CODE

24.2.4.2 *Prestressed members*

24.2.4.2.1 Additional time-dependent deflection of prestressed concrete members shall be calculated considering stresses in concrete and reinforcement under sustained load, and the effects of creep and shrinkage of concrete and relaxation of prestressed reinforcement.

24.2.5 *Calculation of deflections of composite concrete construction*

24.2.5.1 If composite concrete flexural members are shored during construction so that, after removal of temporary supports, the dead load is resisted by the full composite section, it shall be permitted to consider the composite member equivalent to a monolithically cast member for calculation of deflections.

24.2.5.2 If composite concrete flexural members are not shored during construction, the magnitude and duration of load before and after composite action becomes effective shall be considered in calculating time-dependent deflections.

24.2.5.3 Deflections resulting from differential shrinkage of precast and cast-in-place components, and of axial creep effects in prestressed members, shall be considered.

COMMENTARY

R24.2.4.2 *Prestressed members*

R24.2.4.2.1 Calculation of time-dependent deflections of prestressed concrete flexural members is challenging. The calculations should consider not only the increased deflections due to flexural stresses, but also the additional time-dependent deflections resulting from time-dependent shortening of the flexural member.

Prestressed concrete members shorten more with time than similar nonprestressed members due to the precompression in the slab or beam, which causes creep. This creep, together with concrete shrinkage, results in significant shortening of the flexural members that continues for several years after construction and should be considered in design. The shortening tends to reduce the tension in the prestressed reinforcement, reducing the precompression in the member and thereby causing increased time-dependent deflections.

Another factor that can influence time-dependent deflections of prestressed flexural members is adjacent concrete or masonry that is nonprestressed in the direction of the prestressed member. This can be a slab nonprestressed in the beam direction adjacent to a prestressed beam or a nonprestressed slab system. As the prestressed member tends to shrink and creep more than the adjacent nonprestressed concrete, the structure will tend to reach a compatibility of the shortening effects. This results in a reduction of the precompression in the prestressed member as the adjacent concrete absorbs the compression. This reduction in precompression of the prestressed member can occur over a period of years and will result in additional time-dependent deflections and an increase in tensile stresses in the prestressed member.

Any suitable method for calculating time-dependent deflections of prestressed members may be used, provided all effects are considered. Guidance may be found in ACI 209R, ACI Committee 435 (1963), Branson et al. (1970), and Ghali and Favre (1986).

R24.2.5 *Calculation of deflections of composite concrete construction*

Composite concrete members are designed to meet the horizontal shear strength requirements of 16.4. Because few tests have been made to study the immediate and time-dependent deflections of composite members, the requirements given in this section are based on the judgment of ACI Committee 318 and on experience.

In 22.3.3.3, it is stated that distinction need not be made between shored and unshored members. This refers to strength calculations, not to deflections. Construction documents should indicate whether composite concrete design is based on shored or unshored construction, as required by 26.11.1.1.