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Seismic Performance of Cross Laminated Timber (CLT) Platform Building by Incremental Dynamic Analysis

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Abstract

The present study performed Incremental Dynamic Analysis on a case study Cross-laminated timber (CLT) platform building. The building was designed for the seismic modification factors of R_d=2.0 and R_o=1.5 for the soil Class C in Vancouver, BC, Canada. A 2D non-linear finite element model was developed in OpenSees. CLT panels were modelled as orthotropic elastic shell elements and the connections were modelled as non-linear springs that account for both uplift and shear deformation. The connections and wall parameters for hysteresis models were calibrated from test results. The seismic performance of the building was evaluated using the 22 bi-axial ground motions. The seismic demand was recorded in terms of inter-storey drift ratio. The results indicated that the case study CLT platform building has a sufficient factor of safety against collapse (Collapse Margin Ratio of 3.1) under a Maximum Credible Earthquake.

Keywords: Cross-Laminated Timber; Shear Wall; Seismic Loading; Incremental Dynamic Analysis; Finite Element; Collapse Margin Ratio.

1 Introduction

Cross-laminated timber (CLT) is an innovative engineered wood product that has been gaining popularity because of its low carbon foot-print and potential cost-competitiveness. CLT panels, first developed in Europe in the late 1990s, are now gaining popularity in low to mid-rise residential and non-residential buildings in North America. CLT consists of three or more wooden layers glued together. It offers many advantages compared to traditional light-frame wood construction, e.g. improved dimensional stability, better thermal insulation, decreased floor vibrations, and a fairly good behaviour in case of fire. Furthermore, it is a clean product to work with resulting in much less waste produced on site [1].

Platform-type construction, where each floor is acting as a platform for next floor, is the most common form of systems used for low and mid-rise CLT buildings. Consequently, most of the research so far around the world focused on this

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