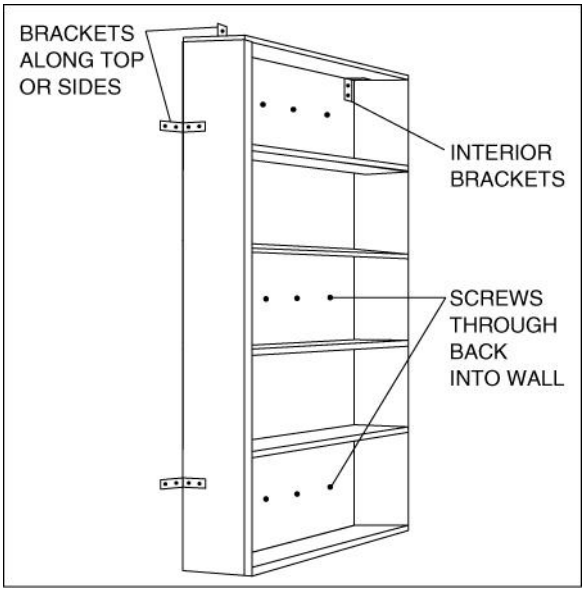
Anchor Tall Bookcases and File Cabinets

FEMA

PROTECTING YOUR PROPERTY FROM EARTHQUAKES

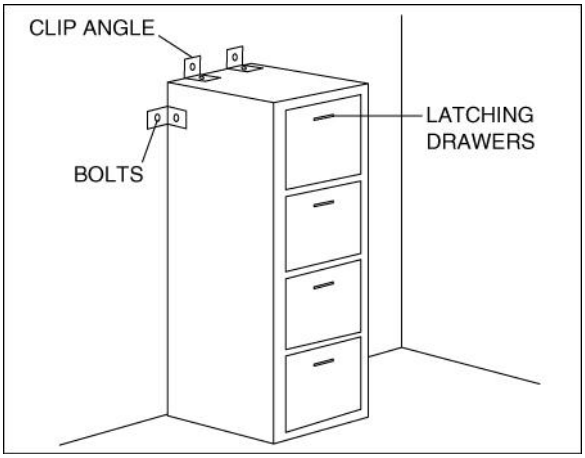
During an earthquake, large pieces of furniture such as tall bookcases and file cabinets can fall on you or others. Toppled furniture can also block exits and prevent you from escaping. Anchoring furniture so that it remains upright not only helps prevent injuries but also helps protect both the furniture and its contents.

You can anchor large pieces of furniture in several ways. The figure shows how to anchor a bookcase to a wall, but the same methods can be used for other pieces of furniture. As shown in the figure, a bookcase can be anchored with metal "L" brackets and screws along its top or sides (either inside or outside) or with screws through its back.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

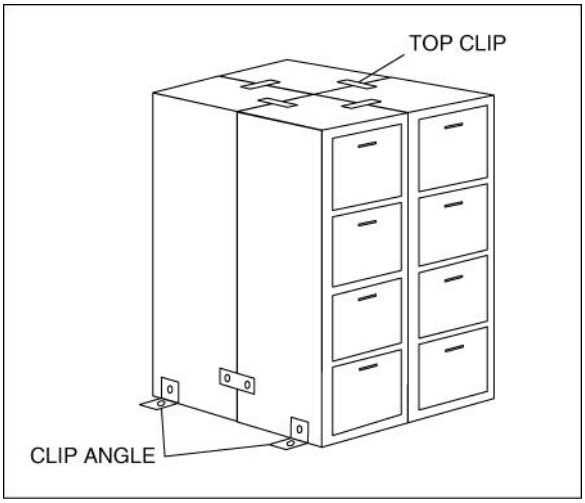
- Helps to prevent toppled furniture from falling on occupants
- Helps to prevent toppled furniture from blocking exits and preventing escape from a structure
- Helps to prevent damage to furniture and the contents of the book cases and cabinets



TIPS

Keep these points in mind when you anchor large pieces of furniture:

- ✓ Make sure that all anchoring screws penetrate not just the wall but the studs behind it as well. Screws embedded only in drywall or plaster will pull out. Regardless of the anchoring method you use, the screws should be long enough to extend at least 2 inches into the wall and studs.
- ✓ Before anchoring a bookcase with screws through its back, make sure the back is sturdy enough and that it is securely attached to the sides, top, and bottom. Some bookcases have backs made of very thin materials that are held in place with only small screws or staples that can easily pull out. Those bookcases should be anchored with brackets.
- ✓ If you have two or more bookcases or file cabinets that sit next to each other, consider connecting them to one another as well as to the wall. They will be even more stable if you do.



- ✓ If possible, move all bookcases, file cabinets, and other large pieces of furniture away from exits so that if they do fall, they won't prevent you from escaping.
- ✓ To prevent the contents of your bookcases from falling out, you can install a thin metal or plastic wire, a wood dowel, or even an elastic guardrail across the front of each shelf.
- ✓ Keep the tops of your bookcases free of heavy items, especially they are located near beds or desks, where persons could be injured from falling items.

