><math>F_A</math> - CALCULATED WIDTH OF OVERHANG FOR DESIGN VEHICLE.</p> <p>L - WHEELBASE OF DESIGN VEHICLE FROM APPROPRIATE TABLE.</p>	<p>LS - LENGTH OF SPIRAL OR SUPERELEVATION TRANSITION LENGTH.</p> <p>M - MULTIPLE LANE FACTOR.</p> <p>N - NUMBER OF LANES.</p> <p><math>n_1</math> - NUMBER OF LANES ROTATED (FROM TABLE).</p> <p><math>P_w</math> - PAVEMENT WIDTH.</p> <p>R - RADIUS OF CURVE.</p> <p>rg - RELATIVE GRADIENT FROM APPROPRIATE TABLE.</p> <p>U - CALCULATED TRACK WIDTH OF DESIGN VEHICLE.</p>	<p>u - TRACK WIDTH OF DESIGN VEHICLE FROM APPROPRIATE TABLE.</p> <p><math>V_D</math> - DESIGN VELOCITY.</p> <p>w - CALCULATED WIDENING.</p> <p>W - PAVEMENT WIDTH</p> <p><math>W_C</math> - CALCULATED TOTAL CURVE WIDTH.</p> <p><math>W_n</math> - WIDTH OF LANE.</p> <p>Z - CALCULATED EXTRA WIDTH ALLOWANCE.</p>																																																																	
<b>GENERAL DESIGN CONSIDERATIONS</b>																																																																			
<p>1. WHERE PAVEMENT WIDENING IS REQUIRED, THE APPROPRIATE WIDENING IS ADDED TO THE LANE WIDTH WHEN CALCULATING THE TRANSITION LENGTH (LS).</p> <p>2. THE COMPUTED TRANSITION LENGTH (LS) IS ROUNDED UP TO THE NEAREST METER.</p> <p>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.</p> <p>4. CROWN RUNOFF IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION.</p> <p>5. NO PAVEMENT WIDENING IS REQUIRED FOR URBAN ROADWAYS.</p> <p>6. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH A CURVE RADIUS GREATER THAN 850 METERS.</p>	<p>7. NO PAVEMENT WIDENING IS REQUIRED FOR RURAL ROADWAYS WITH 3.6 METERS WIDE LANES AND A CURVE RADIUS GREATER THAN 230 METERS.</p> <p>8. PAVEMENT WIDENING IS APPLIED ONLY WHEN CALCULATED WIDENING (w) IS EQUAL TO OR GREATER THAN 0.6 METERS.</p> <p>9. WHEN CALCULATING WIDENING (w) FOR MULTI-LANE RURAL ROADWAYS, WIDENING IS FIRST CALCULATED USING THE SINGLE LANE WIDTH FOR "W".</p> <p>10. AN ALTERNATE METHOD FOR MULTI-LANE UNDIVIDED PAVEMENTS (14.4 m). THE LS IS 1.5 TIMES (M*1.5) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS; AND FOR SIX LANE UNDIVIDED PAVEMENTS (21.6 m), THE LS IS TWO TIMES (M*2) THE CORRESPONDING LENGTH FOR TWO LANE HIGHWAYS.</p> <p>11. CALCULATED WIDENING IS ROUNDED UP TO THE NEAREST 0.1 METER.</p> <p>12. CURVES WITH SPIRAL CURVE TRANSITIONS MUST HAVE A MINIMUM TRANSITION LENGTH (LS) EQUAL TO 2 SECONDS OF TRAVEL TIME AT THE ROADWAY'S DESIGN SPEED AS NOTED IN THE RELATIVE GRADIENT TABLE.</p>																																																																		
<p><u>NO WIDENING REQUIRED</u></p> <p><math>LS = b_w(W - n_1 E / rg)</math></p> <p><math>LS = M (WE / rg)</math> (ALT. MULTI-LANE)</p> <p><u>WIDENING REQUIRED</u></p> <p><math>LS = b_w[E - n_1(W + w/N) / rg]</math></p> <p><math>LS = m[E(W + w/N) / rg]</math> (ALT. MULTI-LANE)</p>	<p style="text-align: center;">FORMULAS USED TO CALCULATE TRANSITION LENGTH (LS) AND WIDENING (w)</p> $U = u + R - \sqrt{R^2 - L^2}$ $F_A = \sqrt{R^2 + A(2L + A)} - R$	$Z = (V_D / \sqrt{R})$ $W_C = N(U + C) + F_A + Z$ $w = W_C - 2W_n$																																																																	
FOR SOLVED PROBLEMS USING THIS METHODOLOGY, SEE THE EXAMPLES ON PAGE 802.23																																																																			
<h1>METHODOLOGIES FOR CALCULATING TC-5.01 VALUES</h1>			<p style="text-align: center;">SPECIFICATION REFERENCE</p>																																																																
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802.22																																																																			



DESIGN FACTORS FOR A DESIGN SPEED OF 30 km/h (RURAL) USING E = 8% MAX.

