



# EARTHQUAKE Preparedness Kit

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**April, 2006.** This year we recognize the 100th anniversary of the earthquake and fire that devastated the San Francisco area early in the morning of April 18, 1906. Even in 1906, with widespread knowledge of the seismic history of the area, it was highly predictable that such an event could and would occur. In the bustle of development, however, limited attention had been given to natural hazard mitigation and fire prevention and suppression. The community was caught unprepared both in terms of pre-disaster mitigation and post-disaster response capability. Toppled and surviving structures alike succumbed to the widespread fires that followed the quake. In the end, of the area's population of 400,000, three-quarters were left homeless; the number of deaths is estimated at 3,000 and property damage at \$400 million. Conservatively the earthquake and fire damage together cost the equivalent of about \$9 billion. In terms of seismic strength, the event was 40 times more powerful than the Loma Prieta event of 1989.

Though this document is not designed to review or commemorate that event, the anniversary is instructive, along with last year's hurricane events, in demonstrating our susceptibility to natural disasters and our need to better prepare for them. The best mitigation measures begin, of course, far in advance, and take the form of applying and enforcing well-considered zoning, building and fire codes that protect lives and property from foreseeable natural hazards. In addition to these measures, effective post-disaster planning requires regular review and testing of our readiness to weather a disaster through community-wide as well as personal disaster response preparation.

The following information is a compilation of materials available from FEMA, the American Red Cross, the Institute for Building and Home Safety, California State and local agencies and other organizations. We hope that these are helpful resources for your constituents to prepare in advance to protect themselves from the potential effects of an earthquake and the immediate aftermath.

The International Code Council develops the International Codes, a comprehensive and coordinated family of building safety codes that are regularly updated to reflect the latest advances in building safety, research and technology. Codes developed by the ICC are used by 97% of American cities, counties and states that enforce building codes. To facilitate the most effective application of the codes, the ICC provides training and certification for public and private sector building industry professionals and provides evaluation services to certify that building materials comply with building safety and fire prevention requirements.

If you have any questions about the Earthquake Preparedness or the ICC in general, please contact our Congressional Relations staff listed at [www.iccsafe.org/congress](http://www.iccsafe.org/congress).



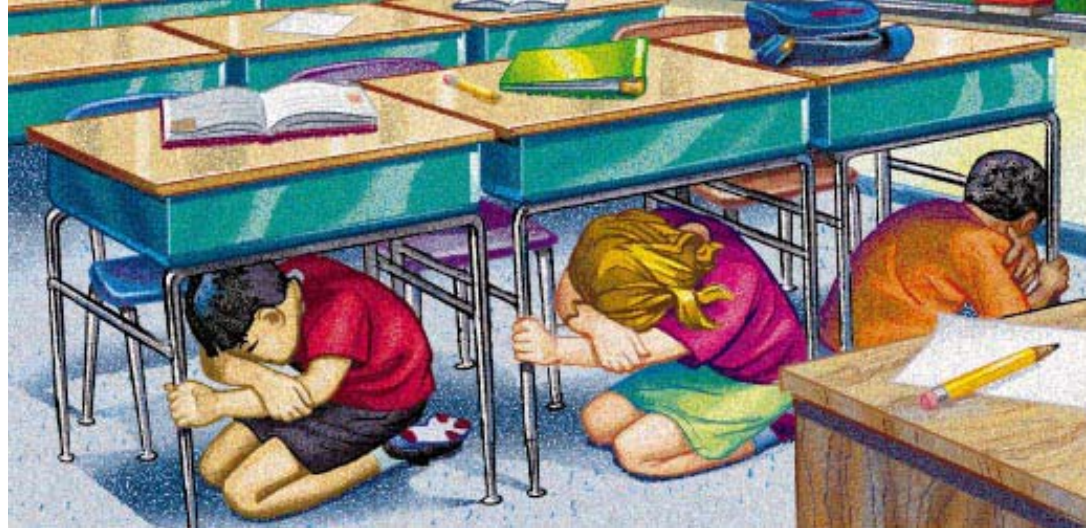


## ICC Earthquake Preparedness Kit

- Pg. 1 Red Cross/FEMA: Are You Ready for an Earthquake?  
[http://www.redcross.org/static/file\\_cont164\\_lang0\\_71.pdf](http://www.redcross.org/static/file_cont164_lang0_71.pdf)
- Pg. 3 FEMA: What to do During an Earthquake  
[http://www.fema.gov/hazard/earthquake/eq\\_during.shtm](http://www.fema.gov/hazard/earthquake/eq_during.shtm)
- Pg. 4 FEMA: What to do After an Earthquake  
[http://www.fema.gov/hazard/earthquake/eq\\_after.shtm](http://www.fema.gov/hazard/earthquake/eq_after.shtm)
- Pg. 5 San Francisco Chronicle: Earthquake Drills Do's and Don'ts  
<http://www.sfgate.com/cgi-bin/article.cgi?file=/earthquakes/archive/quakedrill.dtl>
- Pg. 7 CA Governor's Office of Emergency Services: Emergency Supplies Checklist  
[http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/checklist.pdf/\\$file/checklist.pdf](http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/checklist.pdf/$file/checklist.pdf)
- Pg. 9 Los Angeles Fire Department: Safe Drinking Water (pages 10-11 of the LAFD's Earthquake and Disaster Preparedness Handbook)  
<http://www.lafd.org/ostrich.pdf>
- Pg. 11 Los Angeles Fire Department: Portable/Auto Survival Kit (page 14 of the LAFD's Earthquake and Disaster Preparedness Handbook)  
<http://www.lafd.org/ostrich.pdf>
- Pg. 13 CA Governor's Office of Emergency Services: Tips for the Physically Challenged  
[http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/physically.pdf/\\$file/physically.pdf](http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/physically.pdf/$file/physically.pdf)
- Pg. 14 CA Governor's Office of Emergency Services: Tips for Preparing Children  
[http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/children.pdf/\\$file/children.pdf](http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/children.pdf/$file/children.pdf)
- Pg. 15 CA Governor's Office of Emergency Services: Tips for the Elderly  
[http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/elderly.pdf/\\$file/elderly.pdf](http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/elderly.pdf/$file/elderly.pdf)
- Pg. 16 CA Governor's Office of Emergency Services: Tips for Pet Owners  
[http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/pet\\_owners.pdf/\\$file/pet\\_owners.pdf](http://www.oes.ca.gov/CEPM2003.nsf/htmlmedia/pet_owners.pdf/$file/pet_owners.pdf)
- Pg. 17 Institute for Business & Home Safety: Nonstructural Retrofits for the Home (Complete 48 page document "A Homeowner's Guide to Earthquake Retrofit" accessible via link.)  
[http://www.ibhs.org/publications/downloads/20050927\\_100235\\_26153.pdf](http://www.ibhs.org/publications/downloads/20050927_100235_26153.pdf)
- Pg. 29 Institute for Business & Home Safety: Structural Retrofits for the Home (Complete 48 page document "A Homeowner's Guide to Earthquake Retrofit" accessible via link.)  
[http://www.ibhs.org/publications/downloads/20050927\\_100235\\_26153.pdf](http://www.ibhs.org/publications/downloads/20050927_100235_26153.pdf)

## ICC Earthquake Preparedness Kit

- Pg. 44 Institute for Business & Home Safety: Home Improvement Project List  
Entire 48 pg document “A Homeowner’s Guide to Earthquake Retrofit” available via:  
[http://www.ibhs.org/publications/downloads/20050927\\_100235\\_26153.pdf](http://www.ibhs.org/publications/downloads/20050927_100235_26153.pdf)
- Pg. 45 CA Governor’s Office of Emergency Services: The ABC’s of Post Earthquake Evacuation  
[http://www.oes.ca.gov/Operational/OESHome.nsf/0/b32e05499f2a6da488256c2c00755598/\\$FILE/EVACfor%20web.pdf](http://www.oes.ca.gov/Operational/OESHome.nsf/0/b32e05499f2a6da488256c2c00755598/$FILE/EVACfor%20web.pdf)
- Pg. 47 Los Angeles Fire Department: Emergency Lighting (page 15 of the LAFD’s Earthquake and Disaster Preparedness Handbook)  
<http://www.lafd.org/ostrich.pdf>
- Pg. 48 Los Angeles Fire Department: How to Shut-off Utilities (page 18 of the LAFD’s Earthquake and Disaster Preparedness Handbook)  
<http://www.lafd.org/ostrich.pdf>
- Pg. 51 Los Angeles Fire Department: Emergency Contact Cards (page 27 of the LAFD’s Earthquake and Disaster Preparedness Handbook)  
<http://www.lafd.org/ostrich.pdf>
- Pg. 53 Congressional Hazards Caucus Fact Sheet: Earthquakes  
[http://www.hazardscaucus.org/earthquake\\_factsheet0905.pdf](http://www.hazardscaucus.org/earthquake_factsheet0905.pdf)



## Are You Ready for an Earthquake?

Here's what you can do to prepare for such an emergency

### Prepare a Home Earthquake Plan

- ✓ Choose a safe place in every room—under a sturdy table or desk or against an inside wall where nothing can fall on you.
- ✓ Practice DROP, COVER, AND HOLD ON at least twice a year. Drop under a sturdy desk or table, hold on, and protect your eyes by pressing your face against your arm. If there's no table or desk nearby, sit on the floor against an interior wall away from windows, bookcases, or tall furniture that could fall on you. Teach children to DROP, COVER, AND HOLD ON!
- ✓ Choose an out-of-town family contact.
- ✓ Consult a professional to find out additional ways you can protect your home, such as bolting the house to its foundation and other structural mitigation techniques.
- ✓ Take a first aid class from your local Red Cross chapter. Keep your training current.
- ✓ Get training in how to use a fire extinguisher from your local fire department.
- ✓ Inform babysitters and caregivers of your plan.

### Eliminate hazards, by—

- ✓ Bolting bookcases, china cabinets, and other tall furniture to wall studs.
- ✓ Installing strong latches on cupboards.
- ✓ Strapping the water heater to wall studs.

### Prepare a Disaster Supplies Kit for home and car, including—

- ✓ First aid kit and essential medications.
- ✓ Canned food and can opener.
- ✓ At least three gallons of water per person.
- ✓ Protective clothing, rainwear, and bedding or sleeping bags.
- ✓ Battery-powered radio, flashlight, and extra batteries.
- ✓ Special items for infant, elderly, or disabled family members.
- ✓ Written instructions for how to turn off gas, electricity, and water if authorities advise you to do so. (Remember, you'll need a professional to turn natural gas service back on.)
- ✓ Keeping essentials, such as a flashlight and sturdy shoes, by your bedside.

### Know what to do when the shaking begins

- ✓ DROP, COVER, AND HOLD ON! Move only a few steps to a nearby safe place. Stay indoors until the shaking stops and you're sure it's safe to exit. Stay away from windows. In a high-rise building, expect the fire alarms and sprinklers to go off during a quake.
- ✓ If you are in bed, hold on and stay there, protecting your head with a pillow.

- ✓ If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground.
- ✓ If you are in a car, slow down and drive to a clear place (as described above). Stay in the car until the shaking stops.

### Identify what to do after the shaking stops

- ✓ Check yourself for injuries. Protect yourself from further danger by putting on long pants, a long-sleeved shirt, sturdy shoes, and work gloves.
- ✓ Check others for injuries. Give first aid for serious injuries.
- ✓ Look for and extinguish small fires. Eliminate fire hazards. Turn off the gas if you smell gas or think it's leaking. (Remember, only a professional should turn it back on.)
- ✓ Listen to the radio for instructions.
- ✓ Expect aftershocks. Each time you feel one, DROP, COVER, AND HOLD ON!
- ✓ Inspect your home for damage. Get everyone out if your home is unsafe.
- ✓ Use the telephone only to report life-threatening emergencies.

### Your local contact is:

# Are You Ready for an Earthquake?



Earthquakes can happen in most states . . . anytime . . . without warning. Reducing hazards and knowing what to do can make a big difference in how an earthquake affects your household. Adults and children in the household should talk about what you will do when an earthquake happens. This checklist will get you started in planning. Have various members of the household complete each of the items on the checklist below. Then get together to finalize your Home Earthquake Plan.

**\_\_\_\_\_ Pick one or more “safe places” in each room of your home. Practice DROP, COVER, AND HOLD ON! in each place.**

Write the locations of safe places in each room of your home—

Bedroom: \_\_\_\_\_

Bedroom: \_\_\_\_\_

Living room: \_\_\_\_\_

Kitchen: \_\_\_\_\_

Other rooms: \_\_\_\_\_

**\_\_\_\_\_ Choose an out-of-town relative or friend to be a family contact person.**

Family contact: \_\_\_\_\_

Phone number: \_\_\_\_\_

**\_\_\_\_\_ Put together disaster supplies kits.**

Location of home kit: \_\_\_\_\_

Date assembled: \_\_\_\_\_

Shoes and flashlight put next to everyone’s bed: \_\_\_\_\_  
(date)

Smaller kit put in car: \_\_\_\_\_  
(date)

**\_\_\_\_\_ Teach household members how to turn off utilities.**

Location of gas and water valves and electrical switches and turnoff tools: \_\_\_\_\_

**\_\_\_\_\_ Install strong latches or bolts on cabinets.**

**\_\_\_\_\_ Secure water heater to wall studs with two steel straps.**

**\_\_\_\_\_ Bolt bookcases, china cabinet, and tall furniture to wall studs.**

**\_\_\_\_\_ Secure items that might fall (TV, books, computers, etc.).**

And remember . . . when an earthquake, tornado, flood, fire, or other emergency happens in your community, you can count on your local American Red Cross chapter to be there to help you and your family. Your Red Cross is not a government agency and depends on contributions of your time, money, and blood.

For more information, please contact your local American Red Cross chapter or emergency management office. You can also visit these Web sites:

American Red Cross: [www.redcross.org](http://www.redcross.org)

Federal Emergency Management Agency: [www.fema.gov](http://www.fema.gov)

U.S. Geological Survey: [www.usgs.gov](http://www.usgs.gov)





## What to do During an Earthquake

Stay as safe as possible during an earthquake by doing the following. Be aware that some earthquakes are actually foreshocks, and a larger earthquake might occur.

Minimize your movements during an earthquake to a few steps to a nearby safe place. Stay indoors until the shaking has stopped and you are sure exiting is safe.

If you are	Then:
<b>Indoors</b>	<p><b>DROP</b> to the ground; take <b>COVER</b> by getting under a sturdy table or other piece of furniture; and <b>HOLD ON</b> on until the shaking stops. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.</p> <p>Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.</p> <p>Stay in bed - if you are there when the earthquake strikes - hold on and protect your head with a pillow, unless you are under a heavy light fixture that could fall. In that case, move to the nearest safe place.</p> <p>Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported, loadbearing doorway.</p> <p>Stay inside until shaking stops and it is safe to go outside. Research has shown that most injuries occur when people inside buildings attempt to move to a different location inside the building or try to leave.</p> <p>Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on.</p> <p>DO NOT use the elevators.</p>
<b>Outdoors</b>	<p>Stay there.</p> <p>Move away from buildings, streetlights, and utility wires.</p> <p>Once in the open, stay there until the shaking stops. The greatest danger exists directly outside buildings, at exits, and alongside exterior walls. Many of the 120 fatalities from the 1933 Long Beach earthquake occurred when people ran outside of buildings only to be killed by falling debris from collapsing walls. Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related casualties result from collapsing walls, flying glass, and falling objects.</p>
<b>In a moving vehicle</b>	<p>Stop as quickly as safety permits and stay in the vehicle. Avoid stopping near or under buildings, trees, overpasses, and utility wires.</p> <p>Proceed cautiously once the earthquake has stopped, and avoid roads, bridges or ramps that might have been damaged by the earthquake.</p>
<b>Trapped under debris</b>	<p>Do not light a match. Do not move about or kick up dust.</p> <p>Cover your mouth with a handkerchief or clothing.</p> <p>Tap on a pipe or wall so rescuers can locate you. Use a whistle if one is available. Shout only as a last resort - shouting can cause you to inhale dangerous amounts of dust.</p>



## What to do After an Earthquake

- **Be prepared for aftershocks.** These secondary shockwaves are usually less violent than the main quake but can be strong enough to do additional damage to weakened structures and can occur in the first hours, days, weeks, or even months after the quake.
- **Listen to a battery-operated radio or television** for the latest emergency information.
- **Use the telephone only for emergency calls.**
- **Open cabinets cautiously.** Beware of objects that can fall off shelves.
- **Stay away from damaged areas** unless your assistance has been specifically requested by police, fire, or relief organizations.
- **Be aware of possible tsunamis if you live in coastal areas.** These are also known as seismic sea waves (mistakenly called "tidal waves"). When local authorities issue a tsunami warning, assume that a series of dangerous waves is on the way. Stay away from the beach.
- **Help injured or trapped persons.** Remember to help your neighbors who may require special assistance such as infants, the elderly, and people with disabilities. Give first aid where appropriate. Do not move seriously injured persons unless they are in immediate danger of further injury. Call for help.
- **Clean up spilled medicines, bleaches, gasoline or other flammable liquids immediately.** Leave the area if you smell gas or fumes from other chemicals.
- **Inspect the entire length of chimneys** carefully for damage. Unnoticed damage could lead to a fire.
- **Inspect utilities**
  - **Check for gas leaks.** If you smell gas or hear blowing or hissing noise, open a window and quickly leave the building. Turn off the gas at the outside main valve if you can and call the gas company from a neighbor's home. If you turn off the gas for any reason, it must be turned back on by a professional.
  - **Look for electrical system damage.** If you see sparks or broken or frayed wires, or if you smell hot insulation, turn off the electricity at the main fuse box or circuit breaker. If you have to step in water to get to the fuse box or circuit breaker, call an electrician first for advice.
  - **Check for sewage and water lines damage.** If you suspect sewage lines are damaged, avoid using the toilets and call a plumber. If water pipes are damaged, contact the water company and avoid using water from the tap. You can obtain safe water by melting ice cubes.

