Air Infiltration Review

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International Energy Agency - AIVC

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Night Cooling with AIRLIT-PV

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Oscar Faber Group Ltd.

Introduction

The intention of the European Union AIRLIT-PV project is to develop a prototype for a cost competitive building façade unit, which in application would strongly diminish the necessity for mechanical cooling. A first prototype for the unit is shown in Figure 1. This unit integrates natural ventilation, daylighting, solar protection, intelligent control and photovoltaic power and is being designed to perform optimally in energy efficient buildings. It has previously been described in more detail by Palmer et al (1999).

A preliminary 'sketch' design investigation of the capability of the AIRLIT-PV unit to provide ventilation for night time cooling is described here. This was carried out using the simplified model NiteCool. This study takes the approach of considering a 'base case' example and then examining certain parametric variations on that example. It is shown that subject to simplifications imposed by the use of NiteCool, the design of the prototype AIRLIT-PV unit is acceptable.

Figure 1 The first prototype AIRLIT-PV unit (photovoltaic panel not shown).

In this issue

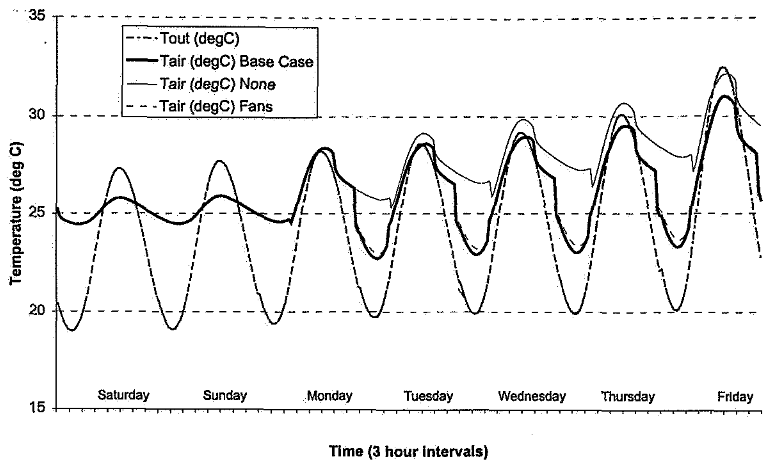


Figure 2 Internal temperature variation with external temperature for the Base Case, and also 'no night time ventilation' and 'continuous' night time ventilation with extract fans.

For future, more detailed tests it is planned to use the simulation tool SIBIL (Eftaxias et al. 1999).

Night Cooling

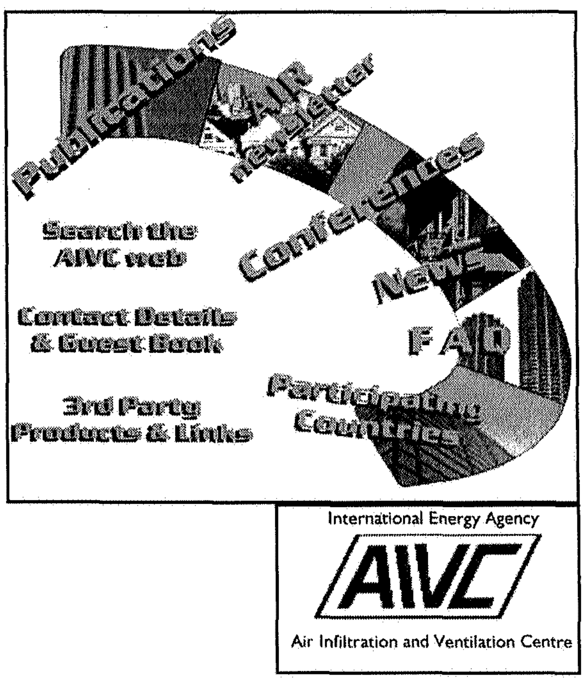
If the outdoor air temperature is lower than the indoor temperature, and cooling is required for occupant thermal comfort, then the outdoor air may be used (perhaps partially) to achieve indoor cooling. If a building has high exposed thermal mass, this may provide sufficient 'damping' to moderate temperature variations. Sensible cooling of incoming air is achieved, as the building reaches thermal equilibrium with its environment. The internal temperature within a building is the essential parameter that must be characterised. Designing for thermal comfort then has the added complexity that the thermal behaviour of the building must be determined, usually over a number of days or even weeks.

Night cooling is a ventilation strategy sometimes adopted in sufficiently dry climates to avoid (or at least reduce) the need for active cooling, by using night-time air to cool the building fabric. (Climates within much of Europe meet this criterion.) In fact, the EU NatVent project (1999) has previously examined this technique. In addition, Liddament (1999) comments on night cooling. The two key conditions to which a building must conform before night cooling might be considered are:

1. the building should have sufficient exposed thermal mass (i.e. the fabric is of 'heavy' construction), and

2. internal and solar gains should be minimised as much as possible.

Air Infiltration Review



Air Infiltration Review has a quarterly circulation of 3,500 copies and is distributed to organisations in 40 countries. Short articles or correspondence of a general technical nature related to the subject of air infiltration and ventilation are welcome for possible inclusion in AIR. Articles intended for publication must be written in English and should not exceed 1,500 words in length. If you wish to contribute to AIR, please contact the Air Infiltration and Ventilation Centre. Please note that all submitted papers should use SI units.

Edited by Janet Blacknell

AIR is also available online at www.aivc.org

NiteCool Fixed Modelling Assumptions

NiteCool Version 2.1 was used for the performed simulations. (See Kolokotroni et al. 1997 for supporting information about this program.) The calculations within NiteCool are based on a high-speed thermal simulation method, called 3TC (because each room is represented by 3 time constants). The 3TC simulation method treats convective and radiant heat transfer separately and this allows the air and radiant temperatures to be calculated. The comfort temperature is a user-defined combination of the two.

In this version of NiteCool, analysis is restricted to a single office cell (measuring 10 m length by 6 m depth by 3 m height. The construction of the cell can be varied (light, medium or heavy), as can the glazing ratio.

Building Weight

The building weight defines the construction of the ceiling of the office cell. The building weight and the glazing ratio are sufficient to define the overall construction of the building. The construction of the various building elements of the office defined with NiteCool are shown below with the outermost layers given first.

