

New Zealand quake raises questions about L.A. buildings

Concrete-framed office buildings, like those on Wilshire Boulevard near the Hollywood fault, are similar to structures devastated in Christchurch's 6.3 quake.

Rong-Gong Lin II and Sam Allen, Los Angeles Times, 2-26-11

The level of devastation from this week's earthquake in New Zealand has some California scientists saying that the state's seismic building codes should be reevaluated to address the striking structural failures seen in Christchurch.

In New Zealand, the quake destroyed many buildings of the types that California officials have long said are most vulnerable in a major temblor: Older unreinforced brick buildings and concrete-framed office buildings erected in the 1960s and '70s. There are thousands of such buildings in the state, and many have not been retrofitted to make them less vulnerable to shaking.

Experts said the New Zealand quake highlights a need to refocus on fixing these buildings, an effort that has met with mixed success and now faces longer odds because of the bad economy. California has struggled to have hospital and college buildings retrofitted, much less private offices and residences.

A big concern are so-called non-ductile concrete frame buildings, which are numerous in California and caused particular loss of life in Christchurch. At the collapsed remains of the roughly 40-year-old Canterbury Television building, about 120 people were believed to be buried.

"People who are living and working in these buildings are largely unaware that they're in buildings that are deemed by most professionals to be dangerous," said Thomas Heaton, professor of engineering seismology at Caltech. "So it's almost for certain that we're going to have some tragedy in the future, and various people will say, 'Oh yeah, we knew that that kind of building was a big problem.' And the rest of society will ask, 'Why didn't we do something about it?'"

The Christchurch quake is also a stark reminder that the size of an earthquake is not necessarily as important as where it occurs. Christchurch was hit by a 7.1 quake in September. But because it was located 30 miles away and was far deeper, it did not cause as much damage as Tuesday's 6.3 shaker, which occurred less than six miles from the historic downtown and caused a surprisingly large amount of ground movement.

"If the dart lands right on you, it generates intense shaking and a lot of buildings that we think are safe turn out to not be safe," said Susan Hough, a seismologist with the U.S. Geological Survey.

There has been much focus in California on the potential for the Big One on the 810-mile San Andreas fault, which at its closest point is 40 miles from Los Angeles. But there are several dangerous faults that run under densely populated sections of the Los Angeles Basin that have long worried scientists: the Puente Hills thrust fault underneath downtown Los Angeles and the Newport-Inglewood fault, which produced the destructive 1933 Long Beach quake.

Another fault of concern is the Hollywood fault, which runs along Sunset Boulevard south of the Hollywood Hills. A sizable quake on this fault could cause major damage because the area is dotted by concrete-frame structures, such as the office buildings along Wilshire Boulevard. Then there are all the unidentified faults in Southern California. Like many quakes in Los Angeles, the Christchurch temblor occurred on a previously unidentified fault system.

To understand why this week's quake was such a catastrophe, it's important to look beyond its magnitude.

The highest ground acceleration was recorded at more than 2G, or twice the force of gravity -- which would make Tuesday's quake among the most powerful in terms of ground-shaking acceleration on record, Hough said.

Hough said there are eyewitness reports of people being thrown into the air. In the end, the quake was simply too strong for many buildings.

"I strongly suspect the accelerations just exceeded the design values," Hough said.

By contrast, the ground shaking in the 6.7 Northridge quake in 1994 was recorded at 1.7G, Hough said. Hough has estimated that the strongest ground shaking in Port-au-Prince in the Haiti earthquake in 2010 was only about 0.5G.

Heaton said that the Northridge and 1987 Whittier Narrows quakes would have been far more damaging had they occurred closer to downtown Los Angeles.

Officials are still tallying the damage in Christchurch. But there is evidence that at least some buildings that receive seismic retrofitting failed. Amir S.J. Gilani, a California-based structural engineer with Miyamoto International, said in a written report that the ChristChurch Cathedral, which crumpled this week, had been retrofitted in the late 1980s and seemed to have performed well last September.

Gilani said that retrofitting project had been used to "showcase our advances in this field," particularly after it survived the September quake. "However, it certainly experienced much larger accelerations in the 2011 earthquake for which it was obviously not prepared for," he wrote.

In New Zealand, town councils are responsible for identifying vulnerable structures and can require strengthening or order demolitions. In some cities, such as Wellington, the effort to prepare for a quake has been particularly aggressive, said Jason Ingham, a civil engineer at the University of Auckland. He estimated that 500 of the 700 buildings in Wellington — the country's capital — identified as vulnerable have been strengthened or torn down in recent years.

But in Christchurch, the country's second-largest city, the response has been more passive, Ingham said. The city was not believed to be the most likely location for a major quake, and authorities were reluctant to press for demolitions because of the costs involved.

"Generally speaking, people don't want to force a demolition, especially of heritage buildings," Ingham said. "So the passive approach is more common."

Ingham said there were about 600 unreinforced masonry structures in Christchurch and that the majority of them suffered some damage during Tuesday's temblor.

California has about 7,800 such buildings in high-seismic zones, and many more vulnerable concrete-frame buildings.

"I would not be surprised that we would face what Christchurch faced in many jurisdictions in California," said Fred Turner, structural engineer with the California Seismic Safety Commission.