Design and evaluation of novel wood-based green composite panels for structural applications

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Amount of Award: $10,000

SUMMARY OF HYPOTHESIS, METHODS, AND ACHIEVEMENTS

The overall objective of the project was to design and develop an engineered wood-based composite material similar to conventional structural sheathing panels in bending properties but having higher shear stiffness. The push for more energy efficiency in green buildings leads to an increased use of non-structural sheathing in lieu of structural sheathing, and consequently, a compromise in the overall strength and stiffness of the structure. The specific objectives of the proposed research were to determine experimentally and compare the changes in mechanical properties of a novel wood composite with oriented strand board (OSB). A novel wood strand based composite was proposed using different orientation and layup pattern of the strand. These composite panels were then evaluated for mechanical properties and structural performance. The results were compared to the performance of conventional structural sheathing panels, like OSB and plywood.

Experimental Methods: The experimental work was divided into two phases:

I. Fabricating a new panel composite using laminated strand veneers for increased shear modulus while keeping the bending modulus similar.
II. Characterization of mechanical properties, such as bending strength, bending stiffness, shear stiffness, and lateral nail capacity of the new panel.

The laminated veneer composite was successfully manufactured. A total of 22 panels were manufactured and tested to characterize bending, shear, and nail resistance capacities. The results were disseminated during the International Convention of Forest Product Society.

DISSEMINATION

Sinha, A (2013). The effect of strand orientation on structural performance of oriented strandboard. Presentation at FPS 67th International convention, Austin, TX. June 9-11, 2013.

ADDITIONAL ACTIVITIES

The preliminary study made possible by the GRF award helped build collaboration with two local manufacturers. One of the local manufacturers is now sponsoring research (industry sponsored research) for a specialty product of their design.

From an education standpoint this project provided valuable research experience to three undergraduate students. This project generated interest and research curiosity in two of the undergraduate students and since then they have strived to be involved in different research opportunities during their stay at OSU. Anthonie Kramer, and undergraduate student working on the project, has since graduated and is pursuing his MS while Byrne Miyamoto (another student

working on this project) has been involved in several other projects since, which has resulted in a peer-reviewed journal publication.

EXPENSES

Undergraduate students who worked on the project: Jarrid Raney, Byrne T. Miyamoto, and Anthonie Kramer

Undergraduate Wages: Undergraduate Student worker/research assistant, approximately 180 hrs @ 12/hr = $2160

OPE: Undergraduate student @ 8% of wages = $173

Salary and OPE (51%) of Faculty Research Assistant = $3398

Services and Supplies: Testing materials and manufacturing cost of the panels, including raw material costs, cost of adhesive, equipment share time, and testing supplies, for 22 panels $ 200 per panel = $4400. This includes design and fabrication of a new test grips for shear panel tests.

LIST OF PROPOSALS SUBMITTED

Sinha A.and DeVallance, D.B. (2013). Collaborative Research: Novel oriented layered strand composite for structural applications. National Science Foundation, CMMI – Structural Materials and Mechanics (SMM). $239,463 for OSU ($156,642 for WVU)(declined).

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