ESTIMATED COST

The cost of anchoring a bookcase or file cabinet will depend on the size (height and width) of the bookcase or file cabinet. In general, if you do the work yourself, you can expect the cost to be approximately $5 per bracket. For example, anchoring a 3-foot wide by 6-foot high bookcase will cost about $30 for six brackets. This amount covers only the hardware you will have to buy and excludes the cost of any tools you use and the value of your time. If you hire a contractor or handyman to do the work, you will have to pay for time as well as materials.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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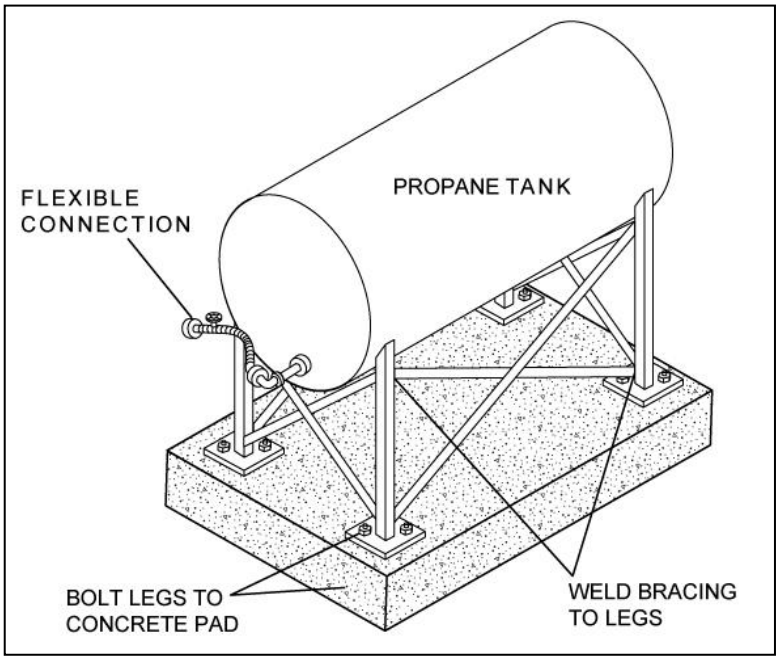
Anchor and Brace Propane Tanks and Gas Cylinders

FEMA

PROTECTING YOUR PROPERTY FROM EARTHQUAKES

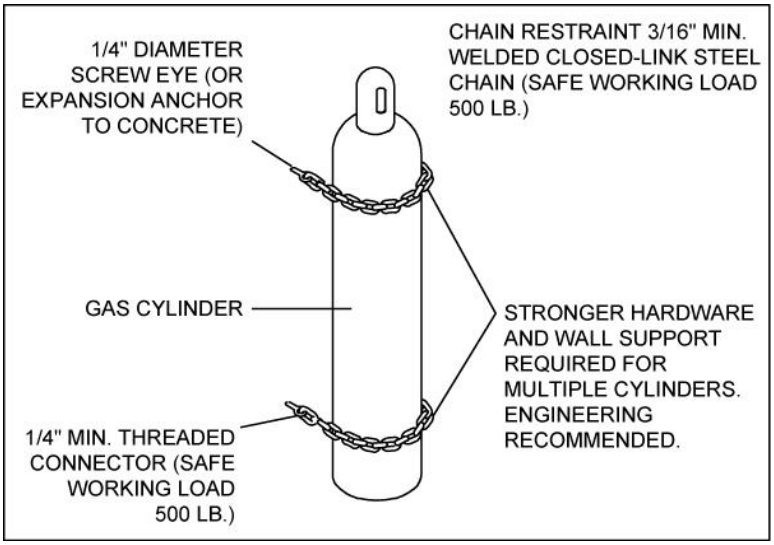
During earthquakes, propane tanks can break free of their supporting legs. When a tank falls, there is always a danger of a fire or an explosion. Even when a tank remains on its legs, its supply line can be ruptured. Escaping gas can then cause a fire. Similar problems can occur with smaller, compressed gas cylinders, which are often stored inside a house or garage.

One way to prevent damage to propane tanks and compressed gas cylinders is to anchor and brace them securely. The figure shows how the legs of a propane tank can be braced and anchored. Using a flexible connection on the supply line will help reduce the likelihood of a leak. Compressed gas cylinders cannot be permanently anchored because they have to be periodically replaced. But you can use chains to attach them to a wall so that they will remain upright.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent the tanks from breaking free from their support legs, which could cause fires or explosions



TIPS

Keep these points in mind when you anchor and brace propane tanks or compressed gas cylinders:

- ✓ Before you alter your propane tank in any way, make sure that the tank is your property and not rented from the propane supplier. Before welding new bracing to the tank legs, you must remove the gas from the tank. You should also check with your propane supplier to find out whether additional precautions are necessary.
- ✓ Clear the area around the propane tank to ensure that there are no tall or heavy objects that could fall on the tank or rupture the supply line.
- ✓ Keep a wrench near the shutoff valve and make sure the members of your family know how to turn off the supply line if they smell a gas leak. On larger tanks, such as farm tanks, consider installing a seismic shutoff valve that will automatically turn off the gas during an earthquake.

