MINOR WORKS AGREEMENT

Perils of nominating under MW'80

Legitimate claims by contractors for extensions of time may result from attempting to nominate subcontractors while using the JCT Minor Works Agreement

BY KEITH PICKAVANCE

The advice given in JCT Practice Note 20, in connection with the use of the Minor Works Agreement (MW '80), is that there is no provision for the nomination of subcontractors.

In earlier versions of MW '80, the headnote stated, among other things: 'The form is not for ... where the Employer wishes to nominate subcontractors...'

But the practice note M2, now available with current versions of MW '80, seems to suggest that it can be. Note 5, for example, states that nomination may be achieved by, among other things: '...instructions on the expenditure of a provisional sum...'

DAVID BANKS

Under Clause 35 of the JCT Standard Form of Building Contract 1980 edition (JCT '80), nomination is a 'term of art', ie there are clauses in the contract conditions which define what is meant by 'nomination' and set out the consequences of the architect nominating a subcontractor. JCT '80 distinguishes between the powers and duties of the parties in regard to a 'nominated', 'listed' or 'domestic' subcontractor. There are no such clauses in MW '80, so the effect of a nomination is not so clear.

Clearly, if the instruction is not a legitimate instruction, the main contractor is not bound to accept it but, if he does, what is the effect? It seems that, in a contract form which does not set out the power to nominate and the consequences of nomination, the subcontractor in question can be accepted or rejected by the contractor; the decision of whether to appoint is that of the contractor, not that of the employer or his or her architect.

One potential point of difficulty seems to be in the period between the start of the contract and 'nomination' of the subcontractor. Theoretically, under MW '80, the contractor has no legitimate expectation of a nomination, but is entitled to be provided with all the information necessary to proceed. The first recital in the articles of agreement states that the contract drawings and/or specification and/or schedules show and describe the contract works. If the contract documents carry all the information necessary, then the subsequent attempt to require the contractor to sublet a portion of the works to others under the imposition of a 'nomination' during the course of the works, at the least may be expected to disrupt the contractor's working arrangements and programme.

> 'Clearly, if the instruction is not a legitimate instruction, the main contractor is not bound to accept it but, if he does, what is the effect?'

In an unreported case, *Rowberry Associates vs Johnson and Johnson*, heard in the High Court in Birmingham in September 1991, the unfortunate architect, in suing for his unpaid fees, was met with the assertion that merely by nominating a subcontractor, under a form which contained no provisions for such a nomination, he was 'causing delay to the contractor'. His Honour Judge Wilson-Mellor QC had no difficulty in disposing of this on the facts, but did not say that such a claim was unsustainable in law.

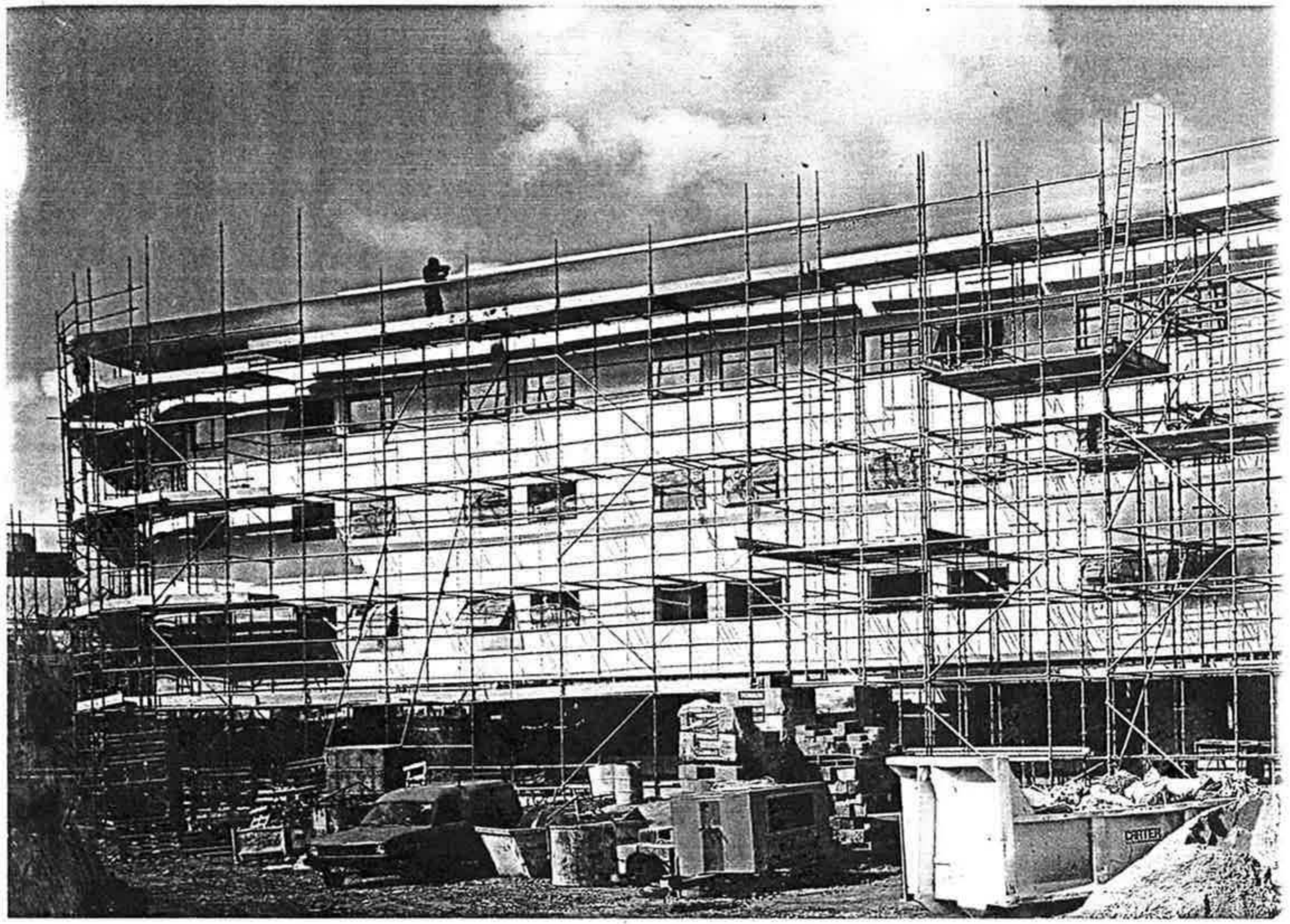
Clause 2.2 of MW '80 states that 'any cause beyond the control of the contractor' is ground for any extension of time and under clause 3.6, the contractor is entitled to loss and expense if the regular progress of the work is affected by compliance with an instruction. Although clause 2.7 makes provision for the expenditure of 'provisional sums', neither provisional sums nor prime costs sums are defined in the contract. Even if the details of the work in question are the subject of a sum of money set aside in the specification as a 'prime cost sum', it would appear that any delay in agreeing under what terms the contractor might accept the nomination of a subcontractor for such work, and any administration in respect of it, might be said to arise directly out of the architect's instruction and thus outside the control of the contractor under this form.

The selection of specialist contractors for specialist elements of the work is a well-established and often useful technique employed in the quest for quality. On the other hand, MW '80 is not a satisfactory form of contract to use for that purpose without the special provisions contained in JCT '80.

The orthodox approach to selecting a specialist contractor to be under the control of the main contractor is to name the specialist and describe the work to be carried out by him, in the main contract tender documents. Under MW '80, this form of appointment will constitute a simple domestic subcontract. The effect is the same when a main contractor selects a specialist from a list submitted for that purpose.

If it is not important that the specialist be under the control of the main contractor, then the work in question can be secured under a separate contract with the employer and for that, the Minor Works Agreement might reasonably be used. □

Keith Pickavance is principal of construction in Europe at Peterson Consulting (UK) Limited Partnership, an international firm specialising in investigatory, arbitration and litigation support services to the construction industry.



Airtight additions to the campus

TEXT BY BARRIE EVANS. MAIN PHOTOGRAPHS BY IAN MCKINNELL

Building	Constable Terrace and Nelson Court student halls of residence
Client	University of East Anglia
Architect	Rick Mather Architects
Quantity surveyor	Stockings & Clarke
Structural engineer	Dewhurst Macfarlane
Services engineer	Fulcrum Consultants
Energy consultant	Halcrow Gilbert Associates
Contractors/ contract	Wates Construction (Nelson Court); R G Carter (Constable Terrace) JCT 80
Cost data/ start dates	Nelson Court £6,166,690/9100m²; Constable Terrace £6,586,910/9600m²/ Nelson Court 24 February 1992; Constable Terrace 18 November 1991

Two new halls of residence, designed by Rick Mather Associates, are currently under construction at the University of East Anglia. All 800 of the near-identical student rooms have en-suite, prefabricated bathrooms, designed to be craned into position. Their low-energy design required high standards of air-tightness and that mechanical ventilation systems be threaded through the buildings

Four years ago, Rick Mather Architects took over the masterplanning of the University of East Anglia (UEA) from Sir Norman Foster and Partners, producing a 25-year plan. It has since undertaken various infrastructure works as well as new buildings, including the two halls of residence, Constable Terrace and Nelson Court, now under construction. It does not, however, have a monopoly of jobs; John Miller Associates is currently constructing an occupational therapy building.

