Material, Component, and System-Level Experimental Efforts within CFS-NHERI

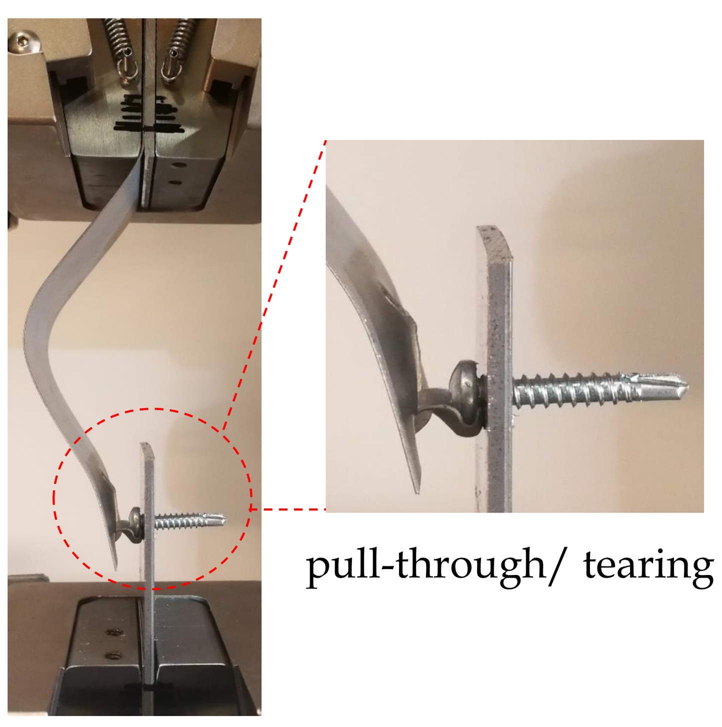
A. Singh, X. Wang, T.C. Hutchinson, Z. Zhang, B.W. Schafer, S. Torabian, H. Castaneda, F. Derveni, K.D. Peterman

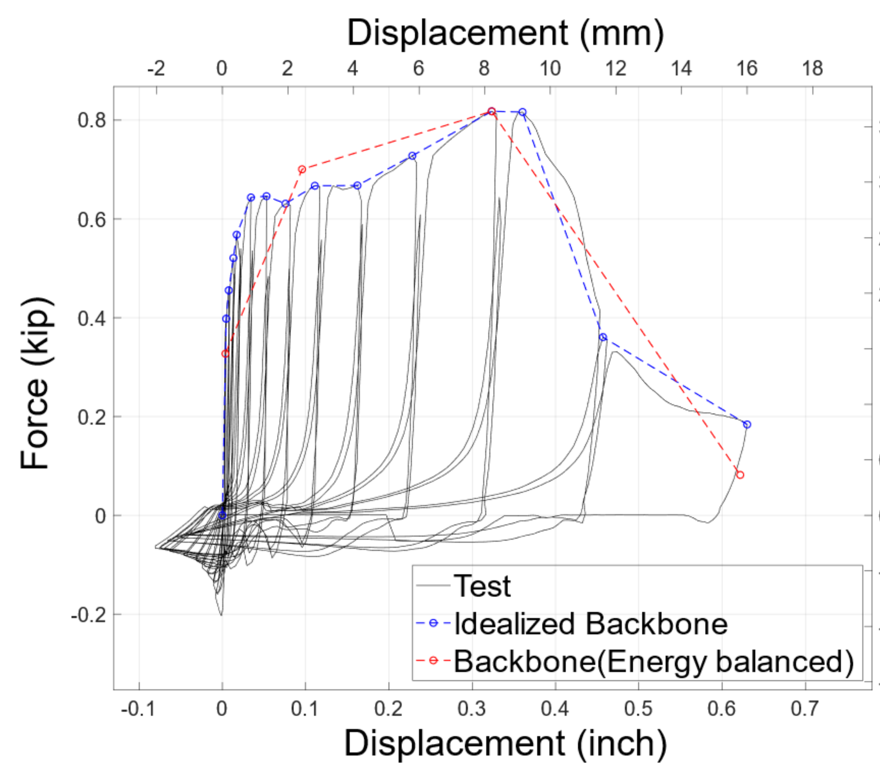
UC San Diego | Johns Hopkins University | UMass Amherst

CFS-to-CFS Connection Tests

Understand failure mechanism and obtain force-displacement behavior data:

