Construction article

Housing at Worlds End, Chelsea

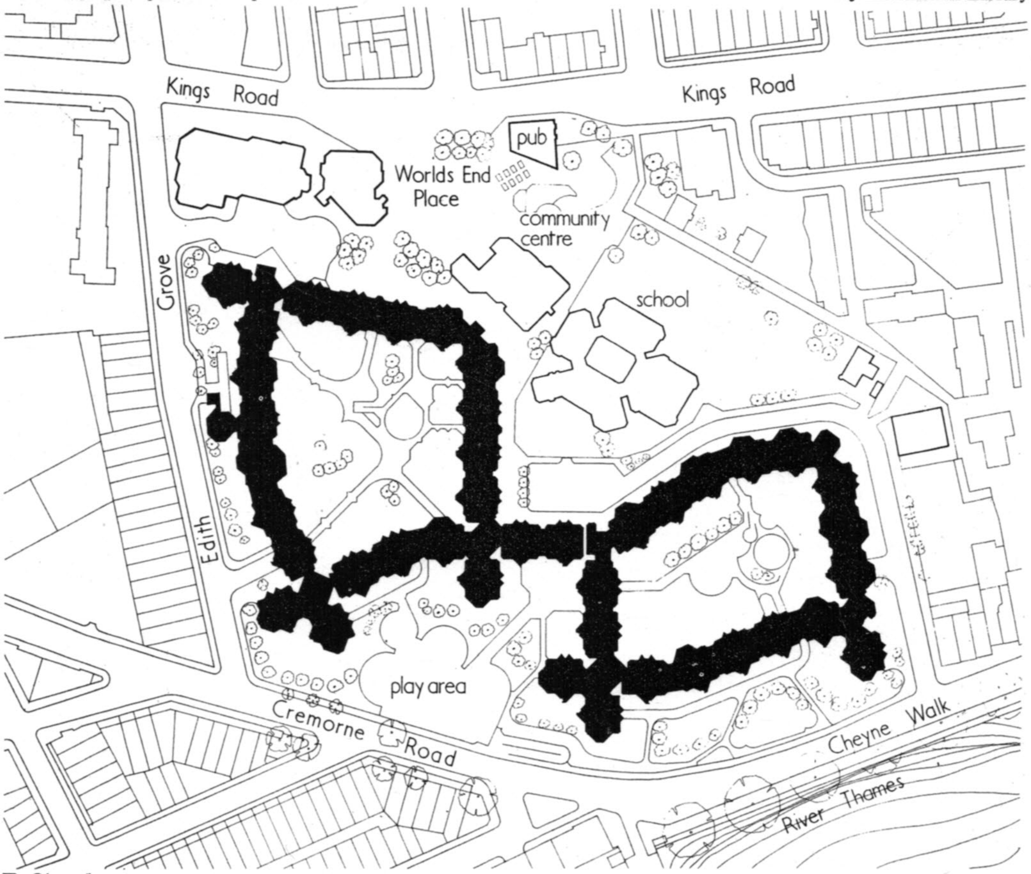
CI/SfB | 81 | | |

Housing
Eric Lyons, Cadbury-Brown, Metcalfe and Cunningham
CI/SfB (1976 revised) 81

The Worlds End scheme at Chelsea has now reached completion. As with the article on the Alexandra Road scheme (AJ 8.9.76), Henry Herzberg, AJ buildings editor, does not attempt to discuss the more obvious architectural significance of the scheme, which readers will perhaps wish to assess for themselves, but instead concentrates on the construction methods used, and their relationship to the design idea.
The scheme contains some interesting and unusual approaches to high rise structures, and, due principally to militant action among the bricklayers, has already become something of a cause celebre in the history of the modern building industry.

Housing

at Worlds End, Kings Road, Chelsea, London SW10
for Royal Borough of Kensington and Chelsea
by Eric Lyons, Cadbury-Brown, Metcalfe & Cunningham
partner in charge John Metcalfe
job architect Oliver West
architects Vic Allison, Elizabeth Cadbury-Brown, Charles Sheppard, Michael Leech, Mike Dampney, Richard Lyons
architect's superintendent of works (resident on site) Robert Kendall
quantity surveyors MDA Monk & Dunstone, Mahon & Scears
services/electrical and mechanical engineers Zisman Bowyer & Partners
structural engineers Clarke Nicholls & Marcel
landscape consultants Eric Lyons, Cadbury-Brown, Metcalfe & Cunningham
partner Ivor Cunningham



B *Site plan.*

A *Location plan.*

1 *The courtyards are carefully landscaped, but lack the imaginative selection and grouping of plants associated with Eric Lyons' earlier work at Blackheath and elsewhere.*

Architect's account

The site

Unique because of its position by the Thames and its high density, the development occupies 4·45 ha stretching north from the river to the Kings Road. It has a primary school, church, community centre, supermarket, shops, children's home, playgroup centre and play spaces.

Accommodation

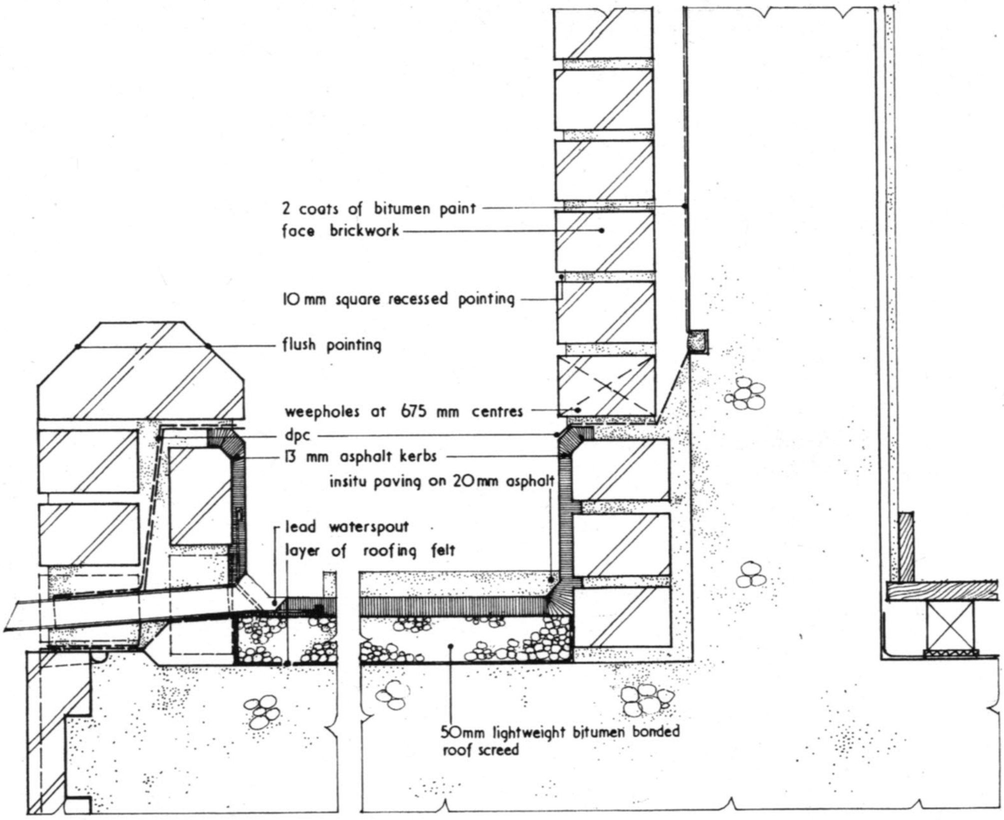
When all the flats are occupied the population will be about 2500 people in 744 homes ranging from special ones for the elderly to those for six-person families. This population is not much more than that which existed in the old terrace houses that occupied the site until 1969. The standards of accommodation are of course, vastly different while the open spaces with trees, lawns, bushes, sitting and walking spaces now provided simply did not exist. Of the 4·45 ha there will remain approx 3·24 ha acres of open space.

