

REVISED 7/02

$V_1 = 0.0260 \text{ m}^3$   
 $V_2 = 0.0162 \text{ m}^3$   
 $V_3 = 0.0205 \text{ m}^3$   
 $V_4 = 0.0189 \text{ m}^3$

From pictorial view it is seen that:

$$V = V_1 W + 2V_2 (N-1) + V_3 (WN+1) + 2V_4$$

Substituting values of elementary volumes:

$$V = 0.0260W + 0.0324(N-1) + 0.0205(WN+1) + 0.0189$$

V - Indicates total volume of steps in cubic meters.  
 $V_1, V_2, V_3$  &  $V_4$  - Indicate elementary volumes used in computing V.  
 W - Indicates clear width of steps, in meters, between sidewalks.  
 N - Indicates number of steps in installation exclusive of landing.  
 L1 - Indicates length of bars A, in millimeters. L1 = 330N + 200  
 L2 - Indicates length of bars B, in millimeters. L2 = 300W + 225  
 L3 - Indicates length of bars C, in millimeters. L3 = 330N + 450

This item may be precast or cast in place.  
 Concrete to be Class 20 if cast in place, 30 MPa if precast.  
 For other widths the approximate spacing of Bars A in millimeters will be equal to  $2000 \div N$  with a minimum spacing of 150 mm.  
 Reinforcing bars to be used in installations of 6 or more steps.  
 For tabulation of concrete and steel quantities see sheet 2.

Bars A to be equally spaced.  
 For no. of bars see table below.

A landing is to be provided where 12 or more steps are req'd.  
 Minimum size of landing to be  $W + 0.3 \text{ m} \times 1.2 \text{ m}$ .

Elev. prop. or existing walk, yard, etc.

PLAN

SECTION A-A

One Bar B to be placed under each step and two under landing as shown.

Elev. prop. or exist. sidewalk or shoulder.

		NUMBER OF BARS A									
		N+1-5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13-25	
W = 0.9 m	No Steel	4	5	5	6	6	7	7	8		
		5	6	7	7	8	8	9	10		
		6	7	8	9	9	10	11	12		

Handrail is to be provided for steps having four or more risers, and will meet the following conditions:

- On steps less than 1115 mm wide having both sides enclosed, at least one handrail, preferably on the right side descending.
- On steps less than 1115 mm wide having one side open, one handrail on each side.
- On steps less than 1115 mm wide having both sides open, one handrail on each side.
- On steps more than 1115 mm wide but less than 2230 mm wide, one handrail on each side.
- On steps 2230 mm or more wide, one handrail on each side, and one intermediate handrail located approximately midway of the width.

SPECIFICATION REFERENCE
105 504

## STANDARD CONCRETE STEPS FOR 1-1/2 : 1 SLOPE

Sheet 1 of 2

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

601.01

## TABLE OF QUANTITIES

N	W = 0.90 Meters		W = 1.20 Meters		W = 1.50 Meters		INCREMENTS *		N
	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	
	Cu. Meters	Kilograms	Cu. Meters	Kilograms	Cu. Meters	Kilograms	Cu. Meters	Kilograms	
1	0.195		0.240		0.290		0.150		1
2	0.290		0.355		0.425		0.220		2
3	0.385		0.470		0.560		0.285		3
4	0.480		0.585		0.695		0.355		4
5	0.570		0.700		0.830		0.420		5
6	0.665	22	0.815	27	0.965	31	0.485	14	6
7	0.760	28	0.930	33	1.100	38	0.555	17	7
8	0.855	31	1.045	40	1.235	46	0.620	19	8
9	0.950	38	1.160	44	1.370	54	0.690	20	9
10	1.045	42	1.275	52	1.505	59	0.755	23	10
11	1.135	49	1.390	57	1.640	67	0.825	25	11
12	1.230	53	1.505	66	1.775	78	0.895	28	12
13	1.325	62	1.620	75	1.910	89	0.960	44	13
14	1.420	66	1.735	81	2.045	95	1.025	47	14
15	1.515	71	1.850	86	2.180	102	1.095	50	15
16	1.610	75	1.960	92	2.315	108	1.160	53	16
17	1.700	80	2.075	97	2.450	114	1.230	56	17
18	1.795	84	2.190	102	2.590	121	1.295	59	18
19	1.890	88	2.305	108	2.725	127	1.365	63	19
20	1.985	93	2.420	113	2.860	133	1.430	66	20
21	2.080	97	2.535	118	2.995	140	1.500	69	21
22	2.170	102	2.650	124	3.130	146	1.570	72	22
23	2.265	106	2.765	129	3.265	152	1.635	75	23
24	2.360	111	2.880	135	3.400	159	1.700	78	24
25	2.455	115	2.995	140	3.535	165	1.770	81	25

\* Increments to be added for each additional 1.0 m of width.

N - Indicates number of steps exclusive of landing.

W - Indicates width between sidewalls.

For detail drawings and dimensions of steps see sheet 1.

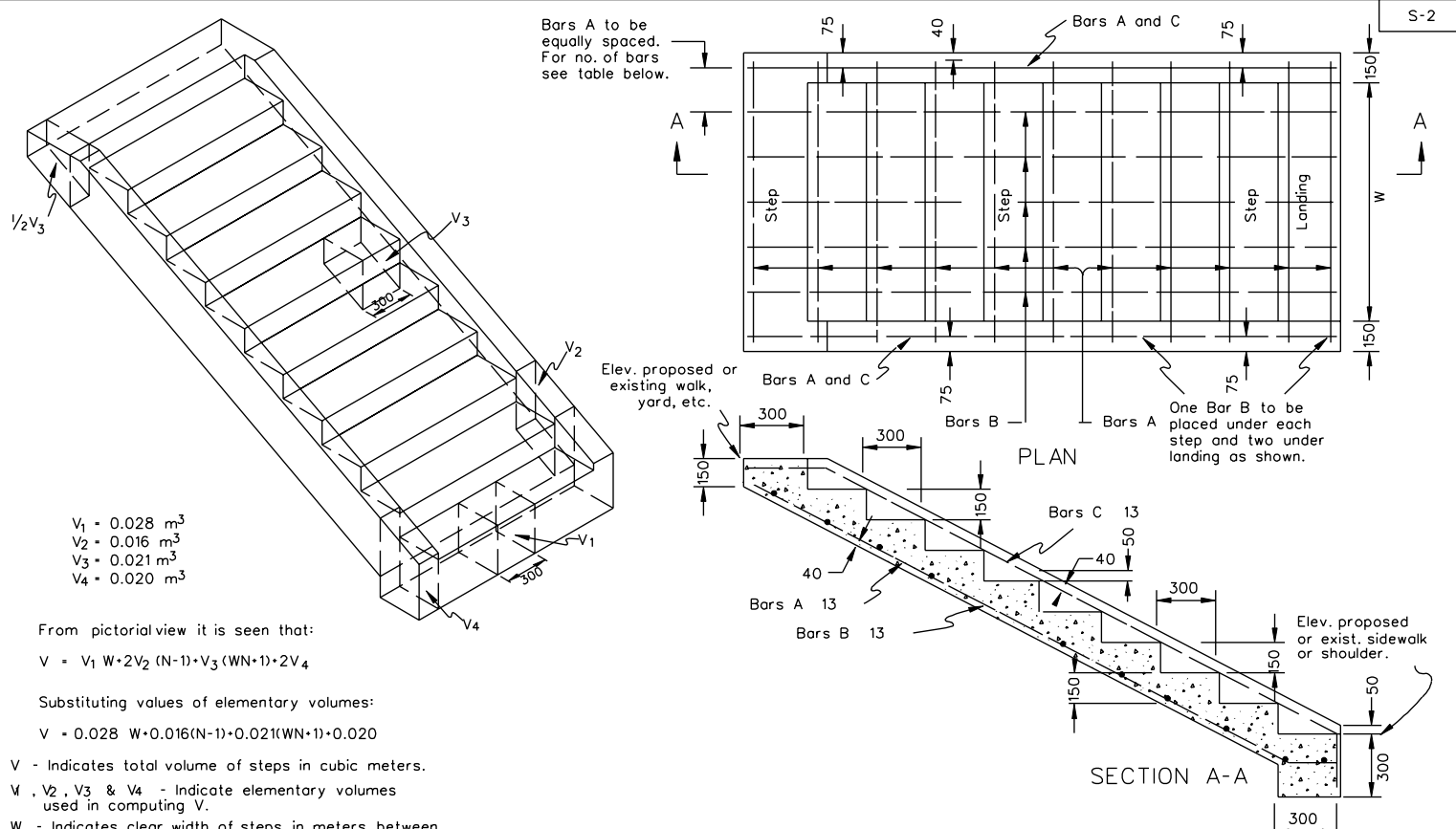
Sheet 2 of 2

## STANDARD CONCRETE STEPS FOR 1 -1/2 : 1 SLOPE

SPECIFICATION  
REFERENCE

105  
504

REVISED 7/02



- V<sub>1</sub> = 0.028 m<sup>3</sup>
- V<sub>2</sub> = 0.016 m<sup>3</sup>
- V<sub>3</sub> = 0.021 m<sup>3</sup>
- V<sub>4</sub> = 0.020 m<sup>3</sup>

From pictorial view it is seen that:

$$V = V_1 W \cdot 2V_2 (N-1) + V_3 (WN+1) + 2V_4$$

Substituting values of elementary volumes:

$$V = 0.028 W + 0.016(N-1) + 0.021(WN+1) + 0.020$$

- V - Indicates total volume of steps in cubic meters.
- W, V<sub>2</sub>, V<sub>3</sub> & V<sub>4</sub> - Indicate elementary volumes used in computing V.
- W - Indicates clear width of steps, in meters, between sidewalls.
- N - Indicates number of steps in installation exclusive of landing.

- L1 - Indicates length of bars A, in mm. L1 = 340 N + 200
- L2 - Indicates length of bars B, in mm. L2 = 305W + 225
- L3 - Indicates length of bars C, in mm. L3 = 340 N + 450

A landing is to be provided where 12 or more steps are required.  
Minimum size of landing to be W + 0.3 m x 1.2 m.

This item may be precast or cast in place.  
Concrete to be Class 20 if cast in place, 30 MPa if precast.  
For other widths the approximate spacing of Bars A in meters will be equal to 2000/N with a minimum spacing of 150 mm.  
Reinforcing bars to be used in installations of 6 or more steps.  
For tabulation of concrete and steel quantities see sheet 2.