- Sheathing thickness: 13/19/30 mil
- Fastener size: #8/#10/#12 Pan Head/PAF
- Framing member thickness: 54/97/118/188/375 mil
- Failure mechanism: Bearing & tilting/ pull-through/ tearing

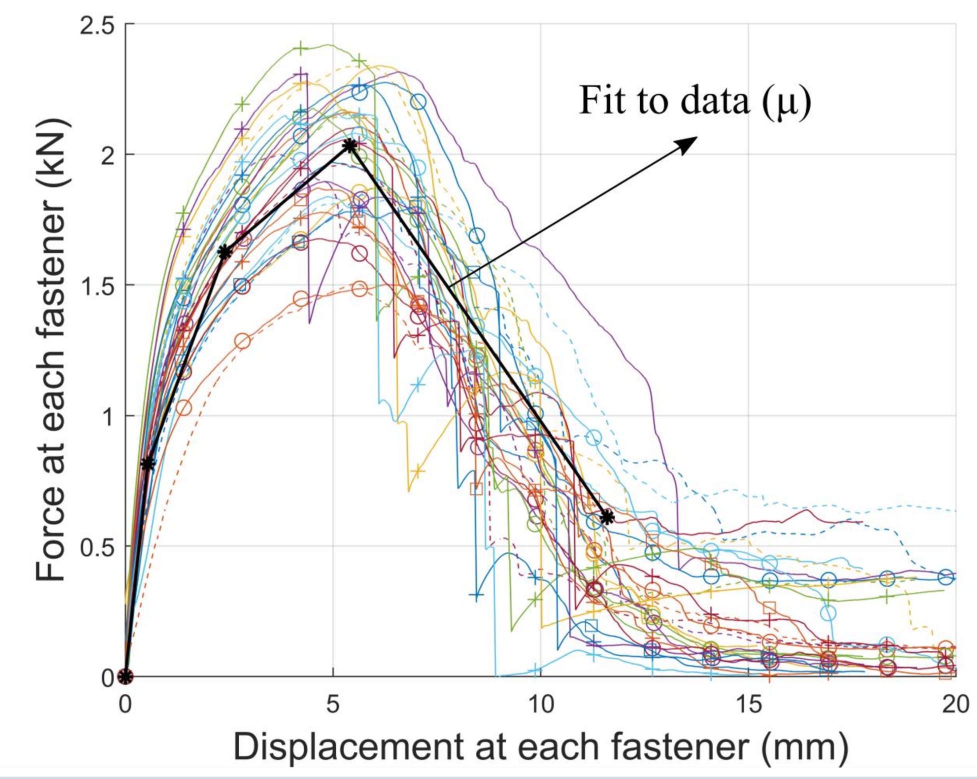




CFS-to-OSB Connection Tests

Quantify connection behavior variation and understand failure mechanism:

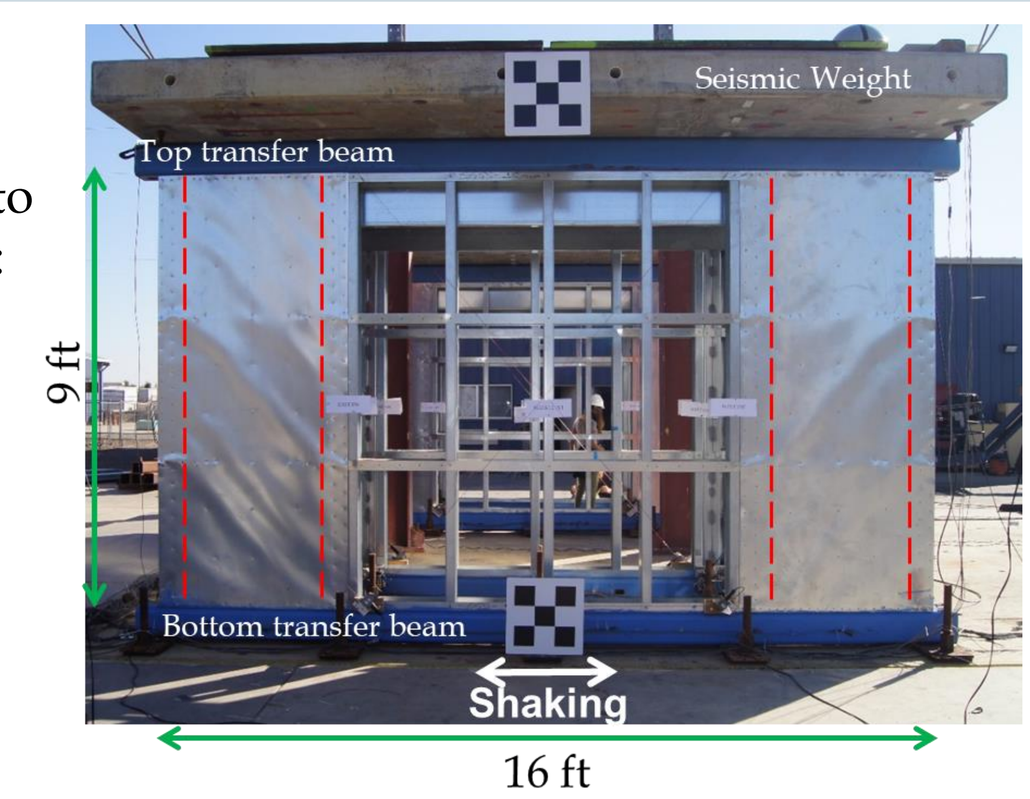
- OSB thickness: 7/16 in
- Fastener size: #8 Flat Head
- Framing member thickness: 54 mil
- Failure mechanism: Screw pull-through/ screw shear failure
- 38% variation in peak strength

