CODE

(b) For frames or continuous construction, it shall be permitted to assume the intersecting member regions are rigid.

6.6.3 *Section properties*

6.6.3.1 *Factored load analysis*

6.6.3.1.1 Moment of inertia and cross-sectional area of members shall be calculated in accordance with Tables 6.6.3.1.1(a) or 6.6.3.1.1(b), unless a more rigorous analysis is used. If sustained lateral loads are present, I for columns and walls shall be divided by $(1 + \beta_{ds})$, where β_{ds} is the ratio of maximum factored sustained shear within a story to the maximum factored shear in that story associated with the same load combination.

Table 6.6.3.1.1(a)—Moments of inertia and cross-sectional areas permitted for elastic analysis at factored load level

Member and condition		Moment of inertia	Cross-sectional area for axial deformations	Cross-sectional area for shear deformations
Columns		$0.70I_g$	$1.0A_g$	b_wh
Walls	Uncracked	$0.70I_g$		
	Cracked	$0.35I_g$		
Beams		$0.35I_g$		
Flat plates and flat slabs		$0.25I_g$		

COMMENTARY

R6.6.3 *Section properties*

R6.6.3.1 *Factored load analysis*

For lateral load analysis, either the stiffnesses presented in 6.6.3.1.1 or 6.6.3.1.2 can be used. These provisions both use values that approximate the stiffness for reinforced concrete building systems loaded to near or beyond the yield level, and have been shown to produce reasonable correlation with both experimental and detailed analytical results (Moehle 1992; Lepage 1998). For earthquake-induced loading, the use of 6.6.3.1.1 or 6.6.3.1.2 may require a deflection amplification factor to account for inelastic deformations. In general, for effective section properties, E_c may be calculated or specified in accordance with 19.2.2, the shear modulus may be taken as $0.4E_c$, and areas may be taken as given in Table 6.6.3.1.1(a).

R6.6.3.1.1 The values of I and A have been chosen from the results of frame tests and analyses, and include an allowance for the variability of the calculated deflections. The moments of inertia are taken from MacGregor and Hage (1977), which are multiplied by a stiffness reduction factor $\phi_K = 0.875$ (refer to R6.6.4.5.2). For example, the moment of inertia for columns is $0.875(0.80I_g) = 0.70I_g$.

The moment of inertia of T-beams should be based on the effective flange width defined in 6.3.2.1 or 6.3.2.2. It is generally sufficiently accurate to take I_g of a T-beam as $2I_g$ for the web, $2(b_wh^3/12)$.

If the factored moments and shears from an analysis based on the moment of inertia of a wall, taken equal to $0.70I_g$, indicate that the wall will crack in flexure, based on the modulus of rupture, the analysis should be repeated with $I = 0.35I_g$ in those stories where cracking is predicted using factored loads.

The values of the moments of inertia were derived for nonprestressed members. For prestressed members, the moments of inertia may differ depending on the amount, location, and type of reinforcement, and the degree of cracking prior to reaching ultimate load. The stiffness values for prestressed concrete members should include an allowance for the variability of the stiffnesses.

The equations in Table 6.6.3.1.1(b) provide more refined values of I considering axial load, eccentricity, reinforcement ratio, and concrete compressive strength as presented in Khuntia and Ghosh (2004a,b). The stiffnesses provided in these references are applicable for all levels of loading, including service and ultimate, and consider a stiffness reduction factor ϕ_K comparable to that for the moment of inertias included in Table 6.6.3.1.1(a). For use at load levels