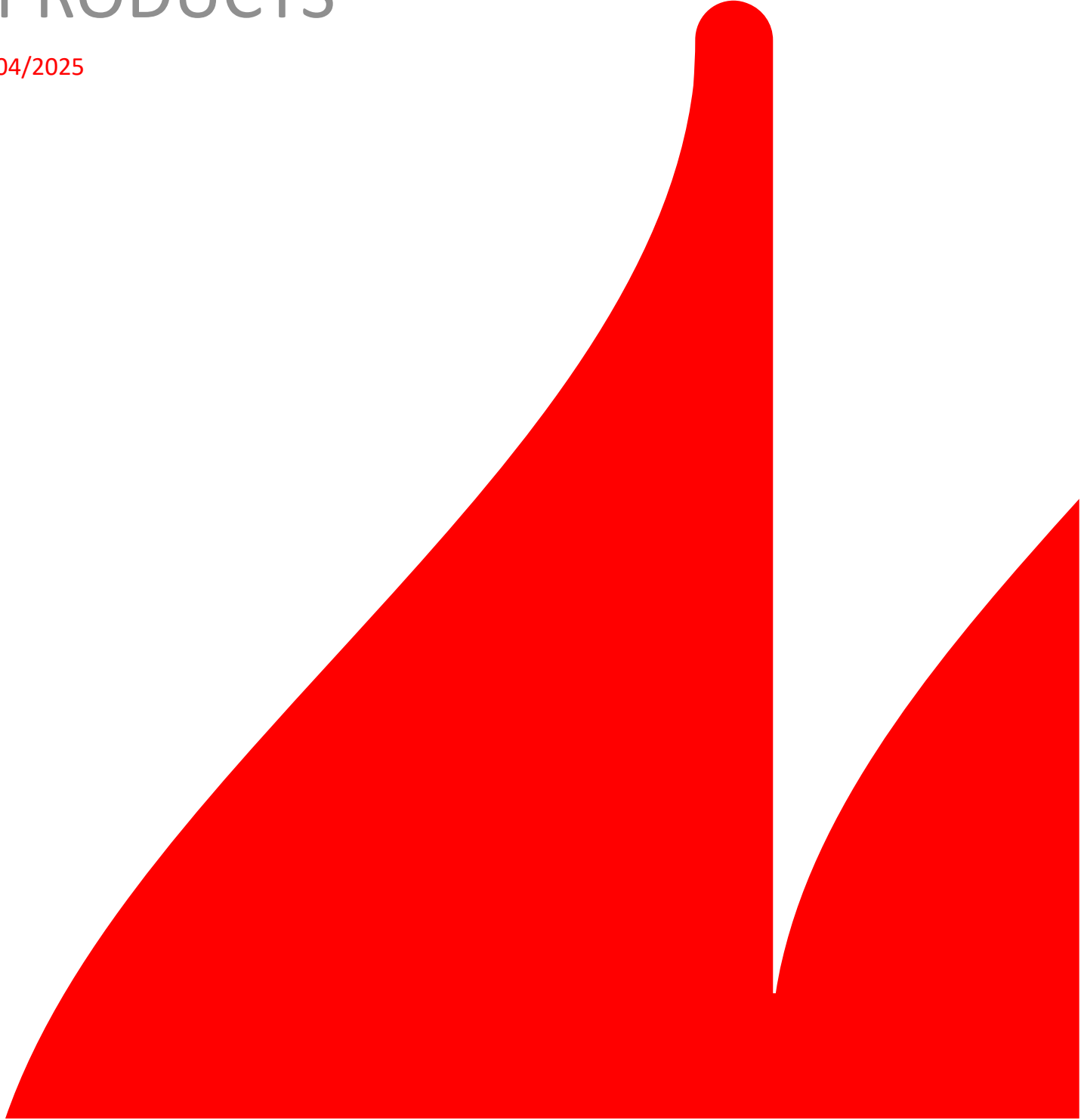


PROJECT PORFOLIO - BIOBASED BUILDING PRODUCTS

04/2025



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PURPOSE OF THIS DOCUMENT

This document provides a summary of some demonstration and research projects conducted by DBI in relation to fire safety of biobased construction.

I hope you will appreciate that the existing projects highlight our competencies in:

- Theoretical and practical understanding of fire behaviour of biobased materials, including wood, CLT, biobased thermal insulation, reed thatch etc.
- Design of standardized and non-standardized fire tests at all physical scales.
- Technical capabilities for conducting fire tests.
- Numerical methods for modelling heat transfer and burning processes.
- Developing performance-based fire safety engineering solutions for buildings with biobased and re-used or recycled materials.

