MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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

CHARACTERISATION OF CROSS LAMINATED TIMBER PROPERTIES

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PRESENTATION

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REPORT

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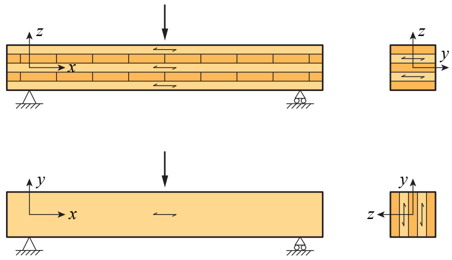
BACKGROUND

A commonly used method for determining the bending stiffness of cross laminated timber (CLT) is to perform a four-point bending test of a plate, where the bending stiffness is evaluated by means of the gamma method and an approximation of the rolling shear modulus. Usually the approximation is taken as 50 MPa. The structure of CLT, where the fibre direction of the laminations are oriented perpendicular to the fibre direction of each adjacent layer, results in the rolling shear modulus impacting the stiffness- and load bearing properties.

The gamma method enables analysis of CLT using conventional Bernoulli-Euler beam theory since shear deformations are taken into account by reducing the stiffness contribution from the longitudinal layers by weighted gamma parameters, and by using an effective moment of inertia. The gamma parameters depend on the thickness of the transverse layer, the modulus of elasticity (MoE) parallel to grain, the rolling shear modulus and the length and boundary conditions of the beam.

The rolling shear modulus is typically many times lower than the longitudinal shear modulus and displays the same uncertainty when it is measured as other material properties for timber. Inaccurate assumptions of the rolling shear modulus can lead to large deviations when determining other stiffness properties from bending tests. Thus, an alternative method has been suggested, where instead two consecutive three-point bending tests are carried out on a CLT beam, where all stiffness properties are determined by rotating the cross section 90 ° about its longitudinal axis between the two tests.



PURPOSE AND METHODOLOGY

This project serves to analyse the possibility of using three-point bending tests to determine the MoE parallel to the fibre direction and the rolling- and longitudinal shear modulus for CLT. The suggested method will be evaluated by comparing data from laboratory tests with results from analytical models and 2D and 3D FE-models. The following sub-goals are defined to fulfil this purpose:

- Define suitable loading conditions and specimen geometry for the suggested testing method.
- Show the effect of different material and geometry parameters when determining the stiffness properties with the alternative method. This is done by the means of hand calculations, calculations with FE-programs and analysis of data from testing.

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