		NUMBER OF BARS A								
		N-1-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13-25
W = 0.9 m	No Steel	4	5	5	6	6	7	7	8	
		5	6	7	7	8	8	9	10	
		6	7	8	9	9	10	11	12	

- Handrail is to be provided for steps having four or more risers, and will meet the following conditions:
1. On steps less than 1115 mm wide having both sides enclosed, at least one handrail, preferably on the right side descending.
  2. On steps less than 1115 mm wide having one side open, one handrail on each side.
  3. On steps less than 1115 mm wide having both sides open, one handrail on each side.
  4. On steps more than 1115 mm wide but less than 2230 mm wide, one handrail on each side.
  5. On steps 2230 mm or more wide, one handrail on each side, and one intermediate handrail located approximately midway of the width.

## TABLE OF QUANTITIES

N	W = 0.90 Meters		W = 1.20 Meters		W = 1.50 Meters		INCREMENTS *		N
	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	CONCRETE	REINF. STEEL	
	Cu. Meters	Kilograms	Cu. Meters	Kilograms	Cu. Meters	Kilograms	Cu. Meters	Kilograms	
1	0.210		0.255		0.305		0.160		1
2	0.305		0.375		0.445		0.230		2
3	0.400		0.495		0.585		0.300		3
4	0.495		0.610		0.725		0.370		4
5	0.595		0.730		0.865		0.440		5
6	0.690	23	0.845	27	1.005	32	0.510	14	6
7	0.790	28	0.965	34	1.140	39	0.575	17	7
8	0.885	32	1.080	41	1.280	47	0.645	19	8
9	0.980	39	1.200	45	1.420	55	0.715	22	9
10	1.080	42	1.320	53	1.560	60	0.790	23	10
11	1.175	50	1.435	58	1.700	70	0.860	25	11
12	1.270	54	1.555	67	1.835	80	0.925	28	12
13	1.370	63	1.675	77	1.975	91	0.995	44	13
14	1.465	68	1.790	82	2.115	97	1.065	47	14
15	1.560	72	1.910	88	2.255	103	1.135	52	15
16	1.660	77	2.025	93	2.395	110	1.205	55	16
17	1.755	81	2.145	99	2.535	117	1.275	58	17
18	1.850	86	2.260	104	2.670	123	1.345	61	18
19	1.950	90	2.380	110	2.810	130	1.415	63	19
20	2.045	95	2.500	116	2.950	136	1.485	66	20
21	2.140	99	2.615	121	3.090	142	1.555	71	21
22	2.240	104	2.735	126	3.230	149	1.625	74	22
23	2.335	108	2.850	132	3.370	156	1.695	77	23
24	2.430	113	2.970	137	3.510	162	1.765	80	24
25	2.530	117	3.090	143	3.645	168	1.830	83	25

\* Increments to be added for each additional 1.0 m of width.

N - Indicates number of steps exclusive of landing.

W - Indicates width between sidewalls.

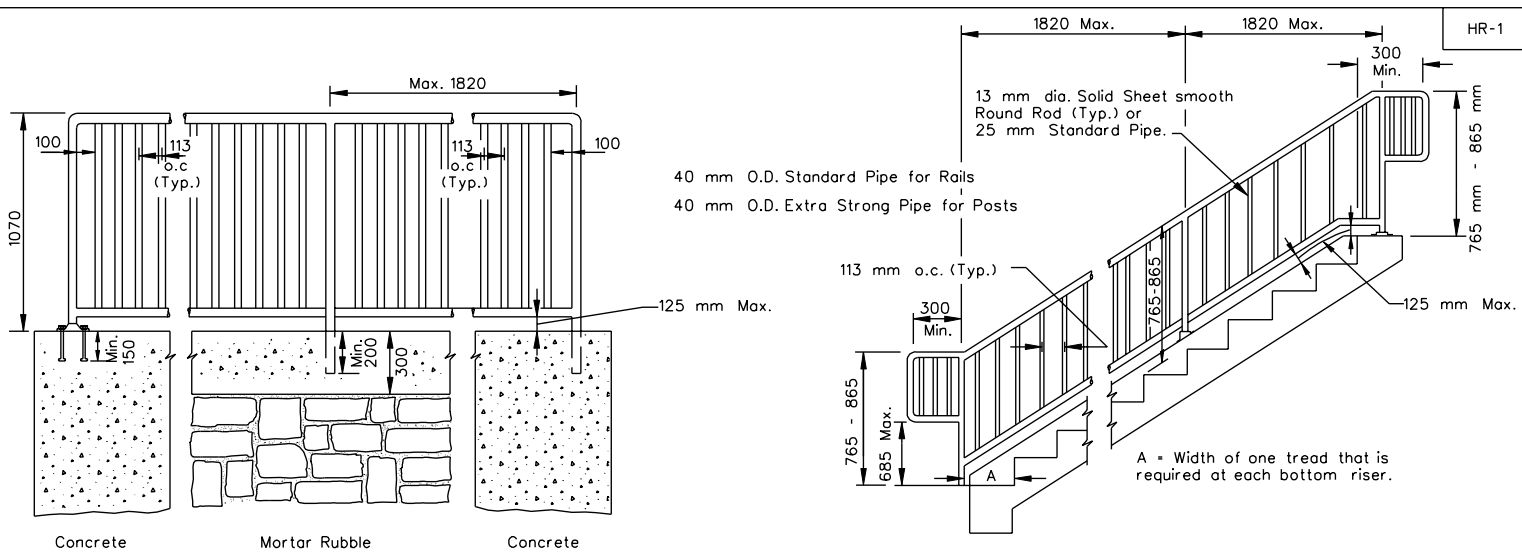
For detail drawings and dimensions of steps see sheet 1.

Sheet 2 of 2

## STANDARD CONCRETE STEPS FOR 2 : 1 SLOPE

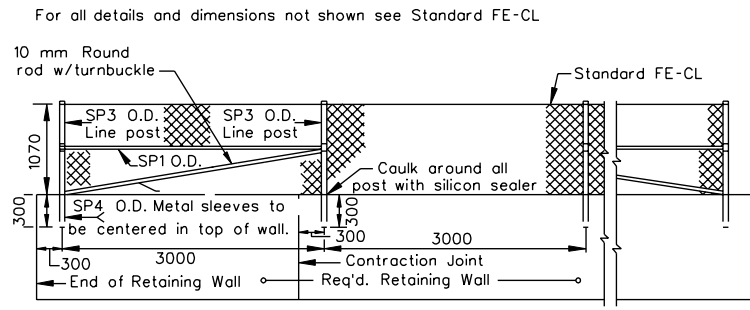
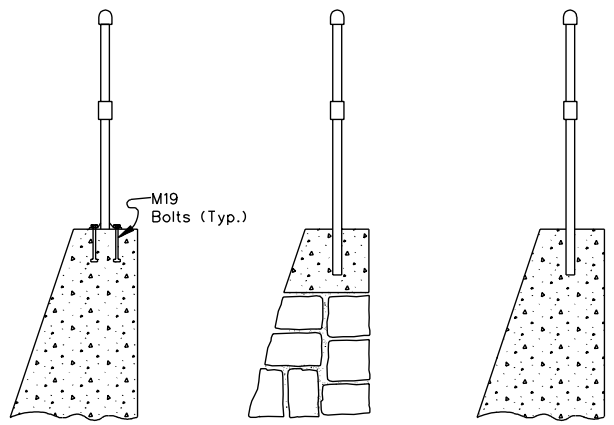
SPECIFICATION  
REFERENCE

105  
504



HAND RAIL (GUARD) INSTALLATION ON WALLS

HAND RAIL INSTALLATION



Notes:  
 This handrail is to be used only as a protection for pedestrians and should not be placed in any location where it might be subject to vehicular impact. For vehicular protection standard guardrail should be used.  
 Handrail to be in accordance with the latest edition of the Virginia Uniform Statewide Building Code.

SPECIFICATION REFERENCE
505

## STANDARD HAND RAIL METHOD OF LOCATING AND ERECTING

VIRGINIA DEPARTMENT OF TRANSPORTATION

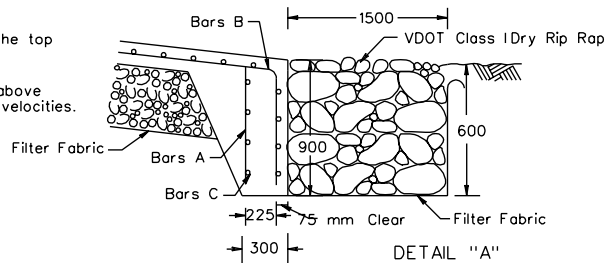
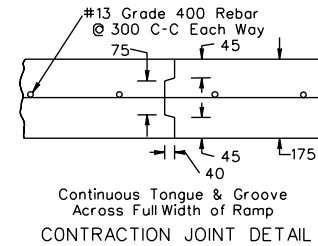
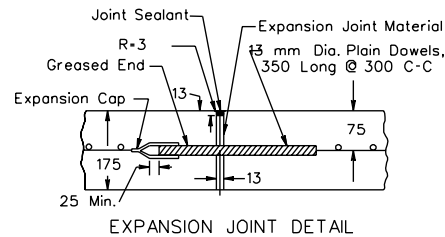
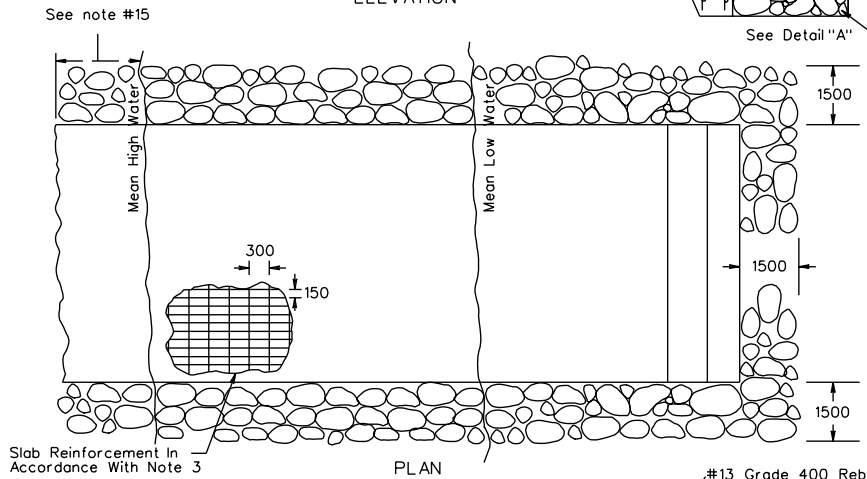
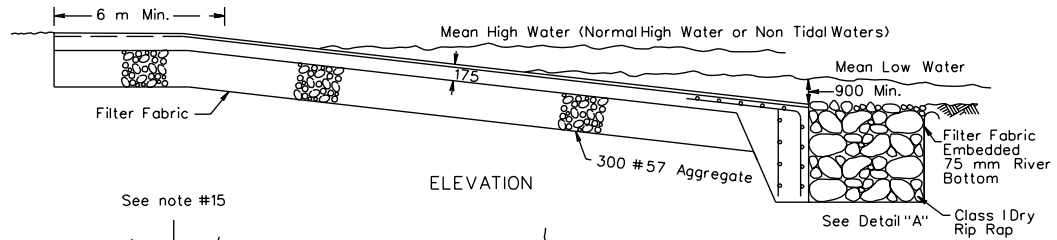
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ON THIS SHEET ARE IN MILLIMETERS

