Abstract

This study investigates the in-plane stiffness of CLT floor diaphragms and addresses the lateral load distribution within buildings containing CLT floors. In practice, it is common to assume the floor diaphragm as either flexible or rigid, and distribute the lateral load according to simple hand calculations methods. Here, the applicability of theses assumption to CLT floor diaphragms is investigated. There is limited number of studies on the subject of in-plane behaviour of CLT diaphragms in the literature. Many of these studies involve testing of the panels or the connections utilized in CLT diaphragms. This study employs numerical modeling as a tool to address the in-plane behaviour of CLT diaphragms. The approach taken to develop the numerical models in this thesis has not been applied so far to CLT floor diaphragms.

Detailed 2D finite element models of selective CLT floor diaphragm configurations are generated and analysed in ANSYS. The models contain a smeared panel-to-panel connection model, which is calibrated with test data of a special type of CLT connection with self-tapping wood screws. The floor models are then extended to building models by adding shearwalls, and the lateral load distribution is studied for each building model. A design flowchart is also developed to aid engineers in finding the lateral load distribution for any type of building in a systematic approach. By a parametric study, the most influential parameters affecting the in-plane behaviour of CLT floor diaphragm and the lateral load distribution are identified. The main parameters include the response of the CLT panel-to-panel connections, the in-plane shear modulus of CLT panels, the stiffness of shearwalls, and the floor diaphragm configuration. It was found that the applicability of flexible or rigid

diaphragm assumptions is primarily dependent on the relative stiffness of the CLT floor diaphragm and the shearwalls.