Abstract submission for 2009 Structures Congress

Nonlinear Analysis of Timber Shear Walls and the Effects of Modeling Assumptions

Authors: Charles B. Chadwell, Ph.D., P.E., Kevin R. Camann

Contact: Charles B. Chadwell, Ph.D., P.E.
Assistant Professor
Department of Civil and Environmental Engineering
California Polytechnic State University
San Luis Obispo, California 93407
Tel: 805-756-1317
E-mail: chadwell@calpoly.edu

The ASCE/SEI 41-06 standard for Seismic Rehabilitation of Existing Structures provides guidelines for establishing hysteretic “backbone” curves that can be used for nonlinear time history analysis. In addition, limit states are identified upon the backbone curves for Immediate Occupancy, Life Safety, and Collapse Prevention. The typical FEMA backbone standard provides guidelines for the construction of representative elastic, plastic, stiffness degrading, and residual strength type response in their Type 1 Force-Deformation articulation model.

This paper investigates the sensitivity of the best fit FEMA backbone Type 1 curve using data from tested timber shear walls with and without non-structural components of gypsum wallboard and stucco façade. With the addition of non-structural components to timber shear walls, the hysteresis exhibits a fracturing type behavior under moderate levels of drift. This rapid loss of lateral load carrying capacity occurs when the non-structural elements become detached from the structural member. Depending on the assumptions used when fitting the FEMA backbone, the prediction of drift demands (and corresponding limit state identification) can vary significantly. Using the SAC ground motion suite for 2% in 50 year, 10% in 50 year, and 50% in 50 year hazard from the greater Los Angeles Area of California, this paper will present a parameter study describing the cause and effect relation between modeling assumptions and performance outcomes in the context of light frame bearing wall construction.