The projects listed here focus on material and construction fire behaviour. Nevertheless, we also have projects related to Life Cycle Assessment and evacuation in timber buildings, as well as non-destructive evaluation of reused timber elements and the durability of fire retardants in external timber cladding.

Should you require further details about the listed or other projects, feel free to reach out to Karlis Livkiss at kal@dbigroup.dk.

BIOBASED FACADES

Project 1: Non-fire treated wood clad facades

Overall aim: Project "Biofacades Uphigh" supports mid-rise construction with non-fire treated wood clad facades and biobased insulation panels.

Specific project goals: Understanding the fire behaviour of non-fire treated wood clad facades at large façade scale and to develop structural means for limiting fire spread. Some of the tested constructions included wall panels with biobased insulation. Hence the project outcomes provided input to fire safety engineers to successfully implement the façade designs in real building projects.

Method: 10 large scale tests were conducted and analysed at DBI. The main constructions parts were non fire treated wood cladding, Insulation panels (in several cases biobased insulation) and plume deflectors (steel constructions to limit fire spread). The large-scale tests are based on the method European approach to assess the fire performance of facades (developed by Rise, Sweden).

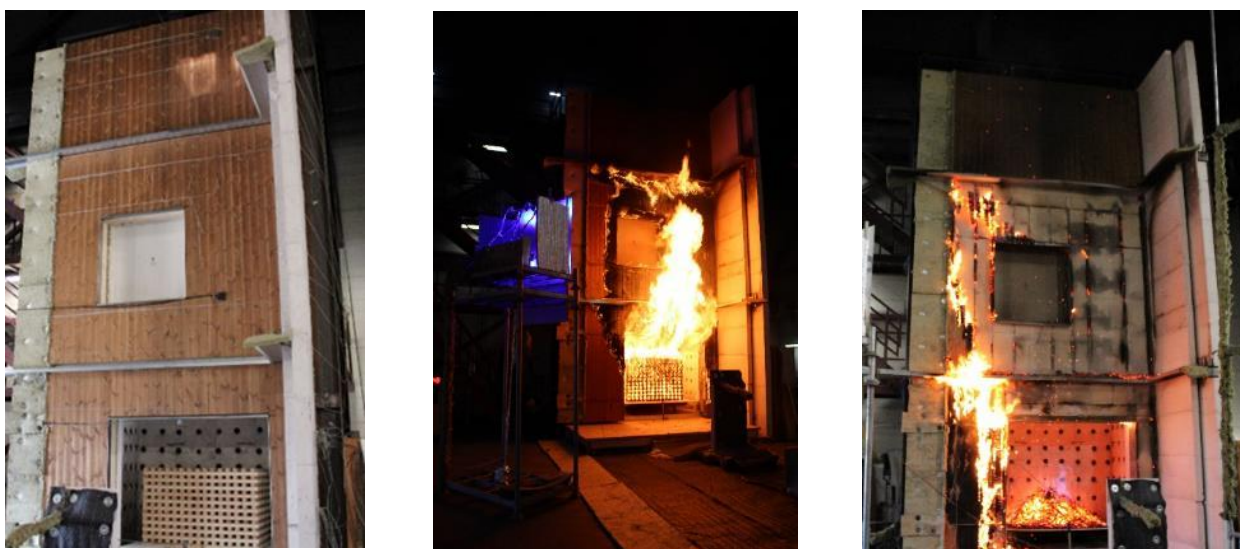


Figure 1: Example of one construction a) prior the test b) during the test c) near the end of the test

Results: 6 out of 10 tested designs were successful to limited upward fire spread. The principal design of the plume deflectors, which would allow limiting upward fire spread, is therefore clarified. The facades will be implemented in 2 actual building projects in near future.

Timeframe: 2023 - 2025

Project 2: Numerical modelling of fire behaviour of wood clad facades

Overall aim: Project aims to support the wood clad facade design process through numerical modelling.

Specific project goals: to validate and quantify errors/uncertainties in numerical fire modelling of wood clad facades in large façade-scale. The model is intended to be used as a cost-effective tool for development of new solutions in the future.



Figure 2 Visualizations from numerical model of large scale façade fire test (European approach to assess the fire performance of facades)

Method: Model Fire Dynamics Simulator (FDS) is applied for the problem. The project uses large scale fire test data for model validation. The input parameter settings are investigated to achieve an acceptable fit for the projects' goals. The investigated test method is European approach to assess the fire performance of facades (developed by Rise, Sweden).

Results: Project is ongoing. The thermal exposure to the façade is modelled with sufficient accuracy and will be reported in a peer reviewed publication (in review process currently). The wood clad facades modelling is ongoing.