Design solution

High densities have problems, not least of which is to maintain a human scale to the buildings. To try and achieve this, the flats have been placed around two very large courtyards which are of irregular shape; the facades of the buildings around them are broken up to avoid long boring lengths; the main external material used is a traditional warm brick; the tallest towers are limited to twenty-one floors, the lowest to eighteen and here again the tops are broken up into sculptural shapes. Every family has an open balcony which although small because of cost, gives a breath of fresh air to the flat and baby can be safely left out in the pram. There are only four flats to a tower floor, so that neighbours are at least on nodding terms very quickly. Some of the homes have quite splendid views—none better in London. But if you are going to feel like a fly on the wall fifteen floors up, the view is not much good in itself: therefore the buildings have been shaped so that from most windows you can see the walls of the tower—you can feel secure. Balconies frequently overlook other balconies so that you are aware of what is going on around you.

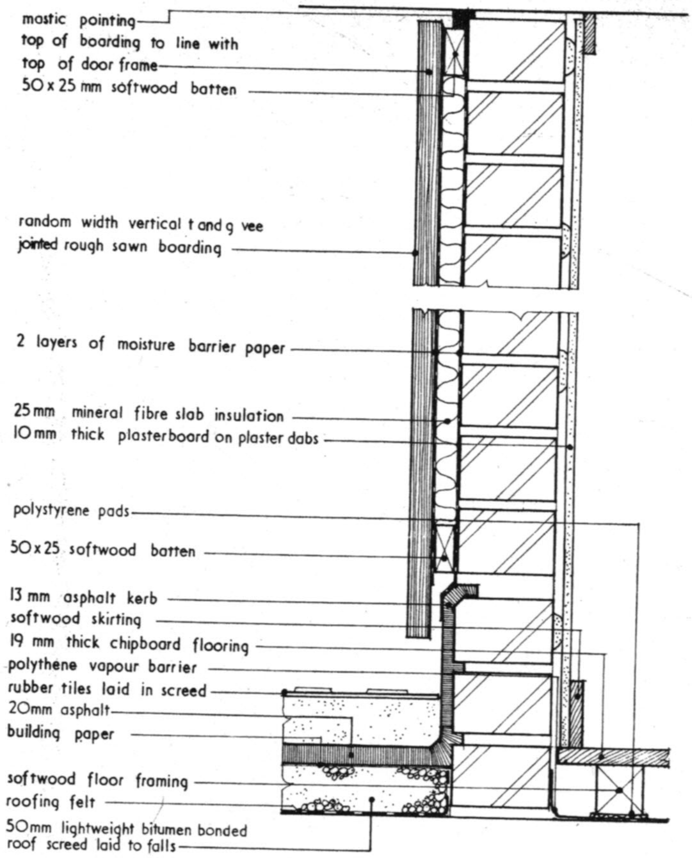
Landscaping

The open areas are planted with lawns, shrubs and mature trees. Scattered around the walks in the building are large planting boxes also filled with shrubs.

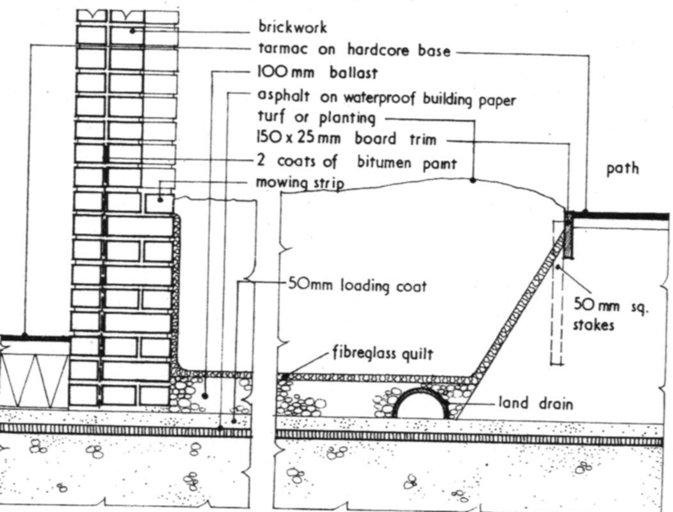


C *Detailed section through typical balcony.*

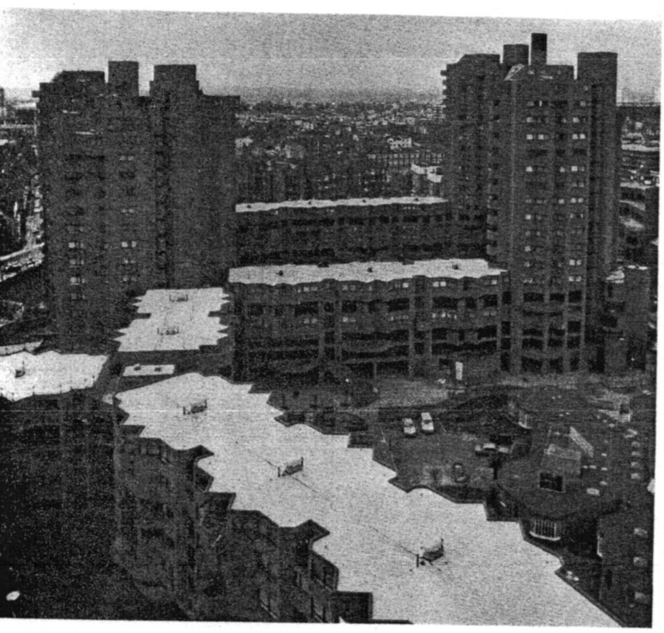
D *Typical floor plan of tower block. There are four flats on each floor.*

