

CODE

COMMENTARY

22.5.5.1.1 V_c shall not be taken greater than $0.42\lambda_s\sqrt{f'_c}b_wd$.

22.5.5.1.2 In Table 22.5.5.1, the value of $N_u/6A_g$ shall not be taken greater than $0.05f'_c$.

22.5.5.1.3 The size effect modification factor, λ_s , shall be determined by

$$\lambda_s = \sqrt{\frac{2}{1+0.004d}} \leq 1 \quad (22.5.5.1.3)$$

22.5.6 V_c for prestressed members

22.5.6.1 This section shall apply to the calculation of V_c for post-tensioned and pretensioned members in regions where the effective force in the prestressed reinforcement is fully transferred to the concrete. For regions of pretensioned members where the effective force in the prestressed reinforcement is not fully transferred to the concrete, 22.5.7 shall govern the calculation of V_c .

22.5.6.2 For prestressed flexural members with $A_{ps}f_{se} \geq 0.4(A_{ps}f_{pu} + A_s f_y)$, V_c shall be calculated in accordance with Table 22.5.6.2, but need not be less than $0.17\lambda_s\sqrt{f'_c}b_wd$. Alternatively, it shall be permitted to calculate V_c in accordance with 22.5.6.3.

Table 22.5.6.2—Approximate method for calculating V_c

V_c		
Least of (a), (b), and (c):	$\left(0.05\lambda_s\sqrt{f'_c} + 4.8\frac{V_u d_p}{M_u}\right)b_wd$ [1],[2]	(a)
	$(0.05\lambda_s\sqrt{f'_c} + 4.8)b_wd$	(b)
	$0.42\lambda_s\sqrt{f'_c}b_wd$	(c)

[1] M_u occurs simultaneously with V_u at the section considered.

[2]When calculating the $V_u d_p/M_u$ term in Eq. 22.5.6.2(a), d_p is the distance from the extreme compression fiber to the centroid of prestressed reinforcement. It shall not be permitted to take d_p as $0.80h$ as in 22.5.2.1.

The criteria column in Table 22.5.5.1 references $A_{v,min}$, which is defined in Table 9.6.3.4 and 10.6.2.2 and referenced throughout the Code.

When applying equations in Table 22.5.5.1, the value of A_s to be used in the calculation of ρ_w may be taken as the sum of the areas of longitudinal bars located more than two-thirds of the overall member depth away from the extreme compression fiber. Definitions for b_w and d to be used with circular sections are given in 22.5.2.2.

R22.5.5.1.3 The parameters within the size effect modification factor, λ_s , are consistent with fracture mechanics theory for reinforced concrete (Bažant et al. 2007; Frosch et al. 2017).

R22.5.6 V_c for prestressed members

R22.5.6.2 This provision offers a simple means of calculating V_c for prestressed concrete beams (MacGregor and Hanson 1969). This provision may be applied to beams having prestressed reinforcement only, or to members reinforced with a combination of prestressed and nonprestressed reinforcement. Expression (a) in Table 22.5.6.2 is most applicable to members subject to uniform loading.

In applying the expression in row (a) to simply-supported members subject to uniform loads, Eq. (R22.5.6.2) can be used:

$$\frac{V_u d_p}{M_u} = \frac{d_p(\ell - 2x)}{x(\ell - x)} \quad (R22.5.6.2)$$

where ℓ is the span length, and x is the distance from the section being investigated to the support. For concrete with f'_c equal to 35 MPa, V_c from 22.5.6.2 varies, as shown in Fig. R22.5.6.2. Design aids based on this equation are given in ASCE Joint Committee (1940).