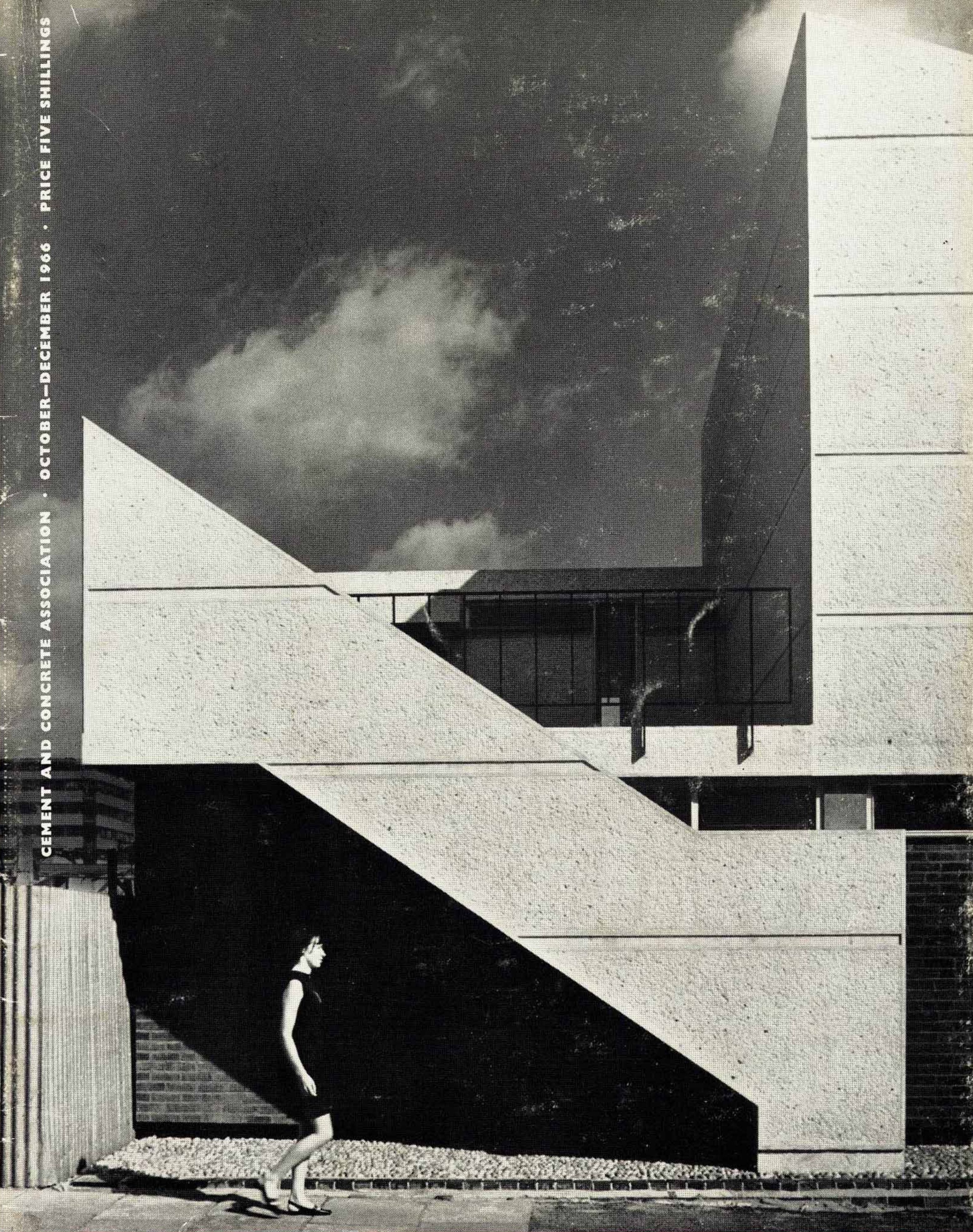
CEMENT AND CONCRETE ASSOCIATION · OCTOBER—DECEMBER 1966 · PRICE FIVE SHILLINGS



Concrete Quarterly 71

Concrete Quarterly

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Contents

Editor: GEORGE PERKIN, ARIBA

Designer: MORRIS TURNER, MSIA, FRSA

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FRONT COVER: *White textured concrete walls enclose the Coverdale and Ebenezer Congregational Church, Stepney (page 22)*

