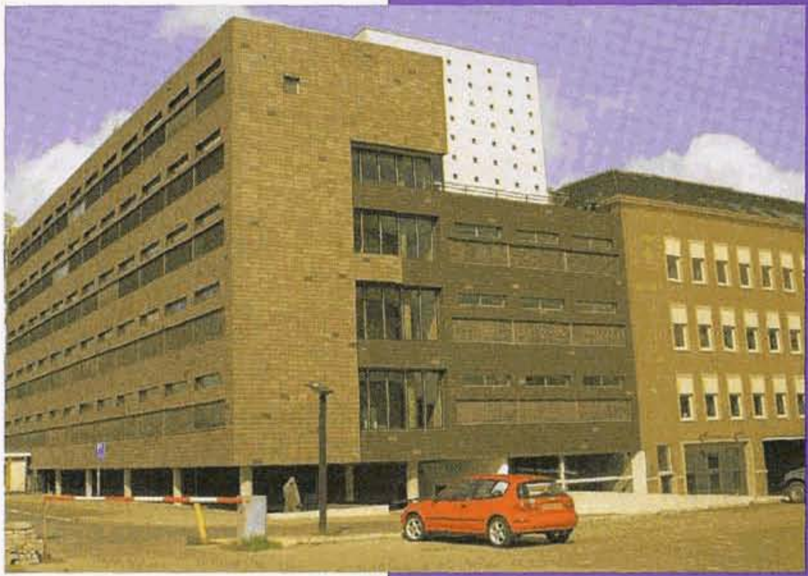
The Enshede tax office achieves the lowest building services related CO_2 emissions of any *PROBE* building.

The building has benefited from airtight construction being adopted at an early stage in the project.

The tax office contains a combination of integrated technical solutions which are ergonomic and user-friendly.

Enschede Tax Office



In 1997 the low energy Elizabeth Fry Building was lauded as "the best building ever". Four years on this advanced naturally-ventilated tax office extension in Holland has scooped the top-spot. How was it done?

BY THE PROBE TEAM

Curious, isn't it, how innocuous buildings often turn out to be little gems. It's not a matter of size (even a modest building can turn out to be a gas-guzzler) but more to do with the ability of designers and constructors to concentrate on the essentials.

The extension to the Tax Office in the Dutch town of Enschede is certainly modest, but not overly utilitarian. Its passive solar, advanced natural ventilation very much represents late 1990s design thinking[1].

Project background

The Netherlands State Tax Department has had a regional office in Enschede since 1940. In the 1990s the original building had finally become too cramped, and the tax office joined forces with the Government Buildings Agency to procure a new building. One of the first decisions was to build an extension rather than knock down the existing building – a choice partly driven by the Agency's sustainable building policy.

The design process began in 1994 and construction started on site in October 1995. During the design period, the tax office extension joined a portfolio of buildings whose development was part-funded through a low energy EC demonstration project Energy Comfort 2000[2].

The EC 2000-funded design brief specified that the extension should use less than half of the energy consumed by the average office building in the Netherlands and that sustainable materials and processes be taken into account[3].

The gross floor area of the tax office extension is 4520 m², including 258 m² of basement car and bicycle parking. Plant space takes up 75 m². The treated floor area is 4210 m², with 50 m² for untreated plant room.

Currently 180 staff have workstations in the building, and typically about 25 work away from the office at any time. Working hours are based on flexitime, and the building can be open between 07.00 h and 18.00 h, except on Mondays when late working is possible until 21:00 h. There is no weekend working.

Building form and function

The extension building has five floors above a ground floor with staff entrance, car and bicycle park, and plant rooms for incoming water, gas and electricity. A wedge-shaped atrium runs down the centre, opening out from a blank wall at the west end to a partly glazed wall at the east end.

The long south facade faces directly onto the platforms of Enschede railway station, while the north facade faces a quadrangle formed by the old and new buildings. The north-east corner connects to the old building via double doors on each of the extension's five floors.

The 5 m deep, cellular offices – designed for two to four occupants – run along the south and north sides of the building. These are accessed by a corridor along the north side of the atrium wedge, with link bridges to the deeper-planned south side, which has offices on the perimeter and service rooms on the atrium side.

