

3 Questions: Eduardo Kausel on Chile's massive earthquake

March 4 2010



Only slight damage can be seen on buildings in Santiago de Chile on the morning after the earthquake in February. Photo: Wikipedia

Santiago native Eduardo Kausel, a professor in MIT's Department of Civil and Environmental Engineering (CEE), is an expert in structural dynamics and earthquake engineering. In an interview with MIT News, Kausel explains why Chile's stronger earthquake led to less-catastrophic damage than the earthquake that struck Haiti in January.

He also explains some of the risks that could be associated with a sizable [earthquake](#) in Boston, and why the philosophy behind building codes may be changing.

Q. Even though the 8.8-magnitude earthquake that rocked Chile was 500

times stronger than the 7.0-magnitude earthquake that struck Haiti in January, the scope of damage was significantly less. Describe for us some of the differences between Chile and Haiti that helped limit loss of life and property.

A. Chile possesses an educated middle class and ranks among the most developed nations in South America whereas Haiti is the poorest country in the Western Hemisphere. Clearly, there is a strong correlation between poverty and quality of housing and infrastructure. It is this difference more than the proximity of the epicenter of the earthquake that led to massive damage in Haiti.

The most fundamental reason for the difference in damage and casualties is that Chile has been taking into account the effect of earthquakes and designing for them since at least the beginning of the 20th century. Chile's building codes are comparable to those of the United States, Japan, Turkey or Mexico, and rank among the most stringent and demanding. They have to, because strong earthquakes are a fact of life in Chile.

In Haiti, however, virtually no construction is earthquake-proof, not even government buildings or the houses of the affluent. This may relate to the fact that although Haiti is in a seismically active zone, strong earthquakes there are much less frequent than in Chile and have return periods measured in centuries, not decades.

Q. In the U.S., earthquakes tend to be associated with the West Coast, but strong earthquakes have struck the Midwest and Northeast over the last few hundred years. In your view, are these areas of the country prepared to withstand an earthquake of considerable magnitude?

A. Considerable research is being carried out at present on how to make the Midwest safe against earthquakes. Fortunately, paleoseismology

seems to suggest that mammoth intra-plate earthquakes such as the four that took place in New Madrid, Missouri, between Dec. 16, 1811 and Feb. 7, 1812, which rank among the strongest in the Midwest in historic times, may be rare — although strong quakes on the order of magnitude 6 or so could be expected to occur sometime this century. Still, the problem is not only technical, but also economical, for any upgrading of the large inventory of old, low-rise, unreinforced masonry structures from Chicago through St. Louis to Memphis would entail enormous costs, which the public would have to weigh against the low risk.

A somewhat different story is that of quakes in the Northeast from Boston to Canada. Although not as strong or frequent as those in California, they may not be so rare either. For example, some strong earthquakes have recently taken place in the Quebec province, but having occurred in largely uninhabited areas, they have been inconsequential. On the other hand, a repeat of the 1755 Cape Ann earthquake some 50 miles to the northeast of Boston could conceivably produce substantial damage to the unreinforced red stone buildings of Back Bay, an area that was reclaimed from the Atlantic Ocean and has very soft ground conditions. But probably the more important risk factor there may be the gas lines embedded in that soft infill soil whose possible rupture could lead to fires.

It is worth keeping in mind that modern high rise buildings in Boston and elsewhere in the East and Midwest are very safe indeed, for they not only account for seismic considerations, but have been designed to resist the enormous overturning forces caused by strong winds or even hurricanes, which are much more frequent than earthquakes in this region.

Q. What can we do to prevent significant damage in the U.S.? How can building codes and processes be improved further?

A. Over time, all codes continuously evolve, reflecting the lessons learned from past design mistakes, most of which were not a-priori obvious. Until recently, the goal of seismic codes was to protect human life, not the buildings themselves. This philosophy may be gradually changing now. It has been argued that the economic loss to the affected region or nation can be far greater than the aggregate of the physical losses. An example is the massive damage to the port facilities in 1995 by an earthquake in Kobe, Japan, which caused much of that port's shipping commerce to move elsewhere. Societal and economic considerations such as these may begin to affect seismic codes yet to come.

In Chile's case, the various bridges that failed on the highway to the south are not only a loss to the local municipalities or the Chilean highway administration, but the damage to the local economy may vastly exceed the cost of the bridges, which could have been made safer if constructed at a modest additional expense. The stricken area is the heart of the Chilean agriculture, akin to California's San Joaquin Valley. Much of the fruit consumed in winter in the U.S., not to mention the wine, comes from that area. If trucks cannot take these to the ports — many of which were also destroyed — then the produce cannot make it to our markets. Thus, the seismic codes that govern the infrastructure may be in need of upgrading. Expect the fruit and vegetable prices in the U.S. to rise sharply in the weeks ahead.

Provided by Massachusetts Institute of Technology

Citation: 3 Questions: Eduardo Kausel on Chile's massive earthquake (2010, March 4) retrieved 25 April 2024 from

<https://phys.org/news/2010-03-eduardo-kausel-chile-massive-earthquake.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private

study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.