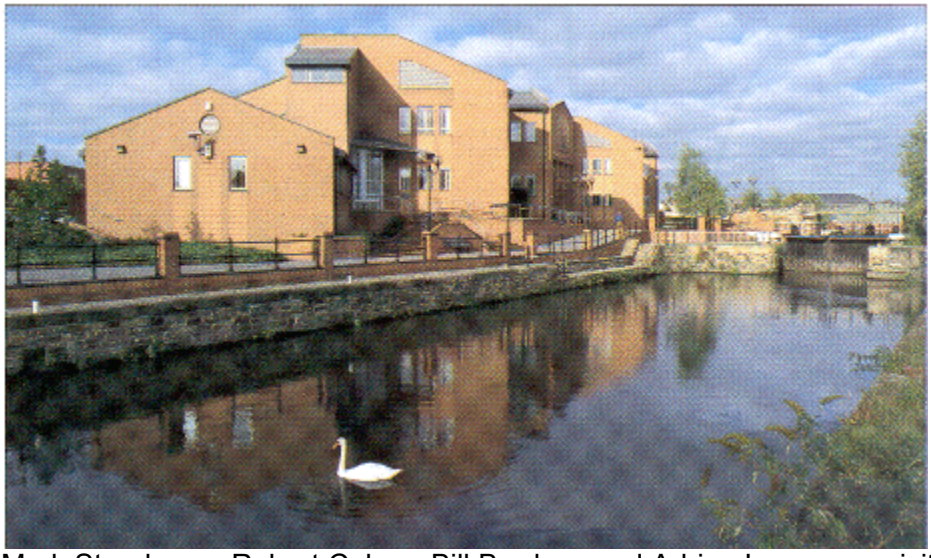
Rotherham Magistrates Court



Mark Standeven, Robert Cohen, Bill Bordass and Adrian Leaman revisit the low energy magistrates courthouse in Rotherham. To understand the building's detailed design, readers should refer to the original article "Natural justice", published in the March 1994 issue of *Building Services Journal.*

Rotherham Magistrates Court was opened in May 1994 after a relatively long procurement process which began in 1987. With financial support from the Lord Chancellor's Department, Rotherham Borough Council commissioned its own architect to design the new accommodation.

After considering a number of locations, a town centre site was chosen, adjacent to the main police station and bounded to the north by a canal and to the west by a railway. The brief set by a committee of magistrates sought a building which avoided air conditioning and provided some daylighting to all courtrooms.

At an early stage, the designer obtained specialist thermal and daylighting advice courtesy of the Building 2000 scheme[1], which informed decisions about the building form and the use of sunspaces and windows for natural lighting.

Building design

As initial tenders in Autumn 1990 were higher than expected, cost savings of £1 million were sought. It was only in the autumn of 1991 that an appropriate tender was obtained, and the building finally started on site in March 1992.

Full details of the building's construction and services design are described in the March 1994 issue of *Building Services Journal*[2]*.* In essence, the building houses ten courtrooms: a high security court, four formal adult courts, the county coroner's court and an informal adult courtroom. Three youth or family courts are within a self-contained section of the main building. Currently, the courtrooms operate at a maximum of 60% capacity.

One of the main challenges for the designer was to provide three separate circulation zones within the building, with magistrates having private secure access to all courtrooms, defendants in custody having secure access to eight courtrooms and the public having access to all courts. This has been achieved by routing defendants from holding areas in the basement (linked via a subway to the police station) to the courts via core stairwells, while a series of daylit perimeter corridors bring magistrates to the bench areas of each court.

Public access to the courts is via south-facing, double-height public waiting areas (or courthalls) and galleries which also function as passive solar sunspaces. The high proportion of circulation space is reflected in the breakdown of 5450 m^2 gross floor area, 3015 m^2 of usable area, 1200 m^2 of circulation space and 1235 m^2 of ancillaries. Treated floor area is estimated to be around 4350 m^2.

The predominant form of ventilation within the courts and public areas is displacement fresh air ventilation from wall-mounted terminals. Five of the seven air handling units (ahus) are located within spacious plantrooms in the roofspace, and incorporate non-bypass crossflow heat exchangers. The remaining two ahus (serving the cell area and the administrative area respectively) do not have cooling coils, but do have heat exchanger bypass.

Chilled water for cooling coils is provided by a packaged, roof-mounted 204 kW chiller, while four gas-fired modular boilers of 800 kW (total output 176 W/m^2) serve ahu heater batteries and perimeter heating circuits. Buoyancy-driven natural ventilation via low-level opening louvres and roof vents supplements the displacement ventilation in the glazed double-height public waiting areas.