DESIGN VELOCITY -30	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMP						
	WIDTH+ 5.4 m			WIDTH+6.0 m			WIDTH+6.6 m			WIDTH+7.2 m			WIDTH+14.4 m						
	1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		2 @ 3.6 m		4.8 m		5.4 m						
RADIUS (m)E (%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	
500	NC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0
322	2.0	17	17	0.7	8	8	0.0	9	9	0.0	10	10	0.0	15	15	0.0	12	12	12
305	2.1	17	17	0.7	8	9	0.0	9	10	0.0	10	11	0.0	15	16	0.0	12	12	13
289	2.2	16	17	0.7	8	9	0.0	9	10	0.0	10	11	0.0	15	16	0.0	12	13	14
275	2.3	15	17	0.7	8	10	0.0	9	11	0.0	10	12	0.0	15	17	0.0	12	13	14
262	2.4	15	17	0.7	8	10	0.0	9	11	0.0	10	12	0.0	15	18	0.0	12	14	15
250	2.5	14	17	0.7	8	10	0.0	9	11	0.0	10	12	0.0	15	18	0.0	12	15	16
239	2.6	14	17	0.7	8	11	0.0	9	12	0.0	10	13	0.0	15	19	0.0	12	15	16
228	2.7	13	17	0.7	8	11	0.0	9	12	0.0	10	13	0.0	15	20	0.0	12	16	17
219	2.8	13	17	0.8	8	12	0.0	9	13	0.0	10	14	0.0	15	21	0.0	12	16	17
210	2.9	12	17	0.8	8	12	0.0	9	13	0.0	10	14	0.0	15	21	0.0	12	17	18
201	3.0	12	17	0.8	8	12	0.0	9	14	0.0	10	15	0.0	15	22	0.0	12	17	18
193	3.1	11	17	0.8	8	13	0.0	9	14	0.0	10	15	0.0	15	23	0.0	12	18	19
186	3.2	11	17	0.8	8	13	0.0	9	15	0.0	10	16	0.0	15	24	0.0	12	19	20
179	3.3	11	17	0.8	8	14	0.0	9	15	0.0	10	16	0.0	15	24	0.0	12	19	20
172	3.4	10	17	0.8	8	14	0.0	9	15	0.0	10	17	0.0	15	25	0.0	12	20	21
166	3.5	10	17	0.9	10	17	0.6	9	16	0.0	10	17	0.0	15	26	0.0	12	20	21
160	3.6	10	17	0.9	10	17	0.6	9	16	0.0	10	18	0.0	15	26	0.0	12	21	22
155	3.7	10	17	0.9	10	17	0.6	9	17	0.0	10	18	0.0	15	27	0.0	12	21	23
149	3.8	9	17	0.9	9	17	0.6	9	17	0.0	10	19	0.0	15	28	0.0	12	22	23
144	3.9	9	17	0.9	10	18	0.6	9	18	0.0	10	19	0.0	15	29	0.0	12	23	24
139	4.0	9	17	0.9	9	18	0.6	9	18	0.0	10	20	0.0	15	29	0.0	12	23	24
135	4.1	9	18	0.9	10	19	0.6	9	19	0.0	10	20	0.0	15	30	0.0	12	24	25
130	4.2	9	18	1.0	10	19	0.7	9	19	0.0	10	21	0.0	15	31	0.0	12	24	25
126	4.3	9	19	1.0	10	20	0.7	9	19	0.0	10	21	0.0	15	31	0.0	12	25	26
121	4.4	9	19	1.0	9	20	0.7	9	20	0.0	10	22	0.0	15	32	0.0	12	25	27
117	4.5	9	20	1.0	9	21	0.7	9	20	0.0	10	22	0.0	15	33	0.0	12	26	27
114	4.6	9	20	1.0	9	21	0.7	9	21	0.0	10	23	0.0	15	34	0.0	12	26	28
110	4.7	9	21	1.1	10	22	0.8	9	21	0.0	10	23	0.0	15	34	0.0	12	27	29
106	4.8	9	21	1.1	10	22	0.8	9	22	0.0	10	24	0.0	15	35	0.0	12	28	29
102	4.9	9	22	1.1	10	23	0.8	9	22	0.0	10	24	0.0	15	36	0.0	12	28	30
99	5.0	9	22	1.1	10	23	0.8	9	22	0.0	10	24	0.0	15	36	0.0	12	29	30
95	5.1	9	23	1.1	10	24	0.8	9	23	0.0	10	25	0.0	15	37	0.0	12	29	31
92	5.2	9	23	1.2	10	24	0.9	10	25	0.6	10	25	0.0	16	41	0.6	12	30	32
88	5.3	9	24	1.2	10	25	0.9	10	26	0.6	10	26	0.0	16	43	0.6	12	30	32
85	5.4	9	24	1.2	10	25	0.9	10	26	0.6	10	26	0.0	16	43	0.6	12	31	33
82	5.5	9	25	1.2	10	26	0.9	10	27	0.6	10	27	0.0	16	43	0.6	12	32	33
79	5.6	9	26	1.3	10	27	1.0	10	28	0.7	10	27	0.0	16	45	0.8	12	32	34
76	5.7	9	26	1.3	10	27	1.0	10	28	0.7	10	28	0.0	16	46	0.8	12	33	35
74	5.8	9	26	1.3	10	28	1.0	10	29	0.7	10	28	0.0	16	47	0.8	12	33	35
71	5.9	9	27	1.3	10	28	1.0	10	29	0.7	10	29	0.0	16	48	0.8	12	34	36
69	6.0	10	28	1.4	10	29	1.1	10	30	0.8	10	29	0.0	17	50	1.0	12	34	36
66	6.1	10	28	1.4	10	29	1.1	10	31	0.8	10	30	0.0	17	51	1.0	12	35	37
64	6.2	10	29	1.4	10	30	1.1	10	31	0.8	10	30	0.0	17	51	1.0	12	36	38
62	6.3	10	29	1.5	10	31	1.2	10	32	0.9	11	33	0.6	17	53	1.2	12	36	38
60	6.4	10	30	1.5	10	31	1.2	10	32	0.9	11	34	0.6	17	54	1.2	12	37	39
58	6.5	10	30	1.5	10	32	1.2	10	33	0.9	11	34	0.6	17	55	1.2	12	37	39
56	6.6	10	31	1.6	10	33	1.3	11	34	1.0	11	35	0.7	18	57	1.4	12	38	40
54	6.7	10	32	1.6	10	33	1.3	11	34	1.0	11	36	0.7	18	58	1.4	12	38	41
52	6.8	10	32	1.6	10	34	1.3	11	35	1.0	11	36	0.7	18	59	1.4	12	39	41
50	6.9	10	33	1.7	10	35	1.4	11	36	1.1	11	37	0.8	18	61	1.6	12	39	42
49	7.0	10	34	1.7	10	35	1.4	11	36	1.1	11	38	0.8	18	62	1.6	12	40	42
47	7.1	10	35	1.8	10	36	1.5	11	37	1.2	11	39	0.9	18	64	1.8	12	41	43
45	7.2	10	35	1.8	10	36	1.5	11	38	1.2	11	39	0.9	18	65	1.8	12	41	43
44	7.3	10	36	1.9	11	37	1.6	11	39	1.3	11	40	1.0	19	68	2.0	12	42	44
42	7.4	10	37	1.9	11	38	1.6	11	39	1.3	11	41	1.0	19	69	2.0	12	42	45
41	7.5	10	37	2.0	11	39	1.7	11	40	1.4	12	42	1.1	19	71	2.2	12	43	45
39	7.6	10	38	2.0	11	40	1.7	11	41	1.4	12	43	1.1	19	72	2.2	12	43	46
37	7.7	10	39	2.1	11	41	1.8	11	42	1.5	12	44	1.2	20	74	2.4	12	44	47
35	7.8	10	40	2.2	11	42	1.9	11	43	1.6	12	45	1.3	20	77	2.6	12	45	47
33	7.9	11	41	2.3	11	43	2.0	12	44	1.7	12	46	1.4	20	79	2.8	12	45	48
29	8.0	11	43	2.5	11	44	2.2	12	46	1.9	12	47	1.6	21	84	3.2	12	46	48

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

TRANSITION CURVES - RURAL  
30 km/h DESIGN SPEED  
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

