BRE low-energy office, Garston (UK)

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5. BRE Low-Energy Office, Garston (UK)

Owner, Architect, Engineer:	*Property Services Agency (UK Department of the Environment)*
Contractor:	*Y.J. Lovell (Midland) Ltd.*
Date of occupation:	*1981*

The basic principle used in the design of the low-energy office at Garston was to make optimum use of solar energy, not only through heat gain but also by exploiting to the full the energy-saving potential of daylighting. This principle means that it is the risk of overheating in summer that is the limiting factor in the low-energy design rather than the wintertime conditions. The designers have therefore paid detailed attention to the natural ventilation of the building in order to avoid air conditioning in the summer, and provided automatic external solar blinds on the south face. The building also features heat loss recovery from winter time ventilation.

Lighting and window design

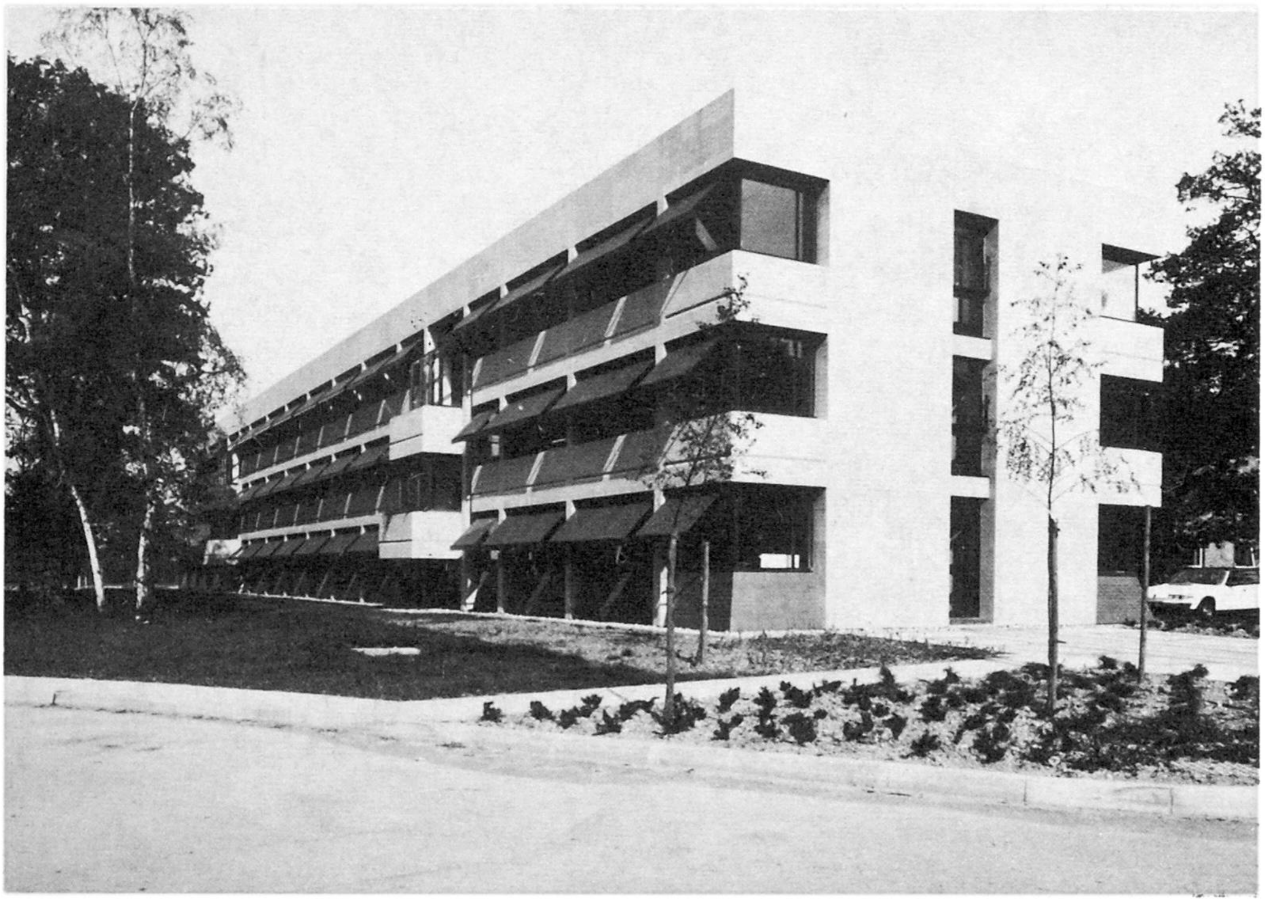
The office is a three-storey building with a total usable floor area of 1745 m², oriented East-West. The requirement for maximum use of daylight and for natural ventilation led to the adoption of a shallow plan, with offices on each side of a spinal corridor. Design illuminances of 350 lux are provided in each office by two banks of luminaires ranged parallel to the window walls.

