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Not My Fault: ShakeOut is a reminder of what it takes to build earthquake-resilient communities

Lori Dengler for the Times-Standard
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A sign at the entrance to a brick building in Eureka's Old Town warning that it could collapse during an earthquake.

On December 21, 1954, Mrs. Hess was in her home in Pepperwood when the ground began to shake. She fled outside and upon reaching the porch, the shaking became stronger and threw her down the steps onto the concrete sidewalk, breaking both of her ankles. At the same time, Jeannie Thompson, a waitress at the Scotia Inn, also felt the tremors. Like Mrs. Hess, she bolted for the door and was thrown from the steps of the Inn as she exited, injuring her knee.

I've been delving into accounts of the 1954 earthquake for the past three years as part of a team reassessing its location and impacts (see Not My Fault 8/30/25). Last week, I spent a few hours at the Humboldt Historical Society where staff had found several folders for me to look at. There were photographs and newspapers and a few letters. The gem of the collection was a scrapbook compiled by a high school student including an essay on the earthquake, and newspaper clippings including the account of Mrs. Hess and Jeannie Thompson.

The injuries sustained by these women were unnecessary. They were both located more than 30 miles from the epicenter where shaking was in the moderate zone. Some items would have fallen from shelves, but no structural damage was reported. Had they just stayed where they were, they would have been uninjured.

The issue of what causes injuries in California earthquakes was addressed by my friend and colleague Jim Goltz for his PhD research. He studied both the 1989 Loma Prieta and 1994 Northridge earthquakes and examined what caused injuries to people who experienced the earthquake. There was only one clear correlation in his data – the further his subjects moved while the ground was shaking, the more likely they were to be injured. Getting under a table or desk didn't make much of a difference, but walking to a doorway if it was more than five feet away, invited harm.

Why does moving cause injuries? Two primary reasons: you are increasing the odds that something will fall on you and are more likely to stumble or trip on something like the two women in 1954. The most tragic inappropriate response story I've heard was during the Northridge earthquake in 1994. A young mother in Rancho Cucamonga was awoken at 4:30 AM by the shaking. She immediately raced to her baby's room, tripped on a toy and fell, breaking her neck on the side of the crib. Rancho Cucamonga was 55 miles from the epicenter, and the shaking was considered "light" and caused no damage.

Instincts take over when we experience something unusual, something we've never practiced for. I understand what drove that young mother to sprint to her infant,
I would likely do the same if the "don't move" message wasn't drilled into my psyche. It's not just stumbling that's a problem, running barefoot and lacerating your feet on broken glass and rubble is another all-to-common consequence.

We are fortunate in California that earthquake design considerations have been part of our building codes for a long time. There were attempts to include resilience to side-to-side stresses after 1906, but California was nervous about publicly addressing earthquake hazards at the time and acknowledged such forces under wind resilience. It wasn't until the 1933 M6.4 Long Beach earthquake that earthquake design criteria made it into state building regulations.

Over 230 schools were damaged or destroyed in the 1933 earthquake, many built of unreinforced stone and masonry. Long Beach lost 75% of its schools in less than a minute of shaking. Fortunately, the earthquake occurred at 5:54 PM and almost all of the schools were unoccupied. In 1933, Robert Milliken chair of a state study on the earthquake wrote:
"In every community where the earthquake was at all intense — severe damage to school buildings was general. Auditoriums collapsed, walls were thrown down, and the very exits to safety were piled high with debris which, a few moments before, had been heavy parts of towers and ornamental entrances. It is sufficient to suggest the terrible consequences, had the same earthquake occurred a few hours earlier."

A month after the earthquake, the Governor signed the Field Act, requiring resistance to the side-to-side earthquake vibrations, the first in the nation aimed at K-12 schools. California schools have been tested in a number of earthquakes that followed, particularly the 1952 M7.3 Kern County earthquake. That earthquake near Bakersfield, damaged or destroyed 20 schools, almost all of them built before the Field Act was enacted. Newer schools built after the design regulations were enacted, performed very well.

Each strong earthquake in the State has triggered a re-examination of how schools and other structures performed, and in some cases, resulted in revising building codes. 1978 is a turning point for earthquake resilient design in California – structures built according to codes since then are considered relatively resilient. Regulations now requiring all public-school buildings to meet current code requirements have made California K-12 and Jr. College building often the most resistant structures in your community.

California schools aren't perfect. The regulations don't cover private schools and charter schools or four-year colleges and universities. Any newer buildings will be fine but there are still a number of older buildings, particularly in urban areas, in need of retrofit. Temporary classrooms can also squeak under the radar and don't necessarily include the tiedown straps that keep mobile homes and manufactured buildings firmly on their foundations.

Over 115 people died in the 1933 Long Beach earthquake, second only to 1906 as the deadliest quake in California's history. The majority of the deaths are attributed to falling debris. The California Geological Survey attributes two-thirds of the casualties caused by people running out of buildings and debris falling on them.

There are far few masonry buildings in California today as there were in 1933. Most counties have actively pushed retrofitting or removal. In California, brick buildings are required to post an alert sign, although they are rarely placed in prominent locations and few notice them. Several years ago, the Sunrise Rotary Club of Eureka asked me to give a talk. I was quite surprised to learn the location was in an Old Town brick building. Not sure if the audience liked what I had to say about their choice – they haven't asked me back.

Building an earthquake resilient community requires a number of pieces and at the top of the list is strong buildings. Earthquake engineering design requires understanding likely ground motions and how structures respond. Every large quake is an opportunity to learn more about this complex interaction. It is important for international teams to conduct detailed post-earthquake surveys and apply lessons learned to here.

Structural integrity is an important part of resilience but not the only one. Buildings can resist ground shaking with no damage, but non-structural items such as ceilings, conduits, and furnishings can cause injuries and damage as well, and in some cases, sparking fires or chemical leaks that do more damage than shaking. There aren't clear cut codes for non-structural parts of buildings, and it requires constant vigilance by occupants to reduce the hazards an ill-place bookcase of filing cabinet may have.

The final piece is human response. Time and time again, injuries are caused by people running when they need to stay put. This is the ShakeOut part. If we can get everyone to restrain those inner instincts to run out the door, we can significantly reduce ambulance calls, hospital time, and get everyone back to a new post-earthquake normal as quickly as possible. But encouraging people to stay put in buildings that might suffer major damage is a bit ingenuous. Let's make sure our building stock is safe.

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt, and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times--Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/taxonomy/term/5 and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column or to request copies of the preparedness magazine "Living on Shaky Ground."