

# DON'T HESITATE – MITIGATE!

**Mitigation** – anything you can do *before* a disaster to reduce damage to property or person

**This document is intended to assist you in preparing your home in order to mitigate the damaging effect of an earthquake. It is not complete because each person's situation and circumstance is different. So the reader must look closely at their own home to determine their appropriate mitigation methods.**

## **What is an earthquake and how does it shake your house?**

Most earthquakes are caused by rock movement along rupturing faults located in the earth's crust. Major faults are typically located at plate boundaries. These Faults move or "slip" when shear stresses deep underground exceed the ability of the compressed rock to resist those stresses.

When faults slip, they move the ground vertically, laterally, or both. When this slip occurs suddenly, it causes seismic shock waves to travel through the ground, similar to the effect seen when tossing a pebble onto the surface of still water. These seismic waves cause the ground shaking that is felt during an earthquake.

Everything in the path of the wave is shaken. The amount of shaking depends on three main factors:

1. the distance to the hypocenter of the earthquake
2. the total energy released by the earthquake -- A magnitude 7.0 earthquake releases 31.5 times more energy than does a magnitude 6.0 earthquake
3. the type of soil or rock at the site. Generally sites with deep soft soils or loosely compacted fill will be more strongly shaken than sites with stiff soils, soft rock, or hard rock. For example, during the 1989 Loma Prieta earthquake, the shaking experienced in the San Francisco Marina District, which is underlain by mud nearly 100 feet thick, was

from three to four times stronger than the shaking measured only a few blocks away on bedrock, near the Golden Gate Bridge.

Different individual buildings shaken by the same earthquake respond differently. Some issues that might make your home more vulnerable:

- Concrete or masonry buildings are “stiff” and more prone to collapse
- Multi-story buildings where the first story is taller or “weaker” than the upper stories. An example of a “weak” story is one where the garage is on the first floor, or where there are lots of large glass windows, or where there is one large area without supporting interior walls or columns. Even homes with a subfloor area that is not reinforced to prevent shear forces are considered to have a weak “first” floor.
- Shape is important too. L or T-shaped buildings concentrate forces on the inside corners. Split level homes are more vulnerable. A simple rectangular building is often the safest because forces are usually distributed evenly.

## **MITIGATION – OUTSIDE OF HOME**

Size-up the **outside of your house** and identify anything that might be a hazard during an earthquake:

### ***Please remember that:***

- Retrofitting before an earthquake is relatively cheap.
- Doing major structural repairs to your home after an earthquake is very expensive.
- Sometimes the damage is extensive enough to require the entire house to be demolished.
- After an earthquake, there is usually a shortage of available licensed contractors and engineers in the impacted area, because of the sudden high demand for their services.
- An appropriate seismic retrofit will reduce damage and save you money.

What to look for:

- Is the home **bolted to the foundation**? The Oregon State Building Code required anchoring homes beginning in 1973.
  - In the crawl space look for the heads of anchor bolts that fasten to the sill plate. The sill plate is the wooden board that sits directly on the foundation. They should be installed every 4 to 6 feet along the sill plate. Sometimes steel plates are used instead of anchor bolts.
  - Most homes with a concrete slab that were built to code will have anchor bolts or straps. If you have an unfinished garage you can see the bolts or straps. Consult a licensed contractor if you aren't sure.
- **Cripple walls** are the short wood stud walls that enclose a crawl space under the first floor. They are easy to see in the crawl space because they do not have bracing such as plywood panels nailed to the studs or diagonal wood sheathing to prevent horizontal movement.
- If the outside of your house is supported by **wood posts resting on unconnected concrete piers**, then these posts may fail during an earthquake if they are not braced against swaying. Often siding is nailed to the outside of the posts, making them not easily visible.
  - Go under the house to see if there is a continuous foundation under the outside walls.
  - Consult a licensed architect or engineer
- **Unreinforced masonry foundation** such as brick, concrete block or stone often can't resist earthquake shaking. They may break apart or not be strong enough to hold anchor bolts.
  - Consult a licensed architect or engineer
- **Unreinforced masonry walls** – houses made of bricks, clay tiles, stone, concrete blocks are very likely to be damaged during an earthquake. The mortar holding the masonry together is generally not strong enough to hold it together.
  - Consult a licensed architect or engineer
- **Chimney** – Do not locate patios, children's play area or parking spaces near a questionable chimney.
- Houses built on the sides of **steep hills** are often set on exposed posts or columns or have walls with very different heights or that are stepped or sloped down the hillsides. If these posts or walls are not properly braced they may collapse during an earthquake
  - Consult a licensed architect or engineer
- **Rooms over garages** are particularly prone to collapse
  - Consult a licensed architect or engineer

- **Windows** – Purchase clear heavy duty plastic sheeting and duct tape. Then when the windows break you can keep the rain out & the sun in.
- Know where your **natural gas meter** is and when to turn off natural gas. Never turn natural gas back on yourself. Call the utility company for a safety inspection and service restoration.
- Do you have an **outdoor propane tank**? Propane tanks can be anchored by mounting the tank on a continuous concrete pad and bolting the four legs to the pad.

**House hunt – involve all family members and use your imagination!**

**YOUR MANTRA...**

**Anything that can move, break, or fall when your house starts to shake is a potential hazard.**

### **MITIGATION – ALL ROOMS**

Make sure that you have a flashlight readily available in every room of your house (and garage). Earthquakes are never planned. When the electricity goes out and debris is everywhere, you don't want to be in the dark. My favorite is a headlamp because it keeps your hands free.

