

# Chapter 17

## SEISMIC DESIGN REQUIREMENTS FOR SEISMICALLY ISOLATED STRUCTURES

### 17.1 GENERAL

Every seismically isolated structure and every portion thereof shall be designed and constructed in accordance with the requirements of this section and the applicable requirements of this standard.

#### 17.1.1 Variations in Material Properties

The analysis of seismically isolated structures, including the substructure, isolators, and superstructure, shall consider variations in seismic isolator material properties over the projected life of the structure including changes due to aging, contamination, environmental exposure, loading rate, scragging, and temperature.

#### 17.1.2 Definitions

##### DISPLACEMENT:

**Design Displacement:** The design earthquake lateral displacement, excluding additional displacement due to actual and accidental torsion, required for design of the isolation system.

**Total Design Displacement:** The design earthquake lateral displacement, including additional displacement due to actual and accidental torsion, required for design of the isolation system or an element thereof.

**Total Maximum Displacement:** The maximum considered earthquake lateral displacement, including additional displacement due to actual and accidental torsion, required for verification of the stability of the isolation system or elements thereof, design of structure separations, and vertical load testing of isolator unit prototypes.

**DISPLACEMENT RESTRAINT SYSTEM:** A collection of structural elements that limits lateral displacement of seismically isolated structures due to the maximum considered earthquake.

**EFFECTIVE DAMPING:** The value of equivalent viscous damping corresponding to energy dissipated during cyclic response of the isolation system.

**EFFECTIVE STIFFNESS:** The value of the lateral force in the isolation system, or an element thereof, divided by the corresponding lateral displacement.

**ISOLATION INTERFACE:** The boundary between the upper portion of the structure, which is isolated, and the lower portion of the structure, which moves rigidly with the ground.

**ISOLATION SYSTEM:** The collection of structural elements that includes all individual isolator units, all structural elements that transfer force between elements of the isolation system, and all connections to other structural elements. The isolation system also includes the wind-restraint system, energy-dissipation devices, and/or the displacement restraint system if such systems and devices are used to meet the design requirements of this chapter.

**ISOLATOR UNIT:** A horizontally flexible and vertically stiff structural element of the isolation system that permits large lateral deformations under design seismic load. An isolator unit is permitted to be used either as part of, or in addition to, the weight-supporting system of the structure.

**MAXIMUM DISPLACEMENT:** The maximum considered earthquake lateral displacement, excluding additional displacement due to actual and accidental torsion.

**SCRAGGING:** Cyclic loading or working of rubber products, including elastomeric isolators, to effect a reduction in stiffness properties, a portion of which will be recovered over time.

**WIND-RESTRAINT SYSTEM:** The collection of structural elements that provides restraint of the seismic-isolated structure for wind loads. The wind-restraint system is permitted to be either an integral part of isolator units or a separate device.

#### 17.1.3 Notation

$B_D$  = numerical coefficient as set forth in Table 17.5-1 for effective damping equal to  $\beta_D$

$B_M$  = numerical coefficient as set forth in Table 17.5-1 for effective damping equal to  $\beta_M$

$b$  = shortest plan dimension of the structure, in ft (mm) measured perpendicular to  $d$