MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING LTH | LUND UNIVERSITY

GUSTAF OLAUSSON
guskon.olausson@gmail.com

PRESENTATION
JUNE 2021

REPORT
Will be published as
Report TVSM-5252

SUPERVISOR
Dr HENRIK DANIELSSON
Div. of Structural Mechanics, LTH

ASSISTANT SUPERVISOR
EVA FRÜHWALD HANSSON
Associate Professor
Div. of Structural Engineering, LTH

EXAMINER
Professor ERIK SERRANO
Div. of Structural Mechanics, LTH

THE WORK IS PERFORMED AT
DIVISION OF STRUCTURAL MECHANICS, LTH

IN COOPERATION WITH
DIVISION OF STRUCTURAL ENGINEERING, LTH

SHEAR STIFFNESS OF CROSS LAMINATED TIMBER DIAPHRAGMS AND INFLUENCE OF CONNECTION STIFFNESS

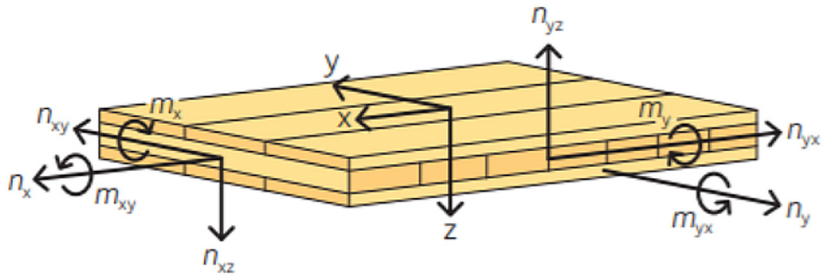

Figure 1 - Definition of main axes and main direction for shell components (Swedish Wood, 2019)

BACKGROUND

The use of wood-based structural materials has continuously increased during the last decades, partly due to the introduction of Cross Laminated Timber (CLT) at the end of the 20th century. The basic structure of CLT consists of an uneven number of layers where the layers are oriented orthogonally compared to the adjacent layers. This composition gives significant strength and stiffness for in-plane axial loading in two directions and for in-plane shear. Thus, CLT may partly overcome some inherent weaknesses of traditional wood-based structural elements with unidirectional fibre orientation.

One possibility to handle the impact from horizontal forces on structures is through diaphragm action which demands a sufficient load bearing capacity and stiffness in the diaphragms to ensure distribution of forces and global stability. The elements within the diaphragm and the connections between these elements both have an influence on the total stiffness of the diaphragm.

AIM

The main aim of this master's project is to determine the effect that different connections have on the total shear stiffness and load bearing capacity of CLT-diaphragms. The study will focus on commonly used connections and CLT layups.

Since CLT is relatively new on the market, a better understanding of the mechanical characteristics could lead to a broader adaptation of the use of the material in multi-storey buildings. As a result, a completely renewable material such as wood can hopefully replace the use of other materials to minimize the impact on our climate that is caused by the building industry.

METHOD

Initially, a literature review is made considering the effects and demands regarding diaphragm action, types of connections that are commonly used for CLT elements and theories considering shear forces and stiffness. Calculations on the effect from connections are initially made by hand followed by modelling in a finite element software (RFEM). Results from both approaches will be analysed, compared, and discussed.

DIVISION OF STRUCTURAL MECHANICS
Faculty of Engineering LTH, Lund University, Box 118, SE-221 00 Lund, Sweden
• Tel: + 46 (0)46-222 73 70 • Fax: + 46 (0)46-222 44 20 • www.byggmek.lth.se

xpTVSM-5252 (2021-01)