Assessment of the durability of the airtightness of building elements via laboratory tests

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The airtightness just after the end of a building phase is assumed to be relevant criteria for high energy performance. Testing on site the initial performance of the airtightness via the blower door test has become nowadays a common practice but generally implemented before the occupation of the building. But a lot of questions are still remaining targeting the sustainability of the performances. Even if retesting a building a few years after the initial test can provide a general view on the evolution of this performance, this could generate the adding cost and couldn't give information on the origin of potential changes. Another approach may be to validate technology and building technics as sustainable solutions. In order to quantitatively evaluate the durability of the airtightness of building elements as well as building technics, a research realized in Belgium has tested in laboratory the initial performance of more than 50 building walls and their materials.

The project called DREAM conducted from 2012 to 2013 by the Belgian Building Research Institute in partnership with the University of Liège has targeted the basic criteria and useful technologies insuring the sustainability of the airtightness.
DREAM aims to evaluate and improve the sustainability of the airtightness of buildings quantifying the air tightness performance of different materials before and after ageing for 46different walls (divided into 4 families).
Four different families of system ensuring the airtightness have been targeted in this project.

- Walls of blocks / bricks whose airtightness is ensured by coatings/plastering (17 cases);
- Walls whose airtightness is ensured by wood panels (11 cases) ;

Walls whose airtightness is ensured by a membrane (11 cases);
- Walls composed by industrialized systems (sandwich panels, architectural concrete panels, ...). (7 cases).

Note that the sample are representative of the existing building method in Belgium.

Air permeability and ageing process are donein laboratory. Three types of ageing were implemented successively on the samples.

- Ageing representing wind effects and storms.
- Ageing representing the variation of moisture
- Ageing representing the variation of temperature

These various types of ageing are organized into 7 phases. All the samples are tested before ageing (step 1) and after each phase.
The results are represented graphically (Q_{50}, Ageing test) for each case as example below. Graphics show the evolution of the air flow at 50Pa after each step of ageing.

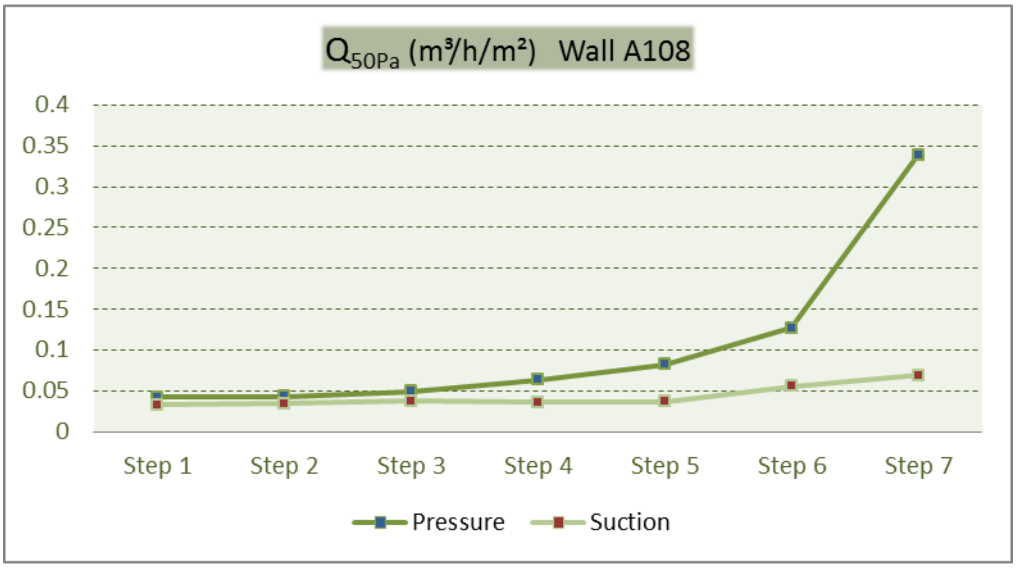

Figure 5: Evolution of the Q50Pa (case of wood panel)

These results give:

- initial performance ;
- critical constraint according to the different system (for instance, only moisture and thermal ageing influence the airtightness of the walls of bricks whose airtightness is ensured by internal plastering) ;
- strengths and weaknessesof the different system

The results of this research areavailablein publications of the Belgian Building Research Institute in the form ofimplementation guidelines. These guidelines are given according to the constraints on the building such as wind exposure on the wall