CODE

10.6—Reinforcement limits

10.6.1 *Minimum and maximum longitudinal reinforcement*

10.6.1.1 For nonprestressed columns and for prestressed columns with average $f_{pe} < 1.6$ MPa, area of longitudinal reinforcement shall be at least $0.01A_g$ but shall not exceed $0.08A_g$.

10.6.2 *Minimum shear reinforcement*

10.6.2.1 A minimum area of shear reinforcement, $A_{v,min}$, shall be provided in all regions where $V_u > 0.5\phi V_c$.

10.6.2.2 If shear reinforcement is required, $A_{v,min}$ shall be the greater of (a) and (b):

(a) $0.062\sqrt{f'_c}\dfrac{b_w s}{f_{yt}}$

(b) $0.35\dfrac{b_w s}{f_{yt}}$

10.7—Reinforcement detailing

10.7.1 *General*

10.7.1.1 Concrete cover for reinforcement shall be in accordance with 20.5.1.

10.7.1.2 Development lengths of deformed and prestressed reinforcement shall be in accordance with 25.4.

COMMENTARY

R10.6—Reinforcement limits

R10.6.1 *Minimum and maximum longitudinal reinforcement*

R10.6.1.1 Limits are provided for both the minimum and maximum longitudinal reinforcement ratios.

Minimum reinforcement—Reinforcement is necessary to provide resistance to bending, which may exist regardless of analytical results, and to reduce the effects of creep and shrinkage of the concrete under sustained compressive stresses. Creep and shrinkage tend to transfer load from the concrete to the reinforcement, and the resultant increase in reinforcement stress becomes greater as the reinforcement ratio decreases. Therefore, a minimum limit is placed on the reinforcement ratio to prevent reinforcement from yielding under sustained service loads (Richart 1933).

Maximum reinforcement—The amount of longitudinal reinforcement is limited to ensure that concrete can be effectively consolidated around the bars and to ensure that columns designed according to the Code are similar to the test specimens by which the Code was calibrated. The 0.08 limit applies at all sections, including splice regions, and can also be considered a practical maximum for longitudinal reinforcement in terms of economy and requirements for placing. Longitudinal reinforcement in columns should usually not exceed 4 percent if the column bars are required to be lap spliced, as the lap splice zone will have twice as much reinforcement if all lap splices occur at the same location.

R10.6.2 *Minimum shear reinforcement*

R10.6.2.1 The basis for the minimum shear reinforcement is the same for columns and beams. Refer to R9.6.3 for more information.

R10.7—Reinforcement detailing