## **Earthquake Drills Do's And Don'ts**

- SF Gate

Chances are good that the next major temblor could hit the Bay Area by 2030, according to scientists. Odds are also high that most people are unprepared for the big quake.

Don't get caught off guard. Protect yourself, your loved ones and your pets by knowing what to do during and after an earthquake.

\*\*\*\*

### **DURING THE QUAKE**

#### Indoors

- Stay inside
- DROP, COVER, AND HOLD ON! Move only a few steps to a nearby safe place. Take cover under and hold onto a piece of heavy furniture or stand against an inside wall. Stay indoors until the shaking stops and you're sure it's safe to exit. Stay away from windows and doors.
- \*\*Never take an elevator
- If you are in bed, hold on, stay there, protect your head with a pillow.

#### Outdoors

- Find a clear spot away from buildings, trees, and power lines.
- Drop to the ground until the shaking stops.

#### In A Car

- Slow down and drive to a clear place (as described above).
- Turn on emergency flashers on and slow to a stop. Do not stop on overpasses, underpasses, or bridges. Be careful of overhead hazards such as power lines or falling building debris.
- Turn off the ignition and set the parking brake.
- Stay inside the car until the shaking stops.

### **PETS: During and after**

- Don't try to hold your pet during a quake. Animals instinctively want to hide when their safety is threatened. If you get in their way, even the nicest pets may hurt you.
- Watch animals closely. Leash dogs and place them in a fenced yard.
- Pets may not be allowed into shelters for health and space reasons. Prepare an emergency pen for pets in the home that includes a 3-day supply of dry food and a large container of water.
- If you can't find your pet or must leave it at home after a quake, leave fresh water in nonspill containers such as bathtubs and sinks. Leave plenty of low-fat dry food,

which deteriorates more slowly and is less tasty so pets won't try to eat it all at once. Leave a note indicating that you have a pet, where you will be and the date.

## **AFTER THE QUAKE**

### Personal Safety

- Expect aftershocks. Each time you feel one, **DROP, COVER, AND HOLD ON!**
- Check yourself for injuries. Protect yourself by wearing long pants, a long-sleeved shirt, sturdy shoes and work gloves.
- Listen to a battery-operated radio or television for the latest emergency information.
- Check others for injuries. Give first aid where appropriate. Do not move seriously injured persons unless they are in immediate danger of further injury.
- Remember to help your neighbors who may require special assistance--infants, the elderly, and people with disabilities.

### Home

- Inspect your home for damage. Get everyone out if your home is unsafe.
- Telephone: Use the telephone only for emergencies. Check to make sure the receiver has not been shaken off the hook and is tying up the line.
- Fires: Look for and extinguish small fires.
- Gas: Check for gas leaks. If you smell gas or hear blowing or hissing noise, open a window and leave building. **Turn off the gas** at the outside main valve if you can and call the gas company.
- \*\*Remember, only a professional can turn the gas back on.
- Electricity: Look for electrical system damage. Turn off the electricity at the main fuse box or circuit breaker if you see sparks or broken or frayed wires, or if smell hot insulation. If you have to step in water to get to the fuse box or circuit breaker, call an electrician first for advice.
- Sewage, Water: Check for sewage and water lines damage. If you suspect sewage lines are damaged, avoid using the toilets and contact a plumber. If water pipes are damaged, contact the water company and avoid using water from the tap.

SOURCE: American Red Cross, FEMA, SF Fire Department, SF Chronicle

URL: <http://sfgate.com/cgi-bin/article.cgi?file=/earthquakes/archive/quakedrill.dtl>

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# Emergency Supplies Checklist

*Stocking up now on emergency supplies can add to your safety and comfort during and after an earthquake. Store enough supplies for at least 72 hours.*

## Essentials

- ✓
- Water — 1 gallon per person per day (a week's supply of water is preferable)
- Water purification kit
- First aid kit, freshly stocked
- First aid book
- Food
- Can opener (non-electric)
- Blankets or sleeping bags
- Portable radio, flashlight and spare batteries
- Essential medications
- Extra pair of eyeglasses
- Extra pair of house and car keys
- Fire extinguisher — A-B-C type
- Food, water and restraint (leash or carrier) for pets
- Cash and change
- Baby supplies: formula, bottle, pacifier, soap and baby powder, clothing, blankets, baby wipes, disposable diapers, canned food and juices.

## Sanitation Supplies

- ✓
- Large plastic trash bags for waste; tarps and rain ponchos
- Large trash cans
- Bar soap and liquid detergent
- Shampoo
- Toothpaste and toothbrushes
- Feminine hygiene supplies
- Toilet paper
- Household bleach

## Safety and Comfort

- ✓
- Sturdy shoes
- Heavy gloves for clearing debris
- Candles and matches
- Light sticks
- Change of clothing
- Knife or razor blades
- Garden hose for siphoning and firefighting
- Tent
- Communication kit: paper, pens, stamps

## Cooking

- ✓
- Plastic knives, forks, spoons
- Paper plates and cups
- Paper towels
- Heavy-duty aluminum foil
- Camping stove for outdoor cooking (caution: before using fire to cook, make sure there are no gas leaks; never use charcoal indoors)

## Tools and Supplies

- ✓
- Axe, shovel, broom
- Adjustable wrench for turning off gas
- Tool kit including a screwdriver, pliers and a hammer
- Coil of 1/2" rope
- Plastic tape, staple gun and sheeting for window replacement
- Bicycle
- City map



# SAFE DRINKING WATER

## WATER IS THE MOST IMPORTANT ITEM TO STORE

Loss of safe drinking water can be deadly. Most people, with few exceptions, will be feeling the effects if they do without water for more than 36 hours. Dehydration occurs much quicker than starvation. Our bodies can tolerate the loss of food much better. With an ample water supply, starvation is delayed many days, even weeks.



The City water supply is vulnerable to the effects of a large earthquake. Contaminants can get into the drinking water supply through ruptures in the pipes, through the mixing up of sediments, through the adulteration of filtering systems, etc. Now, we take our water for granted. That will be dangerous after a big quake.

## HOW MUCH SHOULD I STORE?

A good rule of thumb is: **5 GALLONS PER PERSON (MINIMUM)**

*NOTE: Treat your pet as a family member when thinking about how much to store.*

## WATER SOURCES:

- Bottled Water from the Store - 1- and 2-gallon sealed containers (*NOTE: The 1- and 2- gallon containers you purchase in your local store are **not** designed for long-term storage and will begin to leak/fail after about 6 months.* )
- 1- and 5-Gallon Sealable Containers - From camping or survival stores. Be sure to sanitize container and treat the water that you are storing. Old bleach bottles, clearly marked, make good containers for water storage.
- 20-oz. to 1-Liter Designer Water Containers - Are usually marked with an expiration date, but are generally good for about two years
- 5-Gallon Water Bottles from Private Water Companies - Water companies claim their water and containers are good for up to five years, if still factory sealed & correctly stored in a cool dark location.



**DO NOT STORE ANY PLASTIC WATER CONTAINER DIRECTLY ON CONCRETE.**

*The concrete will leech chemicals into the water, contaminating it and also degrading the plastic bottle, causing failure.*

# PURIFYING YOUR TAP WATER

Store all plastic water containers on a wooden pallet or shelf. Keep water containers in a location where container failure will not destroy your other supplies. Keep all water and supplies in a cool dark place.

## GETTING THE WATER OUT OF YOUR WATER HEATER :

- Use extreme caution. Let the water cool.
- Turn off the cold water supply to the tank
- Turn off the gas or electric heater for the tank
- Open the drain valve at the bottom

Any water that you make up yourself needs to be treated. If left untreated over time, it becomes contaminated with bacteria and algae.

- 8 DROPS OF PURE UNSCENTED LIQUID BLEACH PER GALLON OF WATER WILL REDUCE THE CONTAMINANTS IN THE WATER.
- ADD THE BLEACH WHEN YOU FIRST STORE THE WATER AWAY.



### IF THE PURITY OF YOUR WATER SOURCE IS QUESTIONABLE, USE THE FOLLOWING METHODS TO MAKE THE WATER SAFE TO DRINK:

- BEST! Add Liquid Chlorine Beach to the water (8 drops per gallon of water. Double this dose if the water is cloudy.)  
OR
- GOOD! Add 2% Tincture of Iodine to the water (12 drops per gallon of water. Double this dose if the water is cloudy.)  
OR
- ACCEPTABLE! Boil the water vigorously (5 min. at sea level, adding an extra minute for every 1000 feet above sea level. Double this time if the water is cloudy.)  
AND
- Don't forget to clean and sanitize your food and water containers before using them. Wash with soap and water then fill with a 10% bleach solution. After 5 min. empty the bleach solution and let air dry  
AND
- Water that is dirty should first be strained through a coffee filter, cheesecloth, or a paper towel to remove suspended matter.

*REMEMBER: Some sediment at the bottom of the tank may at first make water flowing out look murky. Continue to drain water until it becomes clear.*

### OTHER SOURCES OF WATER IN YOUR HOME

- Toilet Water Storage Tank. NOTE: Use the water from the Storage Tank - NOT THE TOILET BOWL (Don't drink the water if you use coloring or chemicals in it)
- Melted Ice Cubes are a source of water
- Water-Packed Can Goods (even syrups are mostly water)
- Water Trapped In Home Piping. Water can be removed by locating and shutting off the main water valve. Then, open the valve at the highest point of your property (i.e., shower head, especially on the 2nd floor). Then, when you open the valve at the lowest point, gravity will force the water from the pipes.

**NOTE: ROTATE YOUR WATER EVERY SIX MONTHS** (This includes the 1- and 2-gallon sealed bottles purchased at the store, and the supply you made up from tap water with bleach added.)

Another source of water is the hot water heater. Every water heater has a drain valve near the bottom.

### THE PREVIOUSLY MENTIONED SOURCES ARE FOR DRINKING AND FOOD PREPARATION

*DO NOT DRINK POOL OR SPA WATER! POOL WATER CONTAINS MANY TOXIC CHEMICALS AND HAS A HIGH POTENTIAL OF GIVING YOU DIARRHEA, CAUSING DEHYDRATION!*





# PORTABLE/AUTO SURVIVAL KIT

OK, you've prepared your home. What about when you're away from home? In your Car or at Work?

Southern Californians spend a great deal of time in their vehicles. Our sprawling megalopolis necessitates the use of vehicles for even the simplest of errands. We also need to prepare ourselves while we are away from home. A portable survival kit kept in the car and another kept in our office will give us the ability to get along until we are able to return home.



## HERE IS A LIST OF ITEMS WHICH SHOULD BE KEPT IN YOUR CAR'S MOBILE SURVIVAL KIT:

- Nylon carrying bag or day-pack
- Bottled water
- Nonperishable food
- Can opener
- Transistor radio and EXTRA batteries
- Flashlight and EXTRA batteries
- Fire extinguisher (ABC-type)
- First aid kit
- Gloves
- Essential medication (if refrigeration is not required)
- Blanket, sleeping bag, space blanket
- Sealable plastic bags
- Pre-moistened towelettes
- Small toolkit
- Matches and lighter
- Walking shoes and extra socks
- Change of clothes
- Jacket
- CASH (small denominations and coins)

## HERE ARE ITEMS THAT CAN BE USED FOR A PERSONAL SURVIVAL KIT AT WORK

Your workplace kit should be small and portable. Place it into a small day-pack. You should be able to carry your supplies with you if your business is closed and you need to evacuate to another location. It should include:

- Dry Food - candy bars, dried fruits, jerky, cookies, crackers, etc.
- Drinks - water or juice
- Tennis shoes/walking shoes for office workers
- First aid kit with routine medications (aspirin, acetaminophen, cough/cold tablets, allergy tablets, etc.)
- Extra prescription medications
- Flashlight/batteries
- Chemical light sticks
- Matches
- Small radio (battery-operated portable)
- Small and large plastic bags
- Toiletries/personal hygiene items
- Entertainment Pack - Family photos, notebooks, literature, and games

**REMEMBER:**  
*You could be stranded for up to 72 hours. Make sure you have enough supplies to meet your needs.*





# Tips for the Physically Challenged

## Before an Earthquake

- ✓
  - Set up your home, apartment or workplace so that you can quickly get under a sturdy desk, table or other safe place for protection. Identify doorways that do not have doors in which you can take cover.
  - Maintain a list of medications, allergies, special equipment, names and numbers of doctors, pharmacists and family members with you at all times.
  - Keep extra medication with your emergency supplies.
  - Keep extra emergency supplies at your bedside and by your wheelchair.
  - Have walking aids near you at all times. Place extra walking aids in different rooms of the house.
  - Put a security light in each room. These lights plug into any outlet and light up automatically if there is a loss of electricity. They continue operating automatically for four to six hours, and they can be turned off by hand in an emergency.
  - Have a whistle near you to signal for help.
  - Find two people you trust who will check on you after an earthquake. Tell them your special needs. Show them how to operate any equipment you use. Show them where your emergency supplies are kept. Give them a spare key.

## During and After an Earthquake

- If you are in bed or out of a wheelchair, stay where you are and cover your head and neck.
- If you are in a wheelchair, stay in it and go into a doorway that doesn't have a door. Cover your head and neck with your hands.
- Prepare to be self-sufficient for at least three days.
- Turn on your portable radio for instructions and news reports. For your own safety, cooperate fully with public safety officials and instructions.
- Prepare for aftershocks.
- If you evacuate your home, leave a message at your home telling family members and others where you can be found.

**Ready  
To Ride It Out?**

# Tips for Preparing Children

*Children need to be prepared for an earthquake as much as adults, if not more.*

## Infants and Toddlers

*For infants and toddlers, special emphasis should be placed on making their environment as safe as possible.*

- ✓
- Cribs should be placed away from windows and tall, unsecured bookcases and shelves that could slide or topple.
- A minimum of a 72-hour supply of extra water, formula, bottles, food, juices, clothing, disposable diapers, baby wipes and prescribed medications should be stored where it is most likely to be accessible after an earthquake. Also keep an extra diaper bag with these items in your car.
- Store strollers, wagons, blankets and cribs with appropriate wheels to evacuate infants, if necessary.
- Install bumper pads in cribs or bassinets to protect babies during the shaking.
- Install latches on all cupboards (not just those young children can reach) so that nothing can fall on your baby during a quake.

## Preschool and School-age Children

*By age three or so, children can understand what an earthquake is and how to get ready for one.*

*Take the time to explain what causes earthquakes in terms they'll understand. Include your children in family discussions and planning for earthquake safety. Conduct drills and review safety procedures every six months.*

- ✓
- Show children the safest places to be in each room when an earthquake hits. Also show them all possible exits from each room.
- Use sturdy tables to teach children to Duck, Cover & Hold.
- Teach children what to do wherever they are during an earthquake (at school, in a tall building, outdoors).
- Make sure children's emergency cards at school are up-to-date.
- Although children should not turn off any utility valves, it's important that they know what gas smells like. Advise children to tell an adult if they smell gas after an earthquake.

