E. Nonstructural Seismic Risk Ratings

The risk ratings that appear in this Appendix are provided as an aid to establishing priorities. Nonstructural components are organized by component type, and estimates of the potential risk posed by the component are given for different ground shaking intensities. Each component is rated for High (H), Moderate (M) or Low (L) potential risk to Life Safety, Property Loss, and Functional Loss. The seismic risk ratings are based on the following definitions and assumptions:

SHAKING INTENSITY: For a particular geographic location in the United States, the shaking intensity may be estimated by using the seismic map in Figure 3.2.1-1 that shows the areas that are likely to experience minimal, low, moderate, or high ground shaking during future probable maximum considered earthquake events that may affect the areas. The shaking intensity estimates based on the map in Figure 3.2.1-1 should be adequate for items situated at or near the ground in simple, nonessential facilities. For other situations, it may be advisable to choose the next higher shaking intensity or to seek the advice of professional consultants. Note that for areas with light shaking, a full blown upgrade of nonstructural components may not be warranted, unless an owner is particularly risk averse; the current code would not require many of the protective measures recommended herein, even for new construction.

LIFE SAFETY (LS) RISK: Risk of death or direct injury requiring hospitalization.. This does not include the overall impact on life safety systems in a building, such as loss of emergency power in a hospital or loss of fire detection or suppression capability. These disruptions of service are covered under Functional Loss below.

PROPERTY LOSS (PL) RISK: Risk of incurring a repair or replacement cost because of damage to the item. This property loss, as used here, includes the cost of fixing a broken pipe but not the indirect cost of water leakage damage, and includes the cost of repairing a computer but not the loss of business revenue computer downtime might cause. These indirect effects cannot be estimated here on a generic basis.

FUNCTIONAL LOSS (FL) RISK: Risk that the item will not function because it has been damaged. This includes some consideration of the impact of this loss of function of the component on the operation of an ordinary occupancy building. Not included are off-site functional impacts, such as the loss of function of a piece of equipment because of a city-wide

power outage. Outages of power, water, and other utility company or agency services are real problems to consider but are outside the scope of the item-by-item ratings here.

TYPE OF DETAIL: For components where an illustrated example is provided in Chapter 6, the detail type is indicated as Non-engineered (NE), Prescriptive (PR), or Engineering Required (ER). The example number (e.g. 6.3.1.1 for adhered veneer) is shown at the left.

ASSUMPTION 1: The risk ratings are based on the assumption that the item has been installed without seismic bracing, seismic anchorage, seismic restraint, or allowance for differential movements. In areas of the U.S. where seismic building code provisions have only recently been enforced, this assumption will be generally true. In areas of the western U.S. where seismic codes have been enforced for some time, this assumption may not always be true. Particularly in buildings constructed in the western states since the mid-1970s, some nonstructural items may be anchored or braced, but the assumption of unanchored and unbraced items will still be true for many items on these lists.

ASSUMPTION 2: The item is assumed to be located at or near the ground level, or in a low-rise building. The most common case of a relatively stiff low-rise building with structural walls is presumed in the ratings here. Items such as full-height partitions and glazing are more likely to be damaged in flexible buildings that experience large lateral deformations. Damage to items sensitive to imposed deformation will be greater in buildings or portions of buildings that are more flexible, such as mid- and high-rise buildings; flexible frame buildings without significant structural walls; "soft stories" of buildings with structural walls in most stories but with a story, typically the ground story, that is much less laterally stiff because of the absence of walls; and the "soft wall" sides of bearing wall buildings where there is little or no solid wall area, such as the face of a typical commercial storefront building.

ASSUMPTION 3: For building occupancy, an ordinary occupancy category is assumed. Thus, in the case of essential or specialized facilities, some nonstructural components would be rated differently. For example, in this appendix the risk ratings are given for shelving in an ordinary occupancy building, but the same shelving would be rated quite differently with regard to Life Safety risk in a lab, Property Loss risk in a museum, or risk of Functional Loss in a communications center.