Re-tendering and cost saving removed displacement ventilation and roof glazing in the staff office areas, which were built with perimeter opening windows and mechanical extract fans for fresh air and heat removal. These areas proved uncomfortably warm in summer, and a number of split air conditioning units were installed in 1996.

All domestic hot water is from local electric storage heaters, while control of hvac is via a central Landis & Staefa bems.

In-use performance

The courtyard at the heart of the building and double-height, south-facing glazed sunspaces on the perimeter are clear evidence of the passive solar approach, providing much of the building with daylight. Despite the proximity of the site to a railway line and a busy road the building also benefits from the potential for natural ventilation via opening windows. The courtyard has, however, increased the complexity of the circulation routes within the building and made it difficult for ushers to find people, and people to find each other. An atrium design might have given a simpler layout.

The passive solar concept clearly benefited from the use of thermal and lighting analysis at an early stage in the design. The determination was to provide as much daylight to courtrooms and lower ground courthalls as possible, although in some instances only a small amount may have resulted. This has given rise to some complex internal glazing arrangements to create the necessary fire compartments. The analysis did help cost

reductions to be made while understanding the consequences (eg daylight was deemed to be sufficient without the roof glazing in the courthall sunspaces).

The original logic of the ventilation system and its seasonal modes of operation, as established during the Building 2000 studies, appears to have been compromised in the actual installation due to budget cuffing, changes in personnel and the transition from general concept to practical detailed design. These compromises reduced occupant comfort in staff areas (remedied by the local air conditioning units) and reduced the efficiency and level of control of the hvac systems in the courts.

Ventilation performance

The original design intent was to provide a full fresh air displacement ventilation system with heat recovery to all areas of the building, as well as three seasonal modes of operation.

In winter, incoming fresh air was to be preheated by exhaust air from occupied spaces and the south-facing sunspaces, and supplied to displacement terminals in all areas. In spring and autumn, there would be no mechanical supply of fresh air to the sunspaces. Instead, low-level perimeter louvres would open to provide fresh air which would pass over perimeter heating, be warmed in the sunspace and then extracted at high level to preheat incoming fresh air destined for the courts.

One of the magistrates' courtrooms, which were reported by the courtroom staff to be very effective.

In summer, the sunspaces would be entirely naturally ventilated via the low-level louvres and opening rooflights, while the courts would be supplied with chilled fresh air. Extract air would be exhausted via a bypass to the heat exchanger.

This logic was somewhat watered down. Although comfort appears to be achieved it is at the expense of poor efficiency due to high specific fan power, high supply volumes and poor ability to match operation of the ahus to demand. Heat recovery units without bypasses were installed which means that, during hot periods, unwanted heat is recovered and the chiller has to operate unnecessarily. It is not possible to isolate the supply to the sunspaces according to season or occupancy, and “passive solar” gains from the glazed sunspaces exacerbate the parasitic load.

Knowing that the building was to be only partially used — at least for the early part of its life — could have presented an opportunity for demand-responsive, default-to-off systems which could reduce hours of operation (by at least 40% according to current levels of use, and probably more depending upon the design approach). However, the air distribution system is not easily amenable to this as each ahu tends to serve a number of courtrooms and other, perhaps unrelated areas.

In the public waiting areas within the sunspaces, the automatic natural ventilation via opening low-level louvres and roof vents is likely to provide sufficient summer ventilation, but it is not possible to isolate the displacement ventilation which operates simultaneously. The roof-mounted vents (which also act as smoke vents) appear to provide adequate draught sealing — at least two low-level perimeter louvres were found to be stuck open during the PROBE survey. Sadly, the manufacturer of the natural ventilation system ceased trading and so maintenance has been difficult. A new contract is being arranged.

In the office areas, the opening mechanisms on the top-hung, scissor-action windows were modified in the first year to significantly increase the maximum permitted opening. This failed to make sufficient improvements, and a number of ceiling-mounted Punkah fans were installed to increase internal air movement. The main problem was probably due to the large number of generally small extract fans which were unable to provide adequate cross ventilation.

It is a shame that opening roof vents in the main offices were dropped due to budget constraints: these offices still have high ceilings rising into the roof pitch, which would have provided the potential for substantial cross and stack ventilation.

Services performance

Sixteen split direct-expansion (dx) air conditioning units were installed during 1996 in both cellular and open-plan office areas. These are all permanently enabled and under individual user control via wall-mounted panels.

These dx coolers have not been linked to the bems, and during their final security round the building superintendents manually switch off any units left running. The condensers for these units are mounted on a sheltered, south-facing roof balcony and their efficiencies are therefore. depressed by considerable localised heat gains.