601.05

LR-1

**NOTES**

- The minimum slab width is to be 4.8 m.
- Slab details are to be in accordance with Standard Plan PR-2 except that expansion, contraction, and longitudinal joints may be eliminated unless required by the Engineer.
- Steel fabric slab reinforcement shall consist of members rigidly attached at all joints or points of intersection and shall have an effective weight of not less than 3 kg/m<sup>2</sup>. Longitudinal members shall be of No. 1 gage wire spaced at 150 o-c. Transverse members shall be of No. 4 gage wire spaced at 300 o-c. Alternate grade 60 No. 4 rebars 300 o-c eachway centered in slab.
- Slab is to be constructed on either a straight grade or with vertical curves with a rate of change per foot of less than 2%.
- The gradient of slab is to be 12-15%. Ramps constructed in salt water with the possibility of larger boats using the ramp should be designed using the lower end of this range.
- All reinforcing steel members are to have a minimum of 75 mm concrete cover at edges of slab. Mesh reinforcement is to be placed 50 mm from top of slab.
- Final finish of slab is to be obtained by the use of a steel rake (with tines bent away from the direction of pull) drawn transversely to axis of slab (parallel to water line).
- Portions of slab which will ultimately be below water level are to be protected during pouring, finishing, and curing by the use of cofferdams, cribs, or other methods meeting the approval of the Engineer.
- Class 1 Dry Rip Rap to be in accordance with Road and Bridge Specifications.
- Suitable parking areas for vehicles and trailer are to be provided off of ramp.
- Ramp should be angled downstream in river situations at the discretion of the Engineer.
- On flowing river situations courtesy piers are not desirable, on all other situations a courtesy pier is desirable.
- Launch ramps and parking areas should be free of overhead obstructions, especially electrical wires.
- These facilities should be handicapped accessible to the top of boat ramp and courtesy pier if provided.
- Where wave or tidal action occur, the Rip Rap length above mean high water shall be extended to dissipate water velocities.



SCHEDULE OF REINFORCING STEEL					
Bend to fit grade Bars "B"					
BAR	SIZE	NO.	LENGTH	SPACING C-C	
A	#13	*	600	300	Straight
B	#13	*	1370	300	Bent
C	#13	8	**	225 and as shown	Straight
*No. of bars equals slab width in meter x 0.3					
**Slab width minus 150					

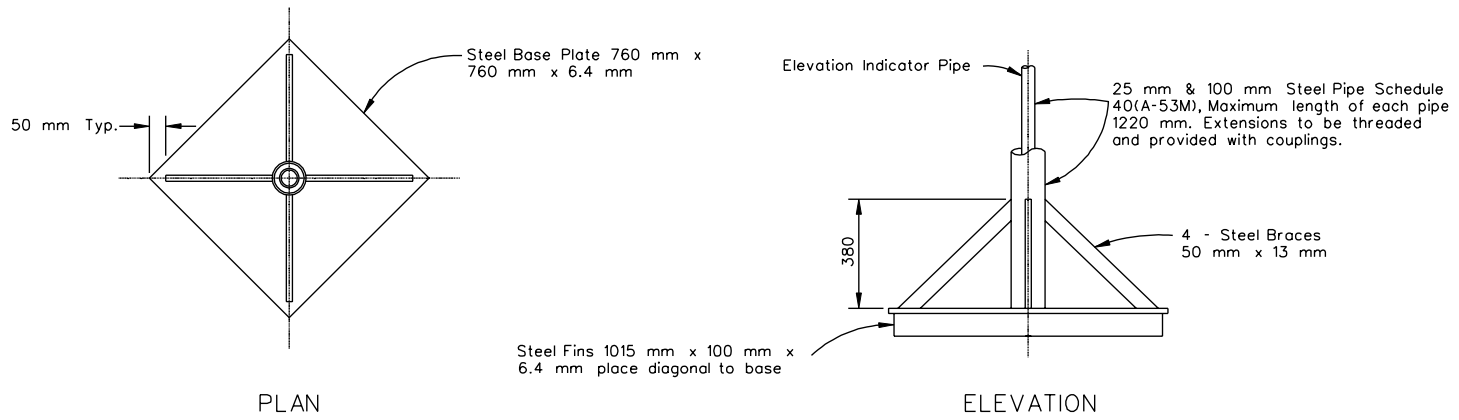
**MINIMUM DESIGN FOR SMALL BOAT LAUNCHING RAMPS AT PUBLIC LANDINGS**

SPECIFICATION REFERENCE

316

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

VIRGINIA DEPARTMENT OF TRANSPORTATION



(Not to Scale)

Note:

Settlement plates are to be placed as shown on plans or as directed by the Engineer.

All connections between base plate, pipes, fins and braces are to be fully welded.

SPECIFICATION REFERENCE
303.10

# SETTLEMENT PLATE

VIRGINIA DEPARTMENT OF TRANSPORTATION

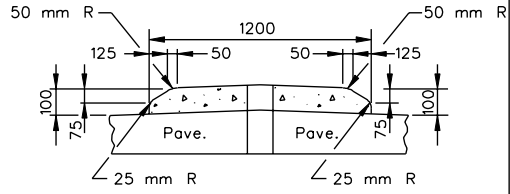
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601.07

SI-1

Note:

☉ of Island is to be perpendicular to ☉ of Major Route regardless of the angle of intersection.



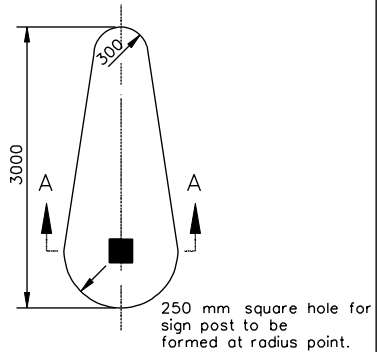
SECTION A-A

Basis of Payment - Each

0.4 m<sup>3</sup> Concrete to be Class 20 if cast in place, 30 MPa if precast.

Note:

Size of island is to be governed by offsets from pavement edges & ☉ as shown on plans.

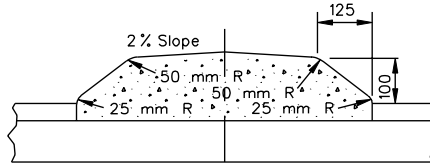


250 mm square hole for sign post to be formed at radius point.

When Sign Island is installed over existing pavement a hole for sign post is to be extended to the subbase.

DETAIL OF STANDARD SIGN ISLAND

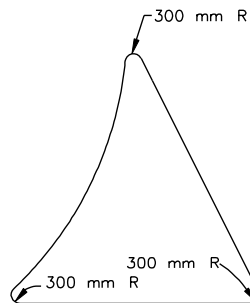
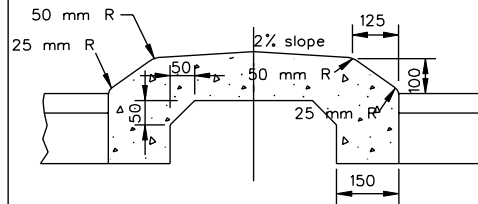
SI-2



Basis of Payment - square meters complete in place exclusive of post and signs

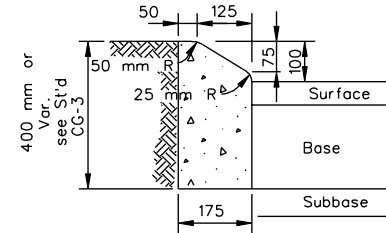
Note:

Size of island is to be governed by offsets from pavement edges & ☉ as shown on plans.



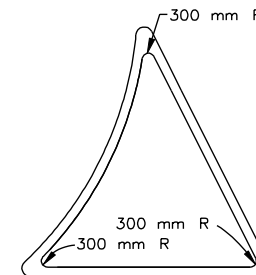
DESIGN OF STANDARD SIGN ISLAND

SI-3



Note:

Size of island is to be governed by offsets from pavement edges & ☉ as shown on plans.



