

# Earthquake-warning system nearly ready to roll

*An estimated \$54 million is needed to bring it to the public*

**Sue Dremann, Palo Alto Weekly, 10-2-14**

A USGS ShakeAlert earthquake early-warning system map shows the location, earthquake intensity and seconds until seismic waves are expected to hit a particular location. Courtesy of U.S. Geological Survey.

A long-desired system for warning of imminent earthquakes on the West Coast is working and can accurately predict temblors, but a public roll-out won't happen without more funding, a U.S. Geological Survey (USGS) scientist said last week.

The USGS has tested the ShakeAlert system with public agencies and private businesses since 2012, including Bay Area Rapid Transit (BART), Metrolink, Google and California Office of Emergency Services.

The system has predicted quakes within four to five seconds of the initial seismic waves. The warning system estimated the Aug. 24 Napa quake would be a 5.7 magnitude, David Oppenheimer, a USGS geophysicist, said at a Sept. 24 earthquake workshop. Seismologists later pegged the temblor a 6.0.

The system works via sensors and distribution stations that blanket much of metropolitan California, but a full system will need updated equipment installed in the ground and distribution stations placed in rural areas and in the Pacific Northwest, Oppenheimer said. As many as 440 sensors will need to be replaced or added in California and about 280 in Washington and Oregon.

The system requires an estimated \$38 million for capital expenses and another \$16.1 million annually to run.

"It's a question for society and our elected officials: Is it worth it to fund this system?" Oppenheimer said.

Even with full funding, it could take three years to develop the system so that it provides public notifications, scientists wrote in the system's implementation plan.

But the money could be well worth it. In California, the Napa quake caused homes and businesses an estimated \$400 million in losses, including an estimated \$80.3 million to the wine industry, the Napa County Executive Office noted on Sept. 8.

Worldwide, countries with early-warning systems have saved millions of dollars and hundreds of lives, Oppenheimer said. Japan saved \$15 million after the Tokachi-oki earthquakes near Hokkaido (magnitude 8.3 and 7.0) on Sept. 26, 2003.

A few seconds' head start could also prevent the loss of life and enable utilities, transit and emergency responders to prepare for the most damaging earthquake shocks to come.

"BART is worried about a derailment. If one train goes off the tracks, the economic impact would be huge. And there are on average 100 people per train," Oppenheimer said.

The early-warning system would allow the rail line to immediately slow or shut down trains before damaging shock waves hit, he said.

In schools and businesses, alerted students and employees could drop and cover; at medical facilities, surgeons and dentists could stop performing delicate procedures; emergency responders could open firehouse doors and prioritize their response based on ShakeAlert maps indicating areas that might be the hardest hit; and electrical utilities staff could control systems to prevent damage to power stations caused by shaking.

Earthquakes trigger two main kinds of seismic waves: primary or "P-waves," the early ripples one feels prior to serious shaking; and cross-directional, up-and-down motion secondary "S-waves," which cause the damage, Oppenheimer said.

ShakeAlert operates by capturing the P-waves, which travel faster than the more-destructive S-waves. And the shaking waves travel through the earth's shallow layers at 0.5 to 3 miles per second -- slower speeds than the warning system transmission, allowing for as much as 10 seconds of warning, according to the USGS.

Using the California Integrated Seismic Network, an existing series of 400 high-quality ground-motion sensors positioned six to 12 miles apart, ShakeAlert sends the sensor information to distribution centers, which transmit a warning to people within four to five seconds of detection of the initial waves.

Alerts appear through a computer program with audio and visual features. When ShakeAlert detects a quake, a map pops up on the computer screen to show the quake's epicenter, and a computer-generated voice warns that the temblor is occurring. A series of concentric rings representing the seismic waves radiate from the epicenter on the screen. A countdown indicates the remaining time until the waves reach. The program also warns of the expected level of the shake's intensity, which is different from the quake's magnitude at the epicenter.

People testing the system in Berkeley received a five-second warning before shaking from the Napa quake began, and Pasadena users had a six-second warning before a March 28 magnitude 5 earthquake, according to USGS.

That length of time may not seem like much, but depending on one's distance from the quake, the system could provide minutes of warning. If a magnitude 9 earthquake occurs with its epicenter off the coast near Cape Mendocino -- a likely scenario, Oppenheimer said -- residents in Seattle, Washington, would have five minutes to prepare.

San Francisco residents might have a little more than a one-minute warning from a magnitude 8 on the San Andreas fault near Ft. Bragg, USGS hazard-levels maps show.

When fully operational, ShakeAlert will be able to distribute alerts through distribution channels such as the Federal Emergency Management Agency's (FEMA) wireless emergency system, smartphone applications, social media providers and other electronic-alert technologies, Oppenheimer said.

But there is a caveat or two. False or missed alerts are possible, and the area nearest to an epicenter -- within 10 to 20 miles -- may receive little or no warning, according to the implementation report.

For Palo Altans and other Midpeninsula residents, that could be sobering news.

Black Mountain, in Monte Bello Open Space Preserve, is within the highest-risk section of any fault segment in the Bay Area, USGS scientists determined in 1988. California Avenue in Palo Alto is just 10.4 miles away from Monte Bello.

And the San Andreas fault traverses the western edge of Foothills Park. California Avenue is just 5.8 miles away, and downtown Palo Alto is 7.7 miles.