The architect aimed to make the building's aesthetics appropriate for a tax office, in other words not experimental, wacky nor extravagant, but businesslike, honest and trustworthy.

The sustainability theme extended to the

PROBE 22

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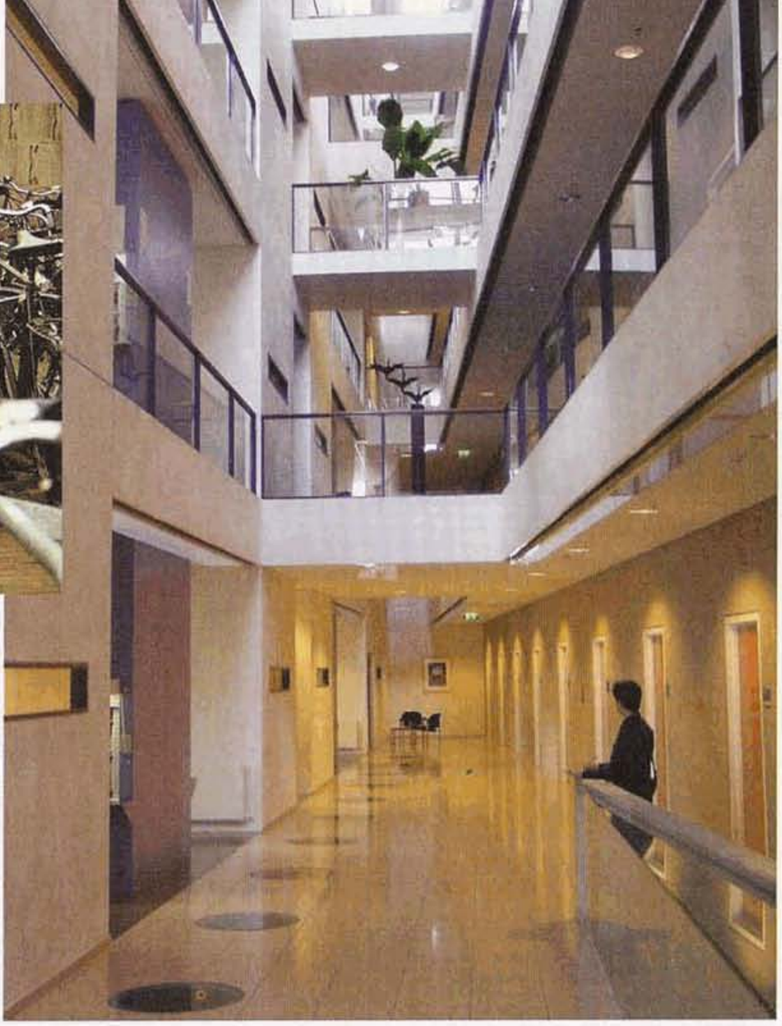

ABOVE: On the day of the PROBE visit the ground level bicycle park was home to over 100 bicycles. RIGHT: It is no ordinary cellular or combi-office block, with their dreary corridors. The simple and imaginative incorporation of the atrium completely changes the experience, while at the same time assisting the natural ventilation strategy.

construction materials. The atrium interior for example, is finished in natural clay plaster, decorated by discreet marble finished squares. Planting is concentrated in well daylit areas of the atrium (mainly on the top floor) to avoid energy being wasted on lighting it.

Services design

The tax office extension is primarily naturally ventilated, with background ventilation from purpose-designed trickle ventilators and rapid ventilation from tilt and turn windows. Stale air is designed to exit the offices via acoustically-lined ducts. These run above the suspended ceilings over corridors and service rooms to the edge of the atrium.

The exhaust air is designed to rise in the atrium and exit via six large chimneys in the roof. The exhaust air is driven by the stack effect and negative pressure exerted by the wind.

The chimneys were purpose-designed, with low flow-resistance and no dependence on wind direction. The bottom of each chimney is fitted with motorised dampers which are opened during occupancy hours (unless the outside air temperature falls below -4°C when half are closed, or below 8°C when all are closed) and at night in warm weather.