Timeframe: 2023-2026

Project 3: Modular thatch / straw insulation external wall

Overall aim: Two consecutive projects in cooperation with Royal Danish Academy aimed to investigate means for improving fire technical properties of reed thatch to support their application as external walls on multistorey buildings.

Specific project goals: To develop sustainable means for improving the fire behaviour of modular external wall construction, consisting of reed thatch and straw based insulation panel.



Figure 3 Intermediate scale tests of thatched façade/external wall construction and physical barrier for limiting fire spread.

Method: Design discussions and workshops, consecutive intermediate scale fire tests and large scale fire tests. Design solution investigated are use of physical barriers to limit the fire spread, in combination with application of clay.

Results: Project is ongoing. Thatch compression and clay impregnation of thatch in combination of use of physical barriers on the façade are currently tested at an intermediate scale. Large scale tests will follow.

BIOBASED CONSTRUCTIONS

Project 4: Fire resistance of timber – biobased insulation constructions

Overall aim: The Wood:UpHigh project aims to accelerate bio-based construction by providing evidence that composite bio-based structures can be more widely and easily employed in multi-storey buildings.

Specific project goals: The project explores, analyse, and document the fire resistance of selected load-bearing timber structures in combination with bio-based insulation.



Figure 4: One of the tests done in project Wood Uphigh with seaweed wool insulated wood construction a) during the assembly prior the test b) after 67 min of test c) specimen seen from exposed side right after the test

Method: 10 accredited full-scale fire resistance tests and several small-scale indicative fire tests were conducted and results analysed.

Results: Project is completed and the results are available following the link [Results from Wood:Uphigh Project](#)

Project 5: Heat transfer in engineered timber

Overall aim: The aim of this work is to develop a method for prediction of how timber structures are damaged during a natural fire, including the effects of heat transfer and moisture transport during both the heating and cooling phases of a fire.

Specific project goals: The project will: (1) characterise the transport, accumulation and re-distribution of moisture in timber products under severe heating and subsequent cooling periods in a natural fire, and (2) develop and validate a heat-transfer model for engineered timber that can predict the mechanical degradation of engineered timber for a natural fire.

Method: Coupled experimental and modelling campaign, including measurement of in-depth temperature and moisture content profiles during bench-scale experiments and large-scale compartment fire experiments.

Results: Project is ongoing. Results to be submitted for publication in scientific journals by the end of 2025.

Project 6: Compartment with visible timber

Overall aim: Quantify and describe the phenomena related to the burning behaviour of timber-lined compartments.

Specific project goals: Generate fundamental underpinning knowledge that can be applied widely – to understanding the key phenomena and how these phenomena influence the growth, development, decay and extinction of a fire in a timber building. This project aims to generate new knowledge that can be used in the future by engineers to both evaluate and/or modify existing design tools, and underpin the construction industry's efforts to address embodied carbon within the built environment.

Method: The method employed was two-fold. The first involved consolidating data from over a decade of research to identify key trends and relationships between these data. The second involved conducting a series of highly instrumented bespoke compartment experiments on the medium scale to allow the internal dynamics to be measured and the data analysed.

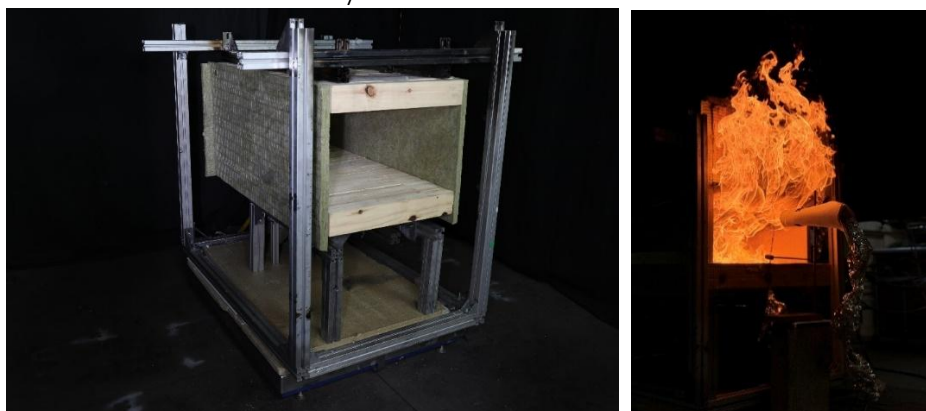


Figure 5: Test setup for investigating compartment fires with visible timber

Results: The project is currently ongoing. The first part of the results can be read [here](#). Work on the results from the second part is currently ongoing and will be published in a journal.

Timeframe: 2022-2025