Is Your Apartment Building Protected From Earthquake Disaster?
by the Institute for Business and Home Safety

Imagine that a strong earthquake strikes in your area. Loose items fall and break. Cabinets and bookcases tip over, blocking exits. Dust billows everywhere. Gas and water lines break, and phone and electrical service are interrupted for days. Your apartment building may collapse, slide off its foundation or simply come apart at the seams.

What You Can Do

You can protect your apartment building by modifying it, or retrofitting it, in two different ways: Nonstructural retrofits protect your apartment building's contents against damage with little cost and effort. Examples of retrofits include: securing water heaters, large appliances, bookcases, pictures and bulletin boards; latching cabinet doors; and using safety film on windows.

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To complete these improvements simply follow the instructions in this article. In most cases, you won't need a building permit. It's a good idea, however, to contact your local building department to make sure. Structural retrofits strengthen your building's structure or skeleton so it can better withstand the force of an earthquake. Your building's structure is made up of many different parts, or components, which must work together in order to resist an earthquake. Modifications to your building's structure tend to be quite involved and generally require the expertise of a registered design professional (engineer, architect or building contractor) and your local building department's approval.

Use this article to identify potential problem areas in your own apartment building. If you have any questions or concerns about what you see, contact a professional engineer or architect.

Nonstructural Retrofits

In this section, you will learn inexpensive and easy ways to protect yourself against some of the damage earthquakes can cause inside your building. Start by looking for objects that could fall and break during an earthquake. Consider items such as water heaters, bookcases and light fixtures, as well as items that are difficult to replace because they have monetary or sentimental value. As you conduct your inspection, think about ways in which you can protect them from damage. If you have any questions about the changes you should make, contact a professional engineer, architect or contractor.

If you are handy yourself, or you have a good handyman, consider offering to your tenant an earthquake survey and installation of some of these non-structural retrofits within their units. The benefits are several: resident retention, the opportunity to inspect the unit, and protecting your property investment, just to name three. You can of course have each tenant who takes advantage of your service sign a wavier of liability in the event of an earthquake. It is also a great opportunity to stress the importance of renters insurance, if your tenants do not already have it.

Picture Frames and Bulletin Boards

Photographs, bulletin boards and artwork you display in your building add to its character. But these items can easily fall during an earthquake if you do not fasten them properly to a wall in the following way: Use closed screw-eyes, instead of traditional picture hangers, for securing picture frames, bulletin boards and mirrors. Depending on the weight of the object and the screw-eye's maximum weight limit, screw one or more closed screw eyes into wall studs. Use a stud finder to figure out where to put them. Attach picture wire to one side of the frame. Thread the wire through the closed screw-eye, fastening it securely to the other side of the frame. If you use an open screw-eye instead of a closed screw-eye, be sure to close it with pliers once you have hung the

picture. Always mount heavy or sharp wall hangings away from areas where they could fall on children.

Ceiling Lights, Suspended Ceilings and Hanging Fixtures

If they aren't well attached and supported, ceiling lights, suspended ceilings and hanging fixtures, such as chandeliers and ceiling fans, can fall in an earthquake and seriously injure those below. Contact your suspended ceiling manufacturer for details. Make sure chandeliers, ceiling fans, other suspended fixtures and hanging plants are safely secured to the permanent structure. Connect all suspended items to strong supports with safety cables capable of supporting each item's entire weight. Each cable should remain slack and not support the item's weight under normal circumstances. Keep in mind that hanging items tend to sway easily. Make sure these objects will not collide with anything if they swing in an earthquake.

Windows and Doors

Your apartment building's windows and glass doors may seem harmless enough. But in an earthquake, glass can break explosively, seriously injuring anyone nearby. One way to protect yourself and your tenants from broken glass is to apply safety film to windows and glass doors: Use a protective film (minimum thickness of 4 mils) on all types of glass, including tempered glass and annealed glass. You can buy it in rolls at your local hardware and home improvement stores, or contact the International Window Film Association for the nearest distributor. Be sure to install the film according to the manufacturer's instructions. As an alternative, consider professional installation.

Large Appliances

An earthquake can cause refrigerators, washing machines and other large appliances to slide or fall over. Heavy objects on wheels may roll if brakes or stops are not provided and locked. To secure these items: Anchor large appliances to walls using safety cables or straps. Replace rigid water or gas connections on large appliances with flexible connectors. Check to see if your local building codes allow you to use flexible connectors and whether a professional must install them. Always lock the rollers of any large appliances or pieces of furniture.

