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Hvad skete der ved Nordic Symposium on Building Physics 2014

Hovedindtryk som Tommy Odgaard oplevede dem

Fokus på:

- Indvendig isolering
- Moisture (fugt) generelt
- Fugt-/temperaturmåling i væg
- Simulering og validering af fugt og temperatur forløb i væg

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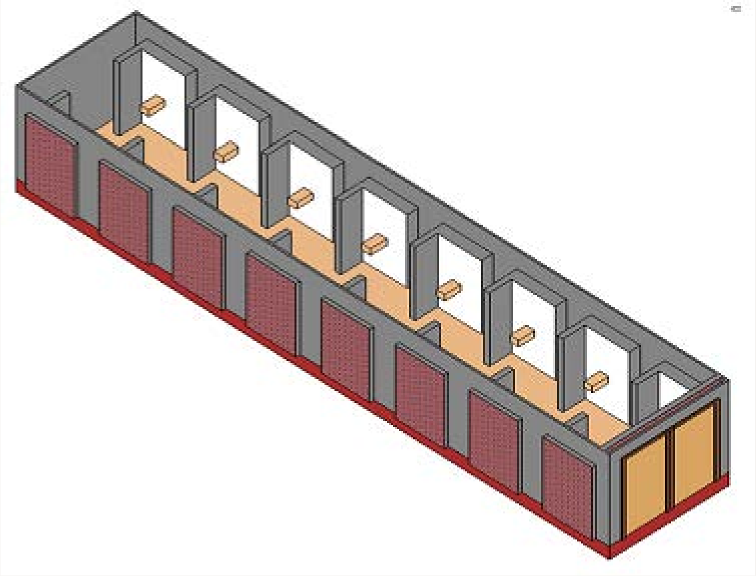
Baggrund

- Projekt periode: Ultimo 2014 → Primo 2017.
- Omhandler at finde en sikker og robust metode til at udføre indvendig isolering af ældre muret etagebyggeri fra perioden 1850-1930.
- Har fået bevilling til 2 projekter hvor forskellige metoder og materialer skal testes på en større række testmure, udsat for kontrolleret indeklima og udvendigt miljø.
- Har deltaget i NSB2014 for at søge inspiration hvad der foregår indenfor dette område, særligt med fokus på indvendig isolering og fugtmåling i murværk.



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Paper 131 – Hygrothermal assessment of wind-driven rain as a risk for internal insulation retrofits of traditional buildings

- Presentation starts of with major point:
  - Glaser method is a demand for characterisation of retrofit – but does not take wind-driven rain into account.
  - WUFI do, but it being used as a "magic tool", lacking comparison with measured data.

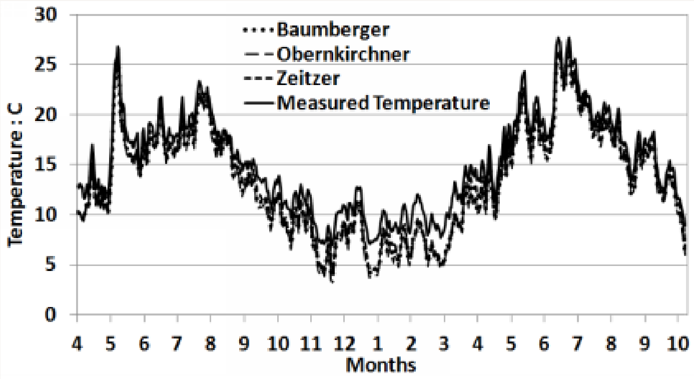
- Article concerns:
  - Interior insulation of a Scottish building which is highly exposed to wind-driven rain.
    - ~100mm insulation inside at ~600mm sandstone wall.
  - Registration of interior and exterior climate.
  - Registration of temperature and humidity in wall/insulation interface.

- Asks a question on the input for WUFI:
  - A real wall is not only just a homogeneous material, but contains of many different elements. This study use a simplified 2-dimensional model.
  - Asks question about the material characteristics available in WUFI – same material has quite different properties and thereby give very different moisture content.

