Heat and Moisture in Wooden Bearings of Monuments

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Abstract

Nowadays, thermal insulation is applied to most buildings. However, this proves to be a challenge for most monumental buildings. When insulation needs to be applied at the interior side of a building, thermal bridges are inevitable. Wooden beam ends beared in an external wall are an example of such a (hygro-)thermal bridge. Adding interior insulation introduces a risk at mould growth and can even lead to the deterioration of wood.

In this area several studies, including measurement studies, have already been performed. With the use of simulation models, however, the risk on deterioration of wooden beams can be analyzed making use of variant studies. A simulation model made with COMSOL multiphysics® that uses the Logarithmic capillary pressure (Lpc) as moisture potential has been developed.

The goal of this research is to calculate the heat and moisture development at the wooden beam end within a monumental building. In the first place this will provide more knowledge about that specific detail. That may contribute to preserving wooden beams of monumental buildings in the future. Second, the calculation itself is of scientific value. The calculations will be made in a state of the art simulation model in COMSOL Multiphysics®. The accuracy of the COMSOL Multiphysics® model using Logarithmic capillary pressure as moisture potential is determined by validating experiments from literature and comparison with Delphin software results.

The COMSOL Multiphysics® models have been validated with measurement results from literature (HAMSTAD). After the COMSOL Multiphysics® and Delphin models have been compared in 1D, there weren't hardly any noticeable differences. Moreover, by adding more detail to this COMSOL Multiphysics® model sophisticated multi-physics models are developed for future use.