The University of Minnesota's Multi-Axial Sub-Assemblage Testing (MAST) Laboratory, the largest and most comprehensive of its kind in the world, provides a powerful tool for investigating the effects of earthquakes, hurricanes, tornadoes, and other extreme events on large structural components up to several stories tall. Key features of the MAST facility include:

- Precise Six Degree-of-Freedom (DOF) Control Technology
- Ability to test large-scale structures and structural sub-assemblages
- Quasi-static ramp and hold control and support for hybrid testing
- Ten high-resolution still image cameras and lighting control on adjustable height platforms or fixed locations
- Staging area for constructing specimen and equipment to relocate to test space

Dimensions & Capacities

- Rigid steel crosshead
- Up to 1320 kips of vertical force and +/- 20 inches of vertical displacement
- Up to 880 kips of horizontal force in each lateral direction with +/- 16 inches of horizontal displacement
- Capable of testing structures up to 28.75 ft in height and 20 ft x 20 ft in plan
- Ability to rotate control geometry and test structures on a diagonal 12 ft x 36 ft in plan.

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MAST LAB

Multi-Axial Sub-Assemblage Testing Facility

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Recent Research Projects

Hexcrete Tower Specimen

Unbonded Post-Tensioned Rocking Wall Specimen

Title: HEXCRETE TOWER FOR HARVESTING WIND ENERGY AT TALLER HUB HEIGHTS
PI: Sri Sritharan (Iowa State University)
Sponsor: Department of Energy

Abstract: A full scale cross-section of a Hexcrete Wind Turbine Tower was constructed and tested at the MAST Laboratory. Service level and extreme loads were applied to test the tower's designed strength capacity. Precast concrete members were provided by Coreslab Structures of Omaha.

Title: MULTI-SCALE, MECHANISTIC FRACTURE PREDICTION AND OPTIMAL PANEL ZONE PARTICIPATION IN STEEL MOMENT FRAME BUILDINGS
PIs: Gary Fry (Texas A&M University) and Michael Engelhardt (University of Texas at Austin)
Sponsor: National Science Foundation

Abstract: Steel moment frames are used widely for seismic-resistant building construction in the United States and many parts of the world. The overall goal of this research is to determine how much panel zone participation should be permitted in for acceptable inelastic seismic response of steel moment frames. Data from large-scale experimental studies at the MAST Laboratory will impact design practice and building codes for seismic-resistant steel moment frames.

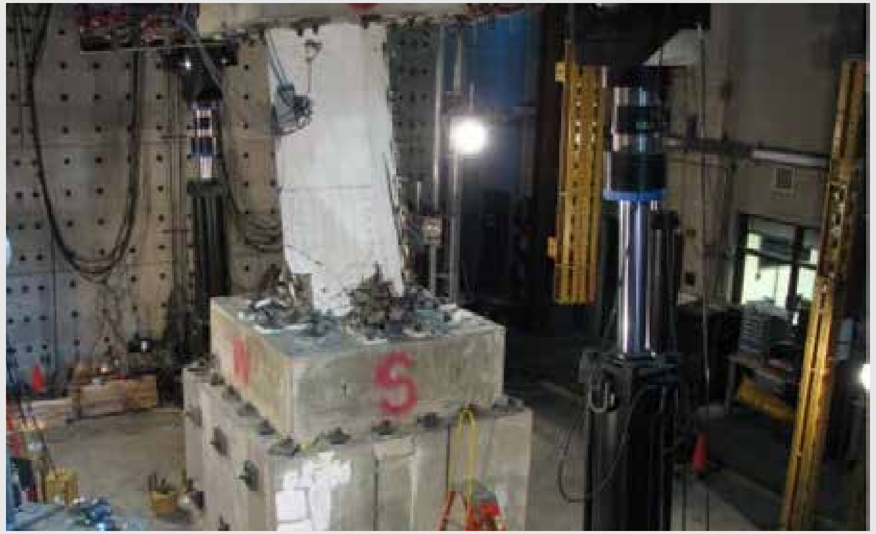
Title: UNBONDED POST-TENSIONED ROCKING WALLS FOR SEISMIC RESILIENT STRUCTURES SPECIMEN
PIs: Sri Sritharan (Iowa State University) and Cathy French (University of Minnesota)
Sponsor: National Science Foundation

Abstract: Resilient buildings can be achieved with self-centering structural systems to resist earthquake lateral loads. Using unbonded post-tensioning tendons, a cost-effective, self-centering wall system known, as a PreWEC subassemblage, was constructed. Tests were conducted to investigate the wall-floor connection concepts and the interaction of the rocking wall with the surrounding building system.

Title: FULL-SCALE RC AND HPFRC FRAME SUB-ASSEMBLAGES SUBJECTED TO COLLAPSE- CONSISTENT LOADING PROTOCOLS FOR ENHANCED COLLAPSE SIMULATION AND INTERNAL DAMAGE CHARACTERIZATION
PIs: Shih-Ho Chao (University of Texas at Arlington), Arturo Schultz (University of Minnesota), John Popovics (University of Illinois), Curt Haselton (California State University, Chico) Sponsor: National Science Foundation

Abstract: The collapse resistance of reinforced concrete (RC) structures is not well understood, even though collapse resistance is fundamental to the life-safety of building occupants. Data from full-scale column and beam-slab-column subassemblage tests was collected to define post- peak behavior. The experimental test data will allow researchers to develop accurate computer simulation models to predict when a building would collapse in an extreme loading event.

Steel Moment Frame



Large Scale Reinforced Concrete Column