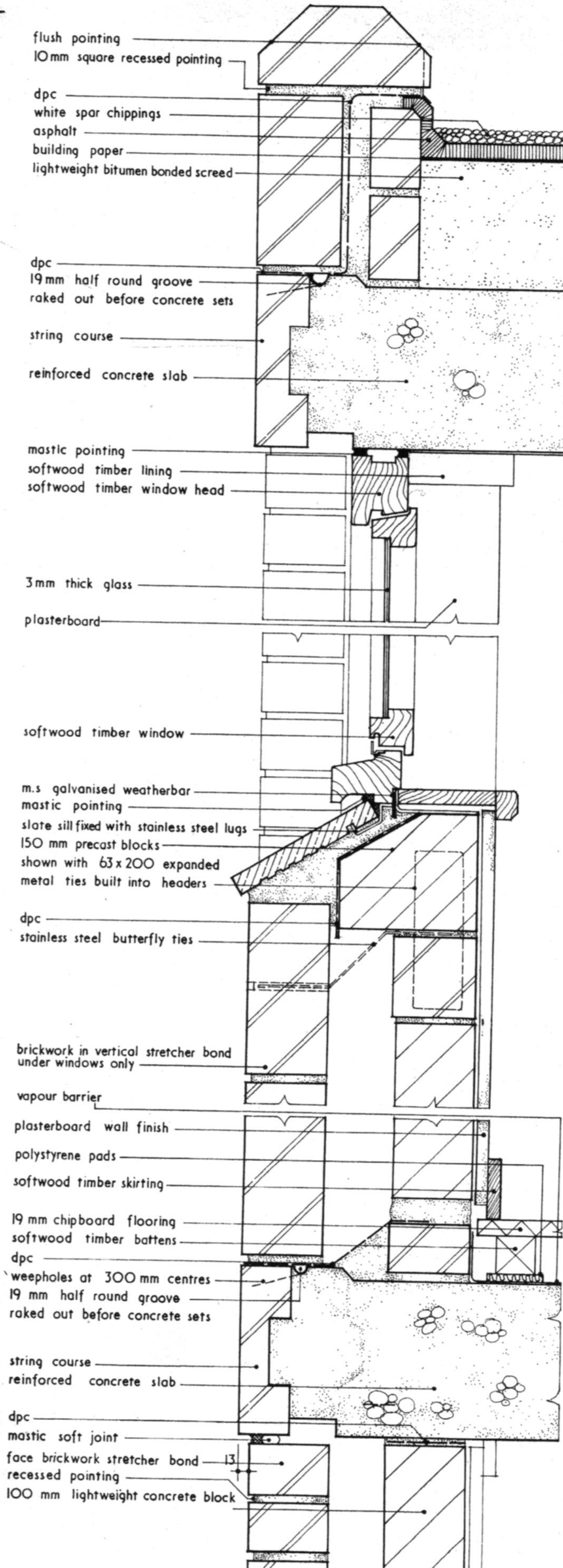


E *Typical section through access gallery.*



F *Typical detail through flower box.*





G *Typical detail through external window wall.*

2 *Roofs of the low blocks provide a rather unimaginative view for those looking out from the tower blocks.*
3 *Beneath the windows are panels of brickwork laid in vertical stretcher bond.*

Appraisal

by Henry Herzberg

Introduction

The new development at Worlds End is important in several respects. First, the buildings were designed in the early 1960s in the face of mounting public opposition to high rise high density developments. Second, the method of construction was quite untypical for tall buildings; and finally, the site was besieged with labour problems which almost resulted in an important subsidiary of a major building firm being put into voluntary liquidation and caused substantial delays to the contract. For these reasons the scheme is likely to find a place in any history of contemporary English building.

Site densities

Design work began in 1963 when the architects were appointed. The borough wanted to build to a density of 200 persons per acre (494 persons per hectare) but the London County Council refused on the grounds that the scheme would contravene their development plan which allowed maximum densities of 136 ppa (336 pph). Chelsea argued that at the LCC's density there would be a net loss of about 500 people from the original site population, and a public inquiry followed. The argument promoted by Eric Lyons at the inquiry was the Parker Morris point that for densities above 140 ppa (346 pph) 'solutions involving the dual use of land may be preferable when 100 per cent provision of parking and surface access is attempted'. Ministerial approval was granted in December 1966 and in 1968 some 11 acres (4·45 hectares) of low rise Victorian housing comprising approximately 830 dwellings was demolished. The first construction contract started on site in December 1969, and ended early in 1973. The site restarted in August 1973 and is now just being completed.

Architectural objectives

Worlds End can be seen as a deliberate architectural attempt to overcome the anti-social qualities associated with previous high rise developments.

Tower blocks are inevitable at such high densities and the architects felt that many problems stemmed from the inadequacy of ground floor lift halls. Also, in most schemes before Worlds End, tower blocks stood in isolation—an arrangement which probably originated from the work of Le Corbusier. In this case the towers are integrated with the six-storey perimeter blocks which enclose two very large irregularly shaped courtyards and the lifts connect with broad walkways at first and fourth floor levels, which attempt to simulate pedestrian streets. The car parking, in two levels below the courtyards, is covered by a landscaped roof in an attempt to create an illusion of a natural park.

An advantage of high density is that it makes it possible to spread the cost of communal buildings and the occupants of 744 units at Worlds End will have the advantage of 18 shops, a pub, a church, a community centre, 9 workshop studios, and a primary school.

Tall blocks constructed with system building techniques have frequently resulted in monotonous and bland facades which have caused the occupants to complain of regimentation and lack of identity. At Worlds End the design of the towers aims to overcome this by an imaginatively shaped plan and close attention to the choice of colour and texture of material, **3**. The 'rippled' effect of

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the facade, **4**, creates a sense of security by allowing tenants to see the external walls from within the flats and relieves the crushing scale when seen from the ground, while the provision of balconies allows some contact with the outside. The switching of balconies from one position to another is in response to differing aspects of sun and view. On this particular site, towers may be justified by the sensational views up and down the river. The use of brick is an attempt to remind us, by association, of the domesticity of the scheme, and is a welcome reaction to the inhumanity of earlier concrete clad jobs. With only four flats at each level of the towers, neighbours should become on nodding terms with each other. The tops of the towers have not been chopped off flat, but are modelled to enliven the skyline, **2**.

Construction

Such a deliberate attempt to provide an alternative architectural form to the tower block was bound to require ingenuity in construction. The effect may be similar to traditional low-rise housing but when stacked up high the problems are different.

Foundations

Foundations were of the large diameter augered pile type with belled bases; they were generally 610 mm diameter and approximately 12 m deep; and loads varied between 150 and 300 tonnes. The ground conditions were London clay underlying river ballast.

River levels apparently had no effect on the ground water level. The towers were constructed on deep rafts with piles taking the main loads, while the low blocks had piles positioned under the main cross walls.

Evolution of the structure

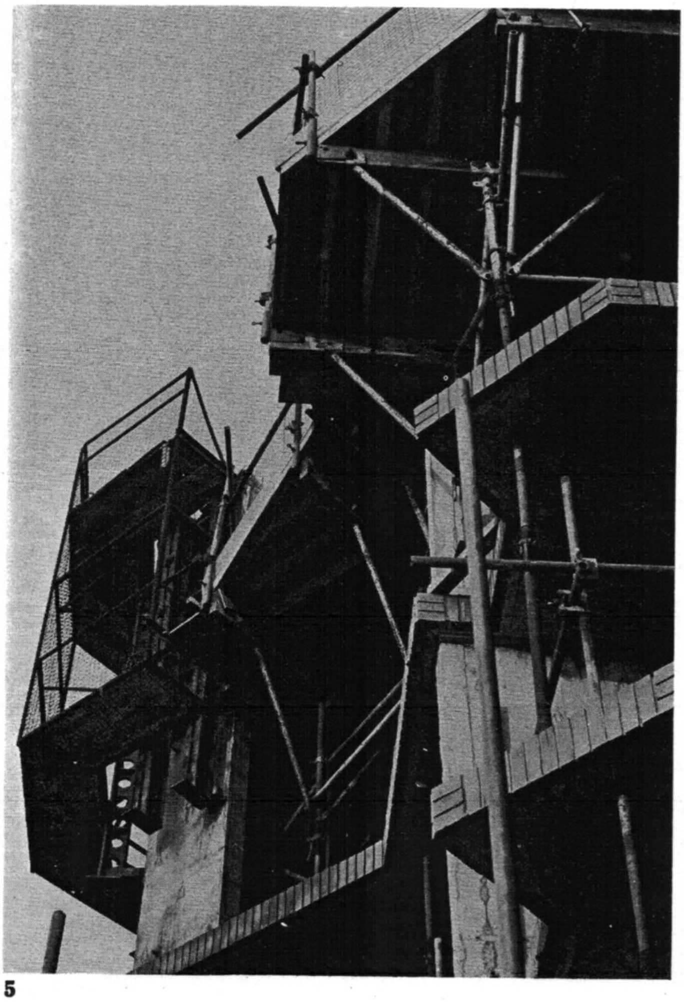
Some consideration was given at design stage to the idea of systemising construction by precasting the loadbearing walls and slip-forming the main shafts of the tower blocks. However, variety of form and plan was a fundamental design tenet and this does not easily lend itself to the repetitive elements normally considered suitable for industrialised building processes.