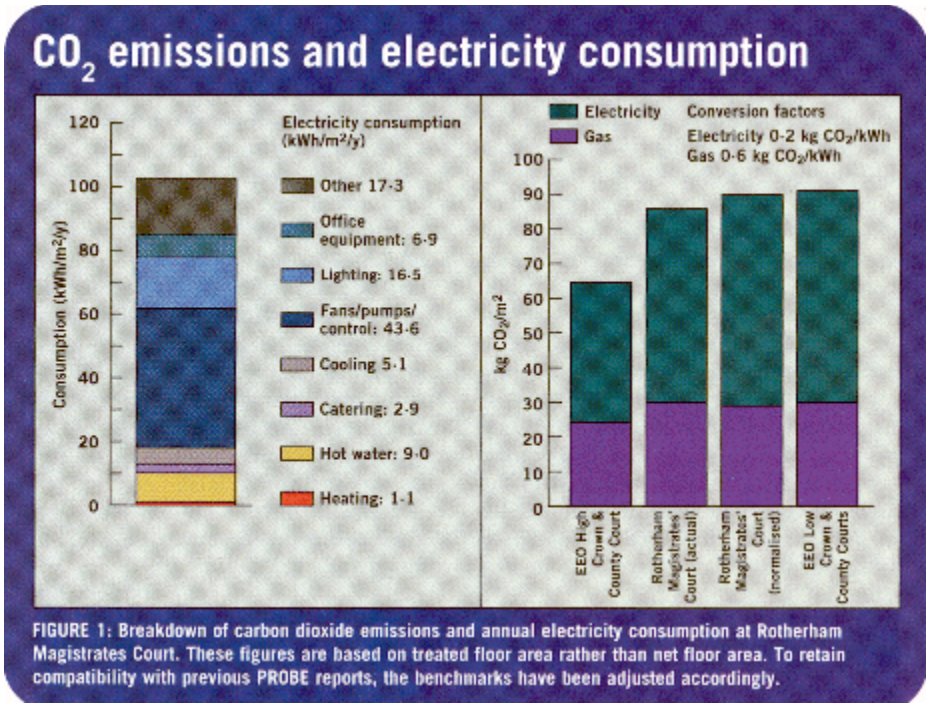


FIGURE 1: Breakdown of carbon dioxide emissions and annual electricity consumption at Rotherham Magistrates Court. These figures are based on treated floor area rather than net floor area. To retain compatibility with previous PROBE reports, the benchmarks have been adjusted accordingly.

Space heating is from four modular boilers, each of 238 kW input and 200 kW output. Sequence control from the Landis & Staefa bems seems to be very good, although offline boilers are not isolated, giving convective flue losses enhanced by a fan-assisted flue. Incoming fresh air is tempered via constant 1thw heater batteries in the ahus — 1thw also serves the perimeter heating via radiators in the two separately compensated north and south heating zones.

During the survey, compensated flow temperatures were very different between the north (66°C) and the south (42°C) — a larger difference than seemed necessary.

The summary panel for the bems, which controls the main heating, ventilation and cooling plant, is prominently located within the main administration office adjacent to the security console. As in previous PROBE buildings, this panel offers limited ability for the building managers to make adjustments. These are generally made by the services contractors using portable terminals.

The summary panel is not only small, but the menu structure ensures a high level of frustration when trying to review the settings. It is also tedious to step through the menu structure to find the cause of alarms once their existence is flagged by a warning lamp. Such alarms are often simply ignored.

Conflict between the control of heating, cooling and the separate natural ventilation control, particularly at mid-season, is managed by a combination of manual tweaks to the control set-points of the Airstream ventilation louvre system and isolation of the heating plant. The design intent was to supply air at 19°C, but during the PROBE survey the supply temperature was generally between 19·5°C and 20·5°C.

Little displacement effect was observed in one of the courtrooms but it had low occupancy at the time. Significant stratification was evident in the double-height public waiting areas, probably exacerbated by heat rising straight from the radiators and, in at

least one case, ventilation inlets being stuck open.

The corridors and public areas have certainly benefited from the Building 2000 daylight analysis, and the magistrates' circulation corridors tend to be particularly well daylit and pleasant.

Ironically, there is a single round gable window which, due to its alignment with the public waiting area, causes unacceptable glare for people waiting at the fines counter over a short period in the afternoon at certain times of the year. This effect has been ameliorated by fitting solar control film.

Over 60 types of light fittings and nearly 20 lamp types have been used in the building. Average installed load is 11 W/m^2, although some cellular offices have lighting providing nearly 1000 lux, creating a $20W/m^2$ load.