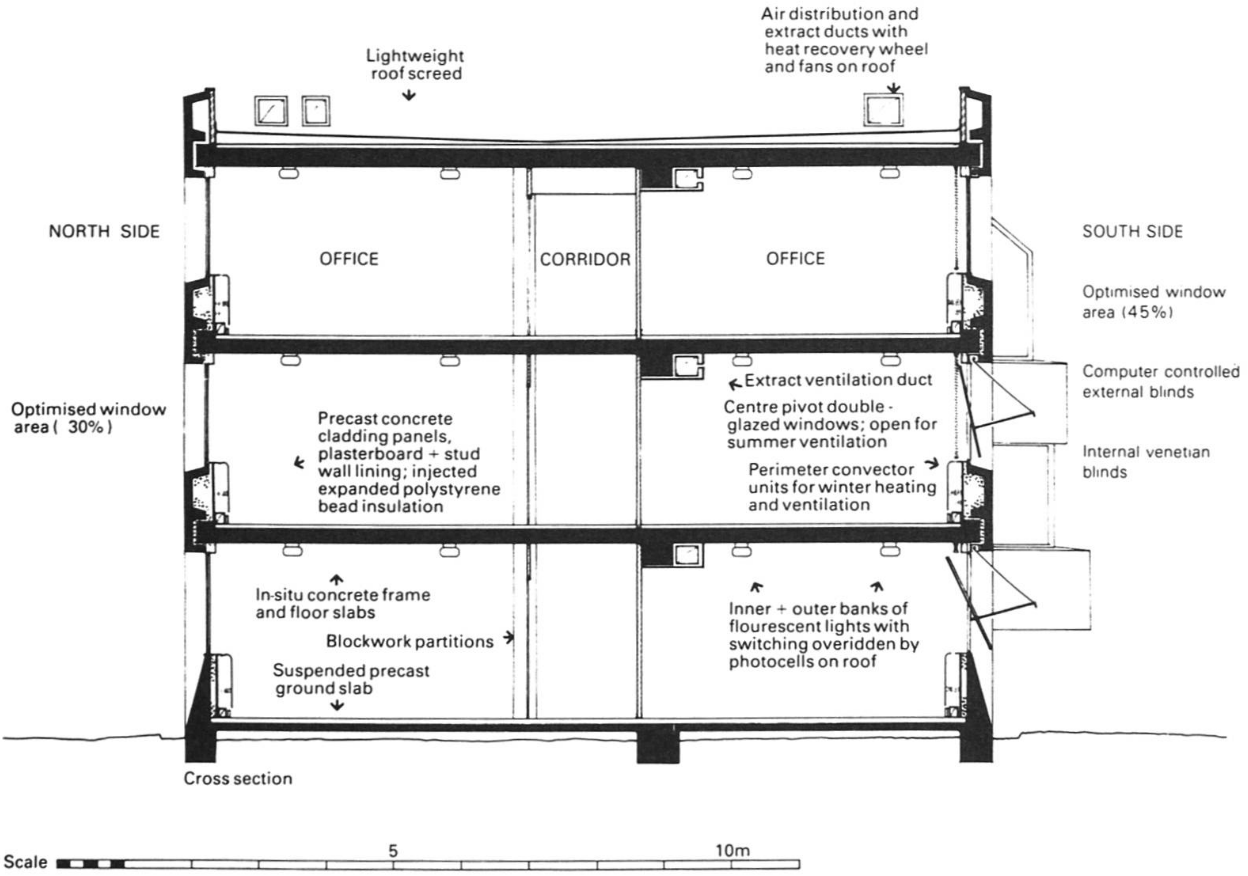
In designing the glazing areas an extended form of the BRE admittance procedure was used to balance the heat loss, solar gain and electricity used for lighting.

