

Adding Foundation Bolts

Developed by the California Governor's Office of Emergency Services.
Illustrations redrawn by Kit Wong, taken from Mary Comerio and Sanford Hirsben: *The Earthquake Advisor's Handbook for Wood Frame Houses*, a National Science Foundation funded project.

Structural Stability

Structural stability begins with the site and soil. Risk increases if a building is on or near an active fault, on land fill, loose, water saturated soil or in a land slide prone area. A foundation or soil engineer or a geologist can advise you on site problems.

If your home is of conventional wood frame construction (including stucco), it will probably be relatively resistant to earthquake damage, particularly if a single story. However, there are some important structural features that will ensure greater stability.

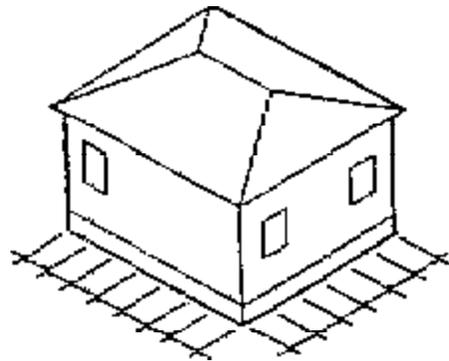
- Check for foundation bolts. Your home may or may not have bolts securing the wood frame structure to the concrete foundation. Your home can be strengthened by adding expansion bolts at the foundation.
- Determine if the vertical studs that extend from the foundation up to the first floor are exposed on the inside. This construction method produces a weak link in the house structure and is particularly dangerous in multi-story buildings. Nail plywood sheeting onto the vertical studs to strengthen these cripple walls.
- Metal connectors strengthen areas where posts and beams join. Nail and lag screw them on exposed framing in garages, basements, porches and patio covers.

Single Story House

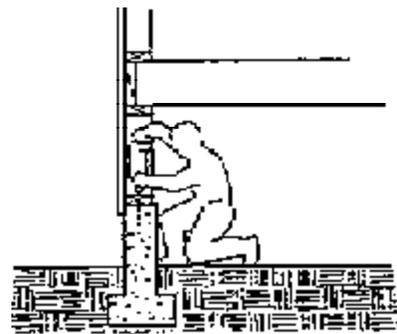
When retrofitting, use at least 1/2 inch diameter bolts of such length (8 1/2 inches is a good general size) as to result in an imbed of at least 6 inches in the concrete, and place them 4 to 6 feet (maximum) apart. For best results, place them 4 feet apart on center, and within 12 inches of the end of any sill plate section. Any single section of sillplate needs at least 2 bolts.

Two-Story House

When retrofitting, use at least 5/8 inch diameter bolts of such length (8 1/2 inches is a good general size) as to result in an imbed of at least 6 inches in the concrete. The house size and weight dictate the bolt size. If in doubt, consult a professional engineer. For best results, place them 4 feet apart on center and within 12 inches of the end of any sill plate section. Any single section of sillplate needs at least 2 bolts.



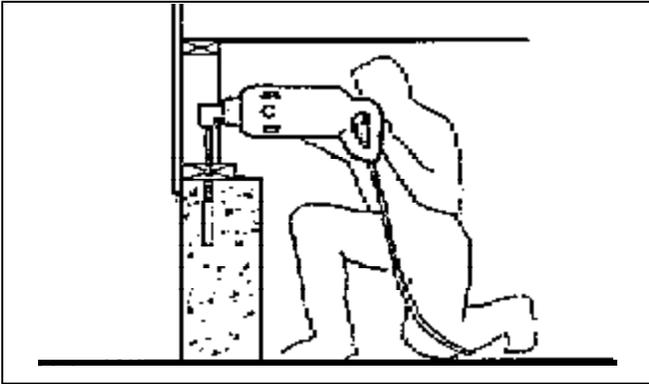
1. Layout bolt locations. For the typical once story house, use 1/2 inch diameter bolts at 4-6 feet on center.



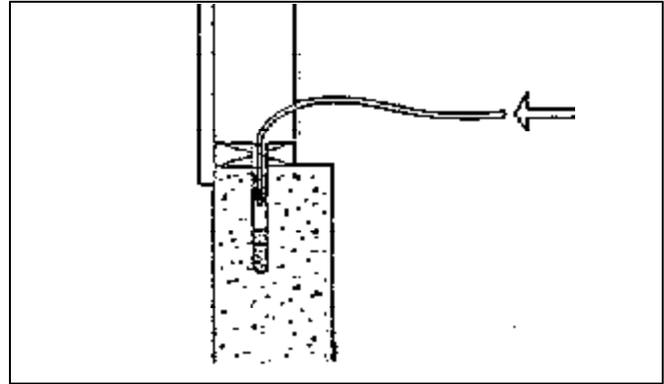
2. Drill holes through existing sill into the concrete foundation for 8 1/2 inch long expansion bolts, using carbide drill bits.

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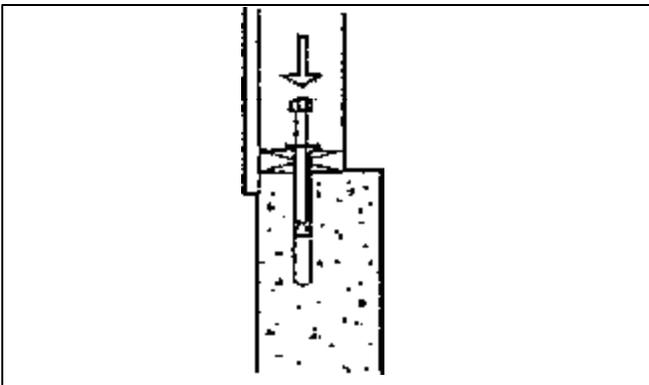
Prepared by the Peninsulas Emergency Preparedness Committee
of Washington 11/00 (www.pep-c.org)



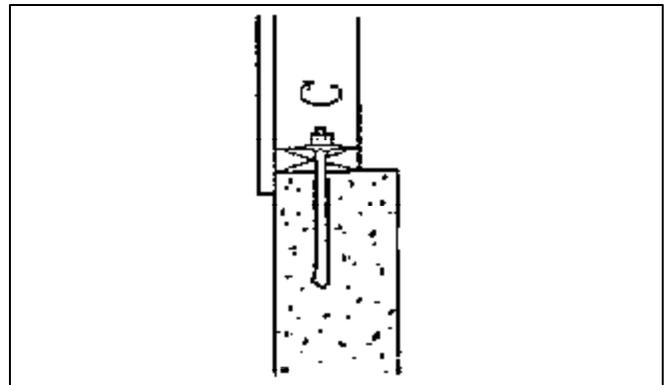
3. Use right angle drill for tight access places where the crawl space is low.



4. Blow all the dust out of the drilled holes using a rubber tube. Wear goggles and dust mask or respirator.



5. Insert expansion bolt with the washer and nut attached. Leave nut at top of bolt when tapping the bolt in place to protect the threads.



6. After tapping bolt in place, tighten the bolt by turning the nut. Do not over tighten or bolt will be damaged.

Mobile Homes

Foundations need to be reinforced and the under-carriage of the home tied securely to the foundation. If not, the mobile home will be thrown off its foundation even during small tremors.

Double wide mobile homes should be tied together. As the two units are of different weight, they will react differently and tend to pull apart.

Add additional plywood to all pony / stem (cripple) walls in crawl space under house. Before installing plywood, check to be sure there are foundation bolts to secure the sill plate to the concrete foundation.

If you can't afford to do all walls at one time, start with corners first, then do tallest (those with biggest dimension between foundation and floor joists) next. Do short sections last.