Following the collapse of the high rise block at Ronan Point in May 1968, the design loads for wind and gas explosion forces were updated, making the use of precast systems more problematic and certainly more unfashionable.

Formwork and concreting

Conventional tableform shutters were used within the tall blocks where they could be moved by the use of the tower crane, but for the lower perimeter buildings, an in situ frame with flat slab construction was devised using simple deck shuttering supported on acrow-props, **6**. Concrete walling was reduced to a minimum to avoid delays in construction and reduce cost of shutters and where possible 178 mm calculon brickwork was used to infill for party walls, **11**. Also to prevent delay, staircases were precast.

4 *Angled facets of the towers are intended to prevent the occupants from feeling like flies on a wall.*
5 *The timber shutters for the concrete tower walls are fairly traditional and table forms are used for the slabs.*
6 *As the cranes were unable to reach, the shuttering method for slabs in the low perimeter blocks is acrow-props and bearers supporting timber deck shutters.*
7 *An ingenious cage arrangement attached to the shutters avoids the necessity of erecting scaffolding around the towers at an early stage.*



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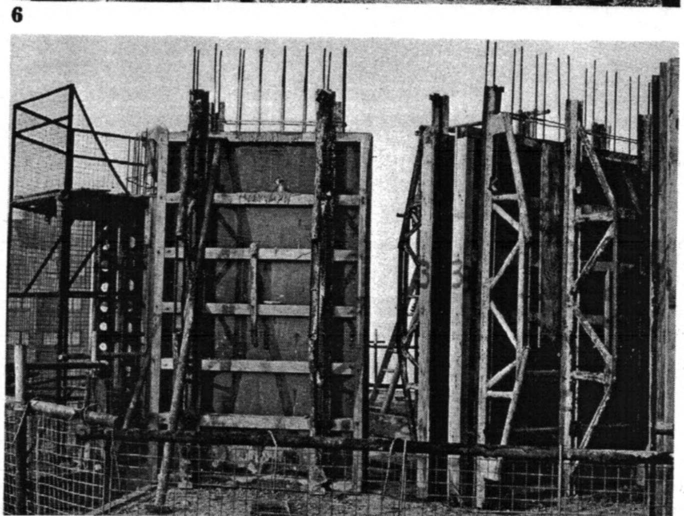

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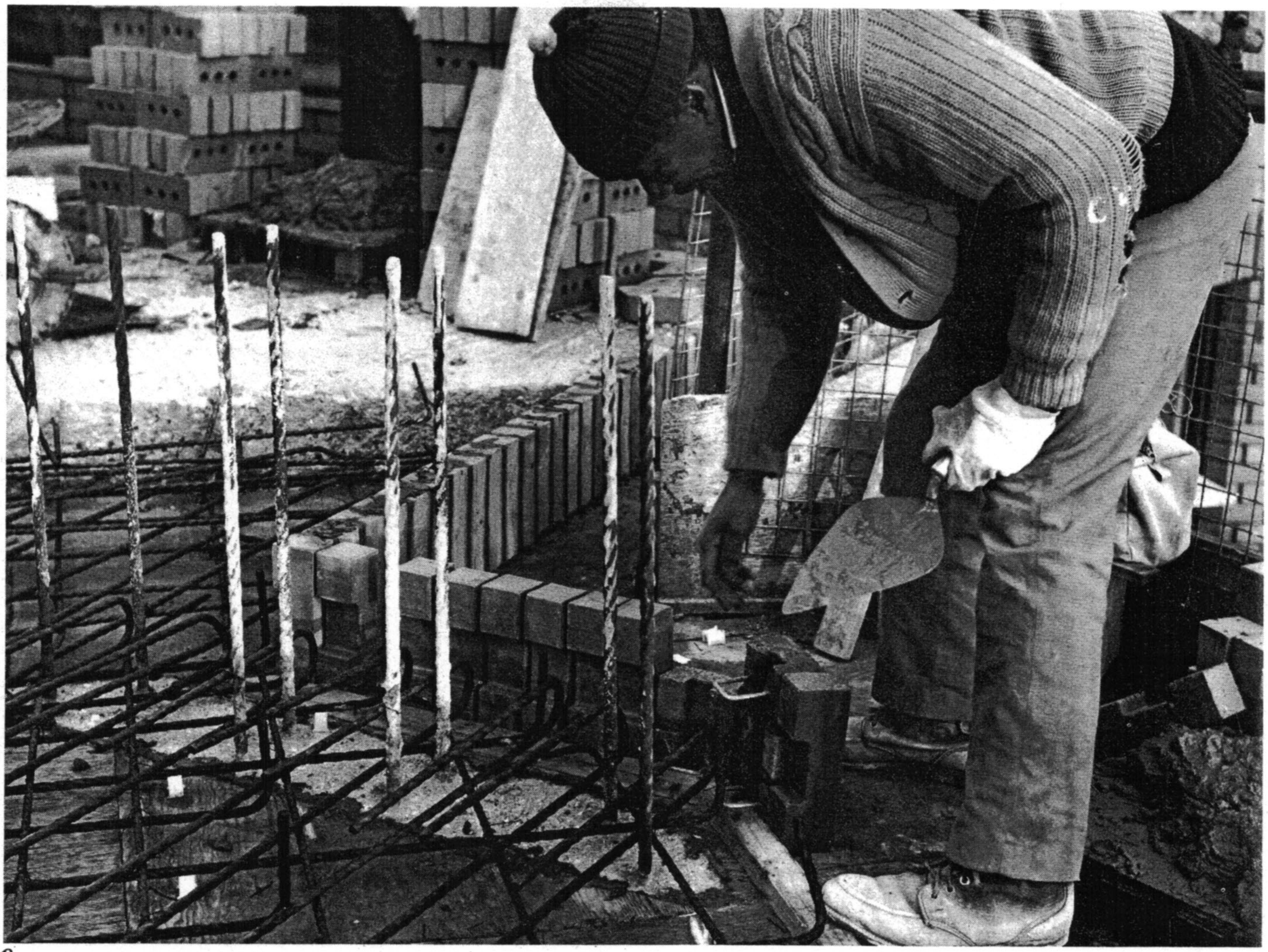

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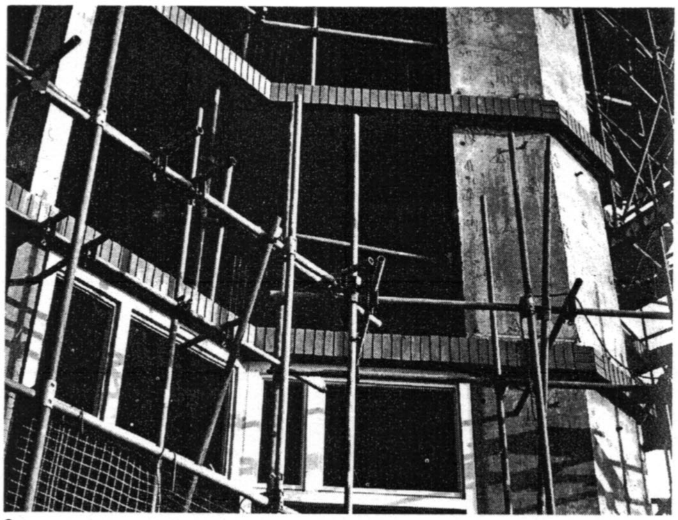
Ironically, the decision to reduce the amount of concrete structure to a minimum caused the little that remained to be poured more slowly, since the quantities involved did not justify the use of a mechanical pump and the alternative method of lifting the concrete by skip was comparatively slow. The frame was erected at the rate of approximately two weeks per floor; the time being taken up in setting out, in erecting formwork, and in placing reinforcement. In the first tower the cranes were erected inside the lift shaft but it was found that this delayed the installation of lift equipment and later they were erected externally and braced back to the building for support. Concrete was generally made in a batching plant on site during the first contract. During the second contract, when about half of the structure had been completed, ready-mixed was used.

