

## Appendix II. Integration Opportunities for Incremental Seismic Rehabilitation for Small Organizations and Individual Owners

Small organizations or individual owners with limited professional facility management may use the following matrix to identify opportunities to integrate incremental seismic rehabilitation with maintenance and capital improvement projects. These opportunities can be identified on the basis of a quick evaluation by a design professional.

The categories of maintenance and capital improvement projects included in the columns of this matrix are:

1. Roofing Maintenance & Repair/Re-Roofing
2. Exterior Wall and Window Maintenance/Façade Modernization
3. Public Area Modernization
4. Fire and Life Safety Improvements
5. New Technology Accommodation
6. Tenant Alterations and Improvements
7. Underfloor and Basement Work

These categories are the same as those included in Section C.2, and are described in detail in the text portions of Sections C.2.1 through C.2.7, respectively. Two remaining categories of maintenance and capital improvement projects are not included in this matrix, but their respective integration opportunities can be identified by reference to several of the preceding seven, as follows:

8. HVAC Upgrade and Energy Conservation—integration opportunities from 1, 2, 3, and 6.
9. Hazardous Materials Abatement—integration opportunities from 3, 4, 5, and 6.

Owners using this Appendix are encouraged to retain the services of a seismic engineer to identify additional incremental seismic improvements as discussed in Part C.

## Simplified Matrix of Seismic Performance Improvements

Level of Seismicity (Low)	Level of Seismicity (Med or High)	Building Structure Element	Structural Sub-System	Seismic Performance Improvement	Purpose	Applicability*	1. Roofing Maintenance & Repair / Re-Roofing	2. Ext. Wall/Window Maintenance/Façade Modernization	3. Public Area Modernization	4. Fire & Life Safety Improvements	5. New Technology Accomodation	6. Tenant Alterations & Improvements	7. Underfloor & Basement Maintenance & Repair
<b>Nonstructural</b>													
✓	✓			Anchorage of Canopies at Exits	Prevent collapse of canopies that would block exits and possibly cause injuries.	all	✓	✓					
	✓			Anchorage and Detailing of Rooftop Equipment	Prevent equipment from sliding or falling off platforms due to connection failure or nonfunction.	all	✓						
	✓			Bracing and Detailing of Sprinkler and Piping	Prevent sprinkler lines from breaking and flooding the building.	all			✓	✓	✓	✓	
	✓			Suspension and Bracing of Lights	Prevent lights from falling and injuring occupants. Lights should not be supported by a suspended ceiling in a high or moderate seismic zone. Pendent lights should have their sway limited.	all			✓	✓	✓	✓	
	✓			Fastening and Bracing of Ceilings	Suspended ceilings should be braced against sidesway to reduce the chance of elements falling.	all			✓	✓	✓	✓	
	✓			Fastening and Bracing of Equipment (Mechanical and Electrical)	Prevent fans and other equipment from swaying and falling on occupants; connections could fail resulting in equipment no longer functioning.	all			✓	✓	✓	✓	✓
✓	✓			Bracing of Parapets, Gables, Ornamentation, and Appendages	Prevent parapets, gables, and ornamentation from falling outward.	all	✓	✓					
✓	✓			Glazing Selection and Detailing	Prevent exterior or interior glass from falling onto the walking surface and causing injuries.	all		✓	✓	✓	✓	✓	
	✓			Attachment and Bracing of Large Ductwork	Prevent ducts from falling on occupants.	all	✓		✓	✓	✓	✓	
✓	✓			Bracing or Reinforcing Masonry Walls at Interior Stairs	Prevent collapse of walls that could block stairways.	all buildings except wood			✓	✓	✓	✓	
	✓			Bracing of Interior Partitions (Masonry and Wood)	Interior partitions must be braced to prevent falling/collapse.	all			✓	✓	✓	✓	
	✓			Support and Detailing of Elevators	Keep elevators functioning.	all buildings, except wood, with cable elevators			✓	✓	✓	✓	
✓	✓			Anchorage and Bracing of Emergency Lighting	Prevent heavy battery packs from falling.	all			✓	✓	✓	✓	

\* For NONSTRUCTURAL improvements: applicable to all wood, masonry, concrete, or steel buildings except as noted.  
 For STRUCTURAL improvements: applicable to all buildings (wood, masonry, concrete, and steel) with wood diaphragms (floors), except as noted.

