

DJCOregon

Oregon's Building Connections

\$2 | VOL. 256, No. 132

EDUCATION IN THE WAKE OF AN EARTHQUAKE

Trip to central Mexico provides learning opportunity for Pacific Northwest engineers



Courtesy of WRK Engineers

Buildings in Mexico City damaged by an earthquake on Sept. 19 were studied by engineers, including one from Vancouver, Washington-based WRK Engineers.

Continuing to prepare the region for a 'big one'

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On Sept. 19, a 7.1 magnitude earthquake rocked central Mexico. With a major seismic event expected to hit the Pacific Northwest in coming decades, engineers visited Mexico City recently to see what they could learn to apply here.

"One of the biggest challenges is to get people prepared and make it a priority for the earthquake that is coming," said Brian Knight, a principal of WRK Engineers in Vancouver, Washington.

Knight traveled to the quake zone Sept. 28 to Oct. 5 as part of a team. He was joined by Erica Fischer, an assistant professor of structural engineering at Oregon State University; David Swanson, principal/director for structural engineering at Reid Middleton in Everett, Washington; Darin Aveyard, a Reid Middleton project engineer; and Kenny O'Neill, another Reid Middleton project engineer.

The earthquake struck exactly 32 years after one with an 8 magnitude hit Mexico City, killing thousands of people. Numerous smaller quakes have since occurred as well.

"They have dealt with infrastructure (damage) before, so this isn't new for them," Fischer said. "That is interesting for us because we haven't had to constantly recover. We haven't had the practice."

The recent earthquake killed 361 people. Swanson attributed much of the reduction in

deaths from 1985 to changes in building codes and more resilient design. Structural frames, in many instances, were not installed on buildings' interiors – a surprising discovery for Swanson.

"I was impressed at the creativity of the building retrofits that took place since 1985," he said. "They put the frames on the exterior of the buildings. They took risks on the retrofits. As a structural engineer, it was cool to see."

Swanson, who specializes in structural engineering, said that in many cases the Mexicans gave up aesthetics for practicality.

"They may not look super pretty, but they performed well," he said. "They made no bones about it and said let's forgo the looks and put these braces on the outside of the buildings."

Many of the buildings that suffered the worst damage featured confined masonry – similar, but not quite the same as the unreinforced masonry found in Portland. Confined masonry walls use brick or concrete block units, and horizontal and vertical RC confining members built on all four sides of a masonry wall panel. Unlike unreinforced masonry, the panels don't bear an entire force upon a building.

"The majority of the buildings that collapsed were the confined masonry," Knight said. "A lot of those had poor structural layouts and configuration."

One of the biggest factors that determined the level of damage was the type of soil underneath structures. Mexico City is largely built on a

dry lake bed. The soft soil amplifies the shaking throughout structures.

All buildings have a natural period, or resonance, which is the number of seconds it takes to naturally vibrate back and forth. Soft soil sediments can significantly elongate the period of seismic waves and the increase in a natural period. That usually leads to more damage.

The phenomenon was also seen in how the city's water and road infrastructure fared.

"What we are interested in is how much the earth moved," Fischer said. "If you have earth moving in two directions, the (water) pipe can't stand it."

She said that information gathered during her trip would be helpful in a study she was conducting on how to make infrastructure, especially water infrastructure, withstand seismic forces better.

Maintenance was a key aspect in how infrastructure fared in Mexico, Fischer said. Water officials had pinpointed areas that were especially vulnerable and needed special attention.

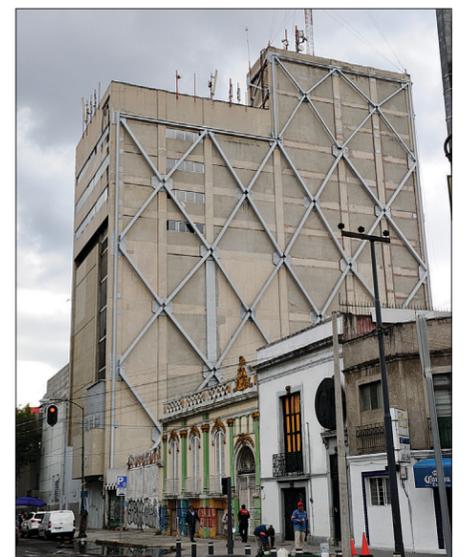
"What we have seen is that there had been repairs that occurred to the pipeline," she said. "By default, they have more modern materials so they are stronger and can resist movement."

A key aspect of Fischer's study, she said, is tied to water infrastructure.

"We are focusing on Western Oregon," she said. "It is looking at the most vulnerable areas in Oregon and how to improve them so people have access to water after an earthquake."

The Mexican trip brought home the danger big quakes pose, Swanson said.

"It reminds us as engineers that certain styles of buildings are known hazards," he said. "We as a community ought to do something about it. It's a vivid reminder that they are still hazardous."



Courtesy of WRK Engineers

Some buildings in Mexico City suffered less structural damage than others from an earthquake on Sept. 19. Engineers from the Pacific Northwest visited the city to learn more.