

APPENDIX A-VIII

EARTHQUAKES

CHECK LIST FOR NON-STRUCTURAL COMPONENTS FOR EARTHQUAKES

This Appendix constitutes a list of items and issues to be considered in designing the non-structural components of healthcare facilities to counteract the effects of earthquakes. Check lists are valuable as *aides-memoire* for the exercise. For any particular project all of the items may not be relevant, but excluding items from a comprehensive list is always easier than adding relevant items to a short list.

1 Electricity

1.1 Generator

- 1.1.1 Anchorage of the emergency generator

1.2 Batteries

- 1.2.1 Attachment of the batteries to the battery rack
- 1.2.2 Cross-bracing the rack in both directions
- 1.2.3 Battery rack bolted securely to a concrete pad

1.3 Diesel Fuel Tank

- 1.3.1 Attachment of the tank to the supports
- 1.3.2 Cross-bracing the tank supports in both directions
- 1.3.3 Bracing attached with anchor bolts to a concrete pad

1.4 Fuel Lines and Other Pipes

- 1.4.1 Lines and pipes attached with flexible connections
- 1.4.2 Able to accommodate relative movement across joints

1.5 Transformers, Controls, Switchgear

- 1.5.1 Items properly attached to the floor or wall

1.6 Bus Ducts and Cables

- 1.6.1 Able to distort at their connections to equipment without rupture
- 1.6.2 Able to accommodate relative movement across joints
- 1.6.3 Laterally braced

2 Fire Fighting

2.1 Smoke Detectors and Alarms

- 2.1.1 Properly mounted
- 2.1.2 Control system and fire doors securely anchored

- 2.2 Fire Extinguishers and Hose-reel Cabinets
 - 2.2.1 Cabinets securely mounted
 - 2.2.2 Extinguishers secured with quick- release straps
- 2.3 Emergency Water Tank
 - 2.3.1 Securely anchored to its supports
 - 2.3.2 Supports braced in both directions
 - 2.3.3 Supports of braces anchored to a concrete foundation

3 **Propane Tanks**

- 3.1 The Tank
 - 3.1.1 Securely anchored to its supports
 - 3.1.2 Supports braced in both directions
 - 3.1.3 Supports or braces anchored to a concrete foundation
- 3.2 Shut-off Valve
 - 3.2.1 System with an automatic, earthquake-triggered, shut-off valve
 - 3.2.2 Laterally braced

4 **Plumbing**

- 4.1 Water Heaters and Boilers
 - 4.1.1 Securely anchored to the floor or wall
 - 4.1.2 Gas line with a flexible connection to the heater or boiler to accommodate movement
- 4.2 Pumps
 - 4.2.1 Anchored or mounted on vibration isolation springs with seismic lateral restraints
- 4.3 Hot and Cold-water Pipes and Wastewater Pipes
 - 4.3.1 Pipes laterally braced at reasonable intervals
 - 4.3.2 Flexible connections to boilers and tanks
 - 4.3.3 Able to accommodate movement across joints
 - 4.3.4 Pipe penetrations through walls large enough for seismic movement
 - 4.3.5 Free of asbestos insulation (which can be broken in an earthquake)
- 4.4 Solar Panels
 - 4.4.1 Securely anchored to the roof

5 **Elevators**

- 5.1 Cab
 - 5.1.1 Properly attached to the guide rails
 - 5.1.2 Alarm system for emergencies
- 5.2 Cables, Counterweights, Rails
 - 5.2.1 Cables protected against misalignment during an earthquake
 - 5.2.1 Counterweights properly attached to guide rails