The natural ventilation strategy is backed up by four fans on the roof adjacent to the atrium clerestory windows on the north facade. These fans are used to exhaust air from the atrium during summer nights when there is negligible wind. In practice this is typically 100 h/y. The roof is also home to a further four mechanical extract fans: two to ventilate meeting rooms via manual wall switches, and two under time control for the printing rooms and toilets.

Space heating to all areas is provided by perimeter radiators with thermostatically controlled valves. Heat is supplied by two natural gas-fired atmospheric condensing boilers rated at 162 kW and 200 kW. This gives a capacity of 86 W/m² treated floor area (tfa). The pumps for the variable flow circuits are inverter driven.

The north and south sides are split into two heating zones. A plantroom panel controls optimum start, external compensation and night setback. Hot water provision for the toilets and staff kitchenettes is provided by 3·25 kW electric water heaters, one per floor, with a 120 litre storage capacity and thermostat control.

The building is controlled by a central building management system which handles the heating, the mechanical and night ventilation and the external shading. There is also a dedicated control panel for the lighting in the communal areas.

Daylighting

The building's main elevations have two fenestration elements: a central strip of windows (some of which are tilt and turn units), and fixed toplights to provide daylight. The latter are positioned above 900 mm-deep internal horizontal lightshelves with mirrored upper surfaces.

These are designed to reduce light levels near the windows while reflecting light on to the 3 m-high white ceiling to illuminate the rear of the offices. This improves uniformity across the depth of the space.

The south elevation has a continuous strip of vision windows and a series of separated toplights. This, says the architect, provides a "visual relationship with the rail lines and the horizontal movement of the trains".

The north elevation has continuous toplights to deliver more daylight, plus discrete blocks of vision windows. The glass in the toplights has an Ipasol coating to give a solar transmission of 38% while maintaining daylight admission to 65%. Interestingly, a monitoring report states that the measured daylight transmission was only 40-45%.

Solar gain through the south-facing vision windows is controlled by motorised external louvres. These come down automatically under the control of the building management system when the incident solar exceeds a set threshold value. Both the lowering of the blinds and the pitch rotation of the blades can be (separately) manually overridden.

Inside, the users have manually operated internal blinds. These are for the vision windows only; the toplights are left clear as the risk of glare is negligible due to the lightshelf and the shallow depth of the offices. This ensures that daylight is available in the offices whenever it is present outside, thus helping to prevent a blinds down, lights on situation. The measured average daylight factor is 5%, with a minimum value of 1% even when the vision windows are shaded by the external louvres.

The atrium has an opaque, flat roof which is raised one storey above the surrounding roof. As well as providing a plenum for hot air at the top of the atrium above the occupied level, the extra height allows daylighting of the atrium via full-height clerestorey windows on the north and south elevations.

The south side is protected by motorised internal fabric blinds which drop down and close automatically in response to incident solar radiation. The ground floor of the atrium has some circular glazed light pipes and a small, glass-enclosed wedge both of which transmit a worthwhile amount of daylight to the circulation corridor on the ground floor.

Electric lighting

Electric lighting to the offices is by high-frequency fluorescent lamps. Two pairs of 58 W lamps are integrated into the underside of the lightshelves by the windows while two pairs of 36 W lamps are integrated into acoustic boards that are suspended near the ceiling at the rear of the office.

The installed load is 10·7 W/m², allowing for gear losses. The design illuminance is 500 lux making the installed lighting efficiency 2·1 W/m²/100 lux. Spot measurements by the PROBE Team suggest the actual illuminance may now be closer to 440 lux, giving an efficiency of 2·4 W/m²/100 lux.

The total lighting load for the building interior is 32 kW (or 7·6 W/m²) and the total annual energy use 8·5 kWh/m². This is the lowest of any building studied by the PROBE Team and exemplary (though considerably higher than the figure of 2·5 kWh/m² quoted in EC 2000 reports).

Lighting control is based on local manual on/off plus photocell dimming. The former achieved by a double wall-switch by the door with separate switches for the lamps in the lightshelves and acoustic boards.

The switches have been wired so that the on position is up on one switch and down on the other. This thoughtful detail prevents both sets of lamps being switched on automatically by a 'sweep of the hand' motion first thing in the morning.

Additionally, the front and rear lamps are separately dimmed by downward-facing photocells adjacent to the respective lamp.

