

NHERI TallWood

Shake Table Testing of a Full-Scale Resilient 10-Story Mass-Timber Building Newsletter Issue 5: February 23, 2023

Final Phase of Test Preparations

The project team, NHERI@UCSD site personnel and collaborators have focused on two major activities since the beginning of the year: final exterior façade installations, and preparation and installation of sensors throughout the building.

The cold-formed steel exterior subassemblies have been detailed with a liquid applied air/vapor barrier, rainscreen, and aluminum composite (ACM) panel system that gets fastened with clips into the steel sheathing. Ehmcke Sheet Metal (and their suppliers) donated all the materials for this system, and they are contracted to do the installations. Ehmcke Sheet Metal also helped us out by installing windows (donated by Innotech Windows + Doors and Winco Window) and exterior joints (donated by Construction Specialties). As of now, two of the three cold-formed steel framed exterior subassemblies are complete, and only the panel installation and final caulking remains for the third subassembly. Views of the subassemblies are shown in Figure 1.



Figure 1: (a) Completed platform-framed subassembly (CFS 1), (b) completed bypass framed subassembly (CFS 2), (c) spandrel framing subassembly in final stages (CFS 3).

The test plan calls for a total of about 710 sensors. More than 85% of these have now been installed in the building, with site staff doing the instrument preparation, and students doing the majority of the installations. Instruments will measure global accelerations and drifts, movement across joints, and strains in rocking walls and connection hardware. Sample installations are shown in Figures 2 and 3 below.

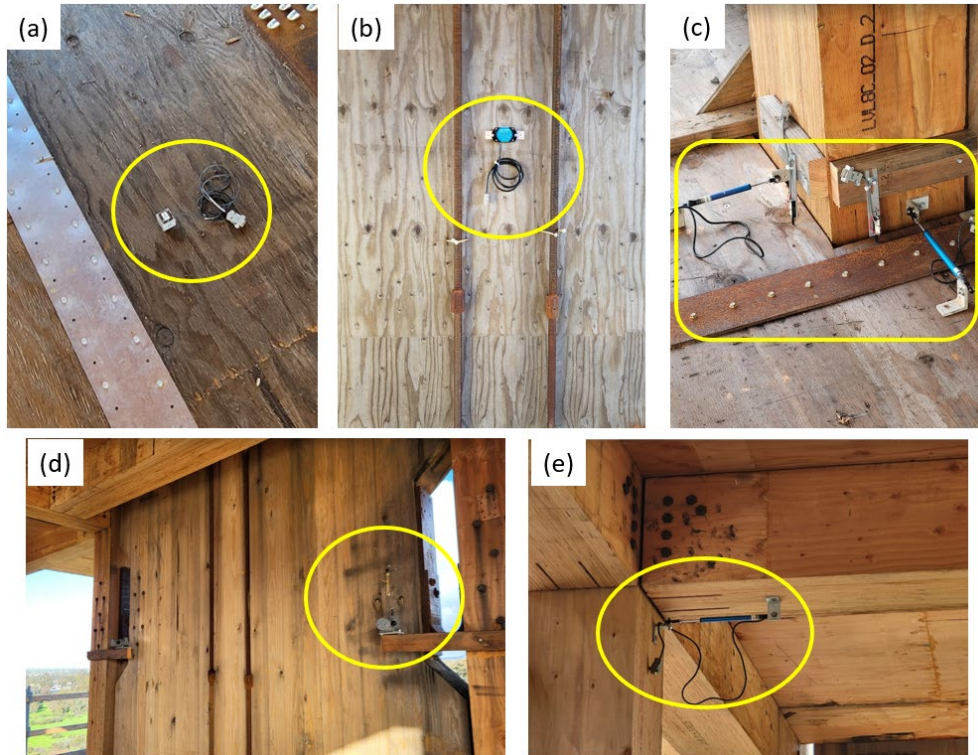


Figure 2: Sample instruments for the structure: (a) accelerometer on a floor diaphragm, (b) tiltmeter to measure rotation on rocking wall, (c) linear potentiometers to measure relative horizontal and vertical movement, (d) string pots to measure movement across UFPs, (e) linear pot to measure beam-column joint rotation.

