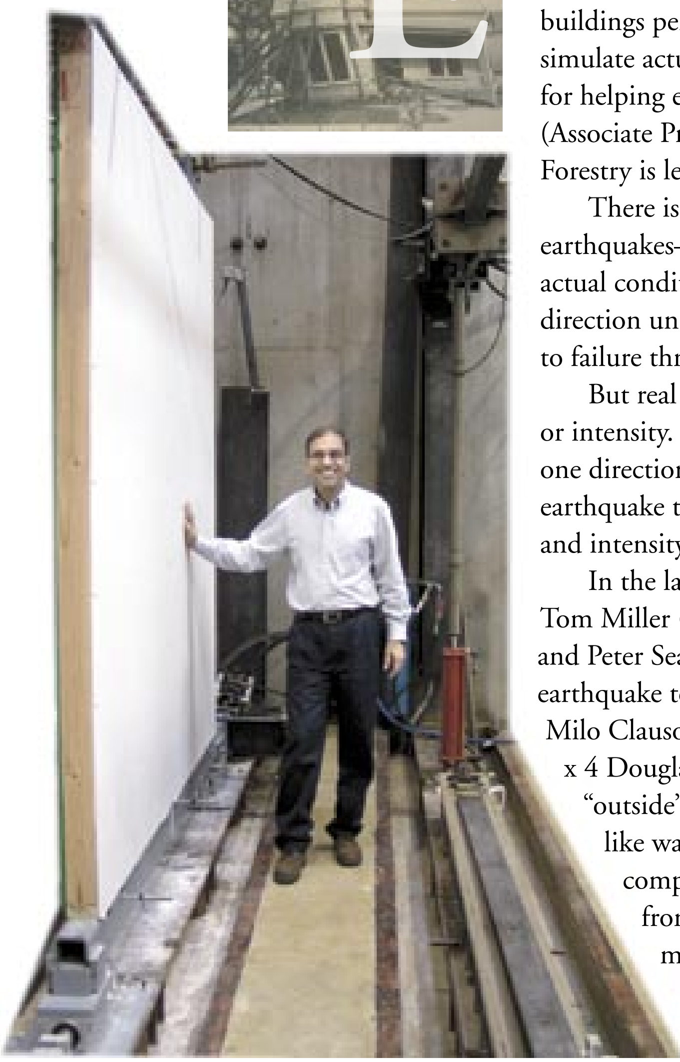
Quake, Rattle, and Roll

Simulating "The Big One" with dynamic earthquake tests

Notable notes in forest research at Oregon State University College of Forestry



Earthquakes and other natural disasters can significantly damage structures. Some of these losses may be due to gaps in our knowledge of the way buildings perform during real earthquakes. Creating better test methods that simulate actual earthquake stresses on buildings would be a valuable tool for helping engineers and architects design safer structures. Rakesh Gupta (Associate Professor, Wood Science and Engineering) at the College of Forestry is leading a team to do exactly that.

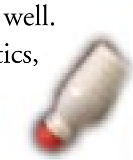
There is no national standard for testing building designs against earthquakes—and although researchers have tried different tests, none match actual conditions. In *monotonic testing*, the test wall is pushed sideways in one direction until it breaks or fails. In *cyclic testing* the wall is pushed and pulled to failure through a regular cycle of increasing and decreasing loads.

But real earthquakes are not regular—they vary in length and strength or intensity. And they create varying stresses on buildings from more than one direction and at fast, random rates. Therefore, to be more effective, earthquake testing should be *dynamic*—simulating the duration, randomness, and intensity of an actual earthquake.

In the large wood engineering lab at Richardson Hall, Gupta and Tom Miller (Civil Engineering) and their graduate students Kevin White and Peter Seaders have been conducting monotonic, cyclic, and dynamic earthquake tests on shear walls with the help of Milo Clauson (WSE). The walls are built of 2 x 4 Douglas-fir with OSB sheathing on the "outside" and sheetrock on the "inside", just like walls found in wood-frame houses. The computer-controlled tests use seismic data from real earthquakes such as the massive Chilean quake of 1960 (magnitude 9.5).

For one test, the inside wall is decorated with metal bracketed book shelves complete with books, containers, and even a teddy bear. As the wall rocks and shakes violently, nails twist and bend loose and items come crashing down from the shelves onto the concrete lab floors.

Despite the teddy bear's tumble, Gupta says the wood-frame wall responded surprisingly well. "An earthquake is a release of energy," he says. "Wood has good energy-absorbing characteristics, and it's lightweight and flexible—so wood buildings usually perform quite well during an earthquake. But we can make them safer still and that's our goal."



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