For most of the nonstructural components listed below, the risk ratings for those components would be reduced significantly if the components were installed or retrofitted in accordance with recommendations of Chapter 6 or were installed within a seismically isolated building.

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.3	Architectural Components					
6.3.1	Exterior Wall Components[1]					
6.3.1.1	Adhered veneer	Low	M	M	L	ER
		Mod	H	H	L	
		High	H	H	L	
6.3.1.2	Anchored veneer	Low	M	M	L	ER
		Mod	H	H	L	
		High	H	H	L	
6.3.1.3	Prefabricated panels	Low	M	M	L	ER
		Mod	H	H	L	
		High	H	H	M	
6.3.1.4	Glazed exterior wall system	Low	L	L	L	ER
		Mod	M	M	L	
		High	H	M	M	
6.3.1.5	Glass blocks	Low	L	L	L	ER
		Mod	M	M	L	
		High	H	H	M	
N/A	Overhead glazing or skylights	Low	L	L	L	
		Mod	H	M	L	
		High	H	M	M	
6.3.2	Partitions[2]					
6.3.2.1	Heavy (CMU, brick, hollow clay tile)	Low	L	L	L	ER
		Mod	H	H	H	
		High	H	H	H	
6.3.2.2	Light (partial- or full-height stud wall partitions)	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	H	H	
6.3.2.3	Glazed	Low	L	L	L	ER
		Mod	M	M	L	
		High	M	H	M	
6.3.3	Interior Veneers[2]					
6.3.3.1	Stone and tile	Low	L	L	L	ER
		Mod	H	H	M	
		High	H	H	M	
6.3.4	Ceilings					
6.3.4.1	Suspended acoustic lay-in tile ceiling	Low	L	L	L	PR
		Mod	L	M	M	
		High	M	H	H	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.3.4.2	Directly applied to structure	Low	L	L	L	NE
		Mod	M	M	M	
		High	M	H	H	
N/A	Soffits (stucco, gypsum board, plaster)	Low	L	L	L	
		Mod	M	M	M	
		High	H	H	H	
6.3.4.3	Suspended heavy ceilings	Low	L	L	L	PR
		Mod	M	M	M	
		High	H	H	H	
6.3.5	**Parapets, Appendages, Roof Tiles**					
6.3.5.1	Unreinforced masonry parapet	Low	M	M	L	ER
		Mod	H	H	L	
		High	H	H	L	
N/A	Parapets, cornices, decoration	Low	M	M	L	
		Mod	H	H	L	
		High	H	H	L	
N/A	Hanging appendages	Low	L	L	L	
		Mod	H	H	L	
		High	H	H	M	
N/A	Clay roof tiles[1]	Low	L	L	L	
		Mod	L	M	L	
		High	M	H	M	
6.3.6	**Canopies, Marquees, Signs**					
6.3.6.1	Canopies, Marquees, Signs	Low	L	L	L	ER
		Mod	H	H	L	
		High	H	H	M	
N/A	Heavy signs or exterior billboards	Low	L	L	L	
		Mod	H	H	L	
		High	H	H	L	
N/A	Flagpoles	Low	L	L	L	
		Mod	L	L	L	
		High	M	L	L	
6.3.7	**Chimneys and Stacks**					
6.3.7.1	Unreinforced masonry chimney	Low	L	L	L	ER
		Mod	M	M	L	
		High	H	M	M	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
N/A	Stacks, small	Low	L	L	L	
		Mod	M	M	L	
		High	H	M	M	
6.3.8	**Stairways**					
6.3.8.1	Stairways	Low	L	L	L	
		Mod	H	M	M	ER
		High	H	M	H	
6.3.9	**Freestanding Walls or Fences**					
6.3.9.1	Freestanding Walls or Fences	Low	L	L	L	
		Mod	L	L	L	PR
		High	M	H	M	
