Lateral Load-Resisting System Using Mass Timber Panel for High-Rise Buildings

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Summary:

As global interest in using engineered wood products in tall buildings intensifies due to the “green” credential of wood, it is expected that more tall wood buildings will be designed and constructed in the coming years. This, however, brings new challenges to the designers. One of the major challenges is how to design lateral load-resisting systems (LLRSs) with sufficient stiffness, strength, and ductility to resist strong wind and earthquakes. In this study, an LLRS using mass timber panel on a stiff podium was developed for high-rise buildings in accordance with capacity-based design principle. The LLRS comprises eight shear walls with a core in the center of the building, which was constructed with structural composite lumber and connected with dowel-type connections and wood–steel composite system. The main energy dissipating mechanism of the LLRS was detailed to be located at the panel-to-panel interface. This LLRS was implemented in the design of a hypothetical 20-storey building. A finite element (FE) model of the building was developed using general-purpose FE software, ABAQUS. The wind-induced and seismic response of the building model was investigated by performing linear static and non-linear dynamic analyses. The analysis results showed that the proposed LLRS using mass timber was suitable for high-rise buildings. This study provided a valuable insight into the structural performance of LLRS constructed with mass timber panels as a viable option to steel and concrete for high-rise buildings.

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