Brickwork

Clearly a major constructional problem with brickwork at this height stems from the need to allow for movement within a single storey. Past cases of perilously balanced banana-shaped panels of brickwork on tower blocks are legend and where the architectural requirement is for a building in which concrete floor slabs are not expressed externally, then the normal solution is to face the slab edge with slip bricks. The solution here is entirely original, and has evolved out of an attempt to avoid the dangers of slip bricks losing their adhesion or looking messy due to the difficulty of fitting them in at a later stage. The edge brick is specially made with a keyed backing profile which allows it to be cast in a soldier course with the in situ concrete slabs, **8**. The advantage is that at each floor level the brickwork can be set out with some accuracy and the bricklayers can then fill in each storey height, lining up



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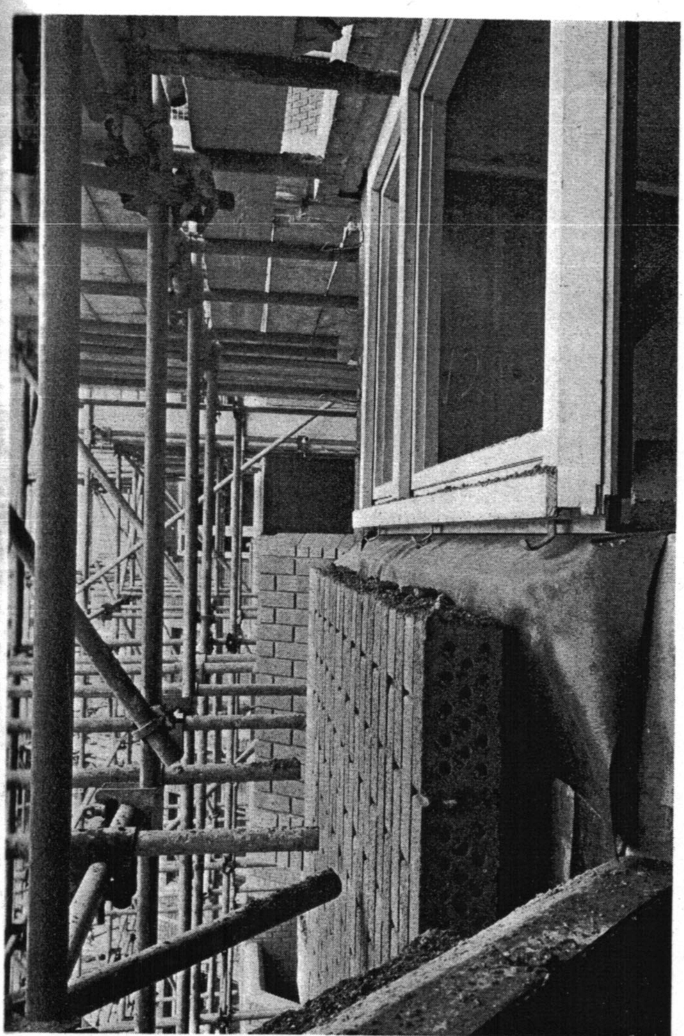
8 *Here the string course is being carefully set out. When the concrete slab is poured the rebated extruded bricks perform as permanent formwork. Stainless steel ties are used as added reinforcement at the corners where bricks are laid horizontally three courses high.*

9 *The brick string courses enabled the bricklayers to set out brick courses.*

10 *The brickwork is built up to the underside of the windows which contain special lugs for attaching the slate sill.*

11 *Timber sub-floor is laid on treated softwood battens. On the left is a prefabricated plumbing unit containing an expansion and storage tank. This simplifies both installation and maintenance.*

12 *All electric wiring from floors feeding upwards to the outlets are protected by PVC sheeting beneath the dry lining.*



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the perpends and measuring the horizontal joints between fixed string courses above and below.

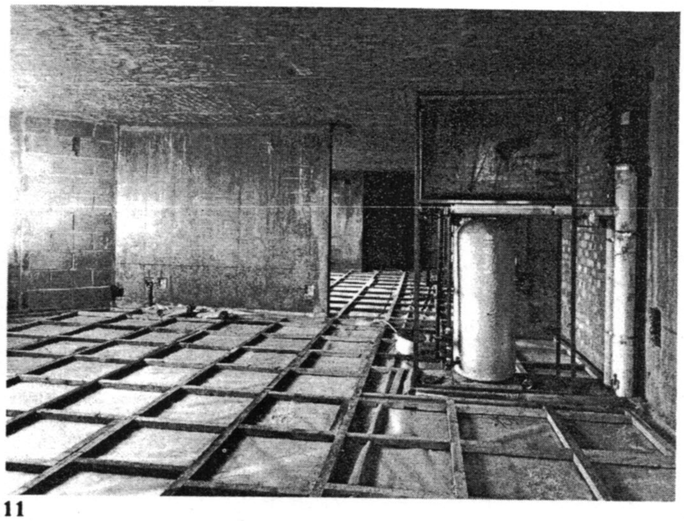
The brickwork below windows was laid in vertical courses after the windows had been secured in place, **10**. It was found that there was a tendency for the mortar to squeeze out if these panels were laid in one lift so work was staggered between panels to allow the mortar more setting time. The sill detail is particularly ingenious. It incorporates a slate flashing which is both long lasting and attractive and is pitched at a steep slope to shed rainwater effectively.

A 'soft' joint is incorporated in every storey height to accommodate movement of the building due to self-load and wind pressure.

The form of the building caused the brickwork to be quite demanding on the bricklayers—a factor which was responsible for some significant contractual difficulties described below. Clearly, angled changes of plan, level, and condition in cavity brickwork require relatively complicated junctions for the tray dpc. In this instance, they were preformed off site and an elaborate system of checking had to be evolved by the architects' superintendent of works before bricklaying continued.

Dry lining

A very important aspect of the construction has been the use of dry lining, in order to eliminate wet trades, and speed up construction by reducing the time required for drying out. Originally it was suggested by the contractor that each dwelling unit would have its own numbered and packaged kit of parts for fitting out—including all battens, linings, skirtings, heating units, etc—with access to the site arranged via labelled gate numbers. In the event the main contractor considered the system too complex and it never



