

## **Not My Fault: Lessons from Ridgecrest**

Lori Dengler/For the Times-Standard  
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One year came and went with only a small ripple of attention. I expected some coverage but, outside of regional media, the attention was minimal. The July 5th M7.1 Ridgecrest earthquake was the largest to shake the state in over twenty years, but it caused relatively little damage and only one death, a man unfortunately working under his car at the time.

More notice has been paid in the scientific community. On Monday, the Earthquake Engineering Research Institute (EERI) released a voluminous report on reconnaissance studies conducted in the first few months after the earthquake.

Studying a sudden onset event like an earthquake poses obstacles. There is no way to predict in advance where, when or how big it will be and coordinating a thorough response requires advance planning. In my early days of studying earthquakes and tsunamis, response was ad hoc. The field was relatively small and a round of phone calls could usually pull together most of the researchers with expertise in the area. Much crucial evidence on both geological phenomena and structural damage is ephemeral and needs to be studied quickly. It often took several days to move equipment and personnel into an area to begin a study.

Back in April 1992, my colleagues and I used our personal networks to contact other researchers to study the Cape Mendocino earthquake. This was pre-internet and it took time to coordinate logistics to bring scientists and equipment into the area. A high priority is deploying seismographs to detect aftershocks to flesh out the details of fault rupture. The equipment needed to come up from the Bay Area and we missed the most vigorous part of the aftershock sequence. We did better on the geologic effects. The HSU Geology Department had world-class field geologists who were quickly able to mobilize students for reconnaissance studies. The one thing that fell through the cracks was the tsunami. By the time we were aware that a tsunami had occurred, it was too late to do a thorough study. We could have done a better job.

EERI established the first prototype clearinghouse after the 1971 San Fernando earthquake, bringing together earthquake engineers, geologists and seismologists and setting up a physical base so that research teams could interact with each other and share findings. It was so effective that then Governor Reagan established the California Post-Earthquake Information Clearinghouse. It became the model for response to subsequent damaging quakes. But when the Loma Prieta quake happened in 1989, the offices of several of the coordinating agencies (EERI, USGS, OES) were heavily impacted and no physical space was established.

In 2009, a formal operational plan for California Earthquake Clearinghouses was implemented, defining the lead agencies, responsibilities and operations framework. It became a proactive structure using scenarios and forecasts of likely epicentral regions of future earthquakes in the state to more fully plan in advance the expertise and equipment that should be deployed. Exercises were conducted testing a variety of likely earthquake events, including one on how to respond to a North Coast earthquake and tsunami.

The July Ridgecrest sequence was the first opportunity to fully test the new clearinghouse framework. EERI and the California Geological Survey were the lead agencies and after the 6.4 on July 4th and quickly established a physical space. Most of the research personnel were on site attending the first evening briefing on July 5th when the M7.1, largest earthquake in the sequence, occurred.

A complication arose immediately. The epicenter of the 6.4 foreshock on July 4th was within the China Lake Naval Air Weapons Station and strictly off limits personnel without clearance. The 7.1 mainshock was also centered within the Naval Air Station and access was needed to look a surface fault rupture and other surface faulting features. The Station also sustained damage and most personnel were evacuated. An arrangement was made between the USGS and the facility to allow limited access to the epicentral area by a select number of USGS scientists escorted by security personnel, to study the geologic features.

I don't have the space for an exhaustive summary of what the EERI report contains (see link below), but it is worth highlighting two points. The earthquakes have been followed by a vigorous, evolving aftershock sequence that continues to the present day. Unlike most San Andreas ruptures, fault slip occurred on many separate segments with different orientations. Triggered seismic activity has

occurred over a much larger region than the immediate aftershock zone extending as far north as Lake Tahoe.

The ground shaking caused relatively little damage to structures considering the size earthquake of this earthquake. Most structures in the Ridgecrest area were built in the past 30 years and are of light wood-frame construction and performed very well during strong shaking. An exception was manufactured homes, especially older ones with poor restraint systems. This is a problem seen in California earthquakes of the past several decades and will occur again in future quakes unless more resilient mobile home restraint systems are adopted.

The EERI report documents the work initiated by Clearinghouse activities. Many of these studies are ongoing and have become the framework of new studies. I have several friends and colleagues who were either part of the organizational structure or were participating scientists and my anecdotal assessment is the Ridgecrest Clearinghouse worked well. It worked because of the effort and resources that the State has put into the clearinghouse structure. It's been over twenty years since the last clearinghouse was activated in the State. Fortunately, the framework was regularly tested and supported and was able to quickly respond when the need arose. This is arguable the most important lesson. Don't slack off on your pre-event planning. Once gone, it's very hard to put back together.

Note: A virtual clearinghouse with photos and data maps is at <http://learningfromearthquakes.org/2019-07-04-searles-valley/> and includes a link to the full Reconnaissance Report.

Note: CGS has prepared a tsunami preparedness guide at <https://cadoc.maps.arcgis.com/apps/MapSeries/index.html?appid=61bc8d30b53e4fb5927ae199d31f5aef>

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