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Actively promoting passive architecture

'Best practice' today can be very good indeed, so how did the Building Research Establishment set about realising a building to be 30% more energy efficient?

Every building is different, so it will never be that all the energy-saving and green features of an important new building on the site of the Building Research Establishment at Garston near Watford will be duplicated in their entirety in any other project. What is quite possible, however, is that the various principles demonstrated will be adopted or adapted to benefit a whole range of future projects.

In its function, the Environmental Building relates to many commercial office projects. The main section comprises 1350 m^2 on three storeys and provides accommodation for 100 BRE staff. The other part is a seminar facility of about 650 m^2.

Flagship

The raison d'être of the building is to be a flagship for integrated environmental design. It is expected to use 30% less energy than current best practice, while providing the occupants with a comfortable, healthy and controllable working environment.

The key issues are heating, ventilation, lighting and cooling. Indeed, the primary focus of the project is to address the issue of extending the application of daylit, naturally ventilated solutions into buildings that would ordinarily require air conditioning.

The approach has been for the means of controlling climate to be integrated within the very fabric of the building, rather than be added afterwards as energy-consuming services.

Passive design

The project is thus a flagship for integrated passive design, to encourage the industry to take up these concepts on a wide scale.

The office block is 30 m long and 13.5 m deep, with the long sides facing North and South.

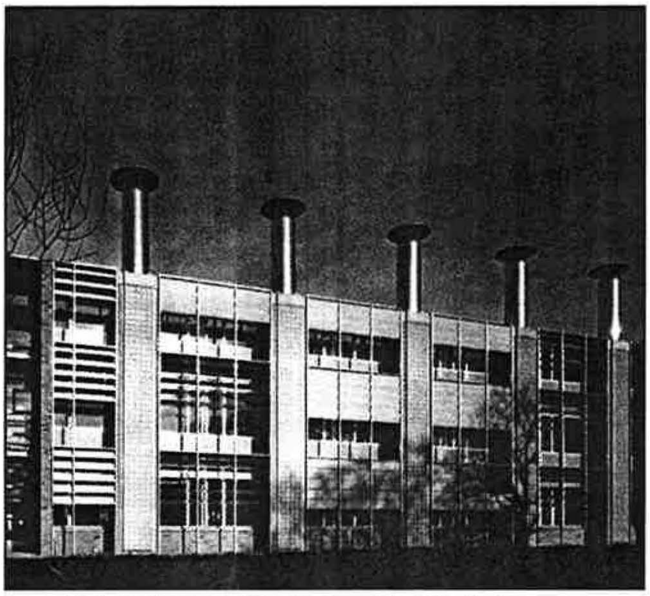
Viewed from the North, the appearance is fairly conventional, comprising a brick facade and opening windows. The discerning eye will also spot the signs of the natural ventilation system.

Panoply

It is when looking from the South that all the panoply of solar architecture is apparent. There are large windows, ventilation stacks and motorised louvres to provide solar shading.

Inside, on the lower two floors, one is struck by the unusual wave-form exposed concrete ceiling, which combines both structural and environmental-control functions. Indeed, this ceiling, and its associated floor slab above, is the key to natural ventilation, thermal storage, underfloor heating, underfloor services and the admission of copious quantities of daylight.

The shape of the slab makes possible a very stiff floor with the minimum use of concrete. Its wave form also provides space for ventilation channels. There are two areas of wave-form ceiling running the length of the building along the North and South sides. They are separated by a 'corridor' zone, which admits air to the core of the building. The direction of the prevailing wind is from the South West.



Integrated environmental design in action. The South facade of this project at the Building Research Establishment clearly shows the ventilation stacks and motorised solar-control louvres. This photograph shows how the louvres can be positioned to provide protection from sunlight or to admit light to maximise the use of daylight.

The deep space in the centre of the offices is thus cross ventilated, except where the ventilation path is blocked by cellular offices on the North side. In this case, fresh air entering on the South side passes through the slab voids to the North side and through the slab air duct above the offices.

Windows

Both sides of the building have large areas of openable windows. There are top openings in line with the ducts, and these, together with other high-level windows, are controlled by the Trend building-management system.

The heavy mass of the concrete slab/ceiling has an important role to play in limiting the peak internal temperatures during the Summer. These high temperatures also occur later in the day. Ventilating the building overnight, when it is cooler, also helps to limit peak temperatures by reducing the temperature of the slab so that incoming ventilation can be cooled the following day.

The worst scenario is a hot Summer day with very little wind. On such occasions the external ventilation stacks come into play. Hopper windows are opened by the BMS, connecting the first and second floors to the stacks, so that stale air is extracted and rises up the stacks. Because the stacks are faced with glass blocks, solar heating should stimulate this ventilation, but they are designed to function without this effect. If passive ventilation proves inadequate, fans in each stack can be turned on as a final back-up.

Extra slab cooling can be provided by the underfloor heating pipework. There is a borehole 70 m deep from which groundwater is drawn to serve the air-conditioning system for the seminar block. Spare capacity from this borehole can be fed indirectly through the underfloor heating tubes. The groundwater is at its coldest in August, when it is needed most. This system is expected to reduce peak interior

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