- ✓ Provide a flexible connection between the propane tank and the supply line and where the supply line enters the property. But keep in mind that adding a flexible connection to a propane tank line should be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.
- ✓ To attach a compressed gas cylinder to a wall, use two lengths of chain around the cylinder – one just below the top of the cylinder and one just above the bottom. The chains should be attached to eye hooks that are screwed into the wall. In wood-frame walls, the eye hooks must be long enough to penetrate not just the wall but the studs behind it as well. In concrete or masonry block walls, the eye hooks should be installed with expansion anchors or molly bolts.

ESTIMATED COST

Bracing and anchoring a propane tank will cost about $250. Having flexible connections installed on the tank and at the property will cost about $75 for the chain restraint. Attaching one gas cylinder to the wall will cost about $30 per linear foot and $50 for single units.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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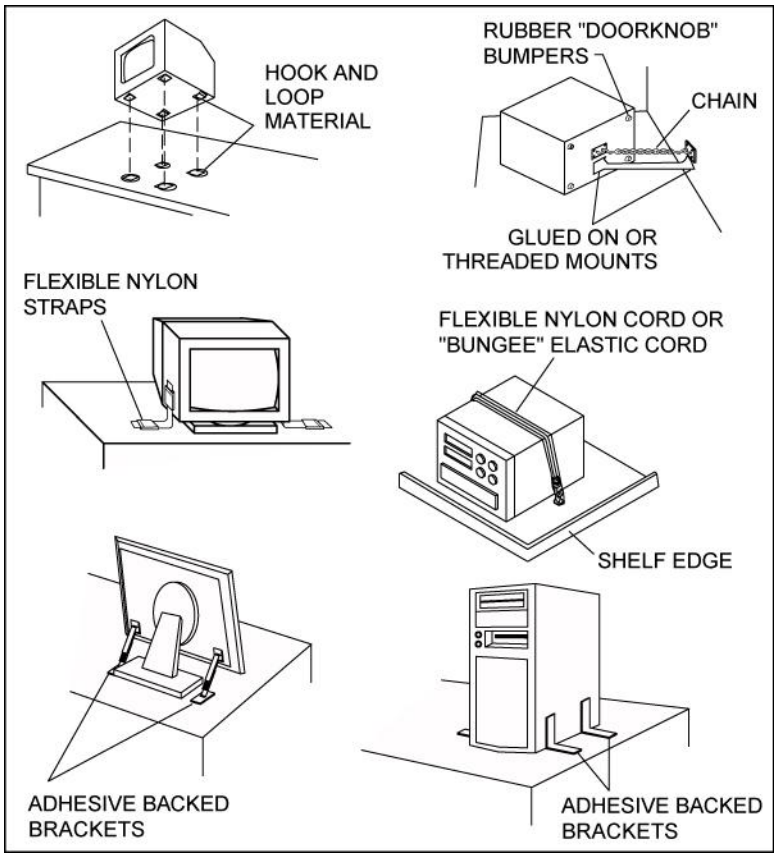
Restrain Desktop Computers and Appliances

FEMA

PROTECTING YOUR PROPERTY FROM EARTHQUAKES

The tremors caused by even minor earthquakes can easily move personal computer systems, stereo systems, television sets, and other small appliances that typically sit on desks, tables, and countertops. If they fall, they can be damaged beyond repair.

You can protect desktop computers and other small appliances by restraining them in a variety of ways. The figure shows three different ways. Methods such as using hook-and-loop material (Velcro, for example) require no tools. Others, which include using chains, cables, flexible nylon or elastic cords ("bungee" cords, for example), will usually require simple hand tools.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to computers and appliances
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you restrain desktop computers and appliances:

- ✓ Make sure that the desk or table the appliance sits on is not so light that it can be easily overturned. If it is, and you can't move the appliance to another location, consider anchoring the desk or table to the floor or wall.
- ✓ You can anchor the ends of chains, cables, or elastic cords to either the wall or the surface of the desk, table, or counter using eye-hooks, rings, screws and washers, or other types of mounts.
- ✓ If you want to use a wall-anchored chain, cable, or cord, attach it to a closed eye-hook screwed into the wall or to a wall mount (such as a ring or plate) attached with screws. Make sure the eye-hook or screws are long enough to penetrate not only the wall but also the studs behind it as well.