Both new halls of residence aim to add long-term coherence to the campus layout. Constable Terrace snakes across a long, thin site addressing the Sainsbury Centre on one side while forming two sides of a courtyard-to-be on the other. Nelson Court encloses a not-quite-square court on three sides. The logic of the out-of-square plan is that future, similarly near-parallel blocks could gently fan out across the adjacent hill.

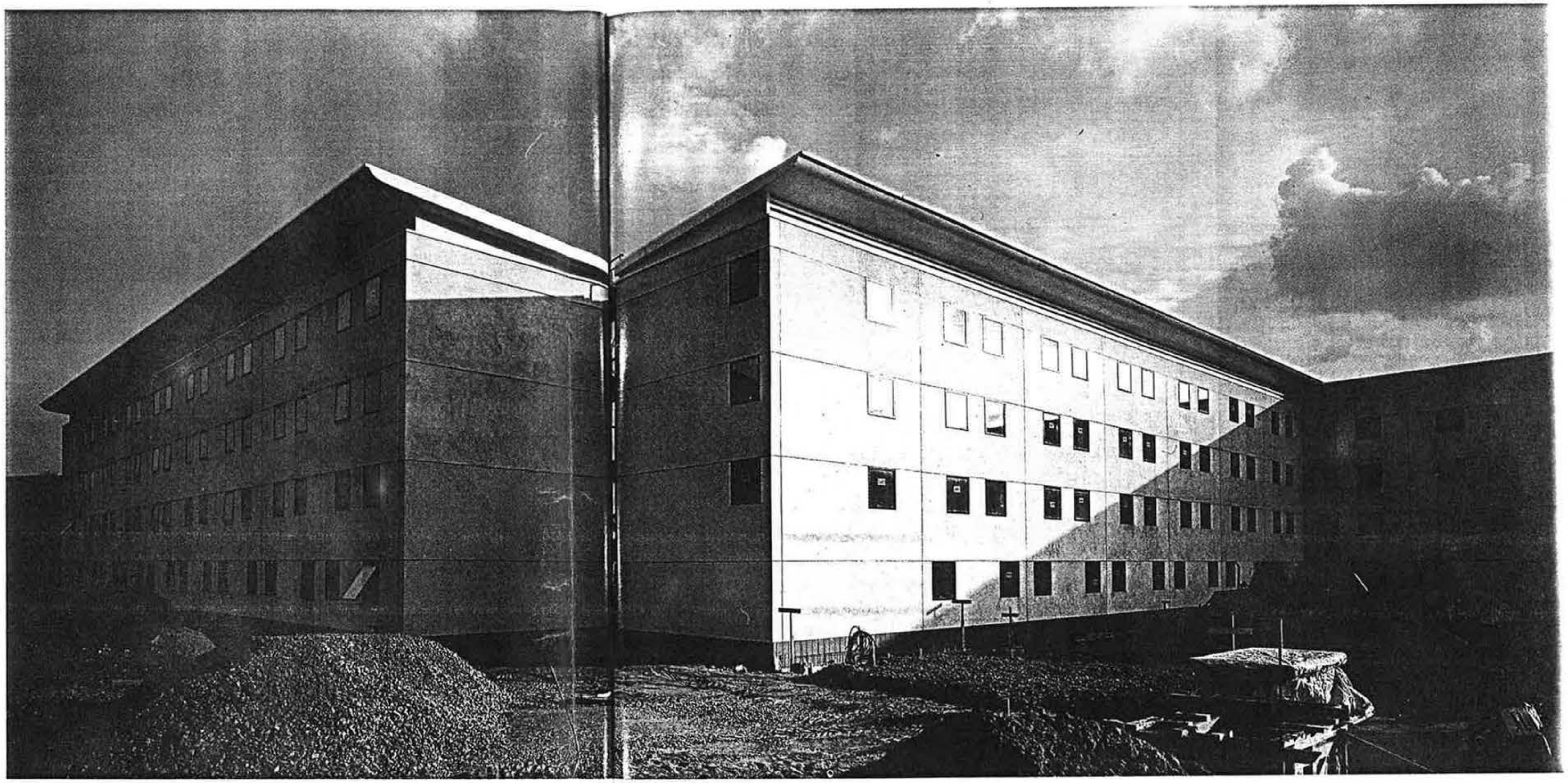
Within this overall configuration, the two halls are very similar in organisation. They comprise houses, on three floors, of 10 bedsits with communal kitchens and common rooms, each house with its own entrance. Above that, the top-floor postgraduate and guest accommodation, with separate access stairs and lift, runs the length of the blocks. As well as the common rooms on the ground floor, there are function rooms at the corners of the blocks. Each hall accommodates about 400 bedsits in total.

The basic construction of each hall is similar. Nelson Court is piled, but above that, both are loadbearing blockwork with concrete plank floors. The outer leaf is stack-bonded Spectraglaze blocks at ground level, with render on block above. To cope with the curved plan at Constable Terrace, roofs are finished in Kal-Zip standing-seam metal sheets, chosen because they can be tapered. Only the larger-span function rooms are insitu concrete.

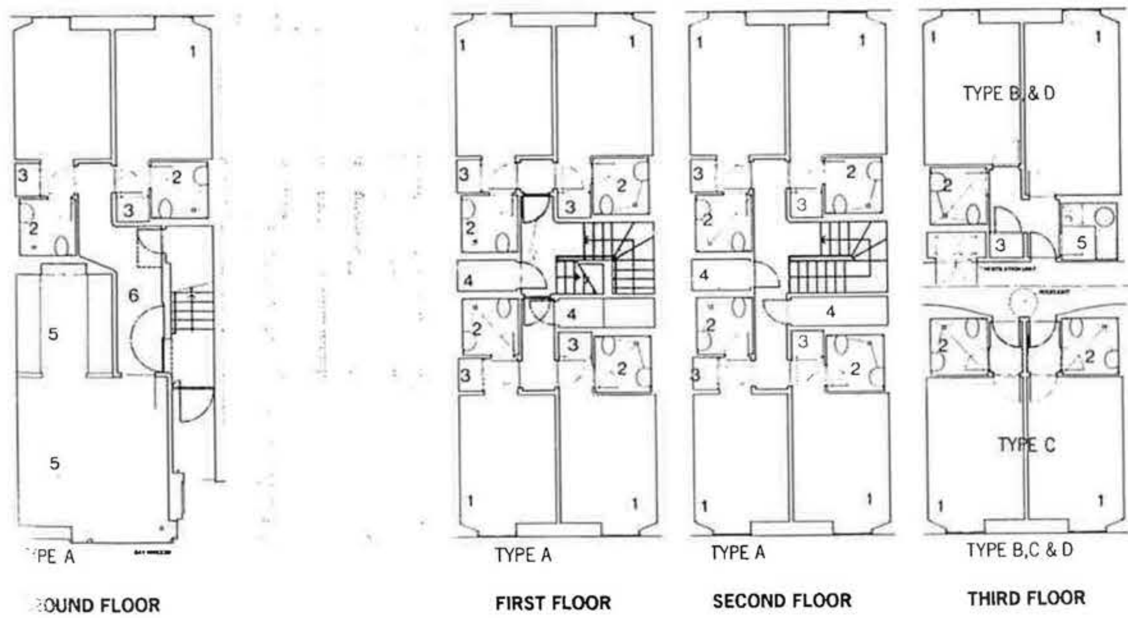
Bedsits are intended for use as conference accommodation as well as for students, so every room has an ensuite bathroom. For these bathrooms, the repetition that arises from 800 near-identical rooms, the need to achieve high quality standards and the tightness of the space – they are 1.7m by 1.7m – encouraged the architects work with a modular building manufacturer to create prefabricated bathrooms that could be craned into the building as it went up.