**Ready  
To Ride It Out?**

# Tips for the Elderly

## Before an Earthquake

- ✓
  - Eliminate hazards. Make it as easy as possible to quickly get under a sturdy table or desk for protection.
  - Anchor special equipment such as telephones and life support systems. Fasten tanks of gas, such as oxygen, to the wall.
  - Keep a list of medications, allergies, special equipment, names and numbers of doctors, pharmacists and family members. Make sure you have this list with you at all times.
  - Keep an extra pair of eyeglasses and medication with emergency supplies.
  - Keep walking aids near you at all times. Have extra walking aids in different rooms of the house.
  - Put a security light in each room. These lights plug into any outlet and light up automatically if there is a loss of electricity. They continue operating automatically for four to six hours, and they can be turned off by hand in an emergency.
  - Make sure you have a whistle to signal for help.
  - Keep extra batteries for hearing aids with your emergency supplies. Remember to replace them annually.
  - Keep extra emergency supplies at your bedside.

- Find two people you trust who will check on you after an earthquake. Tell them your special needs. Show them how to operate any equipment you use. Show them where your emergency supplies are kept. Give them a spare key.

## During and After an Earthquake

- If you are in bed or sitting down, do not get up.
- If you are standing, duck and cover or sit down. You could be thrown to the floor if you are standing.
- Prepare to be self-sufficient for at least three days.
- Turn on your portable radio for instructions and news reports. For your own safety, cooperate fully with public safety officials and instructions.
- Prepare for aftershocks.
- If you evacuate, leave a message at your home telling family members and others where you can be found.

**Ready  
To Ride It Out?**

# Tips for Pet Owners

*When preparing your home for an earthquake, don't forget to include your pets on the list. They will depend on you even more after an earthquake to take care of them and their needs.*

## Before an Earthquake

- ✓  
 Store enough food and water to last for 72 hours, preferably for one week. Prepare a shelter or evacuation kit for your pet, including an unbreakable dish, veterinarian records, a restraint (leash or pet carrier) and medication with instructions.
- Keep your pet's ID tag up-to-date.
- Make sure nothing can fall on your pet.
- Arrange for a neighbor to take care of your pet if you are not able to get home after an earthquake.

## During and After an Earthquake

- Do not try to hold onto your pet during the shaking. Animals will instinctively protect themselves and hide where they're safe. If you get in their way, even the nicest pets can turn on you.
- Be patient with your pets after a quake. They get stressed just like people and need time to readjust. They may disappear for some time, but they generally show up again when things have calmed down.
- If you have outdoor pets, you should keep them indoors until the aftershocks have subsided and they have calmed down.
- If you must evacuate your home, leave your pet secured in a safe place. Pets will not be allowed at shelters. Be sure to leave plenty of clean water and food. If possible, visit your pet daily until you can return home.

**Ready  
To Ride It Out?**

# 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 home. 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.

## Bookcases

It's true that bookcases are great for storing books, toys and supplies. They can, however, shake and tip over in an earthquake, causing considerable damage or injury. For this reason, make sure all bookcases are securely fastened to nearby walls.

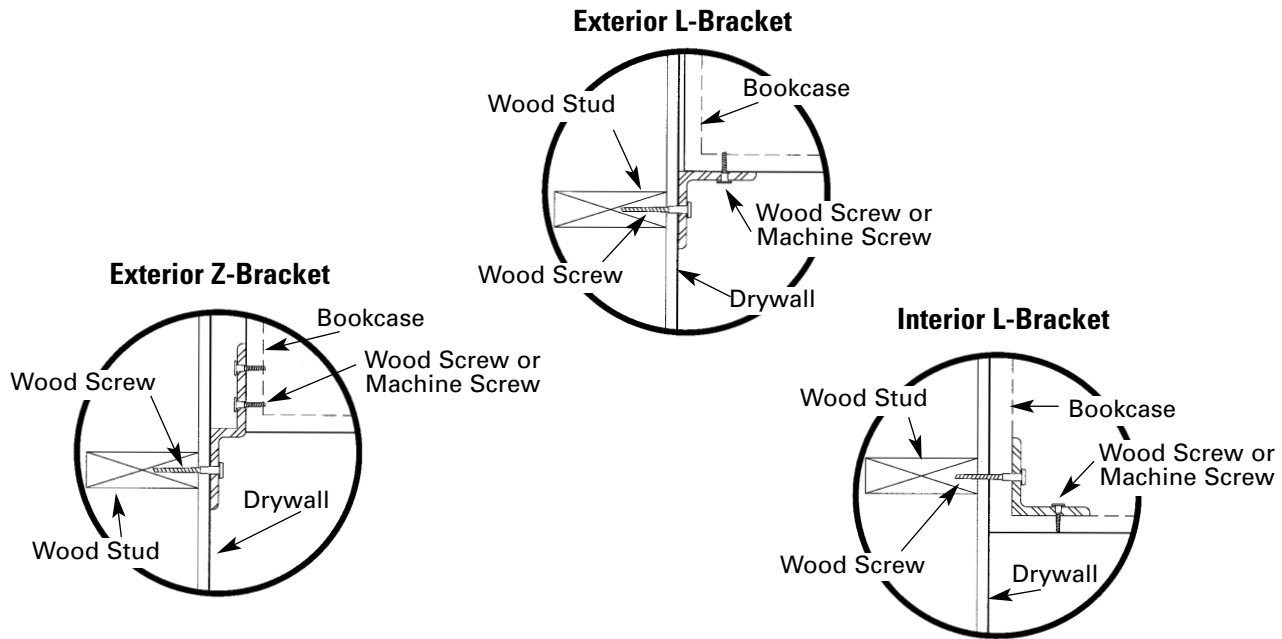
► One way to do this is to attach either L-brackets or Z-brackets to the bookcase and the wall after pre-drilling holes in each. Be sure to use a bracket that can accommodate the fasteners you are using. See **Figure 5** on page 8 for details.



Fallen bookcases at the Lawrence Livermore Lab, Livermore, Calif.

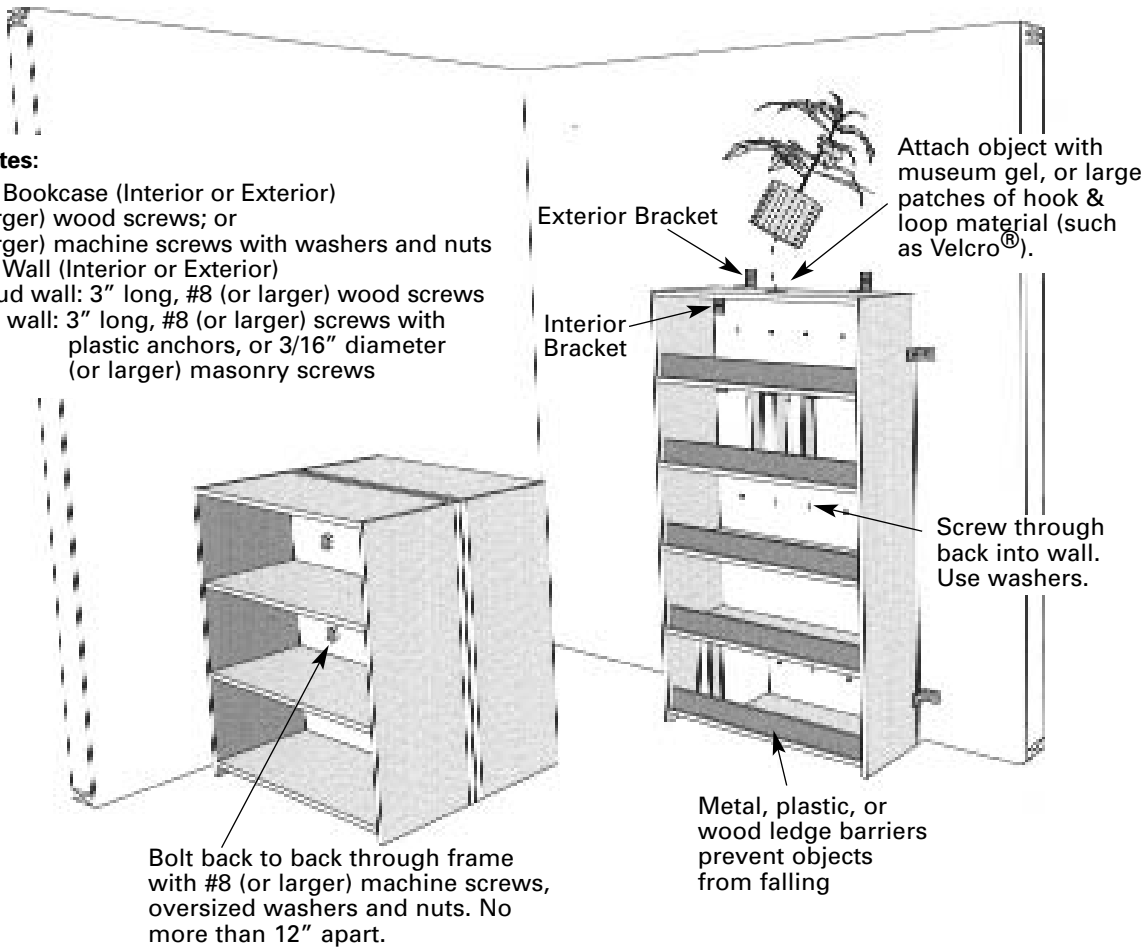
USGS

**Figure 5: Securing Bookcases**



**General Notes:**

- Bracket to Bookcase (Interior or Exterior)  
#8 (or larger) wood screws; or  
#8 (or larger) machine screws with washers and nuts
- Bracket to Wall (Interior or Exterior)  
Wood-stud wall: 3" long, #8 (or larger) wood screws  
Masonry wall: 3" long, #8 (or larger) screws with plastic anchors, or 3/16" diameter (or larger) masonry screws





### **Attaching the bracket to the bookcase:**

- For wood bookcases, attach the bracket with #8 (or larger) wood screws. The screw should be long enough to secure the bracket to the shelf without punching through and creating a sharp edge.
- For plastic and metal bookcases, use #8 (or larger) machine screws with washers and nuts to ensure that the bracket will stay in place. The screw should be long enough to accommodate the bracket, shelf, washer and nut.

### **Attaching the bracket to the walls:**

- For wood stud walls, use 3-inch long #8 (or larger) wood screws to attach each bracket to the wall. Place screws in the wood studs to assure that they are properly supported. Use a stud locator to find the best places.
  - For stone or masonry walls, place plastic anchors in the holes before you screw in 3-inch long #8 (or larger) screws or consider using 3/16-inch diameter (or larger) masonry screws.
- For a bookcase with a solid back, you can pass screws directly through the back into the wall. Use washers to spread contact over a larger area between the screw and the bookcase's back. If you are working with a wood stud wall, use a stud locator to find the best locations for the 3-inch long #8 (or larger) wood screws. For a stone or masonry wall, use plastic anchors with the #8 (or larger) screws or use 3/16-inch diameter (or larger) masonry screws.

➤ You can prevent items on shelves from falling by installing ledge barriers made from strips of wood, metal or plastic. Cut them to fit the shelf and attach them with glue or mechanical fasteners. You can finish the barriers to match the shelves. See **Figure 5** for details.

➤ Place heavy items on lower shelves.

➤ You can stabilize bookcases that are not against walls by attaching them back-to-back with #8 (or larger) machine screws, oversize washers and nuts. See **Figure 5**.

➤ Affix large, heavy items, such as plants and aquariums, and other breakables directly to the shelf to keep them from falling. You can apply hook and loop material (such as Velcro®) or museum gel (or museum wax) to secure these items. For added protection, use metal, plastic or wood ledge barriers. See **Figure 5** for details.

## **Necessary Tools and Materials**

- L- or Z-brackets
- Fasteners
- Plastic anchors for masonry walls
- Variable speed drill and bits
- Screwdriver
- Stud locator
- Wood, plastic or metal strips
- Paint or wood finish
- Hook and loop material (Velcro®) or museum gel/wax



## Cabinets and Drawers

Like bookcases, cabinets can tip over and their doors can open, spilling their contents. Furthermore, the drawers, which sometimes have sharp edges, can slide out and hurt you, or your family.

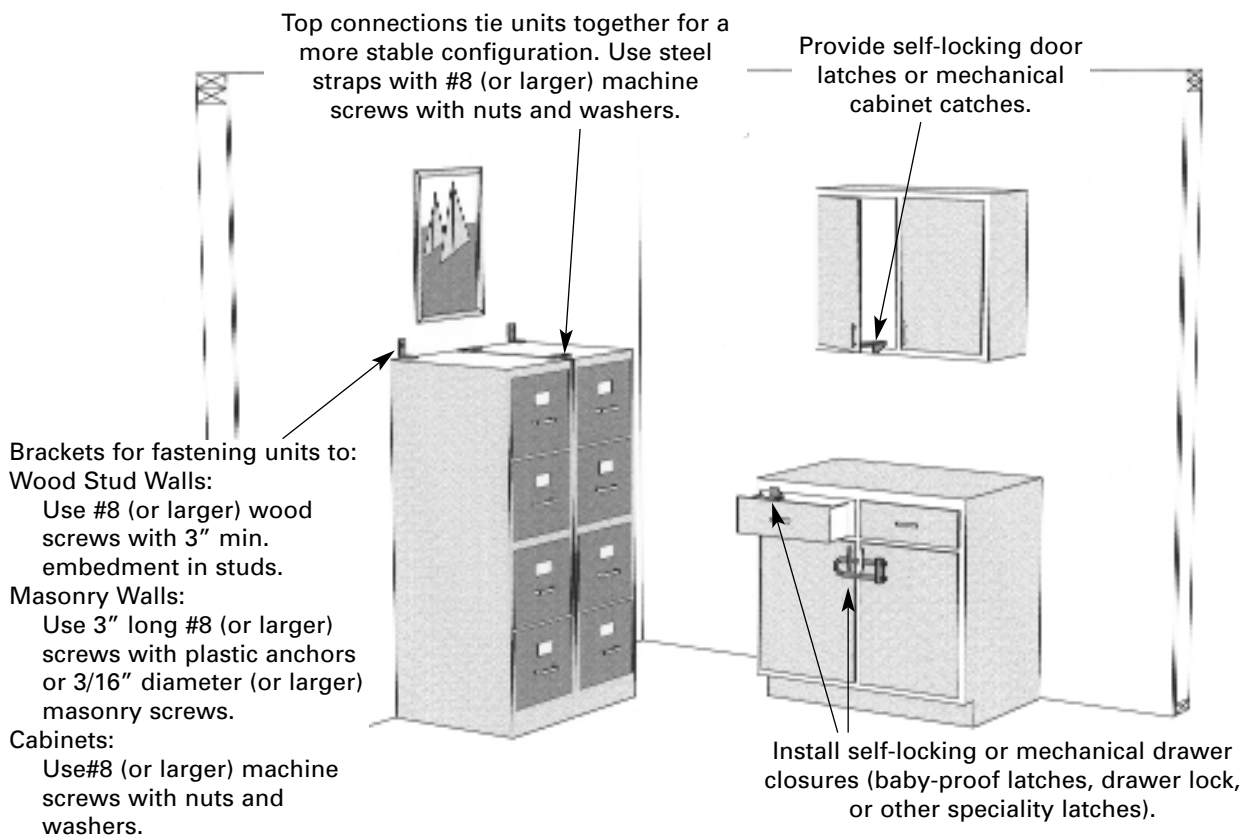
- To secure them, do the following:
  - Attach cabinets to the wall and floors using L-brackets or Z-brackets. Again, be sure to use brackets that can accommodate the diameter of the fasteners. You should follow the specific directions given in **Figure 6** and in the “Bookcases” section for securing the bracket to the wall and cabinet.



EERI Coalinga Earthquake Reconnaissance Team, S. Ribal, Cal. Poly.

Interior damage to kitchen, Coalinga Junior High School, Coalinga, Calif.

**Figure 6: Cabinets and Drawers**



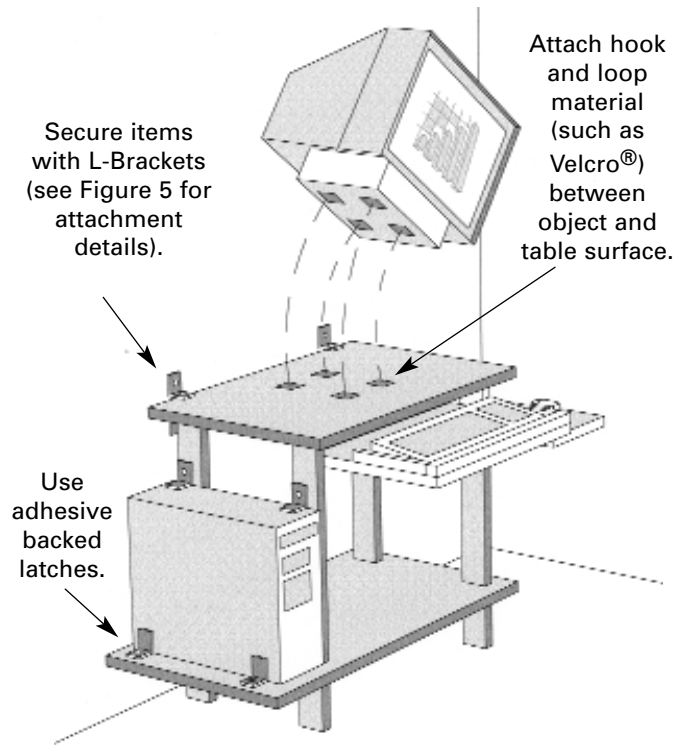
- You can fasten several units together to form a wider footprint using #8 (or larger) machine screws.