ESTIMATED COST

Restraining a single desktop computer or appliance with one of the methods described will cost about $50, depending on the amount of hardware required. Using hook-and-loop material would be the least expensive method. Using chains or cables would be the most expensive method, but may be necessary for heavy items.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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Install Latches on Drawers and Cabinet Doors

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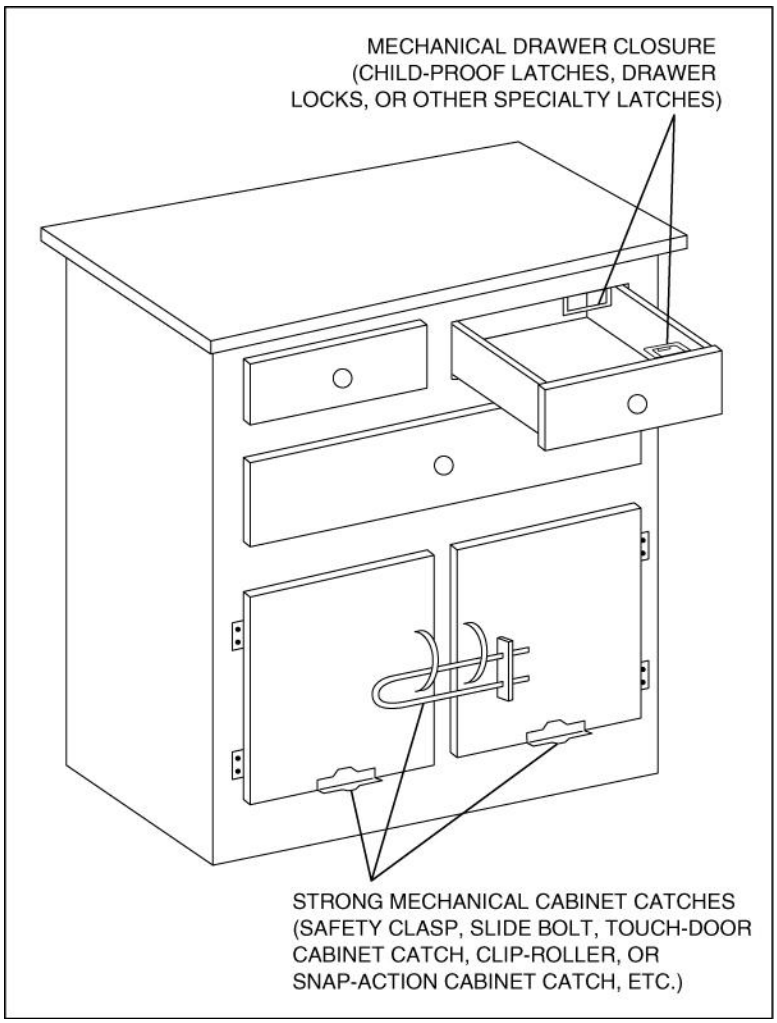
During an earthquake, drawers and cabinet doors can open and the stored materials can spill out and damage floors and floor coverings. Objects that fall from overhead cabinets can injure you or others.

One way to prevent the accidental opening of drawers and cabinet doors is to install latches such as barrel bolts, safety hasps, and child-proof locks. Most hardware and home supply stores stock a variety of latches. The figure shows three types of child-proof locks, one for drawers and two for cabinet doors. Examples of mechanical drawer closures include child-proof or drawer latches. The strong mechanical cabinet catches can include safety clasps, touch-door cabinet catches, slide bolts, clip-rollers, or snap-action cabinet catches, etc.

Most types of permanent latches can be installed easily and will not interfere with opening and closing of drawers and doors. The slide bolt can be used on cabinets that do not need to be opened frequently; it is easily installed and removed.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to floors and floor coverings, as well as to the contents of the drawers and cabinets
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you install latches on drawers and cabinet doors:

- ✓ When possible, do not store heavy, breakable, or dangerous items (such as insecticides, solvents, and bleach) in overhead cabinets.
- ✓ Do not rely on magnetic or pinch-grip catches to hold cabinet doors closed, especially on overhead cabinets and any cabinets that contain heavy, breakable, or dangerous items.
- ✓ Install latches according to the manufacturer's directions. For example, use all of the hardware provided with the latch and do not substitute undersized screws or bolts for those provided.

ESTIMATED COST

The cost of adding latches will depend on the type you decide to buy and the number of drawers and cabinet doors you want to secure. If you do the work yourself, the cost of adding latches to one cabinet could cost approximately $50. If you hire a contractor or handyman to install latches, you will have to pay for time as well as materials.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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Brace Cripple Walls