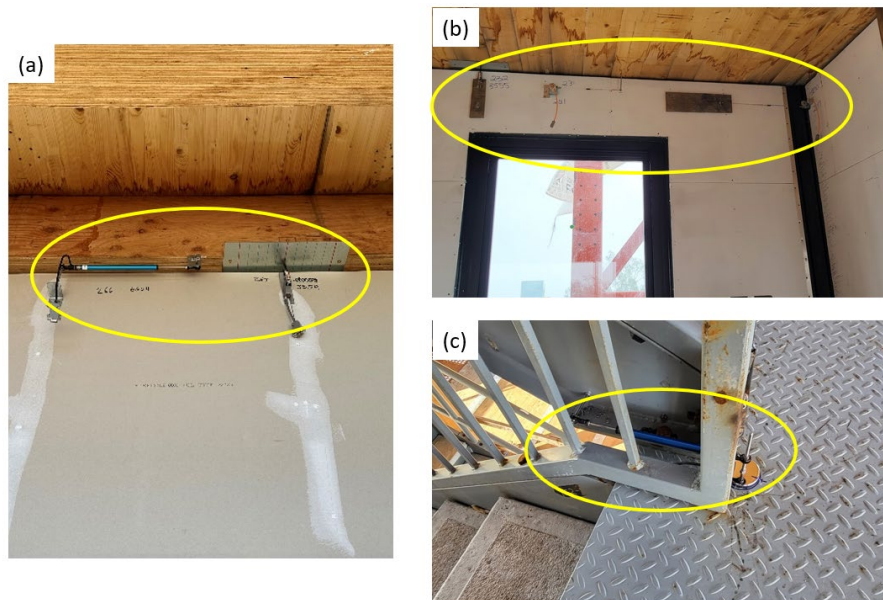


Figure 3: Sample instruments for nonstructural components: (a-b) linear pots to measure horizontal slip and relative vertical displacement at top of wall, (c) linear pot to measure movement of stair stringer relative to the mid-landing

What to Expect During Testing

The following tasks must be completed to be ready for testing. First, cables will be attached to all sensors, bundled and routed down to the data acquisition system located in the shake table control building. All sensors will be tested to make sure they are working properly. Cameras will be mounted throughout the building to capture dynamic response footage during the earthquake. Safety harnesses will be installed on the north side, attaching to the upper floors of the structure and anchored back to the ground, as a back-up catching system for the building. (Such measures are generally required when testing a structure to MCE level shaking.) Finally, the rocking wall post-tensioning forces will be calibrated to make sure they correspond to design target values.

Due to the scale of the test and instrumentation plan, it has been quite challenging to project a solid start date for testing. But all this testing preparation work is essential to accomplish the scientific goals of this project. We are currently projecting a starting in late March, and have optimized the overall testing time frame to fit within 4 weeks after the starting date. As we close in on the final preparation tasks, we should feel more confident about the timeline and will provide updates on the testing schedule.

We aim to send a short communication just before start of testing, and weekly updates during the test program. As mentioned earlier, we will start with low level shaking and gradually/systematically increase intensity over the duration of the test program. We plan to perform trials nearly every day during the 4-week test phase. To reiterate, collaborators and interested colleagues are welcome to visit and view a test in person; if you are interested please email us or reach out to one of the project investigators.

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

The structural system scope of this project is sponsored by NSF Grants No. 1635227, 1634628, 1634204. The nonstructural component scope of this project is sponsored by NSF Grant No. CMMI-1635363 and USFS Grant No. 19-DG-11046000-16. The use and operation of NHERI shake table facility is supported by NSF through Grant No. CMMI-2227407. The test program also received great technical, financial, and material donation support from industry leaders both with the U.S. and internationally; please see the full list of sponsors at <http://nheritallwood.mines.edu/collaboration.html>. The project team is very grateful for this support.