FRONTISPIECE: *Whitney Museum of American Art, New York. The stepped reinforced concrete building has in itself a sculptural form, complemented by this board-marked concrete bridge forming the main entrance over a sunken garden court for sculpture. Architects: Marcel Breuer and Hamilton Smith. Consulting architect: Michael H. Irving.*

NOT THAT journals in the concrete world come and go with the frequency of Fleet Street. All the same, every now and then there is something of a stir: the first issue of *Concrete* is now out, and in case there is any confusion, this may be a good opportunity to clarify the situation and the differences between *Concrete* and *Concrete Quarterly*.

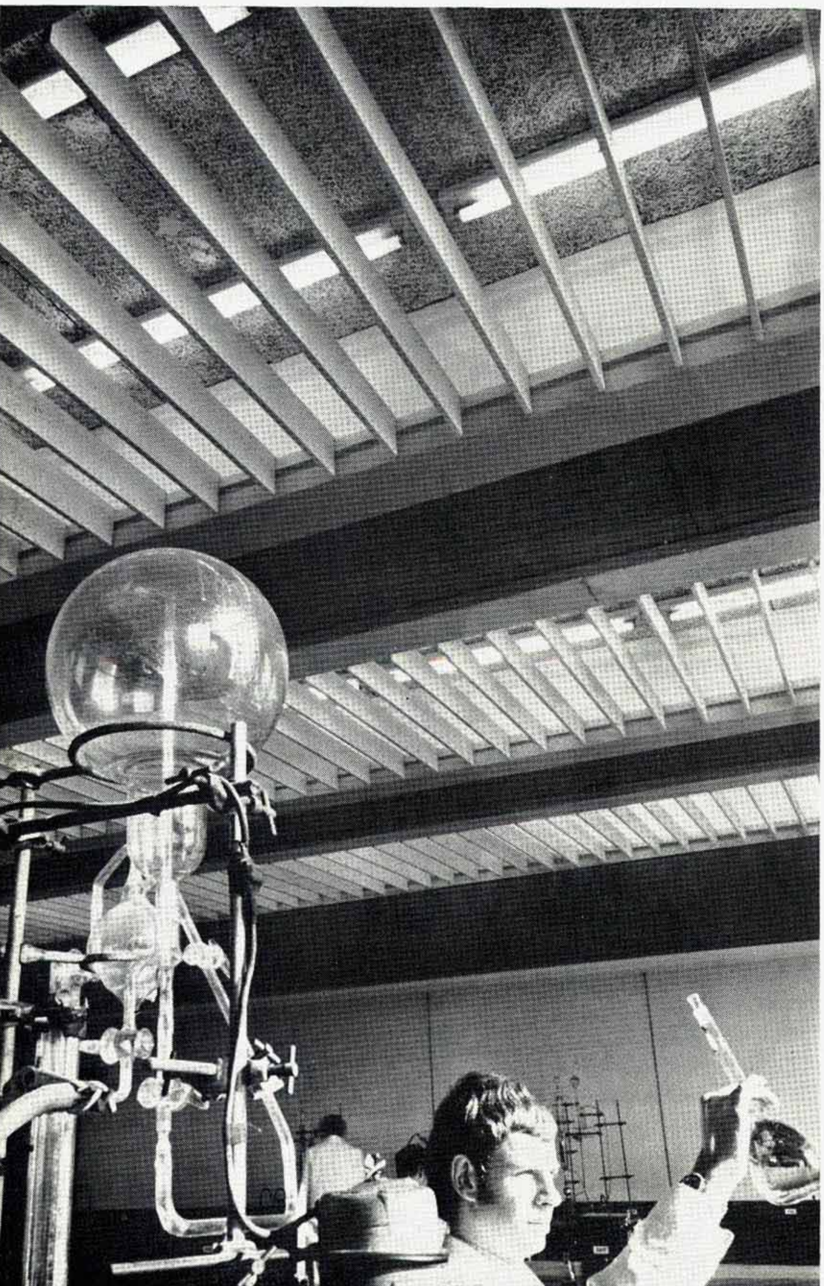
Concrete, as many people will already know, is to be the monthly journal of the newly-formed Concrete Society. As such it incorporates and replaces *Structural Concrete*, the past journal of the Reinforced Concrete Association, as well as that staunch old-stager *Concrete and Constructional Engineering*—a journal which goes back longer than many will recall (about sixty years) although some still remember its early days with affection. The main function of *Concrete* will be to record the activities of The Concrete Society—its papers and reports—at the same time including contributed articles and news features on various aspects of concrete design and construction.