Internal lighting is manually switched, but random wiring of light switch panels from one court to another has discouraged appropriate switching. During the PROBE survey, lights were generally left on in office areas and some corridors irrespective of daylight levels. Magistrates comment that they suffer glare from light reflections from the polished stainless steel edges of desk blotters, and heat from the spotlights onto the coats of arms (most other lamps are low energy).

Facilities management issues

Day-to-day management of the building is carried out by a chief building superintendent and two assistants, who work shifts to provide cover for the 12-h day. They are responsible for opening the building in the morning and getting the courts, particularly the informal ones, ready for court sessions. They are also responsible for overseeing security in the public areas. Contract maintenance is used to maintain and operate the hvac plant.

There have been few significant problems. The large number of smoke dampers (over 150) proved difficult to commission correctly, but fortunately the status of each damper is shown on a central panel.

Several floods were caused by failed thermostats within one or two electric hot water heaters (which are generally rather inaccessible above suspended ceilings), resulting in the collapse of the plastic ball valves. Following these incidents, all hot water heaters were fitted with brass ball valves and time switches (which the PROBE team initially thought had been fitted to save energy).

Energy consumption and CO_2 emissions

The Energy Efficiency Office has produced energy consumption yardsticks for Crown & County Courts[3]. Whereas the benchmark figures quoted in the *Yellow Book* are derived from net area, it is considered more important to retain treated floor area as the benchmark denominator for PROBE comparisons, hence the yardstick values quoted for Rotherham Magistrates Court have been derived from the ratio of net and treated floor area.

For fossil fuel, the *Yellow Book* deems low consumption to be below 114 kWh/m^2, while high consumption is set above 152 kWh/m^2. For electricity, low consumption is below 62 kWh/m^2, while high consumption is above 94 kWh/m^2. Differences in occupancy and usage between crown and magistrates courts mean that these yardsticks should only be used as an indicator.