**Simplified Matrix of Seismic Performance Improvements (continued)**

Level of Seismicity (Low)	Level of Seismicity (Med or High)	Building Structure Element	Structural Sub-System	Seismic Performance Improvement	Purpose	Applicability*	1. Roofing Maintenance & Repair / Re-Roofing	2. Ext. Wall/Window Maintenance/Façade Modernization	3. Public Area Modernization	4. Fire & Life Safety Improvements	5. New Technology Accommodation	6. Tenant Alterations & Improvements	7. Underfloor & Basement Maintenance & Repair
<b>Nonstructural (continued)</b>													
	✓			Anchorage of Masonry Veneer	Prevent inadequately anchored veneer from falling outward onto pedestrians.	all	✓						
	✓			Shut-Off Valves	Gas and water lines could break and should have a means of turning them off.	all	✓						✓
	✓			Anchorage of Exterior Wythe in Cavity Walls	Prevent veneer from falling outward. Existing anchorage should be checked for rust damage and loss of strength.	all buildings except wood	✓						
	✓			Bracing or Removal of Chimneys	Prevent chimneys from toppling into yards or through roofs.	all	✓						
	✓			Attachment and Bracing of Cabinets and Furnishings	Prevent cabinets and other furnishings from toppling or moving and causing damage. Fallen file cabinets may block exit doors.	all			✓	✓	✓	✓	✓
	✓			Anchorage of Steel Stud Backup	Prevent steel studs used as a backup to support veneer or other cladding from becoming detached or falling.	all buildings except wood	✓	✓	✓	✓	✓	✓	✓
	✓			Restraint of Hazardous Materials Containers	Reduce danger of breakage and mixing of chemicals.	all			✓	✓	✓	✓	✓
	✓			Underfloor Bracing of Computer Access Floor	Prevent floors from collapsing and damaging equipment.	all					✓	✓	
<b>Structural</b>													
	✓	Foundation		Anchor Bolts	Improve load path. Prevent building from sliding off foundation.	wood buildings only	✓					✓	✓
	✓	Foundation		Anchorage	Improve load path. Provide adequate connection between the building and the foundation.	wood buildings only							✓
	✓	Foundation		Cripple Stud Bracing	Cripple studs are usually not braced. Prevent them from toppling and causing the building to fall off the foundation.	wood buildings only	✓					✓	✓
	✓	Foundation		New Foundations	Additional foundations may be the preferred solution in some cases.	wood buildings only						✓	✓
	✓	Foundation		Pile Cap Lateral Load	Brace piles at their top to eliminate the chance of lateral movement and reduce chance of foundation failure.	masonry buildings only							✓
	✓	Foundation		Uplift	Reduce the uplift chance by improving foundation system; engineer should evaluate the effects of uplift.	wood and masonry buildings only							✓

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<b>Structural (continued)</b>													
	✓	Horizontal Elements	Diaphragms	Attachment and Strengthening at Boundaries	This is part of the load path, and conveys the diaphragm forces into the walls or other lateral force-resisting elements.	all	✓	✓					
	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing	Make sure the mezzanine is attached to the building to provide a load path for the mezzanine diaphragm and to reduce any pounding of the mezzanine against the building's walls or columns. A large mezzanine may require bracing on the open sides.	all buildings except wood			✓	✓	✓	✓	
	✓	Horizontal Elements	Diaphragms	Strength/Stiffness	Control the movement of the diaphragm to reduce the damage due to drift and to control the out-of-plane loads on vertical elements.	all	✓						
✓	✓	Vertical Elements	Load Path	Lateral Resisting System to Diaphragm Connection	Permits earthquake loads to be conveyed to the foundation. Develops a load path.	all	✓	✓	✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Capacity	Building walls can act as lateral load-resisting elements. They must be connected to the horizontal elements.	wood buildings only		✓	✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Continuity	Discontinuities of lateral-resisting elements create load transfer demands. Design standards may impose higher loads for this condition. This is one of the most cost-effective improvements in buildings.	wood buildings only		✓	✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	Permits walls that were not constructed full height to be used as shear walls in buildings with wood interior walls.	wood and masonry buildings only			✓	✓	✓	✓	
	✓	Vertical Elements	Shear Walls	Lateral Stability	Prevents buckling and possible wall collapse. Walls must be anchored at the top or may have other bracing elements such as diagonal or vertical braces.	masonry buildings only		✓	✓	✓	✓	✓	
✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall	Prevents walls from falling outward due to inadequate connections between the wall and the diaphragms. A cost-effective mitigation measure for bearing wall buildings.	all buildings except wood	✓	✓	✓	✓	✓	✓	✓

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