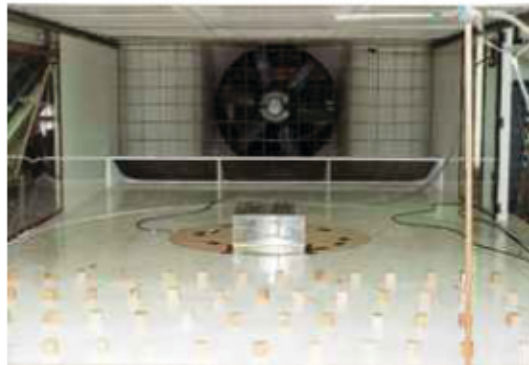


In Touch With The Elements

Nick Locke from Opus Central Laboratories describes research to find ways of making accurate predictions about the behaviour of naturally-ventilated urban buildings.

The wind tunnel at Victoria University, which is being used to measure external and internal air flows in a model of a standard-shaped building - the "Texas Tech" - computer representation above.

Victoria University's School of Architecture building will be the subject of a ventilation study, which considers both the existing situation and the application of natural ventilation concepts.



Anyone who deals with building conditions for office workers knows the most frequent gripes are "too hot", "too cold", "too stuffy" or "too draughty"; consequently, building owners and managers are reluctant to try anything risky which might incur even more complaints.

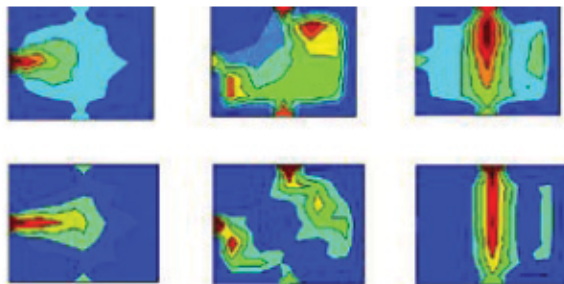
Architects and developers would be more confident about incorporating natural ventilation in their buildings if accurate and effective design tools were available. If people can live and work comfortably in buildings without air conditioning, the potential for energy savings is enormous.

Participants in a three-year study entitled "Energy Efficient Building Ventilation" are assessing ways of measuring the effect of ventilating buildings naturally - without air conditioning systems. They are evaluating several tools: wind tunnel studies; computational fluid dynamics (CFD - carried out on a computer); dynamic thermal modelling; and traffic noise modelling.

Opus Central Laboratories conducted a wind tunnel study which measured at the motion of wind-driven internal air. This provided data for comparison with numerical solutions. The Centre for Building Performance Research (CBPR) at Victoria University has been carrying out computer modelling which simulates the external and internal air flows measured in the wind tunnel.

A standard building shape known as the Texas Tech Building was used in the initial study, as it provides a simple geometry which allows meaningful comparisons to be made between different modelling approaches. When the predictions for wind flow and thermal calibration in the computer model were compared with the actual measurements in the

The coloured diagrams (below, left) show a comparison of the wind speeds inside the building when it has windows cut in three of the four sides. The diagrams are contour plots of the wind speeds measured across a horizontal plane inside the building model. They are not a representation of a the building shape itself. It can be seen the predicted and actual behaviour is similar. wind tunnel, they agreed well.



Comparison of actual results (wind Tunnel measurements, top row) and predicted results (computer calculations, bottom row).

Until now there has been no accepted standard for assessing the accuracy of the computer simulation (CFD) output. The Opus/CBPR research has created a database that will provide a measure of quality assurance for CFD users working in the field of natural ventilation.

Future work will look at dynamic thermal modelling, traffic noise and the performance of windows in naturally ventilated buildings. A ventilation study of the School of Architecture building at Victoria University in Wellington will be performed, for both the existing situation and with natural ventilation concepts incorporated. Differences in the indoor environment quality and net life cycle costs will be assessed for the alternate ventilation strategies. The study is being funded by the Public Good Science Fund, from the Foundation for Research, Science & Technology.

A forum about building services research held at the School of Architecture, Victoria University, on 9 February concluded there is a need for more effective transfer of knowledge to designers about the relationship between building design and the quality of interior environment created.

Dr Jon Hand from the University of Strathclyde talked about the potential applications and practical issues associated with dynamic modelling of buildings. He has helped develop a state of the art thermal simulation program (ESP-r), and has been a consultant on the modelling and design of many large buildings.

The organisers would like to hear from people with an interest in this area who were unable to attend the forum.

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