Summary

Airtight building envelope and dwelling ventilation in interrelation - retrospection and forcast for Switzerland

Professor Dipl. Arch. Hansruedi Preisig

Review

All times the building cover was made as airtight as possible. With massive constructions it was all above the plasterwork, which took over the sealing function. The air exchange was usually realised by the leaky windows, which still had no circular seals. With the usual massive constructions, built after 1945, the relative interieur air humidity was about 30 to 35%, the natural air change rate amounted to nL of about 0,3 to 0,5 per hour. Deep space air humidities prevent to a large extent the mold formation with thermic weak points in the construction; mites dessicate with deep relative humidity and are no longer active.

After the oil shock in the beginning of the 70's it was realized that the unregulated air exchange is connected with large heat losses through the leaky windows. Under multimedia guidance in whole Switzerland the windows were sealed with foam material and rubber bands, with fatal consequences. The natural air change was drastically reduced. It usually decreased under 0.1 per hour, i.e. less than 1/10 of the air were replaced per hour. With constant dampness production inside the buildings the relative interieur air humidity rose to values over 50%; relative interieur air humidities over 70% were not a rarity. These high relative interieur air humidity led to mold in cold areas of the wall surface. This mold growth and rot again caused serious endangerment of the construction.

The low air change also led to an increase of the concentration of indoor air pollutants. Particularly to mention are the human metabolites (CO_2), tobacco smoke, formaldehyde, volatile organic compounds (VOC), radon, house dust etc.

An unappropriate user behavior in individual cases still intensified the increase of the relative interieur air humidity. The frequently asserted allegation that the user alone was responsible for the high relative interieur air humidities, was not correct in most cases. Investigations showed, that such airtight buildings should briefly be ventilated each hour, in order to achieve a sufficient air change over the whole day. This is however hardly practicable, especially not with working people.

View

The demand is clear and also undisputed, to renew compartment air and thus avoid the enrichment of harming and smell materials as well as to high relative interieur air humidity, by air supply from the outside. The fact is just as obvious as well, that the air supply has to take place not arbitrarily and coincidentally by means of any chinks and joints. An organized fresh and exhaust air with heat recovery is necessary. Today already about 1/5 of all newly contructed dwellings might be provided with a ventilation system, the tendency are rising.

In the future the following is to be considered:

- A extensiv equipment inspection is indispensable.
- The individual components of the ventilation system must be controllable and to be cleaned; it is necessary that they can be replaced as well.
- Control, cleaning and source replacement requires a clear system separation. A ventilation system actually has a substantially smaller life span than the built volumes.
- The air ducts for the vertical and horizontal opening up are to be passed therefore in separate accessible sewers as well as in suspended ceiling sections. Inserting the lines into the floor ceilings for the horizonal spreading does not make a sense.
- Increased attention is to be given to the air which is too dry in the winter. After Kriesi [8] a central humidification is problematic from hygenic view; he suggests the use of enthalpy plate heat exchangers, with which not only warmth but also a part of the humidity of the exhaust air can be recovered.
- Each ventilation system requires a extensive adjustment with the start-up.
- The occupants are to be informed about the function of a ventilation system and to be instructed in detail about the new ventilation possibilities.

Ventilation systems can be planned and realized reasonable, if the basics are already considered with the first project steps. Ventilation systems cause sewers, which are to be taken into account during the development of the plan and cut like the elevator and the stairs. In the advanced project stage they can hardly be placed reasonable; channels squeezed into a building later, do not form a basis for a good ventilation system. This is one of the demands after SNARC [9] with architectural projects in the early planning stage.

Single room ventilation systems are not to be excluded for the future. They will then have a chance, if they become a designed facade component, naturally in combination with the window element. First experiences, with a fresh and an exhaust air element with heat recovery, integrated in the lateral framework of the window, like those of the Fentech company [10], are positive and possibly an alternative to central ventilation systems. The advantages are in the possible single room adjustment, the simple control, cleaning and source replacement.