Windows are double glazed with a U-value equal to 3.0 $W/m^2 \cdot K$. Walls are: 3mm steel cladding, air gap, 100 mm insulation, 10 mm plaster. Partition constructions are: 5 mm plaster, 13 mm plasterboard, 100 mm air gap, 13 mm plasterboard, 5 mm plaster. There are three possible ceiling construction types in NiteCool, defined by:

1. lightweight - 12 mm carpet, 150 mm light cast concrete, 400 mm air gap, 20 mm glass fibre quilt, 2 mm steel cladding;

2. medium weight - 12mm carpet, 40mm plywood, 100mm air gap, 110mm heavy cast concrete, 400mm air gap, 20mm glass fibre quilt, 2mm steel cladding;

3. heavy weight - 12mm carpet, 5mm plywood, 200mm air gap, 300mm cast concrete

The Base Case Example

The Base Case example examines the thermal response of a 6 m x 10 m x 3 m office during part of the cooling season. (The model is configured with artificial weather data for this example.) The assumed occupancy is 5 people, who are present from Monday to Friday, from 8:00am until 6:00pm. The building is of 'heavy' construction, has an orientation of 180° (i.e. south facing) and has a glazing ratio of 0.4. Internal gains are assumed to be 20 W/m^2, and the solar protection factor is 0.2. Furthermore, the air infiltration rate is assumed to be constant at 0.5 ach. Solar shading is substantial in this example (blocking 80% of the incident solar radiation).

Night cooling is achieved with single-sided natural ventilation using two vertically separated openings. The opening area is equivalent to the maximum area with the upper (1.4 m^2 = 2 ´ 0.7 m^2) and lower (2.2 m^2 = 2 ´ 1.1 m^2) openings on 2 AIRLIT-PV units.

Night Cooling Control Strategy

Night cooling is initiated at 11:00pm if the following conditions are met:

1. peak inside temperature during the previous day was greater than 23 °C, and

2. the average inside temperature during the previous day was greater than 20 °C, and

3. peak outside air temperature during the previous afternoon was greater than 20 °C.

It continues all night provided that all of the following conditions are met:

1. the inside temperature is greater than the outside temperature plus an offset of 1 °C, and

2. the inside temperature is greater than the heating setpoint temperature 18 °C.

It is switched off at 7:00am each day. However, night cooling does not operate during unoccupied periods at the weekend (Saturday and Sunday). In reality, night cooling may be more effective if it takes place during these times as well, to take advantage of periods of lower internal heat gains. Also, it is not possible with the model to formulate a control strategy that switches from single-sided ventilation to fan-driven ventilation when natural driving forces become insufficient.

Results and Discussion of the Simulations

Three situations are included in Figure 2: the Base Case, "None", which is identical to the Base Case, except that there is no night cooling, and "Fans", identical to the Base Case except that night cooling is achieved using continuously operating extract fans. (The fans provide a total of 300 l/s in place of the openings, equivalent to two 150 l/s fans, with one in each of the units.)

The Base Case has no delivered energy cost. Although "fans" exhibits similar behaviour to the Base Case, there is an electrical energy penalty associated with it. This indicates that the fan installed in each unit (150 l/s) is appropriately sized for the purposes of night cooling. The intention in the AIRLIT-PV project is that the fan power should be provided from a battery charged by solar generated electricity.

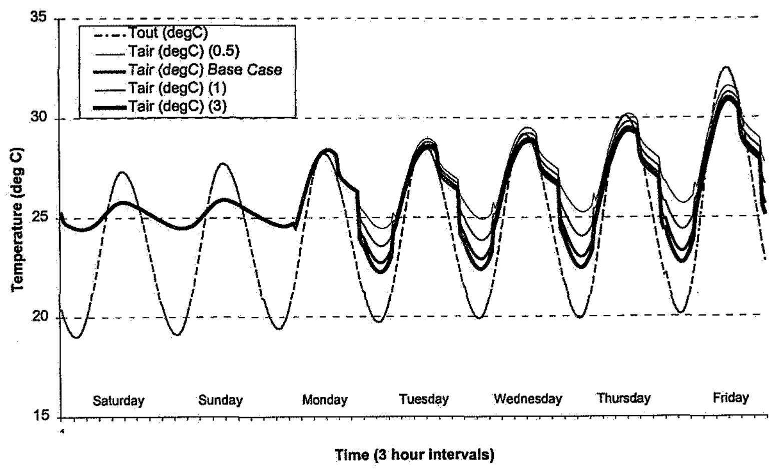


Figure 3 Internal temperature variation with external temperature for the Base Case, and other variations on the total opening area.

Figure 3 shows how variations in the total opening area affect the peak internal temperature. Four cases are included: the Base Case (2 AIRLIT-PV units), half of the opening area of a single unit ("0.5"), the maximum area of a single unit ("1"), and the maximum area of three units ("3"). The performances of case "3" and the Base Case are similar, implying that the most economic option, with 2 units should be chosen, other factors notwithstanding.

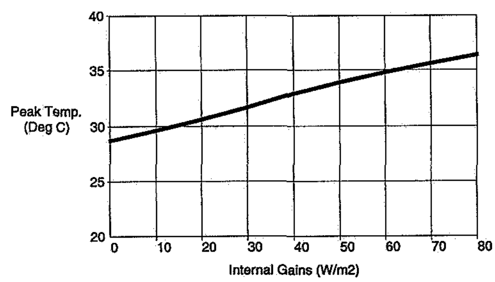


Figure 4 Variation of peak internal temperature with internal gains

With all other Base Case parameters held constant, Figure 4 highlights the variation of peak internal temperature with internal gains. The internal heat gains in the Base Case example are fairly low (20 W/m^2).

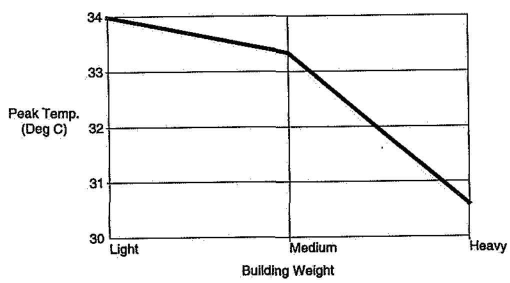


Figure 5 Variation of peak internal temperature with building weight

Figure 5 shows the variation of peak internal temperature with building weight, again for the Base Case. The heavy weight building is observed to lead to a substantially lower peak temperature. The results shown in Figures 4 and 5 together stress the previously stated initial requirements for night cooling to be effective.

