#4368

ENERGY

A house with a mind of its own

Anne-Maree Sheehan reports on a house with 3 mm mortar joints and a £50 annual heating bill

Energy management control guided the design of this prototype bungalow

Seeboard, the electricity supplier to two million people living around Epsom in Surrey, had a redundant sub-station on a plot of land that could take two houses. It went into partnership with house builder Barratt Central London and built two energy-saving homes, called Project Oracle.

Barratt devised construction techniques for optimal insulation. Seeboard used innovative electric hot water boilers, ventilation systems, heating and heat recovery systems and gave them a central controller to manage each home's energy.

The result is a three-bedroom home that can be heated for £50 a year, or so it is projected. The proof will come later this year from data collected by the Seeboard staff who will live in the houses.

The homes have intruder alarms, fire alarms, baby watch and prowler lights.

The additions to the fabric and insulation should add little more than £200 to the cost. And if the houses were to become a standard house type probably even less.

The developer chose the design because of planning constraints and the wish to have a house that would sell. The best design would have been a square, two- or three-storey building, preferably semi-detached or terraced, which would have been more economical of both building materials and use of the plot. However, the bungalow style with a bedroom set within the sloping rooflines is attractive.

Project Oracle consists of two prototypes, but both have the same shell, with a U-value of 0.311 W/m²K.

Fabric construction

The ground floor is of suspended pot and beam construction — Bison concrete beam with aerated autoclaved infill blocks.

A 100 mm Rockwool insulation is hung off tape hangers to the underside of the concrete floor. The system of hanging is a little complicated, being fixed by pins stuck to the underside of the beam. The tapes are attached to the pins and hold the insulation in place. Rockwool is devising a simpler method. A damp proof membrane plus 84 mm to 100 mm screed completes the floor construction.

The walls are quite thick at 325 mm. They consist of Durox blocks, 620 mm by 430 mm by 115 mm constructed using Durox Building Products' thin joint Supasystem. This is a high strength mix of glue and mortar which requires a joint no more than 3 mm thick. The method, claimed to have a quick drying time, avoids the downgrading of the U-value of the wall by thick, poorly insulating joints.

The blockwork was constructed to its full height first then the 125 mm Rockwool insulation was installed, a procedure which gives good quality control, said Barratt's site agent.

The brick was constructed last, with the specified flush jointing.

Rockwool says that you should not have recessed brick jointing if the cavity is to be fully filled because the recessed jointing could lead to rain penetration into the cavity; a fully filled cavity might take a long time to dry out.

The complete wall is calculated to have a U-value of 0.2.

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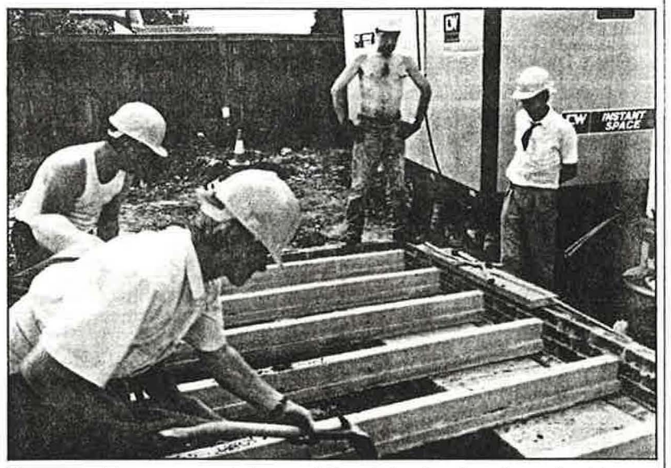
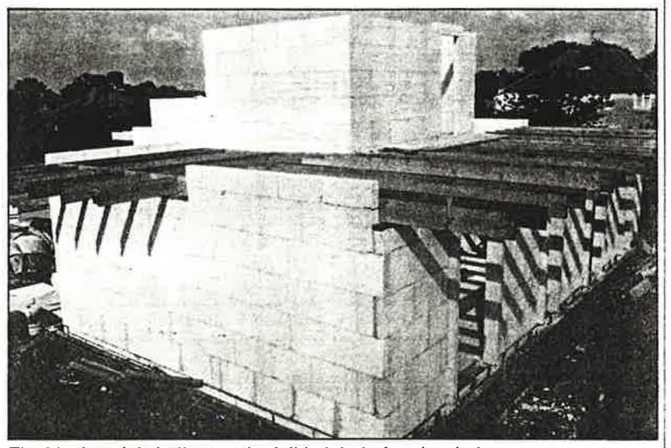
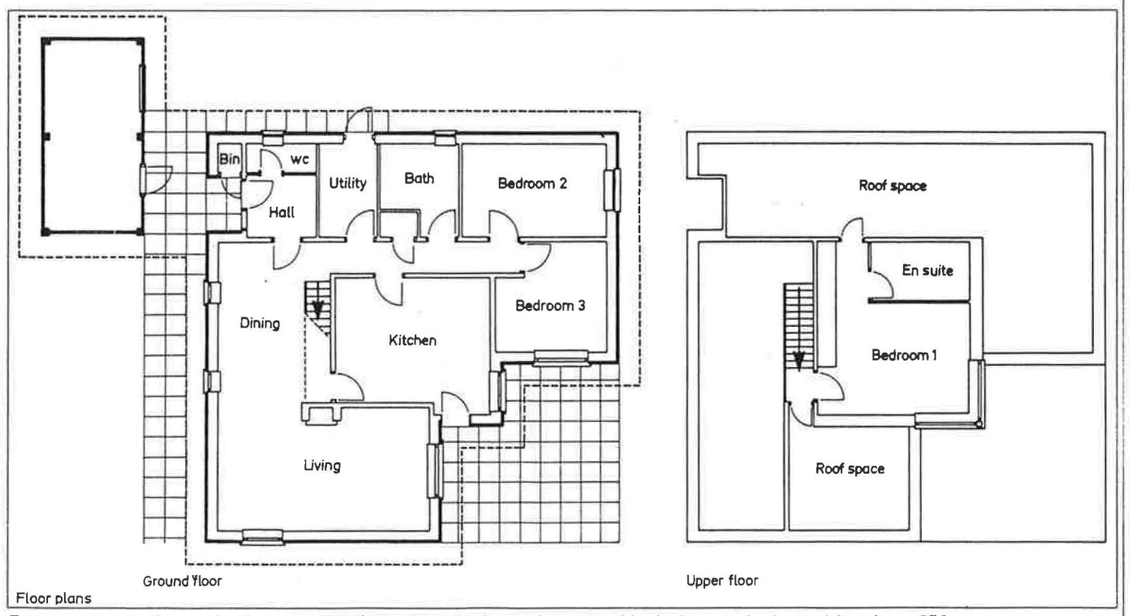