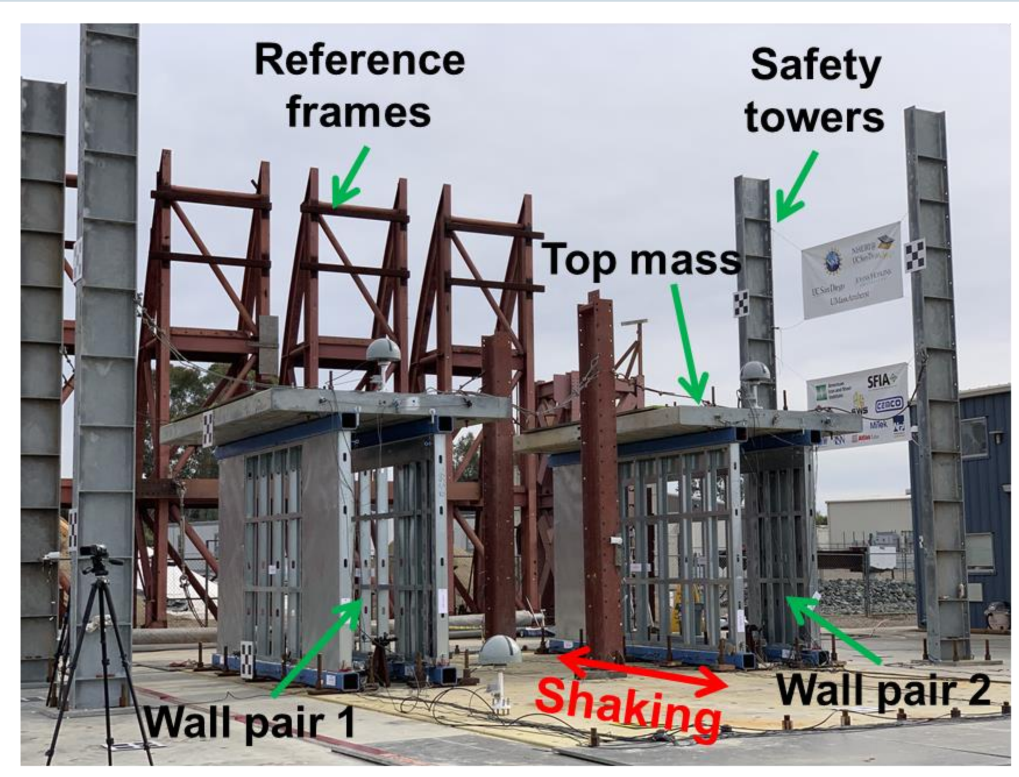


CFS wall-line tests

Characterize performance of CFS framed walls subjected to earthquake motions and displacement-controlled loading:

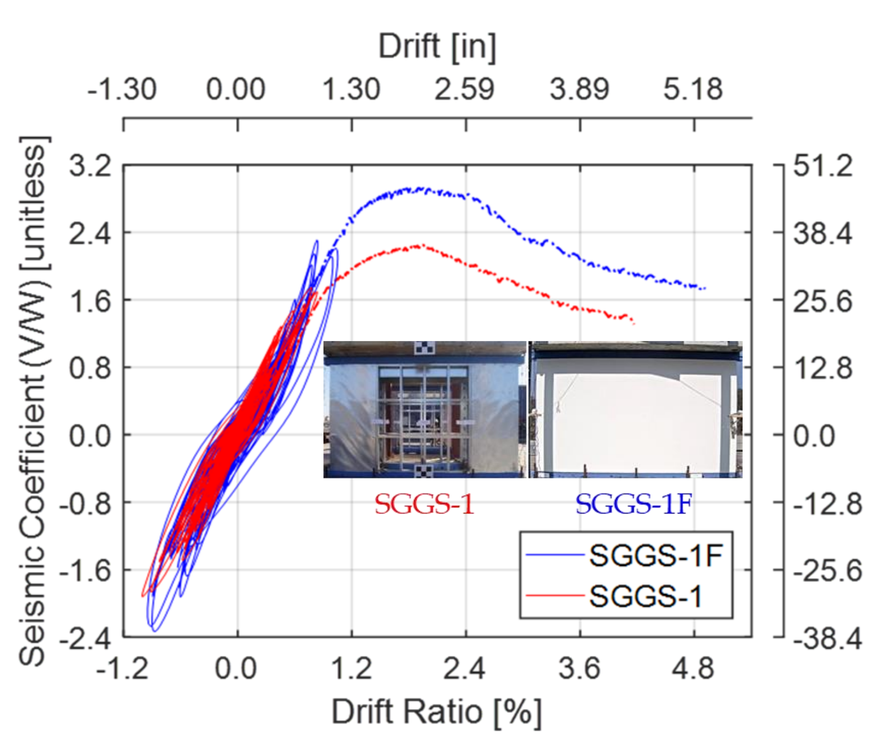
- Effect of finishes and effects of openings on wall behavior
- Comparison of Type I and Type II walls
- Compare steel tension tie-rods assembly versus hold-down systems
- Compare symmetrical and unsymmetrical walls