DETAIL OF DIRECTIONAL ISLAND CURB

SPECIFICATION REFERENCE

105  
502

STANDARD PLAN FOR SIGN ISLANDS

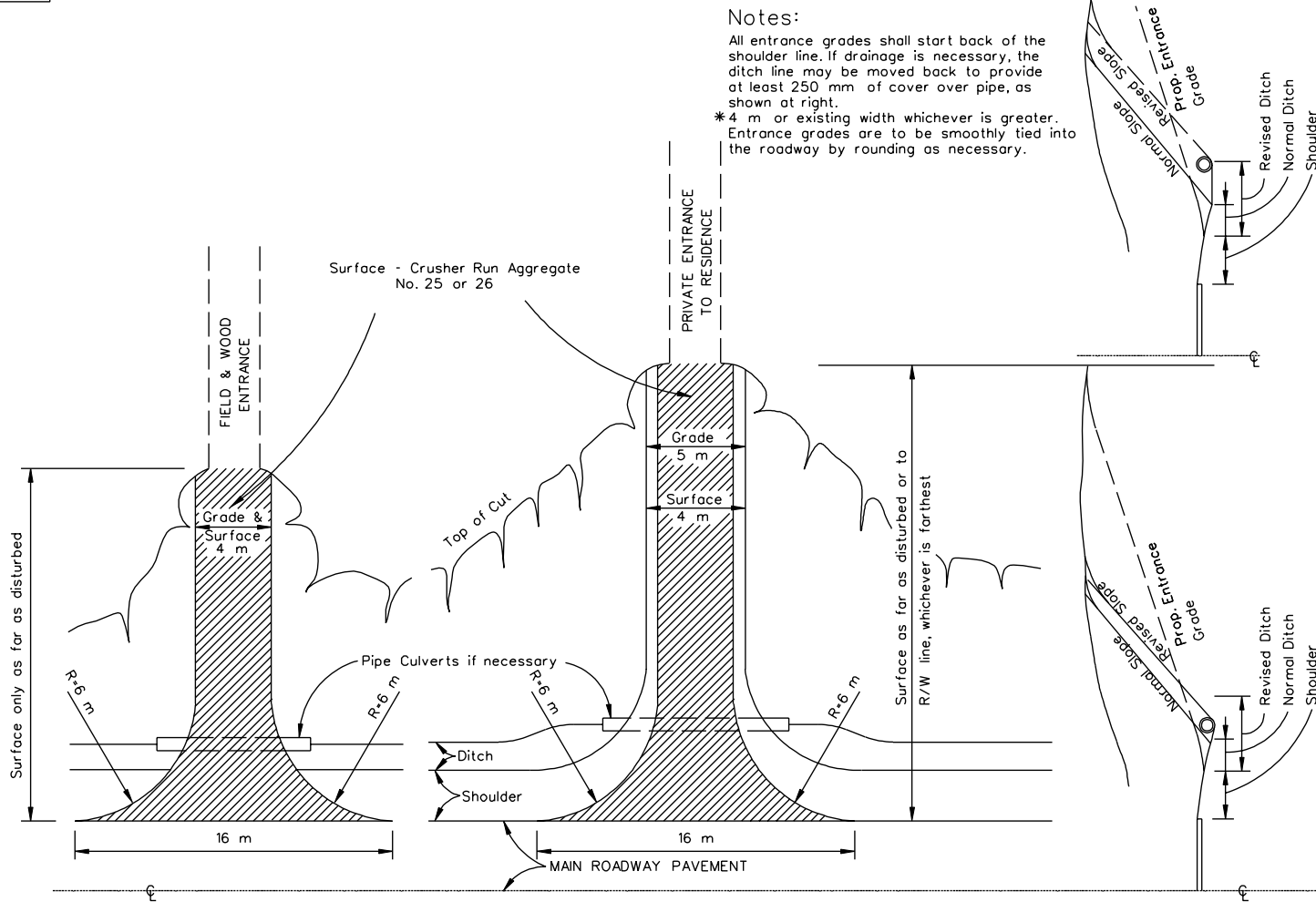
VIRGINIA DEPARTMENT OF TRANSPORTATION

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602.01



PE-1



Notes:  
 All entrance grades shall start back of the shoulder line. If drainage is necessary, the ditch line may be moved back to provide at least 250 mm of cover over pipe, as shown at right.  
 \* 4 m or existing width whichever is greater.  
 Entrance grades are to be smoothly tied into the roadway by rounding as necessary.

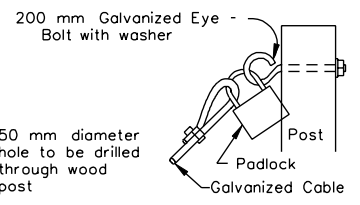
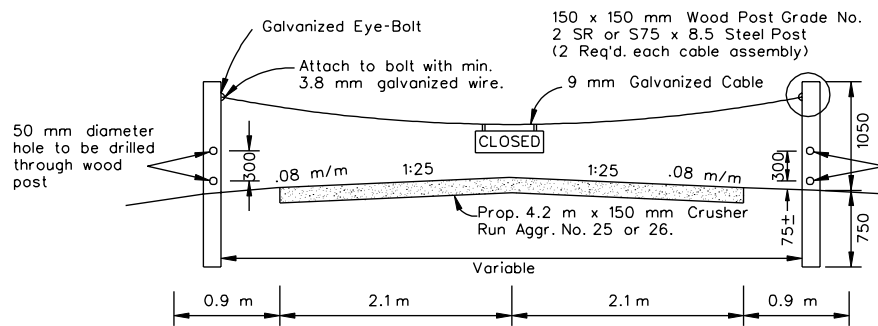
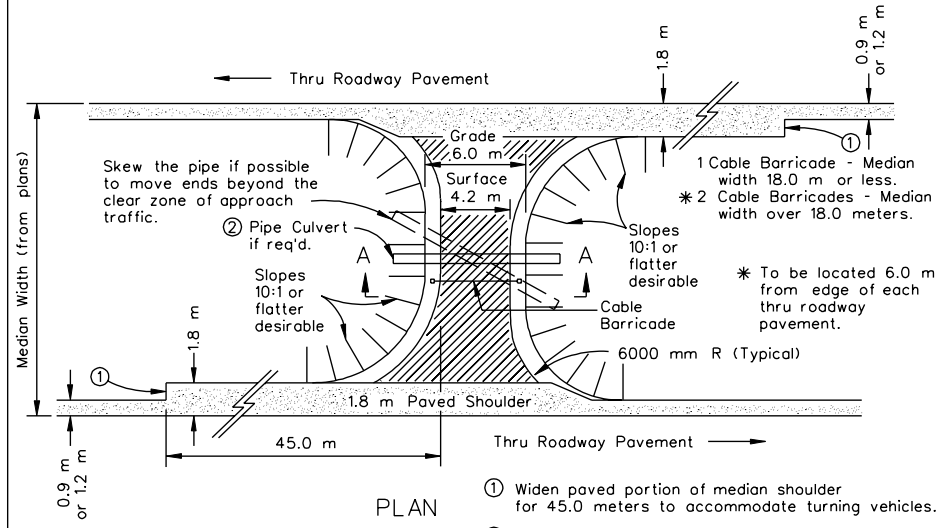
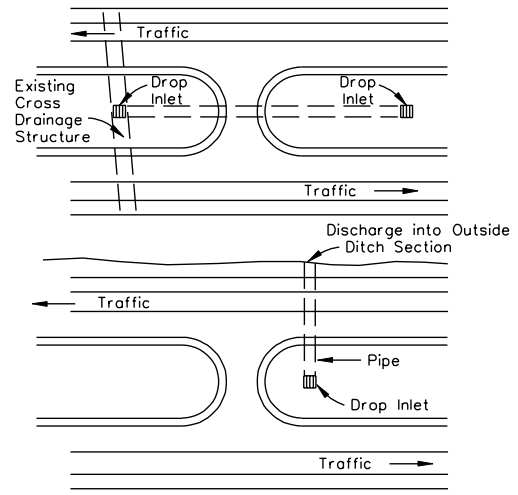
Note:  
 Lengths of culverts shown on road plans for entrances are approximate and shall be adjusted to obtain above roadway widths.

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

STANDARD PRIVATE ENTRANCES

EXAMPLES OF ALTERNATE MEDIAN DRAINAGE

These alternatives could be considered in lieu of a pipe underneath the median crossover.



Padlock to be furnished and installed by State Forces unless otherwise specified. Contractor to temporarily attach cable to Eye-Bolt with minimum 3.8 mm gauge galvanized wire.

Sign • •

- Material: 2 mm Aluminum Alloy 6061 - T6
- Size : 600 mm x 225 mm
- Color Combination : C-1
- Border Width : 12 mm
- Margin Width : 12 mm
- Corner Radii: 40 mm
- Letter Type : L-1 or L-2
- Letter Height and Series : 100 mm - D
- • • In accordance with V.D.O.T. "Manual of Uniform Traffic Control Devices for Streets and Highways".
- • Message, both sides if one cable barricade is used.
- • Message, one side if two cable barricades are used.

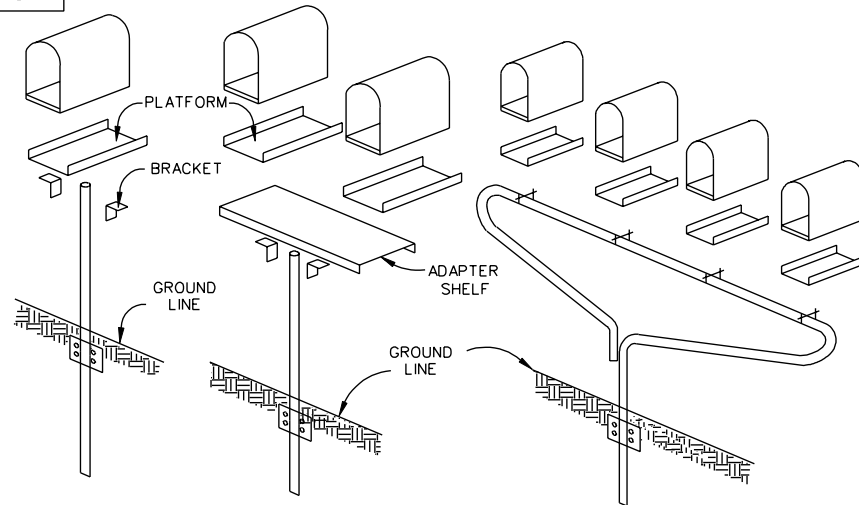
SPECIFICATION REFERENCE
505

STANDARD MAINTENANCE CROSSOVER FOR USE ON FREEWAYS

VIRGINIA DEPARTMENT OF TRANSPORTATION

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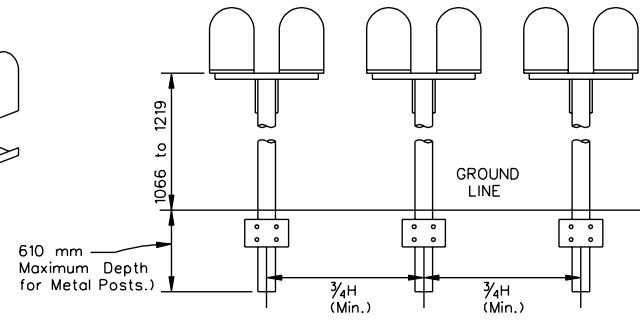
RFD-1



SINGLE

DOUBLE

MULTIPLE  
(Max. 4 Boxes)



GROUPED

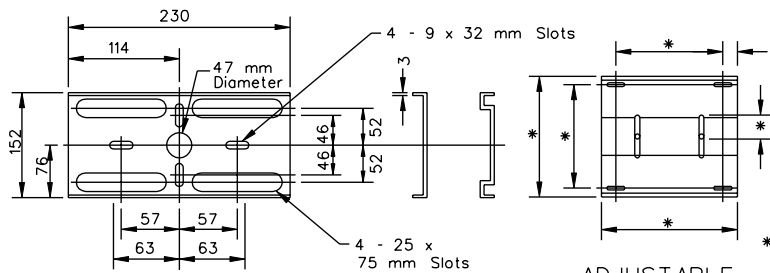
General Notes:

Mailboxes shall be of light sheet metal or plastic construction conforming to the requirements of the U.S. Postal Service.