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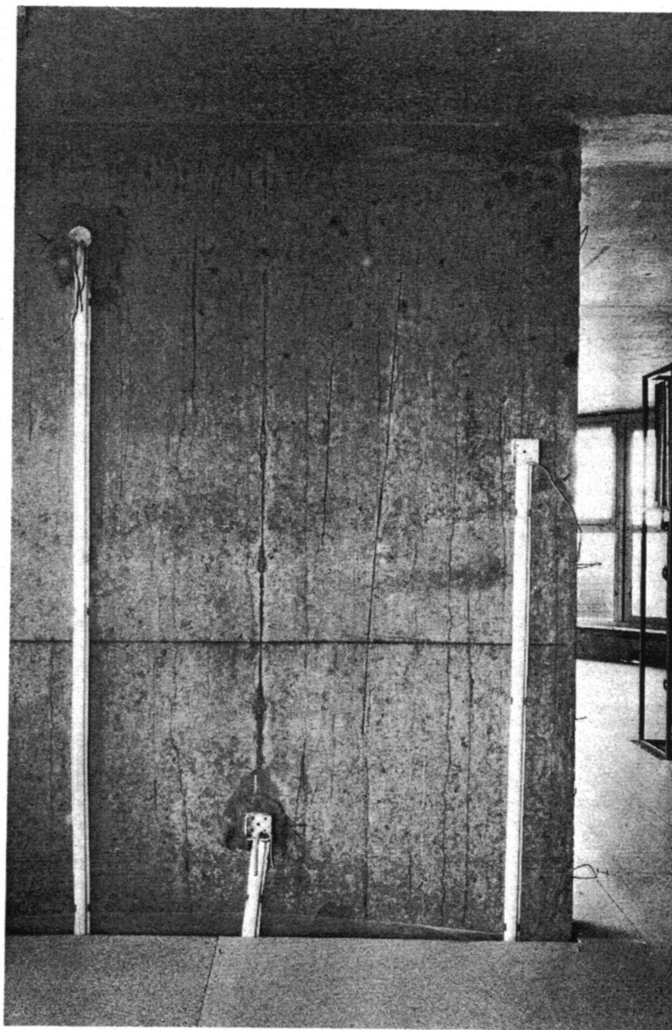

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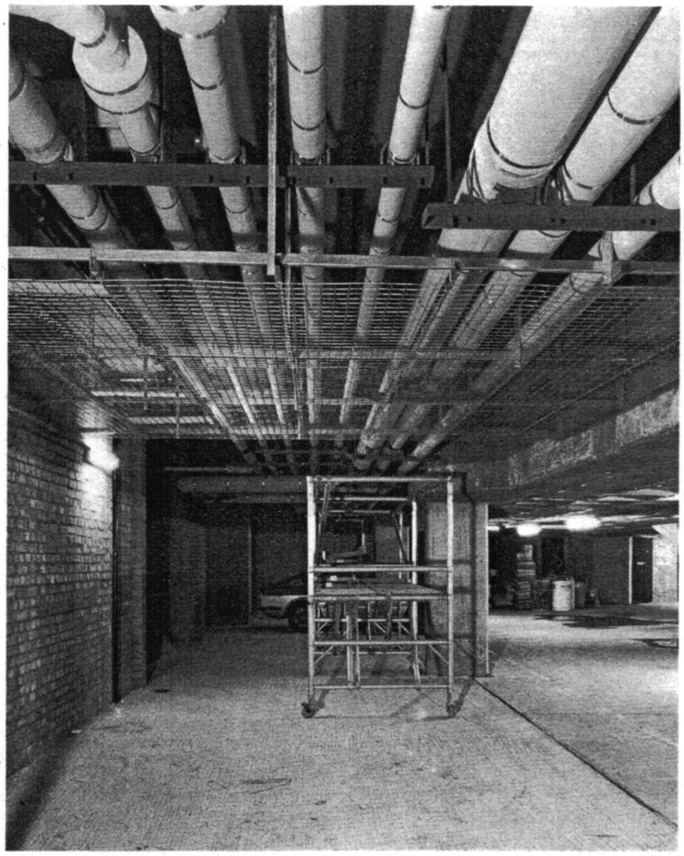
got going. The concept of internal prefabrication remained but was tempered by less radical and more flexible British attitudes, **11**. The ceilings are not dry lined; they have a stippled point applied direct to the concrete soffit.

Services

Each dwelling has a prefabricated plumbing unit containing an expansion and storage tank, which simplifies both installation and maintenance. Each flat has both gas and electricity service in the kitchen because the borough specifies that all council tenants should have a choice of energy supply. Apparently, approximately two-thirds of the tenants use gas and one-third electricity for cooking. The dry lining system for both floors and walls makes the laying of electrical conduit very straightforward. To safeguard against accidental damage to a conduit, a rule has been



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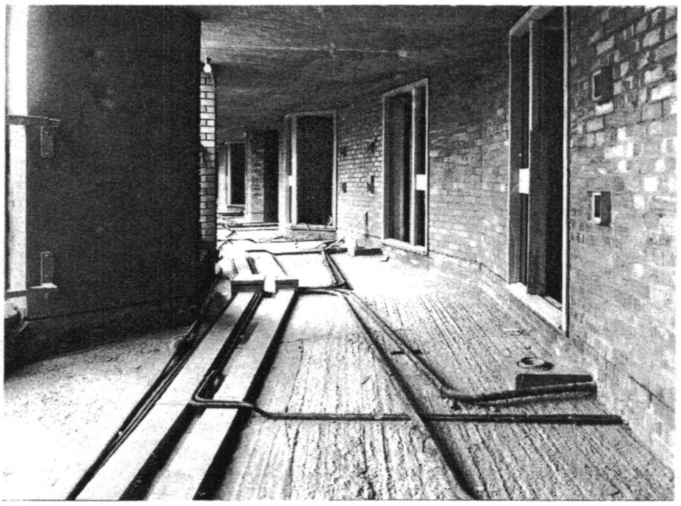

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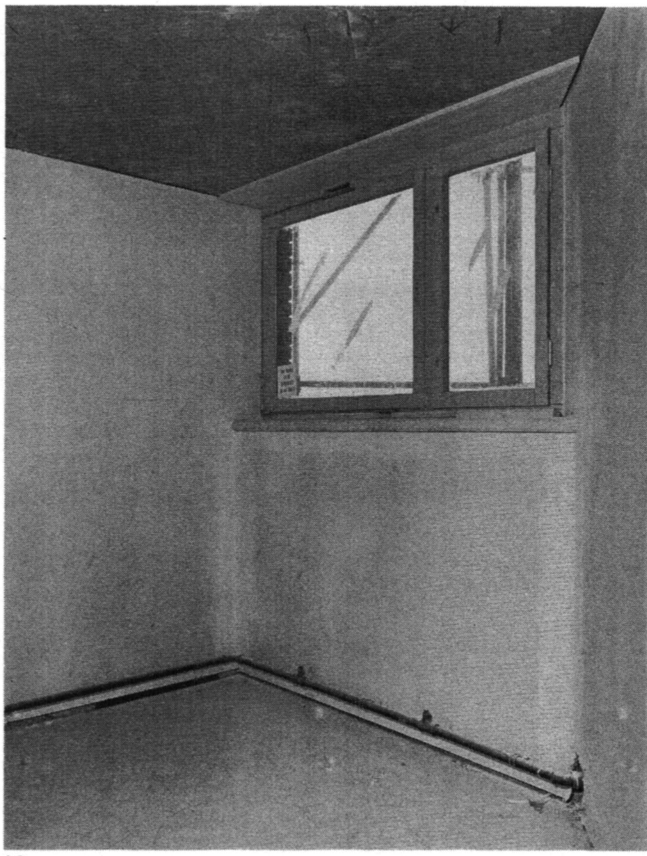

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evolved that all electric outlets and switches in walls are fed vertically upwards from the false floor, and this information is conveyed to the tenants through a maintenance brochure. Unfortunately, the heating system inside the flats makes no effective use of the floor cavity. The radiators are fed by crudely exposed flow and return pipes running through the flat at skirting level. There was no allowance in the cost yardstick for bedroom heating and the designers intended that the exposed pipes would at least offer some 10-15 per cent background heating; certainly maintenance and installation is simplified by this solution but at the expense of appearance and tenants' freedom to arrange furniture. The heating source is from two large and two small natural gas-fired boilers providing high pressure hot water to each flat. Direct injection valves are used to mix hot water with the return water in the system and this is pumped back through the radiators.

