

## CODE

**22.9.1.2** The required area of shear-friction reinforcement across the assumed shear plane,  $A_{vf}$ , shall be calculated in accordance with 22.9.4. Alternatively, it shall be permitted to use shear transfer design methods that result in prediction of strength in substantial agreement with results of comprehensive tests.

**22.9.1.3** The value of  $f_y$  used to calculate  $V_n$  for shear friction shall not exceed the limit in 20.2.2.4.

**22.9.1.4** Surface preparation of the shear plane assumed for design shall be specified in the construction documents.

**22.9.2 Required strength**

**22.9.2.1** Factored forces across the assumed shear plane shall be calculated in accordance with the factored load combinations defined in Chapter 5 and analysis procedures defined in Chapter 6.

**22.9.3 Design strength**

**22.9.3.1** Design shear strength across the assumed shear plane shall satisfy:

$$\phi V_n \geq V_u \quad (22.9.3.1)$$

for each applicable factored load combination.

**22.9.4 Nominal shear strength**

**22.9.4.1** Value of  $V_n$  across the assumed shear plane shall be calculated in accordance with 22.9.4.2 or 22.9.4.3.  $V_n$

## COMMENTARY

assumes that such a crack will form, and that reinforcement is provided across the crack to resist relative displacement along it. When shear acts along a crack, one crack face slips relative to the other. If the crack faces are rough and irregular, this slip is accompanied by separation of the crack faces. At nominal strength, the separation is sufficient to stress, in tension, the reinforcement crossing the crack to its specified yield strength. The reinforcement in tension provides a clamping force  $A_{vf}f_y$  across the crack faces. The applied shear is then resisted by friction between the crack faces, by resistance to the shearing off of protrusions on the crack faces, and by dowel action of the reinforcement crossing the crack. Successful application of this section depends on proper selection of the location of an assumed crack (PCI MNL 120; Birkeland and Birkeland 1966).

**R22.9.1.2** The relationship between shear-transfer strength and the reinforcement crossing the shear plane can be expressed in various ways. Equations (22.9.4.2) and (22.9.4.3) are based on the shear-friction model and provide a conservative estimate of the shear-transfer strength.

Other relationships that provide a more accurate estimate of shear-transfer strength can be used under the requirements of this section. Examples of such procedures can be found in the *PCI Design Handbook* (PCI MNL 120), Mattock et al. (1976b), and Mattock (1974).

**R22.9.1.4** For concrete cast against hardened concrete or structural steel, 26.5.6.1 requires the licensed design professional to specify the surface preparation in the construction documents.

**R22.9.4 Nominal shear strength**