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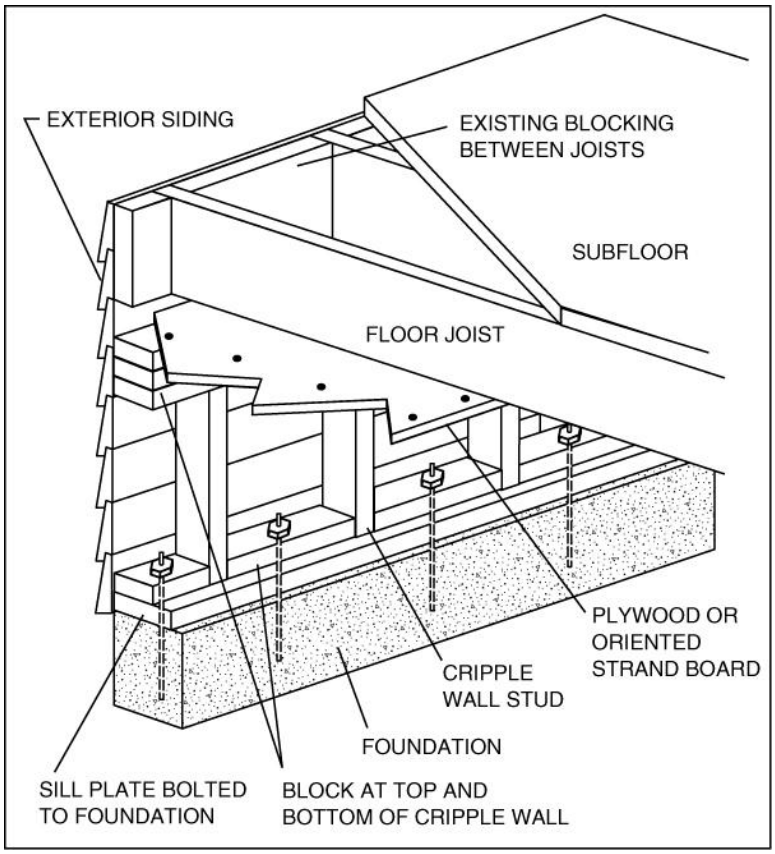
PROTECTING YOUR PROPERTY FROM EARTHQUAKES

Some structures are built on cripple walls. As shown in the figure, a cripple wall is a short wall that rests on the foundation and supports the floor and exterior walls. If the cripple wall is not braced, it can shift during an earthquake. When this occurs, there is a greater likelihood that the structure will be severely damaged and that you and others will be injured.

If your property is built on cripple walls, one way to increase its stability and reduce earthquake damage is to brace the cripple walls. In this method, horizontal sill blocking that consists of 2-inch by 4-inch boards is added between the vertical studs at the top and bottom of the cripple wall and, if necessary, at other locations between the studs. New vertical studs can also be added if necessary. Plywood or oriented strand board is then nailed to the interior face of the cripple wall. Also, nails are added through the existing blocking between floor joists to ensure that the floor is securely attached to the cripple wall.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent a structure from shifting, which can result in severe damage
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you brace cripple walls:

- ✓ Check with your local building officials to see if you need a permit to do this work.
- ✓ Before adding any bracing, check to see whether the sill plate below the cripple wall is bolted or otherwise anchored to the top of the foundation. If it is not, you should consider having bolts or anchors added. Any anchoring of the sill plate should be done before you add bracing. For more information, refer to the separate earthquake protection fact sheet titled “Bolt Sill Plates to Foundation.”

ESTIMATED COST

Bracing a 2-foot high cripple wall will cost approximately $1.50 per linear foot of wall. For example, a structure measuring 60 feet by 30 feet will have a perimeter of 180 feet. So the cost for that structure would be about $270. This figure covers only the materials you will have to buy and excludes the cost of any tools you use, building permit fees, and the value of your time. This figure also excludes the cost of having a contractor anchor your sill plates. Also, bracing higher cripple walls may require more lumber and therefore may be more expensive.

OTHER SOURCES OF INFORMATION

Bolt Sill Plates to Foundation Fact Sheet, FEMA, April 2008, http://www.fema.gov/plan/prevent/howto/index.shtm.

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction,* June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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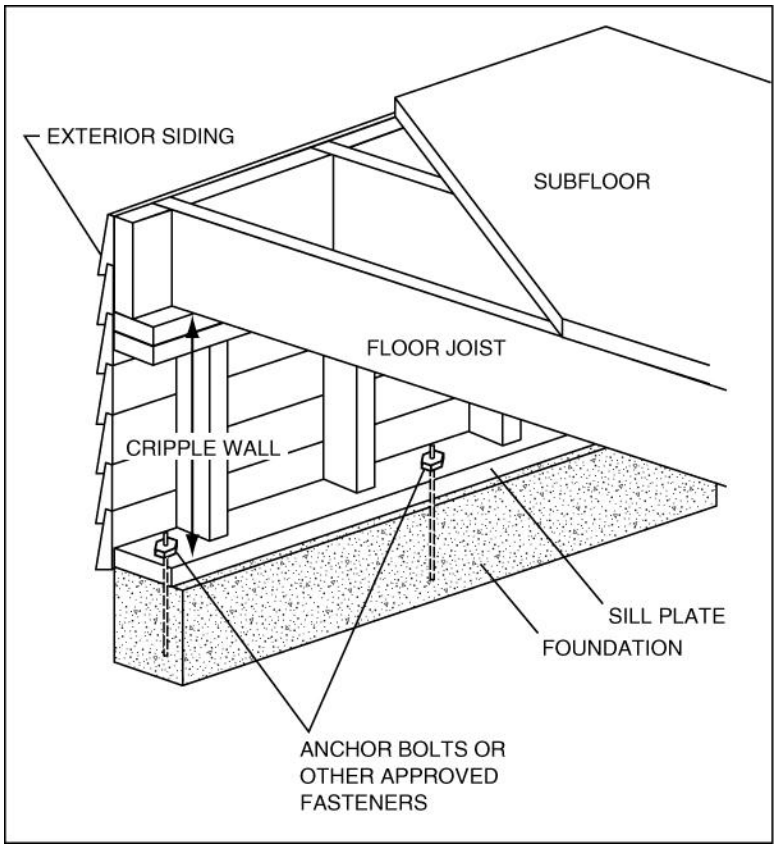
Bolt Sill Plates to Foundation