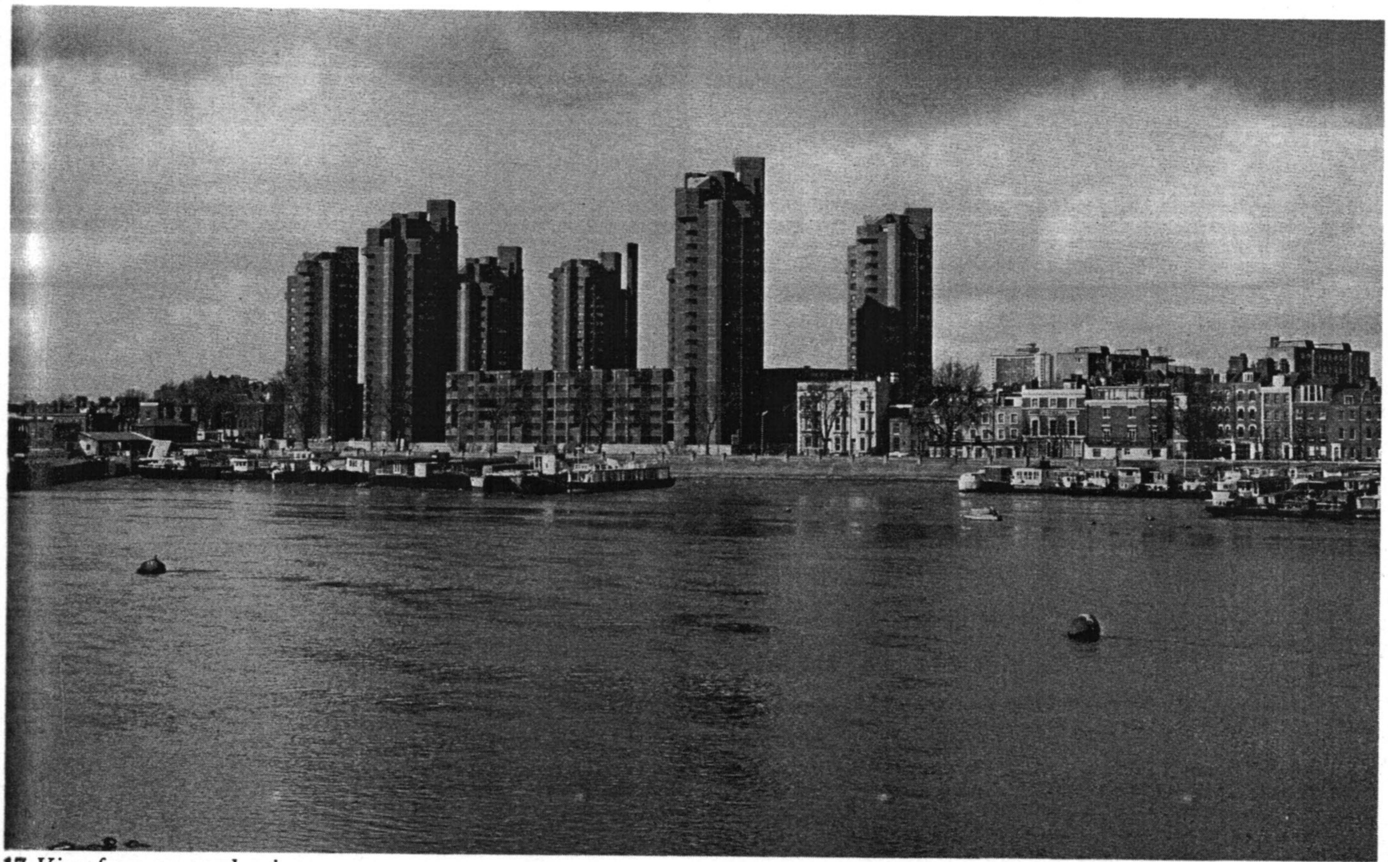
There is no standby generator, so in the event of an electrical power failure, the lifts would cease to function as indeed would the electric pump motivating domestic heating.

The drainage system comprises a single 150 mm stack dropping vertically in the towers. These are prefabricated off site and are of galvanised steel pipes with caulked joints. Cast iron was not used as standard fittings required much more space and would not give sufficient tolerance over such great height. The arrangement includes prefabricated storey-high ducts within the centre of the towers which terminate with fans at roof level and provide ventilation for internal bathrooms and wcs. The system allows an air change rate in excess of 750 cfh for a single wc and 1500 cfh for a combined wc and bath. Walkways through the tower zones imposed planning problems on the routeing of the soil stack. Surface water generally is brought down the soil stack, but rainwater from the

13 *At high level in the car park is a good position for an open horizontal service duct. The pipes are being protected with mesh to prevent the lagging being vandalised.*

14, 15 *The broad walkways incorporate a substantial depth of screed to achieve falls, and provide a route for trunked and conduited services.*

16 *For child safety the windows are a tip and tilt variety providing top opening for ventilation. To assist window maintenance from the inside they incorporate a bolting arrangement for side opening.*



17 *View from across the river.*

balconies is shed through 50 mm barge pipes in the upstands acting as gargoyles. Drainage from the basement car park has to be pumped up to the underside of the ground floor slab where it is collected and discharged to the public sewer.

The water supply is by mains pressure to the low rise perimeter blocks, but in the high rise towers the Water Board's pressure is insufficient, and so plant rooms at ground level containing booster pumps and break tanks are contained in each tower.

Fire fighting is by dry risers in each tower and sprinklers at basement car park level.

Contractual difficulties

Much has been heard about this site being held to ransom by a handful of militant unionists in order to further their political ambitions, and certainly the contractual problems at Worlds End, as at the Barbican, Thamesmead and elsewhere, are now part of building history and legend. Although events were brought to a head by the national building strike which commenced in June 1972 and lasted 13 weeks, the source of the problems can be found much further back. In the early 'sixties main contractors generally were concerned about the growing power of the trades unions in the building industry and also about the employment liability of their own staff. At a time when the main contractors attempted both to reduce the effectiveness of union strength by fragmenting the labour force, and to reduce their overheads, the government brought in the new selective employment tax (1966). The effect was that main contractors began to sub-contract every conceivable trade they could and shed themselves where possible of men 'on the books'. The opportunities open to building workers appeared to improve. Subcontractors offered very attractive pay to their men because they 'lumped' together in the rate a sum for insurance, holidays, profit etc, and the cost to the main contractor seemed attractive because it relieved him of all imponderable overheads, ie no overtime rate, no redundancy pay, no wet-time, no time in lieu of notice etc. The situation was bound to turn sour and it did. The lump payment quickly led to widespread tax evasion which the unions have stoically battled against by employing a system of individual checking of insurance cards and which the government tried to combat at first unsuccessfully by pay retention, and more recently by the implementation of self-employment clauses in the Finance Act.

This background indicates the generalised problems of the building industry which surrounded the particular troubles at Worlds End. But the direct cause of the stoppage on site was the difficulty of agreeing bonus rates for the bricklayers. As has been described, the brickwork was more complex than normal and the general contractor had not appreciated the awkwardness of the work in his original estimate. He had two choices: either to increase the rate and lose money on the contract or to attempt to hold the rate and press on. It seems it was an untenable position either way. If the bricklayers' rate was increased the other trades would have insisted on higher rates also, while the demand for bricklayers was so intense during the period of the hotel building boom (under the Development of Tourism Act 1969, a grant of £1000 a room was offered by the government for new hotels completed before 31 March 1973), that there was no chance of the main contractor holding on to labour working at the relatively low basic rate of 70p per hour according to the joint council working rule agreement when subcontractors were paying their men £1·30p an hour.