**DESIGN FACTORS FOR A DESIGN SPEED OF 40 km/h (RURAL) USING E = 8% MAX.**

DESIGN VELOCITY -40	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMP						
	WIDTH+ 5.4 m			WIDTH+6.0 m			WIDTH+6.6 m			WIDTH+7.2 m			WIDTH+14.4 m						
	1 @ 2.7 m			1 @ 3.0 m			1 @ 3.3 m			1 @ 3.6 m			2 @ 3.6 m		4.8 m		5.4 m		
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	CR	LS
800	NC	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0
571	2.0	22	22	0.6	9	9	0.0	10	10	0.0	11	11	0.0	16	16	0.0	13	13	13
541	2.1	21	22	0.6	9	9	0.0	10	10	0.0	11	11	0.0	16	17	0.0	13	13	14
513	2.2	20	22	0.6	9	10	0.0	10	11	0.0	11	12	0.0	16	17	0.0	13	14	15
488	2.3	20	22	0.6	9	10	0.0	10	11	0.0	11	12	0.0	16	18	0.0	13	14	15
465	2.4	19	22	0.6	9	11	0.0	10	12	0.0	11	13	0.0	16	19	0.0	13	15	16
444	2.5	18	22	0.6	9	11	0.0	10	12	0.0	11	13	0.0	16	20	0.0	13	16	17
424	2.6	17	22	0.7	9	12	0.0	10	13	0.0	11	14	0.0	16	21	0.0	13	16	17
388	2.8	16	22	0.7	9	12	0.0	10	14	0.0	11	15	0.0	16	22	0.0	13	18	18
372	2.9	16	22	0.7	9	13	0.0	10	14	0.0	11	15	0.0	16	23	0.0	13	18	19
357	3.0	15	22	0.7	9	13	0.0	10	15	0.0	11	16	0.0	16	24	0.0	13	19	20
343	3.1	15	22	0.7	9	14	0.0	10	15	0.0	11	16	0.0	16	24	0.0	13	19	20
330	3.2	14	22	0.7	9	14	0.0	10	16	0.0	11	17	0.0	16	25	0.0	13	20	21
318	3.3	14	22	0.7	9	15	0.0	10	16	0.0	11	17	0.0	16	26	0.0	13	21	22
306	3.4	13	22	0.7	9	15	0.0	10	17	0.0	11	18	0.0	16	27	0.0	13	21	22
295	3.5	13	22	0.7	9	15	0.0	10	17	0.0	11	18	0.0	16	27	0.0	13	22	23
285	3.6	13	22	0.8	9	16	0.0	10	17	0.0	11	19	0.0	16	28	0.0	13	22	24
274	3.7	12	22	0.8	9	16	0.0	10	18	0.0	11	20	0.0	16	29	0.0	13	23	24
265	3.8	12	22	0.8	9	17	0.0	10	18	0.0	11	20	0.0	16	30	0.0	13	24	25
256	3.9	12	22	0.8	9	17	0.0	10	19	0.0	11	21	0.0	16	31	0.0	13	24	26
247	4.0	11	22	0.8	9	18	0.0	10	19	0.0	11	21	0.0	16	31	0.0	13	25	26
239	4.1	11	22	0.8	9	18	0.0	10	20	0.0	11	22	0.0	16	32	0.0	13	25	27
231	4.2	11	22	0.8	9	19	0.0	10	20	0.0	11	22	0.0	16	33	0.0	13	26	27
223	4.3	11	22	0.8	9	19	0.0	10	21	0.0	11	23	0.0	16	34	0.0	13	27	28
216	4.4	10	22	0.8	9	19	0.0	10	21	0.0	11	23	0.0	16	34	0.0	13	27	29
208	4.5	10	22	0.8	9	20	0.0	10	22	0.0	11	24	0.0	16	35	0.0	13	28	29
201	4.6	10	22	0.9	10	22	0.6	10	22	0.0	11	24	0.0	16	36	0.0	13	28	30
195	4.7	10	22	0.9	10	23	0.6	10	23	0.0	11	25	0.0	16	37	0.0	13	29	31
188	4.8	10	22	0.9	10	23	0.6	10	23	0.0	11	25	0.0	16	38	0.0	13	30	31
182	4.9	10	23	0.9	10	24	0.6	10	24	0.0	11	26	0.0	16	38	0.0	13	30	32
175	5.0	10	23	0.9	10	24	0.6	10	24	0.0	11	26	0.0	16	39	0.0	13	31	33
169	5.1	10	23	0.9	10	25	0.6	10	25	0.0	11	27	0.0	16	40	0.0	13	31	33
163	5.2	10	24	0.9	10	25	0.6	10	25	0.0	11	27	0.0	16	41	0.0	13	32	34
157	5.3	10	25	1.0	10	26	0.7	10	26	0.0	11	28	0.0	16	41	0.0	13	33	35
151	5.4	10	25	1.0	10	26	0.7	10	26	0.0	11	28	0.0	16	42	0.0	13	33	35
145	5.5	10	26	1.0	10	27	0.7	10	26	0.0	11	29	0.0	16	43	0.0	13	34	36
140	5.6	10	26	1.0	10	27	0.7	10	27	0.0	11	29	0.0	16	44	0.0	13	35	36
135	5.7	10	27	1.0	10	28	0.7	10	27	0.0	11	30	0.0	16	44	0.0	13	35	36
130	5.8	10	27	1.0	10	28	0.7	10	28	0.0	11	30	0.0	16	45	0.0	13	36	37
126	5.9	10	28	1.1	10	29	0.8	10	28	0.0	11	31	0.0	16	46	0.0	13	36	38
121	6.0	10	28	1.1	10	30	0.8	10	29	0.0	11	31	0.0	16	47	0.0	13	37	39
117	6.1	10	29	1.1	10	30	0.8	10	29	0.0	11	32	0.0	16	48	0.0	13	38	40
113	6.2	10	29	1.1	10	31	0.8	10	30	0.0	11	32	0.0	16	48	0.0	13	38	40
110	6.3	10	30	1.1	10	31	0.8	10	30	0.0	11	33	0.0	16	49	0.0	13	39	41
106	6.4	10	31	1.2	10	32	0.9	11	34	0.6	11	34	0.0	17	50	0.6	13	40	42
102	6.5	10	32	1.2	10	33	0.9	11	34	0.6	11	34	0.0	17	50	0.6	13	40	42
99	6.6	10	32	1.2	10	33	0.9	11	34	0.6	11	34	0.0	17	50	0.6	13	41	43
96	6.7	10	32	1.2	10	34	0.9	11	35	0.6	11	35	0.0	17	50	0.6	13	41	43
92	6.8	10	33	1.3	10	34	1.0	11	36	0.7	11	35	0.0	18	51	0.8	13	42	44
89	6.9	10	34	1.3	10	35	1.0	11	36	0.7	11	36	0.0	18	51	0.8	13	42	44
86	7.0	10	34	1.3	10	35	1.0	11	37	0.7	11	36	0.0	18	52	0.8	13	43	45
83	7.1	10	34	1.3	10	36	1.0	11	38	0.7	11	37	0.0	18	52	0.8	13	44	46
80	7.2	10	35	1.4	11	37	1.1	11	39	0.8	11	38	0.0	18	53	1.0	13	44	47
77	7.3	10	36	1.4	11	38	1.1	11	39	0.8	11	38	0.0	18	54	1.0	13	45	47
75	7.4	10	36	1.4	11	38	1.1	11	40	0.8	11	39	0.0	18	55	1.0	13	45	48
72	7.5	10	37	1.5	11	39	1.2	11	41	0.9	12	40	0.6	18	56	1.2	13	46	49
69	7.6	10	38	1.5	11	40	1.2	11	41	0.9	12	41	0.6	18	57	1.2	13	47	49
66	7.7	10	38	1.5	11	40	1.2	11	42	0.9	12	42	0.6	18	58	1.2	13	47	50
62	7.8	10	39	1.6	11	41	1.3	11	43	1.0	12	43	0.7	19	72	1.4	13	48	51
58	7.9	11	41	1.7	11	42	1.4	11	44	1.1	12	44	0.8	19	75	1.6	13	48	51
51	8.0	11	42	1.8	11	43	1.5	12	45	1.2	12	47	0.9	20	78	1.8	13	49	52

