

CODE

where A_{st} is the total area of nonprestressed longitudinal reinforcement.

22.4.2.3 For prestressed members, P_o shall be calculated by:

$$P_o = 0.85f'_c(A_g - A_{st} - A_{pd}) + f_y A_{st} - (f_{se} - 0.003E_p)A_{pt} \quad (22.4.2.3)$$

where A_{pt} is the total area of prestressing reinforcement, and A_{pd} is the total area occupied by duct, sheathing, and prestressing reinforcement; the value of f_{se} shall be at least $0.003E_p$. For grouted, post-tensioned tendons, it shall be permitted to assume A_{pd} equals A_{pt} .

22.4.2.4 Tie reinforcement for lateral support of longitudinal reinforcement in compression members shall satisfy 10.7.6.2 and 25.7.2.

22.4.2.5 Spiral reinforcement for lateral support of longitudinal reinforcement in compression members shall satisfy 10.7.6.3 and 25.7.3.

22.4.3 Maximum axial tensile strength

22.4.3.1 Nominal axial tensile strength of a nonprestressed, composite, or prestressed member, P_{nt} , shall not be taken greater than $P_{nt,max}$, calculated by:

$$P_{nt,max} = f_y A_{st} + (f_{se} + \Delta f_p) A_{pt} \quad (22.4.3.1)$$

where $(f_{se} + \Delta f_p)$ shall not exceed f_{py} , and A_{pt} is zero for nonprestressed members.

22.5—One-way shear strength

22.5.1 General

22.5.1.1 Nominal one-way shear strength at a section, V_n , shall be calculated by:

$$V_n = V_c + V_s \quad (22.5.1.1)$$

COMMENTARY

R22.4.2.3 The effects of prestressing on the axial strength of compression members are taken into account in Eq. (22.4.2.3). Equation (22.4.2.3) is similar to Eq. (22.4.2.2) for nonprestressed compression members. The effective area of concrete subjected to the limiting stress of $0.85f'_c$ is reduced by the term A_{pd} to account for the area of ducts, sheathing, and prestressing reinforcement. A third term is added to account for the reduction of column capacity due to the prestress force. At nominal strength, the stress in the prestressed reinforcement, f_{se} , is decreased by $0.003E_p$, where 0.003 is the assumed compressive strain at the axial capacity of the member.

R22.5—One-way shear strength

R22.5.1 General

R22.5.1.1 In a member without shear reinforcement, shear is assumed to be resisted by the concrete. In a member with shear reinforcement, a portion of the shear strength is assumed to be provided by the concrete and the remainder by the shear reinforcement.

The one-way shear equations for nonprestressed concrete were changed in the 2019 Code with the primary objectives of including effect of member depth, commonly referred to as the “size effect,” and the effects of the longitudinal reinforcement ratio on shear strength.

The shear strength provided by concrete, V_c , is taken as the shear causing inclined cracking (Joint ACI-ASCE Committee 426 1973; MacGregor and Hanson 1969; Joint ACI-ASCE Committee 326 1962). After cracking, V_c is attributed to aggregate interlock, dowel action, and the shear transmitted across the concrete compression zone.