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Ahmed, D., Asiz, A.

Structural performance of hybrid multi-storey buildings with massive timber-based floor elements loaded under extreme lateral loads
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Abstract
Massive timber plate elements, specifically cross laminated timber (CLT), has gained popularity recently in North America as major alternative construction material for building components offering competitive advantages relative to traditional reinforced concrete slab for medium rise applications. There are two major structural applications for this kind of timber plate, as floor slab or shear wall components of multi-storey buildings. The following study will be focused on the structural performance of hybrid multi-storey buildings constructed using CLT plate as the floor slab elements. The specific objective of this paper is to investigate lateral deformability of floor diaphragm that is composed of CLT slab in combination with reinforced concrete and steel floor framing loaded under seismic excitation. Critical irregular floor layouts of medium rise buildings are selected and modeled using computer structural and building analysis software ETABS. Major outputs including lateral floor deformation (drift), storey shear and dynamic characteristic analyses are analyzed and contrasted with the current design practices, i.e. building code application with respect to diaphragm assumption for seismic design. As in the reinforced concrete-based floor diaphragm, expected general outcome from this study is to provide input for design code provision regarding whether rigid, flexible, or in-between (semi-rigid) assumption of CLT-based diaphragm is adequate for performing design standard procedure for seismic design of hybrid multi-storey buildings. Structural analysis and modeling challenges for CLT-based diaphragm used in hybrid multi-storey buildings are presented and design recommendations will be given. © 2017 WIT Press.

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