Abstract

This paper examines CLT-steel hybrid systems at three, six, and nine storey heights to increase seismic force resistance compared to a plain wood system. CLT panels are used as infill in a steel moment frame combining the ductility of a steel moment frame system with a stiffness and light weight of CLT panels. This system allows for the combination of high strength and ductility of steel with high stiffness and light weight of timber. This thesis examines the seismic response of this type of hybrid seismic force resisting system (SFRS) in regions with moderate to high seismic hazard indices. A detailed non-linear model of a 2D infilled frame system and compared to the behavior of a similar plain steel frame at each height.

Parametric analysis was performed determining the effect of the panels and the connection configuration, steel frame design, and panel configuration in a multi-bay system. Static pushover loading was applied alongside semi-static cyclic loading to allow a basis of comparison to future experimental tests. Dynamic analysis using ten ground motions linearly scaled to the uniform hazard spectra for Vancouver, Canada with a return period of 2% in 50 years as, 10% in 50 years, and 50% in 50 years to examine the effect of infill panels on the interstorey drift of the three, six, and nine storey. The ultimate and yield strength and drift capacity are determined and used to determine the overstrength and ductility factors as described in the National Building Code of Canada 2010.