Unhealthy Hospitals - A Balanced Solution

Energy used in U.K. NHS healthcare facilities costs over £400 million annually. This accounts for around 22% of its annual expenditure and results in net emissions of 1 million tonnes of carbon. The NHS England national target for CO2 reduction is 60% by 2050.

'There is a pressing need for Specifiers to keep this target in mind' says Ken Evans, National Specifications manager of Securistyle Limited. Designers should optimise the building fabric for energy efficiency, use renewable energy as much as possible, reduce demand for artificial lighting by providing adequate daylight in activity areas by using the resources of nature in a positive way. Only by following this creed will the buildings of today still be useable in the second half of the 21st century.

The benefits of a carefully designed natural ventilation system, in terms of reduced capital and maintenance costs, are well documented. The choice and style of fenestration is crucial to a successful ventilation strategy in healthcare facilities.

Peterborough Acute Hospital. Image courtesy of Progress Health

These are environments where:-

- The safety and security of the occupants is paramount.
- The requirements for internal CO2 levels, fresh air, temperature stratification and air speeds are all strictly laid down.
- The ventilation system must operate within these boundaries both in summer and winter.
- Any opening or closing of the windows does not conflict with an installed Building Management System.
- The chosen products must be sufficiently robust to reduce long-term maintenance costs.
- Windows are of sufficient size to provide daylight penetration and reduce lighting costs, yet be easily operated and controlled by occupants.
- The windows must be designed and integrated in such a way that draughts are avoided.

Extensive research has been carried out, within the healthcare sector, into the positive benefits of natural light on patient recovery rates and the need for good ventilation to help prevent the spread of infections.

The design of a satisfactory environment has to balance various needs:-

- The Health Technical Memorandum (HTM) 55 – Windows, gives broad guidance on the architectural considerations and main design criteria with which the designers have to comply.

- More specific requirements are prescribed in HTM 03-01: Specialised ventilation for healthcare premises and CIBSE (Chartered Institute of Building Services Engineers) Guide A : Environmental Design.

These two key documents lay down the exacting requirements within the building for air temperatures, minimum fresh air rates per person, air changes per hour, temperature stratification and air speeds (draughts), all of which must be achieved in both winter and summer conditions.

Failing to meet these requirements and getting the balance wrong can have dire results. There are reports from one recently built hospital where the design bias promoted the retention of heat during the winter months. In practice, this has caused serious overheating problems in summer, conditions which have been likened to "working in a greenhouse" and "uncomfortably hot and stuffy" by the hospital staff. Clearly, operable windows are a key element in any ventilation strategy but,

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of equal importance, is the style of window chosen. As will be demonstrated, recent research shows how different window styles provide different ventilation rates.

The current Building Regulations Approved Document F gives guidance on how to measure the purge ventilation of a limited number of traditional window styles against a percentage of the floor area. However this "rule of thumb" reckoner may not be sufficiently sophisticated for the designer to prove that their design choices will meet the rigorous standards demanded by the HTMs and CIBSE guidance.

Fortunately, Computational Fluid Dynamics analysis offers a solution to this problem. These sophisticated computer programmes use a wide range of data such as the type of building construction materials, climatic conditions, internal heat loads, number

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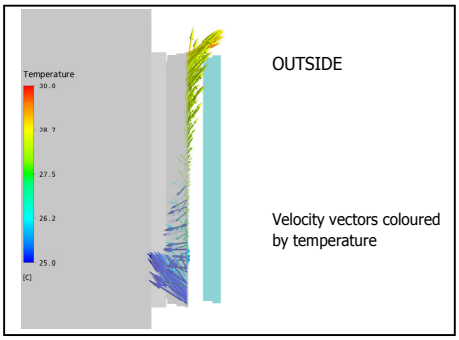
of occupants, lighting, machinery used etc. and all the "boundary" conditions inside and out which affect air temperature and air flow within the room. Using a CFD analysis a designer should be able to incorporate the right balanced ventilation solution into their design before a brick has been laid.

