NHERI TallWood

Shake Table Testing of A Full-Scale Resilient 10-Story Mass-Timber Building
Newsletter Issue 2: August 26, 2022

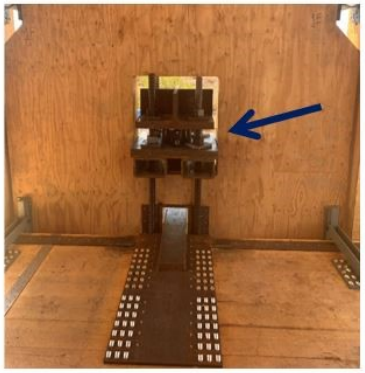
First Three Stories are Complete

As mentioned before, the building will be erected in sets of stories: 1-3, 4-7, 8-10. The first three story module is now complete, together with the bottom segments of rocking walls.



Left: Placing the south rocking wall; Middle: Site staff installing temporary post-tensioning; Right: First three stories complete

The installation of the rocking wall panels involved several steps. First, the wall panels were prepared by attaching all necessary steel hardware on the ground, then hoisted by crane from above and guided into slots to rest on the foundation beams. The steel shoes at the toe of the walls will protect wood material at this critical location from excessive damage from base impact due to rocking. The walls were then temporarily braced to the floor diaphragm before the special shear key connections were inserted into the wall. U-shaped flexural plates (UFPs) were added between the rocking wall panel and bounding columns for energy dissipation. Finally the wall panels were post-tensioned to the foundation through a cutout above floor 2. This post-tension step is needed to provide lateral bracing for the building during construction, and will be released once the full post-tensioning from top of the 10-story tall wall is applied at the completion of the construction.


Left: Rocking wall with base shoes; Middle: Temporary post-tensioning for construction bracing; Right: UFP between wall panel and bounding column

The installation of the second module (stories 4-7) is underway as of 8/24 with progress on the next two levels including stairs, columns and beams. The live cameras at UCSD site has been adjusted to keep following the top of the building (see http://nheri.ucsd.edu/video/).


Left: Story 4 and 5 columns; Right: Placing story 5 stairs

Test Feature Highlight: Rocking Wall Shear Key and Out of Plane Bracing

The connection of the floor diaphragms back to the rocking wall is a critical detail that will influence the resilience of the system. The inertial forces at the floor levels must be collected and transferred to the rocking walls. However, a rigid connection of the floor diaphragms to the rocking walls will tie the floor diaphragms to the rocking wall uplift, inducing large bending demands and potential damage to the floor systems.

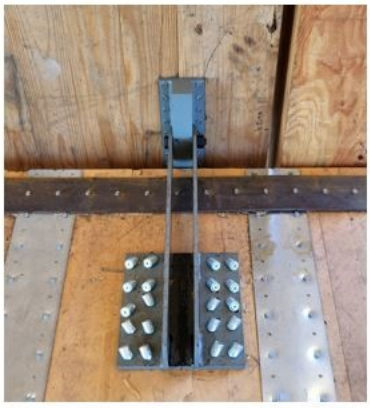
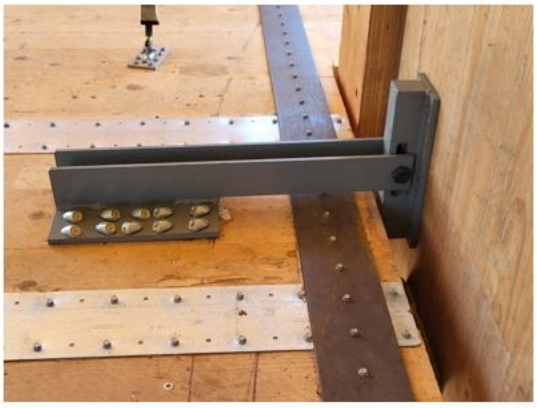
To transfer the inertial forces while isolating the floor system from the rocking wall uplift, this building uses a slotted shear key connection. A large steel plate is secured to the floor diaphragm with SIMPSON 8-MM SDCF 8 5/8" screws drilled in at 45 degree angles in both directions. Then, a solid steel section referred to as “the shear key” is inserted through the slot in the wall and

welded to the plate. This same style connection was used in our 2017 test of a 2-story building with CLT rocking walls, and was shown to effectively isolate the floor diaphragms from the rocking movement. With this detail, large accelerations resulting from the base impact due to rocking can also be attenuated in the floor diaphragms.



Left: Slotted shear key connection overview; Middle: Closeup view of fasteners; Right: Back side of shear key

In addition, the 10-story tall rocking wall panels will behave similar to a beam during lateral loading and are very susceptible to lateral-torsional buckling. At each floor level, two out-of-plane braces for each wall are installed to brace the rocking wall back to the floor diaphragm. This detail shortens the unbraced length and greatly increases the stability against buckling. Note the slotted connection is also implemented here in order to allow the wall panels to rock freely.

Left: Out-of-plane brace for the wall; Right: Complete wall-to-floor connection with shear key in the middle and braces on either side.

Follow Construction Progress

Reminder: You can follow construction progress on your own by looking for our newsletters on the NHERI TallWood website: http://nheritallwood.mines.edu/, checking in with the site webcam http://nheri.ucsd.edu/video/, or following Ling on Twitter: @slpei.

Acknowledgements

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