The lighting in communal areas such as the reception, atrium and toilets is switched manually by security staff at the start and end of each day (07.00 h and 20.00 h). That for the car and bike parks and exterior is switched automatically.

Central dimming is provided to the 36 W PL lamps surrounding the atrium. However, the reliability of these particular high frequency dimmable ballasts has been poor and the replacements expensive. At the time of the PROBE visit the building managers were considering abandoning the dimming system. This would be a pity as this would increase the building's lighting energy consumption by an estimated 15%.

Operation and maintenance

Since handover, the building has been looked after by the on-site facilities manager. Technical issues are referred to the Tax Department's central facilities group based in Arnhem.

The PROBE Team was shown a user guide printed onto an A2 blotter which is made available to all occupants to use on their desks. This describes, in both words and pictures, the design intent for how the building should be controlled and, in particular, how the occupants themselves can control their own environment.

This concept has not been seen before by the PROBE Team and seems to be a subtle mechanism for overcoming the normal tendency for user manuals to disappear or to fall into disuse.

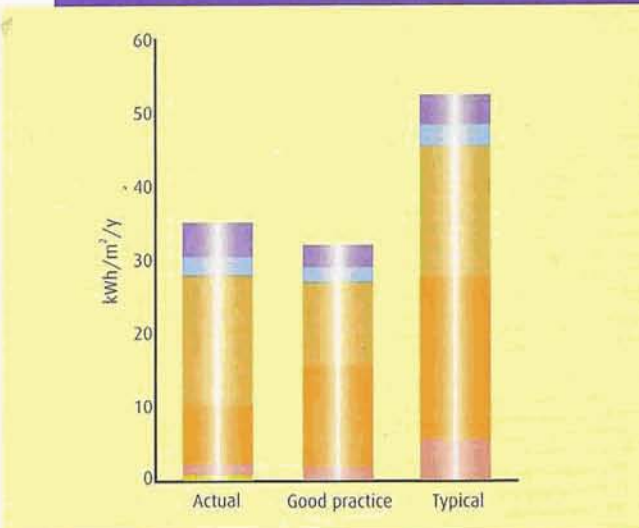

FIGURE 1: System electricity consumption by end-use, calculated using *TM22* compared with benchmarks from *Energy Consumption Guide 19*.

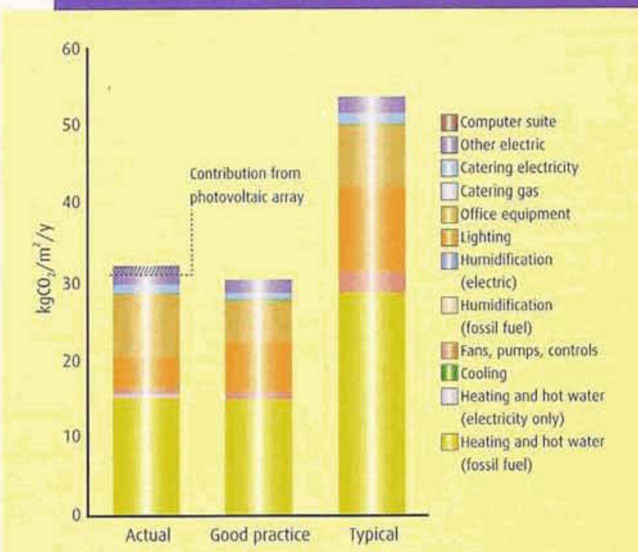

FIGURE 2: Carbon dioxide emissions at the Enschede Tax Office Extension and benchmarks from Energy Consumption Guide 19 (all fuels). The line across the actual bar denotes true emissions, accounting for the zero CO_2 electricity from PV. The conversion factors are 0·46 kg CO_2/kWh for electricity and 0·19 kg CO_2/kWh for natural gas.

Overall performance

Electricity

Actual total electricity consumption, taken from monitoring in 1997 and sub-meter readings taken during the PROBE site visits, is estimated at 152 MWh or 36 kWh/m² (treated floor area).

Gas

In the year from 8 November 1999 to 9 November 2000, total gas consumption is estimated at 339 MWh or 81 kWh/m².

