OBJECTIVE

To identify and reduce nonstructural hazards at the school site.

Nonstructural hazards are caused by the furnishings and nonstructural elements of a building. Anything that does not actually hold the building up is nonstructural, including floors, ceilings, windows, and all furnishings. In Arkansas public schools nonstructural hazards represent one of the major threats to the safety of students and staff. Eliminating these hazards can reduce injuries significantly.

"Based on what I saw on my visits to schools in the (epicentral) area, there would have been numerous injuries from nonstructural hazards if the Loma Prieta earthquake had occurred during school hours."

Dennis Bellet
Code/Research Structural Engineer
Office of the State Architect

KEEP IN MIND

- Nonstructural hazards can often be very easy and inexpensive to fix. Positioning furniture differently in the room, bolting heavy and tall furniture to the walls, and removing dangerous and heavy items from top shelves are all possible fixes.

Use one or a combination of your teams (planning committee and maintenance team) to identify and reduce or eliminate the hazards.
You might also want to consider involving a parent group. Focus on those hazards that represent the greatest life safety treat, and those that are simple to fix. Work incrementally; don't let the problem overwhelm you.

- One of the more expensive nonstructural hazards is windows. Shattered glass can be a significant problem even in moderate earthquakes. The earthquake in Coalinga sent glass shards flying across a library room (fortunately unoccupied at the time). Shatter-resistant films can be put on windows to prevent broken pieces from flying anywhere. The larger the quantity of film you buy the lower the price; consider having, your district investigate buying film for all its schools. Sometimes the vendors will let you install it Yourself, thus reducing the price significantly.

"We had done some preparation. We had attached all cabinets and shelves to the wall, with angle brackets into studs so most of them withstood the quake (October 17th, 1989) quite well ... it was only the rooms where they had not been attached or they were in the center where they fell over. Any cabinets or shelves taller than about three feet fell over."

Kenneth Simpkins, Superintendent
Loma Prieta Joint Elementary School District
Los Gatos, CA
ACTIVITIES

1. Using the Common *Earthquake Hazards* checklist, have individual staff identify existing nonstructural hazards in each area/room of the school.

2. For each identified hazard, note action needed to reduce or eliminate the hazard, assign responsibility, and note and/or research the cost involved, if any. Use the suggested procedures to reduce the hazards as a guide. Refer to FEMA 74 "Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide" for definitive guidance.

3. For the hazards identified, set priorities for reduction. Develop a time frame for completion of each item.

4. Develop a system for periodic review of potential nonstructural hazards and keep the hazard reduction program current.

"We saw the following types of furnishings cause the majority of problems (in the Loma Prieta earthquake): pendant mounted light fixtures; four-drawer file cabinets; bookcases and library shelving."

Dennis Bellet  
Code/Research Structural Engineer  
Office of the State Architect
COMMON EARTHQUAKE HAZARDS
AND
HAZARD REDUCTION PROCEDURES

• Objects on high shelves, (toys, paints, potted plants) that can fall or become projectiles.

*Remove toys, paints and other objects from high open shelves.*

• Fluorescent light fixtures without safety wires and unattached light covers that may drop on people beneath them.

*Put light guards on fluorescent lights attached to the fixtures and make sure the fixtures are securely fastened to the structure above.*

• Pendant mounted light fixtures or chandeliers.

*Attach safety cables. Ensure hanging fixtures can swing 45 degrees without hitting each other or other objects.*

• Spotlights.

*Secure to prevent falling when shaken.*

• Free-standing cabinets, bookcases, wall shelves and their contents that can fall on children.

• Library bookshelves without anchorage/bracing or content restraint.

*Bolt bookcases and cabinets to wall studs and provide content restraints or latches. Secure adjustable shelves to prevent them from slipping forward. Bolt to each other where appropriate. Cross brace in both directions.*
For racks, cabinets or bookcases significantly taller than wide, bolt to the floor:

Place lighter objects on top shelves and cabinets and heavier ones on the bottom (anchor all).

- Hanging plants, mobiles or pendulum light fixtures that may drop on children or swing into windows.

  Keep hanging plants and other free swinging objects far enough away from windows so they cannot swing into them or provide restraining device (45 degrees swing distance minimum).

- Glass that may shatter (windows, mirrors).

  Install shatter-proof glass windows or add plastic membrane to limit movement of fragments.

  Replace glass objects with non-breakable items, such as replacing glass on a desk with a pad or Plexiglas.