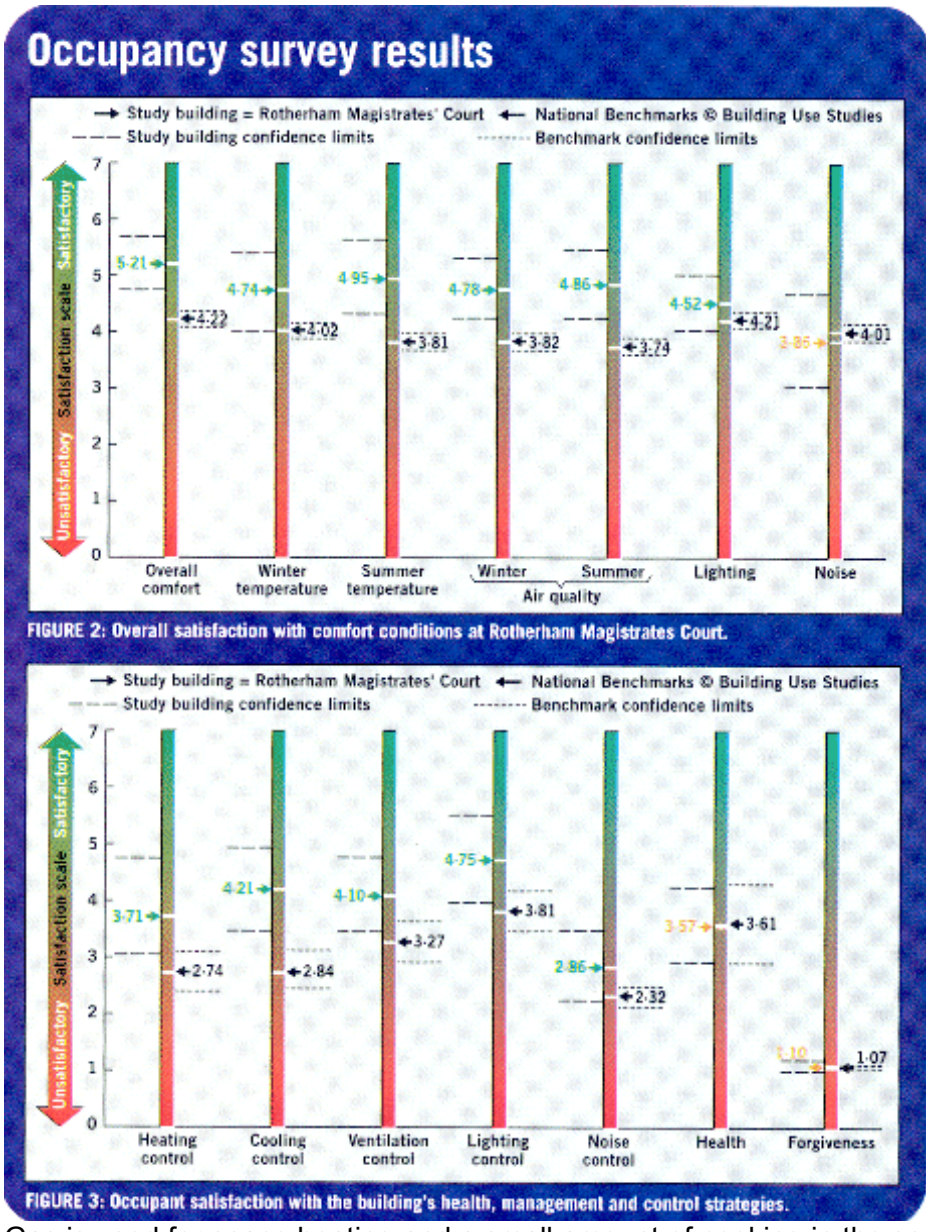


FIGURE 2: Overall satisfaction with comfort conditions at Rotherham Magistrates Court.

FIGURE 3: Occupant satisfaction with the building's health, management and control strategies.

Gas is used for space heating and a small amount of cooking in the snack bar. Actual gas consumption during the 12 months to September 1997 was 620 MWh (142 kWh/m^2 treated floor area) at a cost of £6400. Normalised for standard weather conditions of 2462 degree days, this figure rises to 150 kWh/m^2 treated floor area, which is classified as 'medium' according to the yardstick for a crown or county court — probably a direct consequence of the relatively high mechanical ventilation rates.

Unit electricity consumption in the 12 months to September 1997 was calculated at 444

MWh or 102 kWh/m^2 at a cost of £23 600. This is slightly more than the 'high' yardstick for a crown or county court.

The peak monthly maximum demand reached 212 kVA during May 1997, up from an original 200 kVA, and the availability charge has risen accordingly. Consumption was up by 5.7% on the previous 12 months, while cost was up by 6.4%. This increase is probably due to the effect of increasing use and the addition of office air conditioning systems.

End-use breakdown

Electric heating was measured at 1·1 kWh/m^2. Door air curtains in the main reception of the building are used for short periods in cold weather at the discretion of the duty receptionist, who has access to a manual switch. Partly due to security concerns the reception is enclosed by a glass screen which helps to ensure comfort.

A series of 3 kW electric heater elements under individual thermostatic control are included within five of the Vent-Axia supply fans which serve the administrative offices.

Up to 25 local electric hws storage heaters of various capacities serve the large number of toilet areas within the building. It is only recently that time switches were fitted to these units, and the figure of 9 kWh/m^2 assumes 24-h operation.

There is a small cafe in the building which serves sandwiches, hot drinks and snacks to the public, while the staff room and the magistrates' common room each have a microwave and hot drinks facilities. The overall electricity consumption for catering is estimated to be around 3 kWh/m^2.

The main chiller of 204 kW cooling capacity is estimated to operate for just a few hours each day in the summer months. The lack of bypasses within the heat recovery units will cause some unnecessary chiller operation and this may well account for the peak maximum demands which are seen to occur in spring and autumn.

Cooling is therefore worth around 5 kWh/m^2, although the split air conditioning units are estimated to account for something around half of this figure.

Fans, pumps and controls are estimated to consume 44 kWh/m^2, with the fans alone estimated to use nearly 40 kWh/m^2. This is due to the high ventilation rate of at least 41/s/m^2, a relatively poor efficiency of 3·8 W/l/s, caused by complex air distribution runs and associated pressure losses combined with particularly long running hours.

The whole ventilation system operates for 11 h each weekday, even though courtrooms are only required for up to 6 h per day (and many for less). The office areas are not served by the main ventilation system.

Theoretically there is scope for energy savings through an attempt to match ventilation system operation more closely to room usage, but this may be difficult to achieve in practice due to the supply duct arrangements from each ahu.

By comparison, the heating and cooling pumps consume a modest 1 kWh/m^2, while the bems and pneumatic ventilation controls account for the rest.

At 16 kWh/m^2 average installed lighting power works out at a respectable 11 W/m^2 although this hides the somewhat higher 20 W/m^2 within some office areas. The high proportion of circulation area with its relatively low lighting requirement, combined with good daylighting, helps to keep the lighting consumption down.

During the PROBE survey, lighting was generally left on in office areas irrespective of daylight conditions and occupancy.

