

State lags in early warning system, quake experts say

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What would you do with 10 seconds – the last, steady 10 seconds before California's next big quake upends everything?

Turn off the stove? Get away from a window? Put down that cell phone and place both hands firmly on the steering wheel?

Japan is so confident those few seconds can protect people and property that in October it rolled out a nationwide alert system. Using TV and radio announcements as well as computer networks, the system warns those in a quake's path that the ground is about to start shaking.

California is years behind, still studying which techniques are best and unsure who should sound the alerts and who should pay for setting up hundreds of quake monitoring sites.

"I think we're very remiss in this," said Thomas Jordan, director of the Southern California Earthquake Center.

Earthquake warning systems – already deployed in Mexico, Romania, Turkey and Taiwan as well as Japan – can't predict quakes.

Instead, relying on a network of seismometers, they detect the first jolt, the primary or P waves that move quickly from the fault but don't do much damage. By analyzing those initial waves, sophisticated computer programs can calculate how forceful the slower secondary, or S, waves are likely to be. That gives the alert system time to send out warnings ahead of S-wave shaking that spreads from the epicenter.

Such systems won't help anyone at ground zero. But the farther away you are, the more time the warning has to leapfrog ahead of the ground motion.

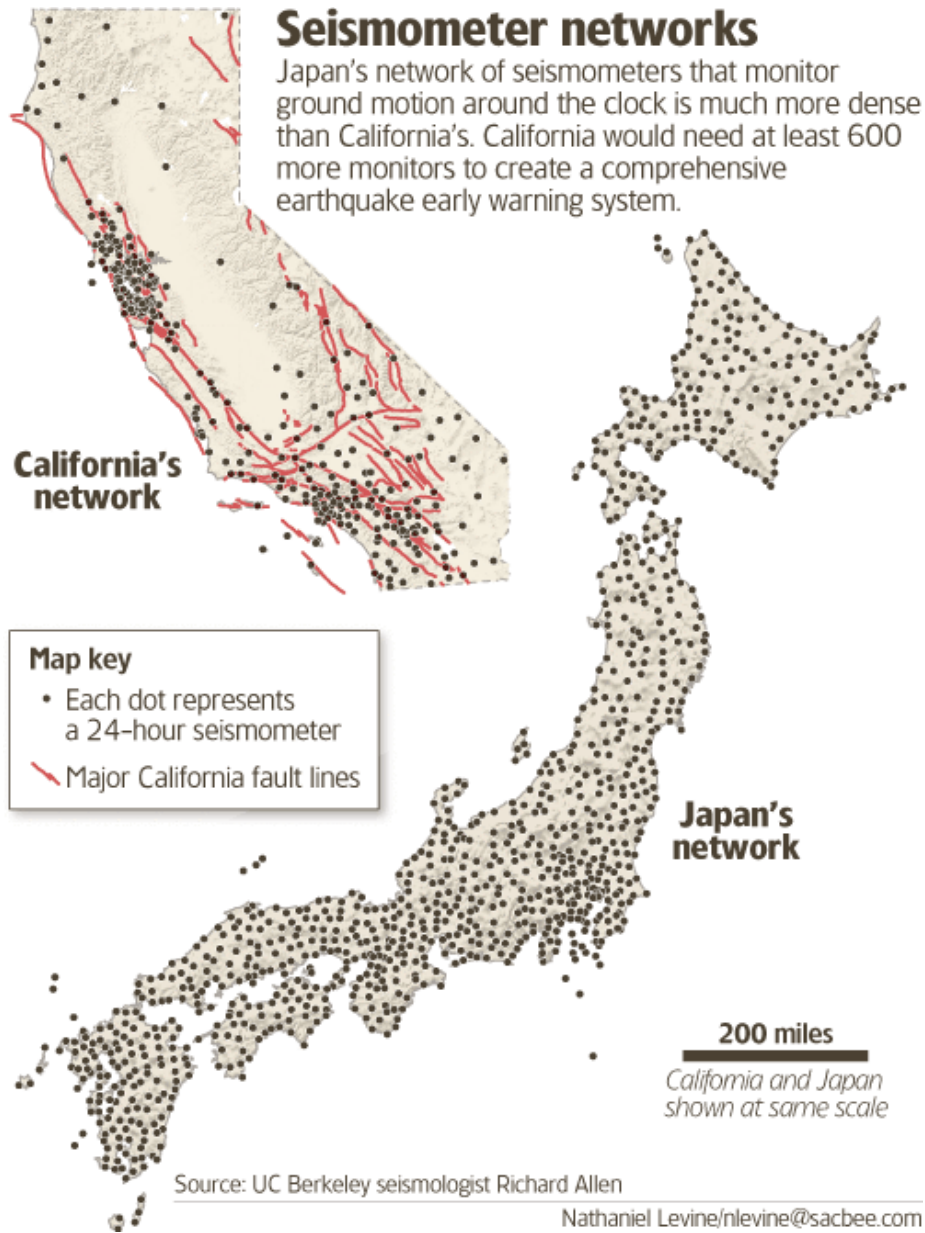
If an alert network had existed in 1989, San Franciscans would have gotten 20 seconds of warning before the Loma Prieta quake surged into the city from its epicenter in the Santa Cruz Mountains, said Richard Allen, a UC Berkeley seismology professor.