In 1973 Cubitts withdrew from the project and the council threatened to sue the firm for £3·6 million for breach of contract. Cubitts, in a counterclaim, argued that relevant information had not been made available to them by the council to enable proper progression of the contract. The council said they had lost confidence in the firm and in 1973 brought Bovis in to complete the job even though their tender was £1·1 million higher than Cubitts' revised quotation. The final cost is now estimated to be some two and a half times the original tender. In early 1976, Kensington and Chelsea agreed, as the result of a negotiated settlement, to accept £1 million from Cubitts.

In December 1975 Drake & Cubitt Holdings applied to the DOE for financial help after getting into difficulties over fixed price public works contracts and last year Cubitts became a member of the Tarmac Group.

The outcome

The scheme was unquestionably a courageous attempt at overcoming the apparently intractable problems of high rise, high density housing. But despite the efforts made to reduce the sense of alienation with the building, one still has to report a significant degree of vandalism in and around the lifts, **18**. It would be interesting to know if such damage would still be caused if the lifts were made private for the residents, and the communal access halls, landings and corridors designated as private lockable internal spaces, as in a mansion block. Is the difficulty with these common parts amplified because they are still halfway between internal and external spaces?

Despite the economic cost rent of £2600 a year for each unit, rents are between £8 and £20 per week, exclusive of rates and central heating. Since there is a separate charge for use of the garage this is now little used and most tenants park in the adjacent side streets.

The average cost per unit works out to £24 000 with a final contract cost estimated to be £15 million for the housing and associated external works (but excluding the ancillary communal buildings), after an initial tender in 1969 of £5·6 million. The work is being completed this month.

Table I Comparative effect of building at different densities

	persons per acre	persons per hectare	published reference	number of storeys
Alton Estate, Roehampton	100	247	AJ 5.11.59	12
Pollards Hill Estate, Merton	100	247	AR April 71	3
Byker housing, Newcastle	100	247	AJ 14.4.76	8
Foundling Estate, Bloomsbury	203	501	AR October 72	8
Lillington Street, Victoria	218	538	AJ 1.10.69	8
Worlds End, Chelsea	250	620		6 and 12

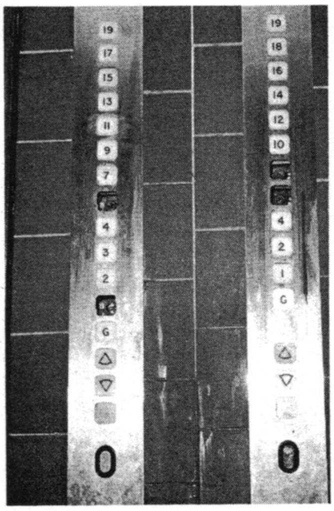
Table I showing notable schemes constructed since the war helps to indicate the comparative effect of building at varying densities.

Contractors

Main contractor: Bovis Construction Limited, in succession to Holland, Hannen & Cubitts. **Sub-contractors: Balustrades** Ironcraft Construction Co (Worthing) Ltd. **Brickwork** Bolton & Moore Ltd. **Carpentry** B. D. Builders Ltd. **Electrics** Stanor Electric Ltd. **Glazing** Aygee (Glass) Ltd. **Heating and ventilation** Servotomic Ltd. **Landscaping** Rapid (Landscapes) Ltd. **Lifts** Express Lift Co Ltd. **Mastic painting** Joint Sealing & Roofing Ltd. **Plumbing** Marryat-Jackson-Norris Ltd. **Paropa paving** Frazzi (Paropa) Ltd. **Plastering and partitions** West London Plastering Ltd. **Reinforced concrete** Howard Shuttering Contractors Ltd. **Roofing** E. J. Prater Asphalte Co Ltd. **Scaffolding** Scaffolding (Great Britain) Ltd. **Painting** Balclutha, CLC (Contractors) Ltd, Gee Brown Ltd, F. Troy & Co Ltd. **Bricks** R. Y. Ames Ltd; Butterley Building Materials Ltd.

Photographs

Henry Herzberg and Bill Toomey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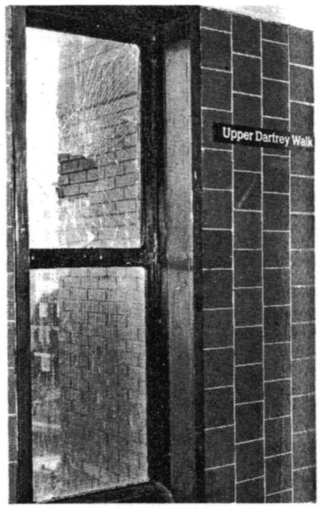

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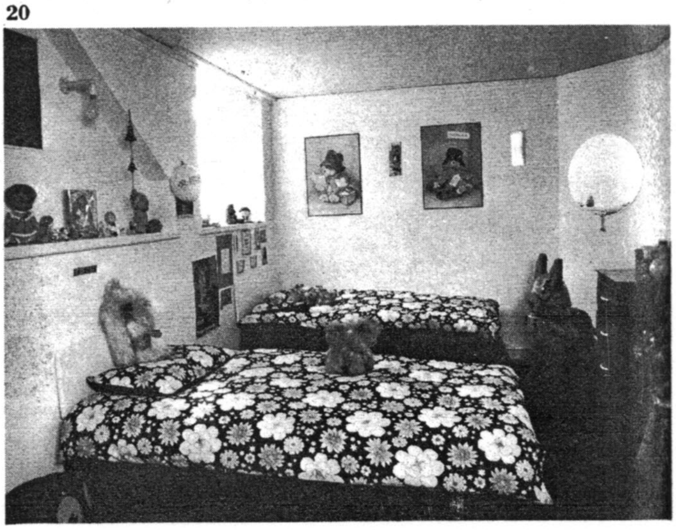
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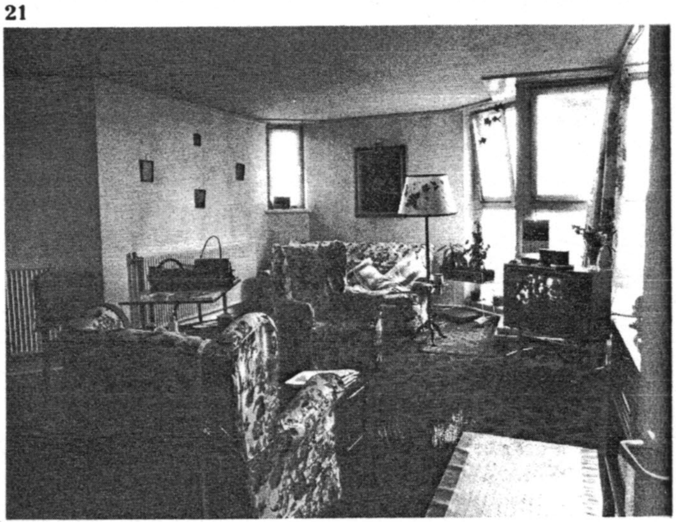

18, 19 *Vandalism is rife, especially in the lifts and lift lobbies. The spaces are not defensible.*
20 *Kitchen of a three-bedroom top floor flat.*
21 *Bedroom in a three-bedroom flat in a tower block.*
22 *Living room of a two-bedroom flat.*