The court is responsible for lighting the public walkway in front of the building throughout the night. At 4 kWh/m^2 this is provided by 150 W SON-T lamps within globe-style luminaires. Photocells mounted on the court building control the switching of external lights.

The office equipment load averages 7 kWh/m^2. Rotherham Magistrates Court shares a central computer system called EQUIS with several other courts in the area, and most courtrooms and offices have terminals for this system. Due to network requirements these terminals are left on continuously, despite managers' concerns about the fire risk. There are 15 pcs and several laser and inkjet printers. The remaining office equipment load is due to three large photocopiers.

Security equipment including cctr, card readers and the telephone system is estimated to consume about 5 kWh/m^2.

There is a significant night-time consumption equivalent to 10 kW (6 kWh/m^2) running continuously every night which remains unaccounted. This is likely to be due to more equipment being left on overnight than has been assumed, but this will require further survey work to confirm its source.

At its briefing and design stages, Rotherham Magistrates Court set out to be a healthy building by seeking good daylighting and avoiding air conditioning. This might have been expected to result in a relatively low energy law court, but this has not been achieved, largely because the fans supply air continuously at the rate required during peak occupancy, and at an average efficiency, rather than at a minimum rate controlled on demand.

The low energy aim is also not fostered by any energy management or monitoring of energy use. This results in a lack of awareness by the occupants of the energy saving potential so that, for example, little heed is paid to switching off lights and local chillers when they become unnecessary.

Water consumption over the two-year period from September 1995 to September 1997 has remained steady at about 550 m^3/y or about 130 litres/m^2/y.

DESIGNER'S FEEDBACK

One of the main stated objectives at the Rotherham Magistrates Courthouse was "to provide a humane and comfortable internal environment for all the building's occupants, relying as much as

possible on natural ventilation and daylighting while exploiting the potential for passive solar heating" *writes Steve Fryer.*

The PROBE study shows that the main part of this objective has been successfully achieved, but we were not so successful in achieving comfort conditions in the office area or significant savings in running costs by using passive solar design.

In terms of the office area it is clear that, had the original proposal for displacement ventilation been implemented, the problems described would not have been experienced, and there would have been no need to install localised air conditioning.

Passive solar heating was seen as an important but secondary part of the design objective. To realise the cost benefits from passive solar design, it needs to be made one of the primary objectives. Although the principles of daylighting and natural ventilation were applied throughout the building, the passive solar heating aspect of the design was applied to the courthalls and courtrooms only.

The use of displacement ventilation in these areas had been part of the design concept from a very early stage and was not a later compromise. With its provision of fresh, non-recirculated air, displacement ventilation was the ideal solution for ventilating the courtrooms and the rear sections of the courthalls. The courtrooms require a tightly-controlled internal environment, and the courthalls are fairly deep in plan, the rear section being remote from the sources of natural ventilation.

"Watering down of the original logic of the ventilation system", and in particular reducing the flexibility provided by detailed zoning of the air distribution systems was a result of budget constraints, as stated in the article, as well as spatial constraints —a huge amount of floor and ceiling space (more than could be made available) would have been required to contain all the necessary ductwork.

There is a suggestion that an atrium, rather than a courtyard, might have simplified the layout. Atrium designs were considered, but were rejected. The floor would have needed to be at ground level to simplify circulation — this would have cut the lower ground floor off from daylight penetration and natural ventilation.

Also, the form of the building would need to be quite different: roofing over the courtyard would have increased the area of the building considerably beyond the allowance set by the Home Office.

Steve Fryer is an architect with the Rotherham Technical Consultancy Land and Property Division.

The occupant survey

Questionnaires were completed by 40 of the office staff and 40 of the 130 magistrates who sit on the bench. A slightly different questionnaire was issued to people who predominantly used the courtrooms, such as magistrates, ushers and clerks. Office staff were also asked a supplementary question about the dx air conditioning.

The survey concentrates on the building's permanent staff and others who are regular users of the building — there are several other constituencies of building users who have not been surveyed (people on trial, visitors from the public, solicitors and lawyers, witnesses and other people attending court sessions).

The analysis of survey results concentrates on the office staff responses which can be compared to the dataset benchmarks provided by Building Use Studies (BUS). There are currently no benchmarks for magistrates, ushers and other specialist court users.

Occupants' scores are very good. The overall comfort score for office staff is one of the best, putting the Rotherham Magistrates Court in the top 10% of the 45 relevant buildings in the BUS dataset.

The average percentile scores for summer and winter air quality, lighting, noise and overall comfort places the Rotherham Magistrates Court fourth best in the dataset. A best "all-rounder" based on the average of percentiles for overall comfort, productivity, perceived control and forgiveness places the Rotherham Magistrates Court second out of the 13 buildings measured this way (Woodhouse Medical Centre being the top-scorer).

