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AN EXPERIMENTAL STUDY OF THE RESPONSE OF REINFORCED CONCRETE FRAMES WITH WOOD PANEL INFILLS TO SIMULATED EARTHQUAKES

Reinforced concrete frames are often retrofitted to reduce seismic risk through the construction of full-bay masonry infills. Masonry infills historically have increased in-plane stiffness and reduced drift demands. An inherent risk remains during intense ground motions that unreinforced masonry infills can develop shear cracks, fail out-of-plane, or lead to the formation of captive-column conditions. This study explored the use of full-bay, plywood panel infills in non-ductile reinforced concrete frames as a novel seismic retrofit. Wood infills were constructed from layers of APA 3/4” Rated Sheathing plywood panels. Infills were tested using two single-bay, single-story concrete frames at 1/3 scale, with initial periods between 0.1 and 0.3 seconds once infilled. External post-tensioning was provided to the columns during all series to prevent column shear failure and doubled as dowel connections between the concrete frame and wood panel infill. Test series were performed on a uniaxial earthquake simulator with the frame bay parallel to the direction of ground motion. Wood infills were approximately $0.26 * b$, $0.18 * b$, and $0.09 * b$ thick, where b is the column width. Multi-layer infills were screw-laminated via a 6” square grid. Infills were tested in previously damaged and nearly pristine frames.

During similar ground motions, masonry infills reduced the effective period of the pristine bare frame by approximately 50%. In nominally pristine frames, one-panel plywood infills reduced the bare frame period by a maximum of 50%, and two-panel infills by 60%. One and two-panel wood infills reduced drift demands in comparison to the pristine bare frame by a factor of $\frac{1}{\sqrt{2*n}}$ in previously damaged frames and by $\frac{1}{2*n}$ in nominally pristine frame, where *n* is the number of panels of plywood forming the infill. There was no extra reduction in drift demands resulting from increasing the wood infill thickness beyond two panels. The one-panel wood infills failed via out-of-plane buckling causing through-the-thickness splitting at a drift demand of approximately 1.5%.

The results of this study confirm that wood panel infill retrofits performed as structurally viable alternatives to masonry infills in non-ductile reinforced concrete frames. Plywood panel infills reduced drift demands more efficiently per unit thickness and unit weight than masonry infills; the resilience and ease of construction of wood infills suggest expanded use should be explored. Experimental study of full-scale wood infills is needed before this retrofit method could become field deployable.