6.4	**Mechanical, Electrical, & Plumbing Components**					
6.4.1	**Mechanical Equipment**					
6.4.1.1	Boilers, furnaces, pumps and chillers (HVAC wet side)	Low	L	L	L	
		Mod	L	L	L	ER
		High	M	M	H	
N/A	Boilers and furnaces (rigid mount)	Low	L	L	L	
		Mod	L	L	L	
		High	M	M	M	
N/A	Chillers	Low	L	L	L	
		Mod	L	L	L	
		High	L	M	H	
N/A	Heat pumps or heat exchangers	Low	L	L	L	
		Mod	L	L	L	
		High	L	M	M	
6.4.1.2	General manufacturing and process machinery	Low	L	L	L	
		Mod	M	M	M	ER
		High	M	H	H	
6.4.1.3	HVAC equipment with vibration isolation	Low	L	L	L	
		Mod	L	M	L	ER
		High	L	M	M	
N/A	Fans, blowers, filters	Low	L	L	L	
		Mod	L	M	L	
		High	L	M	M	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
N/A	Air compressors	Low	L	L	L	
		Mod	L	M	L	
		High	L	M	M	
N/A	Roof mounted HVAC units	Low	L	M	L	
		Mod	L	M	L	
		High	M	H	M	
N/A	Roof mounted equipment, vents or flues	Low	L	L	L	
		Mod	L	M	L	
		High	M	M	M	
6.4.1.4	HVAC equipment without vibration isolation (rigid mount)	Low	L	L	L	ER
		Mod	L	L	L	
		High	L	M	M	
N/A	Wall-mounted room air conditioning units	Low	L	L	L	
		Mod	M	M	L	
		High	M	M	L	
6.4.1.5	HVAC equipment suspended in-line with ductwork	Low	L	L	L	ER
		Mod	L	M	L	
		High	L	M	M	
6.4.1.6	Suspended equipment	Low	L	L	L	ER
		Mod	H	H	L	
		High	H	H	L	
6.4.2	**Storage Tanks and Water Heaters**					
6.4.2.1	Structurally supported tanks and vessels	Low	L	L	L	ER
		Mod	M	H	M	
		High	M	H	M	
N/A	Diesel fuel tank	Low	L	L	L	
		Mod	H	H	L	
		High	H	H	M	
N/A	Propane tank	Low	L	L	L	
		Mod	H	H	M	
		High	H	H	M	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.4.2.2	Flat bottom tanks and vessels	Low	L	L	L	ER
		Mod	M	H	M	
		High	M	H	M	
6.4.2.3	Compressed gas cylinders (oxygen, CO_2, ammonia, etc.)	Low	L	L	L	NE
		Mod	M	M	L	
		High	H	M	M	
6.4.2.4	Gas water heaters	Low	L	L	L	PR
		Mod	M	H	L	
		High	H	H	L	
6.4.3	**Pressure Piping**					
6.4.3.1	Suspended pressure piping	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	H	M	
6.4.3.2	In-line valves and pumps	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	M	M	
6.4.3.3	Flexible connections, expansion joints and seismic separations	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	M	M	
6.4.3.4	Pipe Risers	Low	L	L	L	ER
		Mod	L	M	M	
		High	M	M	M	
6.4.3.5	Floor-mounted supports	Low	L	L	L	ER
		Mod	L	M	M	
		High	M	M	M	
6.4.3.6	Roof-mounted supports	Low	L	L	L	ER
		Mod	L	M	M	
		High	M	M	M	
6.4.3.7	Wall-mounted supports	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	M	M	
6.4.4	**Fire Protection Piping**					
6.4.4.1	Suspended fire protection piping	Low	L	M	M	ER
		Mod	L	H	H	