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

SPECIFICATION REFERENCE

TRANSITION CURVES - RURAL  
40 km/h DESIGN SPEED  
VIRGINIA DEPARTMENT OF TRANSPORTATION

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

Rev. 3/03  
802.34

DESIGN VELOCITY =50	DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMP								
	WIDTH+5.4 m				WIDTH+6.0 m				WIDTH+6.6 m				WIDTH+7.2 m				WIDTH+14.4 m				
	1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		1 @ 3.6 m		1 @ 3.6 m		2 @ 3.6 m		4.8 m		5.4 m				
	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w
1200	0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
851	2.0	9	0.0	10	0.0	11	0.0	12	0.0	12	0.0	12	0.0	12	0.0	17	0.0	17	0.0	13	14
850	2.0	28	28	0.6	10	10	0.0	11	0.0	12	0.0	12	0.0	12	0.0	17	0.0	17	0.0	13	14
796	2.0	28	28	0.6	10	10	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	13	14
754	2.1	27	28	0.6	10	10	0.0	11	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	13	14
716	2.2	26	28	0.6	10	11	0.0	11	0.0	12	0.0	12	0.0	13	0.0	17	0.0	17	0.0	13	15
682	2.3	25	28	0.6	10	11	0.0	11	0.0	12	0.0	12	0.0	13	0.0	17	0.0	17	0.0	13	15
650	2.4	24	28	0.6	10	12	0.0	11	0.0	12	0.0	12	0.0	14	0.0	17	0.0	17	0.0	13	16
620	2.5	23	28	0.6	10	12	0.0	11	0.0	12	0.0	12	0.0	14	0.0	17	0.0	17	0.0	13	16
593	2.6	22	28	0.6	10	12	0.0	11	0.0	12	0.0	12	0.0	14	0.0	17	0.0	17	0.0	13	17
568	2.7	21	28	0.6	10	13	0.0	11	0.0	12	0.0	12	0.0	15	0.0	17	0.0	17	0.0	13	18
544	2.8	20	28	0.6	10	13	0.0	11	0.0	12	0.0	12	0.0	16	0.0	17	0.0	17	0.0	13	19
523	2.9	20	28	0.7	10	14	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	13	19
502	3.0	19	28	0.7	10	14	0.0	11	0.0	12	0.0	12	0.0	17	0.0	17	0.0	17	0.0	13	20
483	3.1	19	28	0.7	10	15	0.0	11	0.0	12	0.0	12	0.0	18	0.0	17	0.0	17	0.0	13	21
465	3.2	18	28	0.7	10	15	0.0	11	0.0	12	0.0	12	0.0	18	0.0	17	0.0	17	0.0	13	21
448	3.3	17	28	0.7	10	16	0.0	11	0.0	12	0.0	12	0.0	19	0.0	17	0.0	17	0.0	13	22
432	3.4	17	28	0.7	10	16	0.0	11	0.0	12	0.0	12	0.0	19	0.0	17	0.0	17	0.0	13	22
417	3.5	16	28	0.7	10	17	0.0	11	0.0	12	0.0	12	0.0	20	0.0	17	0.0	17	0.0	13	23
402	3.6	16	28	0.7	10	17	0.0	11	0.0	12	0.0	12	0.0	20	0.0	17	0.0	17	0.0	13	23
389	3.7	16	28	0.7	10	18	0.0	11	0.0	12	0.0	12	0.0	21	0.0	17	0.0	17	0.0	13	24
376	3.8	15	28	0.7	10	18	0.0	11	0.0	12	0.0	12	0.0	21	0.0	17	0.0	17	0.0	13	24
363	3.9	15	28	0.7	10	18	0.0	11	0.0	12	0.0	12	0.0	22	0.0	17	0.0	17	0.0	13	25
352	4.0	14	28	0.7	10	19	0.0	11	0.0	12	0.0	12	0.0	22	0.0	17	0.0	17	0.0	13	25
340	4.1	14	28	0.8	10	19	0.0	11	0.0	12	0.0	12	0.0	23	0.0	17	0.0	17	0.0	13	26
329	4.2	14	28	0.8	10	20	0.0	11	0.0	12	0.0	12	0.0	24	0.0	17	0.0	17	0.0	13	27
319	4.3	14	28	0.8	10	20	0.0	11	0.0	12	0.0	12	0.0	24	0.0	17	0.0	17	0.0	13	27
309	4.4	13	28	0.8	10	21	0.0	11	0.0	12	0.0	12	0.0	25	0.0	17	0.0	17	0.0	13	28
300	4.5	13	28	0.8	10	21	0.0	11	0.0	12	0.0	12	0.0	25	0.0	17	0.0	17	0.0	13	28
290	4.6	13	28	0.8	10	22	0.0	11	0.0	12	0.0	12	0.0	26	0.0	17	0.0	17	0.0	13	29
281	4.7	12	28	0.8	10	22	0.0	11	0.0	12	0.0	12	0.0	26	0.0	17	0.0	17	0.0	13	29
273	4.8	12	28	0.8	10	23	0.0	11	0.0	12	0.0	12	0.0	27	0.0	17	0.0	17	0.0	13	30
265	4.9	12	28	0.8	10	23	0.0	11	0.0	12	0.0	12	0.0	27	0.0	17	0.0	17	0.0	13	30
256	5.0	12	28	0.8	10	24	0.0	11	0.0	12	0.0	12	0.0	28	0.0	17	0.0	17	0.0	13	31
249	5.1	11	28	0.8	10	24	0.0	11	0.0	12	0.0	12	0.0	28	0.0	17	0.0	17	0.0	13	31
241	5.2	11	28	0.9	11	28	0.6	11	0.0	12	0.0	12	0.0	29	0.0	17	0.0	17	0.0	13	32
233	5.3	11	28	0.9	11	28	0.6	11	0.0	12	0.0	12	0.0	29	0.0	17	0.0	17	0.0	13	32
226	5.4	11	28	0.9	11	28	0.6	11	0.0	12	0.0	12	0.0	30	0.0	17	0.0	17	0.0	13	33
219	5.5	11	28	0.9	11	28	0.6	11	0.0	12	0.0	12	0.0	31	0.0	17	0.0	17	0.0	13	33
212	5.6	10	28	0.9	11	29	0.0	11	0.0	12	0.0	12	0.0	31	0.0	17	0.0	17	0.0	13	34
205	5.7	10	28	0.9	11	29	0.0	11	0.0	12	0.0	12	0.0	32	0.0	17	0.0	17	0.0	13	34
198	5.8	10	29	0.9	11	30	0.6	11	0.0	12	0.0	12	0.0	32	0.0	17	0.0	17	0.0	13	34
192	5.9	10	29	0.9	11	30	0.6	11	0.0	12	0.0	12	0.0	33	0.0	17	0.0	17	0.0	13	34
186	6.0	10	30	1.0	11	31	0.7	11	0.0	12	0.0	12	0.0	34	0.0	17	0.0	17	0.0	13	35
180	6.1	10	31	1.0	11	32	0.7	11	0.0	12	0.0	12	0.0	34	0.0	17	0.0	17	0.0	13	35
175	6.2	10	31	1.0	11	32	0.7	11	0.0	12	0.0	12	0.0	35	0.0	17	0.0	17	0.0	13	35
170	6.3	10	32	1.0	11	33	0.7	11	0.0	12	0.0	12	0.0	35	0.0	17	0.0	17	0.0	13	36
164	6.4	10	32	1.0	11	33	0.7	11	0.0	12	0.0	12	0.0	36	0.0	17	0.0	17	0.0	13	36
159	6.5	10	32	1.0	11	34	0.7	11	0.0	12	0.0	12	0.0	36	0.0	17	0.0	17	0.0	13	36
154	6.6	10	33	1.0	11	35	0.7	11	0.0	12	0.0	12	0.0	37	0.0	17	0.0	17	0.0	13	37
150	6.7	10	34	1.1	11	36	0.8	11	0.0	12	0.0	12	0.0	37	0.0	17	0.0	17	0.0	13	37
145	6.8	10	34	1.1	11	36	0.8	11	0.0	12	0.0	12	0.0	38	0.0	17	0.0	17	0.0	13	38
141	6.9	10	35	1.1	11	37	0.8	11	0.0	12	0.0	12	0.0	38	0.0	17	0.0	17	0.0	13	38
136	7.0	10	35	1.1	11	37	0.8	11	0.0	12	0.0	12	0.0	39	0.0	17	0.0	17	0.0	13	39
132	7.1	10	36	1.1	11	38	0.8	11	0.0	12	0.0	12	0.0	39	0.0	17	0.0	17	0.0	13	39
127	7.2	10	36	1.1	11	38	0.8	11	0.0	12	0.0	12	0.0	40	0.0	17	0.0	17	0.0	13	40
123	7.3	11	38	1.2	11	39	0.9	12	0.0	12	0.0	12	0.0	40	0.0	17	0.0	17	0.0	13	40
119	7.4	11	38	1.2	11	40	0.9	12	0.0	12	0.0	12	0.0	41	0.0	18	0.6	13	48	48	
114	7.5	11	39	1.2	11	40	0.9	12	0.0	12	0.0	12	0.0	41	0.0	18	0.6	13	48	48	
110	7.6	11	39	1.2	11	41	0.9	12	0.0	12	0.0	12	0.0	42	0.0	18	0.6	13	49	49	
105	7.7	11	40	1.3	11	42	1.0	12	0.0	12	0.0	12	0.0	43	0.0	18	0.6	13	50	50	
100	7.8	11	41	1.3	11	42	1.0	12	0.0	12	0.0	12	0.0	44	0.0	19	0.7	13	51	51	
94	7.9	11	41	1.3	11	43	1.0	12	0.0	12	0.0	12	0.0	44	0.0	19	0.7	13	51	51	
83	8.0	11	43	1.5	12	45	1.2	12	0.0	12	0.0	12	0.0	45	0.6	20	0.8	13	52	52	

