

## CODE

## COMMENTARY

which in turn distribute the lateral soil forces to other force-resisting elements.

(b) **Diaphragm transfer forces**—Vertical elements of the lateral-force-resisting system may have different properties over their height, or their planes of resistance may change from one story to another, creating force transfers between vertical elements. A common location where planes of resistance change is at grade level of a building with an enlarged subterranean plan; at this location, forces may transfer from the narrower tower into the basement walls through a podium diaphragm (refer to Fig. R12.1.1).

(c) **Connection forces**—Wind pressure acting on exposed building surfaces generates out-of-plane forces on those surfaces. Similarly, earthquake shaking can produce inertial forces in vertical framing and nonstructural elements such as cladding. These forces are transferred from the elements where the forces are developed to the diaphragm through connections.

(d) **Column bracing forces**—Architectural configurations sometimes require inclined columns, which can result in large horizontal thrusts acting within the plane of the diaphragms due to gravity and overturning actions. The thrusts can act in different directions depending on orientation of the column and whether it is in compression or tension. Where these thrusts are not balanced locally by other elements, the forces have to be transferred into the diaphragm so they can be transmitted to other suitable elements of the lateral-force-resisting system. Such forces are common and may be significant with eccentrically loaded precast concrete columns that are not monolithic with adjacent framing. The diaphragm also provides lateral support to columns not designed as part of the lateral-force-resisting system by connecting them to other elements that provide lateral stability for the structure.

(e) **Diaphragm out-of-plane forces**—Most diaphragms are part of floor and roof framing and, therefore, support gravity loads. The general building code may also require consideration of out-of-plane forces due to wind uplift pressure on a roof slab and vertical acceleration due to earthquake effects.

**12.2.2** The effects of slab openings and slab voids shall be considered in design.

**R12.2.2** Refer to **R7.2.1**.

### 12.2.3 Materials

**12.2.3.1** Design properties for concrete shall be selected to be in accordance with **Chapter 19**.

**12.2.3.2** Design properties for steel reinforcement shall be selected to be in accordance with **Chapter 20**.

## 12.3—Design limits

### 12.3.1 Minimum diaphragm thickness

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