#4930

AIVC Numerical Database

The Objectives and Expected Contents

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The Air Infiltration and Ventilation Centre is currently finalising the detailed work program for its Numerical Database. This is being developed in response to the need to establish a core of numerical data, suitable for model validation, the modelling of real buildings, assessment of standards, the effects of new building methods and the use of differing ventilation systems.

Substantial amounts of data have been collected by researchers in both IEA projects and others, but these are generally uncoordinated, since they form the basis of individual research programs. Unfortunately, once this work is completed the raw data is rarely published, leading to the loss of much useful information.

The aim of the AIVC's Numerical Database is to take the original core data, from as many sources as possible and present it in an easily accessible form, for researchers to use. It is therefore designed to compliment the Centre's bibliographic database AIRBASE (1).

The core data types incorporated in the database will include the following:

Basic climatic data: Sample weather data from as many countries as possible to allow comparisons of building performance between climates, a factor which is becoming more important as wider international standards for construction are established. These should also assist in the selection of appropriate technology transfers, as individual countrys' standards for construction in airtightness, ventilation and energy efficiency are updated.

Standards: As standards are updated and comparisons are drawn, researchers will need easy access to the required information much of it numerical. The numerical database will work hand in hand with the Centre's written reports on national standards, to allow direct rapid comparisons between requirements.

Wind Pressure Coefficients and Associated Algorithms: This data is available from a number of different sources, but by its very nature is complex for all but the most simple building shapes. Data for a basic low square building (aspect ratio: 1:1) or, a low rectangular building (aspect ratio: 2:1) has been published in the AIVC's Calculation Techniques Guide(2). Data for other shapes has been published, but is scattered throughout numerous publications and is often incomplete. This data will be collated into the numerical database where it should be possible to combine a number of similar data sets to produce further unified data for many building configurations. Complete data sets for real buildings will also be included with Cp data as well as dimensional data allowing the whole data set for a building to be used in a modelling exercise.

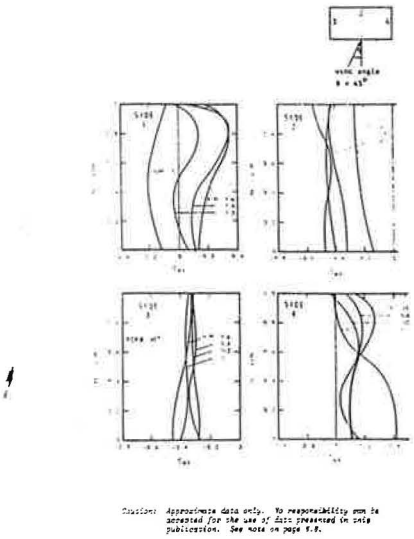

Figure 1: Data from the AIVC Calculation Techniques Guide

Whole Building Leakage Values: These will be stored and linked to files containing any details of the buildings they refer to. This should eventually lead to a large database of values which can be analysed for building type and changing trends over time. Comparisons with required standards and future recommendations for standards, along with comparisons between countries and climates, will thus be possible.

Typical Component Leakage Values: As for the Wind Pressure Coefficients a number of these leakage values have been published in the Calculation Techniques Guide (2). This data will be entered into the database and extended, as and when additional data is available. These values will be essential for the modelling of newly designed buildings, and where the measurement of component leakages of an existing building is impractical.

Air Change Rate Measurements: These will be kept as for the whole building leakage data linked to a building description file, which will allow analysis of changing trends in the building stock for individual countries. Comparisons between countries and the effects of local standards will also be possible.

Interzonal Air Flow Data: In addition to gross air change rate data, interzonal flow rate data will also be stored. This will require far more detailed information on the building concerned and the prevailing weather conditions, both of which will be stored in related files. This type of more detailed information will be of use primarily for model validation purposes. It may also be useful, when comparing the effectiveness of various types of purpose provided passive, and mechanical ventilation systems.

Ventilation Effectiveness and Air Flow Patterns Data: This data will be of use to designers of new buildings and ventilation systems. Air flow pattern data will also be vital for individual room model validation.