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

SPECIFICATION REFERENCE

TRANSITION CURVES - RURAL  
50 km/h DESIGN SPEED  
VIRGINIA DEPARTMENT OF TRANSPORTATION



DESIGN VELOCITY -70		DESIGN FACTORS FOR A DESIGN SPEED OF 70 km/h (RURAL) USING E = 8% MAX.																		
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						INTERCHANGE RAMPS						WIDTH						
		1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		2 @ 3.6 m		2 @ 3.6 m		3 @ 3.6 m		4.8 m		5.4 m		
RADIUS (m/E (%))	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	LS		
2000	NC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	
1447	2.0	10	0.0	11	11	0.0	12	12	0.0	14	14	0.0	20	20	0.0	27	27	0.0	16	
1372	2.1	10	0.0	11	12	0.0	13	13	0.0	14	14	0.0	20	21	0.0	27	28	0.0	17	
1304	2.2	10	0.0	11	12	0.0	14	14	0.0	15	15	0.0	20	22	0.0	27	29	0.0	18	
1242	2.3	10	0.0	11	13	0.0	14	14	0.0	16	16	0.0	20	23	0.0	27	31	0.0	18	
1184	2.4	10	0.0	11	14	0.0	15	15	0.0	16	16	0.0	20	24	0.0	27	32	0.0	19	
1132	2.5	10	0.0	11	14	0.0	15	15	0.0	17	17	0.0	20	25	0.0	27	33	0.0	20	
1083	2.6	10	0.0	11	15	0.0	16	16	0.0	18	18	0.0	20	26	0.0	27	35	0.0	21	
1038	2.7	10	0.0	11	15	0.0	17	17	0.0	18	18	0.0	20	27	0.0	27	36	0.0	21	
996	2.8	10	0.0	11	16	0.0	17	17	0.0	19	19	0.0	20	28	0.0	27	37	0.0	22	
957	2.9	10	0.0	11	16	0.0	18	18	0.0	19	19	0.0	20	29	0.0	27	38	0.0	23	
921	3.0	10	0.0	11	17	0.0	18	18	0.0	20	20	0.0	30	30	0.0	40	40	0.0	24	
886	3.1	10	0.0	11	17	0.0	19	19	0.0	21	21	0.0	20	31	0.0	27	41	0.0	24	
854	3.2	10	0.0	11	18	0.0	20	20	0.0	21	21	0.0	20	32	0.0	27	42	0.0	25	
851	3.3	10	0.0	11	18	0.0	20	20	0.0	22	22	0.0	20	33	0.0	27	44	0.0	26	
850	3.3	24	39	0.6	11	18	0.0	12	20	0.0	14	22	0.0	20	33	0.0	27	44	0.0	26
824	3.3	24	39	0.6	11	18	0.0	12	20	0.0	14	22	0.0	20	33	0.0	27	44	0.0	26
795	3.4	23	39	0.7	11	19	0.0	12	21	0.0	14	23	0.0	20	34	0.0	27	45	0.0	27
768	3.5	23	39	0.7	11	20	0.0	12	21	0.0	14	23	0.0	20	35	0.0	27	46	0.0	28
743	3.6	22	39	0.7	11	20	0.0	12	22	0.0	14	24	0.0	20	36	0.0	27	48	0.0	28
719	3.7	22	39	0.7	11	21	0.0	12	23	0.0	14	25	0.0	20	37	0.0	27	49	0.0	29
696	3.8	21	39	0.7	11	21	0.0	12	23	0.0	14	25	0.0	20	38	0.0	27	50	0.0	30
674	3.9	20	39	0.7	11	22	0.0	12	24	0.0	14	26	0.0	20	39	0.0	27	52	0.0	31
653	4.0	20	39	0.7	11	22	0.0	12	24	0.0	14	27	0.0	20	40	0.0	27	53	0.0	31
633	4.1	20	39	0.7	11	23	0.0	12	25	0.0	14	27	0.0	20	41	0.0	27	54	0.0	32
614	4.2	19	39	0.7	11	23	0.0	12	26	0.0	14	28	0.0	20	42	0.0	27	55	0.0	33
596	4.3	19	39	0.7	11	24	0.0	12	26	0.0	14	29	0.0	20	43	0.0	27	57	0.0	34
579	4.4	18	39	0.7	11	24	0.0	12	27	0.0	14	29	0.0	20	44	0.0	27	58	0.0	35
562	4.5	18	39	0.7	11	25	0.0	12	27	0.0	14	30	0.0	20	45	0.0	27	59	0.0	35
546	4.6	17	39	0.7	11	26	0.0	12	28	0.0	14	31	0.0	20	46	0.0	27	61	0.0	36
531	4.7	17	39	0.7	11	26	0.0	12	29	0.0	14	31	0.0	20	47	0.0	27	62	0.0	37
516	4.8	17	39	0.7	11	27	0.0	12	29	0.0	14	32	0.0	20	48	0.0	27	63	0.0	38
501	4.9	16	39	0.8	11	27	0.0	12	30	0.0	14	33	0.0	20	49	0.0	27	65	0.0	38
488	5.0	16	39	0.8	11	28	0.0	12	30	0.0	14	33	0.0	20	50	0.0	27	66	0.0	39
474	5.1	16	39	0.8	11	28	0.0	12	31	0.0	14	34	0.0	20	51	0.0	27	67	0.0	40
461	5.2	15	39	0.8	11	29	0.0	12	32	0.0	14	35	0.0	20	52	0.0	27	69	0.0	41
449	5.3	15	39	0.8	11	29	0.0	12	32	0.0	14	35	0.0	20	53	0.0	27	70	0.0	42
436	5.4	15	39	0.8	11	30	0.0	12	33	0.0	14	36	0.0	20	54	0.0	27	71	0.0	42
425	5.5	15	39	0.8	11	30	0.0	12	33	0.0	14	36	0.0	20	54	0.0	27	72	0.0	43
413	5.6	14	39	0.8	11	31	0.0	12	34	0.0	14	37	0.0	20	55	0.0	27	74	0.0	44
402	5.7	14	39	0.8	11	32	0.0	12	35	0.0	14	38	0.0	20	56	0.0	27	75	0.0	45
391	5.8	14	39	0.8	11	32	0.0	12	35	0.0	14	38	0.0	20	57	0.0	27	76	0.0	45
380	5.9	14	39	0.8	11	33	0.0	12	36	0.0	14	39	0.0	20	58	0.0	27	78	0.0	46
370	6.0	13	39	0.8	11	33	0.0	12	36	0.0	14	40	0.0	20	59	0.0	27	79	0.0	47
360	6.1	13	39	0.8	11	34	0.0	12	37	0.0	14	40	0.0	20	60	0.0	27	80	0.0	48
350	6.2	13	39	0.9	13	39	0.6	12	38	0.0	14	42	0.0	20	62	0.0	27	83	0.0	49
341	6.3	13	39	0.9	13	39	0.6	12	38	0.0	14	42	0.0	20	62	0.0	27	83	0.0	49
331	6.4	13	39	0.9	13	39	0.6	12	39	0.0	14	43	0.0	20	63	0.0	27	84	0.0	50
322	6.5	12	39	0.9	12	39	0.6	12	39	0.6	14	43	0.0	20	64	0.0	27	86	0.0	51
313	6.6	12	39	0.9	12	40	0.6	12	40	0.0	14	44	0.0	20	65	0.0	27	87	0.0	52
305	6.7	12	39	0.9	12	41	0.6	12	41	0.0	14	44	0.0	20	66	0.0	27	88	0.0	52
296	6.8	12	39	0.9	12	41	0.6	12	41	0.0	14	45	0.0	20	67	0.0	27	90	0.0	53
288	6.9	12	40	0.9	12	42	0.6	12	42	0.0	14	46	0.0	20	68	0.0	27	91	0.0	54
280	7.0	12	41	0.9	12	42	0.6	12	42	0.0	14	46	0.0	20	69	0.0	27	92	0.0	55
271	7.1	12	41	0.9	12	43	0.6	12	43	0.0	14	47	0.0	20	70	0.0	27	93	0.0	55
263	7.2	12	42	1.0	13	44	0.7	12	44	0.0	14	48	0.0	20	71	0.0	27	95	0.0	56
255	7.3	12	43	1.0	13	45	0.7	12	44	0.0	14	48	0.0	20	72	0.0	27	96	0.0	57
247	7.4	12	44	1.0	13	46	0.7	12	45	0.0	14	49	0.0	20	73	0.0	27	97	0.0	58
238	7.5	12	44	1.0	13	46	0.7	12	45	0.0	14	50	0.0	20	74	0.0	27	99	0.0	59
230	7.6	12	45	1.0	13	47	0.7	12	46	0.0	14	50	0.0	20	75	0.0	27	100	0.0	59
221	7.7	12	45	1.0	13	47	0.7	12	47	0.0	14	51	0.0	20	76	0.0	27	101	0.0	60
211	7.8	12	46	1.0	13	48	0.7	12	47	0.0	14	52	0.0	20	77	0.0	27	103	0.0	61
199	7.9	12	47	1.1	13	49	0.8	12	48	0.0	14	52	0.0	20	78	0.0	28	110	0.6	62
176	8.0	12	48	1.1	13	50	0.8	12	48	0.0	14	53	0.0	20	79	0.0	28	111	0.6	62

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.



