

ABSTRACT

The current outbreak of Mountain Pine Beetle (MPB) in the province of British Columbia (B.C.) is the most extensive disturbance event occurring in North American forests in recorded history. The concept of converting the beetle killed wood into engineered wood products by defect removal and reconstitution is employed to maximize value recovery from the material. Cross Laminated Timber (CLT), which is produced in modular form and can be utilized as part of a structural system for floor, wall or roof elements, is considered as an excellent application of the concept. CLT originates from Europe. Such products have been developed as a proprietary product by individual companies aimed at servicing specific markets. There is a need to investigate different ways of making CLT and to define its structural performance suitable for North America. The main focus of this study is to investigate the structural performance of box based CLT system used in floor applications.

Comprehensive three dimensional finite element models, which can be used to analyze the mechanical and vibration behavior of the plate and box type structures, were developed. Four prototype box elements, each having five replicates, were designed and manufactured locally. Third point bending tests were conducted on the specimens in the Timber Engineering and Applied Mechanics (TEAM) Laboratory at the University of British Columbia. The numerical analysis agreed well with experimental data in terms of vertical deflection and bending stiffness. Vibration, which is critical to floor serviceability, was also studied. Three types of excitation were applied to measure the fundamental frequency of the twenty specimens. Finite element analysis provided good predictions of fundamental frequency values comparing to the experimental results. A local built demonstration

building, L41home, was presented and analyzed as an example using the tools developed in this study for CLT applications.

As a pioneer research of CLT materials in North America, this work has contributed to the understanding of the structural performance of floor systems using CLT panels for the commercial and residential applications.