➤ Attach simple mechanical or self-locking latches to cabinet drawers so they cannot slide open.

➤ Install mechanical or self-locking latches to prevent your cabinet doors from swinging open and spilling their contents. Your local hardware store has a large variety of latches, many of which are small, unobtrusive and easy to operate. See **Figure 6** for details.

➤ Most of us place heavy objects such as televisions, computers and stereos on top of cabinets, bookcases and tables. You should fasten these items down so they will not slide off during an earthquake. Several methods of attachment are shown in **Figure 7**.

**Figure 7: Secure Heavy Objects**





### Necessary Tools and Materials

- L- or Z-brackets
- Fasteners
- Door or drawer latches
- Plastic anchors for masonry walls
- Variable speed drill and bits
- Screwdriver
- Stud locator



*J. Prelli*

Damage to framed pictures, Northridge, Calif.

## Picture Frames and Bulletin Boards

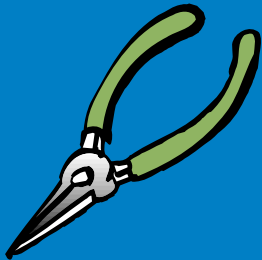
The photographs, bulletin boards and artwork you display in your home add to its character. But these items can easily fall during an earthquake if you do not fasten them properly to a wall in the following way:

► 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. See **Figure 8**.
- 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.

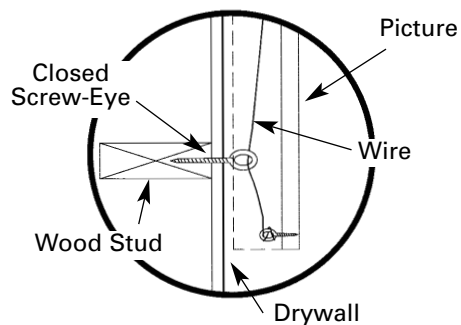
► Always mount heavy or sharp wall hangings away from areas where they could fall on children.

### Necessary Tools and Materials



- Stud locator
- Screwdriver
- Variable speed drill and bits
- Screw-eyes
- Heavy picture wire
- Pliers

**Figure 8: Secure Picture Frame to Wall**



## 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. Here are some ways to protect yourself:

➤ Secure ceiling lights to supports using safety cables.

- Use a chain strap or a minimum 14-gauge wire to attach the light fixture to a nearby ceiling support. Locate the support visually or use a stud locator. Be sure to leave the safety cables slack; they should not support the weight of the lights under normal circumstances. See **Figure 9** for details.
- If your ceiling light has a cover, keep it from falling during an earthquake by fastening it to the fixture itself or to the home's permanent structure.
- Pay special attention to your home's fluorescent lights. Installing plastic sleeves over the fluorescent light tubes will keep the glass from scattering if they break. As an alternative, consider using Teflon<sup>®</sup> fluorescent lights, which are shatter-resistant.

➤ Use safety cables every few feet to attach suspended or false ceilings to the structure of your home.

- Use chain straps, plumber's strapping (metal strapping with holes) or heavy wire (minimum 14-gauge) to secure suspended or false ceilings. See **Figure 9**.



*EERI Coalinga Earthquake Reconnaissance Team  
S. Ribah, Cal. Poly.*



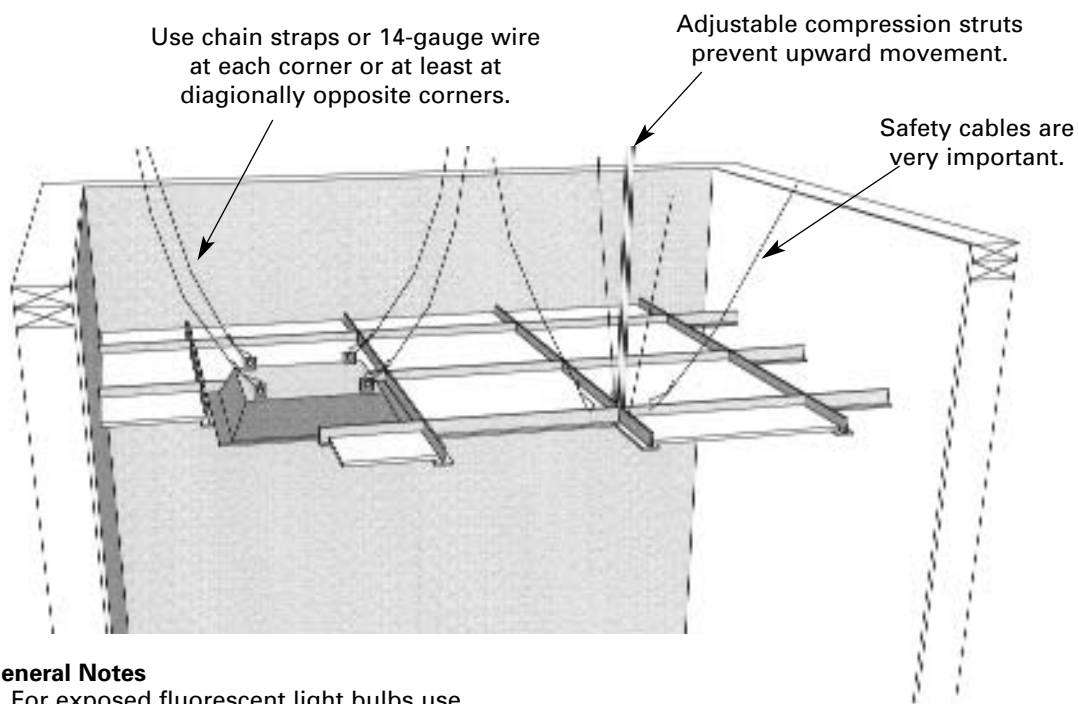
*EERI, S. Swan, EQE Inter.*

**Top: Failure of pendant light fixtures in the Dawson Elementary School library, Coalinga, Calif.**

**Bottom: Damage to suspended ceiling and recessed ceiling lights, Philippines.**

- Use screws, bolts or other appropriate fasteners to attach the safety cables to both the suspended ceiling and the permanent structure.
- You can prevent the ceiling panels from flying upward by installing adjustable compression struts. Contact your suspended ceiling manufacturer for details. See **Figure 9**.

**Figure 9: Secure Lights and Suspended Ceilings**



**General Notes**

- For exposed fluorescent light bulbs use protective sleeves.
- Secure light covers in place.
- To secure a wire or chain, use a minimum of 3 tight turns in 1-1/2" at each end.

**Necessary Tools and Materials**

- Safety cables, chain straps, heavy wire or plumber's strapping
- Fasteners
- Adjustable compression struts
- Screwdriver
- Variable speed drill and bits
- Stud locator
- Plastic sleeves for fluorescent lights
- Light covers

► 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 home'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 family 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. The restraint should be located in the mid- to upper-portion of the appliance. Use the following method:
  - Choose a screw-eye that is sized appropriately for the appliance. For example, use a 3/8-inch diameter screw-eye (or larger) for a refrigerator.
  - For wood stud walls, use a stud locator to find the best wall location to install the screw-eye. For stone or masonry



USGS, M. Hopper

Damaged building, Coalinga, Calif.

walls, place plastic anchors in the pre-drilled holes before you install the screw-eye.

- Connect coated wire cable to the screw-eye at one end and to a snap-hook fastener at the other end.
- Attach the cable to the appliance with the snap-hook fastener.
- ▶ 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.

## Necessary Tools and Materials



- Coated wire cable or other strapping system
- Screwdriver
- Variable speed drill and bits
- Stud locator
- Screw-eyes
- Hook fasteners
- Flexible connectors
- Plastic anchors



Ben Rothholz

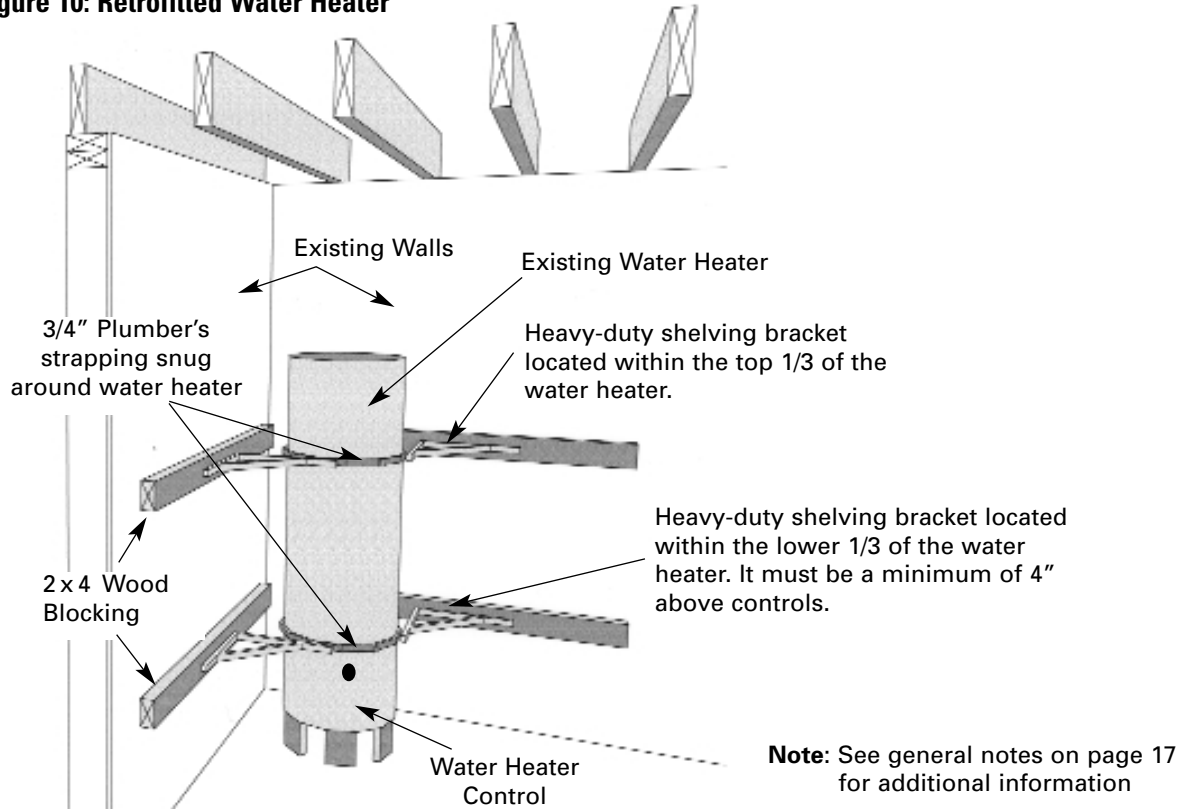
Water heater burned in residential fire caused by a gas leak.

## Water Heaters

Water heaters can move or tip over in an earthquake and the broken water pipe can flood your home, destroying ceilings, floors, walls, furniture, artwork and family photos. If your heater runs on flammable gas and the gas line breaks, the situation becomes far more serious.

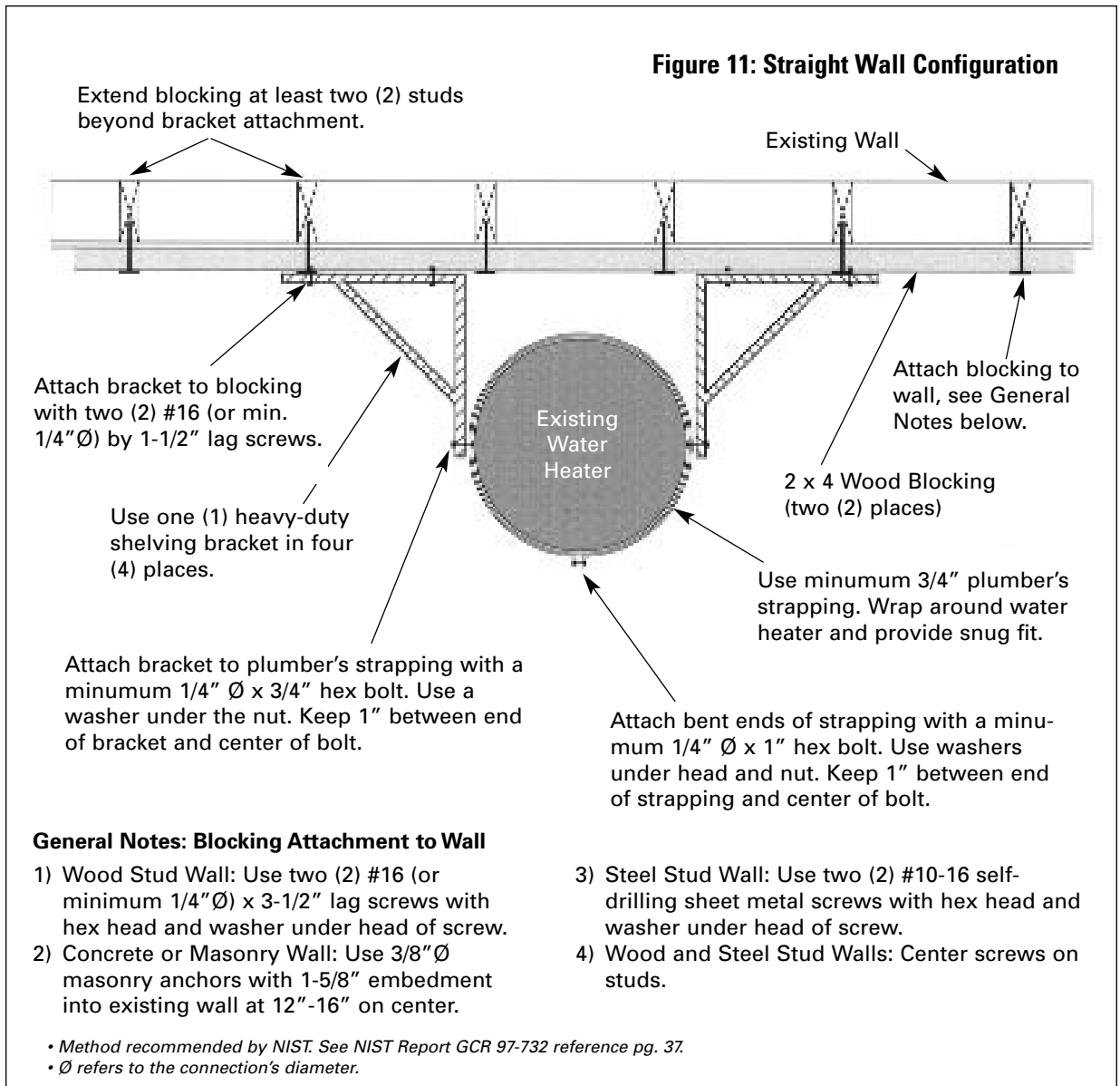
In many areas of the country where earthquakes are common, local building codes may require that water heaters be laterally braced or strapped to resist seismic forces. Most hardware stores sell retrofit kits for different-sized water heaters. In addition, several generic restraint systems are available. **Before you decide on a retrofit method, check with your local building department and make sure that it is approved for use in your area or goes beyond what is required by your local building code.**

