

Air Infiltration Review

a quarterly newsletter from the IEA Air Infiltration Centre

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AIC – What does it stand for?

In case you missed the first issue of AIR, it is worthwhile restating the background to and the main purposes of the Air Infiltration Centre. The Centre was inaugurated through the International Energy Agency and is being funded by eight of the member countries (see back page). The primary role of the AIC is the technical support of active research in air infiltration in buildings. Its main aim is to bring the prediction of air infiltration rates and the associated energy implications up to a level comparable with that developed for other energy transfer processes in buildings.

The Centre offers practical assistance to institutions engaged in air infiltration research by:

operating a technical information service involving the acquisition, appraisal and dissemination of scientific and research data

collating and analysing experimental output to produce reliable numerical data against which mathematical models of air infiltration processes can be validated or refined;

promoting technical interchange by research groups of member countries and taking a lead in encouraging active international co-ordination of research effort.

Enquiries

The AIC has been established to provide a technical service to research workers in the field of air infiltration in buildings. An international network of communication has been established with the nominated organisations in each country acting as the primary links to the Centre. If you wish to make an enquiry, please first introduce yourself to one of the nominated organisations in your country. You will find them listed on the back page of this newsletter. They will be pleased to help you gain the maximum benefit from the AIC's resources.

Should you be in a non-participating country, then please contact the AIC direct and we will be pleased to discuss in what way the services might be available to you. Call us by telephone (+44 344 53123) or telex (848288 (BSRIA G)) or write to the address given overleaf.

Bibliographic data base

Following the appointment of Sheila Manning as Librarian in December, work has been proceeding on the setting up of a specialized data base of published literature on air infiltration and associated subjects. With the generous cooperation of

BSRIA, many of the initial references have been drawn from their library records. Abstracts from that, and other sources, are being compiled in a form suitable for inclusion in a computer-based data storage and retrieval system. The software system adopted by AIC is known as Status II. It provides comprehensive facilities for creating, maintaining and searching reference material and is used by several research organisations in the UK for purposes similar to those of the AIC.

The data base will contain references to published articles together with informative abstracts in English. Retrieval will be possible by subject or group of subjects, by author or by date of publication. Special keywords or any significant words in free text can be used as the identifier for searches.

We anticipate that the initial data base and retrieval system will be operational by April 1980, although input will continue throughout the year as more of the available material is incorporated and new publications are scanned for suitable papers.



The new AIC staff—on the left Sheila Manning our Librarian who graduated at Cambridge University and subsequently gained a Diploma in Librarianship, and on the right Hazel Sutherland (Clerical Assistant) who recently returned to this country from the Middle East.

Snippets from Sweden

The proposed international handbook on 'Airtightness and Building Construction' was the main subject of discussion when the Head of AIC visited Arne Elmroth of the Royal Institute of Technology (Division of Building Technology) in Stockholm last month. The Handbook will initially relate to dwellings and will outline the reasons for designing buildings with minimum leakage. It is expected that a general section on the main principles, design objectives, common problems and control methods will precede sections devoted specifically to recommendations for particular countries taking account of national requirements and local building practice. The Handbook is still in the early stages of preparation and as the work proceeds, AIR will keep you informed of progress. Meanwhile, Arne Elmroth is seeking relevant information and will be visiting the countries involved in this project to familiarize himself with the constructional techniques and precautions against leakage in current use.

A handbook reflecting Swedish practice has already been published and the AIC has translated it into English. The English version will be printed in Sweden and is expected to be available within two or three months.

The visit also included a look around the test laboratory of the Division of Building Technology where a new facility for testing the insulation effectiveness and airtightness of building sections was being commissioned. The facility consisted of two large environmental chambers with the building section under test constructed as the dividing wall. Tests will be conducted with the 'indoor' chamber maintained at normal living conditions and the 'outdoor' chamber controlled at temperatures down to -22°C with typical pressure differentials generated across the intervening test wall. Particular attention will be paid to the effectiveness of various jointing techniques under both steady and cyclic test conditions.

