Hygrothermal assessment of internally insulated solid masonry walls fitted with exterior hydrophobization and deliberate thermal bridge

Relative humidity (RH) and temperature were measured in several solid masonry walls with embedded wooden beams, fitted with autoclaved aerated concrete (AAC) thermal insulation on the interior surface and exposed to a cool, temperate climate. The field study was based on the use of a 40-feet insulated reefer container reconfigured with eight 1 x 2 m holes containing the solid masonry walls. The study investigated the influence of AAC thermal insulation on the interior side with a combination of exterior hydrophobization and a deliberate thermal bridge in front of the embedded wooden wall plate using a material with higher thermal conductivity. Validated HAM simulations were used to investigate the effect of controlling the indoor humidity, and how this would affect the theoretical risk predictions from the damage models. Experimental findings indicate that hydrophobization of solid masonry walls with internal insulation have both positive and negative effects on the moisture balance of the wall, in relation to moisture-induced damage, and that a deliberate thermal bridge installed in front of the embedded wooden wall plate can reduce the moisture content in the wooden elements. Simulation findings indicate that a combination of exterior hydrophobization and decreased indoor moisture load can reduce the RH to acceptable levels in relation to moisture induced damage at the interface between existing wall and new insulation. No major changes were observed in relation to the risk of frost damage at the exterior surface.
satisfactory moisture levels in the attic spaces. A comparison of the passive ventilation strategies in combination with varying infiltration rates, for attic spaces fitted with diffusion-open roofing underlay, indicate that attic ventilation increases moisture levels. The exterior insulation of the attic space improved the hygrothermal performance.

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Xella – Interior insulation – Final report, stage 1

General information
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Contributors: Jensen, N. F.
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Projects:

Hygrothermal assessment of north facing, cold attic spaces under the eaves with varying structural roof scenarios
Jensen, N. F., Contact Person, Design and Processes, Department of Civil Engineering
Bjarløv, S. P., Project Manager, Design and Processes, Department of Civil Engineering
Johnston, C. J., Collaborative Partner
Pold, C. F. H., Collaborative Partner, Goritas A/S
Hjorslev Hansen, M., Collaborative Partner
Peuhkuri, R. H., Collaborative Partner
01/01/2014 → 01/01/2019
Collaborators: Danish Building Research Institute, Fonden BYG-ERFA
Documents:
Deriving process for Equation 8
Polynomial trendlines and flow relation
Processed data_Phase2
Raw data_Phase1
Raw data_Phase1_Re-arranged
Raw data_Phase2
Raw data_Pressure measurements
Raw data_Tracer gas experiment
Summary of key results
Supplementary graphs for research article
VTT mould model
Project: Research
**modelAttic - an OpenModelica model to examine the hygrothermal conditions in a cold, north-facing attic space under the eaves**

The research project was co-funded by the Landowners' Investment Foundation (Grundejernes Investeringsfond) (GI) and supervised by Associate Professor Søren Peter Bjarløv.

Johnston, C. J., Contact Person, Energy and Services, Department of Civil Engineering
Bjarløv, S. P., Project Manager, Design and Processes, Department of Civil Engineering
Hjorslev Hansen, M., Collaborative Partner
Peuhkuri, R. H., Collaborative Partner, Danish Building Research Institute
Pold, C., Collaborative Partner, Goritas
Jensen, N. F., Collaborative Partner, Design and Processes, Department of Civil Engineering

01/09/2017 → 01/09/2018

**Nature of activity type:** Practical Project

**Collaborators:** Fonden BYG-ERFA, Goritas, Danish Building Research Institute

**Documents:**

- User guide - modelAttic
- modelAttic - OpenModelica model
- Miscellaneous weather files
- Info on experimental setup
- Excel sheet to clean output data
- Data used for evaluation
- Casper Pold's MSc Thesis

**Project:** Research

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**Robust solutions of design of internal insulation in historic buildings with regards to hygrothermal performance**

Jensen, N. F., PhD Student, Department of Civil Engineering
Bjarløv, S. P., Main Supervisor
Andersen, B., Supervisor
Rode, C., Supervisor
Fonde

01/03/2017 → 29/02/2020

**Award relations:** Robust solutions of design of internal insulation in historic buildings with regards to hygrothermal performance

**Project:** PhD

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**Xella – Interior Insulation - Stage 1**

Bjarløv, S. P., Project Manager, Department of Civil Engineering, Section for Building Design
Odgaard, T. R., PhD Student, Department of Civil Engineering, Section for Building Design
Svendsen, S., Project Participant, Department of Civil Engineering, Section for Building Physics and Services
Harrestrup, M., PhD Student, Department of Civil Engineering, Section for Building Physics and Services
Pallelsen, N., Project Participant, Xella
Lauridsen, J., Project Participant, Xella
Jensen, N. F., Project Participant, Design and Processes, Department of Civil Engineering

01/01/2014 → 01/05/2018

**Keywords:** Multipor Vapour open Impregnation Moisture transport Mould

**Collaborators:** Xella

**Documents:**

- Xella – Interior insulation – Final report, stage 1

**Project:** Research

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**Activities:**

**modelAttic - an OpenModelica model to examine the hygrothermal conditions in a cold, north-facing attic space under the eaves**

**Period:** Sep 2018

Christopher Just Johnston (Participant)
Søren Peter Bjarløv (Participant)
Morten Hjorslev Hansen (Participant)
Ruut Peuhkuri (Participant)
Casper Pold (Participant)
Description
The research project was co-funded by the Landowners' Investment Foundation (Grundejernes Investeringsfond) (GI) and supervised by Associate Professor Søren Peter Bjarløv.

Documents:
User guide - modelAttic
Links:
http://www.byg.dtu.dk/english/research/publications/software
Keywords: computational model, Building physics, OpenModelica, Moisture problems, wooden beam ends, building renovation
Activity: Other