Figure 10: Retrofitted Water Heater





**Figure 11: Straight Wall Configuration**

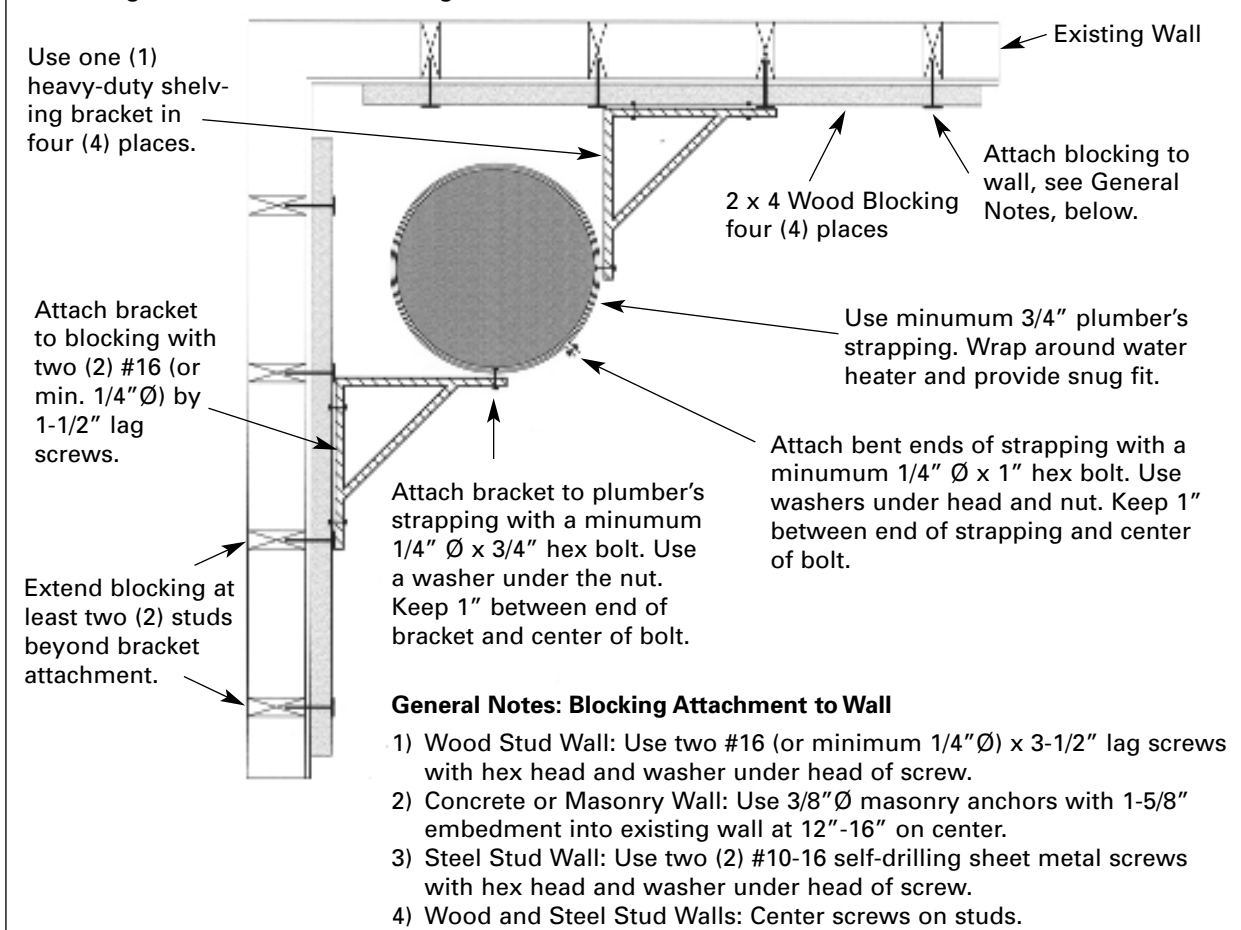


➤ Secure water heaters (up to 50 gallons) to stud walls using the simple, generic method detailed in **Figures 10 through 12**.

- You can anchor the water heater using items that are readily available from the local hardware store.
- To begin: fasten two 2 x 4 wood blocking strips to the nearby wall - one at a

height within the upper one-third (1/3) of the water heater and the other within the lower one-third (1/3) of the water heater. The lower 2 x 4 should be at least four (4) inches above the water heater control. If you are working with a wood or metal stud wall, attach the blocking directly to the studs. Use a stud locator to find the studs.

**Figure 12: Corner Wall Configuration**



**General Notes: Blocking Attachment to Wall**

- 1) Wood Stud Wall: Use two #16 (or minimum 1/4"Ø) x 3-1/2" lag screws with hex head and washer under head of screw.
- 2) Concrete or Masonry Wall: Use 3/8"Ø masonry anchors with 1-5/8" embedment into existing wall at 12"-16" on center.
- 3) Steel Stud Wall: Use two (2) #10-16 self-drilling sheet metal screws with hex head and washer under head of screw.
- 4) Wood and Steel Stud Walls: Center screws on studs.

• Method recommended by NIST. See NIST Report GCR 97-732 reference pg. 37.  
 • Ø refers to the connection's diameter.

**Necessary Tools and Materials**

- 2 x 4s
- Stud locator
- Screwdriver
- Hammer drill & bits (stone & masonry walls)
- Variable speed drill & bits (wood & metal stud walls)
- Various fasteners
- Heavy-duty shelving brackets
- Plumber's strapping
- Flexible connector

- Fasten heavy-duty shelving brackets to the wood blocking. These brackets should fit snugly against the water heater.
- Wrap plumber's strapping (metal strapping with holes) around the heater and secure it to the brackets.
- Remember: Use flexible, not rigid, water and gas connectors and check with local building code officials to see if you must hire a licensed plumber to modify the connections.
- Make certain all adult and teenage family members know where to locate the gas shut-off valve and how to operate it.

## structural retrofits

**W**hen an earthquake strikes, your home's structure is put to the test. The skeleton must absorb the earthquake's energy and provide a stable path to transfer the forces back into the ground. For this to happen, your home's structure must be *tied together*; that is, your home's roof should be tightly attached to the walls, and your walls should be fastened to each other, braced and anchored to a strong foundation. **Figure 13** on page 20 shows how the components of a home can be secured to each other, so that they function as a single unit during an earthquake.

**Keep in mind that the purpose of this section is to help you identify key areas of your home's structure that are**

**susceptible to earthquake damage. If you are uncertain about what you see, or if you decide to have work done, enlist the help of a professional architect, engineer, building contractor or your local building department.**

Remember that an ideal time to inspect and retrofit your home's structure is when you are making a significant change to your home such as adding on a room or remodeling. In either case, it is important that your work conforms to local building code requirements. Although the existing portion of your home may not need to be upgraded to current code requirements, now may be a good time to do so. Contact your local building code official to find out what is required for your project.

Cripple wall  
foundation failure,  
Northridge, Calif.



J. Prelli



## Foundation Systems

Earthquakes can create ground motion in any direction. During a quake, your home's foundation moves with the earth, but the rest of your home reacts more slowly due to its inertia. See **Figure 4** on page 5. 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 home 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.

### SLAB-ON-GRADE FOUNDATIONS

*Slab-on-grade* foundations are just that: concrete slabs that rest on the ground. In an earthquake-prone area, a home's wood-frame structure should be connected to the slab with either *anchor bolts* or other *steel connectors* (including steel plates). **Figure 14** on page 22 illustrates both types of connections.

If your home has anchor bolts, it can be difficult to conduct a thorough inspection, since you must get access to the top of the *sill plate*. This almost always requires that you remove an inside or outside finished wall, so consider doing this when remodeling your house. Your inspection should reveal minimum 1/2-inch-diameter anchor bolts with washers and tightened nuts connecting the sill plate to the foundation. These bolts should be spaced no more than six feet apart. Make sure that the bolts are in good condition and show no rust and that the nuts are tight. The concrete surrounding the bolt should be strong and free of any severe cracks (wider than the edge of a dime).



L. Brewer, USGS



Steinbrugge Collection  
EERC, UCB

Top: Separation of porch from rest of house due to unanchored foundation, Petrolia, Calif.

Bottom: Home has shifted off its unanchored slab-on-grade foundation, Coalinga, Calif.

Steel plates connect the home's sill plate to the foundation. Carefully inspect the plates along the outside perimeter of the structure. This may require removing the exterior cladding. Both the plates and fasteners should be in good condition. Keep an eye out for rust or signs of poor workmanship. The plates should be no more than six feet apart. Next, take a close look at the foundation. Are there severe cracks (wider than the edge of a dime) in the concrete? There shouldn't be.

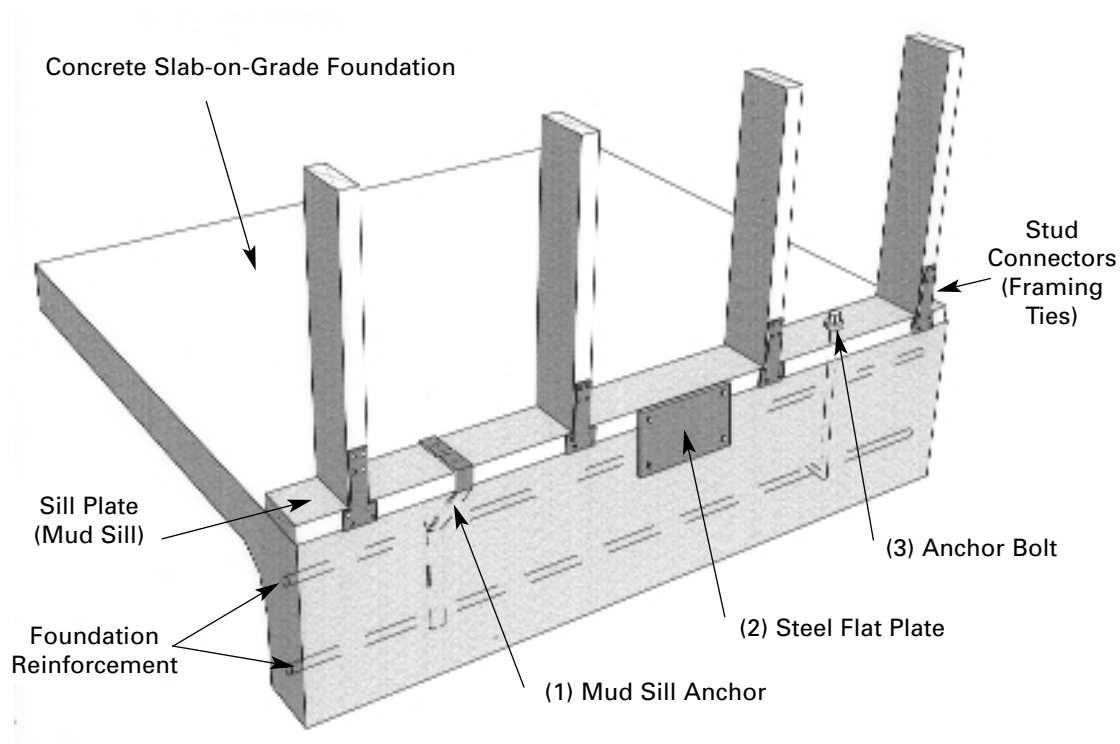
If the foundation is in poor condition or you must add additional anchorage, ask a professional engineer for help.



*J. Preli*

**Cripple wall foundation failure and utility damage, Northridge, Calif.**

**Figure 14: Concrete Slab-on-Grade Foundation**



**Note:** Three different methods of hold-down are presented here. However, only one system is usually required.

**CRAWL SPACE AND BASEMENT FOUNDATIONS**

A foundation with a *crawl space* or *basement* typically has enough room underneath the first floor so that you can inspect the foundation and the underside of the floor-framing members, or *joists*, as long as the space is unfinished. The main difference between a crawl space and a full basement is the amount of headroom available.

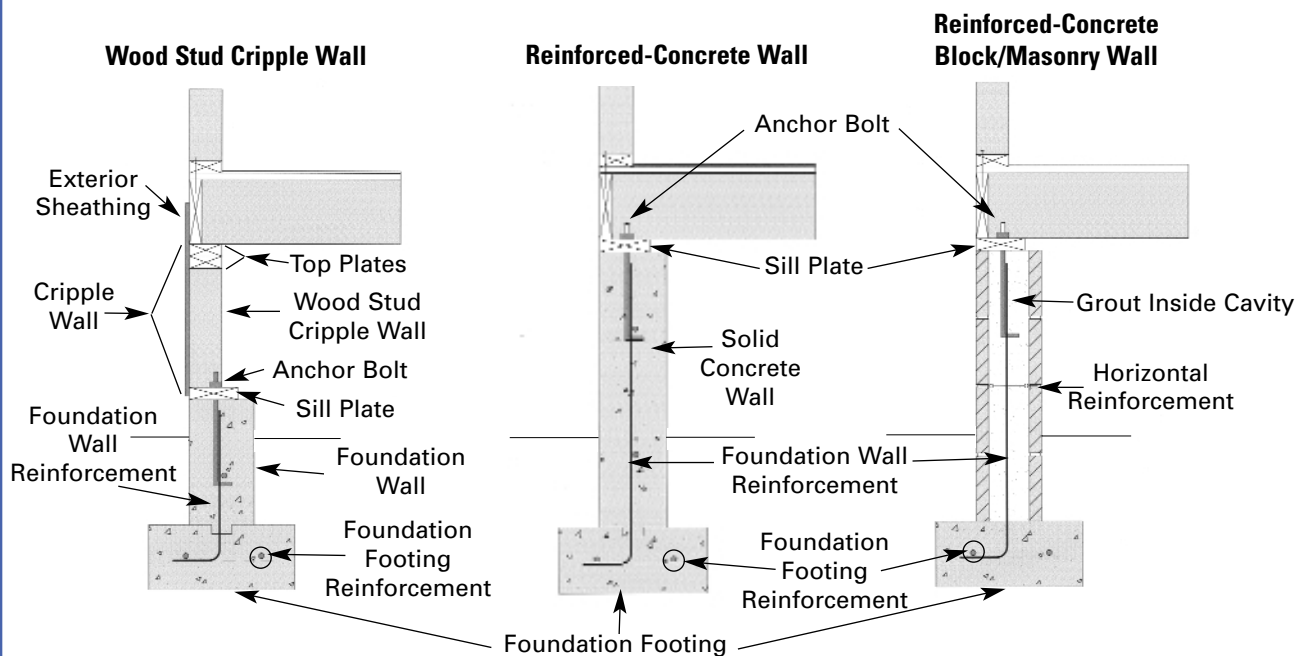
The walls that rise from the foundation footings to the first floor are called *foundation walls*. They are typically made with masonry blocks or concrete. In some cases, a short wood stud wall, or *cripple wall*, is positioned above ground between the top of the concrete or masonry foundation wall and the first floor. Cross sections of the three basic types of wall systems are highlighted in **Figure 15**.



R. Shackelford, R. Chapman

Cripple wall foundation failure, Northridge, Calif.

**Figure 15: Three Types of Foundation Walls**



## Connections

➤ Steel plates or minimum 1/2-inch-diameter anchor bolts should connect the wood-framing sill plate to the concrete or masonry wall. These connections should be spaced no more than six feet apart. All components should be undamaged and rust-free. Also, examine the overall condition of the foundation wall. Make sure you don't see any severe cracks (wider than the edge of a dime) in the masonry or concrete. If a wood cripple wall is present, it should show no evidence of termites or rot.

➤ If the foundation wall needs repair, or you need to add additional anchorage, check with a professional engineer for a suitable retrofit method.

## Bracing

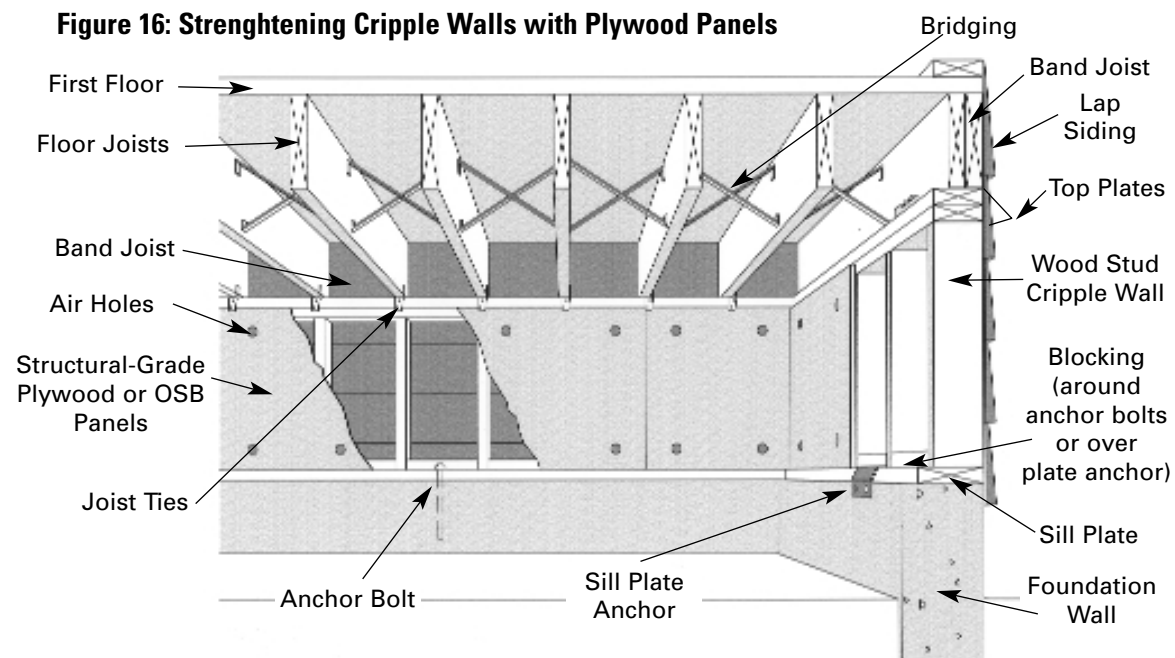
➤ For cripple walls, exterior lap siding alone cannot adequately resist the earthquake's lateral forces. You may need to add interior bracing, if it is not already there, to

prevent the cripple wall from collapsing in an earthquake:

- Nail 3/8-inch minimum structural-grade plywood or oriented strand board (OSB) sheathing to the inside of the wall. Ideally, the entire wall length should be covered. However, if you have limited access, place sheathing in each corner of your home. While the sheathing panels can be oriented in any direction, take care to ensure that each edge is supported by a stud or solid blocking.<sup>2</sup> **Figure 16** illustrates this method. If you have any questions about bracing weak cripple walls, contact a professional engineer.