Carbon dioxide emissions

The building emits 33 kg CO_2/m². This is the lowest but one yet for any PROBE building.

Energy consumption

As the tax office extension is a predominately naturally ventilated, cellular office building, it is appropriate to benchmark its performance against the *ECON 19* Type 1 energy consumption figures. However, the building is 50% larger than the top end of the typical size range of the standard Type 1 office and a lot more sophisticated than the simple corridor blocks to which the Type 1 definition refers.

Occupant and office densities are fairly typical, but the hours of occupation are significantly shorter than most of the UK offices studied by the PROBE Team.

Gas is only used for space heating. In the year from 8 November 1999 to 9 November 2000, total gas consumption was 339 MWh or 81 kWh/m² treated floor area (tfa).

Normalised for standard UK weather conditions of 2462 degree days, the gas consumption for space heating increases to 91 kWh/m² tfa.

From the design team

The fruitful co-operation of the architect and the external consultants has resulted in a building in which the energy concept is the building itself. For example, the central atrium performed a function in the natural ventilation concept, and the window design followed from the recommendations on daylighting and natural ventilation.

Architect Ruurd Roorda developed an architectural translation of the energy strategies which was based on low technology, building physics principles, combined with modern controls. This was been done at a time when most energy efficient office designs focused on high technology solutions and installation-based principles. (It is worth noting that one of the few technological measures applied in this building – the rainwater recycling system – has been criticised on its environmental performance.)

The investment level for this building is not very different from reference buildings built in the same time, thanks to the building concept and cost management by the Government Buildings Agency. Also, tendering for the construction was successful and major cost cutting has not taken place.

Another important factor in achieving a continuous process was the fact that the European Commission funded part of the work through the EU project Energy Comfort 2000. The client and the design team were determined to achieve the objectives laid down in EC2000, the moral side of which was stronger than the financial one.

Improvements continued after completion: a construction mistake appearing as result of initial monitoring was immediately repaired.

It has been very encouraging to learn from the PROBE evaluation about the continuous satisfaction by the users of the building, as well as the good energy performance of the project.

The design team were Chiel Boonstra, Ruurd Roorda and Rik Vollebregt.

This compares well with other PROBE buildings but is not remarkable for a Type 1 office as it is 15% above *ECON 19's* Type 1 good practice value of 79 kWh/m². Nevertheless it is still 40% lower than the typical benchmark of 151 kWh/m².

The 'bottom line' metered electricity consumption was derived from a combination of the detailed monitoring that was undertaken during 1997, and sub-meter readings taken during the PROBE site visits. The analysis shows that the current annual total electricity use is some 152 MWh or 36 kWh/m² tfa, which is 9% above the Type 1 good practice benchmark of 33 kWh/m² and two thirds of the typical figure of 54 kWh/m².

Allowing for the 8100 kWh/y generated by the photovoltaics, net electricity imports from the grid are 144 MWh or 34 kWh/m² which is similar to the Type 1 good practice benchmark. However, this is made up of an exceptionally low energy consumption for building services and a rather high one for office equipment. Currently standing orders require all computers to be left on overnight and at weekends.

Total annual CO_2 emissions after adjustment for weather are 33 kg/m², which is 9% above the good practice level but 38% below typical. Before adjustment for weather these figures are 3% and 42% respectively.

The CO_2 emissions of 33 kg/m² are the lowest yet for any PROBE building. Other notable buildings (those under 50 kg/m²) are Woodhouse Medical Centre at 32 kg/m², the Marston Books warehouse and the Elizabeth Fry Building (both at 36 kg/m²) and the learning resource centre at Anglia Polytechnic University with 43 kg/m². The latter was also in the EC 2000 project.

The excellent energy performance is being achieved with almost no energy management – the central FM resource in Arnhem is probably focused on poorly performing buildings. However keeping an eye on star performers not only precludes them from slipping but also helps them to keep their role as exemplars.

Water consumption

Given the absence of a sub-meter in the new building, water use has been estimated from historic records, which suggest that the new building almost exactly doubled the site's water use. The extension's estimated consumption would then be 630 m³/y or about 3·5 m³ per occupant.

