MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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

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DEFORMATIONS IN CLT DEPENDING ON VARIATIONS IN MOISTURE CONTENT

BACKGROUND

Cross-laminated timber (CLT) was first used in the 1990s, mainly as prefabricated building elements, and is becoming a more used alternative for more sustainable building. CLT can be seen as an upscaled plywood: an uneven number of layers, each built up of multiple boards (laminates), with each layer oriented perpendicular to the adjacent layers. This structure makes the CLT relatively shape stable against variations in moisture, at least for uniform drying. For large moisture variation, especially in combination with an uneven moistening/drying, cracking and delamination can occur, as well as an irregular deformation. In this master's thesis the behavior of CLT under influence of moisture variations is to be examined by numerical modeling. Experimental work is not a part of this project, however, data from other sources might be used for comparison.

AIM

The main purpose of this study is to systematically analyze the behavior of CLT for a number of situations involving moistening and drying. Several arrangements (number of layers and their thickness), influence of edge bonding, gap width between board edges with no adhesive, and various loading cases (uneven drying) should be studied. Generic recommendations and rules of thumb for what arrangements that might work for each purpose will be given if suitable.

Another purpose of this project is to answer questions related to modeling techniques: how can one build realistic models and how should the results from the calculations be evaluated?

METHOD

The project starts with a literature review, gathering information about the material and its properties as well as results from previous modeling and experiments. Calculations and modeling is performed with a finite element software (Abaqus). Parameter studies are most conveniently performed using scripting. The main model is preceded by simpler cases. This is done as a way to give understanding of the material, the structural behavior, and the software itself. The experiences and issues that arises from this pilot test will help to define how the main model will be constructed and the scale of the modeling work. Finally, an analysis of the results is made and all is assembled in a report.

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