

interface considering the most disadvantageous location of eccentric mass.

- c. Assess overturning/uplift forces on individual isolator units.
- d. Account for the effects of vertical load, bilateral load, and/or the rate of loading if the force-deflection properties of the isolation system are dependent on one or more of these attributes.

The total design displacement and total maximum displacement across the isolation system shall be calculated using a model of the isolated structure that incorporates the force-deflection characteristics of nonlinear elements of the isolation system and the seismic force-resisting system.

#### 17.6.2.2 Isolated Structure

The maximum displacement of each floor and design forces and displacements in elements of the seismic force-resisting system are permitted to be calculated using a linear elastic model of the isolated structure provided that both of the following conditions are met:

1. Stiffness properties assumed for the nonlinear components of the isolation system are based on the maximum effective stiffness of the isolation system; and
2. All elements of the seismic force-resisting system of the structure above the isolation system remain elastic for the design earthquake.

Seismic force-resisting systems with elastic elements include, but are not limited to, irregular structural systems designed for a lateral force not less than 100 percent of  $V_s$  and regular structural systems designed for a lateral force not less than 80 percent of  $V_s$ , where  $V_s$  is determined in accordance with Section 17.5.4.2.

### 17.6.3 Description of Procedures

#### 17.6.3.1 General

Response-spectrum and response-history procedures shall be performed in accordance with Section 12.9 and Chapter 16, and the requirements of this section.

#### 17.6.3.2 Input Earthquake

The design earthquake ground motions shall be used to calculate the total design displacement of the

isolation system and the lateral forces and displacements in the isolated structure. The maximum considered earthquake shall be used to calculate the total maximum displacement of the isolation system.

#### 17.6.3.3 Response-Spectrum Procedure

Response-spectrum analysis shall be performed using a modal damping value for the fundamental mode in the direction of interest not greater than the effective damping of the isolation system or 30 percent of critical, whichever is less. Modal damping values for higher modes shall be selected consistent with those that would be appropriate for response-spectrum analysis of the structure above the isolation system assuming a fixed base.

Response-spectrum analysis used to determine the total design displacement and the total maximum displacement shall include simultaneous excitation of the model by 100 percent of the ground motion in the critical direction and 30 percent of the ground motion in the perpendicular, horizontal direction. The maximum displacement of the isolation system shall be calculated as the vectorial sum of the two orthogonal displacements.

The design shear at any story shall not be less than the story shear resulting from application of the story forces calculated using Eq. 17.5-9 and a value of  $V_s$  equal to the base shear obtained from the response-spectrum analysis in the direction of interest.

#### 17.6.3.4 Response-History Procedure

Where a response-history procedure is performed, a suite of not fewer than three pairs of appropriate ground motions shall be used in the analysis; the ground motion pairs shall be selected and scaled in accordance with Section 17.3.2.

Each pair of ground motion components shall be applied simultaneously to the model considering the most disadvantageous location of eccentric mass. The maximum displacement of the isolation system shall be calculated from the vectorial sum of the two orthogonal displacements at each time step.

The parameters of interest shall be calculated for each ground motion used for the response-history analysis. If seven or more pairs of ground motions are used for the response-history analysis, the average value of the response parameter of interest is permitted to be used for design. If fewer than seven pairs of ground motions are used for analysis, the maximum value of the response parameter of interest shall be used for design.