Investigation of the Effects of Spacing between Bolts in a Row in a Single-Shear Timber Connection Subjected to Reverse Cyclic Loading

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(ABSTRACT)

This thesis presents the results of testing to determine if spacing between bolts in a multiple-bolt, single-shear connection subjected to natural hazard loading affects seven strength and serviceability parameters: maximum load, failure load, E.E.P. yield load, 5% offset load, elastic stiffness, E.E.P. energy, and ductility ratio. This research also determines if a statistical difference exists between previously published research for 4D spacing as compared to results produced by this research for five alternate spacings: 8D, 7D, 6D, 5D, and 3D. Finally, this research determines which of the spacings examined: 8D, 7D, 6D, 5D, 3D; produced the most optimal results for each examined strength and serviceability parameter where optimization is based on economy and performance.

Three connection configurations with five different spacings between bolts were subjected to reverse cyclic loading for a total of one hundred and fifty tests. The reverse cyclic protocol was based on recommendations by the Consortium of Universities for Research in Earthquake Engineering (CUREE) for testing woodframe structures. The same connection configurations were also subjected to monotonic loading for an additional forty-five tests.

Results of this research can be used to evaluate the current design recommendation presented in the National Design Specification (NDS) for Wood Construction (AF&PA, 2001) of spacing bolts at four times the bolt diameter (4D) to determine if a different spacing should be recommended for natural hazard loading conditions.

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