

# Open Fire Station Bay Doors

Earthquakes threaten 1 in 4 Americans. Earthquakes currently cannot be predicted, but people can act beforehand to reduce the harm when earthquakes occur. One way to do that is to implement earthquake early warning, which refers to a system that rapidly detects earthquakes just after they begin, quickly calculates how strongly the ground will shake, and notifies people or systems just a few kilometers or tens of kilometers from the epicenter before the shaking arrives. With a few seconds' warning, people and systems can take useful protective actions. The next few pages answer key questions for people deciding whether and how to adopt earthquake early warning to open fire station bay doors before shaking arrives. This material was written by leading earthquake engineers, seismologists, emergency managers, and other pioneers of earthquake early warning, including people who developed, implemented, and use earthquake early warning in real life.

This is one of seven guidelines for different ways to use earthquake early warning. Find the full set at <http://www.sparisk.com/pubs/Porter-2020-EEW-Set.pdf>

## Essence of the Practice

A device receives an alert via the Internet and through a hardware interface to the door controls, opens fire station bay doors to reduce the chance that doors will be jammed closed by racking damage to the station structure (Figure 1). The device also causes an audible alert to be broadcast through the fire station public address system, two-way radio system, or both.



Figure 1. Earthquake early warning can automatically open fire station bay doors and sound an audible alarm through the fire station public address system, two-way radio system, or both (image: anonymous, CC-BY-SA 4.0)

## Context in Which the Use Case Would Work

Requires electrically operated doors, power, and Internet connectivity. Works in places with an earthquake early warning network: California, Oregon, Washington, Mexico, Japan, Turkey, Romania, China, Italy, and Taiwan.

### Realistic Expectations

Expect success when the fire station is far enough away from the epicenter that the alert can be received before strong shaking arrives with enough time to open fire station bay doors. Overhead doors can take less than 10 seconds to open in some facilities and up to 20 seconds in others. Four-fold doors can take 7 seconds or more to open. When an earthquake strikes a large metropolitan area, many fire stations may be too close for doors to completely open before strong shaking arrives; some fire stations will experience strong shaking before the alert arrives and doors begin to open.

### Clear Behavior

No human action is required. Doors open automatically.

### Potential Vulnerabilities

The system may fail to send an alarm because of

- Unexpected changes to the upstream warning system's application programming interface (API) or insufficient time to accommodate the API change. At least one vendor is less susceptible to such changes.
- Electric power or Internet connectivity is lost or cut off before the message is received or the doors can fully open. This potentiality can be somewhat mitigated by the vendor monitoring power and Internet connectivity and alerting end users to loss of power and by providing backup power to the alerting system and to the doors.
- Prior unnoticed or uncorrected damage to hardware. Constant monitoring by the vendor and following a frequent testing protocol can mitigate this problem.
- Failure to start software. Monitoring and testing protocols can mitigate this problem.
- The alert may or may not arrive long enough in advance of strong shaking because of proximity to the rupture and because of the time it takes to open doors.

### Implementation Costs

One vendor charges in the low \$10,000s for initial installation at a single facility, plus \$1,000s per year for maintenance, with economies of scale at multiple locations.

### Hardware and Software Requirements

A proprietary hardware interface controls the bay doors. It also includes an audio output that announces an alert through the public address system in the fire station, the two-way radios, or both.

### Training, Education, and Outreach Materials

None is required.

### Maintenance Requirements

Maintain the public address system, perform annual testing, and ensure remote monitoring and system updates from the vendor.

### Examples of Past Use

The Los Angeles County Fire Department installed an early warning system in station 51 that opens firehouse doors. A successful test was performed in September 2014 (Xia and Lin 2014). Interested readers can contact the Deputy Chief of Special Operations & Hazardous Materials, California Governor's Office of Emergency Services, 1-916-845-8751, or Early Warning Labs, 1-424-238-0060, [Info@EarlyWarningLabs.com](mailto:Info@EarlyWarningLabs.com). Menlo Park, California implemented a system in 2019 (Perry 2019). Readers can contact Alejandro Cantu, SkyAlert, 1-415-374-1214, [alejandroskyalertusa.com](mailto:alejandroskyalertusa.com). Vendors and user contact people may change in the near term.

## References

Perry, T.S. (2019). A 30-second earthquake warning gives a Menlo Park fire station a chance to protect itself. IEEE Spectrum. (June 25, 2019). Retrieved from <https://spectrum.ieee.org/view-from-the-valley/at-work/start-ups/a-30-second-earthquake-warning-gives-a-menlo-park-fire-station> [accessed May 6, 2020]

Xia, R., and Lin, R.G. II (2014). Earthquake early alert system ready to expand in California. Los Angeles Times November 23, 2014. <https://www.latimes.com/local/california/la-me-1123-earthquake-early-warning-20141123-story.html> [accessed April 28, 2020]