DESIGN VELOCITY -90		DESIGN FACTORS FOR A DESIGN SPEED OF 90 km/h (RURAL) USING E = 8% MAX.																		
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						WIDTH+21.6 m						INTERCHANGE RAMPS						
		1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		2 @ 3.6 m		3 @ 3.6 m		4.8 m		5.4 m				
RADIUS (m)	E (%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	
3000	NC	0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0
2186	2.0	12	12	0.0	13	13	0.0	15	0.0	16	16	0.0	23	23	0.0	31	31	0.0	18	19
2074	2.1	12	13	0.0	13	14	0.0	15	0.0	16	17	0.0	23	25	0.0	31	33	0.0	18	19
1972	2.2	12	13	0.0	13	15	0.0	15	0.0	16	17	0.0	23	26	0.0	31	34	0.0	18	20
1880	2.3	12	14	0.0	13	15	0.0	15	0.0	16	18	0.0	23	27	0.0	31	36	0.0	18	21
1794	2.4	12	14	0.0	13	16	0.0	15	0.0	16	19	0.0	23	28	0.0	31	37	0.0	18	22
1716	2.5	12	15	0.0	13	16	0.0	15	0.0	16	20	0.0	23	29	0.0	31	39	0.0	18	23
1644	2.6	12	15	0.0	13	17	0.0	15	0.0	16	20	0.0	23	30	0.0	31	40	0.0	18	24
1514	2.8	12	17	0.0	13	18	0.0	15	0.0	16	22	0.0	23	33	0.0	31	43	0.0	18	25
1456	2.9	12	17	0.0	13	19	0.0	15	0.0	16	23	0.0	23	34	0.0	31	45	0.0	18	26
1402	3.0	12	18	0.0	13	20	0.0	15	0.0	16	23	0.0	23	35	0.0	31	46	0.0	18	27
1352	3.1	12	18	0.0	13	20	0.0	15	0.0	16	24	0.0	23	36	0.0	31	48	0.0	18	28
1303	3.2	12	19	0.0	13	21	0.0	15	0.0	16	25	0.0	23	37	0.0	31	50	0.0	18	29
1258	3.3	12	19	0.0	13	22	0.0	15	0.0	16	26	0.0	23	38	0.0	31	51	0.0	18	30
1216	3.4	12	20	0.0	13	22	0.0	15	0.0	16	27	0.0	23	40	0.0	31	53	0.0	18	31
1176	3.5	12	21	0.0	13	23	0.0	15	0.0	16	27	0.0	23	41	0.0	31	54	0.0	18	32
1138	3.6	12	21	0.0	13	23	0.0	15	0.0	16	28	0.0	23	42	0.0	31	56	0.0	18	32
1102	3.7	12	22	0.0	13	24	0.0	15	0.0	16	29	0.0	23	43	0.0	31	57	0.0	18	33
1088	3.8	12	22	0.0	13	25	0.0	15	0.0	16	30	0.0	23	44	0.0	31	59	0.0	18	34
1036	3.9	12	23	0.0	13	25	0.0	15	0.0	16	30	0.0	23	45	0.0	31	60	0.0	18	35
1005	4.0	12	23	0.0	13	26	0.0	15	0.0	16	31	0.0	23	46	0.0	31	62	0.0	18	36
976	4.1	12	24	0.0	13	27	0.0	15	0.0	16	32	0.0	23	48	0.0	31	63	0.0	18	37
948	4.2	12	25	0.0	13	27	0.0	15	0.0	16	33	0.0	23	49	0.0	31	65	0.0	18	38
921	4.3	12	25	0.0	13	28	0.0	15	0.0	16	33	0.0	23	50	0.0	31	66	0.0	18	39
896	4.4	12	26	0.0	13	29	0.0	15	0.0	16	34	0.0	23	51	0.0	31	68	0.0	18	40
871	4.5	12	27	0.0	13	29	0.0	15	0.0	16	35	0.0	23	52	0.0	31	69	0.0	18	40
850	4.6	12	27	0.0	13	30	0.0	15	0.0	16	36	0.0	23	53	0.0	31	71	0.0	18	41
848	4.6	22	50	0.7	13	30	0.0	15	0.0	16	36	0.0	23	53	0.0	31	71	0.0	18	41
826	4.7	22	50	0.7	13	30	0.0	15	0.0	16	36	0.0	23	54	0.0	31	72	0.0	18	42
804	4.8	21	50	0.7	13	31	0.0	15	0.0	16	37	0.0	23	56	0.0	31	74	0.0	18	43
783	4.9	21	50	0.7	13	32	0.0	15	0.0	16	38	0.0	23	57	0.0	31	76	0.0	18	44
763	5.0	20	50	0.7	13	32	0.0	15	0.0	16	39	0.0	23	58	0.0	31	77	0.0	18	45
744	5.1	20	50	0.7	13	33	0.0	15	0.0	16	40	0.0	23	59	0.0	31	79	0.0	18	46
725	5.2	20	50	0.7	13	34	0.0	15	0.0	16	40	0.0	23	60	0.0	31	80	0.0	18	47
707	5.3	19	50	0.8	13	34	0.0	15	0.0	16	41	0.0	23	61	0.0	31	82	0.0	18	48
690	5.4	19	50	0.8	13	35	0.0	15	0.0	16	42	0.0	23	63	0.0	31	83	0.0	18	48
673	5.5	19	50	0.8	13	36	0.0	15	0.0	16	43	0.0	23	64	0.0	31	85	0.0	18	49
657	5.6	18	50	0.8	13	36	0.0	15	0.0	16	43	0.0	23	65	0.0	31	86	0.0	18	50
641	5.7	18	50	0.8	13	37	0.0	15	0.0	16	44	0.0	23	66	0.0	31	88	0.0	18	51
625	5.8	18	50	0.8	13	38	0.0	15	0.0	16	45	0.0	23	67	0.0	31	89	0.0	18	52
611	5.9	17	50	0.8	13	38	0.0	15	0.0	16	46	0.0	23	68	0.0	31	91	0.0	18	53
596	6.0	17	50	0.8	13	39	0.0	15	0.0	16	46	0.0	23	69	0.0	31	92	0.0	18	54
582	6.1	17	50	0.8	13	39	0.0	15	0.0	16	47	0.0	23	71	0.0	31	94	0.0	18	55
568	6.2	17	50	0.8	13	40	0.0	15	0.0	16	48	0.0	23	72	0.0	31	95	0.0	18	56
554	6.3	16	50	0.8	13	41	0.0	15	0.0	16	49	0.0	23	73	0.0	31	97	0.0	18	56
541	6.4	16	50	0.8	13	41	0.0	15	0.0	16	50	0.0	23	74	0.0	31	99	0.0	18	57
515	6.6	16	50	0.8	13	43	0.0	15	0.0	16	51	0.0	23	76	0.0	31	102	0.0	18	59
503	6.7	15	50	0.8	13	43	0.0	15	0.0	16	52	0.0	23	77	0.0	31	103	0.0	18	60
490	6.8	15	50	0.8	13	44	0.0	15	0.0	16	53	0.0	23	79	0.0	31	105	0.0	18	61
478	6.9	15	50	0.9	15	50	0.6	15	0.0	16	53	0.0	23	80	0.0	31	106	0.0	18	62
465	7.0	15	50	0.9	15	50	0.6	15	0.0	16	54	0.0	23	81	0.0	31	108	0.0	18	63
453	7.1	15	50	0.9	15	50	0.6	15	0.0	16	55	0.0	23	82	0.0	31	109	0.0	18	64
441	7.2	14	50	0.9	15	51	0.6	15	0.0	16	56	0.0	23	83	0.0	31	111	0.0	18	64
428	7.3	14	50	0.9	15	52	0.6	15	0.0	16	56	0.0	23	84	0.0	31	112	0.0	18	65
416	7.4	14	50	0.9	15	52	0.6	15	0.0	16	57	0.0	23	86	0.0	31	114	0.0	18	66
403	7.5	14	51	0.9	15	53	0.6	15	0.0	16	58	0.0	23	87	0.0	31	115	0.0	18	67
390	7.6	14	51	0.9	15	54	0.6	15	0.0	16	59	0.0	23	88	0.0	31	117	0.0	18	68
376	7.7	14	52	0.9	15	55	0.6	15	0.0	16	59	0.0	23	89	0.0	31	118	0.0	18	69
360	7.8	14	53	0.9	15	55	0.6	15	0.0	16	60	0.0	23	90	0.0	31	120	0.0	18	70
342	7.9	14	54	1.0	15	57	0.7	15	0.0	16	61	0.0	23	91	0.0	31	122	0.0	18	71
304	8.0	14	55	1.0	15	58	0.7	15	0.0	16	62	0.0	23	92	0.0	31	123	0.0	18	72

NOTE: CR, LS & w VALUES IN METERS. LISTED RADIUS IS THE MINIMUM ALLOWABLE RADIUS FOR THE CORRESPONDING E, CR, LS, AND w VALUES.