Energy and air-tightness

One of the themes of these buildings is energy conservation. Insulating the envelope has been straightforward. There is a 150mm wall cavity containing 100mm mineral fibre batts, polystyrene insulation (100mm) beneath the screed, Bison load-bearing con-



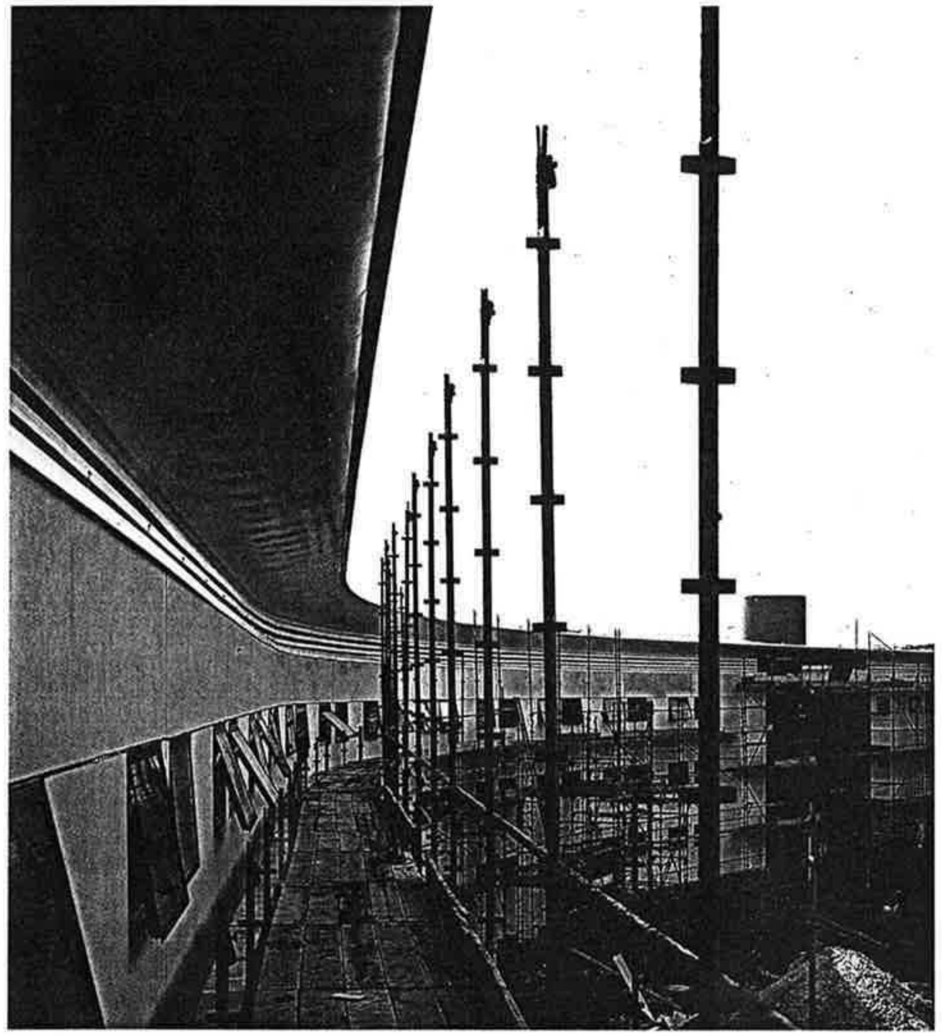
Above: the back of Nelson Court, with the blocks linked by glazed walkways. Left: the snaking Constable Terrace next to the Sainsbury Centre. In the distance, the four white blocks of Nelson Court. Right: floor plans of a 10-person house on three levels, with a continuous corridor on the top floor reached by separate stairs and lifts and the ends of blocks. Previous page: Nelson Court under construction



FLOOR PLANS

A – 10 person house
B/D – 2 person student/visitors' flat
C – visitors' single rooms

1 – study bedroom
2 – en-suite lavatory
3 – wardrobe
4 – cleaners cupboards/stores
5 – kitchen or kitchen/dining
6 – circulation

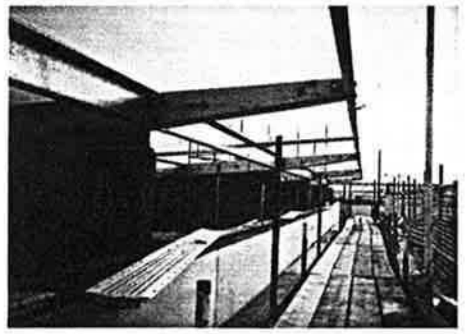


crete planks used for trafficked floors, and Thermalite concrete planks with 200mm of Rockwool on top, at roof level. Above this roof-level sandwich is a void ventilated by vertical louvres and the metal-skinned roof covering. By separating this covering from the insulation, no vapour check is needed and the risks of interstitial condensation are reduced, though some condensation could form on the underside of the roof sheets on cold winter nights and drip on to the ventilated insulation below.

For walling, the architect looked at faience – which was rejected on grounds of cost. Concrete block, as an alternative to Spectraglaze, was also deemed too expensive to clad the whole building. The architect then explored external insulation systems as well as directly applied render, but these systems would have proved more expensive still, and would have lacked impact resistance for ground-floor use.

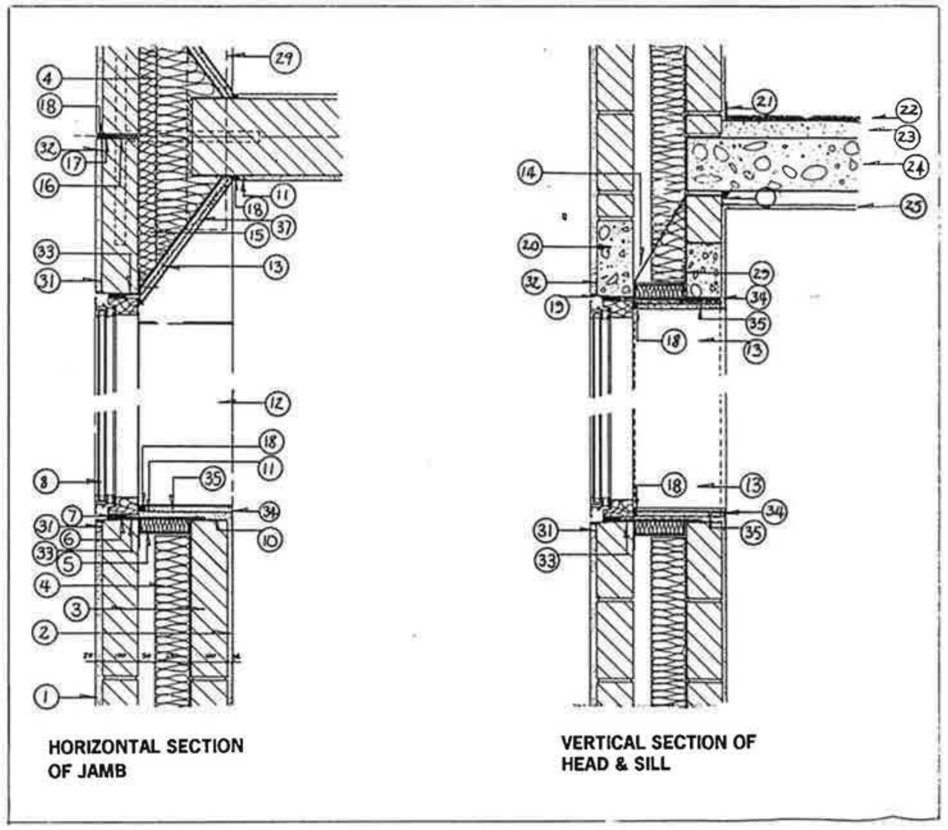
The render used is split into panels, providing breaks at DPCs and party walls. It has a white and relatively rough-textured finish and is a proprietary system from Eglington Stone with local, franchised installers. Most of the metal edging for the render is off-the-peg, but special frames were made up to go round the windows.

