

## CODE

**Table 6.6.3.1.1(b)—Alternative moments of inertia for elastic analysis at factored load**

Member	Alternative value of $I$ for elastic analysis		
	Minimum	$I$	Maximum
Columns and walls	$0.35I_g$	$\left(0.80 + 25 \frac{A_u}{A_g}\right) \left(1 - \frac{M_u}{P_u h} - 0.5 \frac{P_u}{P_o}\right) I_g$	$0.875I_g$
Beams, flat plates, and flat slabs	$0.25I_g$	$(0.10 + 25p) \left(1.2 - 0.2 \frac{b_v}{d}\right) I_g$	$0.5I_g$

Notes: For continuous flexural members,  $I$  shall be permitted to be taken as the average of values obtained for the critical positive and negative moment sections.  $P_u$  and  $M_u$  shall be calculated from the load combination under consideration, or the combination of  $P_u$  and  $M_u$  that produces the least value of  $I$ .

**6.6.3.1.2** For factored lateral load analysis, it shall be permitted to assume  $I = 0.5I_g$  for all members or to calculate  $I$  by a more detailed analysis, considering the effective stiffness of all members under the loading conditions.

**6.6.3.1.3** For factored lateral load analysis of two-way slab systems without beams, which are designated as part of the seismic-force-resisting system,  $I$  for slab members shall be defined by a model that is in substantial agreement with results of comprehensive tests and analysis and  $I$  of other frame members shall be in accordance with 6.6.3.1.1 and 6.6.3.1.2.

**6.6.3.2 Service load analysis**

**6.6.3.2.1** Immediate and time-dependent deflections due to gravity loads shall be calculated in accordance with 24.2.

## COMMENTARY

other than ultimate,  $P_u$  and  $M_u$  should be replaced with their appropriate values at the desired load level.

**R6.6.3.1.2** The lateral deflection of a structure under factored lateral loads can be substantially different from that calculated using linear analysis, in part because of the inelastic response of the members and the decrease in effective stiffness. Selection of the appropriate effective stiffness for reinforced concrete frame members has dual purposes: 1) to provide realistic estimates of lateral deflection; and 2) to determine deflection-imposed actions on the gravity system of the structure. A detailed nonlinear analysis of the structure would adequately capture these two effects. A simple way to estimate an equivalent nonlinear lateral deflection using linear analysis is to reduce the modeled stiffness of the concrete members in the structure. The type of lateral load analysis affects the selection of appropriate effective stiffness values. For analyses with wind loading, where it is desirable to prevent nonlinear action in the structure, effective stiffnesses representative of pre-yield behavior may be appropriate. For earthquake-induced loading, the level of nonlinear deformation depends on the intended structural performance and earthquake recurrence interval.

Varying degrees of confidence can be obtained from a simple linear analysis based on the computational rigor used to define the effective stiffness of each member. This stiffness can be based on the secant stiffness to a point at or beyond yield or, if yielding is not expected, to a point before yield occurs.

**R6.6.3.1.3** Analysis of buildings with two-way slab systems without beams requires that the model represents the transfer of lateral loads between vertical members. The model should result in prediction of stiffness in substantial agreement with results of comprehensive tests and analysis. Several acceptable models have been proposed to accomplish this objective (Vanderbilt and Corley 1983; Hwang and Moehle 2000; Dovich and Wight 2005).

**R6.6.3.2 Service load analysis**