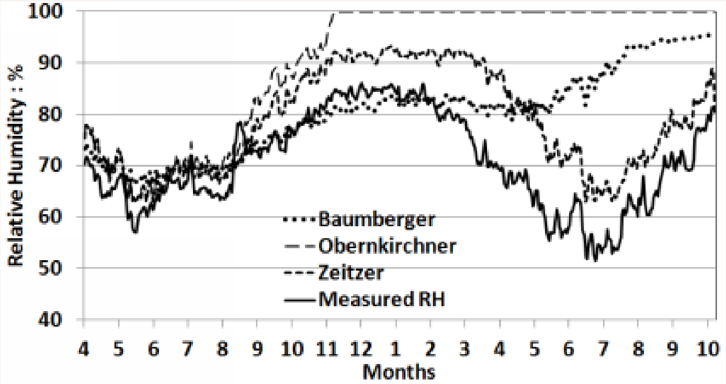
Paper 131 – Hygrothermal assessment of wind-driven rain as a risk for internal insulation retrofits of traditional buildings

Sandstone type	Density [kg/m³]	Porosity	Diffusion resistance factor [-]	Moisture storage at 99% RH [kg/m³]	Liquid transport coefficient at 50kg/m³ [m²/s]
Baumberger	1980	0.23	20.0	115.5	3.9×10^{-9}
Obernkirchner	2150	0.14	32.0	9.4	2×10^{-8}
Zeitzer	2300	0.05	70.0	26	1.0×10^{-8}

Moisture transport properties of the sandstones used in the WUFI model [Sanders et al., 2014]



Simulated and measured temperature [Sanders et al., 2014]



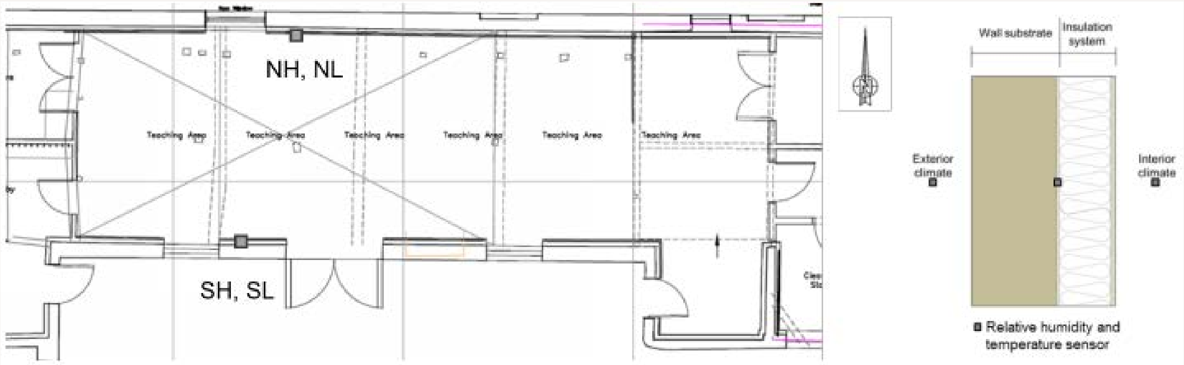
Simulated and measured humidities [Sanders et al., 2014]

- Conclusion of article:
  - No moisture problems after installation of insulation in case
  - Good agreement between modelled and measured temperatures
  - Poor agreement between modelled and measured humidities
  - Choice of material properties are critical to modelling

Paper 154 - Effect of orientation on the hygrothermal behaviour of a capillary active internal wall insulation system

- Study concerns solid brick buildings in the UK, which are often preserved.
  - The need to reduce heat loss due to legislation result in the use of interior insulation.
  - Relative humidity and temperature are evaluated in wall/insulation interface.

- The performance of a capillary active interior insulation is evaluated against the façade orientation.
  - 100mm hygroscopic dry composite board with a light vapour resistance is evaluated
  - Facades are oriented against north and south
    - Highest Wind Driven Rain load is W-SW (WDR zone 2 (UK Classification)).
  - Wetting period: September to march - Drying period: March to September

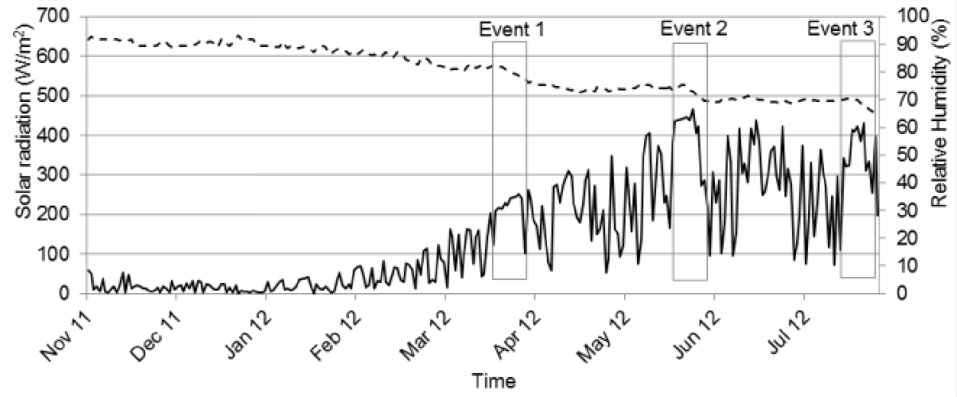


Building plan with focus on the teaching area and locations of sensors [Marincioni & Altamirano-Medina, 2014]

Paper 154 - Effect of orientation on the hygrothermal behaviour of a capillary active internal wall insulation system

› Evaluated by sudden RH drop:
South façade drying out more quickly – depending a lot on the temperature difference in the interface.

