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SeismicWaves
How NEHRP is Advancing Earthquake Safety

Bringing Down the House

NEESwood Project Shakes Full-Scale Wood Townhouse in Northridge Simulation

Glass shattered and the walls shook. In an unprecedented recreation of the 1994 Northridge earthquake, NEESwood, a multi-year research project (CMMI-0529903) funded by the National Science Foundation (NSF), created a risky, very successful public test of the largest wood structure to undergo seismic testing in the world.

If you live anywhere in the United States, there's a very good chance, about 80 to 90 percent, that your home is constructed with wood-frame. For the NEESwood test conducted on November 14, 2006, researchers built a three-bedroom, two-bath, 1,800-square foot wood-frame townhouse on the twin shake tables at the University at Buffalo's Structural Engineering and Earthquake Simulation Laboratory, one of the NSF's George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) equipment sites. The townhouse was completely furnished, down to the car in the garage, two water heaters (one anchored, according to earthquake protection measures, and one not anchored), and dishes on the dining room table.

During the test, 250 sensors inside the townhouse gathered information about the behavior of each component of the building during the simulated earthquake. A dozen video cameras recorded the shaking as it occurred. According to Dr. John van de Lindt, Associate Professor of Civil Engineering at Colorado State University and Principal Investigator for the project, the test has already begun to generate useful data on how to construct wood-frame homes and make buildings safer for occupants during earthquakes. "The results from this benchmark study will probably change the way we model wood-frame structures. That's a huge advance because without those modeling tools, we would not be able to achieve our greatest objective, which is constructing mid-rise (up to six-story) wood-frame structures that perform better during earthquakes and provide an economical and sustainable construction solution."

Unlike most seismic tests, which are conducted on small models, the NEESwood simulation featured both the full-scale structure and very severe ground motions in three directions. Andre Filiatrault is a University at Buffalo Professor of civil, structural, and environmental engineering and lead investigator on the test. "The test demonstrated in a dramatic way how much damage can occur during an earthquake if homeowners don't take the proper precautions." Detailed evaluation of the data gathered by the sensors and cameras will take about 6 months.

Photo is courtesy of the NEESwood project web site, www.engr.colostate.edu/NEESWood

The test ends the first year of the 4-year, $1.24 million NEESwood project. Led by Colorado State University, the NEESwood research is based on the premise that if more were known about how wood structures react to earthquakes, then larger and taller wood structures could be built in seismic regions worldwide, providing economic, engineering, and societal benefits. The NEESwood project will culminate with the validation of the new seismic design processes early in 2009, when a six-story wood-frame structure, pre-fabricated in the United States, will be shipped to Miki City, Japan, and tested on the world's largest shake table.

In addition to showcasing the NEESwood project's research, the test highlighted the equipment, IT capabilities, and staff at the University at Buffalo NSF NEES site. There were 561 simultaneous webcast connections during the test and more than 1,300 hits in the first 24 hours after the video of the test and photos of the event were made available on the University at Buffalo-NEES web site, http://nees.buffalo.edu/projects/NEESWood/video.asp.

NEESwood includes researchers from Colorado State University, the lead institution, Cornell University, Rensselaer Polytechnic Institute, Texas A&M University, and the University at Buffalo. NSF's NEES, which is authorized and funded by the National Earthquake Hazards Reduction Program (NEHRP), consists of 15 earthquake engineering experimental equipment sites available for experimentation on-site or in the field and through telepresence. The NSF NEES equipment sites include shake tables, geotechnical centrifuges, a tsunami wave basin, unique large-scale testing laboratory facilities, and mobile and permanently installed field equipment. With NSF funding, NEES Consortium, Inc., www.nees.org, operates the NEES infrastructure. The NEESwood project web site is www.engr.colostate.edu/NEESWood.