

# THE EFFECTS OF BOLT SPACING ON THE PERFORMANCE OF SINGLE-SHEAR TIMBER CONNECTIONS UNDER REVERSE-CYCLIC LOADING

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# The Effects of Bolt Spacing on the Performance of Single-Shear Timber Connections Under Reverse-Cyclic Loading

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## (ABSTRACT)

Much previous experimentation related to wood structures has employed monotonic loading to replicate static situations. However, instances of natural hazards have raised interest in the response of structural connections to dynamic loads. This increased interest led the Consortium of Universities for Research in Earthquake Engineering (CUREE) to develop a testing protocol for reverse-cyclic loading, which involves cycling loads through zero in order to test specimens in both tension and compression. With the CUREE testing protocol in place, recent research has been devoted to understanding the effects of reverse-cyclic loading on multiple-fastener connections.

Experimentation by Heine (2001), Anderson (2002), Billings (2004) and others contributed to a better understanding of bolted connection behavior under reverse-cyclic loading. However, some questions remained. Billings was unable to consistently produce yield modes III and IV, meaning that her suggested bolt spacing of seven times the bolt diameter (7D) could not be applied to connections subject to these yield modes without further testing. In addition, the work of Anderson and Billings raised questions regarding the proper measurement of bending yield strength in bolts and the relationship between the bending yield strength and the tensile yield strength. These topics are each addressed by this project and thesis report.

Results of the connection testing presented in this report can be used in conjunction with the work of Anderson and Billings to critically evaluate the 4D between-bolt spacing recommended by the National Design Specification (NDS) for Wood Construction (AF&PA, 2001). Results of the bolt testing provide a supplement to the search for a reliable method for the measurement of bending yield strength in bolts.

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