Having achieved a high level of insulation, ventilation heat loss became a greater priority. Both buildings are highly air tight and use mechanical ventilation with heat reclaim. The tender includes the cost of sev-

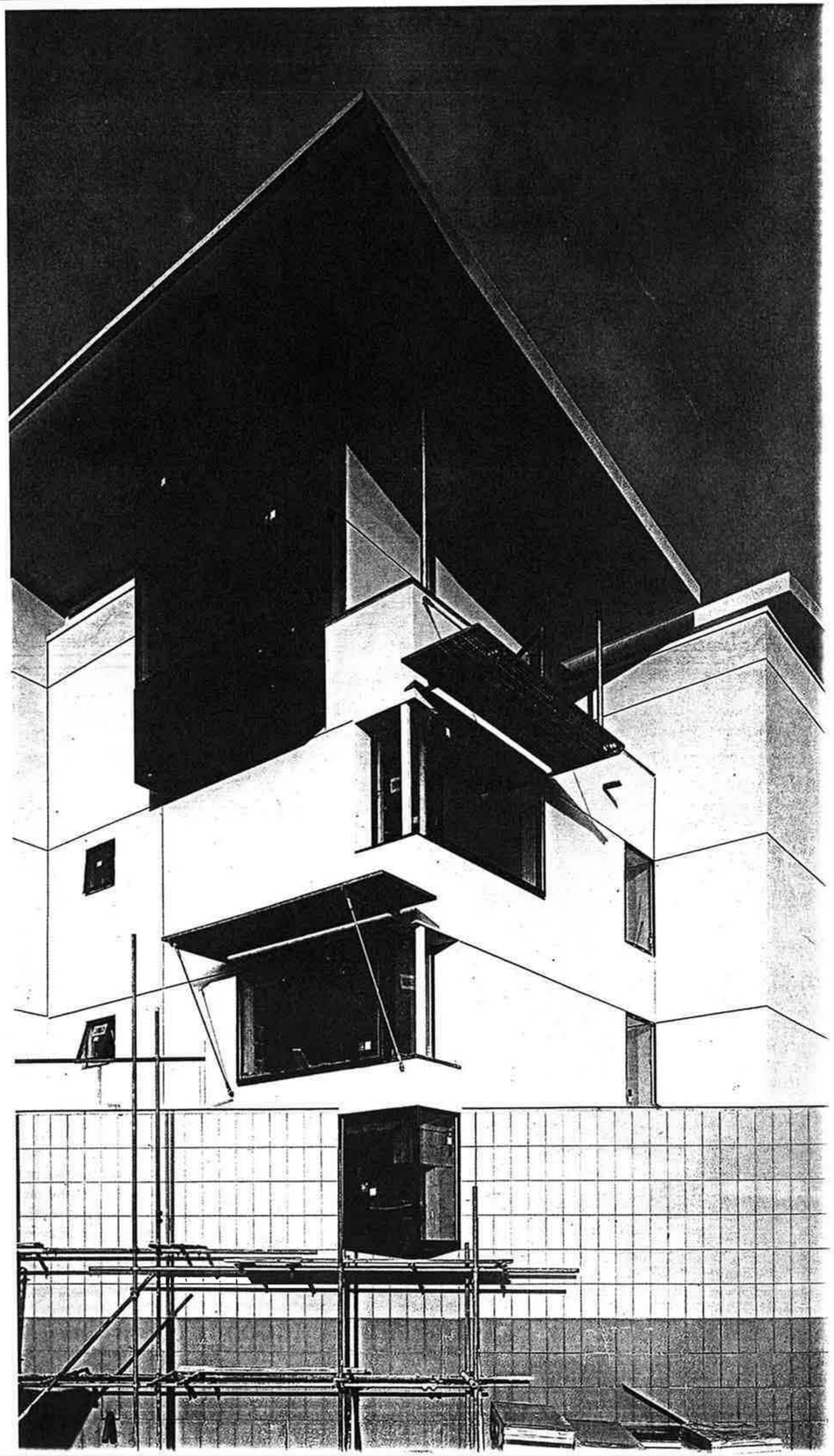


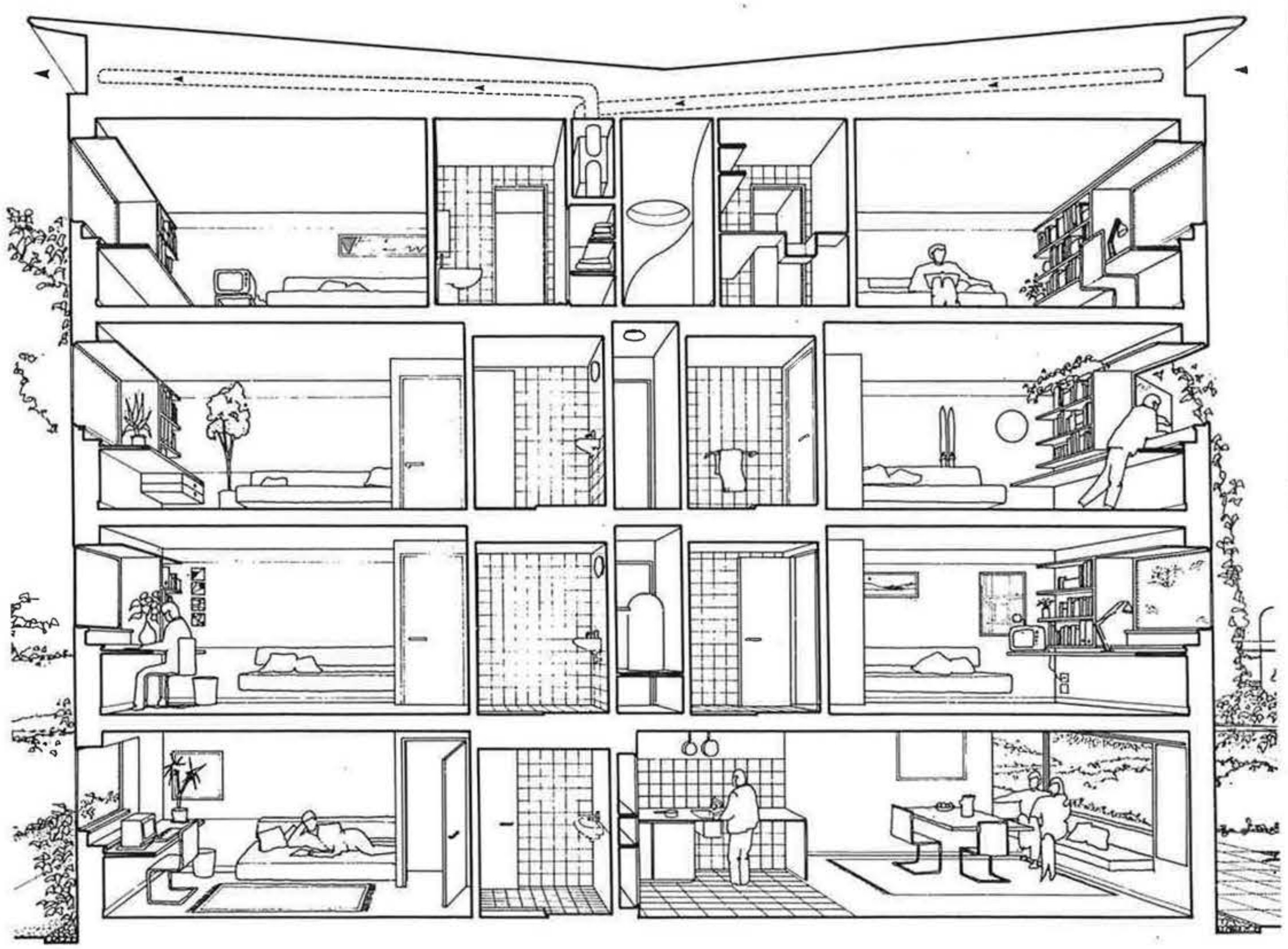
WINDOW DETAILS

1 20mm min render
2 13mm min plaster
3 Thermalite block
4 100mm mineral wool
5 cavity closer
6 packing by window subcontractor
7 sealant/mastic pointing by window subcontractor
8 Velfac window
9 galv corner bead
10 galv mesh
11 galv stop bead
12 ceramic tiles
13 galv steel Gypliner system
14 dpc
15 insulation fire break
16 compressible movement joint
17 packer to mastic
18 mastic pointing
19 PVCu weep hole, turned horizontal
20 precast lintel
21 30mm pvc skirting
22 carpet
23 fully bonded 50mm screed
24 precast planks
25 13mm plasterboard and skim
26 Gyproc ceiling system
27 galv plasterboard stop
28 tanalised softwood packing
29 shelf angle
30 ss tie
31 ss reveal stop bead
32 ss stop bead
33 servicised 150mm dpc, unbonded
34 Expamet thin set bead
35 plasterboard on dabs
36 Bitumastic pointing to seal front wall
37 2 plasterboards: internal 13mm foil backed, external moisture resistant



Left: the eaves during assembly and nearing completion. Note the grille through which the roof construction is cross-ventilated.
Left, below: scaffold boards above the window heads.
Bottom left: plan and section of the bedsit window showing the elaborate detailing for air-tightness, including mastic pointing to the junctions of plaster planes.
Right: the corners of Nelson Court contain function rooms





eral air-pressure tests at intervals to check the air-tightness of the construction. Two critical details were identified: the wall-to-roof junction and, especially, the windows. One window was fully built-in and a pressure test conducted in a space cut off from the window but, because the air volume involved was so small, the results cannot be judged accurate.

The measured rate was about one air change per hour (ac/h) at a test pressure of 50 Pa, suggesting a natural infiltration rate of 0.1-0.2 ac/h. There will be pressure tests of the whole building at a later date.