Mailbox supports shall not be set in concrete unless the support design has been shown to be safe by crash tests when so installed.

Posts may be 100 x 100 mm or 115 mm diameter wood post, 50 mm diameter standard strength steel pipe, or other steel or aluminum post shapes of equal strengths.

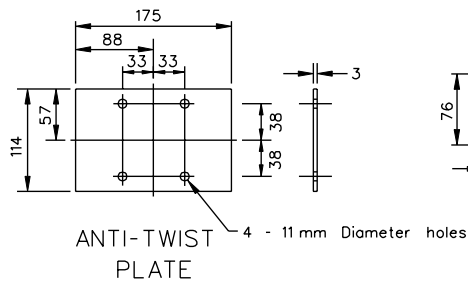
The post-to-box attachment details should be of sufficient strength to prevent the box from separating from the post top if the installation is struck by a vehicle. Hardware shown is suggested only, all guidelines as required by the U.S. Postal Service must be followed.



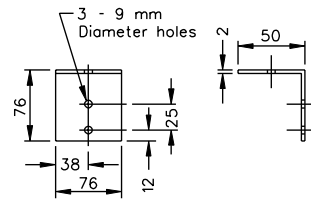
PLATFORM

ADJUSTABLE PLATFORM

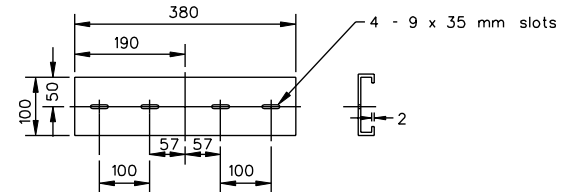
\* Note: (Dimensions vary according to size of Mail box.)



ANTI-TWIST PLATE



BRACKET



ADAPTER SHELF

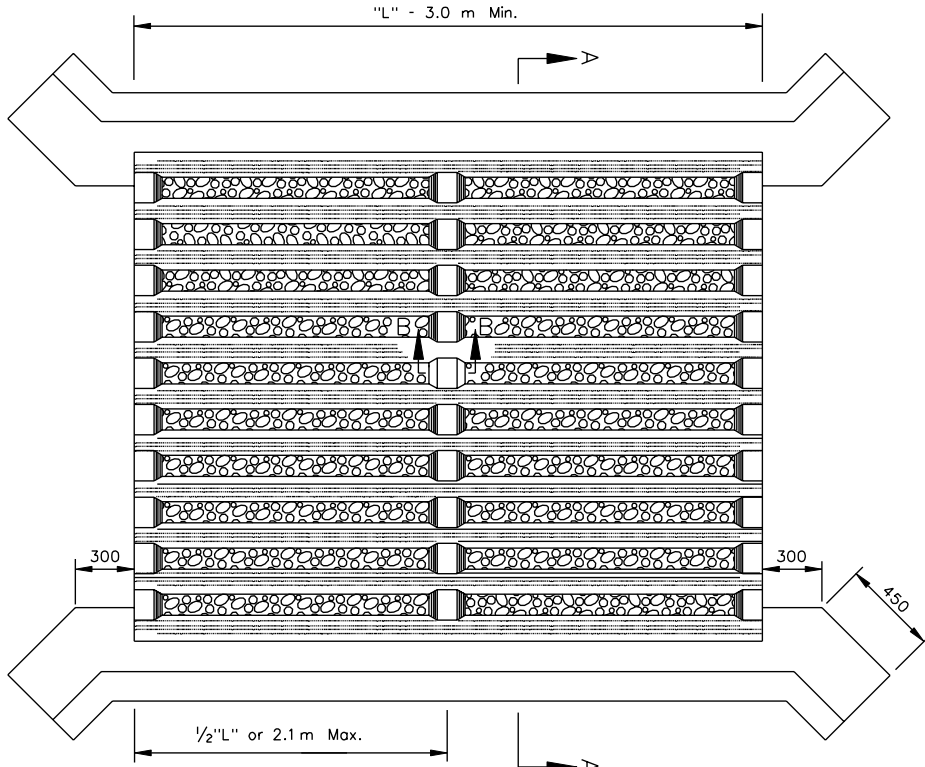
STANDARD MAIL BOX

SPECIFICATION REFERENCE

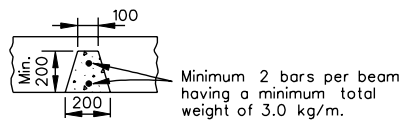
NONE

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

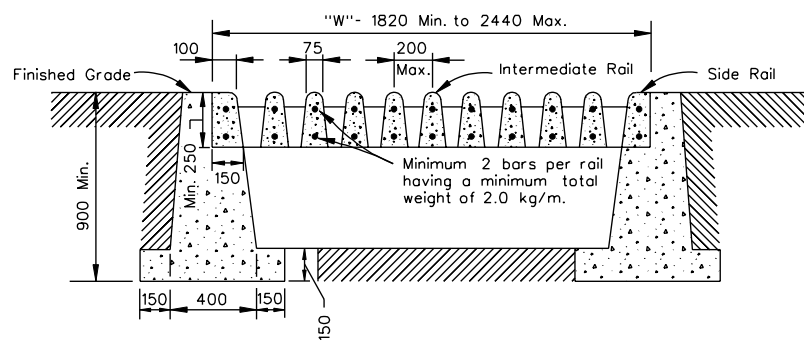
VIRGINIA DEPARTMENT OF TRANSPORTATION



PLAN VIEW



SECTION B-B  
TYPICAL BEAM SECTION



SECTION A-A

Notes

Any manufacturers fabrication meeting or exceeding the minimum design requirements detailed hereon will be acceptable.  
All concrete in precast members to be 30 MPa  
Concrete in footing to be Class 10 or Class 20.  
Length to be as shown on plans.

MINIMUM SECTIONAL AREA OF MEMBERS

- Intermediate Rail — 18,000 mm<sup>2</sup>
- Side Rail — 31,250 mm<sup>2</sup>
- Beam — 30,000 mm<sup>2</sup>

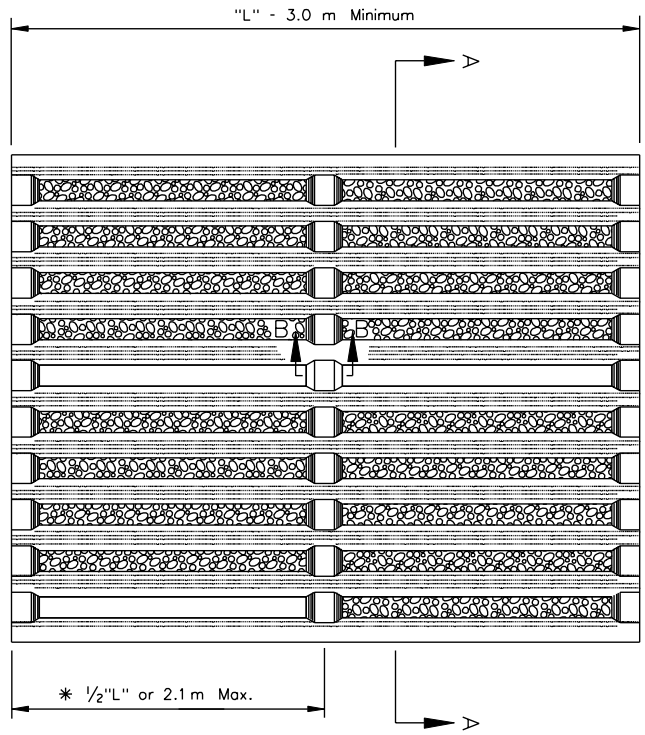
SPECIFICATION REFERENCE
302

PRECAST CONCRETE CATTLE GUARD

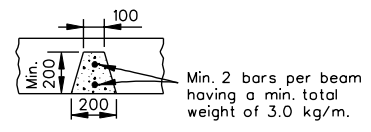
VIRGINIA DEPARTMENT OF TRANSPORTATION

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

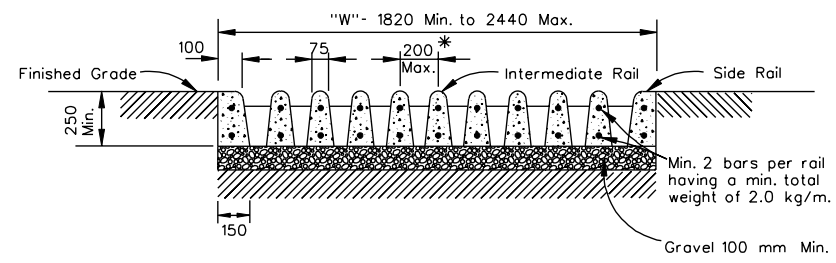
G-3A



PLAN VIEW



SECTION B-B  
TYPICAL BEAM SECTION



SECTION A-A

Notes

- Any manufacturer's fabrication meeting or exceeding the minimum design requirements detailed hereon will be acceptable.
- All concrete in precast members to be 30 MPa.
- Length to be as shown on plans.
- \* A rail spacing of 240 mm would be allowed provided the space of beams does not exceed 910 mm.

MINIMUM SECTIONAL AREA OF MEMBERS

- Intermediate Rail — 18,000 mm<sup>2</sup>
- Side Rail — 31,250 mm<sup>2</sup>
- Beam — 30,000 mm<sup>2</sup>

PRECAST CONCRETE CATTLE GUARD

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE
302

REVISED 5/99

NG-1

NOTES:

Box to be constructed of A36M sheet steel 3.2 mm Min. thickness. When welding to frame use 3 mm fillet welds. All frame work is to be A36M steel angle L 50 x 50 x 6.4. All frame welds are to be 5 mm fillet or butt welded accordingly. Metalscreen shall have openings of 10 to 25 mm<sup>2</sup> and be spot welded to inside of the box over vent openings.

△ The hook shall be welded to the center of the top.

