CODE

COMMENTARY

if $\varepsilon_s < \varepsilon_y$ (yield strain)

$$A_s f_s = A_s E_s \varepsilon_s$$

if $\varepsilon_s \geq \varepsilon_y$

$$A_s f_s = A_s f_y$$

where ε_s is the value from the strain diagram at the location of the reinforcement.

20.2.2.2 Modulus of elasticity, E_s, for nonprestressed bars and wires shall be permitted to be taken as 200,000 MPa.

20.2.2.3 Yield strength for nonprestressed bars and wires shall be based on the specified grade of reinforcement and shall not exceed the values given in 20.2.2.4 for the associated applications.

20.2.2.4 Types of nonprestressed bars and wires to be specified for particular structural applications shall be in accordance with Table 20.2.2.4(a) for deformed reinforcement and Table 20.2.2.4(b) for plain reinforcement.

R20.2.2.4 Tables 20.2.2.4(a) and 20.2.2.4(b) limit the maximum values of yield strength to be used in design calculations for nonprestressed deformed reinforcement and nonprestressed plain spiral reinforcement, respectively.

Grade 690 reinforcement is now permitted to resist tension and compression in some applications. For reinforcement resisting compression, strain compatibility calculations indicate that stresses are not likely to exceed 550 MPa before strain in unconfined concrete reaches the strain limit of 0.003 unless special confinement reinforcement is provided to increase the limiting concrete compressive strain. For beams, the deflection provisions of 24.2 and the limitations on distribution of flexural reinforcement of 24.3 become increasingly critical as f_y increases.

In Table 20.2.2.4(a), for deformed reinforcement in special moment frames and special structural walls, the use of longitudinal reinforcement with strength substantially higher than that assumed in design will lead to higher shear and bond stresses at the time of development of yield moments. These conditions may lead to brittle failures in shear or bond and should be avoided even if such failures may occur at higher loads than those anticipated in design. Therefore, ASTM A706 specifies both a lower and an upper limit on the actual yield strength of the steel and requires a minimum tensile-to-yield strength ratio. ASTM A615 Grade 420 reinforcement in special seismic systems is permitted only if the requirements of 20.2.2.5(b) are satisfied. ASTM A706 Grade 550 and Grade 690 are now permitted to resist tension and compression in some applications. ASTM A706 Grade 550 and Grade 690 are now permitted to resist moments, axial forces, and shear forces in special structural walls and all components of structural walls, including coupling beams and wall piers. ASTM A706 Grade 550 is also permitted in special moment frames. For reinforcement resisting compression, strain compatibility calculations indicate that stresses are not likely to exceed 550 MPa before strain in unconfined concrete reaches the strain limit of