FEMA

PROTECTING YOUR PROPERTY FROM EARTHQUAKES

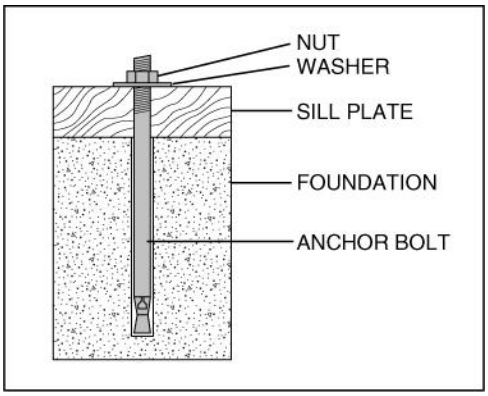
As shown in the figure, the sill plate of a structure rests directly on top of the foundation. (This figure shows the sill plate for a structure built on a cripple wall and crawl space foundation, a type of construction that is especially susceptible to earthquake damage.) If the sill plate is not securely anchored, an earthquake can cause it to slide with respect to the foundation. When this occurs, there is a greater potential for severe damage as well as injury to you and others.



One way to increase the stability of your property and reduce earthquake damage is to have the sill plate bolted or otherwise anchored to the foundation. In the method shown in the figure, bolts long enough to pass through the sill plate and penetrate several inches into the foundation are installed every few feet along the base of the exterior walls. This method is not limited to cripple wall construction; it can also be used for a structure built on a basement or slab-on-grade foundation or on another type of crawl space foundation.

BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent a structure from shifting, which can result in severe damage
- Helps to prevent injuries to occupants



TIPS

Keep these points in mind when you have the sill plates bolted to the foundation:

- ✓ Modifications to the foundation must be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.
- ✓ Anchor bolts are usually installed no more than 6 feet apart. The work involved is likely to be extensive and may require that portions of the walls or floor be cut away temporarily.
- ✓ Your contractor may be able to recommend an alternative anchoring method based on other approved fasteners or connectors that can be installed with fewer changes to your property and less work.

- ✓ If your property is built on cripple walls, you should consider bracing them after the sill plates are bolted. For more information, refer to the separate earthquake protection fact sheet titled “Brace Cripple Walls.”

ESTIMATED COST

Having a contractor bolt the sill plates to the foundation will cost approximately $50 to $75 per bolt, depending on the type of foundation you have. For example, a structure measuring 60 feet by 30 feet would have a perimeter of 180 feet and would therefore require a minimum of 30 bolts (if the bolts are placed no more than 6 feet apart). So the cost for that structure would be about $1,500 to $2,250.

OTHER SOURCES OF INFORMATION

Brace Cripple Walls Fact Sheet, FEMA, April 2008, http://www.fema.gov/plan/prevent/howto/index.shtm.

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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Use Flexible Connection on Gas and Water Lines

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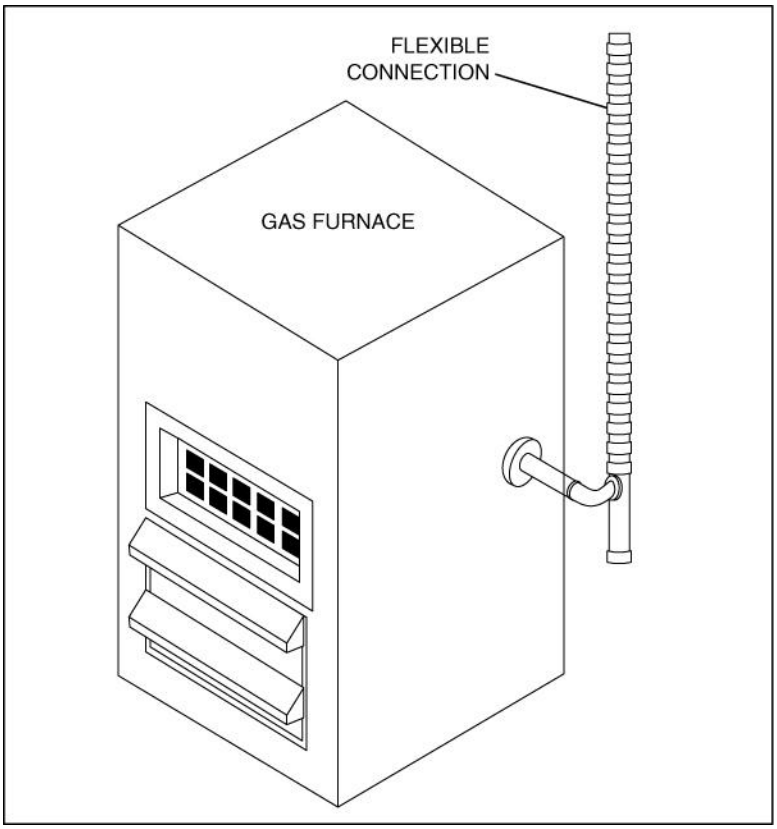
Because most gas and water lines are rigid, they can be torn from their connection points during an earthquake. The results could include not only serious damage to your property but also injury to you and others. A broken gas line is especially serious because of the potential for a fire or even an explosion.