› Capillary active systems allowed dry out of moisture, driven by solar radiation introduced temperature.



Events of sudden relative humidity (dashed line) reduction and solar radiation (solid line). [Marincioni & Altamirano-Medina, 2014]

Relative humidity and temperature measured at four location of the existing wall-insulation interface. [Marincioni & Altamirano-Medina, 2014]

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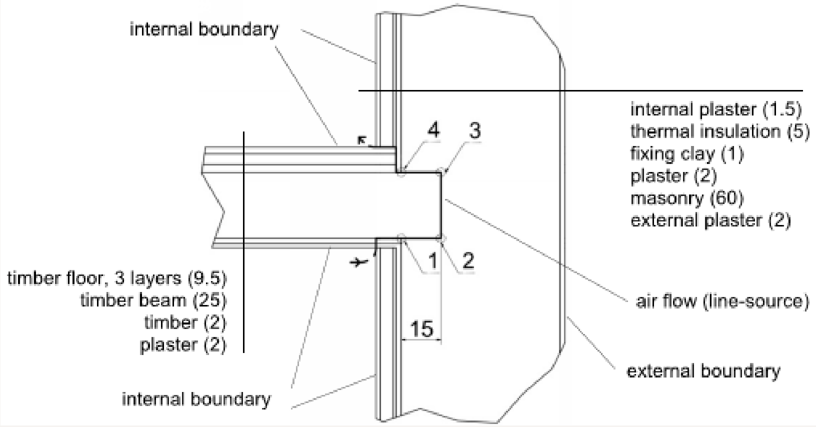
Paper 129 – Assessment of the moisture risk in constructions including convection inside air cavities

Work concerns convective moisture transport around wooden beam ends embedded in a masonry wall with interior



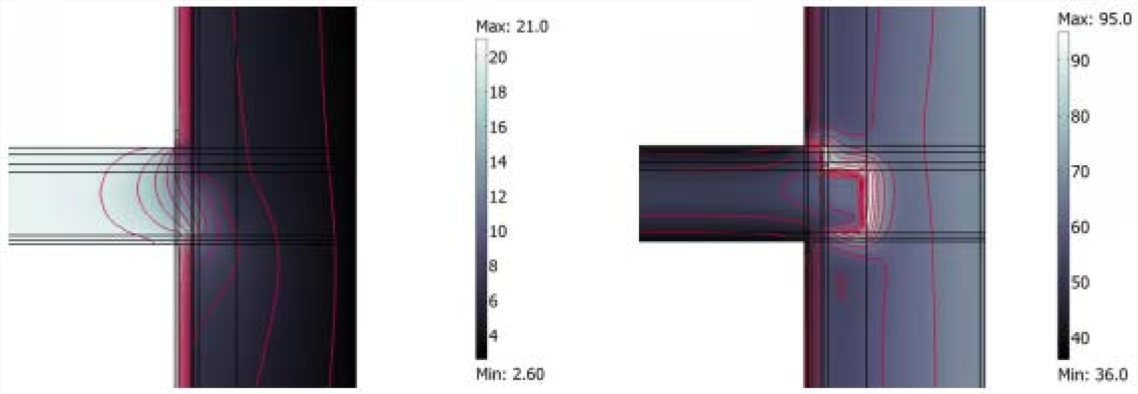
Vertical section of the ceiling-wall junction. The thicknesses of the different layers are reported in centimeters. [Janetti et. al, 2014]

- A self-developed HAM-CFD flow affecting the beam end is simulated in COMSOL Multiphysics. This flow result in a relative humidity and temperature at different points, which is then evaluated against mould/rot risk.

- Concludes on a maximum allowed air flow/un-tightness that should be ensured

Paper 129 – Assessment of the moisture risk in constructions including convection inside air cavities

- The presentation resulted in critical questions:
  - The used driving force: 3Pa pressure difference were considered to large.
  - Only includes HAM-CFD flow, no driving rain due to problems in over-hygroscopic range (critical factor when applying interior insulation).

