

California's earthquake warning app: how it works and what comes next

Seconds before an earthquake hits anywhere in California, people nearby will now get a warning on their smartphones to duck and cover. The first state-wide early warning system in the nation launched today, on the 30th anniversary of the devastating Loma Prieta earthquake that killed 63 people in the San Francisco Bay Area.

The early warning system will reach people in two ways: through an app called MyShake and through the existing wireless emergency alerts that sound an alarm on cellphones for flood warnings and missing children (Amber Alerts). If all goes well, it will give people up to “tens of seconds” of advance notice before they might feel the ground shaking.

just enough time to save lives

That's just enough time to save lives and prevent injuries, its developers say. They are eager to finally get the ball rolling after years of pushing for the political will and technological advances to make it a reality. But they're quick to note that the app that is rolling out today is still likely to face challenges ahead when it comes to expanding to a huge scale, especially during a major earthquake. And work is still underway to make it more inclusive of people who don't use smartphones or who speak different languages.

“We think that there's probably more work to do in the future but if we can save even one life, then it's worth turning it on,” Brian Ferguson, a spokesperson with the California Governor's Office of Emergency Services, tells *The Verge*.

There's a 99.7 percent chance of a magnitude 6.7 or larger quake rocking California in the next 30 years. "That's the reality we live in," California Governor Gavin Newsom said at a launch event today. "The price of admission to live here is preparation."

Had the system been in place back in 1989 during the Loma Prieta earthquake, people in downtown San Francisco could have gotten a warning 15 to 18 seconds before experiencing the damage, Ferguson says. That would have been enough time for drivers to pull off the road or for people indoors to jump under a sturdy table to protect themselves from falling furniture and debris. More than half of all injuries in the Loma Prieta earthquake in the Bay Area, and disastrous 1994 Northridge earthquake outside Los Angeles, were linked to hazards like falling ceiling lights and bookshelves.

This is the most expansive earthquake early warning app to be unveiled in the US. Another app, ShakeAlertLA, came out in January, but it was only available to people within the Los Angeles area. Both apps work with the United States Geological Survey's (USGS) network of seismic sensors.

Here's how the early warning system works: When an earthquake starts, it releases energy that travels through the Earth in two different ways, called primary and secondary waves. Primary waves move faster, but the average person wouldn't notice them. It's the secondary waves that people recognize as the Earth shaking.

everything happens in seconds

There are about 800 sensors positioned across the state that can detect primary waves. Those sensors send data to three processing centers where computers figure out where the quake is and how strong it will be. Then apps and the wireless emergency alert system quickly push out a warning moments before people feel the destructive secondary waves. (App users will need to have location services enabled to get the alert.)

The farther away someone is from the heart of the quake, the more warning time they'll get. Ideally, everything happens in well under a minute. The whole system is automated because there's just no time for humans to be involved.

The system also has to be fast so that it can crunch the data and send out a warning before those dangerous secondary waves have a chance to damage the equipment. The message delivery system is cloud-based to keep it moving in the event of an earthquake. But phones still depend on cell towers that could topple.

"There is always a risk that some portion of that network will not be able to deliver the alert," says Richard Allen, director of the Berkeley Seismology Laboratory, which helped develop the new system along with the USGS, Caltech, and the California Geological Survey. "Our hope is that even if the strong shaking does cause some failures within the network, that we will already have been able to push out the alert, so we will already have done our job," Allen says.

Users will get alerts through the new MyShake app if they're in an area that will experience noticeable shaking. Researchers classify how intense shaking is using something called the Modified Mercalli Intensity Scale, which ranks shaking intensity from lowest (one) to highest (ten). For this app, users will start getting notifications if they're in an area where the shaking is expected to hit an intensity of three or higher.

That threshold used to be higher. But developers of the new app decided to lower it after an earthquake struck outside of Los Angeles in July. Users of the LA app complained that they didn't get a notification, even though the shaking they experienced was weak.

For people without an app on their phone, the wireless emergency alerts will be sent out, but they'll only reach

people who are expected to feel shaking with an intensity level of four or higher. Those alerts will be slower than the app, simply because the system was designed for other types of emergencies where mere seconds don't make such a huge difference. But they should reach a broader audience, since most modern smartphones support the Wireless Emergency Alerts system.

the next big test

Berkeley's Allen says the next big test will be how this works on a scale of alerting millions of people rather than just a few thousand. It was tested earlier this week during a magnitude 4.5 quake in the Bay Area and a 4.7 quake in central California. In the first quake, the early warning system was able to get a message to phones within a median time of 2.1 seconds. Warnings about the second quake reached phones in a median of 1.6 seconds. The app will continue to improve, Allen assures users, "We built this system so that we can test it in flight."

The next wave of innovation will be in making sure that people without smartphones, who have a disability, and who speak different languages will also get alerts, according to Ferguson and Allen. To do that, the alerts could be broadcast over the radio and television in the future. And the app could soon be available in Spanish and other languages. (The ShakeAlert LA app is already available in Spanish.)

"We know that oftentimes people who are differently-abled or non-English speakers are the most vulnerable during emergencies, so that development will continue apace as we move forward," says Ferguson.

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