History and Background of Research on Building Air Tightness

Measures against nuclear accidents

March 1979

Three mile island accident

From 1980 for about 5 years

Commissioned research on "Radioactive gas protection effect of houses" from the Japan Atomic Energy Research Institute

- Creation of regression equation to predict ventilation rate based on the literature surveys for many actual measurements and the results was presented at the Atomic Energy Society of Japan by JAERI (JAEA).
- Development of prediction calculation program using heat, air and gas circuit network model.
- Testing on gap or crack characteristics of various specimens.
- Development of the first generation of a multi-chamber ventilation measurement system and experiments in various houses.

Energy-saving for heating and cooling

From around 1980

The demand of the nuclear accidents measures prompted the development of calculation programs for heat, air and gas movement network model.

For heating and cooling energy saving, taking into account the outside air infiltration through gaps caused by stack effect is also important and became a big motivation.

Airtightness measurement data analysis method

Around 2012

We improved the data analysis method for airtightness measurement, and published a theory and method in the journal Building and Environment [97],2011.

Robustness using the Tukey's biweight least squares method, reliability assessment using the non-compliance rate β of the measurement premise・・・etc.

Sustainable and Healthy buildings

From around 2015

Condensation inside wall ruins occupant's health and durability of building itself. The ventilation expelling the water vapor of air layer inside the wall is important even if it might pass through narrow gaps.

Gap equation model

From around 2016

The equivalent infiltration gap area αA is an evaluation index in which the power exponent n in the power law $\Delta p=D_n \cdot q^n$ is fixed at 2. To properly quantify a gap, it seems necessary to have not only a coefficient related to the opening area, but also a coefficient related to the gap depth. For this, the quadratic model $\Delta p=D_1 \cdot q+D_2 \cdot q^2$ is considered appropriate. If the gap width is w, length is l and depth is d, then the equivalent gap area is proportional to wl and the gap depth coefficient is proportional to d/w^2.