MODELLING METHODS

INCREASING PREDICTIVE POWER

1 Steady-State Calculations

A simple approach using hand calculations, limited application

2 Simple Dynamic Model

Often run as a computer program, suitable for early design stages

3 Computer Environmental Modelling

Three additional services offered by Passivent to provide more detailed and accurate analysis

A Dynamic Thermal Simulation (DTS)

Used to establish the thermal and bulk airflow performance of a building

B Computational Fluid Dynamics (CFD)

Used to establish the detailed ventilation performance and thermal analysis of a building

C Daylight Modelling

Used to establish the daylight illuminance and solar heat gain within a building

FURTHER INFORMATION

Passivent Services

Passivent is one of the most experienced natural and energy-efficient ventilation companies in the market today. A pioneer in natural ventilation, the Passivent name is recognised for providing innovative yet practical solutions for all types of buildings.

Passivent has its own in-house research team dedicated to developing techniques and products for natural ventilation. We can offer a comprehensive design and advisory service tailored to a specific project, covering both natural and mixed mode ventilation. The full service includes complete project appraisal, guidance on ventilation options, computer calculations and budget proposals.

For a free no obligation quotation please contact our technical department: 01732 850770

Passivent products

In addition to design services we can supply a range of natural ventilation and daylighting products to enable solutions to be implemented. These include:

- Aircool Ventilators - systems for windows, curtain walling and walls
- Airscoop - wind driven ventilation terminals
- Airstract - roof terminals for passive stack and other natural ventilation systems
- Ventilation control systems
- Natural ventilation - for commercial buildings
- Sunscoop - tubular rooflight systems
- Litevent - combined ventilator and rooflight
- Metrolite/Metrodome rooflights

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BPD
A member of the Building Product Design Group

LLOYD'S REGISTER QUALITY ASSURANCE (ISO9001) UKAS QUALITY MANAGEMENT 001

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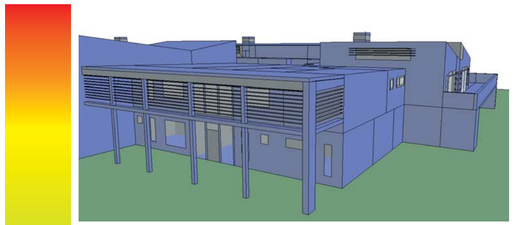
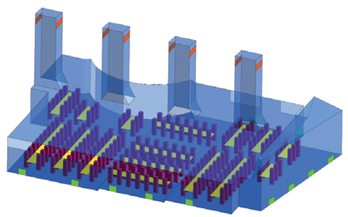
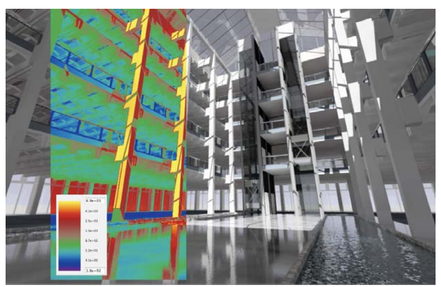
ENVIRONMENTAL MODELLING SERVICES FOR BUILDINGS







passivent

ENVIRONMENTAL MODELLING SERVICES FOR BUILDINGS

Passivent's Environmental Modelling Services provide computer-modelled environmental predictions for internal spaces in buildings.

The services form an invaluable design tool for natural ventilation and daylighting strategies.

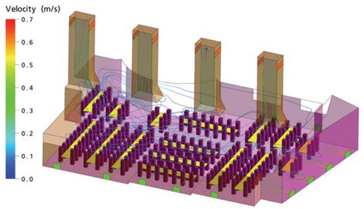
Benefits

- Provide detailed computer analysis of the internal environment, and enables the prediction of temperature, airflow, CO_2 concentrations and daylight levels.
- Assured compliance with Building Regulations Part L (Carbon footprint & overheating analysis).
- Customer peace of mind with extensive professional indemnity insurance cover.
- The services are independent of any one software manufacturer and so the most appropriate design tools are used for each application.
- An invaluable aid to design for optimum comfort with minimum energy use and minimum CO_2 emissions.

Building Regulations

The revised Building Regulations Part L and Approved Document L have introduced measures to counter excessive internal temperatures within spaces, with the objective of ensuring temperatures do not exceed a certain threshold for more than a certain number of occupied hours per year, based on CIBSE design summer data.

The necessary analysis can be undertaken only through computer modelling. Modelling therefore has become even more important to achieving Part L compliance.