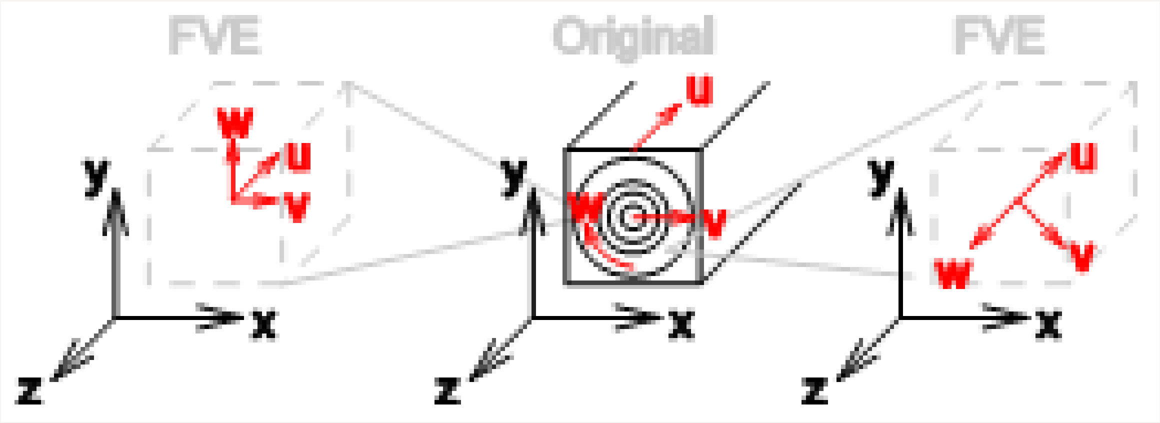


Distributions of temperature [°C] (left) and relative humidity [%] (right) after two years for case d (TABLE 2). [Janetti et. al, 2014]

- I am in contact with author to collaborate about making the model more realistic, hereby:
  - Take 3-dimensional considerations into account.
  - Include realistic conditions at the beam end.

Paper 36 - Modelling and Implementing efficient Three Dimensional Anisotropic Heat Air and Moisture Transport

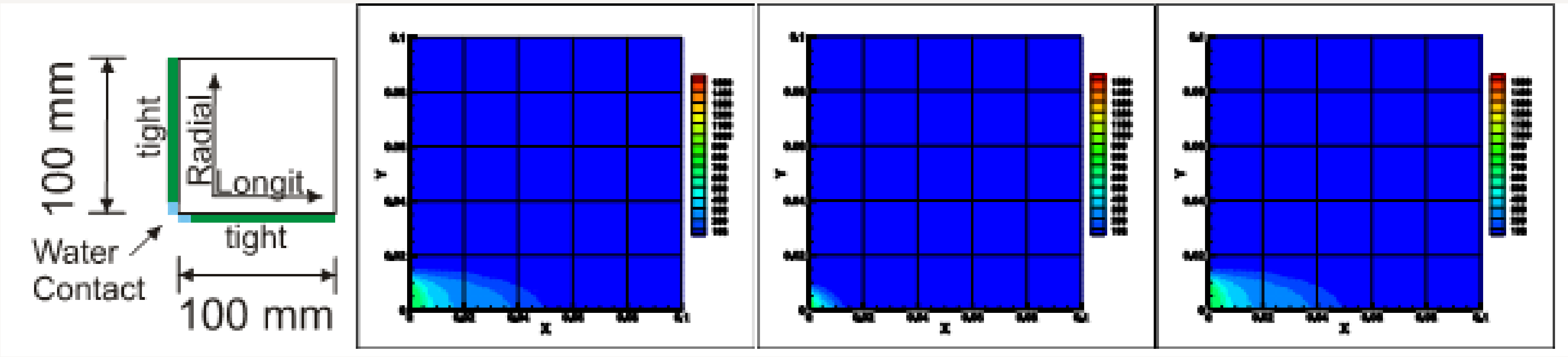
- Further development of the HAM simulation software Delphin:
  - Development of three-dimensional simulation
  - Inclusion of anisotropy (especially important in wood)



Example for a material and simulation reference system that are not aligned [Vogelsang & Nicolai, 2014]

Paper 36 - Modelling and Implementing efficient Three Dimensional Anisotropic Heat Air and Moisture Transport

› Shows promising progress in the development of a 3-dimensional HAM simulation tool. According to the author, they are still testing and there is still long way (especially as it is not his main task and he is finishing his thesis).