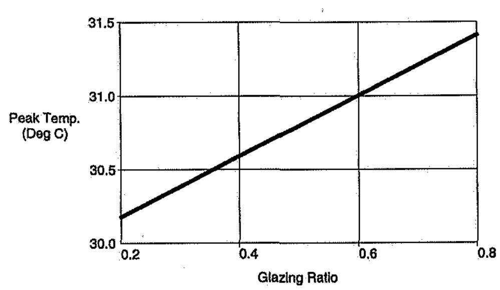


Figure 6 Variation of peak internal temperature with glazing ratio

The Base Case, assumes a glazing ratio of 0.4. This ratio is based here on the design of the AIRLIT-PV unit. It is anticipated that not all units in a façade will be complete AIRLIT-PV units, and there may sometimes be a requirement to adjust this value (for example for daylighting or other reasons). Therefore, there may be some flexibility as to how any adjustment is obtained. Figure 6 reveals a prediction of the relationship between the peak internal temperature and the glazing ratio, with all other Base Case parameters constant.

The maximum night time ventilation rate in the Base Case is approximately 7 ach. This is obtained using single-sided natural ventilation. In Figure 7, it can be seen how peak temperature varies with ventilation rate for mechanical extract ventilation (but otherwise Base Case assumptions). It can be observed that the increase in temperature reduction beyond about 8 ach is obtained only with substantially increased fan energy use.

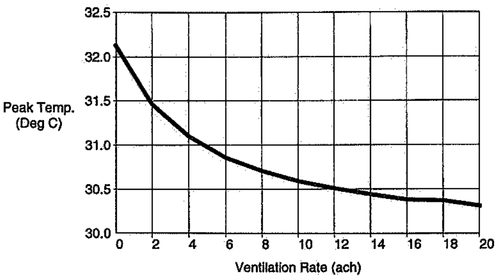


Figure 7 Variation of peak internal temperature with ventilation rate

Conclusions

Although the NiteCool program is not able to model the operation of the AIRLIT-PV unit completely adequately, it does provide an important initial estimate of the likely performance of the unit for night cooling purposes. The results of this sketch design study suggest that the unit, as currently designed, would perform satisfactorily, at least in terms of its capacity to provide night time cooling for daytime thermal comfort. In addition, one unit seems to be able to service a 3 m length of façade. (There were two units installed in 6 m of façade in the Base Case example.)

Acknowledgements

The assistance of the UK DETR through its Partners in Innovation programme and DG XII of the European Commission (Contract JOR3-CT98-0280) are gratefully acknowledged. The essential support of all AIRLIT-PV partner organisations is also recognised.

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Kolokotroni M, Tindale A, Irving S J (1997), "NiteCool: Office Night Ventilation Pre-Design Tool", Proceedings of the 18th AIVC Conference, Air Infiltration and Ventilation Centre, Coventry, UK.

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Palmer J, Perera E, White M K (1999), "AIRLIT-PV - The Development of a Façade Unit to Provide Daylight and Ventilation with Integrated Photovoltaic Power", Proceedings of 1999 CIBSE National Conference, pp. 270 - 277, Chartered Institute of Building Services Engineers, London, UK.

Second Announcement and Call for Papers

The 4th International Conference on Indoor Air Quality, Ventilation and Energy Conservation in Buildings

IAQVEC 2001

Changsha, China, 2-5 October 2001, Organised by Hunan University and City University of Hong Kong. Co-sponsors include the International Energy Agency (IEA) and the Air Infiltration and Ventilation Centre (AIVC). Website: http://www.chinahvacr.com/IAQVEC2001/eindex.htm

An Invitation to IAQVEC 2001

This is the continuation of the series of conferences held in Canada and France in 1992, 1995 and 1998.

Recently, much of the focus in energy R&D has been directed to consider a building and its occupants as a unified system instead of individual systems. This "Integrated Approach" provides a framework for optimising the indoor environment without increasing energy cost. These conferences are devoted to all aspects of an integrated approach to the design and operation of buildings. It is also an attempt to document the most recent advancements in the areas of IAQ, ventilation and energy conservation in buildings; and to serve as a forum for discussion among participants from around the world.

Abstracts should be between 200-300 words in English, and can be submitted by email, fax or post to:

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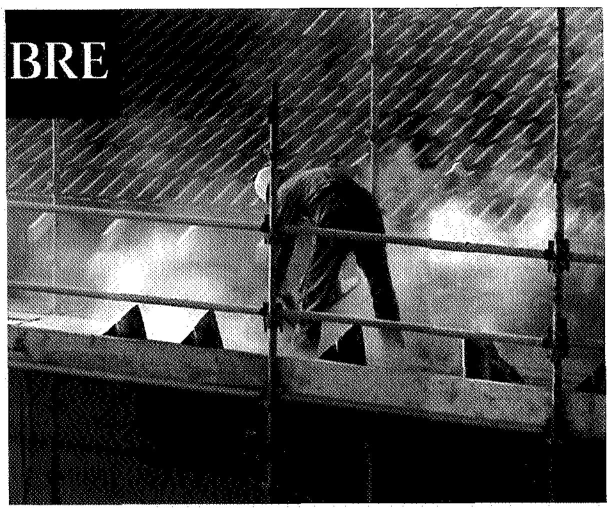
Controlling Particles from Construction and Demolition – A New Code of Practice

BRE (UK) Seminar, 30th March 2000

Seminar Report by Martin W. Liddament

Background

Particle emissions from construction and demolition sites have become of increasing concern both in terms of the health and safety of site workers, nuisance and the potential adverse impact to the occupants of neighbouring buildings. To address this problem, a Code of Practice on controlling particles from construction and demolition is being developed in the United Kingdom. A first draft and review of the current position has produced by Dr Vina Kukadia at the Air Pollution Centre, BRE in the UK (1).



To launch this draft and attract additional input, a supporting seminar was held at BRE on 30th March 2000. This attracted over 150 participants and speakers from many interest groups including the construction industry, local authorities and government departments.

