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Effect of chord splice joints on force distribution in trusses with punched metal plate fasteners

Abstract
Splice joints in timber trusses with punched metal plate fasteners (nail plates) may be assumed rotationally stiff if their deformation has no significant effect upon the distribution of member forces according to Eurocode 5: Design of Timber Structures.

Two simple guidelines for the design and location of splice joints are given in Eurocode 5 for treating the splice joints rotationally stiff. The reasonability of these guidelines is discussed in this paper.

A finite element program TrussLab where the splice joints are given semi-rigid properties is used to analyse two triangulated trusses with three and four splice joints, respectively. The influence of the splice joints on section forces, rotations in the splice joints and global displacements of the trusses is analysed.

Based on the results of the calculations it seems that the guidelines for treating splice joints rotationally stiff do not necessarily lead to more realistic truss models.

Conclusion
As could be expected model S2 (splice joint near maximum moment and nail plates utilised up to 66%) leads to smaller rotations in the splice joints and smaller global displacements compared with model S1 (splice joint near maximum moment and nail plates utilised up to 100%). Due to the larger stiffness of the splice joints in model S2 the bending moments in the splice joints are also larger than for model S 1.

However, when the splice joints are located closer to sections with zero moment (S3) the rotations and displacements are often larger compared with model S 1. Moreover, it is not clear whether the influence on the bending moment distribution is larger for model S I than for S3.

Therefore, it seems that the guidelines (especially the second one in Eurocode 5) for treating splice joints rotationally stiff do not necessarily lead to more realistic truss models compared with a situation with no limitations to the splice joints.

There are relatively large deviations between the results (moment distribution, rotations and displacements) achieved with the models S1-S3 compared with S4. To get a better agreement between real behaviour of a truss and the finite element models semi-rigidity of joints should be implemented. These joint models must include timber contact, since it is important to the stiffness and distribution of the section forces.

From a simple splice joint it is found that the rotations are mainly caused by the anchorage of the nails and not by deformations in the joint line (for GNT150S plate type).