➤ Adequately reinforced concrete foundation walls do not typically require additional bracing. Masonry foundation walls, however, may benefit from an upgrade. Because of the difficulty in evaluating masonry walls, consult a professional engineer.

<sup>2</sup> For design details, see APA's *Earthquake Safeguards*, referenced on pg. 37.





### POST-AND-PIER FOUNDATIONS

A home can also be supported by a *post-and-pier* foundation (**Figure 17**). Large *beams* run under the home's floor *joists* and are held up by *posts*. Each post rests on a separate concrete footing or *pier*. Some post-and-pier foundations are hidden from view by a cripple wall that runs around the home's outside perimeter. This type of foundation is very susceptible to collapse during an earthquake. To better resist seismic forces, all of the foundation's components, including the beams, posts and piers, must be securely tied together.

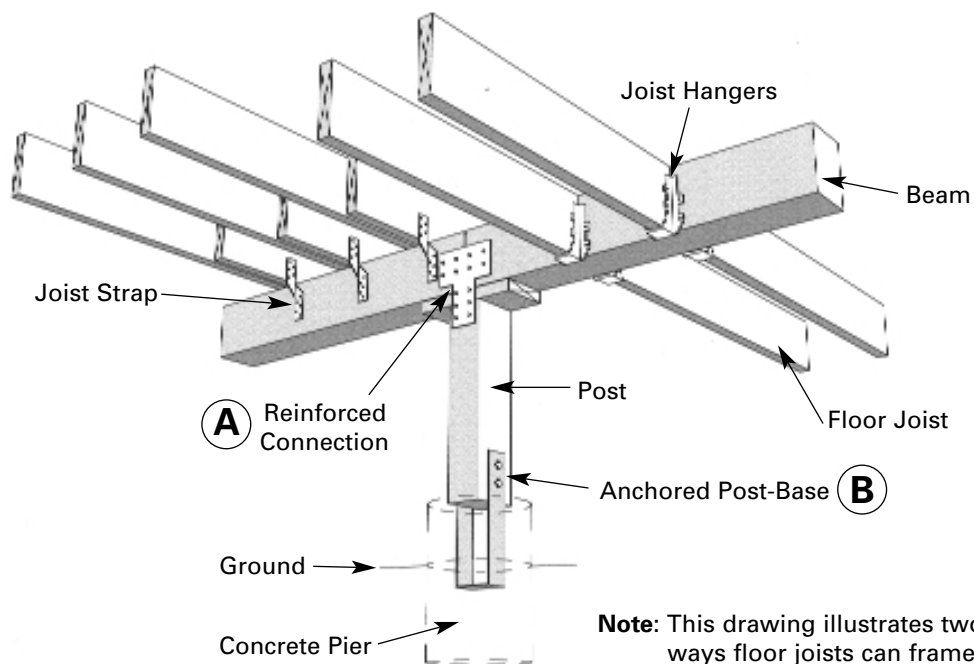
When inspecting the foundation for possible problems, carefully examine the way the components are anchored together. The connection between the beam and the post should be strong and without rust, rot or evidence of poor workmanship. One way to help your home better withstand an



L. Brewer, USGS

Post-and-pier with cripple wall foundation failure, Ferndale, Calif.

**Figure 17: Post-and-Pier Foundation**





*Steinbrugge Collection, EERC, UCB*

**Failure of wood frame dwelling. A post-and-pier foundation with a cripple wall, Kern County, Calif.**

earthquake is to have the connection reinforced with steel plates or with plywood or OSB connectors. Pre-manufactured metal straps or fixtures are available at most hardware stores (“A” in **Figure 17**). This reinforcement is especially important if the joint in the beam falls on top of the post.

The other critical joint in this foundation lies between the post and the pier. Examine this area carefully. The post should be securely fastened to the pier, and all components should be well constructed, free of rust, severe cracks (anything wider than the edge of a dime) and rot. Most new construction will have the post attached to the block with a built-in metal fixture (“B” in **Figure 17**). In older construction, the post may simply rest on the top of the block. Reinforce the connection by nailing heavy-gauge straps onto at least two sides of the post and then bolting them into the concrete block.



*EERI, S. Swan EQE Inter.*

**Post-and-Pier Foundation; undamaged (top) and damaged (bottom), Costa Rica.**

Keep in mind that strong connections between the various components may not be enough - the earthquake’s movement may still knock the home off its foundation. That is why extra connections and lateral bracing may be necessary. If your home has an exterior cripple wall, bracing and anchoring it further can provide the necessary protection. Refer to the previous discussion on cripple wall foundations for inspection and retrofit techniques.

If your home does not have an exterior cripple wall, lateral bracing and strong connections between the posts are critical. Simple toe nailing is not sufficient. Since the seismic evaluation of post-and-pier foundations is complex, you should consult a professional engineer.

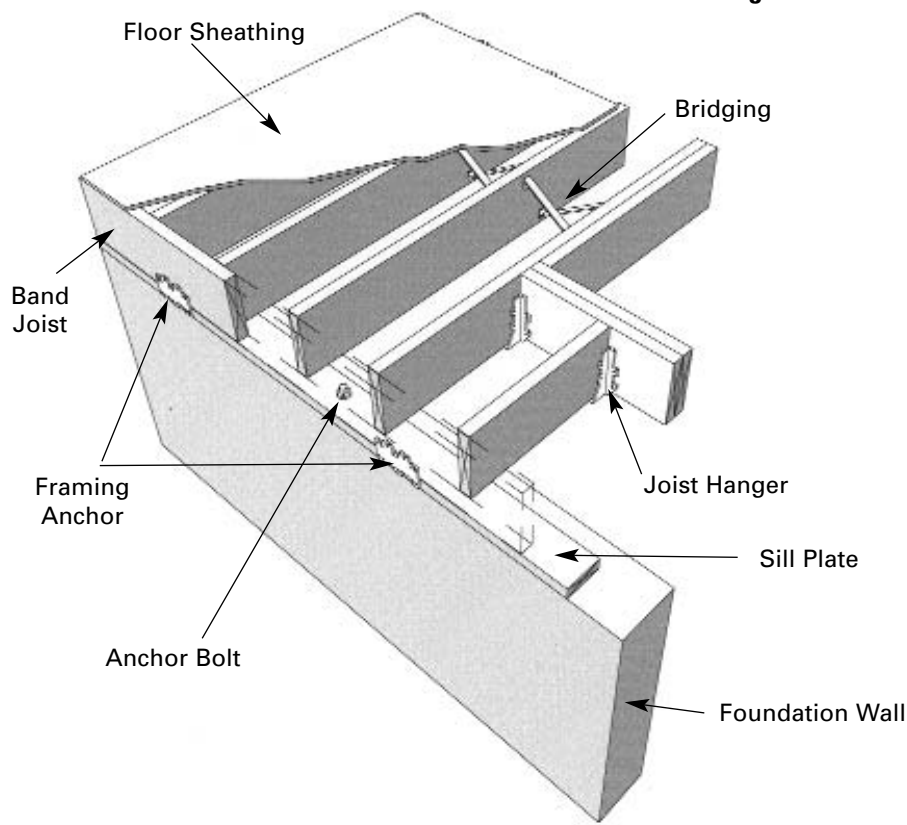
## Floor Systems

An earthquake exposes the floor to substantial forces that can distort and damage the floor system, jeopardizing the strength of your home. The floor system typically consists of *floor joists*, *floor sheathing* and *band joists*, which are located along the floor's perimeter (Figure 18).

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.



**Figure 18: The Floor System**



Steinbrugge Collection, EERC, UCB

Above: Failure of a wood stud wall to sill plate connection. Note anchor bolt and sill plate are still connected, San Fernando, Calif. Below, right: Failure of a unreinforced brick-veneer wall, San Fernando, Calif.

## Wall Systems

During an earthquake, the walls in your home, especially the exterior walls, play an important role in preventing your home 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 home from moving too far. To do their job, your walls must be strong and securely tied to the roof, floor and foundation.

### WOOD-FRAMED WALLS

Traditionally, the exterior walls of wood-frame houses are supported with wood studs attached to structural-grade plywood, oriented strand board (OSB) or diagonal wood

sheathing. To protect the exterior walls from the elements, they are covered with lap siding, stucco, stone or brick veneer. In order for this system to resist damage from earthquake forces, it must be well designed with the appropriate hardware in place to ensure a strong connection between all of the elements. See **Figure 13** on page 20 for details.

Also, consider the number, size and location of the windows and doors, including garage doors, in your home. Too many can weaken your walls and lead to possible collapse in an earthquake. Imagine a closed box with several openings: it will cave in much easier than one with no openings.

Unlike wood siding, brick and stone veneers require special attention because of their weight. During an earthquake, this heavy veneer can fall off, causing injury and significant damage. It is very important that these walls be *tied* to the wood-frames behind them with simple metal ties secured in the mortar. Sound building practices usually provide sufficient ties for the first story - even when not designed specifically for earthquakes. Special attention, however, may be required for the size and spacing of the ties in the upper stories.

Because it is difficult to access these areas, the best time to inspect is while you are remodeling or adding on to your home. If you have any concerns about your home's exterior walls, openings or veneer, contact a



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professional engineer. Ask him or her to determine how well your walls can withstand an earthquake and to recommend necessary retrofit measures.

### UNREINFORCED MASONRY WALLS

If your home's walls are made entirely of brick, stone, clay tile, concrete block or adobe, they could be susceptible to earthquake damage. In newer masonry homes on the West Coast, these types of walls are often reinforced with steel bars grouted inside the walls. If the walls are reinforced and well anchored to the foundations, floors and roofs, they can usually withstand an earthquake. But masonry that is in poor condition, unreinforced or not securely tied to the rest of the structure, has the potential to collapse. **Figure 19** highlights the differences between reinforced and unreinforced concrete block masonry walls.

A proper retrofit generally requires anchorage designed specifically for earthquakes.

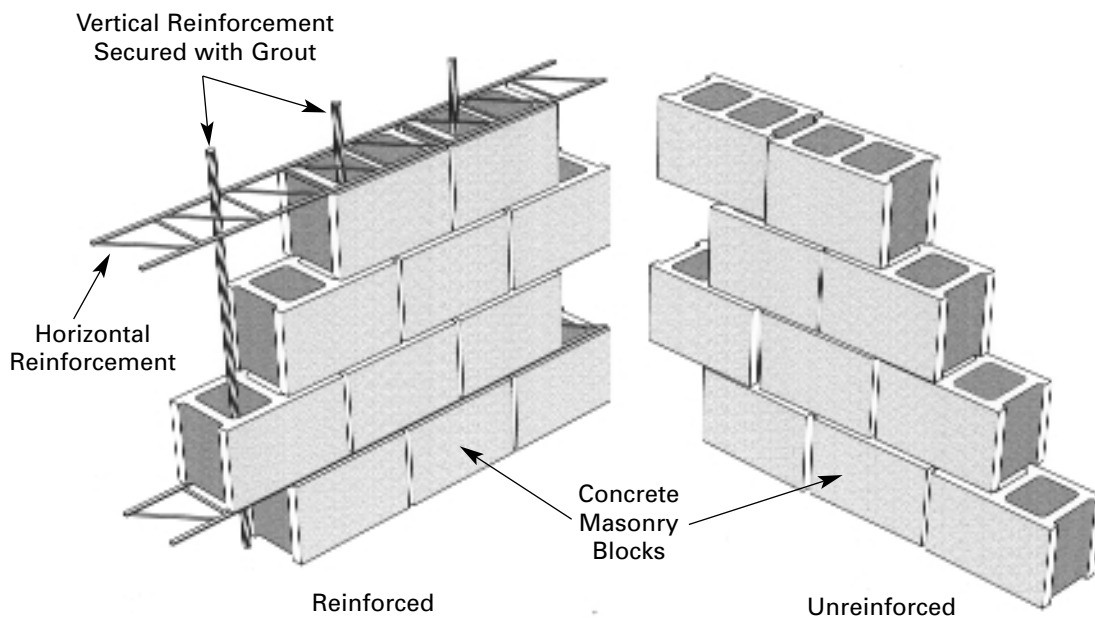


USGS, M. Hopper

Second floor wall failure in an unreinforced masonry home. Note the apparently undamaged two-story wood frame building on right, Coalinga, Calif.

Since evaluating structural masonry walls for general soundness and specific seismic features is quite complex, it would be best to consult a professional engineer.

**Figure 19: Reinforced vs. Unreinforced Masonry Walls**



## Roof Systems

For your home 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 home from coming apart at the seams. The typical roof system includes a *roof covering*, *roof sheathing* and supporting *roof frame* (Figure 20).

Start by inspecting your roof covering - it should be in good condition with no evidence of excessive wear and tear. Non-structural lightweight coverings, such as wood or asphalt shingles, usually behave well during an earthquake. Tile and slate coverings, which are heavy, tend to tax

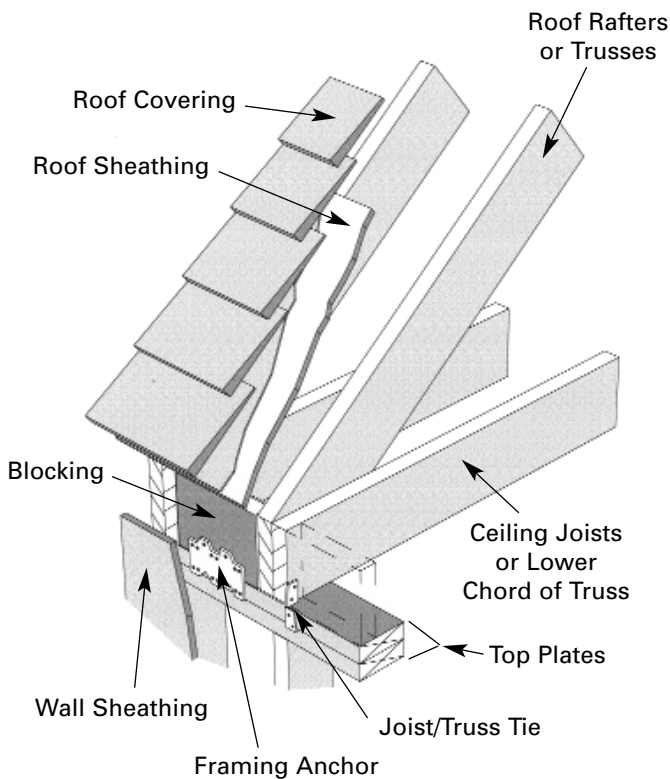


Goddard Collection, EERC, UCB



Steinbrugge Collection, EERC, UCB

**Figure 20: The Roof System**



Top: Collapsed heavy tile roof supported on unreinforced brick masonry, San Fernando, Calif.  
 Bottom: Roof to wall failure on an industrial building, San Fernando, Calif.

your entire earthquake-resisting system and are also susceptible to sliding or falling off the roof during an earthquake.

Next, consider what lies under the roof covering - the roof sheathing. Both plywood and OSB roof sheathing give strength to the roof regardless of the roof style. Roofs fully sheathed with structural-grade plywood or OSB tend to provide the greatest stability to the overall structure.

Board sheathing is not as earthquake resistant as plywood and OSB sheathing, but may be adequate in smaller homes. Consult a professional engineer for more specific information. Also, keep in mind that large *dormers*, skylight openings and any other features that interrupt the sheathing can weaken your roof structure.

