



Preparing Schools for Earthquakes

Why Earthquake Safety Is Critical

Photo: Hawaii Emergency Management Agency



Above: Students learn to drop, cover, and hold on during the Great ShakeOut earthquake drill. (Learn how at www.dropcoverholdon.org and www.shakeout.org)

In this fact sheet:

- Why many schools in the Pacific Northwest are vulnerable
- Why earthquake safety matters
- What school districts and communities can do to improve earthquake safety and resilience

Retrofitting an old building or constructing a new one to meet stricter earthquake design standards can:

- Keep students, teachers, and staff safe in an earthquake.
- Reduce the cost of repairs after an earthquake.
- Reduce the number of buildings that school districts will have to demolish and rebuild after an earthquake.
- Reduce post-earthquake disruption and recovery time for the whole community.

Are Schools Ready for the Next Big Quake?

Sadly, major earthquakes around the globe often result in deaths and injuries in schools. So far, U.S. and Canadian schools have seen few such casualties, but we have owed this more to luck (most schools happened to be unoccupied when damaging earthquakes struck) than to the safety of school buildings.

Growing awareness of the Pacific Northwest's earthquake hazard has prompted many communities to work toward making school buildings safer and more resilient. While the region is making progress, many schools are not yet ready for the next earthquake.

Why Are Schools at Risk?

In the Pacific Northwest, the biggest earthquake hazard is the Cascadia subduction zone, which is expected to produce a magnitude 9.0 earthquake and tsunami, causing widespread damage. Other fault zones trigger earthquakes that inflict severe damage locally. Unfortunately, many schools were built before the extent of these hazards was known and before modern seismic (earthquake) design standards and building codes were adopted. These older schools are more likely to suffer damage or fail in an earthquake. For instance, some building types, such as unreinforced masonry (URM), are prone to collapse. Certain structural features that are common in schools can also make buildings less stable, such as rows of large windows along main floors and big interior spaces with minimal internal bracing.

Even in newer buildings, unsecured nonstructural elements (including light fixtures, air ducts, and parapets) and furnishings may fall, blocking exits and causing injuries and damage.

—Learn more on p. 2



Photo: FEMA (460, 2005)

Light fixtures fell at Dawson Elementary School in Coalinga, CA, during a M 6.4 earthquake in 1983.

Did You Know?

All modern school buildings must meet the minimum *life-safety* seismic standard: This means a building may be damaged beyond repair in an earthquake, but it will not collapse and people can exit safely. If a school is to serve as an emergency shelter after an earthquake, the building must meet a higher seismic design standard, making it safe for *immediate occupancy*.

Why Earthquake Safety Matters

Children are required to attend school and have a right to expect safe buildings. Schools are also essential to a community's post-earthquake recovery: well prepared schools can resume operations more quickly after an event, thereby returning students to class, freeing parents for work, and restoring a sense of stability.

The benefits of upgrading buildings are clear: After the Canterbury earthquakes in 2010–11, New Zealand's Ministry of Education had school buildings assessed. Although 153 were damaged, the report concluded that earthquake upgrades, which the ministry completed before the earthquakes struck, effectively strengthened buildings, preventing collapse and keeping students and teachers safe.



British Columbia has assessed its schools to identify earthquake risks and prioritize up-grades. By the end of 2016, the Ministry of Education invested \$1.2 billion (CAD) in earthquake upgrades; another \$560 million is allocated for additional projects.

Queen Mary Elementary School in Vancouver (left) is a recently completed project. It was rebuilt inside to meet modern building and earthquake codes; the building's exterior was renovated, thereby preserving the historic character of the original structure.

Get Ready: Take Steps Now toward Safer Schools

- Identify hazards that could impact the site and buildings; create and update emergency plans and supplies; and educate staff, students, and families so everyone knows what to do.
- Regularly practice earthquake drills and evacuation procedures.
- Use ASCE/SEI 41-17 (available at www.asce.org) or equivalent evaluation standards to assess buildings in quake-prone areas.
- Prioritize vulnerabilities that impact life safety and develop a mitigation plan based on benefit/cost analysis of the options; consider all potential uses of the building.

Featured Resources

National Clearinghouse for Educational Facilities: www.ncef.org/content/earthquakes-and-schools

Readiness and Emergency Management for Schools: <https://rems.ed.gov/>

EERI School Seismic Safety Initiative: www.eeri.org/projects/schools/

FEMA hazard mitigation assistance grants: www.fema.gov/hazard-mitigation-assistance

British Columbia's mitigation program: www2.gov.bc.ca/gov/content/education-training/administration/capital/seismic-mitigation

New Zealand's report on earthquake impacts on schools: www.education.govt.nz/assets/Documents/Primary-Secondary/Property/Fixing-issues/Earthquake-resilience/CanterburyEarthquakes-ImpactonSchoolBuildings.pdf