		High	M	H	H	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.4.5	**Fluid Piping, not Fire Protection**					
6.4.5.1	Hazardous materials	Low	L	L	L	ER
		Mod	H	H	H	
		High	H	H	H	
N/A	Fuel line	Low	L	L	L	
		Mod	H	H	L	
		High	H	H	M	
6.4.5.2	Nonhazardous materials	Low	L	L	L	ER
		Mod	M	M	M	
		High	M	M	M	
6.4.6	**Ductwork**					
6.4.6.1	Suspended Ductwork	Low	L	L	L	ER
		Mod	L	L	L	
		High	M	M	L	
6.4.6.2	Air diffuser	Low	L	L	L	NE, ER
		Mod	M	M	L	
		High	M	HM	L	
6.4.7	**Electrical and Communications Equipment**					
6.4.7.1	Control panels, motor control centers and switchgear	Low	L	L	L	ER
		Mod	L	L	L	
		High	M	M	M	
6.4.7.2	Emergency generator	Low	L	L	M	ER
		Mod	L	M	H	
		High	L	H	H	
6.4.7.3	Transformers	Low	L	L	L	ER
		Mod	L	L	L	
		High	M	M	M	
6.4.7.4	Batteries and battery rack	Low	L	L	L	ER
		Mod	L	H	M	
		High	L	H	H	
6.4.7.5	Photovoltaic power systems (Solar panels)	Low	L	L	L	ER
		Mod	L	L	L	
		High	M	M	L	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.4.7.6	Communication antennae	Low	L	L	L	
		Mod	L	M	L	ER
		High	M	H	M	
6.4.8	**Electrical and Communications Distribution Equipment**					
6.4.8.1	Electrical raceways, conduit, and cable trays	Low	L	L	L	
		Mod	L	M	M	ER
		High	M	M	M	
6.4.8.2	Distribution panels	Low	L	L	L	
		Mod	L	L	L	ER
		High	M	M	M	
6.4.9	**Light Fixtures**					
6.4.9.1	Recessed	Low	L	L	L	
		Mod	H	L	L	PR
		High	H	M	M	
6.4.9.2	Surface-mounted lighting	Low	L	L	L	
		Mod	H	L	L	PR
		High	H	M	M	
6.4.9.3	Pendant light fixtures	Low	L	L	L	
		Mod	H	L	L	NE
		High	H	M	M	
6.4.9.4	Heavy light fixtures	Low	L	L	L	
		Mod	H	L	L	NE
		High	H	M	M	
N/A	Exterior lighting	Low	L	L	L	
		Mod	M	L	L	
		High	M	M	M	
6.4.10	**Elevators and Escalators**					
6.4.10.1	Hydraulic Elevator (cab and elevator equipment)	Low	L	L	L	
		Mod	L	M	M	ER
		High	M	M	M	
6.4.10.2	Traction Elevator (elevator cab and shaft doors)	Low	L	L	L	
		Mod	L	M	M	ER
		High	M	M	H	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
N/A	Cables, counterweights and guide rails (for cable-traction system)	Low	L	L	L	
		Mod	H	M	M	
		High	H	M	M	
N/A	Elevator motor and motor control cabinets	Low	L	L	L	
		Mod	L	M	M	
		High	L	H	M	
6.4.10.3	Escalator	Low	L	L	L	
		Mod	M	M	M	ER
		High	H	H	H	
6.4.11	**Conveyors**					
6.4.11.1	Conveyors	Low	L	L	L	
		Mod	L	M	M	ER
		High	M	M	M	
6.5	**Furniture, Fixtures, & Equipment**					
6.5.1	**Storage racks**					
6.5.1.1	Light duty shelving	Low	L	L	L	
		Mod	H	M	M	NE, ER
		High	H	M	M	
6.5.1.2	Industrial storage racks	Low	L	L	L	
		Mod	H	M	M	ER
		High	H	H	M	
6.5.2	**Bookcases, Shelving**					
6.5.2.1	Bookshelves	Low	L	L	L	
		Mod	H	M	M	NE
		High	H	M	M	
6.5.2.2	Library and other helving	Low	L	L	L	
		Mod	H	M	M	ER