In introducing the seminar, David Warriner, Managing Director of the Environment Division of BRE, emphasised the need to control particle emissions from construction and the need for industry to respond. The Chairman, Marcus Pearson of WSP Environmental Ltd. then highlighted the importance of control and pointed out that construction sites could often be only a few metres away from occupied buildings. He also illustrated that solutions were possible by showing a video of before and after the use of site control measures to reduce dust emissions. The need for collaboration between industry and the regulatory authorities was also stressed. Bruce Sharpe and Stephanie Coster, from the UK Department of Environment, Transport and the Regions (DETR), outlined the various regulatory and policy issues. In particular, Bruce emphasised national policy towards sustainable construction and improved building specification. This policy was being implemented through best practice benchmarking. It was important, therefore, that the proposed Code of Practice should be integrated into the mainstream thinking and culture of the construction industry. Stephanie Coster concentrated on air quality policy. The fundamental objective of which is that pollution emission and ambient air quality should not cause harm to people or the environment. This policy is being implemented both through national objectives and European Union requirements via the UK National Air Quality Strategy. Currently standards have been set for eight key pollutants including PM_{10}. These thresholds are based on scientific and medical evidence. The target requirement for PM_{10} particles is based on a maximum of 50mg/m^3 24 hour mean with 4 exceedences a year by 2005.

David Hall, an Associate of BRE, outlined the characteristics of particle emissions from construction processes and activities. Construction sites have been identified as producing a significant non-combustion source of PM_{10} emissions, estimated to be about 4% of total 1996 emissions of particles. Although this appears to be a small contribution to the annual emissions of particles, they dominate emissions locally during the construction or demolition period. Particles up to 10mm in size are likely to cause injury to health whereas larger particles contribute to nuisance. Currently, national monitoring has provided circumstantial evidence of increased PM_{10} concentrations in the vicinity of construction sites.

Mike Harrison of the Health and Safety Executive (HSE) emphasised the occupational health risk of exposure to construction particles. The remit of HSE is the protection of workers and the public. He emphasised that there is a significant problem in applying protection measures in the construction industry. Examples showed that workers without protection received pollutant doses well above the maximum permitted exposure levels.

The Draft Code, itself, was introduced by Vina Kukadia who stressed that, currently, there was no formal Code of Practice, although several Local Authorities and large construction companies have independently introduced their own best practice methods. Demand has particularly been placed on Local Authorities because, under the UK Environment Act, they are required to assess local air quality and, where nationally prescribed values are exceeded, plan and implement remedial measures. Construction sites are therefore increasingly likely to become the subject of local environmental attention. The Draft Code reviews relevant statutory requirements covering emissions and air quality requirements. It then comprehensively identifies the individual construction processes and activities that generate particles. Finally particle emission control, management and monitoring measures are considered. In each case, solutions are presented. In presenting this Code, Vina Kukadia stressed the need to provide the industry with specific guidance. She also highlighted gaps in knowledge and the need for further measurements and data.

Philip Chatfield of the Environment Agency stressed concern about water pollution from construction sites. It was important for clear management planning before going on site. Also additives used for dust suppression must be approved by the Agency.

Alan Hawes from the London Borough of Tower Hamlets discussed a case study involving the re-development of an industrial site for housing. The existing site contained a former lead works and highly contaminated land. It was important that development and site clearing did not cause toxic dust to spread to the neighbouring areas. Unfortunately there was no national guidance. Solutions included comprehensive site and personal monitoring combined with road washing, wheel washing, vehicle covering, speed limits, weather monitoring etc. It was also important to deal with local concerns and to gain public confidence.

Linzie Forrester from AMEC Civil Engineering stressed that, as a contractor, it is important to respect everyone's requirements from the HSE to the local population. She felt that the draft Code of Practice gave good background information; it sets out a common basis for everyone and contains a good pool of ideas. There was a need, however, to develop the scientific evidence through further research and to evaluate the cost implications.

John Smith from the Medway Council reviewed the implications of the draft Code for Local Authorities. As an example he referred to how the related Code of Construction Practice had helped to assist good practice in the development of the channel tunnel rail link. This had involved substantial construction of both rail and road systems. He valued the proposed Code in providing useful information and practical guidance, and for explaining the rationale for controls.

Dermot O'Brien, Director of Building Consultancy, NAI Gooch Webster, considered the client's perspective. He noted that:

- The majority of construction will be in the vicinity of existing buildings and occupants therefore protection of surrounding owners and occupants was important;

- The Code of Practice should become a standards clause;

- Cost control should be outweighed by the benefits;

- From the client's perspective the draft Code goes a long way to minimising the potential impact on surrounding business.

Discussion focused various aspects of the Code including:

- Structure, should the Code be prescriptive or contain general guidelines?

- The development of approaches according to site conditions and activities;

- The need for more monitoring and scientific research;

- The need for easy to follow background information and practical guidance;

- Site construction/planning aspects;

- Identifying the roles of each of the public agencies;

- Cost implications.

Following the presentations and discussion that took place at this seminar, this activity is currently being further developed as a collaborative effort between BRE, DETR and industry.

References

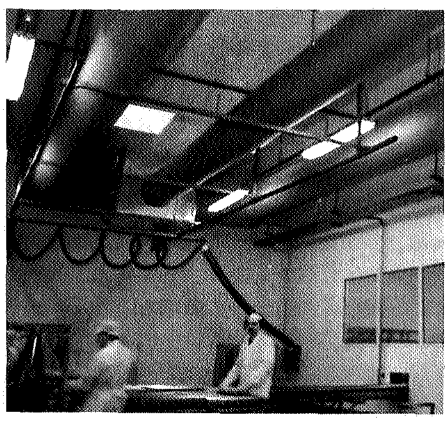
(1) Kukadia V, Upton S L, Hall D J, "Developing a Code of Practice on Controlling Particles from Construction and Demolition: A Review of the Current Position", BRE 81244, March 2000.

