CODE

22.5.1.2 Cross-sectional dimensions shall be selected to satisfy Eq. (22.5.1.2).

$$V_u \le \phi(V_c + 0.66\sqrt{f_c'}b_w d) \qquad (22.5.1.2)$$

22.5.1.3 For nonprestressed members, V_c shall be calculated in accordance with 22.5.5.

22.5.1.4 For prestressed members, V_c, V_{ci}, and V_{cw} shall be calculated in accordance with 22.5.6 or 22.5.7.

22.5.1.5 For calculation of V_c, V_{ci}, and V_{cw}, λ shall be in accordance with 19.2.4.

22.5.1.6 V_s shall be calculated in accordance with 22.5.8.

22.5.1.7 Effect of any openings in members shall be considered in calculating V_n.

22.5.1.8 Effect of axial tension due to creep and shrinkage in members shall be considered in calculating V_c.

22.5.1.9 Effect of inclined flexural compression in variable depth members shall be permitted to be considered in calculating V_c.

22.5.1.10 The interaction of shear forces acting along orthogonal axes shall be permitted to be neglected if (a) or (b) is satisfied.

(a) $\dfrac{v_{u,x}}{\phi v_{n,x}} \le 0.5 \qquad\qquad (22.5.1.10a)$

(b) $\dfrac{v_{u,y}}{\phi v_{n,y}} \le 0.5 \qquad\qquad (22.5.1.10b)$

COMMENTARY

The shear strength is based on an average shear stress over the effective cross section, $b_w d$.

Chapter 23 allows the use of the strut-and-tie method in the shear design of any structural concrete member, or discontinuity region in a member.

R22.5.1.2 The limit on cross-sectional dimensions in 22.5.1.2 is intended to minimize the likelihood of diagonal compression failure in the concrete and limit the extent of cracking.

R22.5.1.7 Openings in the web of a member can reduce its shear strength. The effects of openings are discussed in Section 4.7 of Joint ACI-ASCE Committee 426 (1973), Barney et al. (1977), and Schlaich et al. (1987). The strut-and-tie method as addressed in Chapter 23 can be used to design members with openings.

R22.5.1.8 Consideration of axial tension requires engineering judgment. Axial tension often occurs due to volume changes, but it may be low enough not to be detrimental to the performance of a structure with adequate expansion joints and satisfying minimum longitudinal reinforcement requirements. It may be desirable to design shear reinforcement to resist the total shear if there is uncertainty about the magnitude of axial tension.

R22.5.1.9 In a member of variable depth, the internal shear at any section is increased or decreased by the vertical component of the inclined flexural stresses.

R22.5.1.10 and **R.22.5.1.11** Reinforced concrete members, such as columns and beams, may be subjected to biaxial shear. For symmetrically reinforced circular sections, nominal one-way shear strength about any axis is the same. Therefore, when a circular section is subjected to shear along two centroidal axes, shear strength can be evaluated using the resultant shear. However, for rectangular and other cross sections, calculating nominal one-way shear strength along the axis of the resultant shear is not practical. Tests and analytical results for columns have indicated that for biaxial shear loading, the shear strength follows an elliptical interaction diagram that requires calculating nominal one-way shear strength along two orthogonal directions (Umehara