- Pianos, refrigerators, ranges or other heavy objects on rollers.

  Secure equipment so that it will not slide or roll easily. Lock rollers (wheels). Restrain kitchen equipment with built-in cabinetry, or attachments to floor or wall studs.

- TV monitors that may fall from platforms, computers not fastened to work stations.

  Place TV monitors on table or shelf. Secure monitors and computer hardware with hook and loop materials or bolt to desk / tabletop.
• Cabinets without door latches or restrained shelves.

• Cabinet drawers without latches.

   *Put latches on cabinets (drawers and doors) and restraints on shelving. Secure file cabinets to wall studs and to each other.*

• Shelving without a lip or restraining wire to prevent paint or chemicals from falling.

   *Put lips, restraining wire or restraining bars on open shelving to prevent objects from falling. Store hazardous materials in unbreakable or protected containers.*

• Elevated sound systems.

   *Anchor speakers to structure securely.*

• Suspended space heaters.

   *Brace securely. For gas heaters, provide flexible gas connectors.*

• Large diameter pipes.

   *Brace them.*

• Emergency lights.

   *Fasten securely to shelving, ceiling or walls.*
• Communication equipment.

*Secure intercom speakers to walls, ceiling or shelves. Secure radio cabinets securely to table top with Velcro fasteners.*

• Objects that restrict people from moving to a safe place (books on the floor, broken glass, tables and desks in hallways, stored items).

*Relocate objects that may restrict movement to safety, such as desks or tables stored in hallways.*

• Aquariums that are not secured to the building's structure.

*Place aquarium on floor, if possible. Restrain tank with heavy duty angle clips bolted to the floor. If on table, restrain tank to table (as above) and bolt table to floor.*

• Wall-mounted objects, such as maps, framed pictures, plaques, bulletin boards, projector screens, clocks, and chalk boards that are not securely bolted may become projectiles.

*Bolt maps, chalkboards, projector screens, and wall decorations to wall (anchor to structure, not finishes). Use closed eye hooks for pictures or Velcro for light objects.*

• Suspended ceiling tiles and runners.

*Secure runners to structural ceiling with heavy gage wire attached diagonally.*
• Air-conditioning registers without safety wires.

*Attach register to building structure with safety wire.*

• Large air distribution ducts, especially those suspended.

*Provide secure attachments to structure. Use diagonal bracing.*

• Fire sprinkler risers.

*Brace securely to ceiling or wall. Use diagonal bracing to structure for large sprinkler pipes.*

• Free standing, movable, partial-height partitions.

*Adequately brace.*

• Unbraced water heaters, furnaces, boilers, chillers, pumps, fans, etc.

*Strap water heaters to wall on both top and bottom of heater. Ensure all other equipment is restrained or mounted correctly.*

• Ruptured gas or water lines; downed electrical lines.

*Instruct staff in procedures for turning off gas, water and electricity. Put tools in a place where they will be accessible in emergencies.*

• Gas pipes.

*Install flexible connector lines to water heater, cooking stove, heater, etc.*
• Compressed gas cylinders.

Secure gas cylinders on both top and bottom with safety chains.

• Valuable, fragile art objects or trophies.

Protect against tipping over, breaking glass or sliding off of shelves or pedestals.

• Floor supported free standing shop equipment.

Secure against overturning or sliding.

• Fire extinguishers.

Securely mount to walls.

• Weight room equipment and racks.

Securely anchor to floor and wall studs. Store weights properly.

• Unreinforced masonry partitions.

Remove or retrofit them.

• Light weight drywall partitions floor to ceiling.

Brace or support by structure above.

• Clear panels in partitions.

Replace glass with plastic or safety glass or apply shatter resistant film.
• Decorations, parapets or appendages on exterior of building(s).

  Adequately attach.

• Statues or other free standing decorative objects.

  Anchor adequately.

• Tall back boards or fences.

  Support by pressure treated wood posts or galvanized metal posts anchored to ground. Reinforce or remove fences made of unreinforced concrete block, stone or brick.

• Large trees leaning or in poor health.

  Support or remove.

• Signage.

  Adequately secure.

• Be aware of off-campus earthquake hazards such as; nearby water towers that could fall on the school grounds or buildings, above ground fuel or chemical tanks that could rupture spilling contents on the school grounds, etc.

  Request the City / County to remove the earthquake hazard.

Reference Appendix 2 - School Nonstructural Earthquake Hazard Removal Illustrations.