Concrete Quarterly, on the other hand, will continue, as always, its quite separate role: namely to show the best of recent concrete design in this country and abroad—*mainly* from the architectural point of view, but also (how can one separate these issues?) from the engineering and constructional points of view. This includes, of course, civil engineering structures.

As we have long felt, and tried to show, the architectural use of concrete is a subject of absorbing interest. The 'aesthetic'—for want of a better word—of concrete design is something unique which deserves a study in its own right: something which is developing steadily, becoming more widely appreciated and understood and which is now, with increased industrialization, entering new realms. In addition—to get really off the ground—we also very much believe that there is a challenge and great satisfaction to be found in concrete design for architects, with new territory still to be explored. And it is with this pioneering spirit that *Concrete Quarterly* will continue to be concerned—particularly, it should be said, when good designers are involved.

Meanwhile—all success to *Concrete*.

more from the UNIVERSITIES



THE SCHOOL OF CHEMISTRY UNIVERSITY OF BRISTOL

THE NEW SCHOOL OF CHEMISTRY at the University of Bristol has a magnificent site—on the edge of the hill overlooking the city, with about the best view to be had in the vicinity. For this reason it is also very prominent from below, so that its impact on Bristol—together with the other rather dull University buildings behind—is considerable. It is the greatest pity, therefore, that the School of Chemistry's neighbours have not quite grasped the imaginative possibilities of the situation. However, the School itself makes the most of the sweeping panorama, with open decks and promenades and glass-wall common rooms poised—as it were—betwixt Bristol and sky. Towards the city, the ground falls away precipitously.

This multi-level complex of teaching and research laboratories and lecture rooms was designed by Courtaulds Technical Services. They have produced a group of blocks with some excellent features, such as the intimate entrance cloister with its ribbed white concrete finishes, a precast frame which neatly houses between its twin members the complicated service and duct systems inherent in laboratory buildings, and some carefully detailed facing panels protected from surface rainwater by cavities behind – to mention a few of the best points. It is true that the amount of care and thought that has gone into detailing has in places resulted in too many different finishes, leading one often to the conclusion that the simplest parts of this building are the best. But in general, the University gains vastly from the new school.