		High	H	M	M	
6.5.3	**Computer & Communications Equipment**					
6.5.3.1	Computer access floors	Low	L	L	L	
		Mod	L	L	M	ER
		High	M	H	H	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
N/A	Large computer equipment	Low	L	L	L	
		Mod	L	M	M	
		High	M	H	M	
N/A	Computer networks, data storage	Low	L	L	L	
		Mod	L	M	H	
		High	L	H	H	
N/A	Computer cabling	Low	L	L	L	
		Mod	L	L	L	
		High	L	L	L	
6.5.3.2	Computer and communication racks	Low	L	L	L	NE
		Mod	L	H	M	
		High	M	H	M	
6.5.3.3	Desktop computers and accessories	Low	L	L	L	NE
		Mod	L	H	M	
		High	L	H	M	
6.5.3.4	Television and video monitors, cameras, wall-mounted	Low	L	L	L	NE
		Mod	H	H	L	
		High	H	H	L	
N/A	Suspended speakers in conference room or auditorium	Low	L	L	L	
		Mod	M	M	L	
		High	H	H	L	
6.5.4	**Hazardous materials storage**					
6.5.4.1	Hazardous materials storage, cabinet and contents	Low	L	L	L	NE
		Mod	H	M	H	
		High	H	M	H	
N/A	Chemical, laboratory, medical supplies	Low	L	L	L	
		Mod	H	M	L	
		High	H	M	M	
N/A	Asbestos	Low	L	M	M	
		Mod	L	H	H	
		High	L	H	H	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
6.5.5	**Miscellaneous FF&E**					
6.5.5.1	File cabinets, tall vertical or lateral files	Low	L	L	L	NE
		Mod	M	M	M	
		High	H	M	M	
6.5.5.2	Demountable partitions	Low	L	L	L	NE
		Mod	L	L	L	
		High	M	M	M	
6.5.5.3	Miscellaneous furniture under 4' tall	Low	L	L	L	NE
		Mod	L	L	L	
		High	L	L	L	
N/A	Large kitchen or laundry equipment	Low	L	L	L	
		Mod	M	M	L	
		High	M	H	M	
N/A	Lockers, vending machines	Low	L	L	L	
		Mod	H	M	L	
		High	H	M	L	
N/A	Freestanding wood stove (wood, pellet, or gas-fired)	Low	L	L	L	
		Mod	M	M	M	
		High	H	H	H	
6.5.6	**Miscellaneous Contents**					
6.5.6.1	Shelf-mounted items	Low	L	L	L	NE
		Mod	M	M	L	
		High	H	M	M	
N/A	Especially valuable or fragile merchandise	Low	L	M	L	
		Mod	L	H	L	
		High	L	H	L	

Example No.	Example Name	Shaking Intensity	Life Safety (LS)	Property Loss (PL)	Functional Loss (FL)	Type of Detail
N/A	Potted plants or indoor landscaping resting on shelves above the floor	Low	L	L	L	
		Mod	L	L	L	
		High	M	L	L	
6.5.6.2	Desktop, countertop items	Low	L	L	L	
		Mod	L	M	L	NE
		High	L	H	M	
6.5.6.3	Fragile artwork	Low	L	L	L	
		Mod	L	H	L	NE
		High	L	H	L	
N/A	Tall sculptures (over 5 ft)	Low	L	L	L	
		Mod	M	M	L	
		High	H	H	L	
6.5.6.4	Fire extinguisher and cabinet	Low	L	L	L	
		Mod	M	H	L	NE
		High	M	H	L	

Footnotes:

1. Ratings for exterior components assume an entrance or walkway is located near the exterior wall. At locations where there is limited access, the life safety risk would be low.
2. Ratings assume component is located in a corridor or along the path of egress.