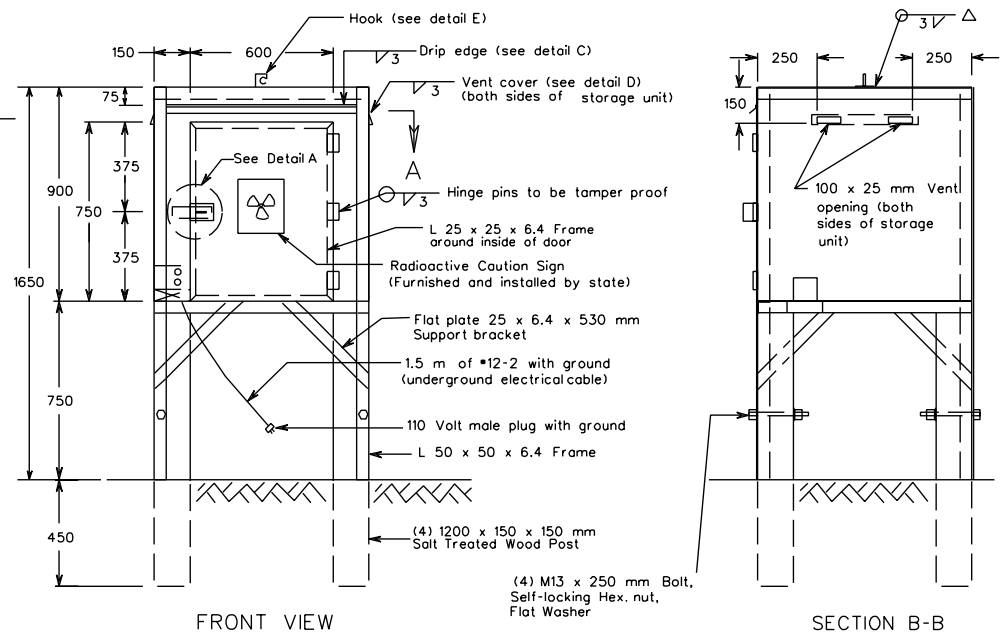
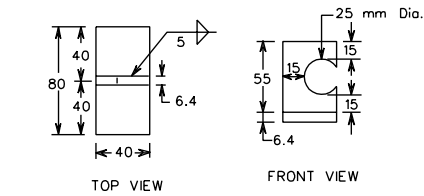
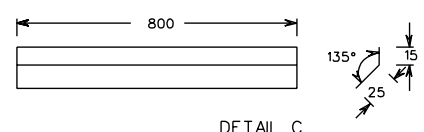
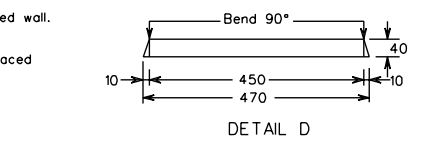
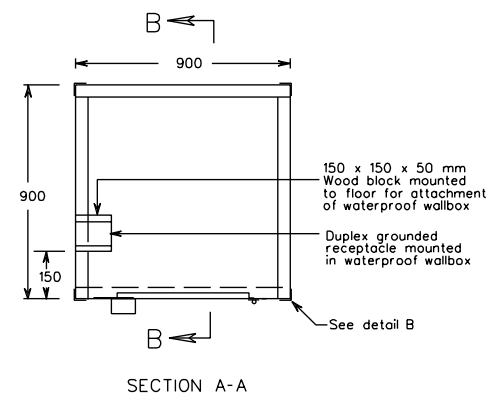
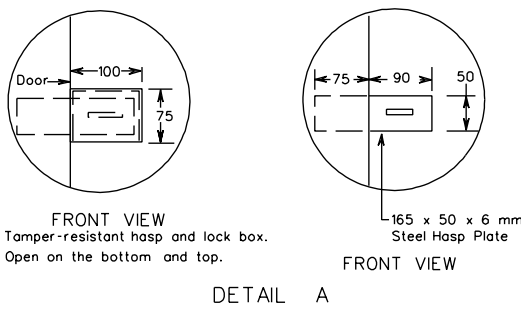
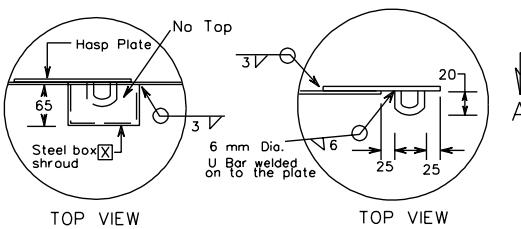
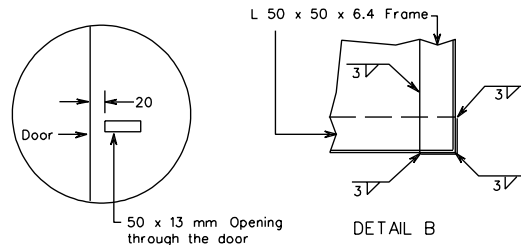
Storage unit shall be painted internally and externally with a system A paint or a three coat system equal. Paint shall be light blue top coat.

☒ Use of a cylindrical design is an allowable option for the steel box shroud. The design is to be 100 mm ID and mounted at a 45° angle over the hasp opening in the door.

Optional shroud design is to be submitted for the engineers review and approval.

Storage area for radioactive source is to be painted on floor to show that a minimum 300 mm space is to be maintained from the gauge to the exposed wall. Contrasting paint is required to depict storage area.

Nuclear caution signs printed with "Caution Radioactive Materials" are to be placed on both front and back of the box (furnished and installed by state).



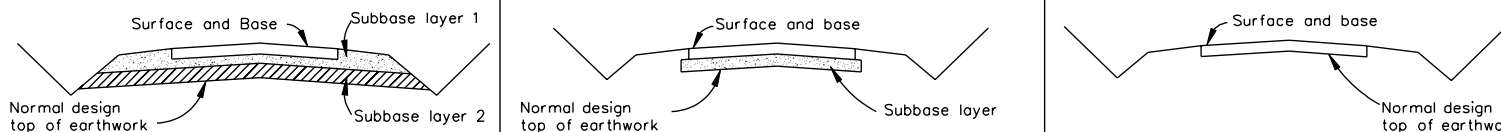
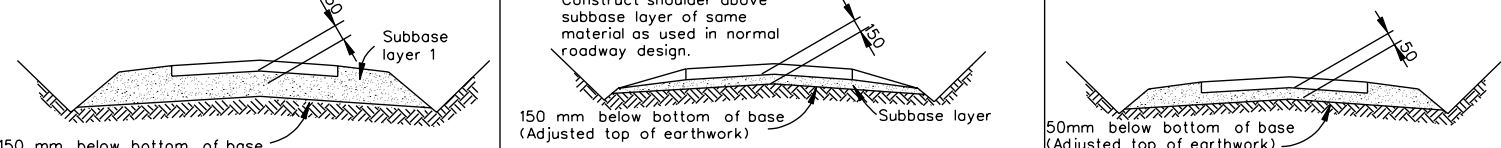
SPECIFICATION REFERENCE

STORAGE FACILITY FOR NUCLEAR GAUGE

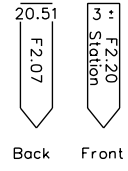
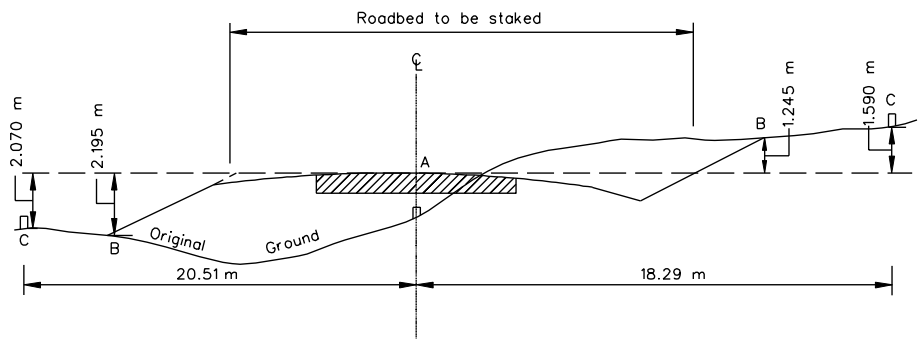
VIRGINIA DEPARTMENT OF TRANSPORTATION

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

605.01

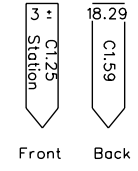
RU-1	DESIGN A	DESIGN B	DESIGN C
 <p><b>NORMAL ROADWAY DESIGN "A"</b> (Surface, base, and one or more courses of subbase material above top of earthwork.)</p> <p><b>NORMAL ROADWAY DESIGN "B"</b> Surface, base, and subbase only. (Subbase not through shoulders.)</p> <p><b>NORMAL ROADWAY DESIGN "C"</b> (Surface and base courses only.)</p>			
 <p><b>SOLID ROCK</b> Remove rock to a point 150 mm below bottom of base for entire width of roadway. Backfill with subbase layer 1 using bottom 50 mm as a leveling course.</p> <p><b>SOLID ROCK OR IRREGULAR ROCK OUTCROPPING, BOULDERS, SHALE OR OTHER NON-SOLID ROCK</b> Remove rock to a point 150 mm below bottom of base for entire width of roadway. Backfill with subbase layer to a depth of 150 mm for entire width of roadway using bottom 50 mm as leveling course. Shoulder design above subbase layer to conform to normal roadway design as shown on plans.</p> <p><b>SOLID ROCK OR IRREGULAR ROCK OUTCROPPING, BOULDERS, SHALE OR OTHER NON-SOLID ROCK</b> Excavate to a point 50 mm below bottom of base for entire width of roadway. Backfill with 50 mm of any aggregate material for which there is a pay item in the contract and use as a leveling course.</p>			
<p><b>Notes:</b> Applicable method as shown hereon is to be used at such locations as designated by the Engineer.</p> <p><b>ROCK CUT SECTIONS</b> In Design "A", if cement or lime subgrade stabilization is included in the normal roadway design, it should be eliminated when solid rock is encountered. Where irregular rock outcroppings, boulders, shale or other non-solid rock is encountered, substitute aggregate base or subbase material for the subgrade stabilization on a mm for mm basis using bottom 50 mm as a leveling course.</p> <p>In Design "B", if cement or lime subgrade stabilization is included in the normal roadway design, it should be eliminated when solid rock, irregular outcroppings, boulders, shale or other non-solid rock is encountered. Substitute aggregate base or subbase material for the stabilization on a mm for mm basis, using bottom 50 mm as a leveling course.</p> <p>In Design "C", if cement or lime subgrade stabilization is included in the normal roadway design, eliminated when solid rock, irregular rock outcroppings, boulders, shale or other non-solid rock is encountered, substitute aggregate base or subbase material for the stabilization on a mm for mm basis using bottom 50 mm as a leveling course.</p> <p>In Design "A", if cement stabilization of aggregate base or subbase material is included as an integral part of the pavement structure above subgrade elevation eliminate the cement when solid rock is encountered.</p> <p>In Design "B", if cement stabilization of aggregate base or subbase material is included as an integral part of the pavement structure above subgrade elevation, eliminate the cement when solid rock or irregular rock outcroppings, boulders, shale or other non-solid rock is encountered.</p> <p><b>ROCK FILL SECTIONS</b> When a fill section is built using good quality stone at subgrade elevation and 600 mm more below subgrade elevation, fill sections shall be handled in the same manner as rock cut-sections. Good quality rock in fill sections should be considered the same as solid rock in cut sections shown in Design "A". All other rock fill subgrade conditions shall be handled according to Design A, B or C as shown.</p>			
<h1>STANDARD METHODS OF UNDERCUTTING ROCK</h1>			SPECIFICATION REFERENCE  303
606.01	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	VIRGINIA DEPARTMENT OF TRANSPORTATION	