Light + Building - A New Annual Exhibition

A new international trade fair, Light + Building, has recently been held in Germany attracting over 1800 exhibitors and 100000 visitors. The exhibition, which took place at Messe Frankfurt between 19th to 23rd March, included 185 air-conditioning equipment and services companies, as well as some 188 building automation exhibitors. Lighting and electrical-engineering companies were also very well-represented. Günther Mertz, Director of the Building Air Conditioning Institute (FGK) remarked that "Although this was the first edition of a new event, our expectations were exceeded by a wide margin." FGK themselves presented a display at the trade fair. The success of this first exhibition was further emphasised by Dr. Michael Peters, Member of the Board of Management of Messe Frankfurt, who commented that, "Light + Building has become one of Frankfurt's seven leading international trade fairs from a standing start."

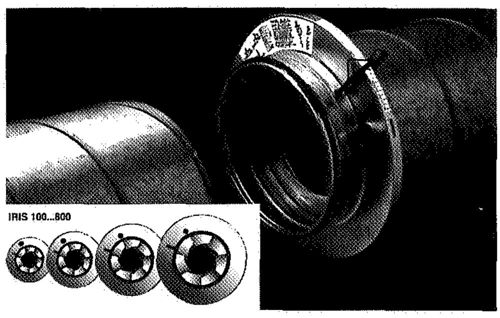
A Selection of Exhibited Products

A product demonstrated by KE Fibertec was a ventilation ductwork network using fabric walls, which is porous allowing air flow through the fabric. Their Low Impulse system can be used for cooling purposes, for loads up to 200W/m^2 without draughts, whilst air velocities are maintained below 0.1 m/s, and operates on a displacement ventilation principle. The very diffuse flow resulting from these ducts ensures a high degree of mixing of the ventilation air close to the ducts, thus avoiding unwanted air flows such as draughts. They may also be easily cleaned, simply by machine washing.



Fabric ventilation ducts (KE Fibertec)

A type of air flow damper that controls flow through ducts by means of an 'iris' mechanism has been devised by ABB. This can be either manually or motor controlled. The dampers also allow easy cleaning inside ductwork, because no parts of the damper are inside the duct when it is fully opened.



Iris dampers (ABB)

Menerga demonstrated a computerised tool for performing psychrometric calculations, "h,x-Diagramm 3.0". This allows user interaction using an on-screen psychrometric chart. The changes in conditions for any process may be quickly evaluated using this tool.

A number of ultraviolet air disinfection systems were demonstrated at the trade fair. These are able to destroy many pathogenic organisms by ultraviolet irradiation. Examples of companies that demonstrated this type of system were HOWATHERM Klimatechnik, Nova Apparate and SterilAir.

The Ventline automatic window opening range for natural ventilation was shown by D+H Mechatronic. The Ventline room controller can be interconnected with a building management system (BMS) via a LON-bus network. The types of devices that may be controlled (possibly manually) includes window drives, heating controllers and external shading. Outdoor wind and rain detection sensors may also be added.

Lindner exhibited their ceiling systems for delivery of heating or cooling, which are suitable for either retrofit or new construction. Aside from being architecturally styled, the systems have been designed to achieve good acoustic and fire prevention properties.

The AEREX unit from Maico HausTechnikSysteme combines heating, ventilation and hot water for dwellings. By a combination of a solar heat collector, used to maintain stored hot water, and a heat exchanger, the system achieves an annual performance factor of 3.5 with an average power input of 0.4 W per m^3/h.

Further information about Light + Building, including details of plans for the next exhibition can be found at on the Web at www.light-and-building.de. Light + Building will next be held from 14 to 18 April, 2002.

New AIVC Annotated Bibliography

Duct Cleaning: An Annotated Bibliography

By Mark J Limb

Introduction

The quality of the indoor air depends not only upon the quality of the outdoor air, but also upon the cleanliness of the equipment and ductwork it passes through before reaching the occupied space. Reasons why HVAC systems get dirty include poor supply air quality, no filters present or if fitted, poorly maintained, general neglect of air handling units and consequent leaks around worn seals. Other contributing factors include duct leakage and deteriorated fiberglass insulation which finds its way into the system as a source of pollution. Poor design and/or maintenance can lead to the accumulation of dusts, microbes, fungi and other waste products within the air distribution system of a building. As air is forced through these systems dust, odours, bacteria and viruses can be picked up and carried around the system along with the ventilation air.

This is not only a supply end problem, along the whole ventilation process dust and pollution can be entrained within the ventilation air, and transported through the system to the exhaust. Re-entrainment is also possible. The amount of debris which becomes trapped within a HVAC system can depend upon the type of system, air velocity within the system, efficiency of the system filtration, the humidity within the system, the hours of operation, housekeeping practices, preventative maintenance programs, and the activities occurring within the building.

A recent comprehensive literature review, focusing on the hygienic aspects of cleaning supply air ducts in ventilation systems, found that the majority of the literature focused on cleaning exhaust ducts and although guidelines were given by some organisations, the authors felt that the scientific basis for these guidelines needed more research. The authors of this review identified five steps to achieve effective cleaning of ventilation ducts, these were;

1. Initial test to determine the level of contamination

2. Source removal

3. Enscapsulation of remaining material

4. Disinfection to prevent mould etc growth

5. Final testing

The overall conclusion of the authors was that duct cleaning provides a valuable means of preventing health effects and discomfort in buildings. Building managers felt that guidelines telling them about the amount and content of, what is believed to be an acceptable amount of debris, would be helpful. However, such information is scarce, due to the complexity of forecasting re-suspension and microbial life cycles. The first standard issued by the Nordic Ventilation Group recommended that surface density of dust should not exceed 1mg/100 cm^2. However, the dust surface densities measured from 13 Danish and 8 Finnish buildings showed higher levels, with ranges from 0.7-3.5g/m^2. Many of the aspects raised in this original literature review have been studied further and are outlined in more detail in the present report.

This bibliography focuses on the cleanliness of ventilation ductwork and examines the extent of this problem, typical contaminants, system design issues, and methods of cleaning and control. It covers sources and types of contamination in ductwork, including dust, oil residue, fungal growth, chemical emissions as well as other forms of contamination. Protocols and maintenance are examined, including when to clean, how often to clean (Maintenance Programmes and Standards), and how to clean. Finally system conditions are considered, including filtration and duct leakage.