Staff report that winter temperature and air quality is comfortable overall: neither too hot nor too cold, stiller, drier and stuffier than benchmark, mid-range on odour and smell and that overall winter air quality is more satisfactory than the benchmark.

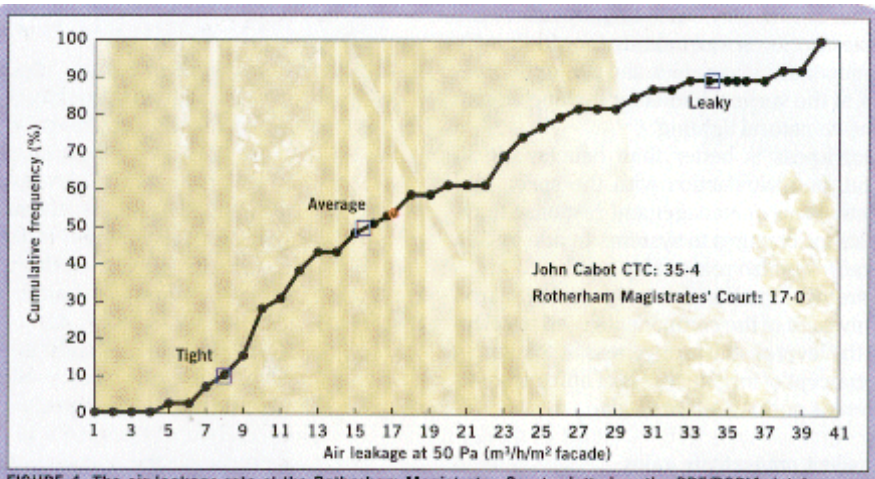


FIGURE 4: The air leakage rate at the Rotherham Magistrates Court, plotted on the BRE/BSRIA database.

The BREFAN pressurisation test

benchmarks for better buildings

The Building Research Establishment carried out a pressure test of the youth and family court areas of the building during a staff training day, *writes Brian Webb*. Although the ground and first floors were sealed from the rest of the building, one of the ahu doors had been forced open due to the pressure created by the fans, and the presure test results were adjusted accordingly.

The results of the test show an air leakage index for the part of the building tested, at a reference pressure of 25 Pa to be 12·2 $m^3/h/m^2$ of envelope area (calculated at 1429 m^2). This compares with the Building Research Establishment benchmark of 5 $m^3/h/m^2$ for a tight building and 20 $m^3/h/m^2$ for a leaky building (or 17 $m^3/h/m^2$ at a reference pressure of 50 Pa, figure 4). It was not possible to conduct a full air leakiness audit, but the low-level external louvres in this area were less leaky than expected and no single or predominant source was identified for air leakage.

The pressure test showed that the windows did not appear to be very leaky, although some leaked a little at the bottom of the frame. Even though the dampers were closed in the ahus there was detectable airflow out through the upper vents. The ventilators in the toilets also showed up as an air leakage path.

The external doors were quite leaky, such that daylight could be seen around the edges of most of them.

The stuck-open louvres identified during the PROBE survey were not in that part of the building which was pressure tested.

Brian Webb runs the pressurisation test rig at the Building Research Establishment.

In summer, occupants report similar levels of satisfaction, with above average summertime overall comfort: too hot but better than benchmark, too still, slightly dry, stuffy, odour-free and good overall summer air quality. It is likely that had the office areas been provided with the opportunity for more effective ventilation, via opening roof lights or improved extract fans, the resultant air movement would have avoided the still and stuffy responses.

The use of suspended up-and-downlighters in the offices is likely to have contributed to the relatively good lighting scores, although the survey confirms that there is probably too much artificial lighting. The perception of natural lighting provision is good, while glare from sun and sky is mid-range.

There are also comments about the difficulties of achieving satisfactory glare control using the vertical louvre blinds, which results in them being fully closed and the lights left on.

Noise is reported as being less satisfactory than the benchmark. A review of staff comments suggests that they feel frequently interrupted by bells, buzzers and alarms as well as telephones and banging doors — many of which may be manageable.

There were also a number of comments about the noise from passing trains, and one of summer window opening letting in a “drone from the generator” (although, ironically, this is more likely to be from the roof-mounted chiller or even the split dx condensers as the generator runs for very short periods).

There is a consistently good (ie high) perception of control for everything except lighting, which is no different from the benchmarks. This survey outcome may reflect the presence of local, wall-mounted controllers for the air conditioning units, and the ineffectiveness of the vertical blinds for making adjustments to natural lighting.

