

CODE

12.3.1.1 Diaphragms shall have thickness as required for stability, strength, and stiffness under factored load combinations.

12.3.1.2 Floor and roof diaphragms shall have a thickness not less than that required for floor and roof elements in other parts of this Code.

12.4—Required strength

12.4.1 General

12.4.1.1 Required strength of diaphragms, collectors, and their connections shall be calculated in accordance with the factored load combinations in **Chapter 5**.

12.4.1.2 Required strength of diaphragms that are part of floor or roof construction shall include effects of out-of-plane loads simultaneous with other applicable loads.

12.4.2 Diaphragm modeling and analysis

12.4.2.1 Diaphragm modeling and analysis requirements of the general building code shall govern where applicable. Otherwise, diaphragm modeling and analysis shall be in accordance with 12.4.2.2 through 12.4.2.4.

12.4.2.2 Modeling and analysis procedures shall satisfy requirements of **Chapter 6**.

COMMENTARY

Diaphragms may be required to resist in-plane moment, shear, and axial force. For diaphragms that are entirely cast-in-place or comprise topping slabs composite with precast members, thickness of the entire diaphragm must be sufficient to resist these actions. For noncomposite topping slabs, thickness of the cast-in-place topping alone must be sufficient to resist these actions. **Section 18.12** contains specific requirements for diaphragms in buildings assigned to Seismic Design Categories D, E, and F.

In addition to requirements for in-plane force resistance, diaphragms that are part of floor or roof construction must satisfy applicable requirements for slab or flange thickness.

R12.4—Required strength

Factored load combinations generally require consideration of out-of-plane loads that act simultaneously with diaphragm in-plane forces. For example, this is required where a floor beam also serves as a collector, in which case the beam is to be designed to resist axial forces acting as a collector and bending moments acting as a floor beam supporting gravity loads.

R12.4.2 Diaphragm modeling and analysis

R12.4.2.1 **ASCE/SEI 7** includes diaphragm modeling requirements for some design conditions, such as design to resist wind and earthquake loads. Where **ASCE/SEI 7** is adopted as part of the general building code, those requirements govern over provisions of this Code.

R12.4.2.2 **Chapter 6** contains general requirements for analysis that are applicable to diaphragms. Diaphragms are usually designed to remain elastic or nearly elastic for forces acting within their plane under factored load combinations. Therefore, analysis methods satisfying theory of elastic analysis are generally acceptable. The provisions for elastic analysis in **6.6.1** through **6.6.3** can be applied.

Diaphragm in-plane stiffness affects not only the distribution of forces within the diaphragm, but also the distribution of displacements and forces among the vertical elements. Thus, the diaphragm stiffness model should be consistent with characteristics of the building. Where the diaphragm is very stiff compared to the vertical elements, as in a low aspect ratio, cast-in-place diaphragm supported by moment frames, it is acceptable to model the diaphragm as a completely rigid element. Where the diaphragm is flexible compared with the vertical elements, as in some jointed precast systems supported by structural walls, it may be acceptable to model the diaphragm as a flexible beam spanning between rigid supports. In other cases, it may be advisable to adopt a more detailed analytical model to account for the effects of diaphragm flexibility on the distribution of displacements and forces. Examples include buildings