AIVC Newsletter
Air Infiltration and Ventilation Centre

AIVC now counts 15 members countries

In 2012, Denmark, New Zealand and Portugal have joined the AIVC, indicating the growing interest of many countries for ventilation and infiltration. There are several reasons behind this trend, including of course the greater share of energy losses for air renewal in low-energy buildings, but also indoor air quality concerns motivated by new construction and ventilation designs and materials. There are great opportunities for the development of new methods and products, e.g. to reduce material emissions, to improve airtightness, to take advantage of ventilative cooling potentials, and at the same time significant needs to evaluate these new approaches with challenging timelines.

AIVC's on-going projects aim at removing barriers and making progress on major issues by bringing experts together from all around the world. The results of some of them will be discussed in topical sessions at the Copenhagen conference in October… so we hope to see you then!

Peter Wouters, Operating Agent AIVC

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In this issue

International Energy Agency
Energy Conservation in Buildings and Community Systems Programme

QUAD-BBC, Indoor Air Quality and ventilation systems in low energy buildings

- Laure Mouradian, CETIAT and Xavier Boulanger, Association air.h

Evaluation of the impact of low energy buildings and ventilation systems on indoor air quality

Changes in building design and construction in the context of increasing building energy performance requirements are to be evaluated in terms of indoor air quality impacts. For instance, there are recurring debates on efforts in lowering the envelope air permeability because this may affect the global air renewal by decreasing the flows associated to leakages and therefore question the ability for ventilation systems to reach their goal of providing an acceptable indoor air quality. To address such problems, the QUAD-BBC project aimed at analysing the interactions between buildings, users and systems. It used pollution databases linked to occupancy, materials and user behaviour together with several ventilation systems.

Simulation of interactions buildings / systems / users and building of indoor air quality indexes

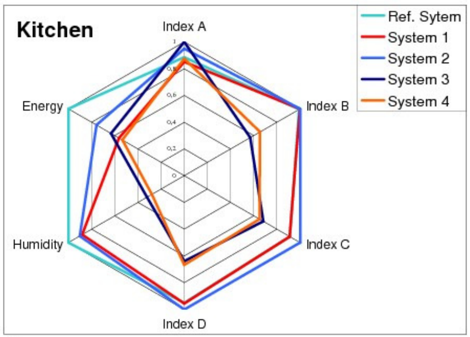
The review of literature and databases led us to define four groups of pollutants representative of similar behaviour, use or effect.

- CO_2 alone as a marker linked to human occupancy,
- NO_2, SO_2 (dwellings) and O_3 (offices) linked to occupants activities,
- CO and 7 VOC linked to materials, activities and behaviour,
- PM2.5 et PM10.

The indexes related to these pollutants are calculated in occupancy periods only. The possible interactions between pollutants or with the building are not taken into account. Humidity is also monitored through specific indicators, both in occupancy and non occupancy periods. Scenarios for pollutant emissions and occupancy have been determined and used as inputs for simulations coupling airflow and thermal effects with an improved version of SIMBAD (Building and HVAC simulation toolbox, http://boutique.cstb.fr/fr/simbad.html). SIMBAD calculations provide airflow rates and airflow patterns for each room, energy needs for auxiliaries and heating, pollutant concentrations for each specie and in each room as well as more synthetics indexes. An additional check with simulations issued from SIREN, a French simulation tool used to evaluate and certify demand control ventilation, has been performed and show consistent results.

Results

Key results of this study are that currently available systems and required airflow rates are well suited for low energy buildings and that they can provide suitable indoor air quality as long as they are correctly designed and installed. Because emissions data from materials are not reliable, using a single aggregated index to characterize the systems is not appropriate. This is why we have proposed to set of indexes and a method that allows one to compare systems. The results displayed as multi-criteria radars may help designers in their choices, although the user behaviour remains one major impact that has to be considered.



IAQ index	Category of pollutant
A	CO_2
B	NO_2, SO_2, Ozone
C	CO, VOCs
D	PM_{10}, $PM_{2.5}$

Through the QUAD-BBC project, we have validated SIMBAD models. Our analyses have demonstrated the high sensibility of every single index to scenarios used for occupancy, pollutant emission, and user behaviour. The results do not affect considerably the existing standards and regulation applicable in France regarding systems and air change levels, although minor changes would help.