One way to prevent broken gas and water lines is to have flexible connection pipes installed between appliances and their supply lines. The figure shows a flexible connection installed on a gas furnace. The same method can be used for other appliances, such as a hot water heater, clothes dryer, or stove. A licensed contractor can usually do this for you easily.

BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent tearing of gas and water lines from their connections
- Helps to prevent serious damage to a structure
- Helps to prevent fires or explosions
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you have flexible connections installed:

- ✓ Changes to the gas lines and plumbing in your property must be done by a licensed contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.
- ✓ A flexible connection will help protect against a small amount of movement but is not designed to function when the appliance it is connected to moves extensively or falls. So you should also consider anchoring the appliance to the floor or wall.

ESTIMATED COST

Having a flexible connection installed on a furnace or another large appliance will cost approximately $75.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

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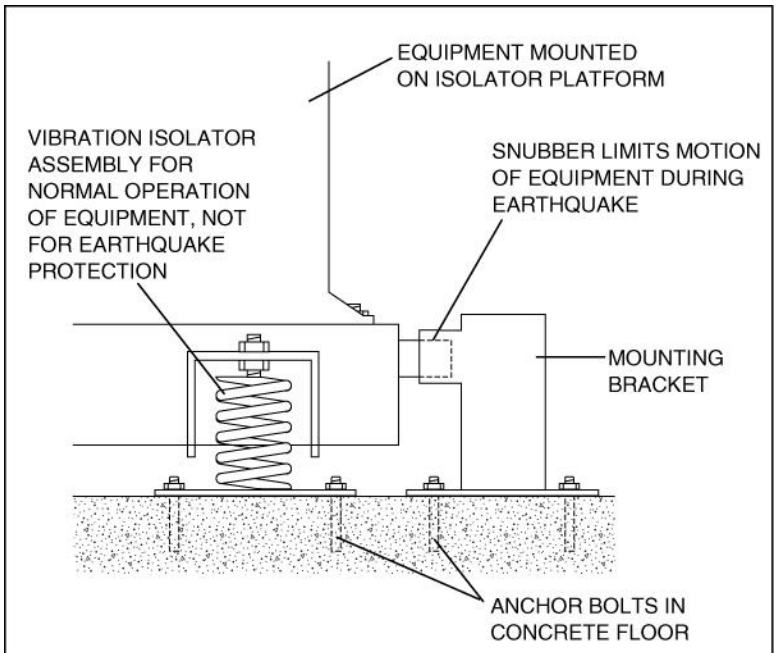
Anchor Equipment Properly

FEMA

PROTECTING YOUR PROPERTY FROM EARTHQUAKES

To control the vibrations created by heavy equipment, many property owners install such equipment on spring-loaded platforms or mounts known as vibration isolators. Isolators are designed to absorb the vibrations created by the normal operation of the equipment, but not the excessive movement that can occur during an earthquake. Earthquake forces, coupled with the weight of the equipment, can stretch the isolator springs beyond their ability to rebound. As a result, the isolators can fail, equipment can be overturned, utility line connections can be broken, and workers may be injured.



VIBRATION ISOLATOR MOUNT EQUIPPED WITH SNUBBER FOR USE IN EARTHQUAKE HAZARD AREA

In earthquake hazard areas, anchoring equipment directly to the floor or another suitable part of the building is preferable to mounting equipment on vibration isolators. If isolators are used, they should be securely anchored and they should be equipped with "snubbers." Snubbers limit the motions resulting from normal operation of the equipment and prevent the equipment from moving beyond the limits of the springs during earthquakes.

BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent the failure of isolators, which can result in equipment overturning
- Helps to prevent broken utility line connections
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you anchor heavy equipment:

- ✓ The multi-purpose isolator system shown in the figure is designed to absorb equipment vibrations resulting from normal operations and to prevent excessive motion during an earthquake. Systems of this type can be used for newly installed equipment and as replacements for existing isolator systems that do not include snubbers or other restraints.
- ✓ Equipment mounted on vibration isolators must be able to move freely. Be sure to use flexible connections wherever utility lines, piping, and ductwork are attached to the equipment.

