

Zukunft Bau

Summary of the research topic (SWD-10.08.18.7-14.20)

Title

Title: Evaluation of imperfections in the air barrier – recommended actions for building practical applications

Motivation

Due to good thermal and hygric performance airtight building constructions have become state of the art over the last two decades. This implies the need to detect and assess air leakages. This assessment is often a subject of discussion and litigation due the lack of commonly accepted and comprehensible criteria.

Content of the research topic

The aim of this research topic is the provision of recommendations for the treatment of air leakages in practical building applications. Three institutions, the Association for Air Tightness in Buildings (FLiB), the Aachen Institute for the study of building damage and for applied building physics (AIBAU gGmbH) and the Fraunhofer-Institute for Building Physics, jointly work in this research topic to adress the aspects of airtightness in sufficient level of detail. The research effort consists of the following main work packages and solutions:

- Literature study leading to a systematic clustering of leakages including definitions and parameters for the assessment
- Survey among approx. 2.000 building surveyors and measurement service providers to benefit from their experience on damage and non-damage cases
- Visit of building objects including investigations, data treatment and documentation of 33 cases that were mentioned. This documentation contains pictures on the nature of damages or nuisances and the associated leakages.
- One of the cases was selected to set up a 3D hygrothermal material layer model with air infiltration to simulate air leakages with regard to their hygrothermal, energetic and comfort impact.
- Contributions of external experts concerning the assessment of leakages with regard to the aspects of ventilation, odour propagation, windows and exterior doors, fire protection, noise protection and legal impact.
- Summary of the broad amount of data to a recommendation for actions with a flexible frame containing statements on general and specific assessment of leakages.

Results

Results of the research topic underline the complexity of the assessment of leakages. The specific treatment of leakages depends on the question or task raised to the acting persons. From a technical point of view, a simple rule of thumb for leakage assessment covering for all cases (type of construction, mode of action etc.) can not be provided. The same leakage can be assessed technically uncritical in one case while it leads to a damage in another configuration. However, avoiding and reducing leakages prevails important for the aspect of moisture damage protection.

Key data

Short title: Assessment of air leakages

Researchers / Project Lead:

Dr. Klaus Vogel (i. A. FLiB e. V., Project leader and researcher)

Prof. Dr.-Ing. Gunnar Grün und Dr.-Ing. Victor Norrefeldt (Fraunhofer IBP, researcher)

Dipl.-Ing. Silke Sous und Prof. Dipl.-Ing. Matthias Zöller (AIBAU gGmbH, researcher)

Total cost: 111.175,85 €

Applicable funding: 76.175,85 €

Project duration: 24 Months

Figures:



Figure 1:

Parameters for the assessment of leakages reaching from the macroscopic investigation of whole buildings or building sections to microscopic investigation of singular leakages

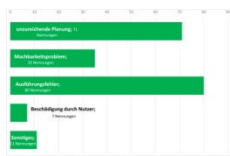


Figure 2:

Results of a survey among building surveyors and measurement service providers on reasons for leakages and associated damages (several answers possible)



Figure 3:

Documentation of leakages in a foil conceived as airtight barrier seen from a dismantled roof (reference case for simulation)

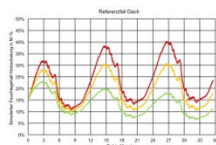


Figure 4:

Simulation results for different subsection of the reference roof with different levels of air tightness (red: severe damage of wooden construction, yellow: intermediate damage of wooden construction, green: nearly free of damage)



Figure 5: Bild 5_englische Fassung

Schematic risk assessment to initiate a decision on the treatment of leakages (e.g. low quality of information – right side of yellow area in diagram – is associated with a higher risk assessment – right side of red area in diagram).