DESIGN FACTORS FOR A DESIGN SPEED OF 100 km/h (RURAL) USING E = 8% MAX.		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)												INTERCHANGE RAMPS												
		WIDTH= 5.4 m			WIDTH=6.0 m			WIDTH=6.6 m			WIDTH=7.2 m			WIDTH=14.4 m			WIDTH=21.6 m			WIDTH						
		1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		2 @ 3.6 m		3 @ 3.6 m		4.8 m		5.4 m		CR		LS		CR		LS		
RADIUS (m) (E (%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS
	5000	NC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2677	2.0	13	0.0	14	0.0	15	0.0	17	0.0	17	0.0	18	0.0	25	0.0	33	0.0	33	0.0	20	20	20	21	21	21	21
2541	2.1	13	0.0	14	0.0	15	0.0	16	0.0	17	0.0	18	0.0	25	0.0	26	0.0	33	0.0	35	0.0	20	21	21	21	22
2417	2.2	13	0.0	14	0.0	15	0.0	17	0.0	18	0.0	19	0.0	25	0.0	27	0.0	33	0.0	36	0.0	20	22	21	21	23
2304	2.3	13	0.0	14	0.0	15	0.0	18	0.0	19	0.0	20	0.0	25	0.0	29	0.0	33	0.0	38	0.0	20	23	21	24	24
2200	2.4	13	0.0	14	0.0	15	0.0	17	0.0	18	0.0	19	0.0	25	0.0	30	0.0	33	0.0	40	0.0	20	24	21	25	25
2105	2.5	13	0.0	14	0.0	15	0.0	17	0.0	19	0.0	21	0.0	25	0.0	31	0.0	33	0.0	41	0.0	20	24	21	26	26
2017	2.6	13	0.0	14	0.0	15	0.0	17	0.0	21	0.0	22	0.0	25	0.0	32	0.0	33	0.0	43	0.0	20	25	21	27	27
1935	2.7	13	0.0	14	0.0	15	0.0	17	0.0	23	0.0	23	0.0	25	0.0	34	0.0	33	0.0	45	0.0	20	26	21	28	28
1859	2.8	13	0.0	14	0.0	15	0.0	17	0.0	23	0.0	23	0.0	25	0.0	35	0.0	33	0.0	46	0.0	20	27	21	29	29
1788	2.9	13	0.0	14	0.0	15	0.0	17	0.0	24	0.0	24	0.0	25	0.0	36	0.0	33	0.0	48	0.0	20	28	21	30	30
1722	3.0	13	0.0	14	0.0	15	0.0	17	0.0	24	0.0	25	0.0	25	0.0	37	0.0	33	0.0	50	0.0	20	29	21	31	31
1661	3.1	13	0.0	14	0.0	15	0.0	17	0.0	26	0.0	26	0.0	25	0.0	39	0.0	33	0.0	51	0.0	20	30	21	32	32
1603	3.2	13	0.0	14	0.0	15	0.0	17	0.0	27	0.0	27	0.0	25	0.0	40	0.0	33	0.0	53	0.0	20	31	21	33	33
1548	3.3	13	0.0	14	0.0	15	0.0	17	0.0	27	0.0	27	0.0	25	0.0	41	0.0	33	0.0	54	0.0	20	32	21	34	34
1497	3.4	13	0.0	14	0.0	15	0.0	17	0.0	28	0.0	28	0.0	25	0.0	42	0.0	33	0.0	56	0.0	20	33	21	35	35
1448	3.5	13	0.0	14	0.0	15	0.0	17	0.0	29	0.0	29	0.0	25	0.0	43	0.0	33	0.0	58	0.0	20	34	21	36	36
1402	3.6	13	0.0	14	0.0	15	0.0	17	0.0	29	0.0	30	0.0	25	0.0	45	0.0	33	0.0	59	0.0	20	35	21	37	37
1359	3.7	13	0.0	14	0.0	15	0.0	17	0.0	30	0.0	30	0.0	25	0.0	46	0.0	33	0.0	61	0.0	20	36	21	38	38
1317	3.8	13	0.0	14	0.0	15	0.0	17	0.0	31	0.0	31	0.0	25	0.0	47	0.0	33	0.0	63	0.0	20	37	21	39	39
1278	3.9	13	0.0	14	0.0	15	0.0	17	0.0	32	0.0	32	0.0	25	0.0	48	0.0	33	0.0	64	0.0	20	38	21	40	40
1241	4.0	13	0.0	14	0.0	15	0.0	17	0.0	33	0.0	33	0.0	25	0.0	50	0.0	33	0.0	66	0.0	20	39	21	41	41
1206	4.1	13	0.0	14	0.0	15	0.0	17	0.0	34	0.0	34	0.0	25	0.0	51	0.0	33	0.0	68	0.0	20	40	21	42	42
1172	4.2	13	0.0	14	0.0	15	0.0	17	0.0	35	0.0	35	0.0	25	0.0	52	0.0	33	0.0	70	0.0	20	41	21	43	43
1139	4.3	13	0.0	14	0.0	15	0.0	17	0.0	36	0.0	36	0.0	25	0.0	53	0.0	33	0.0	71	0.0	20	42	21	44	44
1109	4.4	13	0.0	14	0.0	15	0.0	17	0.0	37	0.0	37	0.0	25	0.0	54	0.0	33	0.0	72	0.0	20	43	21	45	45
1079	4.5	13	0.0	14	0.0	15	0.0	17	0.0	38	0.0	38	0.0	25	0.0	56	0.0	33	0.0	74	0.0	20	44	21	46	46
1051	4.6	13	0.0	14	0.0	15	0.0	17	0.0	39	0.0	39	0.0	25	0.0	57	0.0	33	0.0	76	0.0	20	45	21	47	47
1023	4.7	13	0.0	14	0.0	15	0.0	17	0.0	40	0.0	40	0.0	25	0.0	58	0.0	33	0.0	77	0.0	20	46	21	48	48
997	4.8	13	0.0	14	0.0	15	0.0	17	0.0	41	0.0	41	0.0	25	0.0	59	0.0	33	0.0	79	0.0	20	47	21	49	49
972	4.9	13	0.0	14	0.0	15	0.0	17	0.0	42	0.0	42	0.0	25	0.0	61	0.0	33	0.0	81	0.0	20	48	21	50	50
948	5.0	13	0.0	14	0.0	15	0.0	17	0.0	43	0.0	43	0.0	25	0.0	62	0.0	33	0.0	82	0.0	20	48	21	51	51
925	5.1	13	0.0	14	0.0	15	0.0	17	0.0	44	0.0	44	0.0	25	0.0	63	0.0	33	0.0	84	0.0	20	49	21	52	52
902	5.2	13	0.0	14	0.0	15	0.0	17	0.0	45	0.0	45	0.0	25	0.0	64	0.0	33	0.0	86	0.0	20	50	21	53	53
881	5.3	13	0.0	14	0.0	15	0.0	17	0.0	46	0.0	46	0.0	25	0.0	66	0.0	33	0.0	87	0.0	20	51	21	54	54
860	5.4	13	0.0	14	0.0	15	0.0	17	0.0	47	0.0	47	0.0	25	0.0	67	0.0	33	0.0	89	0.0	20	52	21	56	56
851	5.5	13	0.0	14	0.0	15	0.0	17	0.0	48	0.0	48	0.0	25	0.0	68	0.0	33	0.0	90	0.0	20	53	21	57	57
830	5.5	21	56	0.7	14	38	0.0	15	42	0.0	17	45	0.0	25	68	0.0	33	90	0.0	20	53	21	57	57	57	
839	5.5	21	56	0.7	14	38	0.0	15	42	0.0	17	45	0.0	25	68	0.0	33	90	0.0	20	53	21	57	57	57	
820	5.6	20	56	0.8	14	39	0.0	15	42	0.0	17	46	0.0	25	69	0.0	33	92	0.0	20	54	21	58	58	58	
801	5.7	20	56	0.8	14	39	0.0	15	43	0.0	17	47	0.0	25	70	0.0	33	94	0.0	20	55	21	59	59	59	
782	5.8	20	56	0.8	14	40	0.0	15	44	0.0	17	48	0.0	25	72	0.0	33	95	0.0	20	56	21	60	60	60	
765	5.9	19	56	0.8	14	41	0.0	15	45	0.0	17	49	0.0	25	73	0.0	33	97	0.0	20	57	21	61	61	61	
747	6.0	19	56	0.8	14	41	0.0	15	45	0.0	17	50	0.0	25	74	0.0	33	99	0.0	20	58	21	62	62	62	
731	6.1	19	56	0.8	14	42	0.0	15	46	0.0	17	50	0.0	25	75	0.0	33	100	0.0	20	59	21	63	63	63	
714	6.2	19	56	0.8	14	43	0.0	15	47	0.0	17	51	0.0	25	77	0.0	33	102	0.0	20	60	21	64	64	64	
698	6.3	18	56	0.8	14	43	0.0	15	48	0.0	17	52	0.0	25	78	0.0	33	104	0.0	20	61	21	65	65	65	
683	6.4	18	56	0.8	14	44	0.0	15	48	0.0	17	53	0.0	25	79	0.0	33	105	0.0	20	62	21	66	66	66	
667	6.5	18	56	0.8	14	45	0.0	15	49	0.0	17	54	0.0	25	80	0.0	33	107	0.0	20	63	21	67	67	67	
652	6.6	17	56	0.8	14	45	0.0	15	50	0.0	17	54	0.0	25	81	0.0	33	108	0.0	20	64	21	68	68	68	
637	6.7	17	56	0.8	14	46	0.0	15	51	0.0	17	55	0.0	25	83	0.0	33	110	0.0	20	65	21	69	69	69	
622	6.8	17	56	0.8	14	47	0.0	15	51	0.0	17	56	0.0	25	84	0.0	33	112	0.0	20	66	21	70	70	70	
607	6.9	17	56	0.8	14	48	0.0	15	52	0.0	17	57	0.0	25	85	0.0	33	113	0.0	20	67	21	71	71	71	
592	7.0	16	56	0.8	14	48	0.0	15	53	0.0	17	58	0.0	25	86	0.0	33	115	0.0	20	68	21	72	72	72	
577	7.1	16	56	0.8	14	49	0.0	15	54	0.0	17	59	0.0	25	88	0.0	33	117	0.0	20	69	21	73	73	73	
562	7.2	16	56	0.9	16	56	0.6	15	54	0.0	17	59	0.0	25	89	0.0	33	118	0.0	20	70	21	74	74	74	
547	7.3	16	56	0.9	16	56	0.6	15	55	0.0	17	60	0.0	25	90	0.0	33	120	0.0	20	71	21	75	75	75	
532	7.4	16	56	0.9	16	56	0.6	15	56	0.0	17	61	0.0	25	91	0.0	33	122	0.0	20	72	21	76	76	76	
516	7.5	15	5																							



