RE-CENTERING MASS TIMBER WALLS FOR TALL BUILDINGS IN THE UNITED STATES

Reid B. Zimmerman, P.E. (presenter)\(^1\), Eric McDonnell, P.E.\(^2\)

The use of mass timber walls as a lateral force-resisting system in regions of high seismicity has gained recent interest in the United States. Mass timber walls, in the form of cross-laminated timber (CLT), laminated veneer lumber (LVL), laminated strand lumber (LSL), or similar, have been implemented outside the United States in lateral force-resisting systems, almost exclusively for wind load.

Mass timber walls are natural candidates as a component in a rocking/re-centering system, owing to their inherent tendency to rock. While code provisions and design guidance for mass timber walls is sparse, when used in a rocking/re-centering system, they can emulate a rocking precast concrete wall for which an approved code path exists. Additionally, their use in a rocking/re-centering system encourages consideration of beyond-code performance (e.g., low damage design, repairability design, etc.). Current implementation of re-centering mass timber walls in the United States is through the performance-based procedures of ASCE/SEI 7, typically substantiated through nonlinear response history analysis.

Extending mass timber walls to taller buildings in the United States is feasible; however, it requires an additional level of thoughtful design, explicit analysis and testing, and careful detailing. These include:

- **Deformation compatibility of gravity connections** – These connections are typically concealed for architectural reasons and, to date, have not been tested to story drifts expected of a tall building in a high seismic region.

- **Shear modulus of wood** – Compared to reinforced concrete and steel, the ratio of an equivalent shear modulus to the elastic modulus of wood is much smaller. This results in the greater significance of shear deformations. Furthermore, equivalent shear moduli for mass timber panels, such as CLT, are not well bounded in the current literature and research.

- **Serviceability under wind loads** – As re-centering mass timber wall buildings become taller, the effect of wind loads on base rocking and floor accelerations begins to become a critical aspect of design.

- **Post-tensioning loss** – Post-tensioning loss due to wood creep and moisture change can be more significant than for a comparable precast concrete wall. This is further exacerbated in a tall building.

The presentation will feature select examples from a case study project, Framework. The Framework Project is currently under design by KPFF Consulting Engineers and recently won the U.S. Tall Wood Building Prize Competition [https://tallwoodbuildingcompetition.org](https://tallwoodbuildingcompetition.org). Findings from a collaborative research project between the University of California Los Angeles and KPFF Consulting Engineers on the application of rocking/re-centering concrete walls for tall buildings will also be presented for comparisons against tall mass timber buildings.

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\(^1\) Associated, KPFF Consulting Engineers, 111 SW Fifth Avenue, Suite 2500, Portland, OR 97204, reid.zimmerman@kpff.com

\(^2\) Associate, KPFF Consulting Engineers, 111 SW Fifth Avenue, Suite 2500, Portland, OR 97204, eric.mcdonnell@kpff.com