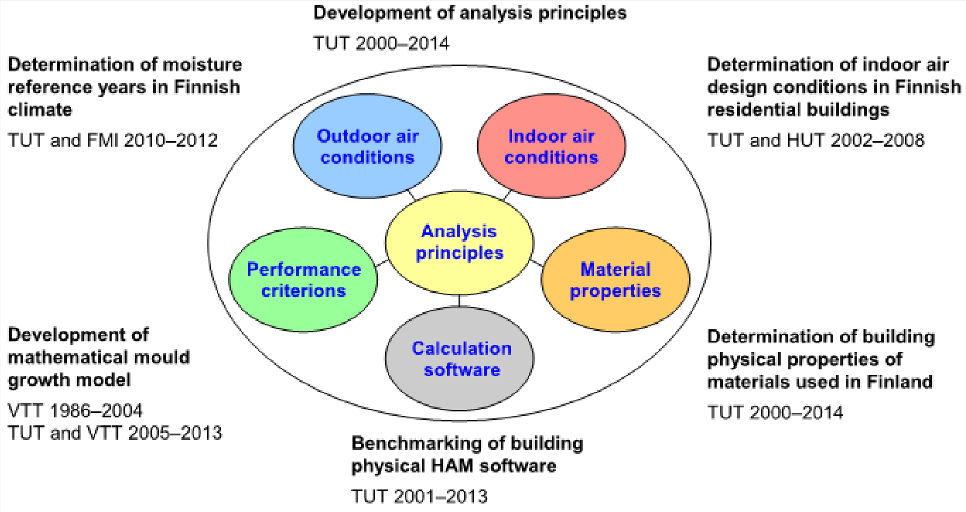


Anisotropic Transport for Spruce, Oak and Beech (24h) sorption in a corner experiment [Vogelsang & Nicolai, 2014]

› Currently work is done within implemention of parallel computing in Delphin, as 3-dimensional simulation is a very computational heavy.

Paper 135 – New analysis method for moisture performance of envelope structures

› New method for analysing moisture performance/risk.



Principle drawing of the TUT analysis method, and research activities regarding to different components of method. [Vinha, 2014]

› Many elements, but especially:
  - › further developed mathematical VTT mould growth model to include mould sensitivity classes (different material sensitivity to mould growth).
    - › Glass and metal is not as sensitive as organic wooden materials
    - › Example: In class 1 & 2, the limit might be 80% RH, while it might be 85% RH in 3 & 4.

Paper 137 – Method for determination of the critical moisture level for mould growth on building materials

- Mould resistance: Resistance against mould growth at optimum conditions
  RHcrit: Lowest RH at which mould can grow

- Two ways to prevent mould growth:
  - Make sure mould growth conditions do not occur in construction.
  - Make sure used material are resistant to mould.
    - This data are not normally present.

- Article present method to evaluate critical relative humidity Rhcrit.
  - The RHcrit of the different materials can be used against the temperature and relative humidity expected in the construction to evaluate risk of mould growth and maybe change the planned material.

- Comment: Test only concern clean material → in the real construction, dust will occur at material which will change the RHcrit.

References

Investigation of wall/insulation:

- [Sanders et al., 2014] Sanders, C, Baker, P, & Hermann, C 2014, 'Hygrothermal assessment of wind-driven rain as a risk for internal insulation retrofit of traditional buildings', Full papers – NSB 2014, pp. 1053-1060.
- [Marincioni & Altamirano-Medina, 2014] Marincioni, V, & Altamirano-Medina, H 2014, 'Effect of orientation on the hygrothermal behaviour of a capillary active internal wall insulation system', Full papers – NSB 2014, pp. 1238-1243.

Simulation:

- [Janetti et. al, 2014] Janetti, MB, Ochs, F, & Feist, W 2014, 'Assessment of the moisture risk in constructions including convection inside air cavities', Full papers – NSB 2014, pp. 1037-1044.
- [Vogelsang & Nicolai, 2014] Vogelsang, S, & Nicolai, A 2014, 'Modelling and Implementing efficient Three Dimensional Anisotropic Heat Air and Moisture Transport', Full papers – NSB 2014, pp. 287-294.

New mould investigation models (short presentaions/homework):

- [Vinha, 2014] Vinha, J 2014, 'New analysis method for moisture performance of envelope structures', Full papers – NSB 2014, pp. 1085-1092.
- [Johannson et al., 2014] Johansson, P, Ekstrand-Tobin, A, & Bok, G 2014, 'Method for determination of the critical moisture level for mould growth on building materials', Full papers – NSB 2014, pp. 1101-1107.