Other Bibliographies in this series:

(1) Ventilation and Infiltration Characteristics of Lift shafts and Stairwells
(2) Garage Ventilation
(3) Natural Ventilation
(4) Air Intake Positioning to Avoid Contamination of Ventilation Air
(5) Heat Pumps for Ventilation Exhaust Air Heat Recovery
(6) Ventilation in Schools
(7) Ventilation and Acoustics
(8) Passive Cooing Technology for Office Buildings
(9) Impact of Urban Air Pollution of the Indoor Environment

New AIVC Technical Note

Residential Passive Ventilation Systems: Evaluation and Design

By James W Axley

Air Infiltration and Ventilation Centre, 2000, TN 54, Available to enquirers in participating countries only, price £30.00

Infiltration has long served the residential ventilation needs in North America. In Northern Europe it has been augmented by purpose-provided natural ventilation sytems - so-called passive ventilation systems - to better control moisture problems in dwellings smaller than their North American counterparts and in a generally wetter climate. The growing concern for energy use, and the environmental impacts associated with it, has, however led to tighter residential construction standards on both continents and, as a result, problems associated with insufficient background ventilation have surfaced.

Recognising the energy penalty of uncontrolled natural ventilation, building researchers and practitioners in North America are turning to mechanical systems to provide the necessary ventilation for air quality control. Northern Europeans are following suit but have not completely abandoned the passive ventilation methods that have served them for the past century. Research programs have been initiated in Britain, The Netherlands and France, in particular, to improve the understanding and performance of these traditional and largely empirically-based ventilation methods in the hope that they can more reliably provide basic background ventilation while avoiding the energy penalty associated with uncontrolled over-ventilation.

This state of affairs begs, then, a simple question: Can European passive ventilation systems be adapted for use in North American dwellings to provide ventilation in an energy conservative manner?

This technical note attempts to answer this question. The configuration, specifications and performance of the preferred European passive ventilation system - the passive stack ventilation (PSV) system - will be reviewed; innovative components and system design strategies recently developed to improve the traditional PSV system performance will be outlined; and alternative system configurations will be presented that may better serve the climatic extremes and more urban contexts of North America. While these innovative and alternative passive ventilation systems hold great promise for the future, a rational method to size the components of these and other systems to achieve the control and precision needed to meet the conflicting demands of new ventilation and airtightness standards has not been forthcoming. Such a method will be introduced in this technical note, based on a review of existing simulation and design methods, and a series of applications of this method will be presented. Finally, provisions of the new International One-and Two-Family Dwelling Code that are likely to relate to the installation of passive ventilation systems will be reviewed and proposals for changes to this code will be put forward.

The contents include: review of European passive ventilation methods; alternative passive ventilation options; analysical methods- simulation and design; a first-order design method based on "loop" equations; North American construction and dwelling codes. An appendix gives additional design examples.

New AIVC Technical Note

Acoustics and Ventilation

by Matthew K Ling

Air Infiltration and Ventilation Centre, 2000, TN 52, Available to enquirers in participating countries only, price £30.00

The contents include the basics of acoustics, acoustics and mechanical ventilation, acoustics and natural ventilation, and standards and tools for building performance

Europe-Wide Research Inventory on the Indoor Environment

MRC Institute for Environmental Health

University of Leicester, UK

An extensive research inventory on the indoor environment is currently being established and managed by the MRC Institute for Environment and Health for the European Chemical Industry Council (CEFIC), as part of the latter's Long-Range Research Initiative. This work will compliment an existing IEH database covering air pollution research (both indoor and outdoor) in the UK, being developed on behalf of the UK Department of Health.

The purpose of the European inventory is to provide an up-to-date source of information which may be used to identify the current topics and knowledge gaps in the indoor environment field across Europe, to highlight new advances in indoor air quality research, and to assist in the prioritisation of future research on indoor air pollution.

The inventory will provide useful links to other European collaborators working on related projects and provide a channel through which researchers can communicate effectively with each other. It is planned to make the inventory available via an internet website by the end of this year, in a searchable format.

Those interested in contributing to the inventory, or to find out more about it, should view the following website:

http://www.le.ac.uk/ieh/update/update.html#database

which gives a brief outline of the project, and describes how the researchers may obtain a questionnaire and more information on the database.

ROOMVENT 2000

The Conference

The 7th International Conference on Air Distribution in Rooms will be held at the University of Reading, UK for the period 9-12 July 2000. Reading will be the first UK venue for this well-established conference. The theme of the Conference is Ventilation for Health and Sustainable Environment. There are some two hundred papers from 30 countries to be presented in this conference, covering the following subject areas:

- *Indoor Environment (Thermal Comfort, Indoor Air Quality, Human Health)*

- *Predictive Methods (Physical Models, Analytical Models, CFD Models)*

- *Ventilation Strategies (Displacement Ventilation, Natural Ventilation, Hybrid Ventilation)*

- *Ventilation System Efficiency (Ventilation Effectiveness, Energy Efficiency)*

- *Air Distribution (Air Supply/Extract Devices, Air Handling Devices, Room Air Movement)*

- *Applications (Residences, Offices, Schools and Educational Buildings, Large Spaces, Industrial and Livestock Buildings, Transport, Internal/External Environment)*

The Exhibition

Associated with this conference is an exhibition of ventilation hardware, measuring and data logging equipment, design software, technical books and publications, etc. This is being organized by Faversham House Group Ltd.

Correspondence Address

Conference Secretariat, ROOMVENT 2000, Department of Construction Management & Engineering, The University of Reading, P.O. Box 219, Whiteknights, Reading RG6 6AW, United Kingdom.

Tel: +44 118 931 8198, Fax: +44 118 931 3856

Email roomvent7 @rdg.ac.uk

Web http ://www. rdg.ac.uk/rv2000

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In the following list, Order Codes appear in brackets e.g., (TN 54), prices for customers in AIVC non participating countries are listed first, followed by the discount price in brackets, e.g., £22.50 (£15.00). The discount price applies to customers in AIVC participating countries only, as listed on page 16 of this newsletter. Please note that some items are restricted to AIVC participants only.

FORTHCOMING

Use the order form to be placed on our forward orders list - you will be invited to order when the item is available.