Remember: sheathing can only do so much. You must also consider the roof system's framing - the *trusses* or *rafters* that support the roof covering and sheathing. Similar to floor systems, roof-framing systems can rotate or fall over when your home starts to move in an earthquake. To prevent this, *blocking* can be placed between the rafters or trusses where they rest on the wall. See **Figure 20**. Be sure to nail the blocking to the roof sheathing in order to transfer the lateral loads into the wall. Metal strap connectors or properly placed toe-nailing ensure that the blocking is adequately connected to the wall and rafters.

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 home. 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 home.



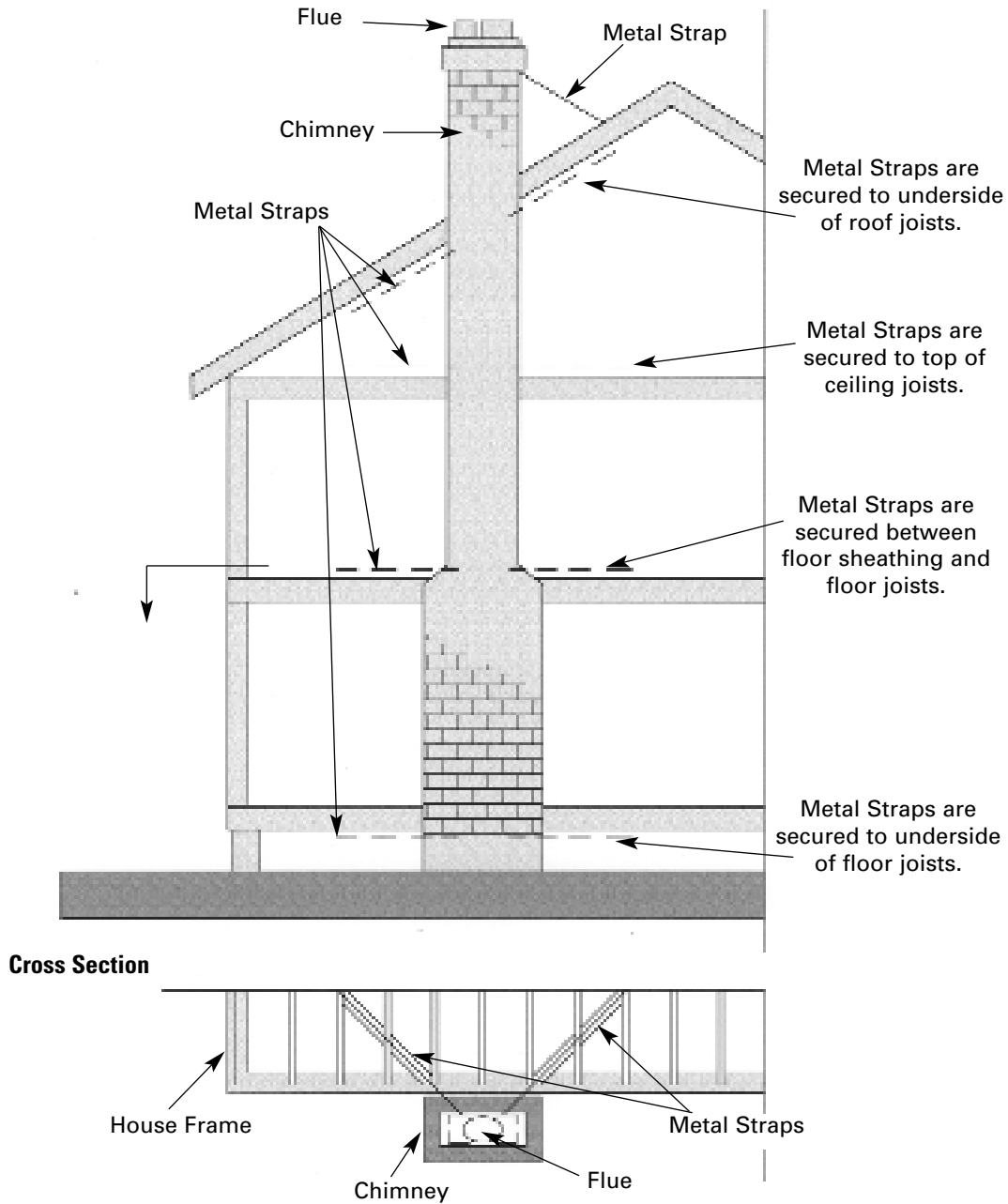
Steinbrugge Collection, EERC, UCB

Chimney damage, San Fernando, Calif.

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 home. 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 home (**Figure 21**).

**Figure 21: How to Reinforce a Chimney**



**Note:** (1) Wood blocking should be added to joists underneath metal straps.  
(2) See FEMA-232 for specific details, referenced on pg. 37.



## Garages

Garages are particularly vulnerable to earthquake damage. The situation becomes especially serious if the garage has a portion of the home 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 home.

## Room Additions

If you've put on an addition or made other modifications in the past, you may have unknowingly weakened your home's earthquake resistance. Sometimes, homes that were originally very simple and structurally sound undergo changes that make them bigger or fancier, but also more prone to earthquake damage.

If you are planning to make major changes to the structure of your house, or if you suspect existing features lack good engineering details, consult a professional engineer.

*Steinbrugge Collection, EERC, UCB*



*U.S. Geological Survey  
(D. Perkins)*

Top: Two stories now crushed to one story due to weak lower level (note crushed auto), San Fernando, Calif. Bottom: Damage due to inadequate lateral bracing on the ground level, San Francisco, Calif.

### STRUCTURAL CHANGES THAT INCREASE THE RISK OF EARTHQUAKE DAMAGE INCLUDE:

- replacing large portions of walls with windows or glass doors;
- adding large skylights or additional stories;
- opening large portions of existing floors; or
- additions that create an "L" configuration.

# home improvement project list

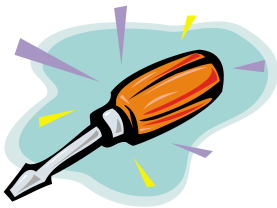
This list of home improvements divides the different retrofits into cost categories. The categories reflect the cost of each individual item. The cost will be slightly higher if you hire someone

to complete the work. You or your contractor can tackle these projects one at a time, but remember, the more you do the stronger your home becomes.



## Category \$ (<\$300)

- Fasten bookcases and cabinets to nearby walls;
- Install latches on cabinet doors and drawers;
- Secure electronic equipment, artwork and other breakable items to the tops of bookcases and cabinets;
- Anchor large appliances to nearby walls;
- Secure pictures and bulletin boards to walls;
- Attach safety cables to light fixtures, suspended ceilings and other hanging items;
- Apply safety film to windows and doors;
- Secure water heater to nearby wall.



## Category \$\$ (\$300-\$1000)

- Reinforce cripple wall;
- Strengthen narrow walls on either side of garage opening;
- Anchor unreinforced chimneys.



## Category \$\$\$ (>\$1000)

- Add anchor bolts or steel plates to foundation;
- Secure post-and-pier foundation;
- Modify floor system;
- Strengthen wood-framed walls;
- Reinforce masonry walls;
- Retrofit roof system;
- Evaluate unique room additions.

## **The ABCs of Post-Earthquake Evacuation**

### *A Checklist for School Administrators and Faculty*

---

**"If I had needed to evacuate students, I don't know where I would have taken them. The campus was a mess: trees down, glass, stuff fell off the buildings and was lying all around, water mains were leaking and making geysers in the play field." -Principal, Northridge, 1994**

---

**A. Evacuation should NEVER be automatic.**

- There may be more danger outside your building or facility than there is inside.
- There may be no safe assembly area outside. There may be no clear routes to get outside, and alternate routes may need to be cleared.
- The lighting inside your building or room will probably be out--it may be DARK
- Before any decision is made to vacate all or part of a school, someone must find out that there IS 1) a safe route out, and 2) a safe place to assemble the students outside.

**B. BEFORE an earthquake (NOW), survey your school with evacuation in mind.**

1. Look for potential post-earthquake hazards **INSIDE** the building:

- Suspended ceilings
- Pendant light fixtures
- Large windows--either exterior or interior--not protected against shattering
- Tall bookcases or cabinets that may topple because they are not bolted to the wall
- Classroom equipment such as computers, TVs, VCRs, stereos, and slide projectors
- Stairwells
- Science labs, especially chemistry
- Storage areas for cleaning, painting, or other hazardous materials
- Shop areas
- Places where the main gas supply or electric current enters the building

- Designate evacuation routes that avoid as many of those areas as possible.
- In addition, decide on alternate routes to your main routes.
- Consider students with disabilities as you think about your evacuation routes.
- Make sure staff knows what to do and where to go if the students are already outside the facility when the earthquake happens.

2. Look for potential post-earthquake hazards **OUTSIDE** the building:

- Power lines
- Trees
- Areas near buildings that may have debris fall on them--parapets, roof tiles, chimneys, glass
- Routes past concrete block walls
- Covered walkways
- Places under which large gas mains run
- Areas near chain link fences (which can be electric shock hazard if touched by live wires)
- Hazardous materials storage areas

- Designate open areas outside that are without overhead hazards and removed from potential danger spots; choose one, off-campus spot such as a park for back-up.
- Assembly areas should be as close to the facility as is safe so that students and staff have easy access to bathrooms, phones, and the student release point.
- Designate who will have the responsibility to assess conditions after a quake and report findings to administration and co-workers.

---

**"After the shaking stopped, I just wanted to get those kids out of there as fast as I could, but luckily I looked**

**out the door first--trees, bricks and wires all over. It's a good thing we didn't leave the building."**  
*-Daycare program teacher, Santa Cruz, 1989*

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3. Everyone should be informed about evacuation plans:

- Once routes and assembly areas have been chosen, make floor plans and maps and distribute to all staff.
- Inform all personnel and students about the plans made and the routes chosen.
- Have all substitute teachers review the plan before starting each class.
- Make it clear that a post-earthquake evacuation route differs from a fire evacuation route, and that alternate routes may need to be used
- Include all students and staff with disabilities in the drills and exercises
- Hold drills and exercises **two or three times a year**; practice alternate routes.
- Evaluate your drills and exercises and make changes as necessary.

C. **AFTER** the earthquake, gather information and make decisions.

**ADMINISTRATORS:**

1. Assess the situation--inside and outside
2. Decide whether to evacuate all or parts of buildings.
3. Choose the route(s) and the assembly place
4. Communicate directions to all teachers

**FACULTY:**

**Do NOT automatically rush your class out into the corridor or outside the building.**

1. Wait to hear instructions from an administrator, or the designated scout.

**In circumstances in which you wait a long time without hearing anything, you will have to make decisions yourself:**

2. If you are in an unsafe classroom--the ceiling has collapsed, wires are crackling, broken glass or chemicals are all over the floor, you smell gas or smoke--you will want to leave, BUT you must inspect for damage before you move to safety.
3. Have another teacher watch your students while you find the best way to evacuate and the safest place to go . You may not need to go outside to the assembly area, but merely move from one inside room to another.
4. Account for all your students before you leave the classroom.

**If the classroom damage forces your class to evacuate, take injured students with you ONLY if moving them will not cause further injury. If you must leave an injured student, try to protect the student from items that might fall during aftershocks. Post a large, visible sign indicating the student is there.**

**The lights will probably be out and it may be dark--ALWAYS have a flashlight that works.**

5. Be alert, as you lead students down stairwells or corridors to anything (dangling lights and ceiling struts, broken glass, slippery floors) that could hurt them or you.

**In an aftershock, everyone should duck and cover until the shaking stops.**

6. Once you get to a safe location, communicate your location to the administrator by whatever methods have been specified in your plan--sending a runner, using a walkie-talkie, or returning to your classroom to post a note.

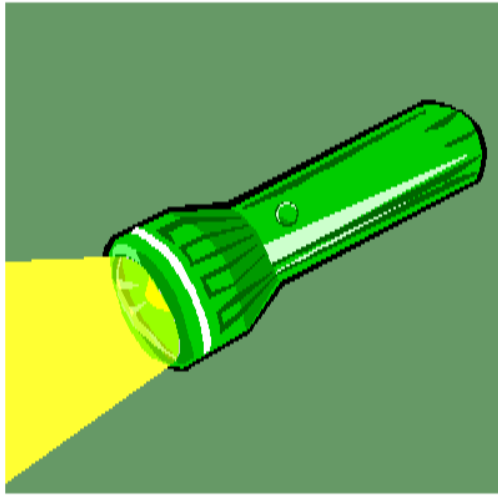
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**"We waited to see what the teacher did after the earthquake, but he didn't know what to do. He kept saying, 'Don't worry don't worry, stay calm stay calm,' but it was scary"**  
*-Student, After-school program, Loma Prieta, 1989*

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# EMERGENCY LIGHTING:

DON'T use matches, candles, or oil lamps, especially right after the quake. Aftershocks are coming and they could cause candles or oil lamps to fall, causing fires. Immediately after an earthquake there is the danger of natural gas or propane leaks and any source of flame could cause an explosion.



- Flashlight or battery-operated lantern for the home (plus EXTRA batteries and ROTATE them)
- Flashlight/penlight for personal use
- Power failure lights (the type left plugged into the wall)
- Chemical light sticks (very SAFE light source)
- Gas/propane lanterns (plus MANTLES, MATCHES, FUEL) protect these lamps from falling or being knocked over during aftershocks.
- Portable electric generator (plus FUEL). Remember, light requires little energy from a generator. A 200-watt light bulb will light a camp well enough to read by. Creating heat or cold require large amounts of electricity. Your hair dryer probably requires 1500 watts of output to

run. So purchase your generator with sufficient power for your needs. Or plan your appliances according to your generator's output.

## COOKING AFTER THE EARTHQUAKE:

Cold food for more than a few meals is unappealing. You need to try and eat as normally as possible after the disaster. This is for your physical as well as your mental health. Basically, you'll be on a camp-out for three or more days.

- Camp stove (Have plenty of propane or white gas)
- Backpacking stove
- FIREPLACE should not be used after an earthquake, until it has had a video inspection by a chimney specialist. Unseen damage may cause an attic fire or allow carbon monoxide into dwelling.
- Barbecue (Charcoal and starter fluid)
- Sterno (type) stove
- Cooking utensils
  - Pots
  - Pans
  - Cups & glasses
  - Forks and knives and spoons
- MANUAL CAN OPENER. To open all your cans of stored food.
- IMPORTANT SAFETY NOTICE:** Don't use any of these stoves indoors. Carbon monoxide poisoning can occur.



# HOW TO SHUT OFF UTILITIES

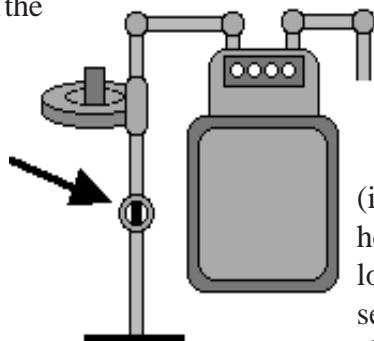
## GAS SHUT-OFF

Locate main gas shut-off (usually outside house) at the gas meter. The valve is usually on a pipe coming out of the ground, going into the gas meter. Turn the valve crosswise to the pipe (see the large example on the "Utilities" page under "Before the Earthquake". All the pilot lights in and around your home (stove, furnace, clothes dryer, swimming pool/spa heater, water heater, etc.) will go out when you turn the valve off. You will need to have the gas company, or another qualified individual (plumber, contractor, or trained homeowner), relight every pilot when turning the gas back on. **Forgetting to relight all the pilot lights could result in a dangerous gas buildup in your home.** Remember, if you don't smell gas or have severe damage to your home you should not have to shut the gas off. It's your decision.

Clear the area around the main gas shut-off valve for quick and easy access in case of emergency.

A wrench (or specialty tool), for turning off the gas, should be attached to a pipe next to the shut-off valve or in another easily accessible location.

You may want to paint the shut-off valve with white or fluorescent paint so that it can be located easily in an emergency.



If you are concerned about your ability to turn off the main gas shut-off valve or are unsure if it is in proper working order (indication of rust, etc.) or do not know how to relight your pilot lights, contact your local gas company. They can send a service representative to your house to show you the proper procedure and check the valve and pilot lights to be sure they operate properly.

## AUTOMATIC GAS SHUT-OFF VALVES

Automatic gas shut-off valves are an excellent way to insure that your gas is shut off in the case of a major earthquake. They are recommended by the Fire Department. In many cities in California they are required to be installed when you sell your home or do more than a \$10,000 remodel. With an automatic valve your gas will be off even if you aren't home at the time. Contact your local gas company for more information and installation.