DESIGN VELOCITY -110		DESIGN FACTORS FOR A DESIGN SPEED OF 110 km/h (RURAL) USING E = 8% MAX.																									
		DESIGN SOFTWARE EQUIVALENTS (NUMBER OF LANES AT LANE WIDTH)						WIDTH+21.6 m						WIDTH													
		1 @ 2.7 m		1 @ 3.0 m		1 @ 3.3 m		1 @ 3.6 m		1 @ 3.6 m		2 @ 3.6 m		2 @ 3.6 m		3 @ 3.6 m		4.8 m		5.4 m							
RADIUS (m)	E (%)	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w	CR	LS	w		
5000	NC	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0
3096	2.0	14	14	0.0	15	16	0.0	17	0.0	18	18	0.0	19	0.0	20	0.0	21	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26
2941	2.1	14	14	0.0	15	16	0.0	17	0.0	18	19	0.0	20	0.0	21	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27
2799	2.2	14	15	0.0	15	17	0.0	18	0.0	18	20	0.0	20	0.0	21	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27
2670	2.3	14	16	0.0	15	17	0.0	19	0.0	18	21	0.0	21	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27	0.0	28
2551	2.4	14	16	0.0	15	18	0.0	17	0.0	18	22	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27	0.0	28	0.0	29
2442	2.5	14	17	0.0	15	19	0.0	17	0.0	18	22	0.0	22	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27	0.0	28	0.0	29
2341	2.6	14	18	0.0	15	20	0.0	17	0.0	18	23	0.0	23	0.0	24	0.0	25	0.0	26	0.0	27	0.0	28	0.0	29	0.0	30
2248	2.7	14	18	0.0	15	20	0.0	17	0.0	18	24	0.0	24	0.0	25	0.0	26	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31
2161	2.8	14	19	0.0	15	21	0.0	17	0.0	18	25	0.0	25	0.0	26	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32
2080	2.9	14	20	0.0	15	22	0.0	17	0.0	18	26	0.0	26	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	33
2004	3.0	14	20	0.0	15	22	0.0	17	0.0	18	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	33	0.0	34
1934	3.1	14	21	0.0	15	23	0.0	17	0.0	18	28	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	33	0.0	34	0.0	35
1867	3.2	14	22	0.0	15	24	0.0	17	0.0	18	29	0.0	29	0.0	30	0.0	31	0.0	32	0.0	33	0.0	34	0.0	35	0.0	36
1805	3.3	14	22	0.0	15	25	0.0	17	0.0	18	29	0.0	29	0.0	30	0.0	31	0.0	32	0.0	33	0.0	34	0.0	35	0.0	37
1746	3.4	14	23	0.0	15	25	0.0	17	0.0	18	30	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	38
1691	3.5	14	24	0.0	15	26	0.0	17	0.0	18	31	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	39
1639	3.6	14	24	0.0	15	27	0.0	17	0.0	18	32	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	40
1589	3.7	14	25	0.0	15	28	0.0	17	0.0	18	33	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	41
1542	3.8	14	26	0.0	15	28	0.0	17	0.0	18	34	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	42
1498	3.9	14	26	0.0	15	29	0.0	17	0.0	18	35	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	43
1455	4.0	14	27	0.0	15	30	0.0	17	0.0	18	36	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	44
1415	4.1	14	27	0.0	15	30	0.0	17	0.0	18	36	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	45
1376	4.2	14	28	0.0	15	31	0.0	17	0.0	18	37	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	46
1340	4.3	14	29	0.0	15	32	0.0	17	0.0	18	38	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	47
1305	4.4	14	29	0.0	15	33	0.0	17	0.0	18	39	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	48
1271	4.5	14	30	0.0	15	33	0.0	17	0.0	18	40	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	49
1239	4.6	14	31	0.0	15	34	0.0	17	0.0	18	41	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	50
1208	4.7	14	31	0.0	15	35	0.0	17	0.0	18	42	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	51
1178	4.8	14	32	0.0	15	36	0.0	17	0.0	18	43	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	52
1150	4.9	14	33	0.0	15	36	0.0	17	0.0	18	44	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	53
1123	5.0	14	33	0.0	15	37	0.0	17	0.0	18	44	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	54
1096	5.1	14	34	0.0	15	38	0.0	17	0.0	18	45	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	55
1071	5.2	14	35	0.0	15	39	0.0	17	0.0	18	46	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	56
1047	5.3	14	35	0.0	15	39	0.0	17	0.0	18	47	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	57
1023	5.4	14	36	0.0	15	40	0.0	17	0.0	18	48	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	58
1000	5.5	14	37	0.0	15	41	0.0	17	0.0	18	49	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	59
978	5.6	14	37	0.0	15	41	0.0	17	0.0	18	50	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	60
957	5.7	14	38	0.0	15	42	0.0	17	0.0	18	51	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	61
937	5.8	14	39	0.0	15	43	0.0	17	0.0	18	51	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	62
917	5.9	14	39	0.0	15	44	0.0	17	0.0	18	52	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	63
898	6.0	14	40	0.0	15	44	0.0	17	0.0	18	53	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	64
879	6.1	14	41	0.0	15	45	0.0	17	0.0	18	54	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	65
861	6.2	14	41	0.0	15	46	0.0	17	0.0	18	55	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	66
851	6.3	14	42	0.0	15	47	0.0	17	0.0	18	56	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	67
850	6.3	20	61	0.8	15	47	0.0	17	0.0	18	56	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	68
843	6.3	20	61	0.8	15	47	0.0	17	0.0	18	56	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	69
826	6.4	20	61	0.8	15	47	0.0	17	0.0	18	57	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	70
809	6.5	19	61	0.8	15	48	0.0	17	0.0	18	58	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	71
793	6.6	19	61	0.8	15	49	0.0	17	0.0	18	58	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	72
777	6.7	19	61	0.8	15	50	0.0	17	0.0	18	59	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	73
760	6.8	18	61	0.8	15	50	0.0	17	0.0	18	59	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	74
744	6.9	18	61	0.8	15	51	0.0	17	0.0	18	60	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	75
728	7.0	18	61	0.8	15	52	0.0	17	0.0	18	61	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	76
711	7.1	18	61	0.8	15	52	0.0	17	0.0	18	62	0.0	27	0.0	27	0.0	28	0.0	29	0.0	30	0.0	31	0.0	32	0.0	77
695	7.2	17	61	0.8																							