- ✓ Before anchoring equipment to floors or walls, make sure they are strong enough to resist earthquake forces.
- ✓ Tall pieces of equipment with narrow bases are more likely to overturn during earthquakes and will therefore need additional anchoring.
- ✓ Equipment suspended from the ceiling must also be braced to resist earthquake forces.
- ✓ The equipment manufacturer or dealer may be able to provide or recommend mounting methods and hardware for use in earthquake hazard areas.

ESTIMATED COST

The cost of anchoring a piece of heavy equipment will depend on its size, weight, location, and operation; the type and number of utility lines connected to it; and the anchoring method used (e.g., rigid connectors or vibration isolators).

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 547, *Techniques for the Seismic Rehabilitation of Existing Buildings*, February 2007, http://www.fema.gov/library/viewRecord.do?id=2393.

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Mount Framed Pictures and Mirrors Securely

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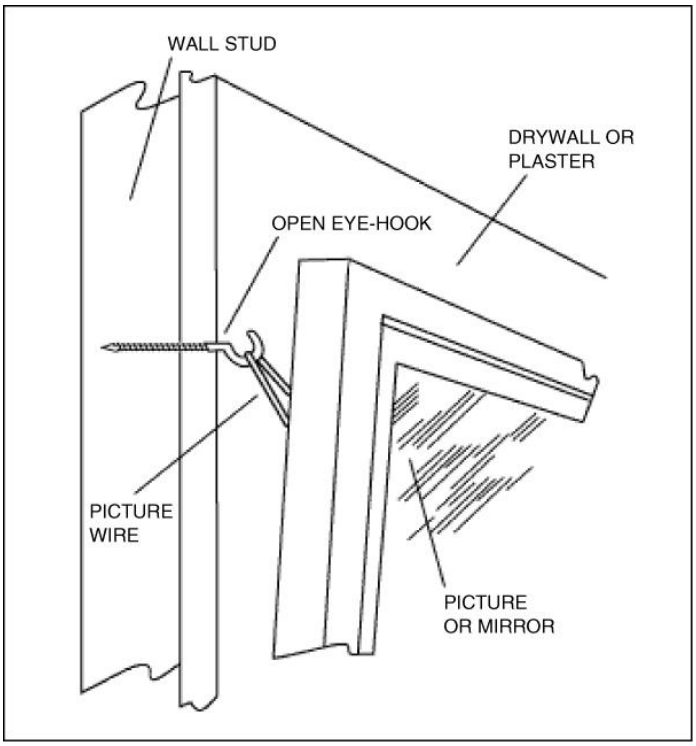
During an earthquake, framed pictures and mirrors that are not securely attached to walls can easily fall. Large pictures and mirrors can cause injuries when they fall, and the broken glass that often results increases the potential for injury.



As shown in the figure, one way to mount framed pictures and mirrors securely is to use long-shanked, open eye-hooks instead of traditional picture hangers. The eye-hooks must be long enough to penetrate the wall stud as well as the drywall or plaster. Eye-hooks used in this way are much less likely to pull out of the wall than picture hooks installed with nails that penetrate only the drywall or plaster. Also, an alternative to running wire across the back of the picture or mirror is to use closed eye-hooks securely screwed into the back of the frame.

BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent injuries to occupants
- Helps to prevent damage to the pictures or mirrors

TIPS

Keep these points in mind when you hang framed pictures or mirrors:

- ✓ The number of eye-hooks you need for a picture or mirror will depend on its size and weight. Large pictures and mirrors will be more stable when mounted on two hooks rather than one.
- ✓ Make sure that eye-hooks penetrate not just the wall but the studs behind it as well. Eye-hooks embedded only in drywall or plaster are likely to pull out. To be embedded deeply enough, eye-hooks should be at least 1 to 2 inches long.
- ✓ Regardless of whether you use picture wire or closed eye-hooks on the back of the picture or mirror, make sure the hooks, screws, or other types of mounting hardware are securely attached to the frame.
- ✓ If possible, don't hang large pictures or mirrors in places where they are more likely to fall on someone, such as over beds, chairs, or couches.

ESTIMATED COST

The cost of mounting a picture or mirror with eye-hooks will depend on its size and weight. In general, for a large picture or mirror that requires two eye-hooks, the cost would be approximately $5. This amount covers only the hardware you will have to buy, not any tools you use or the value of your time. If you hire a contractor or handyman to do the work, you will have to pay for time as well as materials.

OTHER SOURCES OF INFORMATION

FEMA 74, *Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide*, Third Edition, September 1994, http://www.fema.gov/library/viewRecord.do?id=1574.

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, June 2006, http://www.fema.gov/library/viewRecord.do?id=2103.

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