## ELECTRICAL SHUT-OFF

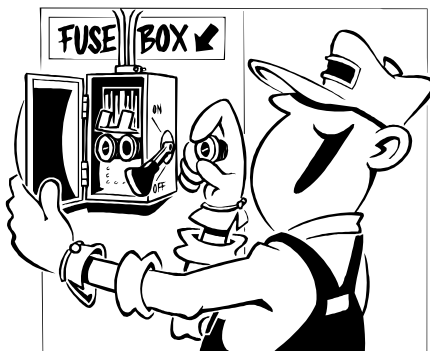
First locate all of your home's electrical panels. Note: There may be more than one.

Your house may be equipped with fuses or circuit breakers. If your house has fuses, you will find a knife switch handle or pullout fuse that should be marked "MAIN." If your house has circuit breakers, you may need to open the metal door of the breaker box to reveal the circuit breakers (never remove the metal cover). The main circuit breaker should be clearly marked showing on and off positions.

**Remove all the small fuses or turn off all the small breakers first, then shut off the "main."** If you have any sub-panels adjacent to the main fuse or breaker panel or in other parts of the house, in an emergency be safe and shut them off too.

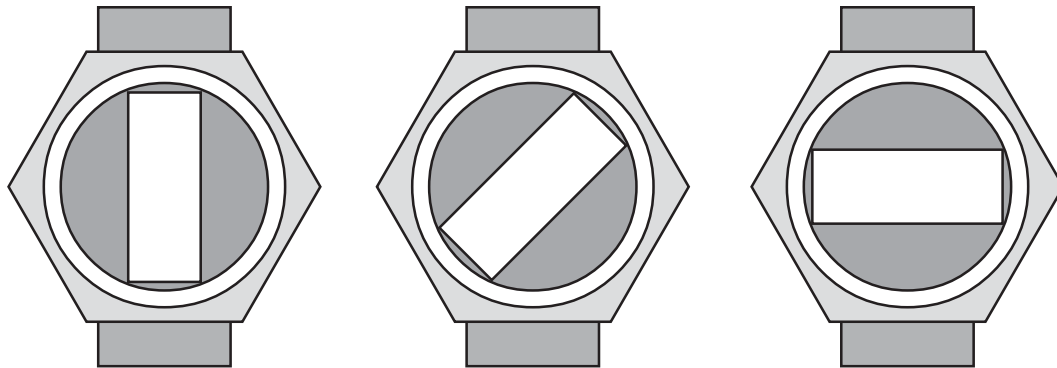
Shorts can sometimes develop that cause a circuit to bypass the breaker or fuse.

Note: All responsible family members should be shown how to turn off utilities in case of emergency. They need to know what the utilities look like in both on and off positions.



# UTILITIES

There is no cost involved in teaching everyone in your home about how & when to turn off the gas, electricity, and water after an earthquake. This can be as simple as clearly marking where the shut-off valves are, and posting instructions close by. Below are some common examples of shut-off valves. Even if you have something different, like a propane tank, the shut-off will be similar. If you cannot find the shut-off valves, or you do not understand the valve system, call your local utility company or tank provider. **Remember, consider shutting off utilities if you can smell gas, smell or see fire, or see damage to, from, or near the utility lines. It is wise to shut off utilities if you are going to leave the home for extended periods of time. This is because of the probability of aftershock.**



Gas ON

Test Gas Valve  
*TURN 1/8 TURN*

Gas OFF

## ***BEFORE AN EARTHQUAKE...***

- **TEST YOUR GAS VALVE:** Locate and identify your gas meter and main shut-off valve with those persons you believe could and should know how to shut off your gas if necessary. Identify the master shut-off valve. Paint the valve bright red. Note: Caution, there may be more than one shut-off on your meter.
- Use the illustrations of gas meter (pg. 18) and main shut-off valves (above) to help you identify yours.
- Using a 12" adjustable, or other appropriate wrench, turn the main valve 1/8 of a turn only to the right or left. *(This movement may be difficult at first)*
- **CAUTION:** Be careful, do not to turn any valve MORE than 1/8 turn to the right or left when testing. (If you do, pilot lights will very likely go out and it will require a trained person to relight them.)
- After you have moved that valve to ensure that it works, **KEEP THE WRENCH AT THE METER**, use plastic "zip ties" or straps to secure it to your meter.
- If you use an adjustable wrench be sure to store it pre-fit to your valve. That way in case it rusts or corrodes it will still fit. Heavy oil or grease applied to the moving parts of the wrench, before you secure it, will help keep it functional and ready for use. *Do not buy any plastic or fiberglass gas wrenches. They become brittle with time.*

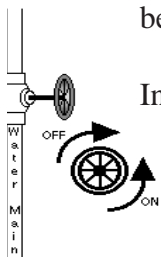
***IF THE MAIN VALVE WILL NOT TURN 1/8 TURN, THEN CALL THE GAS COMPANY IMMEDIATELY AND THEY WILL COME OUT AND FIX OR REPLACE IT***

# HOW TO SHUT OFF UTILITIES *CON'T.*

## WATER SHUT OFF

Locate the main water service pipe into your house (probably in the front at the basement level). You will see a gate valve on the pipe. If you know you have leaks after an earthquake, you can shut off all water in your house with this valve. You may wish to paint the valve so it is easy to find in an emergency.

You can shut off all water to your property by finding the water meter box (usually at the street or sidewalk). Open the cover with a long screwdriver or specialty tool. If this box is inaccessible or you cannot find it, call your local water department. Be sure to



identify this box and the water valve inside before the need to use them arises.

Inside the water meter box you will see a valve that is similar to the valve on your gas meter. Turn it just the same as your gas valve.

---

## AFTER THE EARTHQUAKE

### TURN OFF YOUR GAS AT THE GAS METER SHUT-OFF VALVE. . . .

- ✱ If you smell, hear, or even suspect gas is escaping in your damaged or undamaged building(s).
- ✱ If your gas water heater or any other gas appliance has been knocked over and/or pulled free from its wall connection.
- ✱ If your building has suffered extensive damage, such as large cracks in the walls or in the concrete slab floors, etc. AND you suspect the gas lines may have been damaged.
- ✱ If you smell smoke and/or see or suspect fire

**NOTE: If you have none of the above you are probably OK leaving your utilities on.**

**NOTE: Many gas companies have training programs to teach you how to turn your gas back on. Contact your local company for information.**

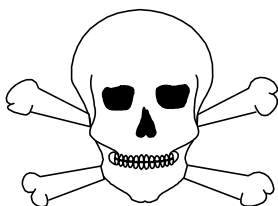
**WARNING . . .** If you smell gas don't turn on or off any switches. Don't use any open flame to check for leaks. Don't turn on any battery operated flashlights, unless they are a safety/waterproof light. Chemical light sticks are a safe source of light in the event of gas leak.

**WARNING . . .** It is very dangerous and therefore not recommended that you go searching for gas leaks inside any damaged building.

**BE AWARE:** After an earthquake, aftershocks will continue to occur, possibly causing additional damage (or even first damage) to your building(s).

**REMEMBER:** Do not turn the gas valve back on after an earthquake, unless a qualified person has checked extensively for gas leaks.

**REMEMBER:** A qualified person (plumber, contractor, or trained homeowner) or gas company employee will have to relight all the pilot lights.



**DANGER**





# EMERGENCY CONTACT CARDS

1. Call a friend or relative who lives outside the state and ask them to be your family's "out-of-state contact".
2. Explain to them that after a disaster they will be your surest means of communicating with other family members, both in and out of state. Make sure that they understand that it will be their responsibility to be available to take calls immediately following a disaster in your area.
3. Agree to do the same for your contact in case disaster should strike their state.

4. Notify all your friends and family members that this one person will be the person to contact if they need to get a message to you. Tell them not to call direct.

5. Completely fill in the contact card. It should be typed or printed in ink and then "plasticized" to protect it from wear and water.

6. Have each member of your family carry this card at all times. Xerox this page so that you can have spare cards in cars, lunch pails, taped to the bottom of your phone at work, etc.

7. Have family members in other areas or states agree on the same out-of-state contact for any family emergency. Plan for an alternate contact in case disaster strikes in the area where your emergency contact lives.

EMERGENCY OUT-OF-STATE CONTACT		
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	( )	
NAME	ALTERNATE CONTACT	PHONE
	( )	
ADDRESS		
CITY	STATE	ZIP

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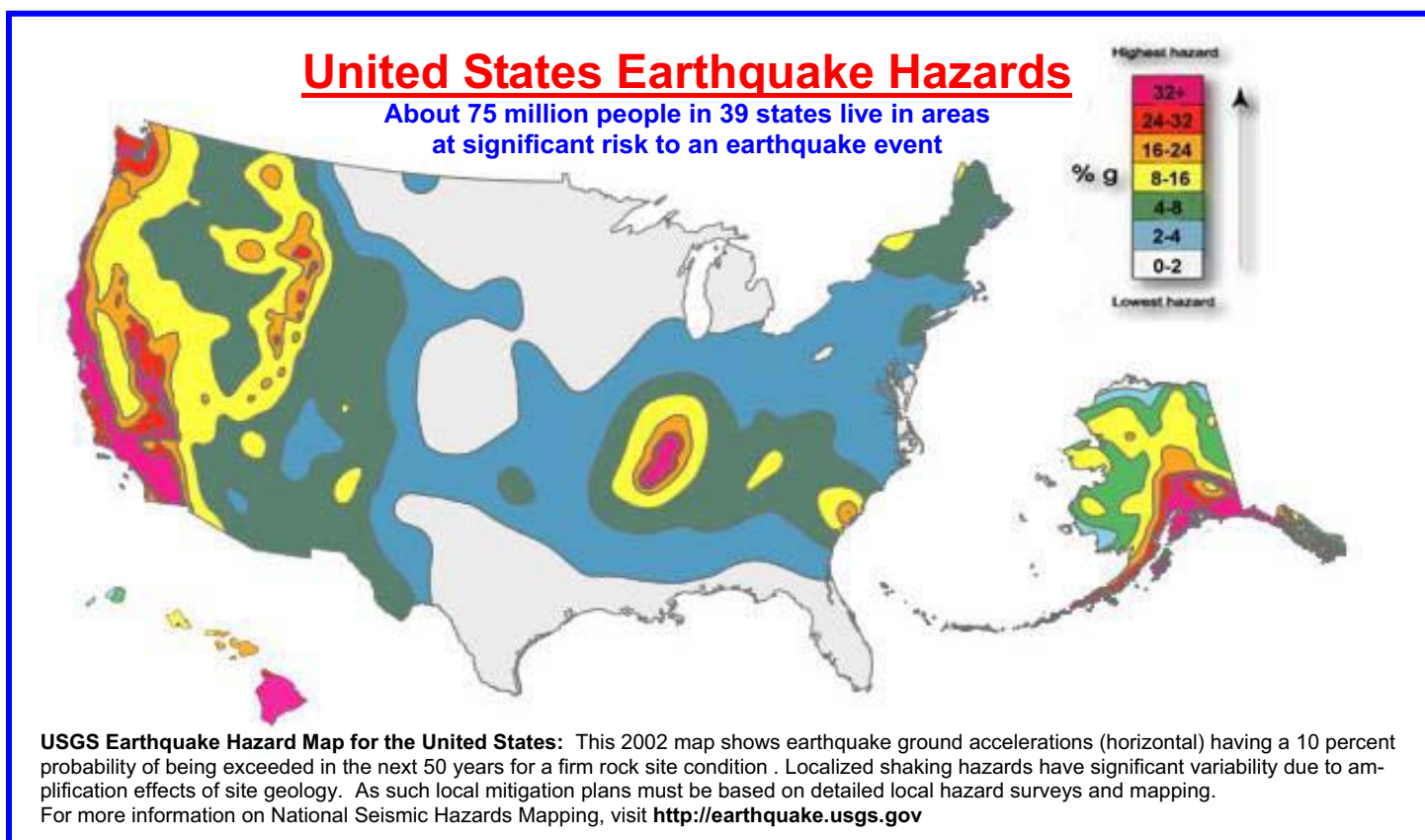
# Congressional Hazards Caucus Fact Sheet

# EARTHQUAKES

An **earthquake** is a sudden slip on a fault that is caused by stress buildup in the crust. It is most often caused by the tectonic movement of crustal plates but can also be precipitated by volcanic or magmatic activity. An earthquake releases energy in the form of seismic waves that can cause shaking and damage over large distances.

Earthquakes can cause significant loss of life and major economic damage. Events in Alaska, California and Hawaii that precipitated landslides, tsunamis and fires caused the highest casualties. The largest magnitude earthquakes in the contiguous U.S. occurred in New Madrid, Missouri in 1811 and 1812. Both coasts are susceptible to earthquakes. The 1886 Charleston earthquake caused 60 deaths and destroyed 90% of the homes. The 1994 Northridge earthquake caused 61 deaths and \$44 billion in damage with an additional \$30 billion in federal and private insurance losses, making it one of the costliest natural disasters in United States history.

The **Congressional Hazards Caucus** encourages all citizens and communities to be aware of earthquake hazards and take appropriate steps to reduce their vulnerability to earthquakes.



## What You Can Do To Prepare For An Earthquake

### BEFORE:

- Ensure that heavy household items like shelves and bookcases are secured properly.
- Identify safe places in each room and ensure that all household members know emergency plans.
- Have an emergency kit that includes first aid supplies, flashlight, radio, batteries, food, and water.

### DURING:

- If indoors, take cover under a piece of heavy furniture or against an inside wall and hold on.
- If outdoors, move into the open, away from buildings, street lights, and utility wires.
- If in a moving vehicle, stop quickly and stay in the vehicle until the shaking stops.

### AFTER:

- Once the shaking stops move to a safe and open area, avoiding damaged buildings and roadways.

The **Congressional Hazards Caucus** is co-chaired by Senators Ted Stevens (AK), Mary Landrieu (LA), Jim DeMint (SC), and Ben Nelson (NE) and Representatives Wayne Gilchrest (MD), Dennis Moore (KS), Jo Bonner (AL) and Zoe Lofgren (CA). The Caucus helps individuals, businesses, and communities better prepare for and mitigate the costs of disasters. The Caucus seeks to foster dialogue on steps that government and citizens can take to lessen the severity of these disasters. To learn more about the Caucus, go to [www.hazardscaucus.org](http://www.hazardscaucus.org).

## Protecting Yourself and Your Community

**MAKE A PLAN:** Making a plan of how to reduce risk over time and what to do in the event of an earthquake can make a tremendous difference.

**EDUCATION:** Take the time now to become aware of the earthquake risk to you and your community.

**ZONING AND LAND-USE:** Your community can make sure that new buildings are not constructed on or near land that may be subject to liquefaction, landslides, faulting, or tsunamis.

**BUILDING CODES:** Building codes are one of the most powerful mitigation tools that can be adopted by a community in anticipation of a seismic event.

**RETROFITTING:** Before the next strong earthquake in your area, ensure that homes and buildings meet the recommended standards for earthquake safety.

**Earthquakes can cause more than just shaking. Communities must also prepare for:**

**Aftershocks** that follow the main shock and may cause additional damage

**Tsunamis** that can cause destruction to low-lying coastal areas.

**Fires** that are sparked by leaking natural gas or other flammable materials.

**Landslides** that are triggered by earthquakes or aftershocks.



### Learning From Past Failures

After the 1994 Northridge earthquake damaged the 188 Freeway (left), replacement columns with more vertical and wrapping rebar (right) were installed. Source: CalState Northridge



### The Trans-Alaska Oil Pipeline: Mitigation Works!

The pipeline survived the 2002 Denali earthquake because of careful engineering to meet stringent earthquake design specifications. Source: FEMA

## Earthquake Terms

**Aftershock:** Earthquakes that follow the main shock over a period of weeks, months, or years. The larger the main shock, the larger and more numerous the aftershocks.

**Epicenter:** The point on the surface vertically above the point in the crust where a seismic rupture begins.

**Liquefaction:** When water-saturated sediment loses strength and acts like a fluid because of earthquake shaking.

**Magnitude:** A number based on maximum recorded motion that characterizes the relative size of an earthquake.

## Resources

National Earthquake Hazards Reduction Program (NEHRP)

<http://www.fema.gov/hazards/earthquakes/nehpr/>

USGS Earthquake Hazards Program

<http://earthquake.usgs.gov/>

Federal Emergency Management Agency: Mitigation Division

<http://www.fema.gov/fimal/>

Earthquake Engineering Research Institute (EERI)

<http://www.eeri.org/>



1906 photograph courtesy of the EARTHQUAKE ENGINEERING RESEARCH CENTER of the UNIVERSITY OF CALIFORNIA BERKELEY.