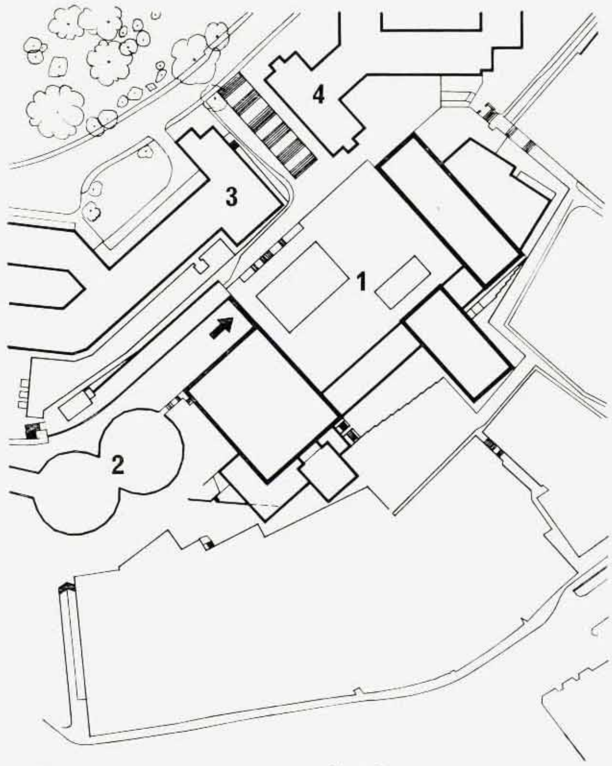
Broadly speaking, the building comprises three main laboratory blocks, one for teaching and two for research, linked at two separate levels by concrete decks. The lower deck comprises the entrance cloister leading to the main suite of lecture rooms, the library and, below again, to the workshops, plant rooms and service areas. The upper deck forms a traffic-free promenade and, rising above this, are the three main laboratory blocks linked by glass-walled bridges containing common and conference rooms. The

Typical laboratory interior. Note the neat integration of services between pairs of beams forming horizontal ducts. Lighting is placed between ducts and shielded by louvres.

Photographs: Derek Balmer

building is served by a new road which was driven along the contours of the hill, providing access to two circular car-parking decks close to the entrance of the site.

