Abstract

The advantages of using timber as the primary construction material in mid- and high-rise buildings are undisputed. Timber is sustainable, renewable, and has a very good strength-to-weight ratio, which makes it an efficient building material. However, perceived shortcomings with respect to its ductility and system level behavior; along with lack of appropriate design guidance currently limits the use of timber in taller structures. Overcoming these obstacles will allow timber, and its wood product derivatives, to further expand into the multi-storey construction sector - most likely in hybrid-type structures.

The ―Finding the Forest Through the Trees‖ (FFTT) system is an innovative timber-steel hybrid system that may allow high-rise timber construction, even in highly seismic regions. The FFTT system utilizes engineered timber products to resist gravity and lateral loads with interconnecting steel members to provide the necessary ductility and predictability for seismic demands.

For a novel hybrid system, such as the FFTT, to gain recognition, experimental data must be gathered and supported by computational modeling and analysis in order to prove its component- and system-level performance. This thesis presents research utilizing nonlinear dynamic analysis of finite element (FE) models of the FFTT system, with properties calibrated to physical component tests, to capture the response under significant wind and seismic loads. From the results presented herein, it appears that the FFTT system can meet the design performance requirements required for seismic loading; however, due to its relatively low weight, may be susceptible to wind induced vibrations. All results are based on Vancouver, BC loading as specified by 2010 the National Building Code of Canada.