### SLOPE STAKES ON TANGENTS

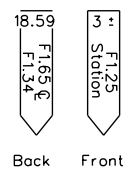
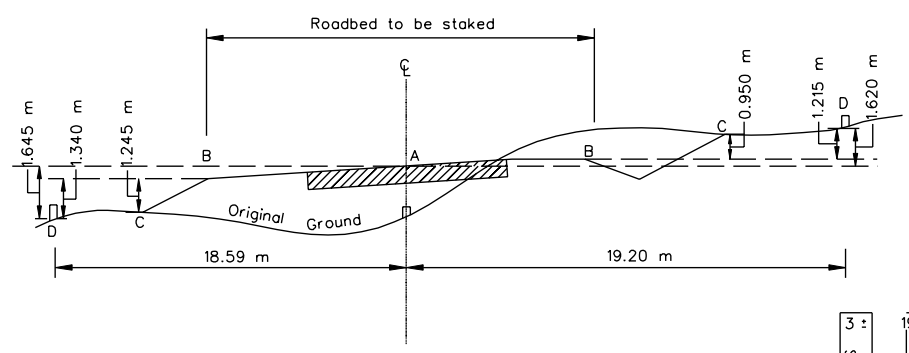


The front of the stake shall indicate the cut or fill to the slope intersection (vertical distance A to B), the offset distance (B to C), and the station.

The back of the stake shall indicate the cut or fill at the point where the stake is set (vertical distance A to C), and the distance to the centerline (A to C).

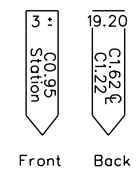


### SLOPE STAKES ON CURVES



The front of the stake shall indicate the cut or fill to the slope intersection including superelevation (vertical distance B to C), the offset distance (C to D), and the station.

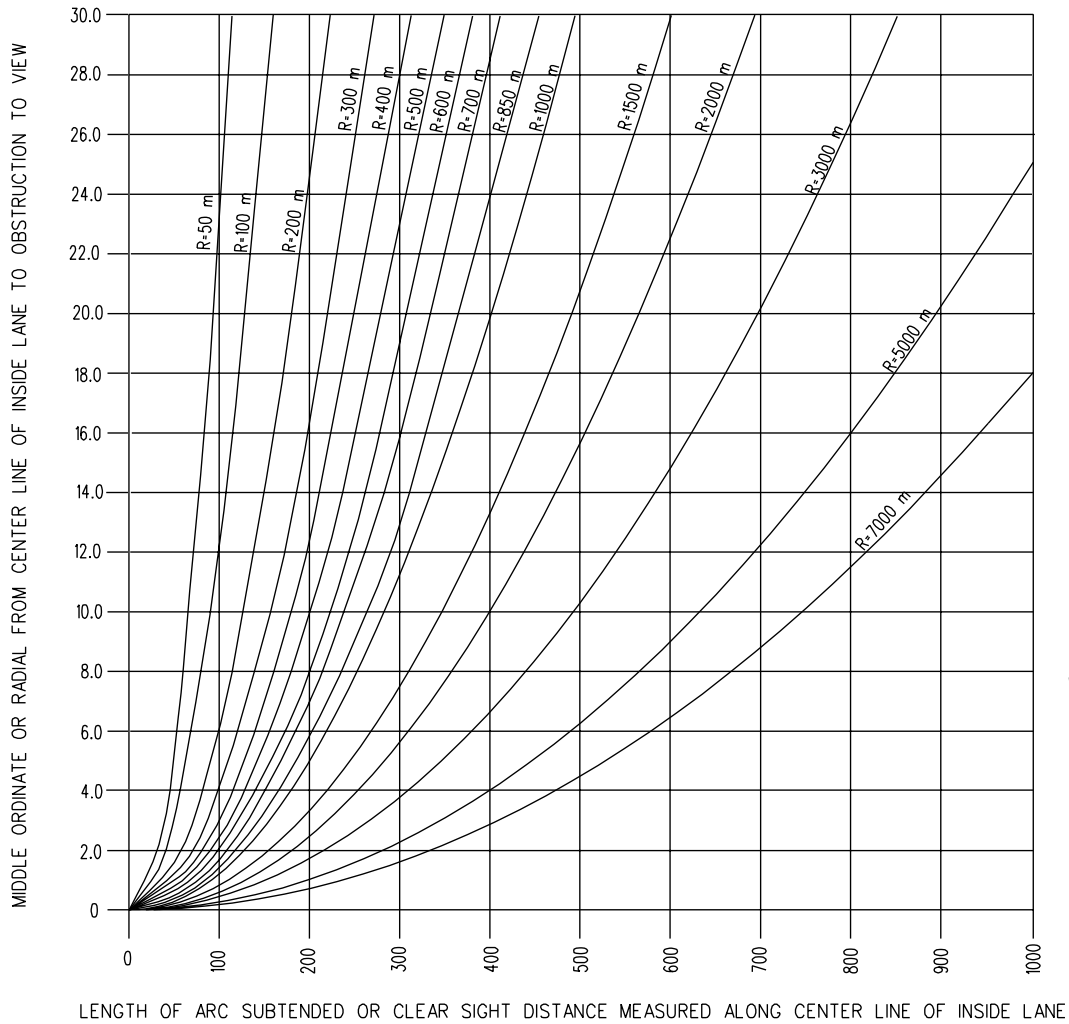
The back of the stake shall indicate the cut or fill to centerline at the point where the stake is set (vertical distance A to D), the cut or fill where the stake is set, including superelevation (vertical distance B to D), and the distance to centerline (A to D).



SPECIFICATION REFERENCE
105

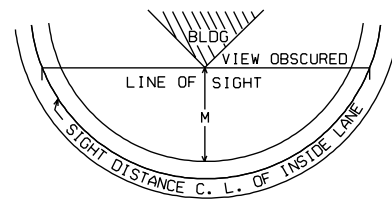
## STANDARD METHOD OF SETTING AND MARKING SLOPE STAKES





✕ 0.15 METERS STOPPING  
 1.3 METERS PASSING  
 LINE OF SIGHT AT MID-POINT  
 TO BE 0.75 m ABOVE EDGE OF  
 PAVEMENT FOR STOPPING SIGHT  
 DISTANCE AND 1.5 m FOR PASSING  
 SIGHT DISTANCE.

APPLICATION OF SIGHT DISTANCE TO HIGHWAY CURVES



### SIGHT DISTANCES ON HORIZONTAL CURVES

HEIGHT OF EYE 1.07 m      HEIGHT OF OBJECT 0.15 m AND 1.30 m ✕

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

VIRGINIA DEPARTMENT OF TRANSPORTATION

A-Geometric Difference of Grades in Percent	When S>L: $S = \frac{202.1249}{A} \cdot \frac{L}{2}$																				When S<L: $S = 20.10597 \sqrt{\frac{L}{A}}$																				SD-2 A-Geometric Difference of Grades in Percent
	S = Sight Distance in Meters																																								
	L = Length of Vertical Curve in Meters																																								
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400																					
2.0	111	121	131	141	151	161	171	181	191	201	211	220	229	238	246	254	262	270	277	284	2.0																				
2.5	91	101	111	121	131	141	151	161	171	180	189	197	205	213	220	227	234	241	248	254	2.5																				
3.0	77	87	97	107	117	127	137	147	156	164	172	180	187	194	201	208	214	220	226	232	3.0																				
3.5	68	78	88	98	108	118	127	136	144	152	159	166	173	180	186	192	198	204	209	215	3.5																				
4.0	61	71	81	91	101	110	119	127	135	142	149	156	162	168	174	180	185	191	196	201	4.0																				
4.5	55	65	75	85	95	104	112	120	127	134	141	147	153	159	164	170	175	180	185	190	4.5																				
5.0	50	60	70	80	90	98	106	114	121	127	133	139	145	150	156	161	166	171	175	180	5.0																				
5.5	47	57	67	77	86	94	101	108	115	121	127	133	138	143	148	153	158	163	167	171	5.5																				
6.0	44	54	64	73	82	90	97	104	110	116	122	127	132	137	142	147	151	156	160	164	6.0																				
6.5	41	51	61	71	79	86	93	100	106	112	117	122	127	132	137	141	145	150	154	158	6.5																				
7.0	39	49	59	68	76	83	90	96	102	107	113	118	123	127	132	136	140	144	148	152	7.0																				
7.5	37	47	57	66	73	80	87	93	98	104	109	114	118	123	127	131	135	139	143	147	7.5																				
8.0	35	45	55	64	71	78	84	90	95	101	105	110	115	119	123	127	131	135	139	142	8.0																				
8.5	34	44	53	62	69	76	82	87	93	98	102	107	111	115	119	123	127	131	134	138	8.5																				
9.0	32	42	52	60	67	73	79	85	90	95	99	104	108	112	116	120	124	127	131	134	9.0																				
9.5	31	41	51	58	65	71	77	83	88	92	97	101	105	109	113	117	120	124	127	130	9.5																				
10.0	30	40	49	57	64	70	75	80	85	90	94	98	103	106	110	114	117	121	124	127	10.0																				
10.5	29	39	48	55	62	68	73	78	83	88	92	96	100	104	107	111	114	118	121	124	10.5																				
11.0	28	38	47	54	61	66	72	77	81	86	90	94	98	101	105	108	112	115	118	121	11.0																				
11.5	28	37	46	53	59	65	70	75	80	84	88	92	96	99	103	106	109	112	116	119	11.5																				
12.0	27	37	45	52	58	64	69	73	78	82	86	90	94	97	101	104	107	110	113	116	12.0																				
12.5	26	36	44	51	57	62	67	72	76	80	84	88	92	95	98	102	105	108	111	114	12.5																				
13.0	26	35	43	50	56	61	66	71	75	79	83	86	90	93	97	100	103	106	109	112	13.0																				
13.5	25	35	42	49	55	60	65	69	73	77	81	85	88	92	95	98	101	104	107	109	13.5																				
14.0	24	34	42	48	54	59	64	68	72	76	80	83	87	90	93	96	99	102	105	107	14.0																				
14.5	24	33	41	47	53	58	62	67	71	75	78	82	85	88	91	94	97	100	103	106	14.5																				
15.0	23	33	40	46	52	57	61	66	70	73	77	80	84	87	90	93	96	98	101	104	15.0																				
16.0	23	32	39	45	50	55	59	64	67	71	75	78	81	84	87	90	93	95	98	101	16.0																				
17.0	22	31	38	44	49	53	58	62	65	69	72	76	79	82	84	87	90	93	95	98	17.0																				
18.0	21	30	37	42	47	52	56	60	64	67	70	73	76	79	82	85	87	90	92	95	18.0																				
19.0	21	29	36	41	46	51	55	58	62	65	68	71	74	77	80	83	85	88	90	92	19.0																				
20.0	20	28	35	40	45	49	53	57	60	64	67	70	72	75	78	80	83	85	88	90	20.0																				

