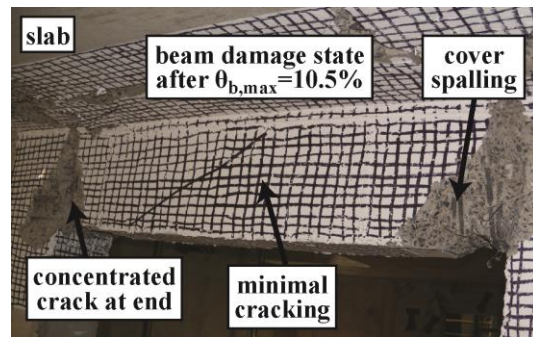
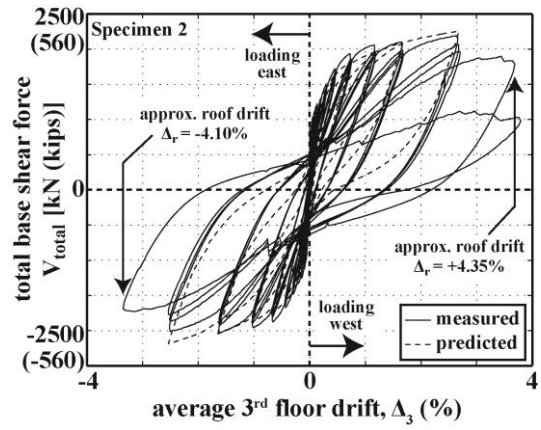


Earthquake Behavior of Concrete Coupled Wall Structures

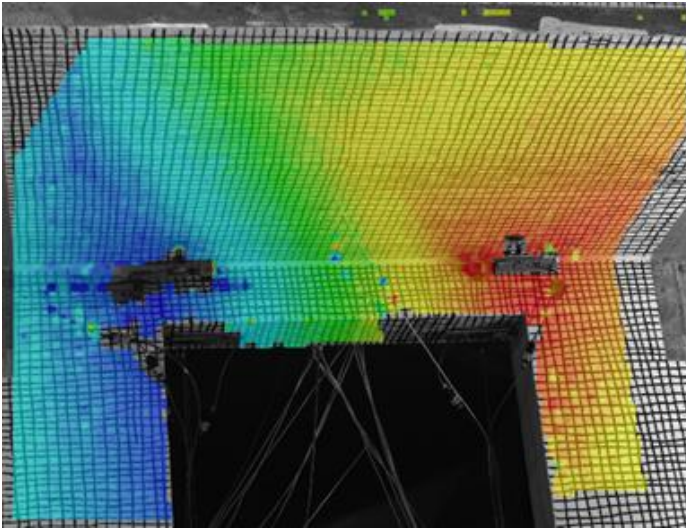
The seismic design, analysis, and large-scale experimental evaluations of a novel multi-story coupled shear wall system with post-tensioned coupling beams are presented in this final project report. In the new system, high-strength unbonded post-tensioning (PT) strands are used to couple (i.e., link) reinforced concrete (RC) shear wall piers and provide a self-centering (restoring) effect to the structure for primary lateral load resistance in building structures. Reversed-cyclic quasi-static testing of two 40%-scale coupled wall specimens with the proposed details was conducted to evaluate the system according to the requirements of the American Concrete Institute (ACI). The laboratory specimens represented the most critical bottom three stories of an eight-story prototype structure, consisting of two C-shaped wall piers, six coupling beams (two beams at each floor level), tributary slabs at each floor, and the foundation. The other (less critical) regions of the eight-story structure were simulated analytically. Overall, both test specimens performed very well and significantly better than conventional RC coupled shear wall structures. The specimens achieved ductile behavior through the completion of three full cycles exceeding the “validation-level” lateral roof drift prescribed by ACI, thus demonstrating the classification of these structures as “special” RC shear walls. In addition to a dense array of conventional sensors, the deformations of the laboratory specimens were monitored using up to 14 two- and three-dimensional digital image correlation (DIC) sensors, providing unprecedented near-full-field response data of the most critical regions of the structures. Ultimately, the high-fidelity measured data from these tests support the ACI validation of the design procedures and modeling/prediction tools for the use of post-tensioned coupled shear wall structures as primary lateral load resisting systems in moderate and high seismic regions of the U.S.

Funded by NSF Grant 1041598 NEESR-CR: Post-Tensioned Coupled Shear Wall Systems





Large Scale Coupled Wall Specimen, coupling beam, and load displacement response



Vertical Displacements of Coupling Beam Region during earthquake response