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What S.F. homeowners need to do to be ready for an earthquake

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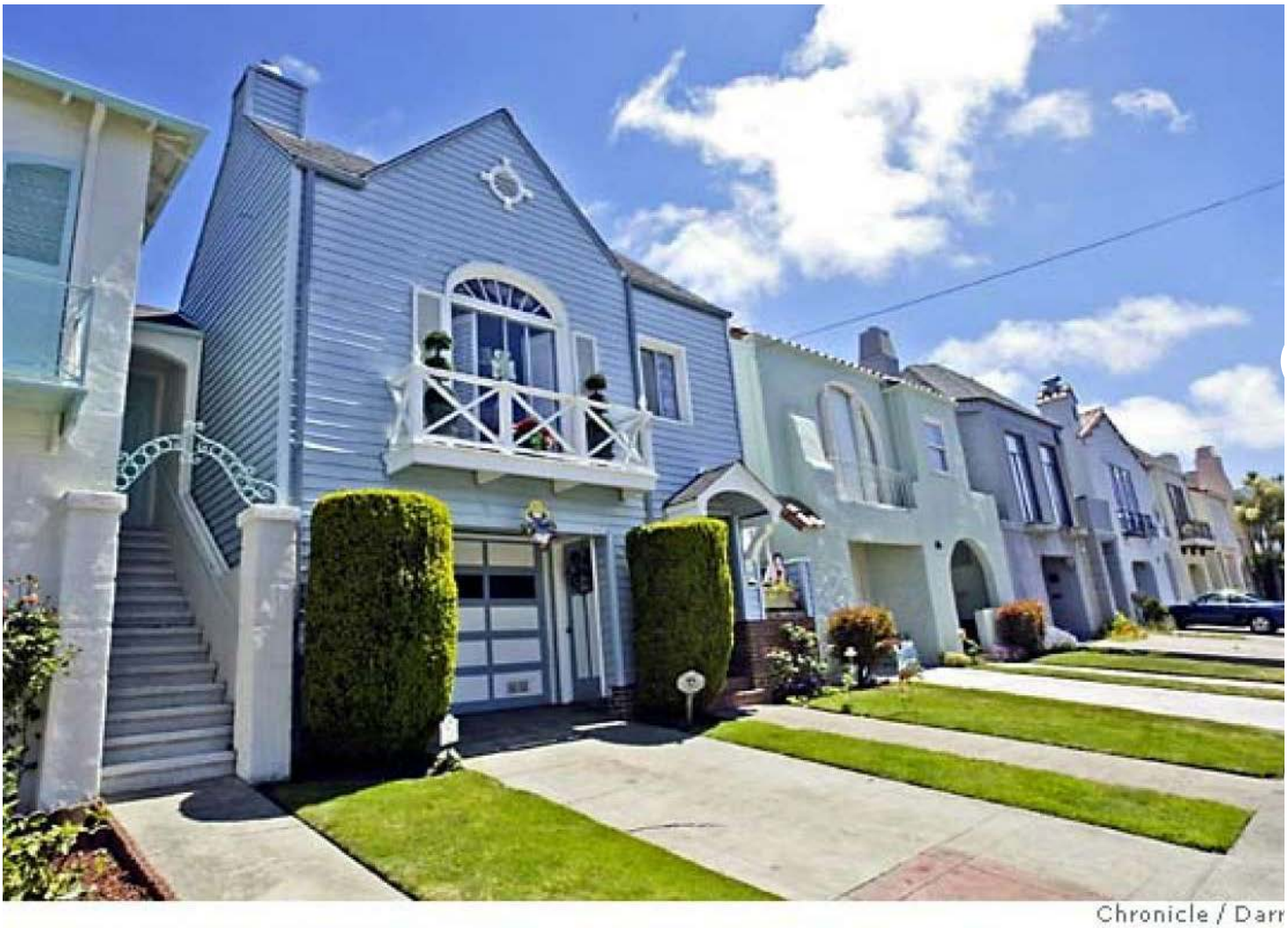
May 8, 2004 | Updated: April 17, 2014 11:59 a.m.



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Howard Cook of Bay Area Retrofit based in Richmond, CA., drills a hole for a "hold down" to be attached with "epoxy bolt" in concrete on the side wall of a garage of a single family home on 76th Street in Oakland. Cook homes to be seismically safe. Event on 5/4/04 in Oakland. Darryl Bush / The Chronicle

San Francisco is full of them. Row after row of houses that stand shoulder to shoulder, their stairs leading up from a ground-level garage to their first- and second-floor living areas.

These homes can be beautiful, especially when gussied up in the vivid colors of the Victorian era. No doubt they give the city much of its character.

But they serve a greater purpose -- as shelter for tens of thousands of San Francisco's middle class. For most of these families, their house represents by far the greatest part of their net worth.

A report that has recently come to light says much of that net worth is vulnerable.

San Francisco's Earthquake Risk, a study done for the city Department of Building Inspection and reported on in last Sunday's Chronicle, predicts that a 7.2 magnitude earthquake and post-quake fire would destroy 70 percent of the wooden single-family buildings on the west and south sides of the city -- 20, 857 in all.

Although there's no such thing as an earthquake-proof building, engineers agree that seismic retrofitting, when done properly, can give these homes a fighting chance against the Big One.

Howard Cook, founder of Bay Area Retrofit, a company that has done more than 1,000 retrofits since opening in 1994, said the best thing homeowners can do is educate themselves. "Once people understand retrofit principles they'll be able to ask the right questions and pick the contractor that will do the best

job for them."

The concept of a seismic retrofit is a simple three-step process: Bolt the house to the foundation, add plywood to brace the walls, then use special hardware to attach those walls to the floor framing above them.

