An Investigation of Nailed Connection Performance in a Cyclic Humidity Environment

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(ABSTRACT)

The effect of cyclic moisture infiltration on connections in light-frame wood buildings has received limited research attention. Specifically, the connections between wood-based sheathing materials (OSB, plywood) and solid wood studs are of interest. A comprehensive understanding of connection performance will enhance structure and material design, thereby improving the overall integrity and robustness of light-frame structures.

The focus of this research project was to evaluate the strength and stiffness of wood-frame connections exposed to cyclic humidity conditioning. Nailed sheathing/stud connection samples were tested for lateral resistance following various periods of moisture exposure. Elastic stiffness, 5% offset yield load, maximum yield load, and failure yield were computed and analyzed using the data collected. The parameters were compared among connection specimens receiving either 0, 1, 5, 10, 15, 25, or 40 periods of cyclic moisture conditioning. In addition, the bearing resistances of the materials were investigated for application to the general dowel equations for calculating lateral connection values, the current basis for design of single dowel-type fastener connections between wood-based members. An x-ray density profilometer was used to observe the de-densification processes within the composite sheathing materials throughout the moisture conditioning regime.

Results indicated moderate to extreme changes in the performance of cycled connections involving lower density sheathing materials. Higher density sheathing materials performed favorably at each cycle test period. Comparisons to the yield model were similar to the control results, but usually differed as cycling increased.

Analysis of connection performance following cyclic moisture loading is a vital component in developing a holistic model for service-life prediction of nailed connections in light-frame residential construction.

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