SIGHT DISTANCE ON VERTICAL CURVES

HEIGHT OF EYE 1.07 METERS

HEIGHT OF OBJECT =0.15 METERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

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

SD-2 A- Algebraic Difference of Grades in Percent	When S>L: $S = \frac{202.1249}{A} \cdot \frac{L}{2}$ When S<L: $S = 20.10597 \sqrt{\frac{L}{A}}$ S = Sight Distance in Meters																				A- Algebraic Difference of Grades in Percent
	L = Length of Vertical Curve in Meters																				
	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	
2.0	291	298	305	311	318	324	330	336	342	348	354	360	365	371	376	381	387	392	397	402	2.0
2.5	261	267	273	279	284	290	295	301	306	311	317	322	327	332	336	341	346	351	355	360	2.5
3.0	238	243	249	254	260	265	270	275	280	284	289	294	298	303	307	311	316	320	324	328	3.0
3.5	220	225	230	235	240	245	250	254	259	263	268	272	276	280	284	288	292	296	300	304	3.5
4.0	206	211	216	220	225	229	234	238	242	246	250	254	258	262	266	270	273	277	281	284	4.0
4.5	194	199	203	208	212	216	220	224	228	232	236	240	243	247	251	254	258	261	265	268	4.5
5.0	184	189	193	197	201	205	209	213	217	220	224	227	231	234	238	241	245	248	251	254	5.0
5.5	176	180	184	188	192	195	199	203	206	210	213	217	220	224	227	230	233	236	239	242	5.5
6.0	168	172	176	180	184	187	191	194	198	201	204	208	211	214	217	220	223	226	229	232	6.0
6.5	162	165	169	173	176	180	183	187	190	193	196	200	203	206	209	212	215	217	220	223	6.5
7.0	156	159	163	166	170	173	177	180	183	186	189	192	195	198	201	204	207	209	212	215	7.0
7.5	150	154	157	161	164	167	171	174	177	180	183	186	189	191	194	197	200	202	205	208	7.5
8.0	146	149	152	156	159	162	165	168	171	174	177	180	183	185	188	191	193	196	199	201	8.0
8.5	141	145	148	151	154	157	160	163	166	169	172	174	177	180	182	185	188	190	193	195	8.5
9.0	137	141	144	147	150	153	156	159	161	164	167	170	172	175	177	180	182	185	187	190	9.0
9.5	134	137	140	143	146	149	152	154	157	160	162	165	168	170	173	175	177	180	182	185	9.5
10.0	130	133	136	139	142	145	148	150	153	156	158	161	163	166	168	171	173	175	178	180	10.0
10.5	127	130	133	136	139	141	144	147	149	152	154	157	159	162	164	166	169	171	173	175	10.5
11.0	124	127	130	133	136	138	141	143	146	148	151	153	156	158	160	163	165	167	169	171	11.0
11.5	122	124	127	130	133	135	138	140	143	145	148	150	152	155	157	159	161	163	166	168	11.5
12.0	119	122	124	127	130	132	135	137	140	142	145	147	149	151	154	156	158	160	162	164	12.0
12.5	117	119	122	125	127	130	132	135	137	139	142	144	146	148	150	153	155	157	159	161	12.5
13.0	114	117	120	122	125	127	130	132	134	137	139	141	143	145	148	150	152	154	156	158	13.0
13.5	112	115	117	120	122	125	127	129	132	134	136	138	141	143	145	147	149	151	153	155	13.5
14.0	110	113	115	118	120	123	125	127	129	132	134	136	138	140	142	144	146	148	150	152	14.0
14.5	108	111	113	116	118	120	123	125	127	129	131	134	136	138	140	142	144	146	147	149	14.5
15.0	106	109	111	114	116	118	121	123	125	127	129	131	133	135	137	139	141	143	145	147	15.0
16.0	103	105	108	110	112	115	117	119	121	123	125	127	129	131	133	135	137	139	140	142	16.0
17.0	100	102	105	107	109	111	113	115	117	119	121	123	125	127	129	131	133	134	136	138	17.0
18.0	97	99	102	104	106	108	110	112	114	116	118	120	122	124	125	127	129	131	132	134	18.0
19.0	95	97	99	101	103	105	107	109	111	113	115	117	119	120	122	124	125	127	129	130	19.0
20.0	92	94	96	98	101	103	104	106	108	110	112	114	115	117	119	121	122	124	126	127	20.0

SIGHT DISTANCE ON VERTICAL CURVES  
HEIGHT OF EYE 1.07 METERS      HEIGHT OF OBJECT =0.15 METERS



SD-3 A-Geometric Difference of Grades in Percent	When S>L: $S = 472.881 \cdot \frac{L}{A}$																				When S<L: $S = 30.753 \sqrt{\frac{L}{A}}$																				S = Sight Distance in Meters		Sheet 2 Of 2		A-Geometric Difference of Grades in Percent
	L = Length of Vertical Curve in Meters																																												
	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800																									
2.0	446	456	466	476	486	496	505	515	524	533	541	550	559	567	575	584	592	599	607	615	2.0																								
2.5	399	408	417	426	435	444	452	460	468	476	484	492	500	507	515	522	529	536	543	550	2.5																								
3.0	364	372	381	389	397	405	413	420	428	435	442	449	456	463	470	476	483	489	496	502	3.0																								
3.5	337	345	353	360	368	375	382	389	396	403	409	416	422	429	435	441	447	453	459	465	3.5																								
4.0	315	323	330	337	344	351	357	364	370	377	383	389	395	401	407	413	418	424	429	435	4.0																								
4.5	297	304	311	318	324	331	337	343	349	355	361	367	372	378	384	389	394	400	405	410	4.5																								
5.0	282	288	295	301	308	314	320	325	331	337	342	348	353	359	364	369	374	379	384	389	5.0																								
5.5	269	275	281	287	293	299	305	310	316	321	327	332	337	342	347	352	357	362	366	371	5.5																								
6.0	257	263	269	275	281	286	292	297	302	308	313	318	323	327	332	337	342	346	351	355	6.0																								
6.5	247	253	259	264	270	275	280	285	291	295	300	305	310	315	319	324	328	333	337	341	6.5																								
7.0	238	244	249	255	260	265	270	275	280	285	289	294	299	303	308	312	316	320	325	329	7.0																								
7.5	230	236	241	246	251	256	261	266	270	275	280	284	288	293	297	301	305	310	314	318	7.5																								
8.0	223	228	233	238	243	248	253	257	262	266	271	275	279	284	288	292	296	300	304	308	8.0																								
8.5	216	221	226	231	236	241	245	250	254	258	263	267	271	275	279	283	287	291	295	298	8.5																								
9.0	210	215	220	225	229	234	238	243	247	251	255	259	263	267	271	275	279	283	286	290	9.0																								
9.5	204	209	214	219	223	228	232	236	240	244	248	252	256	260	264	268	271	275	279	282	9.5																								
10.0	199	204	209	213	217	222	226	230	234	238	242	246	250	254	257	261	265	268	272	275	10.0																								
10.5	195	199	204	208	212	216	221	225	229	232	236	240	244	247	251	255	258	262	265	268	10.5																								
11.0	190	195	199	203	207	211	215	219	223	227	231	235	238	242	245	249	252	256	259	262	11.0																								
11.5	186	190	195	199	203	207	211	215	218	222	226	229	233	236	240	243	247	250	253	256	11.5																								
12.0	182	186	190	195	199	202	206	210	214	217	221	225	228	232	235	238	241	245	248	251	12.0																								
12.5	178	182	187	191	195	198	202	206	209	213	217	220	223	227	230	233	237	240	243	246	12.5																								
13.0	175	179	183	187	191	195	198	202	205	209	212	216	219	222	226	229	232	235	238	241	13.0																								
13.5	172	176	180	183	187	191	195	198	202	205	208	212	215	218	221	225	228	231	234	237	13.5																								
14.0	168	172	176	180	184	187	191	195	198	201	205	208	211	214	217	221	224	227	230	232	14.0																								
14.5	166	169	173	177	181	184	188	191	195	198	201	204	207	211	214	217	220	223	226	228	14.5																								
15.0	163	167	170	174	178	181	185	188	191	195	198	201	204	207	210	213	216	219	222	225	15.0																								
16.0	158	161	165	168	172	175	179	182	185	188	191	195	198	200	203	206	209	212	215	217	16.0																								
17.0	153	156	160	163	167	170	173	177	180	183	186	189	192	195	197	200	203	206	208	211	17.0																								
18.0	149	152	155	159	162	165	168	172	175	178	180	183	186	189	192	195	197	200	202	205	18.0																								
19.0	145	148	151	155	158	161	164	167	170	173	176	178	181	184	187	189	192	195	197	200	19.0																								
20.0	141	144	147	151	154	157	160	163	166	168	171	174	177	179	182	185	187	190	192	195	20.0																								
SIGHT DISTANCE FOR CROSSOVERS																																													
HEIGHT OF EYE 1.07 METERS																					HEIGHT OF OBJECT =1.30 METERS																								
608.05	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS																				VIRGINIA DEPARTMENT OF TRANSPORTATION																								