The pot and beam suspended ground floor is insulated on the underside



The blockwork is built up to its full height before insulation



Energy consumption projections suggest that a three-bedroom house to this design can be heated for about £50 per year

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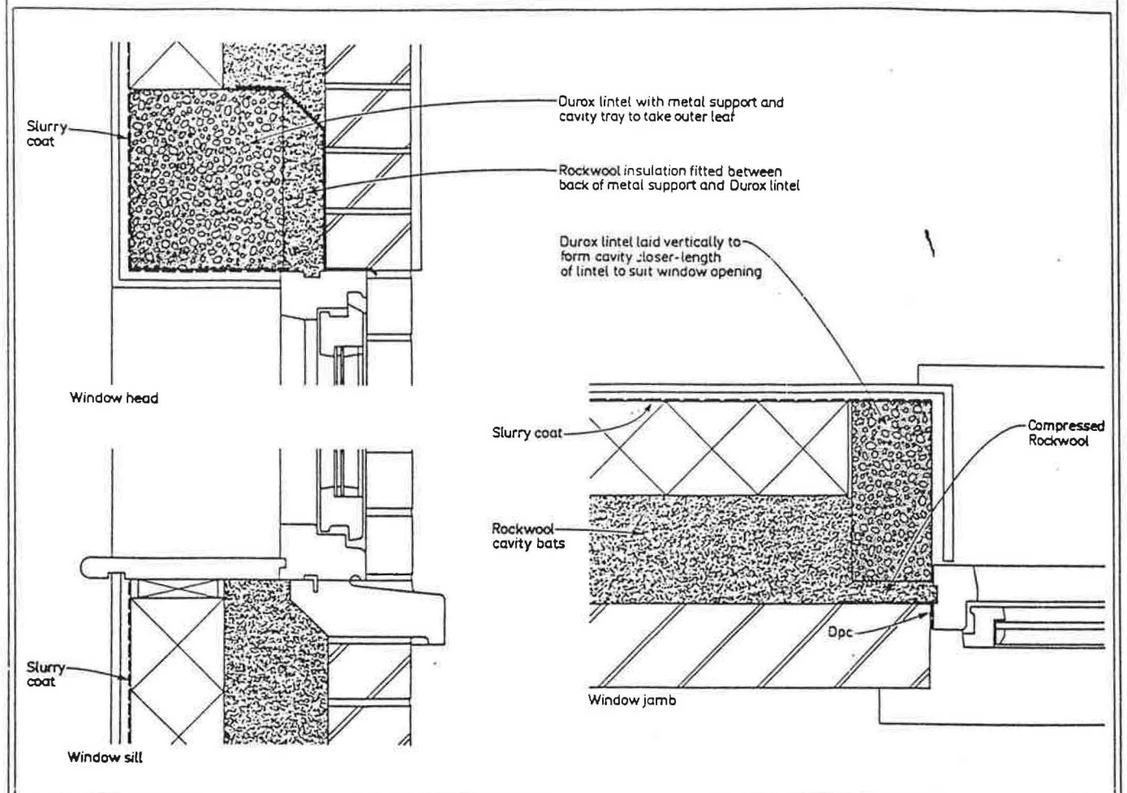
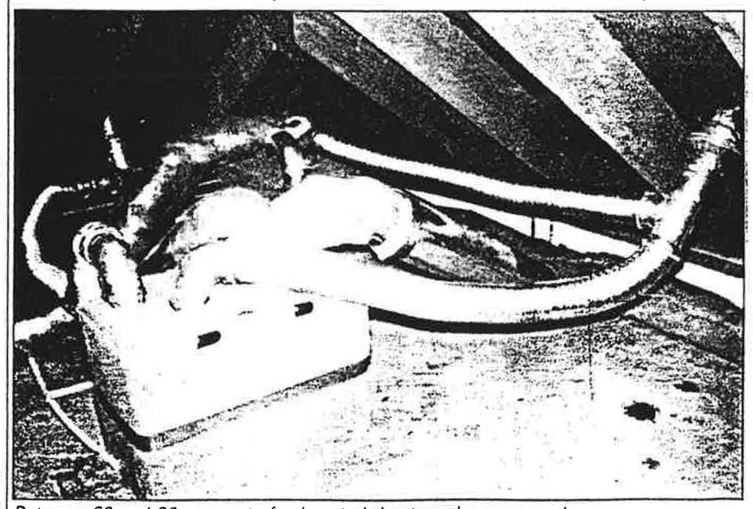