Air-tightness detailing at the roof-to-wall junction was made straightforward by dry-packing concrete planks rather than building in timber joists, which move much more with moisture content changes. This should reduce the likelihood of the plaster cracking.

It is on the window detailing, which has had to be repeated 800 times, that most attention on air-tight construction has been focused. Though the windows are differently proportioned in the two buildings – square for the more block-like Nelson Court, wider to pick up the dynamic of the flowing Constable Terrace – the edge detailing is the same.

Window areas are the minimum allowable under the regulations, to minimise winter heat loss and reduce summer heat gain – the client decided curtains would provide enough solar protection.

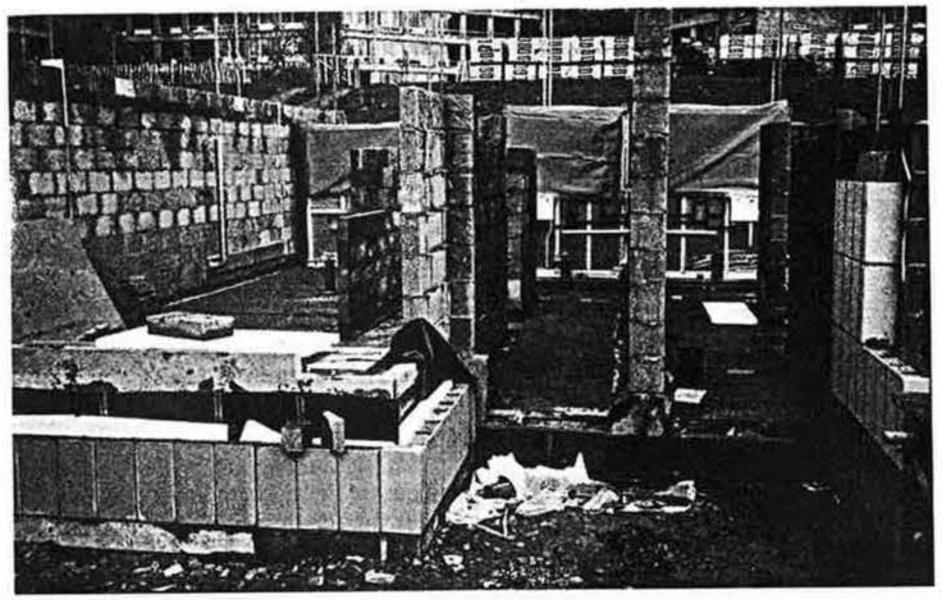
Letting in more daylight is not felt necessary, with a minimum overall designed light level of 100 lux from background and task lights. However, one side of the window reveal is splayed to allow greater daylight penetration. The splay is faced in Pyroc board which was treated as a joinery item rather than as part of the plaster finish, though this has not turned out to compromise air-tightness.

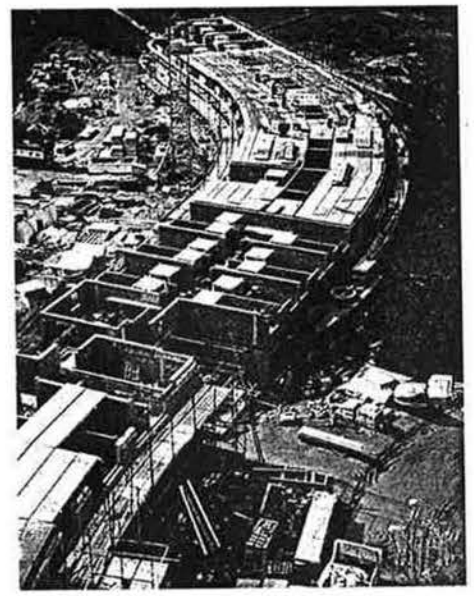
In addition to the external mastic sealing, which is recessed and so sheltered from the weather, cavity closers have been used. There are internal mastic joints around the windows and where the splayed reveal board and plaster meet to combat plaster cracking. The window frame has a deep section so the surrounding plaster can partially overlap this.

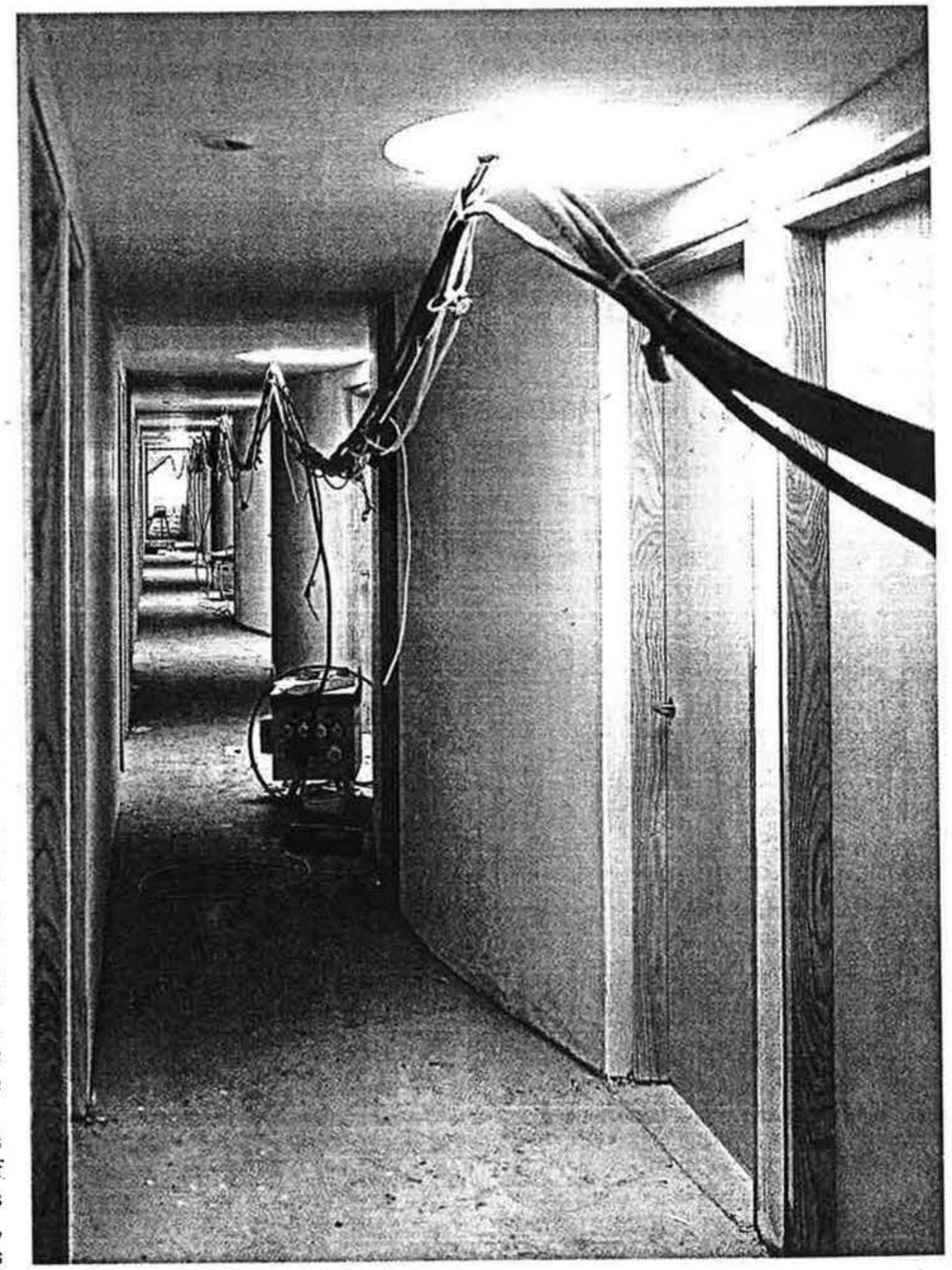
Spectraglaze and curved walls

The architects had used Spectraglaze stack-bonded glazed-faced concrete blocks before at UEA for the climate research, information systems and education building (AJ 5.3.86). One advantage this time is that the same UEA clerk of works, Tony Evans, is working on the halls again. A disadvantage, however, is that Spectraglaze is no longer made in the UK. Not only was sourcing from the US an additional problem – especially when one batch had to be returned – but delivery problems led, at one stage, to a two-week delay to the job as the blocks are part of the structural masonry. Also, the blocks now come in US sizes that do not course with UK blockwork. The outer face of the inner leaf blockwork is fitted with vertical channels into which fit sliding wall ties to link to the Spectraglaze.

