

Accidental eccentricity design

Are accidental-eccentricity load cases not required when using semi-rigid diaphragms?

Extended Question: IBC code requires consideration of additional seismic load cases with 5% eccentricity when designing rigid diaphragms. Can this design check be avoided by using semi-rigid diaphragms?

Answer: Accidental eccentricity must be considered because reinforced-concrete slabs [designed](#) without the [ETABS](#) rigid-diaphragm feature are not necessarily flexible diaphragms, as explicitly defined by IBC 2006 and ASCE 7-05:

IBC 2006 Clause 1601.1

- **Diaphragm flexible.** A diaphragm is flexible for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE7, as modified in Section 1613.6.1.

ASCE 7-05 Clause 12.3.1

- **12.3.1 Diaphragm Flexibility.** The structural analysis shall consider the relative stiffnesses of diaphragms and the vertical elements of the seismic force-resisting system. Unless a diaphragm can be idealized as either flexible or rigid in accordance with Sections 12.3.1.1, 12.3.1.2, or 12.3.1.3, the structural analysis shall explicitly include consideration of the stiffness of the diaphragm (i.e., semi-rigid modeling assumption).
- **12.3.1.1 Flexible Diaphragm Condition.** Diaphragms constructed of untopped steel decking or wood structural panels are permitted to be idealized as flexible in structures in which the vertical elements are steel or composite steel and concrete braced frames, or concrete, masonry, steel, or composite shear walls. Diaphragms of wood structural panels or untopped steel decks in one- and two-family residential buildings of light-frame construction shall also be permitted to be idealized as flexible.
- **12.3.1.2 Rigid Diaphragm Condition.** Diaphragms of concrete slabs or concrete filled metal deck with span-to-depth ratios of 3 or less in structures that have no horizontal irregularities are permitted to be idealized as rigid.
- **12.3.1.3 Calculated Flexible Diaphragm Condition.** Diaphragms not satisfying the conditions of Sections 12.3.1.1 or 12.3.1.2 are permitted to be idealized as flexible where the computed maximum in plane deflection of the diaphragm under lateral load is more than two times the average story drift of adjoining vertical elements of the seismic force-resisting system of the associated story under equivalent tributary lateral load as shown in Fig. 12.3-1. The loadings used for this calculation shall be those prescribed by Section 12.8.

See Also

- [Diaphragm forces using Section Cuts](#) article
- [Rigid vs. Semi-rigid diaphragm](#) article