Taken over a nominal heating season of October to May, the expected total primary energy consumption varied only slowly with increasing glazing area.

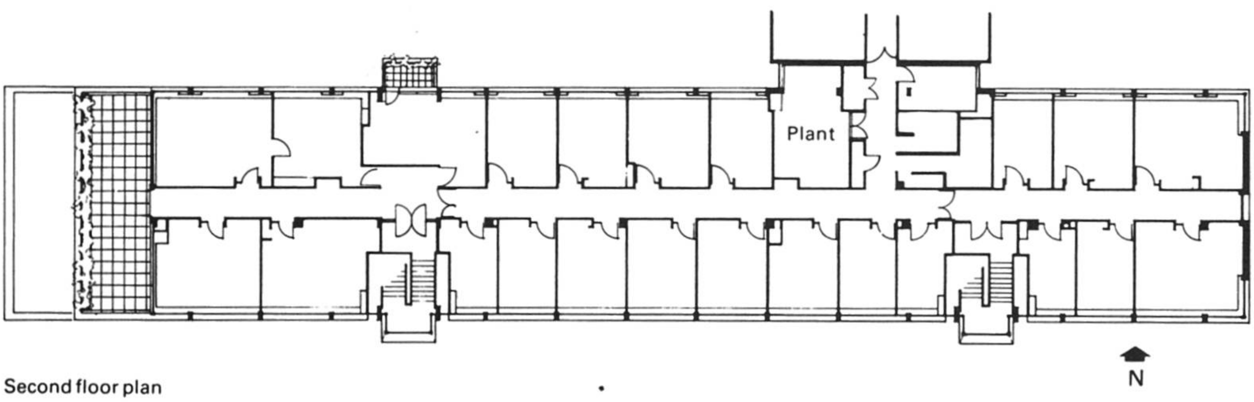
This design procedure showed, however, not only that much of the positive energy contribution of glazing comes from the spring and autumn months, but also that there is a risk of overheating during some days in these periods. Because it had already been decided to include a mechanical ventilation system for experiments on ventilation rates there was a strong argument for windows to be kept secured during the heating season. Solar protection is provided in the form of motorised projecting blinds on the south face which respond automatically to the internal temperature. Each office has a manual override control.

Once the blinds were included in the design study, a final estimate of the appropriate glazed area could be made, based on a minimum total energy requirement. The wall cavities were injected with expanded polystyrene granules, and the windows are fitted with sealed double-glazed units, giving an overall mean U-value including glazing of 1.8 W/m²K.



