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Alert system could provide seconds' warning of quake

By Staff and Wire Services

Scientists have proposed a way to interpret the first, feeble tremors that herald a large earthquake to give residents of Southern California advance warning of more violent shaking to come, according to research published today in the journal Science.

The system theoretically could give anywhere from seconds to tens of seconds of advance notice – enough time to send schoolchildren diving below their desks or to cut the flow of gas through pipelines vulnerable to rupture, scientists said.

But the system would offer no warning of blind-thrust temblors such as the 1994 Northridge Earthquake. And it would not forecast earthquakes, but rather detect the milder tremors that precede the main quake.

The 6.7-magnitude Northridge Quake occurred along a blind-thrust fault, rather than a more conventional fault line such as the San Andreas.

Details of the study appear today in the journal Science.

Gerry Simila, a California State University, Northridge, earthquake geologist who was not involved in the study, said an early detection system would be useful primarily by triggering automatic systems, such as ones that shut down gas lines and trains.

"The problem is, we're very close to the San Andreas (Fault), so we'll only have seconds (warning)," Simila said. "By the time you've thought of it, your 10 seconds are up."

The detection system would track the flow of energy from the underground source of quakes to the surface.

The first indication at the surface that a large earthquake has occurred is typically the jolt caused by the arrival of a fast-moving but low-energy wave called the primary or "P" wave.

It is followed by the more energetic but slower moving shear, or "S" wave, that causes far more violent shaking.

Richard Allen of the University of Wisconsin-Madison and Hiroo Kanamori of the California Institute of Technology

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- Science Magazine Online
- Calif. Institute of Technology
- Calif. Governor's Office of Emergency Services
- U.S. Geological Survey (USGS)
- USGS Earthquake Hazards Program
- Federal Emergency Management Assoc. (FEMA) Web site on Earthquakes
- Southern California Earthquake Center
- Earthquake Engineering Research Institute

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developed a way to determine the location, origin, time and -- most importantly – magnitude of an earthquake from as little as four seconds of measurements of the frequency of the energy in the P wave. The system would rely on a network of seismic instruments already deployed across the Greater Los Angeles region.

"If we can detect this P wave and use the information contained in it to estimate the hazard associated with an earthquake, then there is the potential to issue a warning before any significant ground motion reaches the surface," Allen said.

The California Office of Emergency Services is spending $2.8 million a year to develop an early warning system, but needs to work out the question of how to disseminate information about earthquakes as they strike.

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"In the emergency services business, you really worry about how people will react once they get the warning," said Ed Bortugno, an OES senior geologist. "The technology is rapidly getting there."

The amount of forewarning would depend on the distance of the sensors from an earthquake's epicenter.

If directly above the epicenter, there would be no time for a warning, since the S wave would arrive almost immediately after the P wave. At 37 miles from the epicenter of a major quake, the system could give a magnitude estimate 16 seconds before the arrival of the S wave and the strong ground motion that accompanies it, Allen said.

A similar system is already in use in Japan, where individual sensors are used to provide early warnings.

In the United States, scientists have long studied the potential for a few seconds' warning of a violent earthquake, but the possibility of actually predicting earthquakes remains elusive.

Tom Henyey, a professor of earth sciences at the University of Southern California, said the system described by Allen and Kanamori isn't particularly novel.

"The idea's been around for a long time, but whether or not it's practical remains to be seen," he said.

If developed, it would work best if plugged into a region's infrastructure, allowing it to automatically prompt shutdowns of everything from trains to factories during major quakes, Allen said.

Such a system would allow a utility to quickly cut power to its grid, minimizing but not eliminating damage, said Philip Mo, a structural engineer with Southern California Edison.

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