CODE

6.3—Modeling assumptions
6.3.1 *General*

6.3.1.1 Relative stiffnesses of members within structural systems shall be selected based on a reasonable set of assumptions. The assumptions shall be consistent throughout each analysis.

6.3.1.2 To calculate moments and shears caused by gravity loads in columns, beams, and slabs, it shall be permitted to use a model limited to the members in the level being considered and the columns above and below that level. It shall be permitted to assume far ends of columns built integrally with the structure to be fixed.

6.3.1.3 The analysis model shall consider the effects of variation of member cross-sectional properties, such as that due to haunches.

6.3.2 *T-beam geometry*

6.3.2.1 For nonprestressed T-beams supporting monolithic or composite slabs, the effective flange width b_f shall include the beam web width b_w plus an effective overhanging flange width in accordance with Table 6.3.2.1, where h is the slab thickness and s_w is the clear distance to the adjacent web.

COMMENTARY

R6.3—Modeling assumptions
R6.3.1 *General*

R6.3.1.1 Separate analyses with different stiffness assumptions may be performed for different objectives such as to check serviceability and strength criteria or to bound the demands on elements where stiffness assumptions are critical.

Ideally, the member stiffnesses E_cI and GJ should reflect the degree of cracking and inelastic action that has occurred along each member before yielding. However, the complexities involved in selecting different stiffnesses for all members of a frame would make frame analyses inefficient in the design process. Simpler assumptions are required to define flexural and torsional stiffnesses.

For braced frames, relative values of stiffness are important. A common assumption is to use $0.5I_g$ for beams and I_g for columns.

For sway frames, a realistic estimate of I is desirable and should be used if second-order analyses are performed. Guidance for the choice of I for this case is given in 6.6.3.1.

Two conditions determine whether it is necessary to consider torsional stiffness in the analysis of a given structure: 1) the relative magnitude of the torsional and flexural stiffnesses; and 2) whether torsion is required for equilibrium of the structure (equilibrium torsion) or is due to members twisting to maintain deformation compatibility (compatibility torsion). In the case of equilibrium torsion, torsional stiffness should be included in the analysis. It is, for example, necessary to consider the torsional stiffnesses of edge beams. In the case of compatibility torsion, torsional stiffness usually is not included in the analysis. This is because the cracked torsional stiffness of a beam is a small fraction of the flexural stiffness of the members framing into it. Torsion should be considered in design as required in Chapter 9.

R6.3.1.3 Stiffness and fixed-end moment coefficients for haunched members may be obtained from the Portland Cement Association (1972).

R6.3.2 *T-beam geometry*

R6.3.2.1 In ACI 318M-11, the width of the slab effective as a T-beam flange was limited to one-fourth the span. The Code now allows one-eighth of the span on each side of the beam web. This was done to simplify Table 6.3.2.1 and has negligible impact on designs.