

New data shake quake strategy

Analysis of foreign disasters may allow state to ease strict building codes.

By Carrie Peyton Dahlberg - Bee Staff Writer
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Like aftershocks that just keep rumbling, big earthquakes from Taiwan to Turkey could leave a lasting mark on California.

Evidence from those distant quakes has bolstered a growing conviction that California won't shake as violently as once feared when the next big one hits.

Implications could be widespread, from relief for hospitals now struggling with how to pay for earthquake retrofits to cities fighting which overpasses they can afford to upgrade.



It will take years for such a potentially radical shift in thinking to make its way fully into building codes. Along the way, it could be softened by engineers and code developers who prefer to stick closer to today's tough earthquake standards. Yet in the meantime, some engineers are already using new calculations of reduced shaking to evaluate major construction projects.

"Anybody involved in the design of any type of important or critical facility in the Western United States has been following this," said Ivan Wong, principal seismologist at the Oakland offices of URS Corp., an international engineering company.

Chris Poland, president of Degenkolb Engineers, estimates that 50 percent to 90 percent of the California hospitals facing staggering retrofit costs could learn they actually need little or no change after all.

Poland said the shift in thinking is an engineering rarity: findings that could lead to relaxed — not toughened — building codes.

Seismologists have been conferring for years over the best ways to update equations that predict ground motion. Their work is far enough along to have plopped, more than a little uncomfortably, into the interface between science and engineering.

"If the hazard had gone up, I think it would have been more acceptable to the engineers," said Wong.

This month, the U.S. Geological Survey incorporated much of the new thinking into preliminary seismic hazard maps that it has released for public comment.

As part of a regular update of seismic risks facing the nation, the maps incorporate everything from new research into Lake Tahoe faults to a major collaborative effort to revamp ground-motion equations.

The maps, which the USGS expects to finalize soon, show relatively few changes for the Sacramento region and nearby foothills, according to Michael Reichle, chief seismologist of the California Geological Survey.

The USGS has tentatively concluded that the Tahoe area faces higher quake risks, potentially leading to tougher building requirements there.

The more dramatic changes elsewhere, reflecting a decreased hazard in many coastal fault zones, were based on two new ways earthquakes are analyzed.

One involved better characterizing soil conditions in spots where past quakes were measured, to make it easier to extrapolate to future quakes.

The other relied on gathering more ground-motion data from big quakes.

For that, scientists can thank ground-motion detectors, which use the same motion-detecting technology that tells a car's air bag when to open.

So many black boxes were deployed around Taiwan by the past decade that a single killer quake in 1999 dramatically increased the store of ground-motion data, said Greg Deierlein, a Stanford structural engineering professor.

Deierlein, deputy director of the Pacific Earthquake Engineering Research Center at UC Berkeley, is among dozens of consultants, professors and government scientists who toiled to understand implications of data from Taiwan, Turkey and other recent deadly quakes.

The result was a set of five "attenuation" equations that can be used to predict how much a given quake, in a given spot, will make different types of ground shudder miles away.

For much of California, that means 10 percent to 35 percent less shaking, said Yousef Bozorgnia, associate director of the quake research center at Berkeley.

"We are so proud of these" equations, Bozorgnia said, because they could reduce construction costs by hundreds of millions of dollars in much of coastal California, where new or retrofitted buildings would not need to be as robust.

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Major steps loom before savings can be realized.

Once the USGS finalizes its maps, perhaps as soon as September, a fresh round of scrutiny will start, from tiers of federal officials and professionals who produce maps that turn into model codes that turn into state or local laws.

"That part is out of our hands," said Bozorgnia. "That is less science and more social policy. We have done the science."



He is among those predicting that because lighter standards would go against the grain of many engineers and building code developers, they will toughen other construction rules, at least slightly, to partially reduce the impact.

While that process won't be complete until 2012, new attenuation equations are likely to get plenty of use in the meantime.

At the urging of its own panel of seismic experts, the Bay Area Rapid Transit District will use them to re-examine a planned \$1.3 billion earthquake upgrade, making sure it's not over-designing based on outdated science.

"Any time we can stretch the critical infrastructure dollars we have further, we're certainly going to do that," said BART spokeswoman Molly McArthur.

Reservoir owners around California, who routinely re-evaluate soundness of their dams, also are asking officials how they can incorporate new equations in their assessments.

The state will consider the new equations this summer, said William Fraser of the state's geology unit. He anticipates they'll have relatively minor impacts on 1,200 dams the state regulates, because they face many other complex seismic issues.

Hospitals could also begin making a case that new quake-motion equations can be used for analyzing retrofit needs.

At this point, John Gillengarten, the office's deputy director, said he'd turn down such a request, considering it premature before the Building Seismic Safety Council evaluates the maps for FEMA.

That work could be done by 2009, still four years ahead of a deadline, already extended once, for 338 hospitals to upgrade one or more of their quake-threatened retrofits. Since most hospitals opt to replace instead of retrofit, the price tag for meeting the 2013 deadline could hit \$110 billion statewide, according to a Rand Corp. study done earlier this year for the California HealthCare Foundation.

Engineer Poland thinks hospitals will see "huge" impacts from the new view of earthquake hazards, with billions ultimately slashed off price tags.

He anticipates a lesser, but noticeable, impact on building construction. The cost for buildings taller than 10 stories could dip about 5 percent in some areas.

Roads, too, could be candidates for retrofits. "There may be a whole family of overpasses out there they don't have to strengthen because they're good enough," Poland said.

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