There are three sets of benchmarks against which this figure could be compared: The 1995 Office Toolkit for existing offices, BREEAM 98 for new and existing offices, and Environmental Performance Indicators issued in July 2001 by the sustainability working group of the Movement For Innovation (M⁴I). In addition, the Construction Industry Council (CIC) has issued its *Guide to Water Consumption in Business*, which quotes benchmarks lower than BREEAM 98 and which the BRE says will be used in BREEAM 2002 for Offices.

Compared with the Office Toolkit benchmarks, water consumption in the tax office extension is remarkably low. It is also much less than the lowest-consuming offices found so far in PROBE: 7 m³/occupant at Charities Aid Foundation[4] and 8 m³/occupant at Barclaycard[5].

Against the newer benchmarks, the tax offices's water consumption meets the best practice levels of BREEAM 98, but only good practice in the CIC and M⁴I indicators.

This low water consumption is partly due to slightly shorter working hours in the building per occupant, but also using rainwater for toilet flushing. Rainwater storage (also used for the sprinklers) forms a water feature by the building's main entrance. The rainwater is collected in two small concrete reservoirs either side of the entrance ramp. To prevent stagnation during occupancy hours, a submersible pump keeps water flowing through a sand filter, into the upper reservoir, and down a cascade into the lower reservoir.

It was not possible to calculate the mains water saved by the scheme as it is dependent on the daily rainfall pattern. Although water is saved, there is a cost in carbon emissions.

In the UK, CO_2 emissions attributable to water supply[6] are modest – only 0·37 kg/m³. So even if water use is halved, the CO_2 savings would only be 233 kg CO_2/y. Applying UK factors to the tax office extension, the carbon emissions attributable to electricity use by the circulating pump are estimated at 1700 kg CO_2/y – over seven times as much. Arguably, the pump should be viewed as a necessity for the water feature rather than as a penalty for rainwater recycling.

The occupant survey

The exercise differed from other PROBE surveys in two major ways. First, the normal (Dutch translated) questionnaire was censored and distributed by an office manager who said the staff were suffering from "survey fatigue". He removed all the questions relating to health, productivity, storage, cleaning and facilities management response times. Second, the survey was only submitted to 20 occupants found in the building on the day of the PROBE visit.

The censorship and the small sample means the data is less statistically reliable and unsuitable for graphical representation (or even direct comparison with the BUS benchmarks).

In relation to UK norms, the building has fewer staff under 30 and more men. All staff say they sit next to a window as against 50% or less in most UK buildings.

All rooms have less than four people. Around 80% of staff have worked in the building for more than a year, with 50% at their present work area for more than a year.

Staff perceptions of comfort are very good, apart from summertime temperature. However, a high overall comfort score suggests that staff are prepared to forgive this in forming their overall impressions.

Air quality ratings follow the same pattern as temperature: better in winter than summer.

Splitting the data into north side and south side revealed that respondents on the north side are more comfortable than their colleagues on the south side, although the south side is still better than the benchmark upper limit for comfort.

Lighting is rated very highly and noise performance is also good, assisted by the cellular offices and the acoustically lined ducts (and acoustic trickle ventilators) on the south side facing the railway.

Generally, staff spend less days a week in the building (4·3 days) than the UK norm (4·7 days) and slightly fewer hours per day in the building. Around 35% of staff spend less than five days a week in the building – a relatively high value. The likely effect of these characteristics is to increase the already high ratings.

Tantalisingly, the survey revealed the best perception of personal control the PROBE Team has yet encountered, along with good scores for the building's speed of response in providing comfortable conditions.

The performance of the building has many similarities to that of the Elizabeth Fry Building: high perceived levels of user control, shallow-plan form, cellularisation, lower densities, regular and predictable occupancy, thermal stability and good background ventilation.

Other noteworthy results are the apparent excellence and range of physical controls in the form of manually over-ridable external shading, automatic dimming, and understandable night-time ventilation with a clear intervention strategy for occupant operation. Cleanliness also seems good, as do the arrangements for space planning and meetings.

Possible downsides include desks in fixed positions, mostly at right angles to the windows, which gives users little opportunity to manoeuvre. However, it is a good orientation for reducing glare in computer screens.