With these ties, bed-joint reinforcement every two courses (the blocks being slender and somewhat irregular in shape), their US size and most of the batches being at the top end of the tolerance range, setting out and





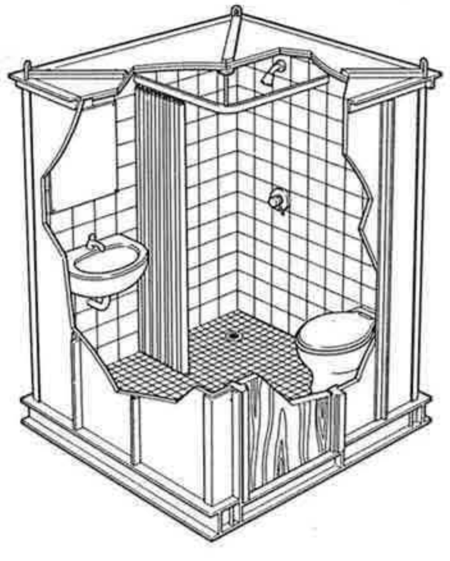


Left: section of student accommodation in Constable Terrace. Above: basic construction of the block – note the Spectraglaze blocks to left and right. Top right: Constable Terrace, with some of the bathroom pods in place. Right: theundulating walls on the top floor reduce tunnel effect and provide service voids

laying has not been easy. The architects produced drawings locating every block, with instructions on where any cut blocks could be located. The builders used a 10m-long curved ply template at Constable Terrace to locate each block and joint in plan. When necessary, they telephoned the architects to check whether irregularities should be taken up in alterations to the nominal 6mm joints or whether and where to cut blocks.

Inside Constable Terrace, the curved plan produces a change of dimension of only about 15mm and this has been plastered over as a straight wall. This makes it easier to fit the built-in work bench on the window wall. For the floors at Constable Terrace, the contractor, RG Carter, chose to cast the curved edge of the slab, which is about a metre wide, finished to the depth of the screed laid on the concrete planks that make up the rest of the floor.

The curved theme of Constable Terrace's plan is taken up in the longer top floors of both buildings, where the corridor wall is serpentine in plan. This, and the rooflights, mute the tunnel effect common to the likes



Above: light steel fabrication for the bathroom pods. Above right: the pods craned into place. Right: schematic of pod. Below right: access side of pod on a staircase. Below: a finished bathroom

of hotel extensions, and the curves create riser spaces. The air ducting – at 250mm in diameter – is large, but necessary to keep down air velocities. All the air handling and heat reclaim is brought to roof level.

In the bedsits, air is inlet at only 0.2 m/s, providing 1 ac/h. It is extracted through the bathroom providing 5-6 ac/h there – the bathroom is also intended to be used for clothes drying. With cooler air inlet at floor level (beneath the bed/settee), there is the possibility of displacement ventilation (stratification and forced air movement both working bottom-up). This required warm-air removal at high level. The door frame head to the bathroom is cut back to encourage air flow in this way.

Mock-ups and pods

Under the supervision of Peter York, UEA's buildings officer for new works, the university is an experienced client. It is concerned with running costs, as well as having a green agenda. The brief was minutely detailed, even down to the number of shelves in cleaners' cupboards.

One focus of shared client-architect attention has been the study/bedroom, which was built as a mock up (initially without bathroom) to work out details including furnishing, gathering reactions from staff and student representatives, as well as the project team.

The architect has used prefabricated pods before and explored the possibility of prefabricating all the bedsits. However, this did not stack up, structurally or in cost, over four floors. Even the bathroom pods that were produced were more expensive than estimates for site construction. The argument for them had to be won.

There are, however, benefits to prefabricating these high-added-value items – notably quality control, smoothness of the building programme, reducing conflicts between trades and avoiding later snagging. While each of these has a price, they are not specific items that can be isolated in a tender to be set against the extra cost of pods.

From the architect's performance specification and tender drawing, RB Farquhar won the job with a good price and produced unsolicited a mock-up which 13 people from the project flew up to Aberdeen to see. Modifications were agreed both to the mock-up, such as fittings, and to the architect's ideas, such as replacing the roof hatch with a single roof panel that could be removed if necessary. Modifications at this stage were critical. £10 saved is worth £8000, spread over 800 units. There are four pod variants: doors on one of two adjacent walls, and the pods handed.

UEA HALLS – ENERGY COMMENT

Energy Efficient Buildings

By Don Ward of BRECSU

Very high insulation standards and mechanical ventilation with heat recovery are common practice in Scandinavia and Canada, but are still rare in the UK. The new halls of residence at UEA not only do this but bring together a range of low-energy design features.

The blocks have been designed and orientated so that most of the ground-floor lounge and communal areas face south. Air tightness, detailing to avoid cold bridging and the compact plan (with a minimum external wall area) combine with the high insulation level and heat recovery ventilation system to produce a building with an exceptionally low heating demand.

Computer modelling by Halcrow Gilbert predicted that the high insulation levels would reduce the average heating season to just six weeks a year. For the rest of the year the 'free' heat from people, appliances, etc, as well as solar gains through the windows, would be sufficient to keep the building warm.

Controlled ventilation

With such well-insulated fabric, ventilation heat losses could easily account for more than half of heating costs. The architects sealed the building as tightly as possible, supplying a controlled level of fresh air near floor level in study bedrooms and common rooms, while extracting stale air at ceiling level from the shower rooms and communal kitchens.

A plate heat exchanger is used to recover 60 to 70 per cent of the heat from extract air, with an electric-heater battery used as necessary to ensure that the incoming fresh air does not enter the room at less than 18°C.

As the mechanical ventilation operates continuously, the ventilation system was designed with low air velocities at the low-level supply outlets to reduce the fan power requirement. Low-level supply is more effective than ceiling diffusers in removing contaminants and internal gains.

For the mechanical supply and extract to operate effectively, the building needs to be tightly sealed to prevent air leakage heat loss, as described in the main text. To check airtightness, the architects are having the building pressure tested. The specification calls for a maximum leakage rate of one air change per hour at 50 Pa pressure difference (an extremely airtight building). Tests are currently being carried out to see whether this is being achieved.

One of the most intriguing design aspects is how best to provide the small heating requirement to each study bedroom that follows from high insulation and ventilation heat recovery. Heating in each study bedroom is by electric panel heater using 500 W units down-rated to 250 W. They are fitted with integral thermostats allowing students individual temperature control up to 23°C.

Domestic hot water is stored in one 300-litre cylinder for each 10-person student house, heated differently in the two halls.

At Nelson Court, where there is no gas available, heating is from a plate heat exchanger in the nearby campus district heating main. At Constable Terrace there is a gas main close by which is used to fuel a low-pressure modulating boiler designed to run efficiently at low load.

Meters have been installed for both electricity and hot-water consumption to give the university the possibility of charging students for excessive consumption.

Energy design features

- **High insulation levels:**
Walls – rendered block/50mm cavity/100mm insulation/lightweight block (U = 0.22 W/m²K)
roof – 200mm mineral wool insulation (U = 0.15 W/m²K)
floor – 100mm expanded polystyrene (U = 0.18 W/m²K)
windows – double-glazed, low-emissivity glazing to common rooms.
- **Southerly orientation.**
- **Compact plan form.**
- **Mechanical ventilation with heat recovery supplies fresh pre-heated air to common rooms and study-bedrooms and provides six air changes per hour to kitchens and en-suite shower rooms.**
- **Airtight construction.**
- **Thermal mass of concrete floors and masonry separating walls prevents summer overheating.**
- **Brise soleil canopies to large south-facing common room windows.**
- **Detailing to avoid cold bridging.**
- **High-frequency fluorescent lighting to 99 per cent of the building.**
- **Compact fluorescent sources for all desk lamps.**
- **Water heating by district heating, or by modulating gas boiler operating at high efficiency at low load.**

BEST PRACTICE PROGRAMME

Energy Efficiency Office
DEPARTMENT OF THE ENVIRONMENT

Preventing overheating

Overheating, mainly from a build-up of solar gain, is potentially the main source of discomfort in well-insulated buildings. The risk has been recognised and attacked by the architects on three fronts:

- thermal mass – the high thermal capacity of the concrete intermediate floors and masonry separating walls help to even out temperature fluctuations
- brise soleil canopies – these are provided to the large south-facing common room widows on the ground floors
- bypassing the heat exchanger – during summer months the heat exchanger in the ventilation system is bypassed to prevent heat reclaim.