A vertical lintel forms the cavity closer: a Danish detail which has been adopted for this design



Between 60 and 80 per cent of exhaust air heat can be recovered

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The window details are designed to avoid cold bridging and keept the U'-values at their best. A Danish design detail which is followed is to use a lintel in the jamb position. The double glazed timber casement windows have low-emissivity glass designed to reduce heat loss considerably.

Crushable seals make the windows more or less draughtproof.

Electrical elements

While the two prototype homes are constructed by the same method, the heating and hot water systems are different. They show the developments in electrical installation, and the variety now on the market. One house has underfloor heating with ceiling heating as a top-up. One advantage is that there are no radiators to clutter the wall space.

The ESWA underfloor heating consists of a series of electrical elements, sheathed and cast into the floor screed. Should one of the coils or cables fail, the location of the damage can be pinpointed to within a square foot by sending a signal down the line. This means only one square foot of the floor need by drilled up for repairs.

Seeboard's representative says that rewiring of modern electrics will not be needed for 60 years, suggesting it is unlikely that anything will go wrong within the screed.

The ceiling heating consists of metal foil enclosed in plastic behind the plasterboard. To assist the downward direction the heating elements are backed by insulation.

The Gledhill PulsaCoil mains pressure hot water system is a combination unit with cold storage so there is no water cistern in the roof space.

The PulsaCoil will deliver 15 litres of hot water a minute in 4 to 4½ minutes with average mains pressure. It is sufficient hot water for a standard size bath, making it suitable for the bathroom or shower room. In the prototype Epsom home there are two hot water tanks, 144 litre and 210 litre, one upstairs and one downstairs, one for each bathroom. Two immersion heaters take maximum advantage of the overnight Economy 7 electricity tariff. Supply from mains pressure gives a powerful flow rate for showers, with no need for booster pumps.

A three coil-high efficiency heat exchanger located in the hot store is connected to the cold supply. The cold water passing through is heated and then blended down to the required temperature.

It is an open vented system which takes advantage of conventional installations. It is not therefore subject to building control and need not be approved by the British Board of Agrément.

Such a highly insulated and well-sealed house would almost undoubtedly be subject to condensation if it did not have mechanical ventilation.

In the Oracle prototypes the ventilation is housed within the cooker hood in the kitchen and is on low all the time. In times of huge cooking activity the occupier can boost the ventilation but it cannot be turned off.

In the second house heating is by storage radiators and heating panels from Creda coupled with a ventilation system.

The Creda TSR Supa-Auto storage heaters, like all storage heaters, use off-peak Economy 7 electricity. Where the Supa-Auto is different is that it will sense inside and outside temperatures to adjust input and output according to the outside temperature so that heat is not wasted.

There is also a TSR Combi heater — a storage heater and direct convector heater combined.

Panel heaters for the smaller rooms come with built-in thermostats and are a back-up to the storage radiators. The heating is backed by an air management system for controlled ventilation.

