VENTILATION TECHNOLOGY - RESEARCH AND APPLICATION

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SUMMING UP

M J HOLMES

Ove Arup Partnership
13 Fitzroy Street
London
W1P 6BQ

Thank you for asking me to sum up. The opinions I am about to present are personal, and from the point of view of a consulting engineer, but not one directly involved in day-to-day design work. I may upset some of you, and apologise beforehand, but I must reflect what I believe to be the implications of the papers presented.

It would seem that the papers can be grouped under four headings:

Measurement
Prediction
Design
The positive aspects of ventilation - passive heat recovery.

Taking each of these in order:

Measurement Techniques

After 15 years or so it would seem that we are still in the development stage; certainly there is still no compact instrument available to the consulting engineer for the accurate measurement of infiltration rates. The impression I get is that there is, as yet, no general agreement on the best way to measure air change. One reason for this may be a lack of rigour during the development phase of the methods - especially in the attention paid to error analysis. I do recognise that the purpose of the measurements has also changed from the determination fairly high air change rates related to energy, to detecting low figures that might give rise to air quality problems, and of course, from empty to occupied buildings. In some cases I get the impression that if using the equipment results in what appears to be a reasonable figure for air change (anywhere between 1 and 5) then this proves that the technique and apparatus are sound.

The development of simple methods, PFT's and bag sampling is important so that the practicing engineer can give his client a good idea of the performance of an existing building. In this case the objective will often be to confirm that the building is not too leaky - precise values will not be very important, possibly $\pm$ 0.25, or even 0.5 air changes may be good enough.

I anticipate that many of these problems will be solved with the publication of the AIVC Measurement Techniques Guide next year.

Calculation Techniques

Whilst there was not too much emphasis on this aspect this time it is obviously still a topic of great interest - as was shown by the interest in the demonstrations during the Poster session. The main talking points appear to be:

Validation
Simple vs Complex Models

It is clear that unless methods for validation are available, arguments over techniques are not very relevant. As I see it only two forms of validation need to be considered.

1) Will the method reproduce a standard (probably manual) design calculation?

2) Reproduction of measured data.

The first, whilst applicable to many computerised design methods is probably not valid (yet?) with respect to ventilation and infiltration calculations. To reproduce experimental results implies that suitable data (together with error assessments) are available. The task of providing such data sets should not be underestimated as they must contain all relevant parameters and be demonstrated as suitable for validation checks. I would suggest that a central record of validated data sets be created; this is obviously a task for the AIVC.

The simple vs complex argument can only be relevant if the data input to simple methods is also simple, the availability and application of suitable hardware for the more complex technique are certainly no longer a discussion point. In general it can be said that even with the most sophisticated computer programs the data preparation and checking time exceeds the run time. This is true for what may be the ultimate infiltration model - computational fluid dynamic codes.

I think one encouraging trend in the development of prediction techniques is the introduction of statistical methods in an attempt to reproduce variations found in practice. I am sure that there will be more papers on this approach at future AIVC conferences. Again validation is important and it will be interesting to see how the predictions check against some of the large sample surveys now being carried out.

Design (Control of the internal environment)

The best way to get acceptable air quality throughout a building is to ensure appropriate quantities of fresh air are delivered to each occupied space and not to rely on random factors such as weather and windows (cracks). The design of suitable systems is trivial for engineers familar with design of commercial buildings, however, it appears that those who only have experience of dwellings have some difficulty in accepting such concepts. There is therefore, a need to educate the industry and to demonstrate the need for and advantages of good ventilation design. The general public should be made aware of this need. To do this it will be necessary for the AIVC to prepare information suitable for publication in national newspapers. Research is of little value unless the results find their way into everyday life.

The Positive Aspects of Ventilation and Infiltration

It is very interesting to learn that the building can be used as a passive heat recovery device so that not all the energy used to heat infiltrating air is lost to the surroundings. The measurements required to validate the theory are quite difficult and consequently great care is required if meaningful results are to be obtained. Again a case for a rigorous examination of errors, as emphasised in the discussion of dynamic insulation which appears to be a very interesting development.

Finally we need to be aware of differences between countries. These can be obvious such as weather - which may make a technique that is cost effective in one country not worthwhile in another - or more subtle, such as attitude. The United Kingdom contingent will understand the difficulty that would be encountered when requesting a relaxation of building regulations because the effective 'U' value is 10% (say) lower than the standard value because of the positive effect of infiltration.