Other visits in Stockholm included one to the offices of Tyrens Företagsgrupp AB (Consulting Engineers) to meet Per-Olof Nylund. Among many interesting topics discussed were models for predicting air infiltration in dwellings and a method for leakage testing large office buildings using the normal ventilation system fans for pressurization. A call was also made on Lars Sundbom at the Swedish council for Building Research, who outlined the general scope of the government research programme over the next few years.

USA Tour

A most interesting and informative visit to several research organisations in the USA was made by the Head of AIC last October. The first call was to Princeton, New Jersey, where David Harrje helpfully described the work currently in progress at the University. Of particular interest was the technique developed for detecting insulation and air leakage faults in dwellings. The technique involved the use of a pressurization/evacuation system in conjunction with portable infra-red scanning equipment. A practical demonstration in a typical American dwelling was given. Some fuel utilities were evidently interested in training teams, nick-named 'house doctors', to perform these diagnostic surveys.

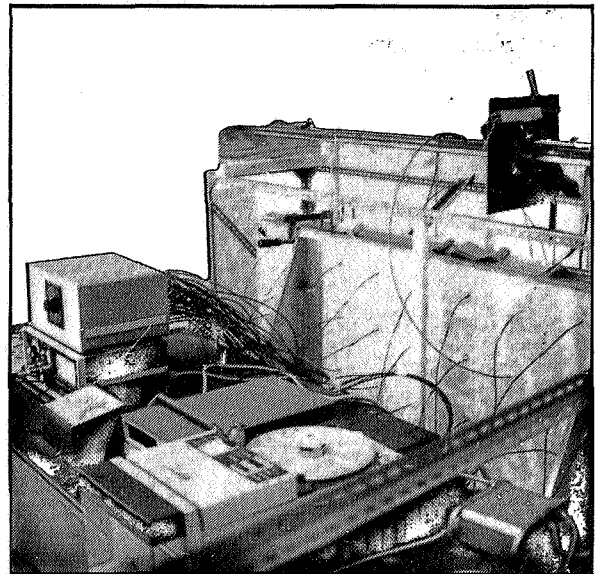
An infiltration measurement technique which involved the storage of SF_6 contaminated air samples in small plastic bottles was also demonstrated. This method allows a sequence of samples to be taken on site and then returned to the laboratory for subsequent analysis. This technique was also described by Dr. Max Hunt and Dick Grot at the Centre for

Moving south to Lund, a profitable day was spent with Professor L. E. Nevander and Johnny Kronvall at the Lund Institute of Technology. Discussions centred on the work being conducted at the Institute on moisture transfer and air leakage through building materials.

Johnny Kronvall describes his research project 'Air leakage characteristics of building enclosures' as follows:

'The main aim of this project, sponsored by the Swedish National Board of Building Research, is to establish a better knowledge of how air moves in and through building components under influence of pressure differences caused by for example, wind, stack effect and ventilation systems. An important aspect of the project is the application of common fluid mechanics to problems of building physics. A calculation model based mainly on the concept of pipe flow has been established. The model will be verified in both laboratory and field studies.

As part of the project such basic parameters as roughness of surfaces of different building materials and their air permeability coefficients will be determined. The experimental work on determination of roughness factors is well under way and the picture below shows the apparatus for this.'



Building Technology, NBS, Washington. Instead of plastic bottles, multi-film plastic 'envelopes' were used and returned to the NBS laboratory by post. In this way a large survey of dwellings was being made with infiltration rate assessments conducted before and after structural improvements aimed at reducing air leakage. Interesting developments in fully-automated infiltration measurements and sample analysis techniques were discussed.

The sight at NBS of a full-size dwelling constructed inside a large test room with wide-ranging environmental control facilities was enough to make any research worker in this field green with envy. Perhaps one day we will see a two-storey house in a wind-tunnel!

The Lawrence Berkeley Laboratory in Berkeley, California was also visited during the tour. David Grimsrud kindly made himself available for discussions on various subjects of common interest including the establishment of a bibliographic data

base. He also arranged a visit to the test house where the LBL pulsating pressurization method of determining the leakage characteristics of the dwelling was demonstrated. The method involves the use of a large piston assembly driven at controlled speeds and stroke by an electric motor. The leakage characteristic of the dwelling may be determined by the appropriate analysis of the internal fluctuating pressure signal. It was claimed that this technique was particularly suited to leakage assessment at low pressure differentials—conditions under which measurements with imposed steady pressure levels were difficult because of the disturbance of wind effects.

