

CODE

12.4.2.3 Any set of reasonable and consistent assumptions for diaphragm stiffness shall be permitted.

COMMENTARY

in which diaphragm and vertical element stiffnesses have approximately the same value, buildings with large force transfers, and parking structures in which ramps connect between floors and act essentially as bracing elements within the building.

For diaphragms constructed of concrete slabs, **ASCE/SEI 7** permits the assumption of a rigid diaphragm if the diaphragm aspect ratio falls within a prescribed limit, which is different for wind and earthquake loads, and if the structure has no horizontal irregularities. **ASCE/SEI 7** provisions do not prohibit the rigid diaphragm assumption for other conditions, provided the rigid diaphragm assumption is reasonably consistent with anticipated behavior. Cast-in-place concrete diaphragms designed with the rigid-diaphragm assumption have a long history of satisfactory performance even though they may fall outside the **ASCE/SEI 7** index values.

R12.4.2.3 For low-aspect-ratio diaphragms that are entirely cast-in-place or comprise a cast-in-place topping slab on precast elements, the diaphragm is often modeled as a rigid element supported by flexible vertical elements. However, effects of diaphragm flexibility should be considered where such effects will materially affect calculated design actions. Such effects should be considered for diaphragms that use precast elements, with or without a cast-in-place topping. Where large transfer forces occur, as outlined in **R12.2.1(b)**, more realistic design forces can be obtained by modeling diaphragm in-plane stiffness. Diaphragms with long spans, large cutout areas, or other irregularities may develop in-plane deformations that should be considered in design (refer to Fig. **R12.4.2.3a**).

For a diaphragm considered rigid in its own plane, and for semi-rigid diaphragms, the diaphragm internal force distribution can be obtained by modeling it as a horizontal rigid beam supported on springs representing lateral stiffnesses of the vertical elements (refer to Fig. **R12.4.2.3b**). Effects of in-plane eccentricity between applied forces and vertical element resistances, resulting in overall building torsion, should be included in the analysis. Elements of the lateral-force-resisting system aligned in the orthogonal direction can participate in resisting diaphragm plan rotation (**Moehle et al. 2010**).