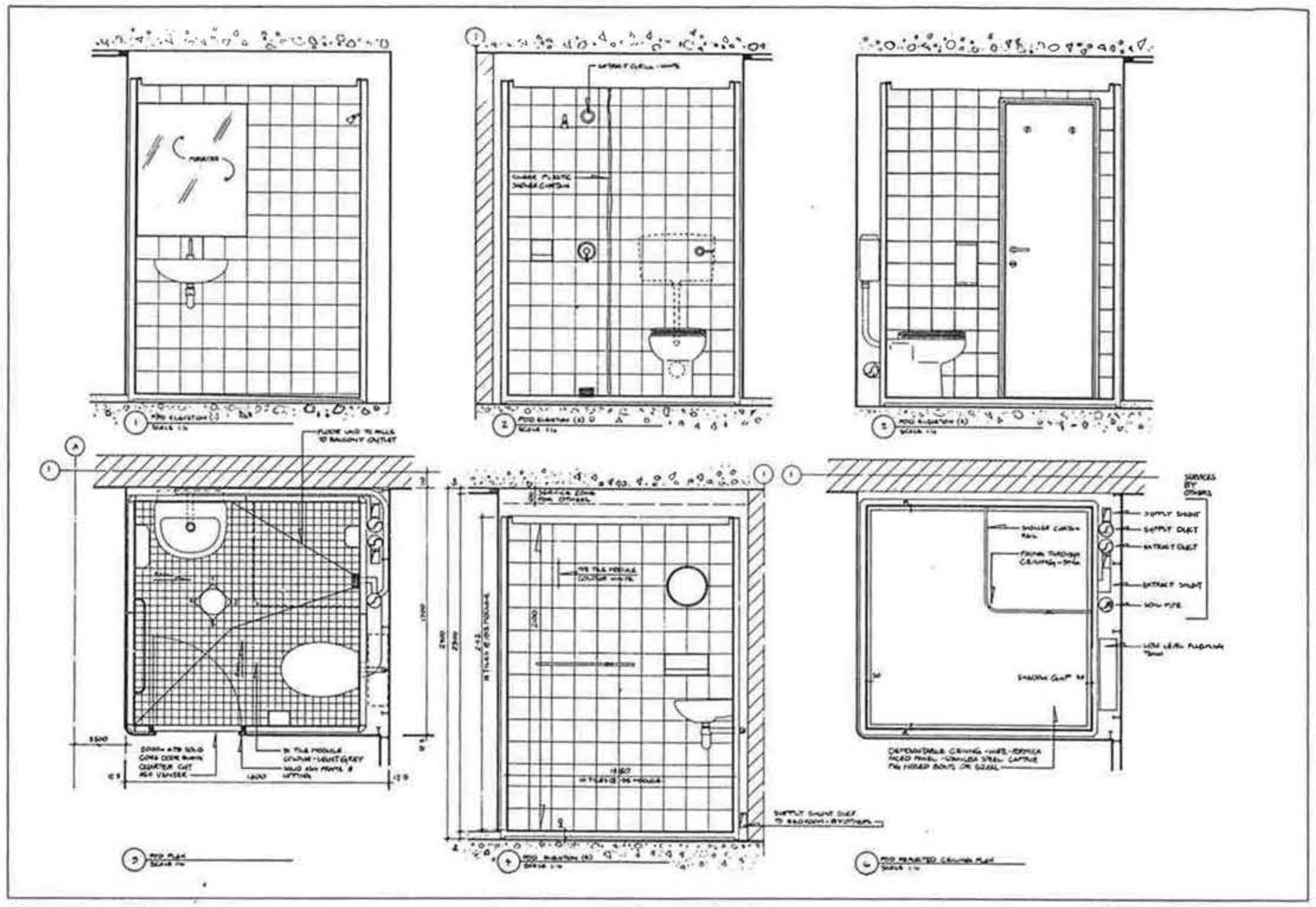
Computer simulations showed that internal summer-time temperatures should be less than 0.2°C higher than if the halls had been insulated to the 1990 Building Regulations standards.

Costs under control

Good energy performance has been achieved without incurring higher construction costs. The UEA halls cost no more than they would had they been built to 1990 Building Regulations insulation standards, with a conventional heating system.

Generally, once they have experienced the benefits of high comfort levels, lower fuel bills and better air quality, owners of well-insulated houses are reluctant to settle for lower insulation standards. Perhaps the occupants of Rick Mather's halls of residence will be among the clients who demand high insulation standards in the homes of the future □

This article was commissioned as part of the Energy Efficiency Office Best Practice programme. Don Ward is head of Energy Efficiency in Housing, BRECSU, Building Research Establishment, Garston, Watford, WD2 7JR. The author was assisted by NBA Tectonics under contract to BRECSU for the EEO



Above: the architect's pod tender drawing, updated to as-manufactured, taking in agreed modifications such as making the ceiling a single panel and using a low-level flush tank

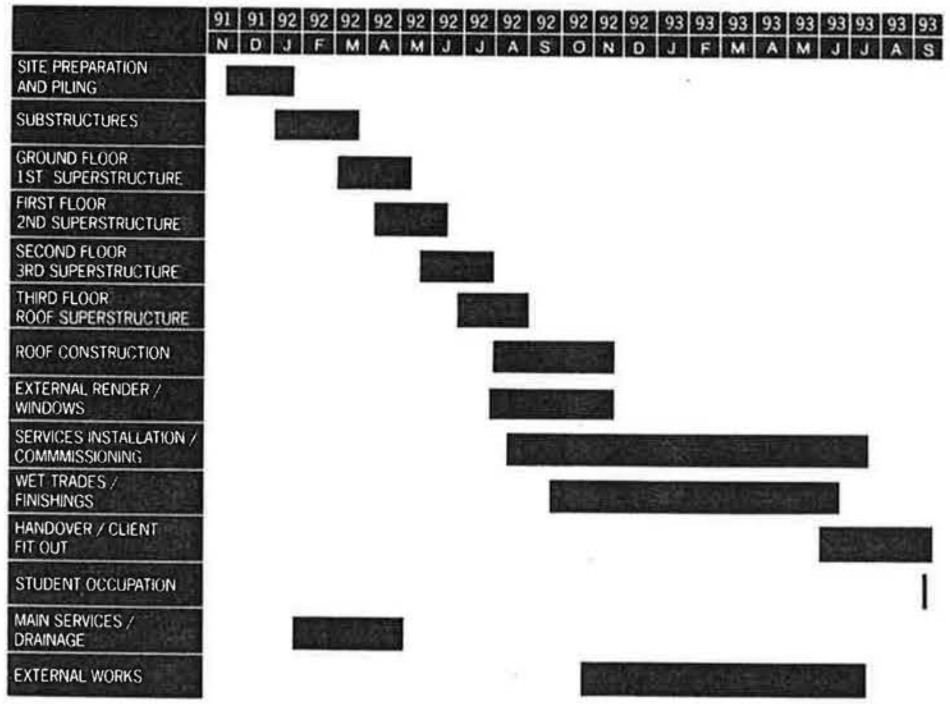
Farquhar proved very effective at sourcing proprietary components and fabricated ones such as the ash doors. The final cost of the pods was about £2 million. Seven months later, modifications had been done and a smaller group went from UEA to look at a mock up. A bathroom was also incorporated in the mock-up bedsit at UEA.

Farquhar's background is in prefabricating accommodation for oil rigs. Robustness is needed at UEA too, with the possibility of high-spirited students swinging from towel and shower rails or leaving the showers on. The pods are welded-steel framed with a welded-steel floor, exterior-grade MDF walls and melamine ceiling. The internal 1.5 by 1.5m plan fits the 150mm wall tile grid and the 50mm floor tiles. Rather than a shower tray, which would have looked lumpen in such a small space, the whole floor is the shower tray, as in many continental bathrooms. Farquhar took it upon itself to prove the adhesives and grout for the tiling. The pod base is welded steel plate, providing falls and adding stiffness. There are also steel stiffeners below. A two-pack epoxy adhesive across the floor and 150 up the walls provides a complete DPM and tile adhesive. A flexible grout has been used for floor and wall, except for a silicone sealant at wall-to-floor and wall-to-wall junctions.

The pods were delivered, 14 to a lorry, without constituting an abnormally wide load. At one stage, there were four loads in circulation but normally delivery was about a load a week. They were shrink-wrapped for weather protection and unloaded on to the site. Each was then craned into place by the site contractor. Ventilation extract ducts were connected to pods via stub ducts, though this ran the risk of crushing the ducts as the pods were manoeuvred into position.

With hindsight, the pods should have been connected direct to the ducts. Another lesson would be to fit the doors opening inward for delivery and to seal the pods with a board for protection.

With floor-to-ceiling height of 2.4m in the buildings, space was tight. About 100mm is needed above the pod for any service crossovers, and the lifting hooks are cut off where needed. At floor level, about 50mm is needed for sliding pods a few millimetres, where necessary. The steel frame is designed to play the role of skids. The pods are levelled with shims. A special shallow water outlet was developed for the shower water outlet under the floor so that there was not a step up into the pod. A tray only 15mm deep feeds into a 54mm pipe, with the trap located beyond the pod.