Allen, who was among the scientists discussing quake warning systems at the American Geophysical Union conference in San Francisco this week, is confident that "this is coming" to California.

He is part of a coalition assessing three approaches to quickly analyzing P waves. Their three-year study, which should wrap up in 2009, aims to spell out how a California system should be designed and how many seconds of warning it could provide in different scenarios.

After that, said Allen, a warning system could take another two or three years to build, including upgrading telemetry at more than 250 existing seismic monitoring sites and adding at least 600 sites.

He has no detailed cost estimate yet, but guesses the price tag might run \$10 million to \$30 million.



Jim Goltz, earthquake and tsunami manager for California's Office of Emergency Services, is glumly anticipating something more expensive, and doesn't know where the money will come from.

"This is a time of considerable budget uncertainty," Goltz said. "I don't think we're going to rush out and spend \$30 to \$40 million on new seismic stations," Goltz said.

He predicts it will take "a decade or more" before California gets anything like what Japan has today. And he's not sure whether the state would be in charge, or would be part of a broader, national network.

Ultimately, several scientists said, Californians are going to have to decide whether early quake warnings are worth the money.

Unlike seismic retrofits, a warning system won't prevent buildings from falling down or freeways from collapsing. It won't help those close to a quake's epicenter. It won't be needed in minor quakes, although versions being testing now could work for anything above a magnitude 3.

Most likely, warnings would be issued for quakes above a 5.5 magnitude, and would be tailored to let people know how much ground motion is expected where they live or work.

If a big quake starts on the San Andreas fault well north of San Francisco, or a giant shaker erupts well south of Los Angeles, a useful warning could come as long as one minute in advance.

"Time is valuable," but we haven't yet seriously investigated how valuable, said south state geophysicist Jordan.

In Japan, computers have been programmed to unlock apartment doors or slow trains in response to quake warnings, said Osamu Kamigaichi of that country's meteorological agency, which oversees quake and tsunami warnings.

Japan spent a year briefing the public on what to do when a quake warning comes over the TV or radio. Ducking under desks was heavily featured.

With longer warnings, say 10 to 30 seconds, more possibilities open up, OES' Goltz said. Construction workers could anchor themselves to scaffolding or come down. People handling hazardous materials could move out of a splash zone. Schoolchildren could be escorted outside if it were appropriate. Response teams could be activated, and initial communications could race ahead of any post-disaster crunch.

Exploring those possibilities will help California decide what happens next.

As the three-year study of a quake alert system for the state continues, several seismologists have offered up the same dark speculation.

All it would take is one big earthquake – and the finger-pointing sure to follow – to shake loose funding fast.