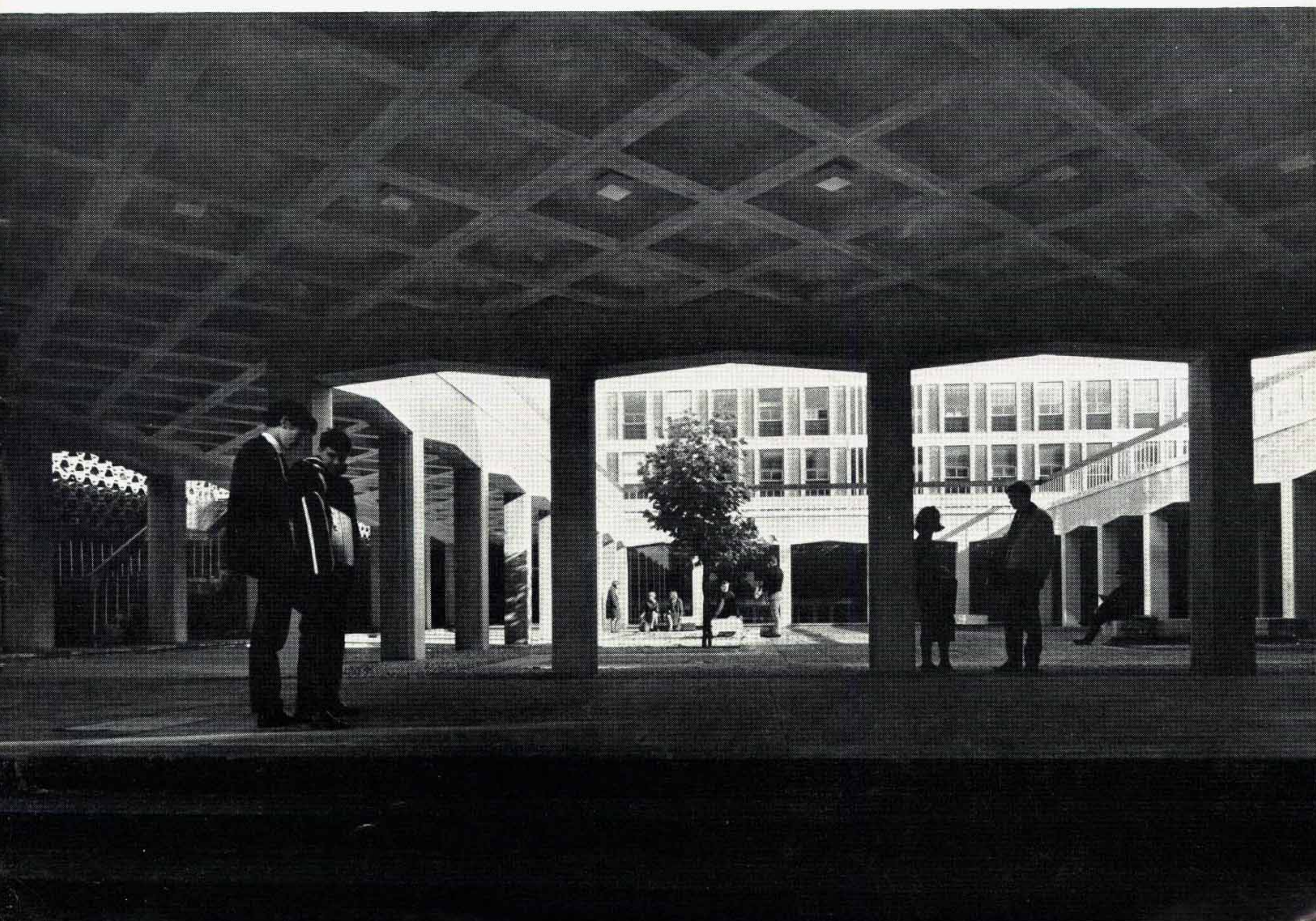
The most basic fact about the building is the close integration of services and structure. Although the plan of the three main laboratory blocks is different, they have similar structural and service arrangements, resulting in an internal and external expression of twin beams and columns. The precast concrete frames are 4 ft. 6 in. wide overall and at 10 ft. centres – dimensions which remain standard throughout – and these are divided into pairs of beams and columns between which the horizontal and vertical services are housed. The pairs of beams extend across the laboratory blocks, supported centrally by pairs of columns and externally by wide columns each of which is, in fact, expressed on the façades as twin columns with a cladding panel between. The 5 ft. 6 in. space between each pair of columns is filled entirely on the outer walls by a floor-to-ceiling window unit. In the laboratory ceilings, the corresponding 5 ft. 6 in. space between each pair of beams is used as a lighting trough, with metal louvres placed flush with the soffits of the beams to diffuse the light. The laboratory interiors thus have a very neat appearance, with the structure clearly expressed, and none of the usual suspended ceilings: the horizontal bands of artificial lighting continue down the outer walls as vertical strips of natural lighting. Fume cupboards are housed between the inner pairs of columns.



