

## Natural Ventilation and Mixed Mode

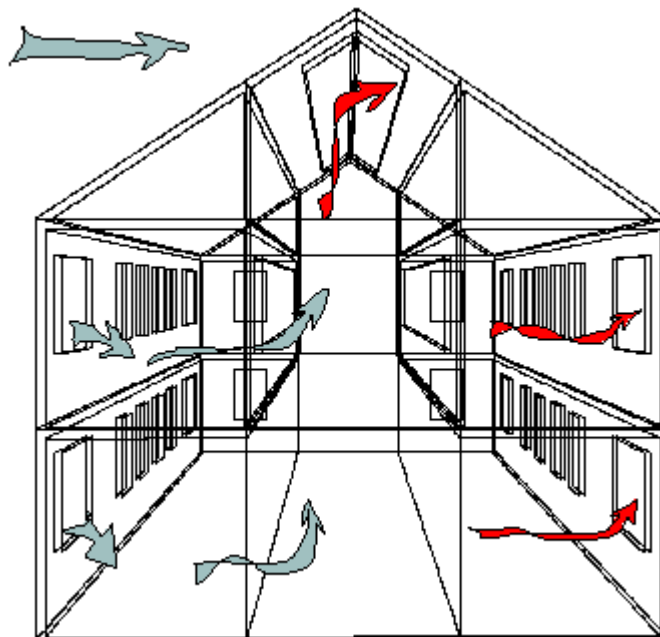
### Dynamic Building Simulation with Fully Integrated Stack and Wind Pressure Driven Air-Flow Analysis

This powerful combination, called TAS-Flows, provides a comprehensive design tool for the development of successful passive design strategies. The effective use of thermal mass, solar protection and natural, or mixed mode, ventilation regimes can all be studied in a fully integrated simulation.

Opening of windows etc, and the use of solar controls, may be scheduled against a range of performance parameters for the occupied spaces and external climate.

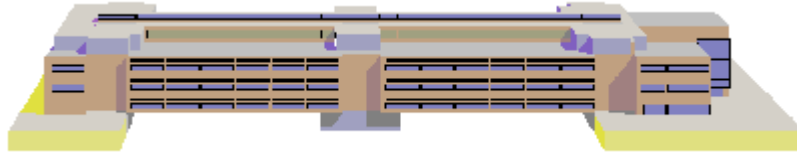
During the development cycle TAS-Flows has been used to evaluate the passive design strategies for a number of projects. Notable amongst these is the new Powergen HQ, for which monitored data is available on the behaviour of the occupied building.

Over the exceptionally hot summer of 1995 the building performed well, exhibiting many of the behavioural characteristics predicted by the TAS-Flows simulations undertaken by the design team.

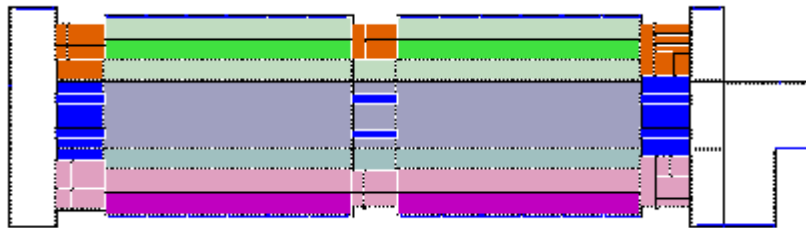


## The New Powergen HQ - Simulated and Monitored Performance

Simulation of air movement through the building required information on size and location of both exterior and interior openings. It was also important to know the relative position of internal spaces. This array of relational geometric data was automatically derived from the 3D-TAS model of the building.



The PowerGen office areas are on three floors and open plan onto a central atrium. In order to determine the performance at different locations, the open plan floors were zoned into 4m wide strips across the width of the building. This was done for the north and south sides and for each floor. The atrium was separately zoned at each floor. Zoning of the open areas in this way allows free air exchange between adjacent zones whilst generating data on comfort conditions for each.