Pollutant Transport: Data concerning the migration of pollutants will allow modellers and designers to assess the effectiveness, and possible problems associated with old and new building methods and ventilation systems. It will be possible to compare the properties of various pollutants related to their different sources, chemistries, densities, and relative absorption/breakdown rates. Data on occurrence of different pollutants in differing structures and countries, and the effect on and of occupant behaviour will also be available.

Occupant Effects on Air Change Rates and Energy Usage: The effect of occupant behaviour is also closely related to the real energy usage of buildings. How ventilation systems alter occupant behaviour due to their real or perceived qualities can be critical in the energy equation. The close interaction between the building fabric and its internal/external environments varies from country to country according to local lifestyles and prevailing weather conditions. The numerical database will allow these complex interactions to be assessed and compared between building styles, ventilation systems, countries, and their applied standards.

Ventilation Heat Loss: Throughout the IEA member states, energy conservation measures have made ventilation heat losses increasingly critical in the energy equation. The large amount of data collected will assist in the recommendation of appropriate measures according to prevailing climate and building practices.

Cost Effectiveness Data: The cost effectiveness of different ventilation strategies varies enormously, according to climate, building type, ventilation system, and occupant behaviour. The requirements for pollutant control are also vital in this assessment. Appropriate balances have to be struck between cost and effectiveness for any building/ventilation system combination. The numerical database will aid in this assessment, by its contributions in all of the above described categories. Ultimately however the least cost alternatives will prevail. The correct assessment of these options will be vital both from health and energy considerations. It is hoped that the database will provide a valuable contribution in this assessment.

Data for the database is already being received from several sources. These include multizone leakage and ventilation data from the LESO building (Figure 2) collected for Annex 20 by EPFL in Lausanne,Switzerland (3). This data will be included in the numerical database as a set of files describing the whole building. Typical data from any of these files may eventually be combined into summary files, or the whole file used for model validation purposes. The climate data set may also serve a useful function as being typical for its location.

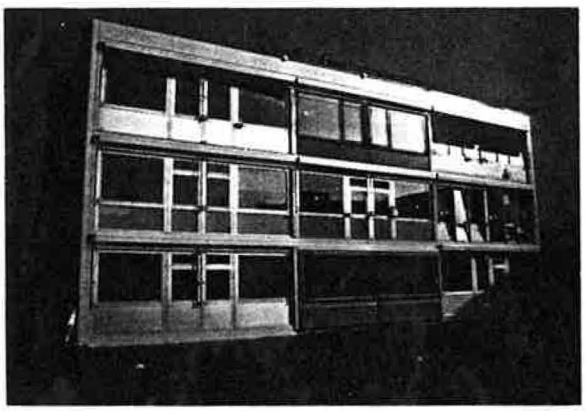

Figure 2: The LESO building, EPFL Lausanne, Switzerland

An important aspect of the database software is its data processing capabilities. Compatible data can be extracted from any part of the database and output in an acceptable form. A number of model interface programs will be made available to produce output files compatible with common models used at the Centre. The flexibility of the chosen software will also allow users to design their own output modules. These can be fully menu driven programs, operating as a shell over the database software itself. Similar modules can be developed for data output into most commonly available spreadsheet formats. Quality reports of selected data can also be produced directly from the database. As well as being available as a computer package, selected parts of the numerical database will be published as a new AIVC Guide. Any relevant portions of the existing Calculation Techniques Guide will be updated. The database will also be used as source data for future AIVC Guides and Technical Notes.

References:

1) See AIRBASE - Now available for your PC, later in this magazine.

2) Air Infiltration Calculation Techniques-An Applications Guide, Martin Liddament, June 1986, The Air Infiltration and Ventilation Centre.

3)Weather and aeraulic data set for validation. The LESO Building. Part 1: Content of the data set. February 1989. J.-M. Furbringer, R. Compagnon. Ecole Polytechnique Federale De Lausanne.