- 5.2.3 Guide rails properly attached to the building structure
- 5.3 Motors and Control Cabinets
 - 5.3.1 Anchored
- 6 **Air Conditioning**
 - 6.1 Chillers, Fans, Blowers, Filters, Air Compressors
 - 6.1.1 Anchored, or mounted on vibration isolation springs with seismic lateral restraints
 - 6.2 Wall-mounted Units
 - 6.2.1 Securely mounted
 - 6.3 Ducts
 - 6.3.1 Laterally braced
 - 6.3.2 Able to accommodate movement at locations where they cross separation joints
 - 6.4 Diffusers
 - 6.4.1 Grills anchored to the ducts or to the ceiling grid or to the wall
 - 6.4.2 Hanging diffusers adequately supported
- 7 **Non-structural Walls and Partitions**
 - 7.1 Concrete Block, Brick, Clay Block
 - 7.1.1 Reinforced vertically and/or horizontally
 - 7.1.2 Detailed to allow sliding at the top and movement at the sides
 - 7.1.3 Restrained at the top and the sides against falling
 - 7.2 Stud-wall and other Lightweight Walls
 - 7.2.1 Partial-height partitions braced at their top edges
 - 7.2.2 If they support shelving of cabinets, securely attached to the structure of the building
- 8 **Ceiling and Lights**
 - 8.1
 - 8.1.1 Suspended ceilings with diagonal bracing wires
 - 8.1.2 Plaster ceilings with the mesh of wood lath securely attached to the structure above
 - 8.2 Lighting
 - 8.2.1 Light fixtures (*e.g.* lay-in fluorescent fixtures) with support independent of the ceiling Grid
 - 8.2.2 Pendant fixtures with safety restraints (*e.g.* cables) to limit sway
 - 8.2.3 Emergency lights mounted to prevent them falling off shelf supports
- 9 **Doors and Windows**
 - 9.1 Doors
 - 9.1.1 If exit doors are heavy metal fire doors that might jam in an earthquake, provision of a Crowbar or sledge hammer readily available to facilitate emergency opening

- 9.1.2 Automatic doors with manual overrides
 - 9.1.3 Directions in which the doors swing
- 9.2 Windows
 - 9.2.1 Glazing designed to accommodate lateral movement
 - 9.2.2 Large windows, door transoms and skylights with safety glass
- 10 **Appendages and Sundries**
 - 10.1 Parapets, Veneer and Decoration
 - 10.1.1 Parapets reinforced and braced
 - 10.1.2 Veneers and decorative elements with positive anchorage to the building
 - 10.2 Fences and Garden Walls
 - 10.2.1 Designed to resist lateral forces
 - 10.2.2 Masonry walls reinforced vertically and rigidly fixed to their bases
 - 10.3 Signs and Sculptures
 - 10.3.1 Signs adequately anchored
 - 10.3.2 Heavy and/or tall sculptures anchored to prevent overturning
 - 10.4 Clay and Concrete Roof Tiles
 - 10.4.1 Tiles secured to the roof with individual fixings for each tile
- 11 **Movable Equipment**
 - 11.1 Communications
 - 11.1.1 Radio equipment restrained from sliding off shelves
 - 11.1.2 Telephones placed away from edges of desks and counters
 - 11.1.3 Elevated loud speakers and CCTV anchored to the structure
 - 11.2 Computers
 - 11.2.1 Vital computer information backed up regularly and stored off site
 - 11.2.2 Heavy computer equipment of significant height relative to width anchored or braced
 - 11.2.3 Desktop items prevented from sliding off tables
 - 11.2.4 Access floors braced diagonally or with seismically-certified pedestals
 - 11.3 Storage of Records and Supplies
 - 11.3.1 Shelving units anchored to walls
 - 11.3.2 Shelves fitted with edge restraints or cords to prevent items from falling
 - 11.3.3 Heavier items located on the lower shelves
 - 11.3.4 Filing cabinet drawers latched securely
 - 11.3.5 Heavily-loaded racks braced in both directions
 - 11.3.6 Fragile valuable items restrained from tipping over
 - 11.3.7 Chemical supplies secured or stored in "egg crate" containers
 - 11.4 Hazardous Items
 - 11.4.1 Gas cylinders tightly secured with chains at top and bottom (or otherwise)

- 11.4.2 Chemicals stored in accordance with manufacturers recommendations
- 11.4.3 Cabinets for hazardous materials given special attention with respect to anchoring

11.5 Furniture

- 11.5.1 Heavy potted plants restrained from falling or located away from beds
- 11.5.2 Beds and tables and equipment with wheels provided with locks or other restraints to Prevent them rolling unintentionally