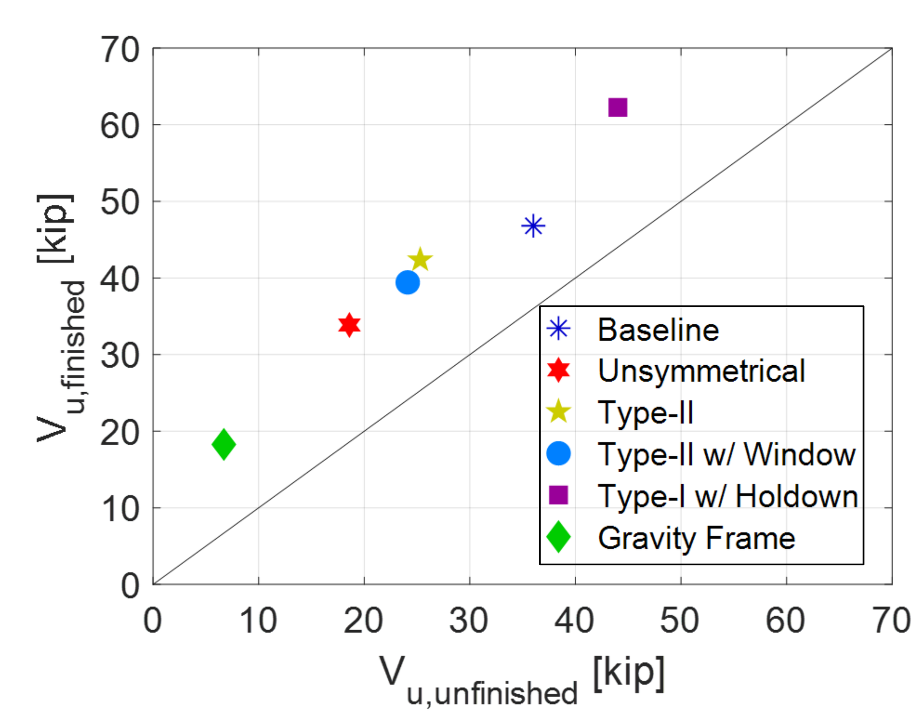


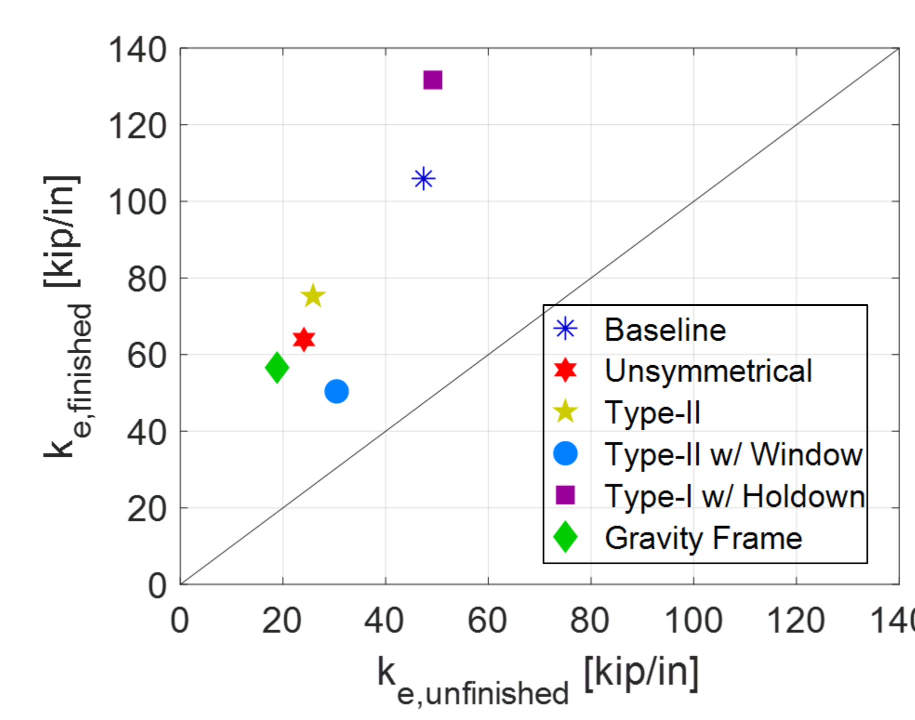


Effect of Finishes

Specimen	Peak Strength, V_{max} [kip]	Drift, $\delta_{V_{max}}$ [in] (%)
SGGS-1	36.0	2.11 (1.95%)
SGGS-1F	46.8 (↑30.0%)	2.05 (1.90%)



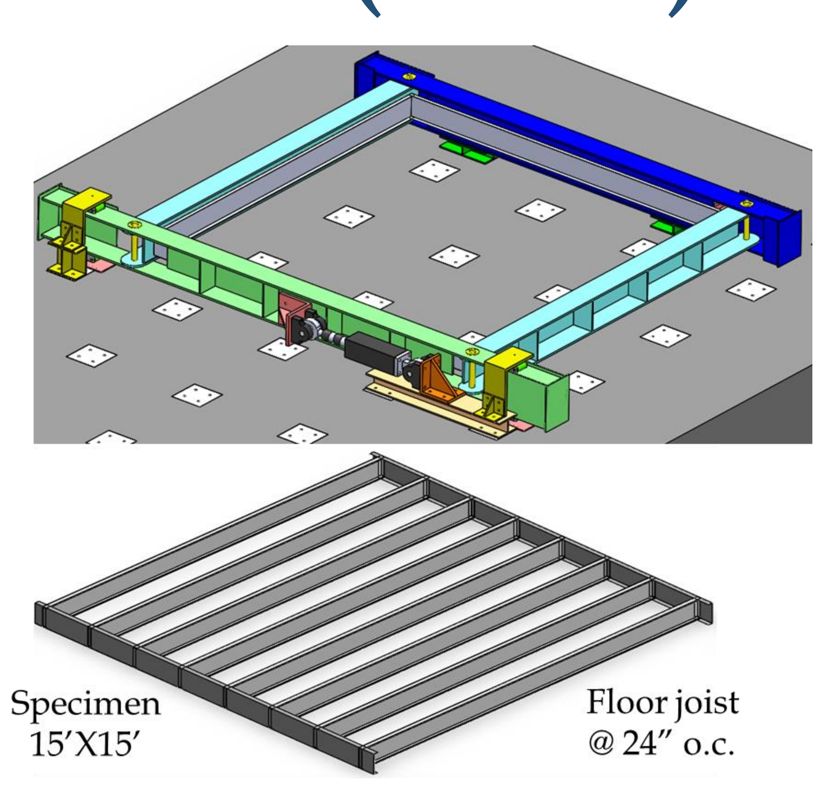




CFS diaphragm tests (2020)