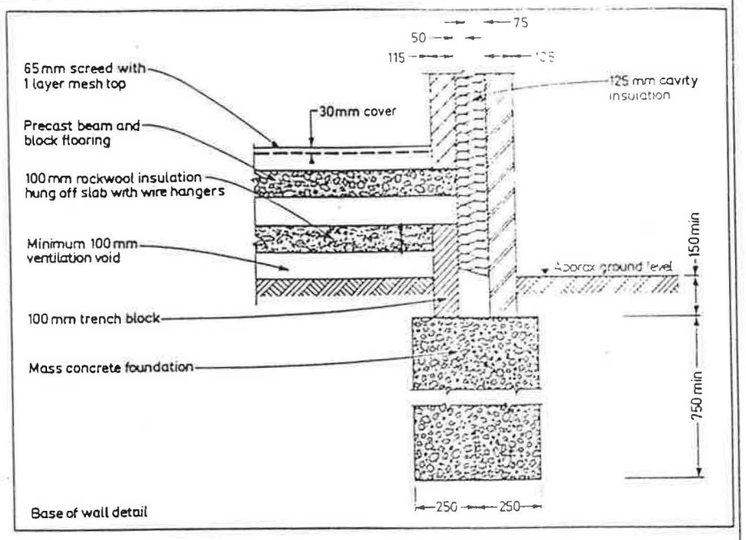
Computer-optimised heat exchanger

Located in the cooker hood in the kitchen, the ventilation extracts stale warm air through the ducting. The air passes through a computer-optimised cross-flow heat exchanger transferring up to 80 per cent of the residual heat to the incoming air. The stale, cooler air is vented outside and fresh, pre-warmed air is ducted into the living rooms and bedrooms. In reclaiming waste heat it adds to the fuel saving.

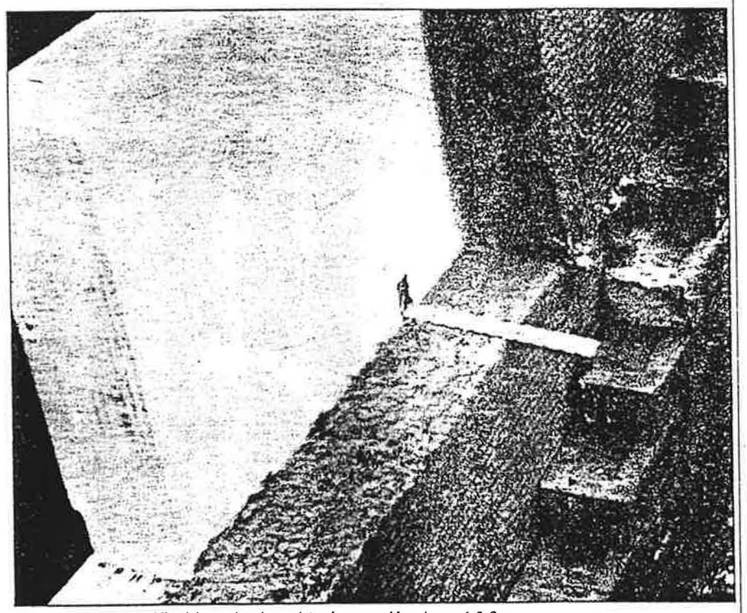
The air distribution is by British company Flow Engineering. The system is fan driven, the load of each fan being about the equivalent of that of a 100 W lamp. It runs 24 hours a day and, when correctly commissioned, is quiet enough not to disturb the household. Ductwork is hidden between the joists and in the roof space.

Air is fed into the rooms through inlet terminals.

Hot water is provided by an Elson Economy 7 water heater. Added to a hot water cylinder is a Showerplus which is fed directly from mains supply maintaining an equal pressure of hot and cold water to the shower mixing valve. It does not need an extra storage tank.



Base of wall detail



The wall as specified is calculated to have a U-value of 0.2

The brain

The showpiece, if you could see it, would be the Photrax control system. It is the brain of the house. It is a microprocessor which sends and receives information about all the electrical elements, transmitted through the mains wiring. While not a really new idea, signalling through mains wiring has only just arrived as a cheap and reliable element for the average house.

The Photrax central control will look after the daily switching on and off of heating, hot water, appliances and security lighting to coincide with the cheap rate. Just to prove that it is user-friendly, not big brother, the householder can boost hot water, or override the controls to turn on or off any of the electrically operated systems and appliances.

When the controller is manually overridden the display shows which heaters and rooms are being controlled manually.

The purpose of these two specially built houses is to show how, without compromising comfort, an electrically powered home is not expensive to run.

The Photrax can run up to 64 channels through its brain so it can supervise the automatic drawing of curtains (not exactly an energy saver) and turn on lights when the household is away.

It even governs the bath with preset depth and preset temperature making sure no hot water is wasted. ○