Performance in use

The building is successful for many reasons. One key factor has to be the shallow-plan cellular offices, which offer more opportunities and fewer downsides for natural light, natural ventilation and individual control. Another benefit is the relatively simple, predictable, and routine pattern of use.

The self-regulating trickle ventilators are critical components. Each two-person office has a pair of these vents, effectively one for each person, which are individually adjustable by a hand winder. The vents are positioned near the top of the wall which allows the incoming air to cling by the coanda effect to the ceiling. A clearly visible indicator on the drive mechanism adjacent to the vent shows whether it is closed (0) partially open to provide 14 litres/s/person (1) or fully open (2), in which position it is designed to provide 28 litres/s/person. Setting 2 is intended primarily for enhanced ventilation during summer nights.

In many buildings trickle ventilators are often treated as fit-and-forget items, but at Enschede there is a clear management strategy for their use. Ventilators are supposed to be on setting 2 from June to September. During the heating season, people are asked to shut them

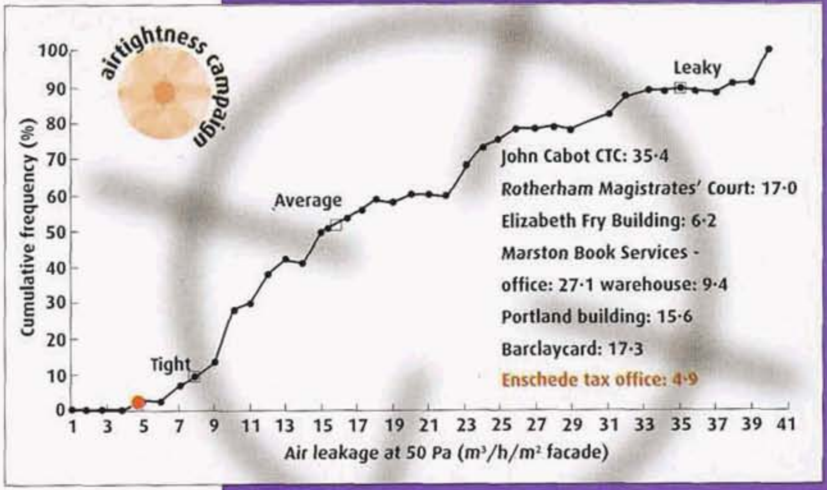

FIGURE 3: The air leakage data for the Tax Office Extension building, plotted on the BRE/BSRIA database. The cumulative distribution represents a sample of three building types: those *designed to be airtight*, buildings designed without airtightness as a design criterion, and some older buildings.

The BRE pressure test

The Building Research Establishment carried out a pressure test on the extension building on 5 May 2001.

The air leakage index for the whole building (at a reference pressure of 50 Pa) was calculated to be 4·9 $m^3/h/m^2$ of envelope area. This puts the building better than the tight benchmark on the BRE/BSRIA database curve.

As many of the air leakage points in the building were related to component assembly rather than site construction, the building would appear to have benefited from construction practice where airtight construction was adopted at an early stage in the project.

The air leakage audit confirmed the building's airtightness. The junctions of the external walls with floors and ceilings were well sealed, although there was some leakage at the skirting boards and through electrical sockets.

Air leakage was also noted in the window corners, where the glazing unit seals abutted against each other. Air leaks were also observed between the opening panels and the frames. Where they were able to be checked the window-to-wall junctions (with the exception of one window) did not show signs of leakage. However, there was considerable air leakage between the window units around the top of the atrium. The detection of leakage in the atrium glazing suggested that little or no sealing had been undertaken.

Components of both the mechanical and natural ventilation systems exhibited air leakage. For the mechanical ventilation at the top of the atrium, the nature of the leakage suggested that the dampers were either not fully closed or did not seal well when closed.

The dampers in the chimneys also did not close tightly. Only two of the trickle ventilators in the building could not be closed completely.

Two of the three medium BREFANs set up in the basement car park of the Enschede Tax Office extension.

Sixty four trickle ventilators were checked for air leakage out of 420. Twenty eight showed no sign of air leakage when in the closed position. The remainder showed varying degrees of air leakage, and some were very leaky. There was also air leakage around the frames of several trickle ventilators.