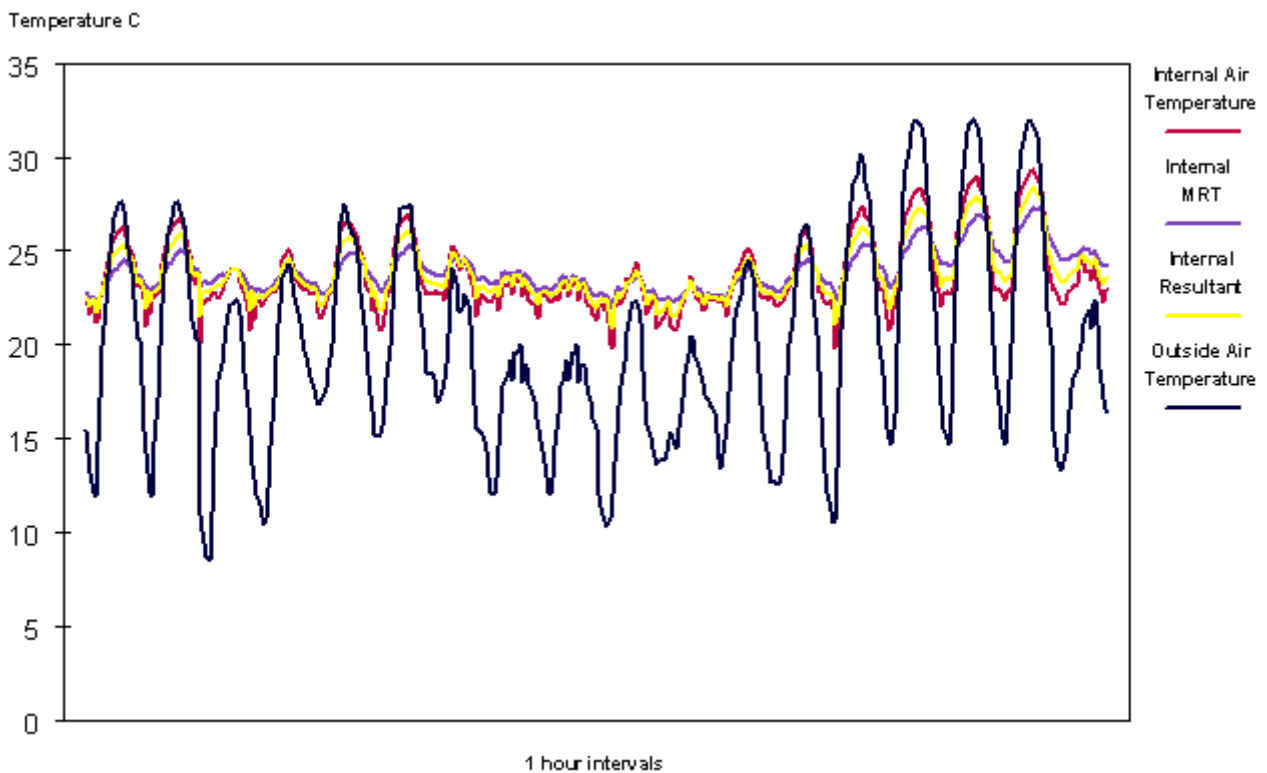
In addition to the location of openings, data was input on their openable proportion, with a schedule of when they would be allowed to be opened. The proportion of window opening was controlled by changes in simulated zone temperature and external wind speed. In the actual building motorised top windows are controlled, in groups, by a bems, driven by air temperature in particular zones.

Schedules were also included in the model for operation of internal blinds for solar control.