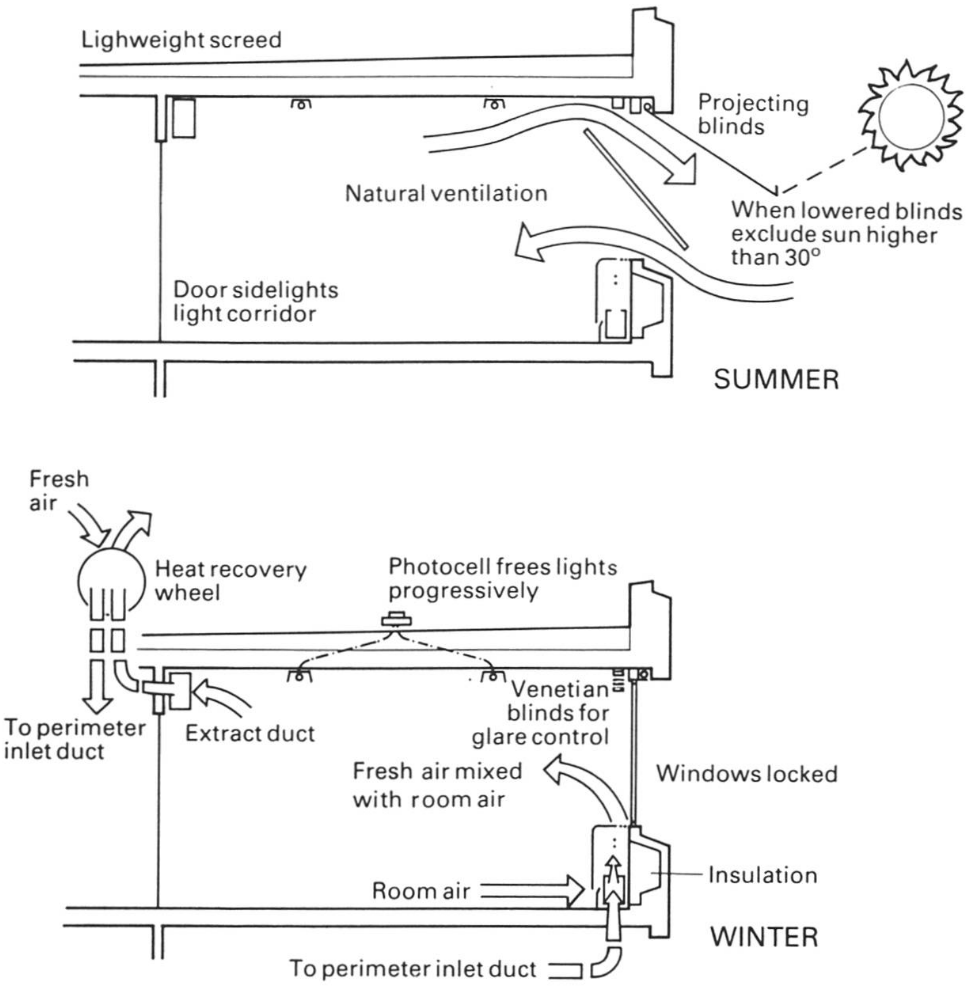


Cross section through offices showing difference between north and south sides, and arrangement of blinds on south side



Second floor plan

Cross section and plan of low-energy building



Section through typical south-facing office showing how comfort conditions are achieved in summer and winter

Heating and ventilation

In the mechanical ventilation system there is a heat wheel to recover heat from exhaust air to the fresh air stream, which is introduced into the offices through perimeter ducting. A heater battery provides top-up so that the fresh air can be supplied approximately to the design temperature of 18.5 + 1°C. The remaining heat load is met by a perimeter two-pipe finned convector system, controlled by thermostatic radiator valves, zoned north and south, with separate weather compensator flow temperature control.

Outside the formal heating season, the heating plant supplies only domestic hot water, the windows are openable, and only the roller blind and lighting controls are operative. The windows have a horizontal centre pivot to induce as much buoyancy ventilation as possible. The occupants on the south side also have use of a traditional venetion blind as a glare control when the projection blind is withdrawn.

Results from the twelve-month monitoring programme[1] indicate that the energy performance of the low-energy office building is close to its designer's expectations, with an annual energy consumption (measured in primary energy terms) of between two-thirds and one half of that of similar 1960s naturally ventilated offices an one quarter of that of typical air-conditioned offices.

Costs

The cost of the building at Tender stage (ie early 1979) was £ 760000.

Running costs

Running cost or primary energy consumption (ie energy consumption after allowing for the efficiency of use of raw fuel by the energy supply industries) are probably more important descriptions of the building's performance in resource terms.

Primary energy p.a.	0.7 GJ/m^2
Annual running cost	£ 2.44/m^2

(A.C. Salvidge)

[1] The BRE low-energy office report. V H C Crisp, D J Fisk & A C Salvidge

(Copies of this report are available from the Publications Sales Office, BRE, Garston, Watford)