ASTM Standards

During his visit to the USA, the Head of the AIC was invited to attend a meeting of one of the sub-committees of ASTM, the American Society for Testing and Materials. The sub-committee E06.41 on Infiltration Performance was discussing standard test methods for the determination of air leakage (1) by the pressurization/evacuation method and (2) by the tracer gas dilution method. These standards are still in draft form and as soon as they are formally issued the AIC will obtain copies for reference.

AIC Conference

As announced in the last issue of AIR, a conference is being planned for 6–8 October, 1980. The theme of the conference will be:

'Instrumentation and Measuring Techniques'

and a number of papers outlining new methods have already been submitted.

The conference will take place at Cumberland Lodge, attractively set in the beautiful landscape of the Great Park at Windsor, about 25 miles (40 km) west of London, UK. Attendance at the conference will be limited to four or five delegates per country; please check with your representative about vacancies.



Cumberland Lodge



Glasgow Commercial Building Monitoring Project

The IEA Executive Committee on Energy Conservation in Buildings and Community Systems has initiated studies to compare and evaluate the computer programs of the participating nations which simulate the energy flows within buildings (Annex 1). The first exercise was a comparison of the predictions for a hypothetical building and the study continued with the analysis of a real building which had been monitored.

Under a separate Annex (No. 4) complementary work has commenced on the monitoring of the Collins Office building in Glasgow, Scotland. This is a steel framed structure with a basement and three upper floors and incorporates a variable flow rate air conditioning system with heat recovery. Glasgow University is the Operating Agent for the Annex.

As part of the energy flow assessment, the fresh air intake to the air conditioning systems will be monitored. The magnitude of adventitious air infiltration rates will also be measured. These measurements will be made using sulphur hexafluoride (SF_6) as a tracer gas and Dr. C. M. Hunt of NBS Washington will be providing the instrumentation. This will consist of

computer-controlled equipment with multiple SF_6 injection systems and up to ten sampling ports linked to an electron capture detector. The decay method of determining ventilation rates will be adopted with periodic injection of the tracer gas into the supply air and samples drawn from the return air. The bulk of the measurements will be made during occupancy of the building when the air conditioning systems are operating. Subsidiary tests will be conducted to determine the air infiltration with the mechanical systems closed off.

Max Hunt and his colleague Dick Grot were recently in Glasgow to discuss the instrumentation and the data acquisition procedures. Peter Jackman, Head of AIC, was invited to share in these discussions.

Much of the discussion centred on the integration and interaction of the ventilation rate monitoring procedures with the main data-logging facilities being used for the energy consumption monitoring. It is expected that the ventilation rate data together with appropriate climatic data will be isolated for separate detailed analysis.

Survey

The AIC is currently conducting an international survey of ongoing research in air infiltration. The results of the survey will be circulated in member countries to keep researchers informed of the work of others in the same field.

The survey questionnaires have been distributed via the nominated organisations in member countries. To some institutions known to be conducting relevant research in non-member countries, questionnaires have been sent direct. You are reminded to return the forms promptly please.

If you are engaged in a research programme on the subject of air infiltration in buildings but have not received a questionnaire form, then please contact your nominated organisation or the AIC direct.

Your cooperation in this survey will ensure that it fulfils its purpose of providing comprehensive information on research studies being undertaken worldwide.

Recent Conferences:

An ASHRAE/DOE sponsored Conference entitled: *'Thermal Performance of the Exterior Envelopes of Buildings'* was held on 3-5 December 1979, in Florida. The following papers were included:

- **'The use of sound to locate infiltration openings in buildings'*, David N. Keast and Hsien-Sheng Pei, Bolt Beranek and Newman, Inc., Cambridge, MA.
- 'Low pressure leakage function of a building'*, M. H. Sherman, D. T. Grimsrud and R. C. Sonderegger, Lawrence Berkeley Laboratory, University of California, Berkeley, CA.
- 'A model correlating air tightness and air infiltration in houses'*, Ake Blomsterberg, M. H. Sherman and D. T. Grimsrud, Lawrence Berkeley Laboratory, University of California, Berkeley, CA.
- **'Analysis of infiltration by tracer gas technique, pressurization tests, and infrared scans'*, Michael B. Stewart, Thomas R. Jacob and J. G. Winston, Owens-Corning Fiberglas Corporation, Granville, OH.
- 'Field air infiltration performance of new residential windows'*, S. Selkowitz, Lawrence Berkeley Laboratory, Berkeley, CA. J. Weidt, John Weidt Associates, Chaska, MN.
- 'Air exchange measurements in a high-rise office building'*, C. M. Hunt, National Bureau of Standards, Washington, DC.
- 'Air leakage characteristics of low-income housing and the effectiveness of weatherization techniques for reducing air infiltration'*, Richard A. Grot and Roy E. Clark, National Bureau of Standards, Washington, DC.
- **'Air infiltration measurement and reduction techniques on electrically heated homes'*, John O. Collins Jr., John-Manville Co., Denver, CO.
- 'Residential ventilation with heat recovery: improving indoor air quality and saving energy'*, G. D. Roseme, J. V. Berk, M. L. Boegel, C. D. Hollowell, A. H. Rosenfeld and I. Turiel, Lawrence Berkeley Laboratory, University of California, Berkeley, CA.
- 'A field study of moisture damage in walls insulated without a vapor barrier'*, George A. Tsangas, Dept. of Engineering and Applied Science, Portland State University, Portland, OR. F. Glen Odell, Seton, Johnson, and Odell Inc., Portland, OR. James C. Thompson, Oregon Dept. of Energy, Salem, OR.

Copies of papers marked * are already available from the AIC. It is understood that the full proceedings will be issued in mid-1980.

The ASHRAE 1980 Semi-annual Meeting took place at Los Angeles on 3-7 February, 1980. This included a seminar at which the following papers were presented:

- 'Air leakage, indoor air quality and ventilation in residences'*, Dr. Craig D. Hollowell, Chairman, Lawrence Berkeley Laboratory.
- 'Air infiltration measurement and reduction techniques on electrically heated homes'*, J. O. Collins, Jr., Johns-Manville Sales Corp.
- 'Air leakage and condensation in houses'*, G. O. Handegord, National Research Council, Canada.
- 'Air leakage measurements and building retrofits'*, D. T. Harrje, Princeton University.
- 'Indoor air quality and air-to-air recovery devices'*, G. D. Roseme, Lawrence Berkeley Laboratory.
- 'Current status of ASHRAE ventilation standard 62-73R'*, Dr. J. E. Woods, Iowa State University.

Copies of these papers will be available when the proceedings are published later in the year.

Forthcoming Conferences:

XX1 International Congress for Building Services Engineering, Berlin, 17-18 April, 1980.

With an emphasis on the reduction of the energy demand of buildings, the programme covers a wide range of subjects including the ventilation of buildings. Of special interest are the following:

- 'Air quality within buildings'*, H. U. Wanner.
- 'Experimental study on the exchange of air and air quality in buildings with natural ventilation'*, B. Schwarz.
- 'Theoretical and experimental studies of heat loss due to ventilation'*, D. W. Etheridge.
- 'The low pressure leakage function of a building'*, D. T. Grimsrud, M. H. Sherman, R. C. Sonderegger.

Conference details are available from:

Professor H. Esdorn,
Hermann Rietschel Institute for Heating
and Air Conditioning Engineering,
Technical University Berlin,
Marchstrasse 4,
1000 Berlin 10.

ICEM. *'International congress on building energy management'*, 12-16 May, 1980, Povoá de Varzim, Portugal.

The programme includes over 100 papers of which the following are of special interest:

- 'Impact of air infiltration and ventilation of energy losses of buildings'*, F. D. Heidt, F. Haberda and L. Trepte.
- 'Proposed nordic standard for ventilation and thermal comfort'*, P. O. Farger.
- 'The influence of ventilation, humidification and temperature on the sensation of freshness and dryness of air'*, B. Berg-Murch.
- 'Building ventilation and indoor air quality'*, C. D. Hollowell.
- 'Air flow forming, energy consumption and utilization in ventilated rooms'*, S. Mierzwiński.

Further information from:

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