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Research Poster Competition Registration Form

Student Name Blériot V. Feujofack K. Supervisor(s) Dr. Cristiano Loss

Email Address* bleriotvincent.feujofackkemda@ubc.ca

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Title of Poster

Seismic Response of a Cross-Laminated Timber Building Equipped with High-Performance Dowelled Multiple-Shear Planes Slotted-in Steel Connections

Author Names

B. V. Feujofack K., A. Roncari, and C. Loss

Abstract

No more than 250 words. Both the abstract and the poster will be published on the Forestry website.

Mass timber products are increasingly used in mid- to high-rise buildings, with Cross-laminated timber (CLT) playing a major role. Balloon-type construction appears to be a particularly advantageous system when using CLT panels–it enables to avoid the compression perpendicular-to-grain in floor diaphragms. Conversely, balloon-type construction requires high-performance connections to transfer high forces and dissipate energy when under seismic loads. Since most of the knowledge draws to low-rise CLT buildings, there is a lack of design guidance and provisions for mid-rise to high-rise CLT buildings.

In this work, the seismic response of a 15-story CLT building equipped with multiple-shear slotted-in steel plate hold-down connections is studied. Special attention is paid to examining how such CLT shear-wall connections affect the overall seismic response of the lateral force-resisting system (LFRS). Linear static analysis (LSA) and linear dynamic analysis (LDA) were conducted separately to find and compare the fundamental period of the building, the base shear, and the uplift forces.

The results confirm that the use of LSA and simplified representations of connection properties showed inappropriate predictions of inter-story drifts, uplift forces, and base shear. Conversely, the use of LDA and proper design models led to more appropriate values of inter-story drifts, uplift forces, and base shear—which implies a greater mechanical and economic efficiency. As LFRS of tall CLT buildings largely relies on connection properties, further research is needed to accurately evaluate the effective structural performance of connections such as stiffness, strength, and ductility, and draw anticipated failure modes.

Keywords: CLT, Mass Timber Construction, Mid-Rise Buildings, Hybrid Structure, Seismic Response Spectrum Analysis, Mechanical Connections.