Occupant Impact on Ventilation, Liddament M W, due 2000 (TN 53) Restricted to participants (£30.00)

NEW/LATEST

Residential Passive Ventilation Systems: Evaluation and Design, Axley J W, 2000, (TN 54), Restricted to participants (£30.00)

Ventilation and Acoustics, Ling M K, 2000 (TN 52) Restricted to participants (£30.00)

Annotated Bibliography: Duct Cleaning, Limb M J, 2000 (BIB 10) Restricted to participants (£15.00)

Photovoltaics and Natural Ventilation as Part of Building Facade design - AIRLIT-PV, Liddament M W (TP 1999:5) £20.00 (£20.00)

QUARTERLY JOURNALS

Available in print and online

Air Infiltration Review. Quarterly newsletter containing topical and informative articles on air infiltration research and application. Web: www.aivc.org/air.html (AIR) £25.00 (Free)

Recent Additions to AIRBASE. Quarterly listing of the latest 200 or so items added to AIRBASE, AIVC's bibliographic database, and the AIVC Library. Web: www.aivc.org/publications_password.html (RA). See below for the full version of "Airbase". £10.00 (Free)

AIRBASE

The AIVC's bibliographical database, containing over 12,500 records on air infiltration, ventilation and related areas, is available on CD ROM. Enquirers in AIVC member countries also have access to the AIVC's extensive library, which runs alongside. (AB) £150.00 + VAT (£100.00 + VAT)

WORLD WIDE WEB

The AIVC's home page is at www.aivc.org.

GUIDES AND HANDBOOKS

Improving ductwork: a time for tighter air distribution systems, Carrie F R, Andersson J, Wouters P (eds.) (TP 1999:4) £45.00 (£35.00)

Guide to Energy Efficient Ventilation, Liddament M W, 1996 (GV) £60.00 (£40.00)

Air Infiltration Calculation Techniques: an Applications Guide, Liddament M W, 1986, (CT) £22.50 (£15.00)

Air Infiltration Control in Housing: Handbook, Elmroth A, 1983 (HNBK) £22.50 (£15.00)

TECHNICAL NOTES

(Code TN)

Validation and comparison of mathematical models, 1983 (TN 11) £22.50 (£15.00)

Wind pressure data requirements, 1984 (TN 13) £22.50 (£15.00)

Wind Pressure Workshop Proceedings, 1984 (TN 13.1) £22.50 (£15.00)

Leakage Distribution in Buildings, 1985 (TN 16) £22.50 (£15.00)

Ventilation Strategy - A Selected Bibliography, 1985 (TN 17) £22.50 (£15.00)

Airborne moisture transfer: workshop proceedings, 1987 (TN 20) £22.50 (£15.00)

Review and bibliography of ventilation effectiveness, 1987 (TN 21) £22.50 (£15.00)

Inhabitants' behaviour with regard to ventilation, 1988 (TN 23) £22.50 (£15.00)

AIVC Measurement Techniques Workshop, 1988 (TN 24) £22.50 (£15.00)

Minimum ventilation rates, IEA Annex IX 1989 (TN 26) £22.50 (£15.00)

Infiltration and leakage paths in single family houses, 1990 (TN 27) £22.50 (£15.00)

A guide to air change efficiency, 1990 (TN 28) £22.50 (£15.00)

A guide to contaminant removal effectiveness, 1991 (TN 28.2) £22.50 (£15.00)

Reporting guidelines for airflows in buildings, 1991 (TN 32) £22.50 (£15.00)

A review of building air flow simulation, 1991 (TN 33) £22.50 (£15.00)

Air flow patterns: measurement techniques., 1991 (TN 34) £22.50 (£15.00)

Advanced ventilation systems, 1992 (TN 35) £22.50 (£15.00)

Airgloss Air Infiltration Glossary, Limb M J, 1992 (TN 36) £22.50 (£15.00)

A Strategy for Future Ventilation Research and Applications, Liddament M W, 1992 (TN 37) £22.50 (£15.00)
A Review of Ventilation Efficiency, Liddament M W, 1993 (TN 39) £30.00 (£20.00)
An Overview of Combined Modelling of Heat Transport and Air Movement, Kendrick J F, 1993 (TN 40) £30.00 (£20.00)
Infiltration Data from the Alberta Home Heating Research Facility, Wilson D and Walker I, 1993 (TN 41) £30.00 (£20.00)
Current Ventilation and Air Conditioning Systems and Strategies, Limb M J, 1994 (TN 42) £30.00 (£20.00)
Ventilation and Building Airtightness: an International Comparison of Standards, Codes of Practice and Regulalions, Limb M J, 1994 (TN 43) £30.00 (£20.00)
Numerical Data for Air Infiltration and Natural Ventilation Calculations, Orme M S, 1994 (TN 44) £30.00 (£20.00)
Air-to-Air Heat Recovery in Ventilation, Irving S, 1994 (TN 45) £30.00 (£20.00)
1994 Survey of Current Research, Limb M J, 1995 (TN 46) £30.00 (£20.00)
Energy Requirements for Conditioning of Ventilation Air, Colliver D, 1995 (TN 47) £30.00 (£20.00)
The Role of Ventilation in Cooling Non-Domestic Buildings, Irving S J, 1997 (TN 48) £30.00 (£20.00)
Energy Impact of Ventilation: Estimates for the Service and Residential Sectors, Orme M S, 1998 (TN 49) Restricted to Participants only (£20.00)
Introduction to Ventilation Technology in Large Non-Domestic Buildings, Dickson D, 1998 (TN 50) Restricted to Participants only (£20.00)
Applicable Models for Air Infiltration and Ventilation Calculations, Orme M S, 1999 (TN 51)

ANNOTATED BIBLIOGRAPHIES

Aim to review and technically assess current literature and provide a concise but in depth overview of a variety of subjects. (Code BIB)

Ventilation and infiltration characteristics of lift shafts and stair wells, 1993 (BIB 1) £22.50 (£15.00)
Garage ventilation, 1994 (BIB 2) £22.50 (£15.00)
Natural ventilation, 1994 (BIB 3) £22.50 (£15.00)
Air intake positioning to avoid contamination of ventilation air, 1995 (BIB 4) £22.50 (£15.00)
Heat pumps for ventilation exhaust air heat recovery, 1996 (BIB 5) £22.50 (£15.00)
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Ventilation and Acoustics in Buildings, 1997 (BIB 7) £22.50 (£15.00)
Passive Cooling Technology for Office Buildings in Hot Dry and Temperate Climates, 1998 (BIB 8) £22.50 (£15.00)
Annotated Bibliography: Impact of Urban Air Pollution on the Indoor Environment, Limb M J, 1999 (BIB 9) £22.50 (£15.00)