The study also shows that the ventilation performance can be improved, especially in main rooms when improving building airtightness. While we could fear the contrary, improved airtightness appears to be beneficial to IAQ in our test cases.

For more information, the reader may download the synthesis report (in French) at http://www.airh.asso.fr/etudes.aspx

Feedback on the airtightness workshop

- F.R. Carrié, Consultant for INIVE

On behalf of AIVC and TightVent Europe, INIVE organized the workshop entitled “Achieving relevant and durable airtightness levels: status, options and progress needed” in Brussels, March 28-29 2012. 70 participants exchanged their views on the basis of presentations given by 20 experts representing 10 countries on requirements, quality and durability issues with regard to building airtightness.

Concerning requirements, several speakers have underlined the opportunity with airtightness to move to the era of performance checks with measurements. Experience with mandatory testing schemes in regulations (e.g., in the UK) or low-energy programmes (e.g. Effinergie, Guaranteed Performance Homes) have shown the virtue of airtightness measurements to urge building professionals to revisit their methods and techniques.

However, especially if such measurement requirement is attached to a regulation, the tests have to be reliable and their results consistent with the inputs in the energy performance calculations. This is the reason why several bodies have engaged in qualification or certification schemes for air leakage testers. Examples from France, Germany, United Kingdom, Finland, Japan were discussed during the workshop, but initiatives have also been identified in Denmark or Norway for instance.

Speakers have also underlined the benefits of methods to secure desired airtightness levels, contain costs and avoid unpleasant surprises including building damage. The French and Japanese frameworks giving credit to builders who have implemented quality management approaches while requiring tests to be performed on a sample of the production only are worth considering because of cost and testers availability issues as well as their encouragement for builders to engage in quality schemes.

A method and device has been developed in Germany to test the fatigue of adhesives due to wind stress with artificially aged samples, which should be used as the basis for justifying the durability requirement in the German regulation. There is also work on-going in Belgium and Sweden to characterize airtightness durability. These initiatives could be important steps for securing airtightnesslevels over the buildings’ lifetime. However, the discussions also showed that airtightness durability characterization remains a topic where significant research is needed.

Nevertheless, from a practical point of view, experience shows that durability can be seriously affected by poor design and execution or inappropriate interventions of users and occupants. Although there is no scientific evidence of this, it seems reasonable to assume that quality approaches implying a well-designed and implemented airtightness strategy is more likely to remain effective in time than last-minute remedial actions. Therefore, fostering such approaches and informing occupants and users appear to be effective short-term actions to make significant progress in practice with regard to airtightness durability.

The need for structured air leakage databases in energy conservation in buildings policies
Friday 25 May 2012
15.30-17:30 (Brussels, BE)

There are several initiatives to collect building airtightness data from field measurements whose number increases rapidly with the trend towards low-energy buildings. The objective of this webinar was to give an overview of the needs identified in several countries and reasons behind the development of air leakage databases. This webinar was organized within the AIVC-TightVent project whose aim is to facilitate the development and applications of building air leakage databases. The programme included presentations from Canada, Czech Republic, France, Germany, United Kingdom and USA focusing on the reasons behind on-going developments in these countries.
Recording will be made available soon at www.tightvent.eu/events/recordings

New AIVC publication

Contributed report 14 : Methods and techniques for airtight buildings

This paper gives an overview to the design principles and construction methods for building airtightness. Its primary objective is to disseminate basic information on steps to follow at design stage as well as on tightening products and frequent field issues.

It stems from the MININFIL project run between 2009 and 2010 under the PREBAT programme with the support of ADEME. In particular, it can be read as an introduction to the over 150 construction details developed within this project.

Download the report at http://www.aivc.org/frameset/frameset.html?../publications/publications.html~mainFrame

Topical sessions at the AIVC-TightVent conference

Copenhagen, October 10-11 2012

In addition to oral and poster sessions with papers from the call for abstracts, the joint '33rd AIVC Conference' and '2nd TightVent Conference' will include the topical sessions below.