Brian Webb is a senior scientist and heads the airtightness Technical Consultancy at the BRE. This pressure test was funded by the DETR as part of the BRE/BSRIA/*Building Services Journal* initiative on improving building airtightness.

key design lessons

1. Good component detailing The advanced natural ventilation system works – the exception that proves the rule. The Enschede Tax Office is the first PROBE advanced naturally-ventilated building to achieve the ultimate prize: low energy consumption and high occupant satisfaction. The Enschede design team arguably had the luxuries of a supportive client, the mission to create a national exemplar of sustainability, and the financial resources and technical expertise to carry it off.

2. The **office trickle ventilators** are a particularly interesting example of how to control natural ventilation flow rates while also largely passing the airtightness test – an Achilles Heel of similar equipment seen in other PROBE buildings. The ergonomic design of the ventilation controls is also notable. Such design features may seem obvious, but their absence in similar UK buildings has been a crucial flaw.

3. Cellular offices are a major factor in the success. They offer more opportunities and fewer downsides for natural light, natural ventilation and individual control. The simple and predictable pattern of occupancy also help but perhaps most crucially the technology actually works: controlled rates of natural ventilation and secure night venting, effective manual light switching, glare control without blinds down and lights on, and automatic dimming in response to daylight levels.

4. Daylight delight Although the design team only had to illuminate a space 5 m deep, and had the luxury of a 3 m floor to ceiling height, the chosen approach to daylight control and electric lighting is a triumph of joined-up thinking. It optimises solar shading, daylight availability and the displacement of electric lighting in a way that is intuitive to use and liked by the users. The shallow depth and rectilinear planning of the cellular offices has avoided the main bugbear of using daylight in offices: glare.

5. Sea trials and user training The performance of even vaguely sophisticated and innovative buildings will be greatly increased if they are nursed through the first year or two of operation. The monitoring provided by EC 2000 during the first year of the Enschede Tax Office enabled the designers and building managers to test if all the systems were operating smoothly. User training was also not neglected: the user manual in the form of a desk blotter was an inspired innovation.

at night and to open them as required during the day. At other times they are instructed to leave them at position 1.

It appears that these guidelines are followed rigorously, through a combination of individual habit and facilities management support. The security guard is also instructed to open vents at night in warm weather and close them when it is cold.

The approach to the control of lighting and glare is also exemplary. The tax office has individual manual switching of each pair of luminaires and effective photocell dimming, again with separate photocells for the perimeter and inner luminaires in each office.

Many PROBE buildings used photocells to control zones of lights and lacked the resolution to respond to local needs. Consequently, they were often at best de-tuned or, at worst, over-ridden.

The imaginative ergonomics of the controls, where light switches on the same base-plate operate in different directions, makes people think about the lights they need rather than switching them all on regardless. The occupant survey suggests that satisfaction with the lighting and its control is very high.

Undoubtedly the effort put into this building by the architect has made its interior both comfortable and aesthetically pleasing while remaining true to the broad sustainability objective. It has also achieved very low energy consumption despite – in common with many UK offices – the IT department insisting that computers are left on all the time. Together with constant lighting of the car and bicycle park – this virtually doubled the building's electricity consumption.

The attention devoted to occupant satisfaction was genuine, and the expression of this in so many concrete forms has produced an enduring and robust solution. As a consequence the building is well looked after and enjoys a continuing celebrity status among the country's environmentally aware community. Many will say that its approach does not suit many UK situations: the corporates and the letting agents tell us we must have open-plan flexibility; and as designers we are often pleased to oblige. But are we quite sure we cannot achieve good results by developing the more intrinsically user-friendly and energy-efficient cellular model?

The PROBE team for the investigation of the Enschede Tax Office Extension was Dr Robert Cohen of Energy for Sustainable Development (ESD), John Field of Target Energy Services, Dr Bill Bordass of William Bordass Associates and Adrian Leaman of Building Use Studies. The article was written by PROBE manager Roderic Bunn of BSRIA.

PROBE is a collaborative research project conducted by *Building Services Journal*, co-funded under the Department of Trade and Industry's Partners In Innovation (PII) initiative, and managed by Energy for Sustainable Development.

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