



$V_1 = 1.000$ CU. FT.
 $V_2 = 0.583$ CU. FT.
 $V_3 = 0.750$ CU. FT.
 $V_4 = 0.708$ CU. FT.

FROM PICTORIAL VIEW IT IS SEEN THAT:

$$V = \frac{V_1 W + 2V_2 (N-1) + V_3 (WN+1) + 2V_4}{27}$$

SUBSTITUTING VALUES OF ELEMENTARY VOLUMES:

$$V = \frac{1.000 W + 1.166(N-1) + 0.750(WN+1) + 1.416}{27}$$

- V - INDICATES TOTAL VOLUME OF STEPS IN CUBIC YARDS.
- V_1, V_2, V_3 & V_4 - INDICATE ELEMENTARY VOLUMES USED IN COMPUTING V.
- W - INDICATES CLEAR WIDTH OF STEPS, IN FEET, BETWEEN SIDEWALLS.
- N - INDICATES NUMBER OF STEPS IN INSTALLATION EXCLUSIVE OF LANDING.
- L1 - INDICATES LENGTH OF BARS A, IN INCHES. $L1 = 13.416 N + 8''$
- L2 - INDICATES LENGTH OF BARS B, IN INCHES. $L2 = 12W + 9''$
- L3 - INDICATES LENGTH OF BARS C, IN INCHES. $L3 = 13.416 N + 18''$

A LANDING IS TO BE PROVIDED WHERE 12 OR MORE STEPS ARE REQUIRED. MINIMUM SIZE OF LANDING TO BE $W + 1$ FOOT X 4 FEET.

THIS ITEM MAY BE PRECAST OR CAST IN PLACE. CONCRETE TO BE CLASS A3 IF CAST IN PLACE, 4000 PSI IF PRECAST. FOR OTHER WIDTHS THE APPROXIMATE SPACING OF BARS A IN INCHES WILL BE EQUAL TO $80/N$ WITH A MINIMUM SPACING OF 6". 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
NO STEEL	W - 3'	4	5	5	6	6	7	7	8	
	W - 4'	5	6	7	7	8	8	9	10	
	W - 5'	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 44 INCHES WIDE HAVING BOTH SIDES ENCLOSED, AT LEAST ONE HANDRAIL, PREFERABLY ON THE RIGHT SIDE DESCENDING.
2. ON STEPS LESS THAN 44 INCHES WIDE HAVING ONE SIDE OPEN, ONE HANDRAIL ON EACH SIDE.
3. ON STEPS LESS THAN 44 INCHES WIDE HAVING BOTH SIDES OPEN, ONE HANDRAIL ON EACH SIDE.
4. ON STEPS MORE THAN 44 INCHES WIDE BUT LESS THAN 88 INCHES WIDE, ONE HANDRAIL ON EACH SIDE.
5. ON STEPS 88 OR MORE INCHES WIDE, ONE HANDRAIL ON EACH SIDE, AND ONE INTERMEDIATE HANDRAIL LOCATED APPROXIMATELY MIDWAY OF THE WIDTH.

SPECIFICATION REFERENCE
105
504

STANDARD CONCRETE STEPS FOR 2 : 1 SLOPE

VIRGINIA DEPARTMENT OF TRANSPORTATION