RESILIENCE AND SUSTAINABILITY IN MASS TIMBER STRUCTURAL SYSTEMS

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Short Bio

Dr. Andre Barbosa's career spans over a quarter century in industry and academia. His research focuses on developing experimental testing programs and numerical tools geared to improving the resilience of the built environment to natural hazards (earthquake, tsunamis, hurricanes), with a focus on reinforced concrete and mass timber structures. He worked for seven years as a structural engineer in Portugal, before crossing the Atlantic and landing in the Western USA, where he has been for nearly 20 years. Dr. Barbosa completed his Ph.D. at the University of California in San Diego (UCSD) and has been at Oregon State University (OSU) since 2011. At OSU, he is the Glenn Willis Holcomb Professor in Structural Engineering. He holds an Honorary Professor position at the University of Bristol and an adjunct professor position at the Composite Materials & Engineering Center at the Washington State University.

Dr. Barbosa has co-authored more than 100 archival journal publications in top-tier peer-reviewed journals and has delivered more than 50 international conference presentations. In teaching and mentorship, Dr. Barbosa focuses on student and faculty diversity, engagement, and success. His student advisees have gone on to successful careers in academia and industry. His efforts and outputs have received various awards, such as the *2017 State of Oregon Daily Journal of Commerce Newsmaker* for contributions to the Cross- Laminated Timber Industry in Oregon and the 2023 ASCE Croes Medal for work on soil-structure interaction.

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Abstract

Mass timber buildings are changing skylines and changing the way engineers and architects think about buildings made out of wood. These buildings are not only made from sustainable resources, but they are getting taller and taller. Combined with innovative low-damage lateral force-resisting systems and non-structural components, tall wood buildings can serve as a promising resilient, sustainable solution for regions affected by strong earthquake ground shaking.

This presentation summarizes a recent testing program completed in April 2024 on the largest outdoor shake-table in the world. The testing program was developed with the goal of promoting resilient and sustainable structural solutions. With this goal, a full-scale, 6-story mass timber building structure was tested in three phases. The three resilient lateral force-resisting systems included: (1) a self-centering rocking walls with u-shaped flexural steel plates distributed over the height of the building, (2) a self-centering rocking wall with concentrated energy dissipators materialized using buckling-restrained boundary elements, and (3) an innovative steel moment resisting frame/concentrically braced frame hybrid structural system. The different tested building configurations also included non-structural walls, façade elements, resilient modular stair systems, and fire sprinklers. With the newly upgraded UCSD shake-table, the building systems were subjected to more than 100 ground motions and white noise shaking tests. The design, modeling, testing, and initial results from these tests will be discussed.