Water Heaters

Water heaters can move or tip over in an earthquake and the broken water pipe can flood your apartment building, destroying ceilings, floors, walls, furniture, and other objects. If your heater runs on flammable gas and the gas line breaks, the situation becomes far more serious. In many areas of the country where earthquakes are common, local building codes may require that water heaters be laterally braced or strapped to resist seismic forces. Most hardware stores sell retrofit kits for different-sized water heaters. In addition, several generic restraint systems are available.

Earthquake Gas Shutoff Valves

Many appliances run on gas and each one is a potential fire hazard in the event of an earthquake. The technology of gas shutoff valves, or earthquake valves has improved considerably, and there are now several varieties to choose from that are appropriate to different circumstances. Particularly in an older building, one earthquake shutoff valve has the potential to keep your building intact. However, especially in the case of gas line work, contracting with a good licensed professional plumber is absolutely necessary. Gas work should not ever be undertaken by do-it-yourselfers.

Foundation Systems

Earthquakes can create ground motion in any direction. During a quake, your apartment building's foundation moves with the earth, but the rest of your apartment building reacts more slowly due to its inertia. This creates a tremendous amount of stress on the connections between the foundation and the remaining structure. If these connections are not strong enough, your apartment building may slide or fall off its foundation. In fact, this is one of the most common and costly types of structural damage. Depending upon the foundation, however, this may be relatively easy to fix. Since the seismic evaluation of some foundations is complex, you should consult a professional engineer.

Floor Systems

An earthquake exposes the floor to substantial forces that can distort and damage the floor system, jeopardizing the strength of your building. The floor system typically consists of floor joists, floor sheathing and band joists, which are located along the floor's perimeter. If you have access to the underside of your floor, make sure that your floor system is tied together and that the sub-floor is securely connected to the underlying floor joists. To reduce the possibility of rotation in an earthquake, each joist should be nailed to a band joist. Blocking or bridging can also be placed between joists to keep them from falling over. The forces absorbed by the band joist or blocking must, in turn, be transferred to the foundation. Secure this connection by using metal ties or framing anchors.

Finally, make sure you do not find any evidence of poor workmanship, rust or rot. It may be difficult for you to access these areas. Often, the best time to evaluate your floor system is when you are planning to remodel. If your inspection reveals any problems, consult a professional engineer for the best way to retrofit your floor system.

Wall Systems

During an earthquake, the walls in your apartment building, especially the exterior walls, play an important role in preventing your apartment building from collapsing. The walls along with the floors and roof create a box. As the ground shakes, the floors and roof sway back and forth, while the walls in between try to stop your apartment building from moving too far. To do their job, your walls must be strong and securely tied to the roof, floor and foundation.

Roof Systems

For your apartment building to adequately resist the force of an earthquake, your roof structure must function like the top of a box, keeping the walls tied together and preventing your apartment building from coming apart at the seams. The typical roof system includes a roof covering, roof sheathing and supporting roof frame. Start by inspecting your roof covering - it should be in good condition with no evidence of excessive wear and tear. Nonstructural lightweight coverings, such as wood or asphalt shingles, usually behave well during an earthquake. Tile and slate coverings, which are heavy, tend to tax your entire earthquake-resisting system and are also susceptible to sliding or falling off the roof during an earthquake.

You may not be able to thoroughly examine your roofing system due to limited access. The best time for a complete inspection is just before you re-roof your building. If you have any concerns about your roof 's covering, sheathing, openings or framing members, talk to a professional engineer or qualified roofing contractor.

Unreinforced Chimneys

Unless specifically designed and reinforced for lateral forces, brick or stone chimneys often come apart or topple during an earthquake, causing serious damage and injury. Usually, only the top portion of the chimney breaks apart during an earthquake; however, in some cases the entire chimney peels away from the side of the apartment building. Check the top of your chimney to be sure it is free of severe cracks (anything wider than the edge of a dime). Take a close look at the mortar between the bricks. It should not scrape away easily with a metal tool. Even if your

chimney is in good condition, it may still be at risk, especially if it is tall and slender. Some chimneys have metal straps that hold them to the side of the apartment building. Carefully inspect these fastenings. They should be in good condition with no evidence of poor workmanship or rust. If you are uncertain about what you see, consult with a professional engineer. The engineer may recommend adding a brace between the top portion of the chimney and the roof. You may also need to use metal straps at several points to anchor the chimney to the apartment building.

Garages

Garages are particularly vulnerable to earthquake damage. The situation becomes especially serious if the garage has a portion of the building over it. The large garage door opening removes almost an entire side of the box configuration and requires the remaining narrow walls on either side to support the roof and extra rooms. If these walls are not designed carefully to handle the situation, the entire structure may collapse when an earthquake strikes. Strengthening the narrow garage walls generally requires engineering details, such as specially detailed plywood panels, steel bracing or a steel frame. A professional engineer can help you decide what will work best for your apartment building.