Quickness is better than benchmark all round, and satisfaction with the speed and effectiveness of management response to requests for changes to systems (made by 52% of staff) was also reasonably good.

Due to the fact that the staff generally scored highly each of the components used to calculate the level of staff forgiveness or tolerance, the concept of forgiveness is of little meaning — there is nothing left to forgive.

Perceived productivity gains

Office staff report a positive perceived productivity gain of 1·8% attributable to the building, putting the Rotherham Magistrates Court in the top 25% of the BUS dataset.

However, given the very high overall comfort ratings, this productivity increase is lower than might have been expected, but there is no other court building in the BUS dataset which can be used for comparison.

Courtroom users were asked for their perceived “effectiveness” rather than productivity, which was considered to be somewhat inappropriate for magistrates. For their part the magistrates reported a positive 20% effectiveness, while the court clerks and ushers reported plus 8%.

All those members of staff who answered the question referring to the recently installed air conditioning units in the office areas rated this as an improvement (75% of respondents gave it the maximum score of 7, the rest a 5 or a 6). They also thought it improved “normal” summertime conditions (72% scoring 7), but for other times of year 40% of respondents said they felt it made no difference.

This result, together with the high overall comfort figure, suggests that occupant-switched local air conditioning units for peak summertime conditions may be extremely effective — indeed, this is supported by other recent UK and Australian findings in buildings with mixed-mode systems.

Key design lessons

Daylight analysis at the design stages has undoubtedly contributed substantially to the building being well liked by its occupants, particularly the magistrates who, it must be noted, had been instrumental in including daylighting in the original brief. However, good daylighting has not necessarily resulted in the expected electricity savings, largely due to unhelpful light switching arrangements, vertical blinds often permanently closed and the usual indifference of occupants to achieving lower electricity consumption.

While the courtrooms were regarded as very effective overall, magistrates did complain of glare from these light fittings, made worse by reflections from the desks.

DX air conditioning was retrofitted at considerable expense in response to summertime overheating in the office areas, particularly during the record heat wave in the summer of 1995. It appears that this local on-demand cooling to alleviate hot discomfort when it occurs has been extremely effective in contributing to the very high overall comfort score. The building has ended up, through this provision, as a successful example of zonal mixed-mode whose energy cost (for this specific element) is modest, so long as operation is restricted to those periods when it is genuinely required.

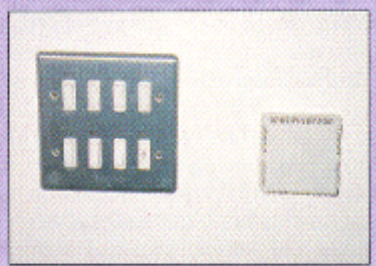
Two ventilators, behind the radiators in the public waiting areas, were found to be stuck open. Maintenance has been a problem.

Summertime comfort problems in the offices and open-plan areas led to the installation of 16 dx air conditioners, which are permanently enabled and manually switched. This retrofit solution can be directly linked to design compromises and budget cuts. Passive solar to mixed-mode by default?

Heat recovery As electricity for the fans costs more than five times that of a unit of gas, a 3% saving in fan energy would achieve as much as the ventilation preheat. When using mechanical ventilation with heat recovery, great care needs to be taken that gas savings are not more than wiped out by "parasitic" electricity. It is even more important to ensure that all other elements of the ventilation system and its operation are also low energy (eg lower pressure drops, more efficient fan design and control).

More evidence, if it were needed, that engineers believe their controls to be intuitive to users and facilities managers when clearly they are not.

Energy design advice concentrated on the courtrooms and public areas. If thermal modelling had been extended to cover the office areas, the overheating risk of the design may have been identified, better ventilation provision ensured and the retrofitting of air conditioning avoided. This narrowness of focus is common and a major reason for the disappointing gaps between theory and practice in achieved comfort and en-



More of the same. Without clear labelling, all lights will tend to be switched on by one

References

[1]Commission of the European Communities, *Building 2000 — Magistrates Courthouse,* Issue P1, February 1991.

[2]Ashley 5, 'Natural justice', *Building Services Journal,* 3/94.

[3]EEO, Yellow Book: Introduction to energy efficiency in prisons, emergency buildings and courts, Department of the Environment, March 1994.

The PROBE team acknowledges the kind assistance of Gill Thomas (finance and administration manager), David Maplethorpe (chief building superintendent), the magistrates and staff at Rotherham Magistrates Court, Brian Webb of the BRE and Steve Fryer of the Rotherham Technical Consultancy Land and Property Division.