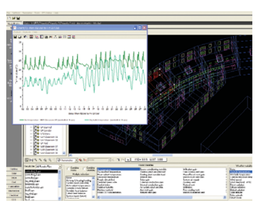


Combined expertise

In developing these services Passivent have engaged the expertise of the Institute of Energy and Sustainable Development (IESD) of De Montfort University, Leicester.

dmu.ac.uk
DE MONTFORT UNIVERSITY
LEICESTER

IESD are award winners of the 'Building Services Environmental Initiative of the Year 2006' for their work on passive downdraught cooling in city centre buildings, and are specialists in the field of advanced computer simulation. Combined with Passivent's natural ventilation product solutions, a uniquely powerful and dependable



environmental control capability is achieved.

Range of services

We offer a range of modelling services with varying levels of complexity and accuracy, applicable at different stages of the design process from initial estimates to detailed design.

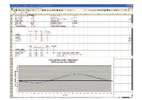
① Steady-State Calculations

A simple approach to estimating heating and cooling loads using hand calculations.

Steady-state calculations assume a constant temperature difference between the internal and external environment.
Used for simple applications or first assessments.
CIBSE recommends that this method should not be used to determine summertime temperatures and cooling loads because it does not take account of the time delays associated with the storage of heat within the building fabric.

② Simple Dynamic Model

Suitable for use at an early stage of design as a means of predicting the internal peak temperature and cooling loads.



Often run as a computer program, and also known as admittance method or CIBSE cyclic model calculation. There is evidence that this method predicts peak temperatures close to those that actually occur within naturally-ventilated buildings.
The admittance method, as a simple dynamic model, is recommended by CIBSE especially for natural ventilation solutions at an early design stage. However, it must be used with care as it does not represent the effects of rapid changes in load or of large thermal-capacity buildings.

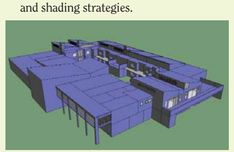
③ Computer Environmental Modelling

Three additional computer modelling services offered by Passivent, provide detailed and accurate environmental analysis providing solutions to avoid overheating and ensuring comfortable conditions for the building occupiers.

Ⓐ Dynamic Thermal Simulation (DTS)

Used to establish the thermal and bulk airflow performance of a building.

- The entire building envelope is modelled geometrically, together with the fabric of the rooms according to the specification and drawings provided. This ensures accurate modelling results, due to effects of surrounding zones of the building.
- All heat sources can be added to the model (eg occupants, computers, lighting etc).
- The effect of surrounding buildings, specifically wind and solar shading, can be modelled along with the effects of different glazing specifications and shading strategies.

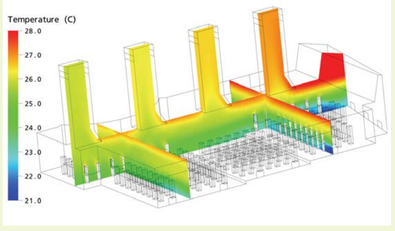


- The simulation is run to consider a particular period of the year (typically May to September) at one-hour intervals. Allowing over-heating criteria to be analysed on an hour by hour basis.
- The simulation uses CIBSE hourly-weather data, as prescribed in the Building Regulations, and takes into account historical (previous day's) thermal data to model the transient behaviour of the building.
- Forecasted data sets can be produced, facilitating 'future-proof' buildings.
- The simulation can predict, but is not limited to, bulk air flow rates (air changes per hour), internal CO_2 concentrations, and hours for which prescribed internal peak temperatures are exceeded.
- Simulation can be run using specific control algorithms so the building operates as intended when installed which gives a true representation of the actual operating strategy.

Ⓑ Computational Fluid Dynamics (CFD)

Airflow modelling used to establish the detailed ventilation performance and thermal analysis of a building.

- The modelling indicates the quality and efficiency of the proposed ventilation strategy from which recommendations can readily be drawn.
- CFD predicts spatial information including fresh air distribution, temperature, CO_2 levels, neutral pressure level, air velocities and draughts.
- CFD indicates how compliance with regulations can be achieved, and through visual images gives confidence that the design will function as intended.
- Guidelines prescribe maximum temperatures and CO_2 levels at 'seated head height'. CFD can model conditions at such specific locations.
- CFD demonstrates how the ventilating flow regimes develop, and so can reveal for example the likelihood of reverse flow/down-draughting from stacks. Consequently it can be used to help to formulate control strategies or to modify designs.



Ⓒ Daylight Modelling

Climate-based software used to establish the daylight illuminance and solar heat gain within a building.

- Details how daylighting and direct solar penetration illuminate the space.
- Recommendations can then be made for solar shading requirements, type of glazing, size and number of windows etc.
- The modelling technique is based on real climate data thereby providing realistic predictions of how effectively natural light will illuminate a space and how much solar heat is likely to penetrate the building and challenge a cooling strategy.
- A unique methodology has been developed by IESD for analysing the daylight performance of buildings.
- External factors such as other buildings, obstructions and reflections are considered.
- Enables Passivent natural light systems to be introduced into designs and the associated reduced energy consumption to be estimated.