Guest Editorial

Ventilation and Airtightness in Transforming the Building Stock to High Performance Extended Papers from the 35th AIVC Conference 2014

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Since 1980, the annual conference of the Air Infiltration and Ventilation Centre AIVC has been the meeting point for presenting and discussing major research results and developments regarding infiltration and ventilation in buildings. The 35th edition of the AIVC Conference was organized in Poznan, Poland in September 2014 together with the 4th TightVent Conference and the 2nd Venticool Conference. The conference theme was 'Ventilation and airtightness in transforming the building stock to high performance'. This theme was selected to highlight the need and challenges to upgrade existing buildings to high energy performance as well as good indoor climate conditions. Provisions must be made to ensure good indoor air quality by limiting indoor contaminant sources and providing fresh air, bearing in mind potential issues with the quality of the outdoor air. The need for active cooling should be minimized by addressing the management of solar loads, airflow rates and thermal mass. Another challenge lies in the reduction of infiltration losses through the building envelope, which is one of the barriers to achieving high energy performance in refurbished buildings.

Nearly 90 papers were presented at the conference, after a call for contributions on aspects of ventilative cooling, airtightness, and ventilation in relation to indoor air quality and health in the building stock. After the conference a number of representative papers was selected and the authors were invited to submit extended versions for peer review. This special issue presents seven papers addressing issues raised by the conference theme.

The retrofit of existing buildings requires the development and testing of tailored solutions for energy-efficient and comfortable ventilation. Two papers present specific solutions and address their

performances. Prefabricated window modules, façade integrated air ducts and a heat and moisture recovery ventilation device were implemented in Germany. The analysis presented in the paper is based on a measurement campaign and focuses on the influence of the façade integrated air ducts on the energy performance of the whole system and on thermal comfort. A slot louver ventilation component as a retrofit strategy for space cooling was studied in the UK. The paper presents an analysis of the mechanisms contributing to time average ventilation rates from test results of the component operated as part of a single sided ventilation strategy.

With increased building airtightness in energy-efficient buildings, the performance and installation of ventilation systems are important in order to guarantee healthy indoor environments. Two papers study the indoor climate in relation to the design, control and use of ventilation systems. The indoor air quality and energy use of 10 different mechanical ventilation solutions have been compared in a Dutch monitoring campaign on 64 dwellings that meet strict airtightness standards and comply with current building regulations. In a Norwegian study the perceived indoor climate resulting from two demand control ventilation strategies was evaluated in the first school built according to the passive house standard in Norway. A new strategy was implemented which consisted of a combined CO₂ and temperature control, with the aim of addressing overheating and to account for the relation between perceived indoor air quality and temperature.

When airtightness requirements become more severe, testing procedures to show compliance need to produce reliable and repeatable test results. The three remaining papers deal with these issues. The

analysis of a time series of leakage tests on passive houses in Belgium shows that fan pressurization tests render robust results in extremely tight construction. However, test conditions and small preparation details can easily determine whether the dwelling will pass or fail ambitious leakage limits. In large existing buildings, it may be convenient to use the mechanical ventilation systems in the building for airtightness testing. A Polish paper presents the methodology and reliability of airtightness measurements in a number of case studies, using a ventilation system in comparison to fan pressurization. Finally, a new approach for measuring air infiltration rates in buildings is proposed in a Portuguese paper. The proposed

method uses the measured response of the indoor environment to the daily, quasi-periodic, variations in ambient CO₂ concentrations for estimating infiltration rates. The new method has the advantages that no tracer gas injection is needed, and time resolved results are easily obtained.

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