Characterize performance of CFS framed diaphragms subjected to displacement-controlled monotonic and cyclic loading:

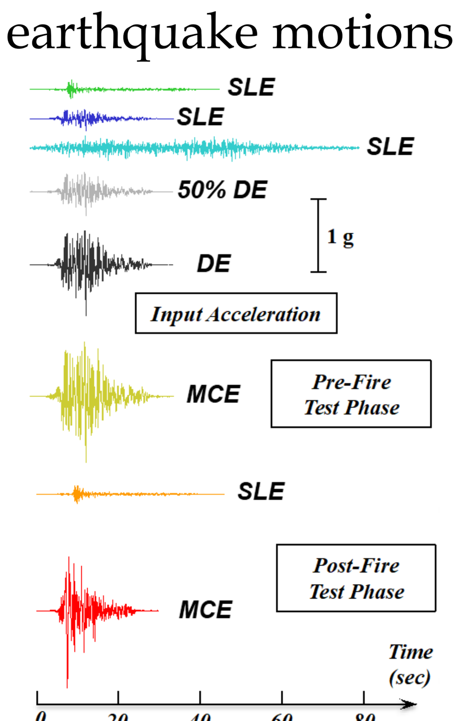
- Effect of sheathing material: OSB, Fiber Cement Board, and corrugated metal deck
- Effect of floor joist spacing: 24″ o.c./48″ o.c.
- Effect of open web floor joist

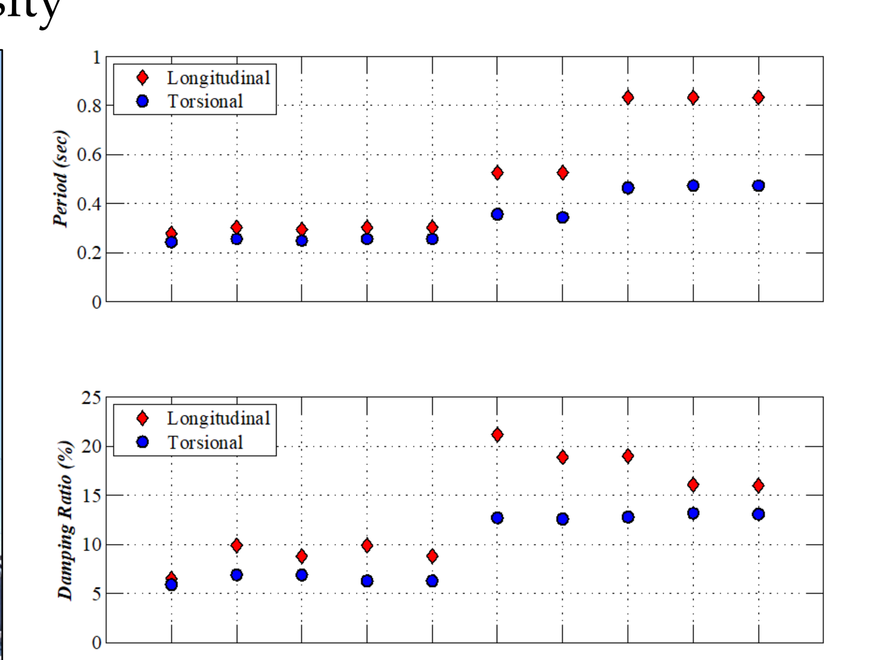


CFS building test (2022)

NHERI@ UC San Diego

Full-scale CFS framed building subjected to 6-DOF earthquake motions of increasing intensity





Figures and results courtesy of Wang et. al. (2016)

American Iron and Steel Institute

SFIA STEEL FRAMING INDUSTRY ASSOCIATION

Acknowledgements

The research presented is funded through the National Science Foundation (NSF) grants CMMI 1663569 and CMMI 1663348, project entitled: *Collaborative Research: Seismic Resiliency of Repetitively Framed Mid-Rise Cold-Formed Steel Buildings*. Ongoing research is a result of collaboration between three academic institutions: UC San Diego, Johns Hopkins and UMass Amherst, two institutional granting agencies: AISI & SFIA and ten industry partners including ClarkDietrich, CEMCO & SWS Panel. The efforts of NHERI@UCSD and Powell Lab staff in support for the test program are greatly appreciated.