

- d. The lower portion shall be designed as a separate structure using the appropriate values of  $R$  and  $\rho$ . The reactions from the upper portion shall be those determined from the analysis of the upper portion amplified by the ratio of the  $R/\rho$  of the upper portion over  $R/\rho$  of the lower portion. This ratio shall not be less than 1.0.
- e. The upper portion is analyzed with the equivalent lateral force or modal response spectrum procedure, and the lower portion is analyzed with the equivalent lateral force procedure.

### 12.2.3.3 $R$ , $C_d$ , and $\Omega_0$ Values for Horizontal Combinations

The value of the response modification coefficient,  $R$ , used for design in the direction under consideration shall not be greater than the least value of  $R$  for any of the systems utilized in that direction. The deflection amplification factor,  $C_d$ , and the overstrength factor,  $\Omega_0$ , shall be consistent with  $R$  required in that direction.

**EXCEPTION:** Resisting elements are permitted to be designed using the least value of  $R$  for the different structural systems found in each independent line of resistance if the following three conditions are met: (1) Risk Category I or II building, (2) two stories or less above grade plane, and (3) use of light-frame construction or flexible diaphragms. The value of  $R$  used for design of diaphragms in such structures shall not be greater than the least value of  $R$  for any of the systems utilized in that same direction.

## 12.2.4 Combination Framing Detailing Requirements

Structural members common to different framing systems used to resist seismic forces in any direction shall be designed using the detailing requirements of Chapter 12 required by the highest response modification coefficient,  $R$ , of the connected framing systems.

## 12.2.5 System Specific Requirements

The structural framing system shall also comply with the following system specific requirements of this section.

### 12.2.5.1 Dual System

For a dual system, the moment frames shall be capable of resisting at least 25 percent of the design seismic forces. The total seismic force resistance is to be provided by the combination of the moment frames and the shear walls or braced frames in proportion to their rigidities.

### 12.2.5.2 Cantilever Column Systems

Cantilever column systems are permitted as indicated in Table 12.2-1 and as follows. The required axial strength of individual cantilever column elements, considering only the load combinations that include seismic load effects, shall not exceed 15 percent of the available axial strength, including slenderness effects.

Foundation and other elements used to provide overturning resistance at the base of cantilever column elements shall be designed to resist the seismic load effects including overstrength factor of Section 12.4.3.

### 12.2.5.3 Inverted Pendulum-Type Structures

Regardless of the structural system selected, inverted pendulums as defined in Section 11.2, shall comply with this section. Supporting columns or piers of inverted pendulum-type structures shall be designed for the bending moment calculated at the base determined using the procedures given in Section 12.8 and varying uniformly to a moment at the top equal to one-half the calculated bending moment at the base.

### 12.2.5.4 Increased Structural Height Limit for Steel Eccentrically Braced Frames, Steel Special Concentrically Braced Frames, Steel Buckling-restrained Braced Frames, Steel Special Plate Shear Walls and Special Reinforced Concrete Shear Walls

The limits on structural height,  $h_n$ , in Table 12.2-1 are permitted to be increased from 160 ft (50 m) to 240 ft (75 m) for structures assigned to Seismic Design Categories D or E and from 100 ft (30 m) to 160 ft (50 m) for structures assigned to Seismic Design Category F provided the seismic force-resisting systems are limited to steel eccentrically braced frames, steel special concentrically braced frames, steel buckling-restrained braced frames, steel special plate shear walls, or special reinforced concrete cast-in-place shear walls and both of the following requirements are met:

1. The structure shall not have an extreme torsional irregularity as defined in Table 12.2-1 (horizontal structural irregularity Type 1b).
2. The steel eccentrically braced frames, steel special concentrically braced frames, steel buckling-restrained braced frames, steel special plate shear walls or special reinforced cast-in-place concrete shear walls in any one plane shall resist no more than 60 percent of the total seismic forces in each direction, neglecting accidental torsional effects.