CODE

(a) Bonded reinforcement is provided in accordance with 8.6.2.3 and 8.7.5.3
(b) No portion of the column cross section is closer to a discontinuous edge than four times the slab thickness h
(c) Effective prestress f_{pc} in each direction is not less than 0.9 MPa

22.6.5.5 For prestressed, two-way members conforming to 22.6.5.4, v_c shall be permitted to be the lesser of (a) and (b)

(a) $$v_c = 0.29\lambda\sqrt{f'_c} + 0.3f_{pc} + \frac{V_p}{b_o d} \quad (22.6.5.5a)$$

(b) $$v_c = 0.083\left(1.5 + \frac{\alpha_s d}{b_o}\right)\lambda\sqrt{f'_c} + 0.3f_{pc} + \frac{V_p}{b_o d} \quad (22.6.5.5b)$$

where α_s is given in 22.6.5.3; the value of f_{pc} is the average of f_{pc} in the two directions and shall not exceed 3.5 MPa; V_p is the vertical component of all effective prestress forces crossing the critical section; and the value of $\sqrt{f'_c}$ shall not exceed 5.8 MPa.

22.6.6 *Two-way shear strength provided by concrete in members with shear reinforcement*

22.6.6.1 For two-way members with shear reinforcement, v_c at critical sections shall be calculated in accordance with Table 22.6.6.1.

COMMENTARY

conservatively calculated by the expressions in 22.6.5.5, where v_c corresponds to a diagonal tension failure of the concrete initiating at the critical section defined in 22.6.4.1. The mode of failure differs from a punching shear failure around the perimeter of the loaded area of a nonprestressed slab calculated using expression (b) in Table 22.6.5.2. Consequently, the expressions in 22.6.5.5 differ from those for nonprestressed slabs. Values for $\sqrt{f'_c}$ and f_{pc} are restricted in design due to limited test data available beyond the specified limits. When calculating f_{pc}, loss of prestress due to restraint of the slab by structural walls and other structural elements should be taken into account.

R22.6.6 *Two-way shear strength provided by concrete in members with shear reinforcement*

Critical sections for two-way members with shear reinforcement are defined in 22.6.4.1 for the sections adjacent to the column, concentrated load, or reaction area, and 22.6.4.2 for the section located just beyond the outermost peripheral line of stirrup or headed shear stud reinforcement. Values of maximum v_c for these critical sections are given in Table 22.6.6.1. Limiting values of v_u for the critical sections defined in 22.6.4.1 are given in Table 22.6.6.3.

The maximum v_c and limiting value of v_u at the innermost critical section (defined in 22.6.4.1) are higher where headed shear stud reinforcement is provided than the case where stirrups are provided (refer to R8.7.7). Maximum v_c values at the critical sections defined in 22.6.4.2 beyond the outermost peripheral line of shear reinforcement are independent of the type of shear reinforcement provided.

R22.6.6.1 For two-way slabs with stirrups, the maximum value of v_c is taken as $\mathbf{0.17}\lambda_s\lambda\sqrt{f'_c}$ because the stirrups resist all the shear beyond that at inclined cracking (which occurs at approximately half the capacity of a slab without shear reinforcement (that is, $\mathbf{0.5} \times \mathbf{0.33}\lambda_s\lambda\sqrt{f'_c} = \mathbf{0.17}\lambda_s\lambda\sqrt{f'_c}$) (Hawkins 1974). The higher value of v_c for two-way slabs with headed shear stud reinforcement is based on research (Elgabry and Ghali 1987).