PRE-CONSTRUCTION PROGRAMMES

TENDER	
First working drawings (Constable)	27 Feb 1991
First working drawings (Nelson)	15 August 1991
Tender issue (Constable)	6 September 1991
Tender received (Constable)	18 October 1991
Tender accepted (Constable)	6 November 1991
Tender issue (Nelson)	11 November 1991
Site start (Constable)	18 November 1991
Tender received (Nelson)	19 December 1991
Tender accepted (Nelson)	20 January 1992
Site start (Nelson)	24 February 1992
POD SCHEDULE	
Pod drawing	1 March 1991
Tender issue	17 May 1991
Tender return	10 June 1991
First factory visit	27 June 1991
AI for pods	13 November 1991
Second factory visit	11 February 1992
Third factory visit (sign off)	3 March 1992
First delivery of pods	9 March 1992

Programme and contract

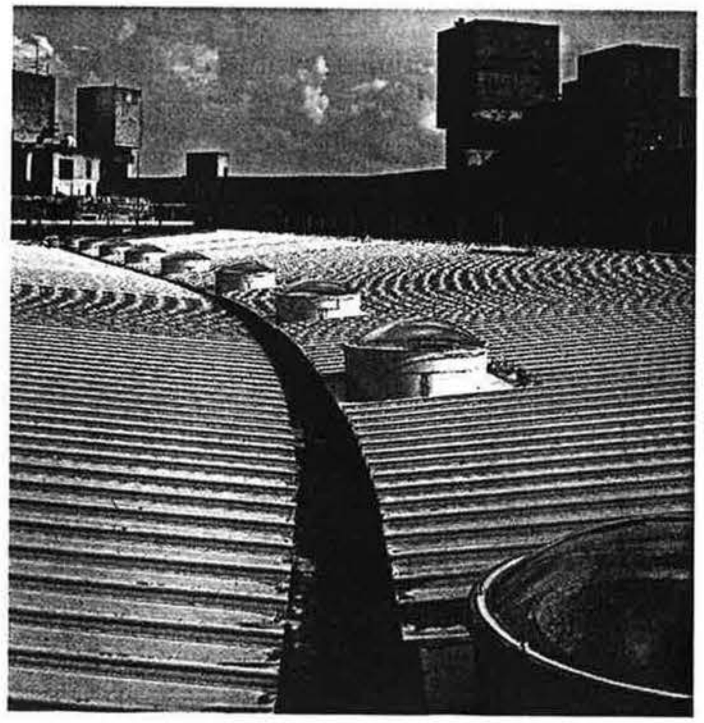
Procuring the pods can be seen in the programme chart. Agreeing to have them took more time – which was critical – than producing them would have taken.

On the Nelson Court site, there have been brief delays from the bankruptcy of two groundworks contractors and two block laying contractors. Overall, the halls are a little behind and UEA will have to speed up its fit-out reducing the time-scale from three months to a few weeks in order to complete this for the new term in October.

As well as selecting Farquhar, two packages were nominated by the architect: the secondary roof structure, roof covering and soffit panels from High Profile Systems and windows from Vista Brunswick, the frames a mix of standard and special profiles. This supplier was also responsible for working with the other window supplier, Velfac, so that there was a single point of contact and a matching set of windows.

Because parts of the campus are sensitive areas of landscape conservation (hence the decision to build the Sainsbury Centre extension underground) the Constable Court site is tight and sometimes two tower cranes have had to work simultaneously. One of the Nelson Court contractors, Wates Construction, made less use of tower cranes, partly through use of a telescopic fork-lift truck that can lift materials, though not pods, to the top floor.

Overall, there has been a spirit of co-operation, helped significantly by having a committed client. The relationships established within JCT 80 continue to work, though the client is aware of the possibilities of other procurement routes such as design and build. □



Above: on-site tender and pod programmes at Constable Terrace. Pods were an early tender item followed by design development with the manufacturer.
Left: aluminium strip roofing following the curve of Constable Terrace. The bubbles are the top floor rooflight shafts

CREDITS

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FIRE CONSULTANT FISEC
SUBCONTRACTORS AND SUPPLIERS *roof* High Profile Systems, *pods* RB Farquhar, *lift* Kone Lifts (Constable), Express Lifts (Nelson), *windows and doors* Vista Brunswick, Velfac International, *render* Eglington Stone, *ironmongery* Elemsystems, *carpet* Lees Flooring

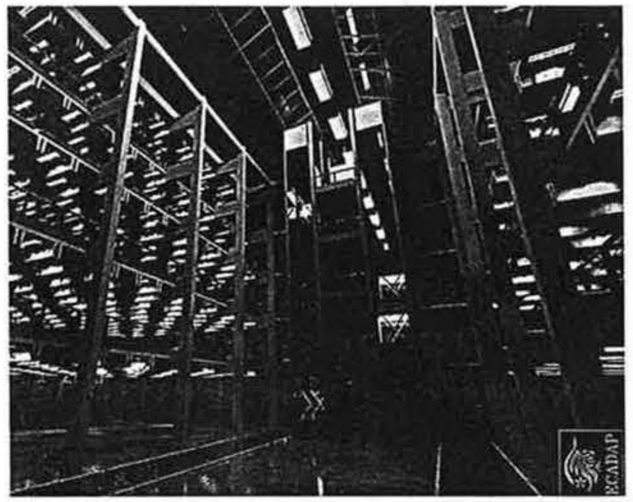
LOW-ENERGY OFFICES

Using natural light and air flow

Three practices have produced plans to build or refurbish urban offices using daylight and natural ventilation, providing low-energy but tightly controlled alternatives to artificial lighting and air-conditioning

BY BARRIE EVANS

The Energy Technology Support Unit has commissioned three practices to explore the possibilities of low-energy urban offices. The cases are diverse. Short Ford Associates' scheme is a refurbished 1970s office in Bristol. Peter Foggo Associates designed a new urban business-park building, as if for Chiswick Park, London. Holder Mathias Alcock designed new offices surrounded by busy London streets.



Lighting simulation of the Peter Foggo Associates scheme atrium by night and day. What distinguishes these images from many shaded and rendered images is that the underlying model is calibrated to give precise light levels. (The ridge luminaires are not to the architect's design.) Modelling by Kevin Lomas of De Montfort University

Robust performance

High IT heat gains, pollution, deep plans and spaces broken by partitioning make opening windows potentially unreliable for ventilation and inadequate for cooling. Without air-conditioning, something similarly reliable must be sold to clients.

All three designs are 'mixed mode', not just naturally ventilated. At their simplest, air flow is power-assisted through the building. One design uses tall, stack-effect chimneys, while the other two employ fan-driven filtered air. All these air systems have motorised grilles/louvres/dampers integrated by the building's management system.

Partitioning can interrupt air cross-flow. The two new-build designs provide air input from a raised-floor plenum (and thus also the potential for local mechanical cooling). The refurbishment also allows inlet air to be delivered locally if required. It can be extracted from both sides of the floors in all the buildings, either direct or, where partitions interrupt, ducted. External extract chimneys, stack or fan-powered, are features of all three designs.

Even with this elaboration of air handling, and the cooling capacity of the structure noted below, summer temperatures are less tightly controlled than they are with air-conditioning. There can be several days in the 23-25°C band and a few up to 27°C. These are probably more acceptable to users than to letting agents. And there can be compensations, such as openness to the exterior, daylight and natural ventilation. Opening windows are provided, sometimes as part of an energy strategy, sometimes just because users like them.

Thermal capacity

To provide thermal stability, it is essential to expose substantial thermal capacity of the building fabric to the office spaces and air flows. In offices, heavyweight partitions are rare and floor surfaces are typically insulated with carpet. The main options for exposed fabric are running air across the slab soffit and through raised floor voids, which tends to rule out continuous suspended ceilings, though leaving them out brings its own problems of services routeing, acoustics and supporting partition heads. All schemes have forms of partial suspended ceilings.

Night purging sounds primitively medical but may help with sick-building syndrome. It is the jargon for running air through the building at night to cool it and, incidentally, improving indoor air quality. With exposed thermal capacity, removing heat from the structure is very important, otherwise it is re-radiated into the office spaces.

One problem with cooling the building thoroughly at night in order to provide adequate cooling capacity for the daytime is that the building may be too cool first thing in the morning. As a result, occupiers may elect to maintain a hotter temperature than the computer modelling projected.

Providing secure openings for night-time air inlet and outlet is also likely to pose problems. Air-change rates for purging in these designs are relatively large, at around four to seven air changes