For more information about the programme and registration, please visit www.aivc.org

Ventilative cooling	Building and ductwork airtightness	Ventilation, health and comfort	Ventilation technologies, simulation and site implementation
International initiatives on ventilative cooling	Philosophy and approaches for building airtightness requirements	Health and comfort in highly energy efficient buildings	Demand-controlled ventilation (Clear-Up project)
Ventilative cooling in residences	Quality and building airtightness	Health-Based Ventilation Guidelines for Europe (HealthVent project)	Multi-zone airflow simulation
Advanced ventilative cooling concepts in Nearly Zero-Energy Buildings	Ductwork airtightness	Ventilation and cooling strategies for high performance school renovations (School Vent Cool project)	Quality of domestic ventilation systems
Ventilative cooling in building regulations		European Policies on Indoor Air Quality	

A Study on Air-tightness Performance of Apartment Buildings in Korea

-Yun Gyu Lee and Cheol Woong Shin
Korea Institute of Construction Technology

In preparation for the Climate Change Convention and the energy conservation in buildings, the issues of building energy efficiency including zero-energy building (ZEB) are rapidly coming to the fore in Korea. This led to reinforced insulation standard for building envelopes and building energy conservation standard in December 2009, which are designed to prevent heat loss in buildings.
Establishing the standards of air leakage related to building envelope is vital for the energy conservation related criteria to be effectively implemented. In general, poor building envelopes are often the major cause of air leakage. This has a negative impact on overall performance of energy and environmental performance, which will give rise to heat loss, condensation resulting from vapor movement between indoors and outdoors, residents' discomfort caused by cold draft, lower energy efficiency of ventilation facilities, and such others.
In this study, field measurements of air leakage in apartment buildings that had been constructed most recently in major cities were carried out as a part of research conducted to establish the standards of air leakage in apartment buildings in Korea.
Fan Pressurization method (ISO 9972) as measuring method on building air-tightness performance was used on 45 apartment units in seven apartment complexes completed between May and August of 2011. Those subject to measurement comprised of five complexes with mechanical ventilation system and two complexes with natural ventilation system. The table below shows an outline of the apartment buildings subject to air-tightness performance.
'Minneapolis Blower Door System - Model 3' installed on entrance doors were used as the measuring equipment by de-pressurization method. For apartment units subject to measurement, one representative flat type from each complex was selected together with two units from each of the bottom, middle, and the top floor, all of which are in the same building and vertically aligned.

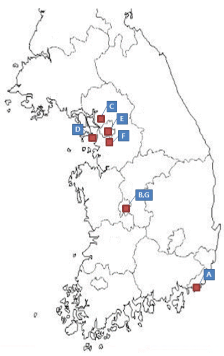


Figure 1 - Location of the measured apartment complexes

Figure 2a - Example of representative flat-type of the measured apartment buildings

Figure 2b - Example of representative flat-type of the measured apartment buildings

Air-tightness performance was tested on a total of 45 apartment units from seven complexes and the results showed that average ACH50 value was about 2.8 h-1 (1.67 minimum, 4.49 maximum) on average, not much different from 3.0h-1 of J. Jo's study (350 apartment units in Daejeon, Incheon, etc.) conducted around the same time, and similar to air-tightness performance standard in Norway, Germany, Finland, and Canada.

Korea Institute Construction Technology and the Ministry of Land, Transport and Maritime Affairs of Korea are planning to put this research results together, and establish the air-tightness standard at about 3.0 h-1 level in November 2012 as the first phase of the regulating plan, and continue to reinforce it by further breaking it down into phase 1, where passive houses will be mandatorily required in 2017, and phase 2, where ZERB will be mandatorily required in 2025.

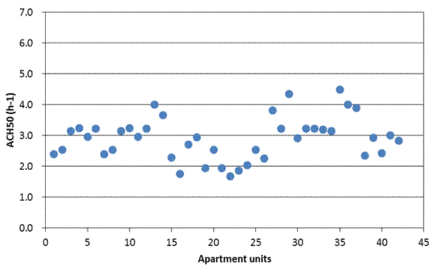


Figure 3 - Air-tightness performance distribution by ACH50

Table 1 - Outline of the apartment buildings subject to measurement

	A (Busan)	B (Daejeon)	C (Goyang)	D (Incheon)	E (Seoul)	F (Suwon)	G (Daejeon)
total apartment units	1,012	752	445	1,172	397	980	704
measured units	6	9	6	6	6	6	6
floor space	84m^2 -132m^2	132m^2 -163m^2	84m^2 -111m^2	130m^2 -155m^2	115m^2 -144m^2	36m^2 -51m^2	56m^2 -115m^2
number of floors	21	23	17	22	26	15	22
ventilation systems	mechanical ventilation	mechanical ventilation	mechanical ventilation	mechanical ventilation	mechanical ventilation	natural ventilation	natural ventilation