### **MITIGATION – GARAGE**

- Strap your water heater to the wall and install flexible connectors for the water and gas lines
  - Broken gas lines and gas leaks
  - Fires causing major damage to homes
  - Broken water lines and flooding
- Use latches designed for earthquakes to secure drawers in cabinets
- Secure the top corners of all shelving to the wall with L brackets into the wall studs
- Use nylon straps to keep contents in the shelves

- Be sure all flammable liquids, such as painting and cleaning products, are secured on their shelves or stored away from heat sources and appliances, particularly your water heater and furnace.
- Store heavy items and breakables on lower shelves
- Place heavy or breakable objects on lower shelves.
- Ensure that items stored above or beside your vehicle cannot fall.

### **MITIGATION – FRONT ENTRYWAY**

- Are there any furniture items that may topple and block your exit from the home? Bookcases, cabinets are common culprits. You may need to exit quickly to escape a tsunami
- Are there items in the entryway that might cause you to trip such as rugs

### **MITIGATION – KITCHEN**

- Prevent refrigerators, washers, and other heavy appliances from moving by blocking the rollers.
- Make sure that any gas appliances use flexible connectors for their gas supply.
- Anchor china cabinets and other top-heavy furniture to wall studs using flexible fasteners (e.g., nylon straps) and lag screws.
- Make sure that the glass shelves in your china cabinet are secured
- Use removable putty, museum wax or quake gel to secure breakable items to shelves
- Consider replacing magnetic “touch” latches on your kitchen cabinets with ones that will hold the cabinet doors shut during an earthquake. This especially includes your china cabinet.
- Add lips to shelves to prevent costly items from sliding.
- Move heavy objects and breakables to lower shelves.
- Do you have hanging light fixtures or plants? Could they swing and hit a window or swing off their hooks? At a minimum, transfer hanging plants from heavy clay pots to lighter ones and used closed hooks on all hanging items.
- Where possible, replace glass jars and similar items with plastic.
- Be sure your fire extinguishers and alarms are current and working. Make sure all household members old enough to use a fire extinguisher know where they are in your home and how to use them properly - an excellent family drill

## **MITIGATION – LIVING ROOM**

- Secure tall, heavy furniture that could topple, such as bookcases, china cabinets, entertainment units & filing cabinets. “L” brackets with three-inch lag bolts into a stud are recommended.
- Secure heavy electronic equipment (televisions, computers and microwaves) by strapping them down or placing them on top of a specially designed quake mat (non-skid mat).
- Hang mirrors and heavy pictures more securely using eye-bolts or special earthquake proof picture hangers.
- Do you have a wood stove?
  - Anchor stove feet by bolting to floor or creating brick and mortar bracing to keep stove from sliding. Note: anchors must not conduct heat.
  - Brace stove pipes.

## **MITIGATION – BEDROOM**

- Get an old plastic grocery bag and fill with a flashlight (preferably a headlamp), extra batteries, sturdy gloves, an old pair of shoes, and an old pair of glasses (if you use them) and tie the bag to the bedpost. When the shaking stops, the flashlight you keep on your bedside table may end up in Benton County. All you will have to do is reach down, grab your plastic bag and turn on your flashlight. Then put on your shoes and your gloves so your feet and hands won't get cut on broken glass and fallen debris.
- Consider adding a bicycle helmet and goggles or protective eyewear to your under-the-bed bag. After an earthquake or explosion, falling and fallen debris are major sources of serious injury.
- Locate beds away from the windows
- Remove, or anchor any pictures, mirrors or other items near the bed.
- Make sure than any light fixtures or ceiling fans are properly secured.

## **MITIGATION – BATHROOM**

Replace glass bottles in the medicine cabinet and around the bathtub and shower with plastic containers.

## **MITIGATION – OF A PERSONAL NATURE**

**Assemble a go-bag** and keep one in your home and in each of your vehicles!

According to the Oregon Resiliency Plan, it will take from 1 to 3 years to restore our drinking water and sewer after a Cascadia 9.0 earthquake

**Water** – the essence of life! It is essential to store water in the event of a disaster. The best plan is two-fold:

- store as much as possible, at least one gallon per person per day
- Devise a plan and secure equipment (water filters, buckets, etc) to acquire, treat, and store water for long term needs. See [www.AreYouReady.org](http://www.AreYouReady.org) for more information

**Sewer** – it's nasty but necessary. I personally subscribe to the recommendations of the Lincoln County Sheriff's Department as described in their brochure, "Disaster preparedness for you and your household" (see references below. Most people will not want to use a public latrine. And elderly residents may not be mobile enough to go to a public latrine. And it is essential that residents not flush waste down their toilets because it imposes significant risk to public health and safety. A good option is to make your own emergency toilet:

- Remove all water from the toilet bowl and line it with TWO heavy duty plastic bags.
- Place kitty litter, fireplace ashes, or sawdust into the bottom of the inner bag.
- At the end of each day, add a small amount of deodorant or disinfectant, secure the bag with twist-ties, and dispose of it in a large trash can lined with a sturdy trash bag and with a tight fitting lid.
- Eventually, there will be a means of disposal for these bags.

### **References:**

[Earthquake Home Hazard Hunt](#), FEMA Publication

[Earthquake Safety Guide for Homeowners](#), FEMA Publication

[Homebuilder's Guide to Earthquake Resistant Design and Construction](#), FEMA Publication

[Homeowners Guide to Earthquake Safety](#), California Seismic Safety Commission Publication

[Living on Shaky Ground](#), Publication by Oregon Emergency Management  
[Disaster preparedness for you and your household](#), Lincoln County  
Sheriff's Office, Oregon