'Tie the house together'

"What you want to do is tie the house together," said Fareed Himmati, a structural engineer with Holmes Culley company in San Francisco.

"The idea is to transfer all the force of an earthquake to the foundation. A building that's tied together and then attached firmly to its foundation is a lot less likely to slide off its foundation or to collapse entirely."

Cook and Himmati agree that while the concept is simple, execution can be technical. Many contractors, they say, know they need to use foundation bolts, shear walls and transfer ties. But knowing exactly where to use them is another matter.

"The biggest problem we notice with engineers and contractors," Himmati said, "is a lack of knowledge of how this seismic thing works. They'll slap the plywood on the wall and it's in the wrong place or it's not tied down. The owner thinks he's added a shear wall and, in reality, it's doing nothing."

On his Web site (www.bayarearetrofit.com), Cook tells of a Kensington couple who bought a house that had already been retrofitted. The contractor unknowingly used hardware designed to resist hurricanes, not earthquakes. The couple ended up paying $3,000 to have the work redone.

"It's not that these guys are out to get you," Cook said, "it's just that they don't

have the specific knowledge needed to do earthquake retrofit." In fact, Cook says, up to one-third of his work is repairs of retrofits that were botched by well-meaning but improperly trained contractors.

Costs can vary widely

The most vulnerable buildings are the so-called "soft-story structures," those that have living space stacked atop a less strongly supported ground floor, usually because of a garage door opening or, in the case of commercial buildings, storefront windows.

Assuming the foundation is serviceable, retrofitting a soft-story building can cost as little as $6,000 or as much as $30,000 and up, Cook said.

"It's so variable -- no two houses are alike. Every retrofit must be engineered. Sometimes we're able to put in bolts, attach sheets of plywood and ties and be done with it. Other times a full-blown, custom-welded steel frame and engineering calculations are needed."

Reed Lagedrost, a longtime San Francisco contractor and property inspector, said it may not be necessary to hire an engineer, especially if the job is straightforward.

"The procedures are pretty well established, and the code is clear. Simple foundation bolting, shear walling and the like can be handled by a competent contractor," Lagedrost said.

But Lagedrost admits that he sees "a lot of mistakes" when doing property inspections and recommends that an engineer with seismic retrofitting experience be brought in on all but the most straightforward jobs.

Owners of soft-story buildings who are considering beefing them up should first call in a structural engineer, Himmati said. "When you are not changing the exterior of the building, adding windows and the like, an engineer should be able to provide drawings and take a project through the planning and permit process."

It's specialty work

The next step is hiring a contractor who is qualified to engineer a retrofit and then carry it out. The best way to do that, Cook says, is to ask prospective contractors for the name of a structural engineer they consult for retrofit work, then call that engineer for a reference.

Also, the Association of Bay Area Governments provides a county-by-county list of contractors who have taken a course in seismic retrofitting.

Go to www.abag.ca.gov/cgi-bin/contractors.pl.

The association warns against fraud, saying "some contractors are marketing themselves as 'seismic retrofit' specialists and telling homeowners that they should pay for a variety of services that are probably not needed. For example, the need to replace bolts due to 'rust' is highly unlikely."

Himmati said most of the problems he sees when inspecting west- and south-side San Francisco homes are in the foundation. "Some of these houses have their original brick foundations. If that's the case, owners need to either replace them or cap them with concrete."

Usually when a foundation is capped, concrete is poured around the old foundation and a new mud sill and foundation bolts are added. "It takes up more space," Himmati said, "but often it's more cost-efficient because it

doesn't require that a new wall be built to support the house while the old brick foundation is being removed."

Foundation work is usually the most expensive part of a seismic retrofit. Himmati says a routine job in San Francisco can cost $50,000 and, depending on the crawl space and how much access workers have, can easily balloon to $80, 000.

Bolt (to keep it) upright

In any case, engineer Himmati and inspector Lagedrost agree that a proper retrofit starts from the ground up.

"Bolting the foundation is the most important thing a homeowner can do. An unbolted foundation is the weakest link in the chain," Lagedrost said.

"We always tell our clients that the very least they should do is bolt the foundation," Himmati said.

Cook says a solid, bolted foundation is a good start but that shear walls and shear transfer ties that attach the shear wall to the foundationalso are vital.

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"If you've bolted your foundation and done nothing else and a big quake comes along, you could be left with a nice, firmly attached mud sill but no house on top of it," Cook said.

No help from government

If building owners decide to do a seismic retrofit, it will be up to them to see that the job is done properly. It's unlikely the city building inspector will be able to tell them if the work will stand up to a quake.

Throughout California, seismic retrofits are voluntary and are not required by law. Building inspectors will check the quality of the workmanship on any given job but won't vouch for the design and engineering.

"Any new construction, such as a vertical addition, must beengineered to current seismic requirements, but San Francisco doesn't have a building code for seismic retrofits," said Yan Chew, a plan check manager for the building inspection department.

Chew said the city is working on guidelines for residential retrofits but is still some time away from publishing them.

When to call in a structural engineer

Contractors who have been trained in seismic retrofitting can tackle many jobs, but when these situations present themselves, it's best to contact a structural engineer.

-- Your home has two or more stories.

-- Part of your home is supported by posts, not a wall.

-- Your foundation is brick or is weak.

-- Your home has an unusual shape, is very long and narrow, or is shaped like an "L."

-- Your home is on a steep hill.

-- Your home has a two-car or larger garage with rooms above it, or is a "split-level."

-- Your home has a porch that is recessed under a second story.

-- Your home is almost touching an adjacent home.

From a paper by Tony DeMoscole, Association of Bay Area Governments Housing Mitigation Review Committee

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Written ByBill Burnett

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