AIVC CONFERENCE PROCEEDINGS

Papers from earlier AIVC Conference Proceedings are also available. Contents pages can be forwarded on request.(Code CP)

'Ventilation System Performance' Belgirate, Italy, 1990 (CP 11) £35.00 (£35.00)
'Air Movement and Ventilation Control within Buildings', Ottawa, Canada, 1991, 3 volumes (CP 12) £50.00 (£50.00)
'Ventilation for Energy Efficiency and Optimum Indoor Air Quality', France, 1992 (CP 13) £50.00 (£50.00)
'Energy Impact of Air Infiltration and Ventilation', Denmark, 1993 (CP 14) £50.00 (£50.00)
'The Role of Ventilation', Buxton, UK, 1994 (CP 15) £50.00 (£50.00)
'Implementing the Results of Ventilation Research', Palm Springs, USA, 1995 (CP 16) £50.00 (£50.00)
'Optimum Ventilation and Air Flow Control in Buildings', Gothenburg, Sweden, 1996 (CP 17) £50.00 (£50.00)
'Ventilation and Cooling', Athens, Greece, 1997 (CP 18) £65.00 (£65.00)
'Ventilation Technologies in Urban Areas', Oslo, Norway, 1998 (CP 19) £65.0 (£65.00)
20th AIVC Conference Proceedings: 'Ventilation and Indoor Air Quality in Buildings', Edinburgh, Scotland, 1999 CD ROM with printed abstracts and indexes. (CP 20) £65.00 + VAT (£65.00 + VAT)

LITERATURE LISTS

Literature lists are searches carried out on the AIVC's bibliographical database, "Airbase". They are an up-to-date selection of material, usually between 30-40 abstracts, which provide a useful introduction to the relevant subject area. Papers listed are available from AIVC library. Contact AIVC for full list. (Code LL)

Computational fluid dynamics (LL 20) £2.50 (Free)
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Renewables: the Energy for the 21 Century. World Renewable Energy Congress - VI WREC 2000
1-7 July 2000
Metropole Hotel, Brighton, United Kingdom
Professor Ali Sayigh, Congress Chairman and Director General of WREN, 147 Hilmanton, Lower Earley, Reading RG6 4HN, UK, Tel: +44 1189 611364, Fax: +44 1189 611365, email: asayigh@netcomuk.co.uk, http://www.WRENUK.CO.UK

Architecture, City, Environment
PLEA 2000 The millennium conference on Passive and Low Energy Architecture
The 17th International Conference on Passive and Low Energy Architecture
2-5 July 2000
Cambridge, UK
Ms Lynda Bryers, University of Cambridge, Programme for Industry, 1, Trumpington Street, Cambridge CB2 1QA, UK Tel: +44 (0)1223 342100, Fax: +44 (0)1223 301122, email cpi@hermes.cam.ac.uk

An Alternative Approach to Infection Control. Symposium & Exhibition. TB and MRSA Control.
The first symposium on the application of engineering measures to control tuberculosis and airborne nosocomial (hospital acquired) infections, including methicillin resistant Staphylococcus aureus (MRSA).
12 July 2000
University of Leeds, UK
Francesca Snaddon, Marketing Department, University of Leeds Innovations Ltd, 175 Woodhouse Lane, Leeds, LS2 3AR, Tel 0113 233 3444, Fax: 0113 234 3811, email marketing@ulis.leeds.ac.uk

Engineering Solutions to Indoor Air Quality Problems, an International Symposium
July 17-19, 2000
Sheraton Capital Center, Raleigh, North Carolina, USA
http://www.awma.org

Energex 2000 The 8th International Energy Forum
23-28 July 2000
Las Vegas, Nevada, USA
Dr Peter Catania, Faculty of Engineering, University of Regina, Regina, SK S4S 0A2, Canada, Tel: 306 585 4364, Fax: 306 585 4855, email: ief@cableregina.com Web: www.GlobeEx.com, www.energysource.com/ief/updates, www.cableregina.com/nonprofits/ief/index.htm, or email: globalenergy@pgi.com

Healthy Buildings 2000
6-10 August 2000
Espoo, Finland
Conference Secretariat, Healthy Buildings 2000, attn: Ms Leila Sarajarvi, PO Box 25, FIN-02131 Espoo, Finland, Tel: +358 9 4355 560, Fax: +358 9 4355 5655 email info@sisailmayhdistys.fi internet: www.hb2000.org

Efficiency & Sustainability 2000 ACEEE Summer Study on Energy Efficiency in Buildings
20-25 August 2000
Asilomar Conference Center, Pacific Grove, California, USA

7th International Conference on Air Distribution in Rooms - Roomvent 2000
9-12 July 2000
The University of Reading, UK

Dublin 2000: "20 20 Vision" ASHRAE/CIBSE Meeting
20-23 September 2000
Royal College of Surgeons, Dublin, Ireland
ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329-2305, USA, email dublin2000@cibse.org or dublin2000@ashrae.org

Energy for Buildings Fourth International Conference
21-22 September 2000
Vilnius, Lithuania
Prof A Skrinska, Organising Committee, "Energy for Buildings", Vilnius Gediminas Technical University, Sauletekio al. 11, 2040 Vilnius, Lithuania, Tel: +370 2 769600, Fax: +370 2 700497, email: energy@konf.vtu.lt

Innovations in Ventilation Technology The 21st AIVC Annual Conference
26-29 September 2000
Steigenberger Kurhaus Hotel, The Hague, Netherlands
Helen Shawcross, Conference Organiser, Air Infiltration and Ventilation Centre, Sovereign Court, University of Warwick Science Park, Sir William Lyons Road, Coventry CV4 7EZ, UK Tel: +44 (0)24 76 692050, Fax: +44 (0)24 76 416306, email airvent@aivc.org

Canada's Energy Efficiency Conference and Awards 2000
October 10-12, 2000
Ottawa Congress Centre, Ottawa, Ontario, Canada
http://oee.nrcan.gc.ca/conference, Tel: +1 877 633 7440

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