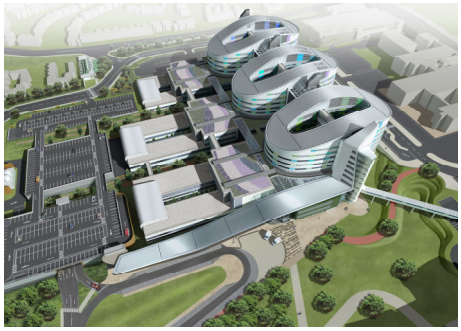
Over the last two years Securistyle Limited, in collaboration with the BRE's Building Diagnostics and HVAC Engineering team and Arups Consulting, have embarked on a programme of comparative testing of various window styles and their effectiveness in terms of ventilation in a variety of room types from a single occupancy ward in a hospital, to a school room with 30 children.

The window styles chosen for the initial testing at the BRE were traditional top and bottom hung windows and the innovative parallel opening window, which, as its name suggests, opens in plane, parallel to the building façade. Within the tested parameters the BRE concluded that the parallel window "gave the best opening configuration for natural ventilation in that fresh air and exhaust paths were less constrained and interacted less than with the other window types". For the same room heat gains this window only required a 40 mm clear opening whereas the top hung required a minimum of 100 mm and the bottom hung 110 mm.



Arups CFD analysis showing a side view of air movement through an open parallel window with a flow rate in of 0.124m3/s (124 litres/s) & 10.9 air changes per hour

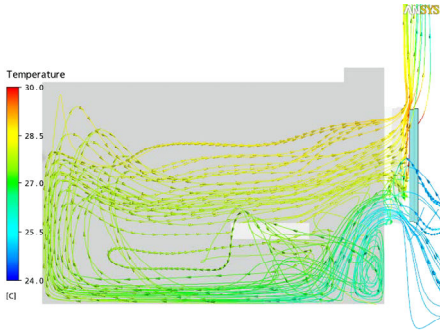
Computational Fluid Dynamics (CFD) testing carried out by Arups, using a notional occupied classroom, further demonstrated the effectiveness of parallel windows in comparison with top hung in reducing carbon dioxide concentration levels and resultant air temperatures. The test showed that, within the parameters of the modelled classroom, the parallel window significantly exceeded all the acceptance criteria and provided a much better result than the top hung window.



The Queen Elizabeth Hospital, Birmingham. Parallel hinges were used for this state of the art hospital

Meeting increasing demands for balanced and effective natural ventilation, whilst maintaining a safe and secure environment, requires a highly innovative solution. Securistyle have developed the Parallel Plus hinge system which has been successfully used, worldwide, on many prestigious buildings including healthcare projects.

The Parallel Plus hinge system allows windows weighing up to 200kgs, and 2 metres in height, to be manually operated. Because they provide an equal opening on all four sides they achieve an improved exhaust air path over traditional multi vent systems e.g. two top hung windows separated by a fixed light, where the upper row of windows have to be mechanically operated. The use of parallel windows permits a simpler facade design with a reduced number of openings and an initial cost saving on framing materials and expensive mechanical operators. Ongoing maintenance costs can also be significantly reduced.



Arups CFD analysis showing a vertical section through the room. Air movement vectors (arrows) through room coloured by temperature.

Parallel windows can easily be restricted to a maximum opening of 100 mm for safety.

Securistyle has a world class facility for the testing of projecting windows at its manufacturing facility in Cheltenham. Sophisticated data collection software is employed for the recording of opening and closing forces on windows, throughout the life cycle of the product.

Parallel Plus hinges are manufactured from 304 grade austenitic stainless steel for high corrosion resistance. They are tested to over 30,000 full cycles of operation and come with a 12 year Manufacturers guarantee.

Should you wish to see a full copy of the Arups CFD Results please contact our Marketing Department, or alternatively, book our RIBA approved Natural Ventilation CPD seminar online at www.securistyle.co.uk

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