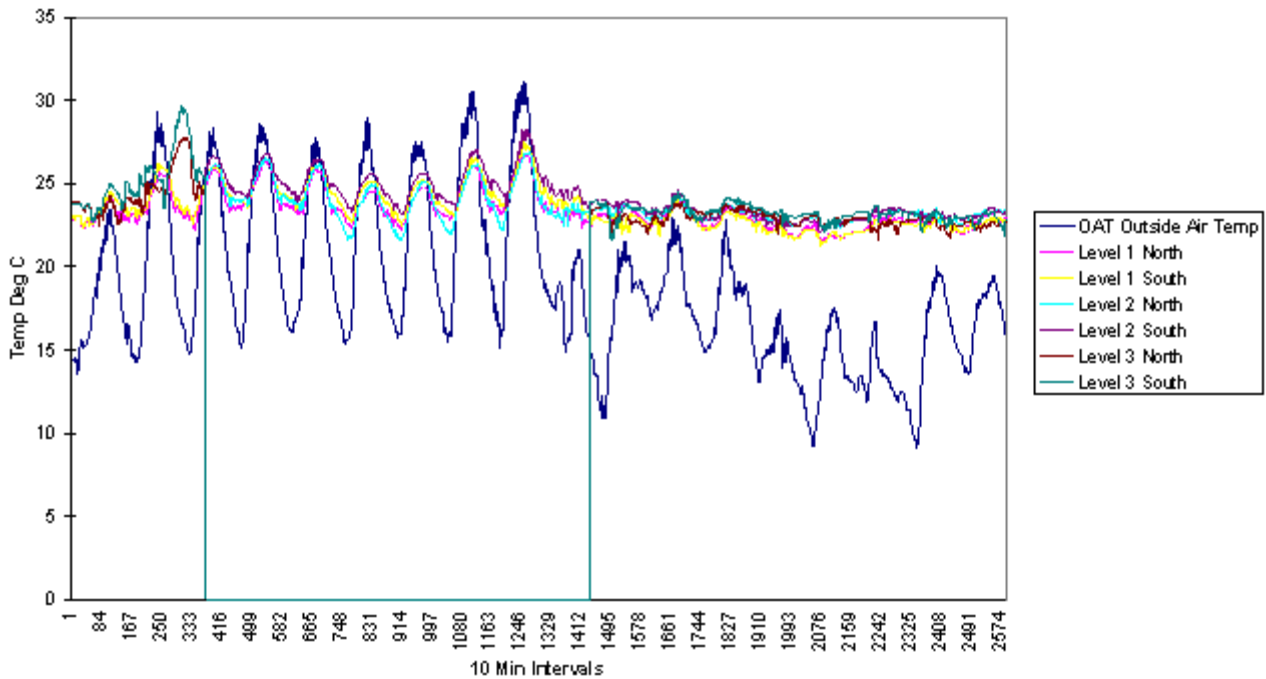
### Prediction vs. Reality

When comparing the simulation predictions with the actual performance of PowerGen HQ (see opposite page) it is clear that the characteristics of the building and its ventilation control strategy are well represented in the computer model. The monitored data, for the summer of 1995, does not include site solar data, so the simulation is based on a similar hot period of detailed recorded weather data for 1994.

During very hot weather night ventilation is used to cool the building and during the day, when external temperatures exceed those internally, the windows are closed. This allows the building to remain below outside conditions even for prolonged periods of extreme weather. This strategy is helped by the thermal mass built into the structure, particularly the exposed concrete coffer which has an average thickness of 300mm. The benefit of using thermal mass to create a long term dynamic in the structure can be seen in both the simulated and monitored data, as internal temperatures rise only slowly over the period of very high external temperatures.



Simulated Performance: Powergen HQ Days 179 to 196 BRE climate data 1994



Monitored Performance: Powergen HQ - 14/08/95 to 31/08/95

EDSL are grateful to the following organisations for permission to use the simulated and monitored data for the Powergen building.

- Client: PowerGen PLC
- Architect (Shell & Core): Bennetts Associates
- Architects (Fit-out) Fletcher Priest
- Services Engineer: E Griffiths & Son
- Project Manager: Buro Four Project Services
- Structural Engineers: Curtins Consulting Engineers
- Controls: Kinross Control Systems Ltd