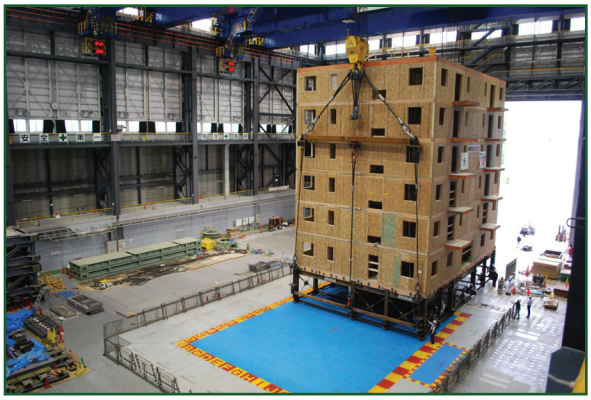
RESEARCH in Progress

Coalition for Advanced Wood Structures
a university, industry, government partnership

Understanding the Behavior of Mid-Rise Light-Frame Wood Buildings—Phase II

Mid-rise wood-frame construction provides many benefits, ranging from rapid and economical construction to sustainable and resilient construction. A design philosophy recently developed in the NEESWood (Network for Earthquake Engineering and Simulation: Development of a Performance-Based Seismic Design Philosophy for Mid-Rise Woodframe Construction) project enables this type of construction for six-story multi-family buildings in high seismic regions of the United States. The world's largest earthquake shake table test took place as part of this project in Miki, Japan, on a building with over 14,000 ft^2 of living space in 23 living units, with a total of 36 bedrooms.



The 820,000-lb NEESWood Capstone Building being moved to the shake table using twin 450-ton cranes at the E-Defense laboratory in Miki, Japan.

Background

The development of a new design philosophy is typically based on existing test data and experience. In this case, test data are not available because buildings of this type and size have never been tested and most existing buildings are only four stories, thus practitioners and researchers have limited knowledge of their behavior in an earthquake. Therefore, the results of these tests will provide the first-ever data set on a mid-rise light-frame wood building subjected to a large earthquake.

Objective

The two major objectives of this research are (1) to demonstrate that a mid-rise light-frame wood building designed using the performance-based design approach of the NEESWood project performs as expected under a series of large three-dimensional earthquakes and (2) to examine how a mid-rise wood-frame building similar to the four-story buildings found in the western United States performs under large earthquake ground motion.

Approach

The research involves designing the building using the new design philosophy and developing detailed design drawings. Seventeen 8- by 8- by 40-ft shipping containers of wood and wood products were shipped from the U.S. west coast to Osaka, Japan. The building was constructed from February to June 2009 and instrumented in late May to early June 2009. The building was tested in July 2009, and the report is being written currently. FPL researchers worked closely with Colorado State University to optimize instrumentation and ensure that key measurements were gathered during testing to help guide how light-frame wood buildings are designed in high seismic regions.

Expected Outcomes

Results of this project will provide key information to the light-frame wood seismic design community for

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The mid-rise light-frame wood NEES-Wood Capstone Building sits on top of the world's largest shake table in Miki City, Japan, awaiting testing in July 2009.

safely increasing the height of this type of construction in seismic zones of the United States. In addition, it is anticipated that shortly after the report is released in 2010, a new design philosophy for mid-rise light-frame wood buildings will be discussed for adoption.

Timeline

The key benchmarks for the project are July 2009 for completing the final large test and conducting media day and March 2010 for submitting the draft FPL report for review.

Cooperators

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