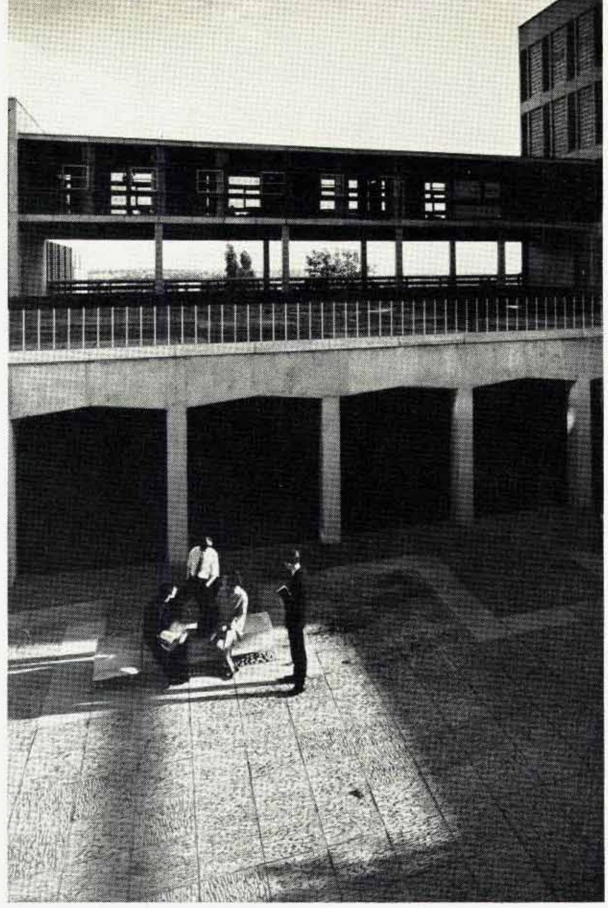
Site plan

KEY:
1 School of chemistry
2 Car park
3 Engineering school
4 Medical school

The entrance cloister with its colonnade of white ribbed concrete. The diagonal grid beams of the slab soffit are formed by casting against dished fibreglass moulds.



Above: View of a laboratory block, from the pool at upper deck level, showing a typical arrangement of cladding panels between pairs of columns, expressing the services arrangement within. Cavities behind the white horizontal cladding units at floor levels prevent streaking from rainwater.



Looking down into the entrance cloister from the upper deck, with the common-room link block beyond.

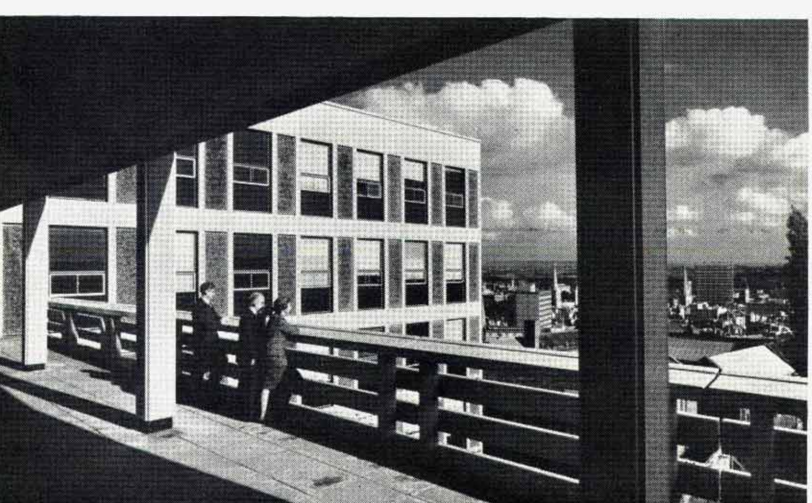
MORE FROM THE UNIVERSITIES: *continued*

An unusual detail which should be mentioned is the disposal of surface water behind the white concrete cladding units which form horizontal bands on the outer walls at each floor level. As these are vulnerable to staining and streaking, a 2 in. cavity has been provided behind, so that surface water running down the building is diverted at each floor level behind these white bands, thus reducing pattern staining to a minimum.

All the exposed frame members in the building are of white concrete cast with white cement and Cornish de Lank granite aggregate. The external faces of columns have a finish of lightly exposed aggregate achieved by grinding with a coarse carborundum and fine silica sand about 24 hours after striking the forms. The outside third only of the cross-sectional area of columns is cast with white cement, the remainder with ordinary grey.

The vertical cladding panels between windows have a coarse exposed aggregate finish of 85 per cent blue Shap granite and 15 per cent pink Shap granite. Combined, this presents, in fact, a greenish-black appearance. The slabs were cast face down on a sand bed.

The upper deck is constructed of in situ reinforced concrete with columns and edge beams in white concrete. The part of the slab soffit which forms a surround to the cloister at the lower deck level comprises a diagonal grid of beams formed by casting



Left: View from the upper deck over the city of Bristol below. A robust precast concrete rail is provided.

The west elevation of the Electrical Engineering and Architecture building, Nottingham, showing the simply detailed precast concrete façade.

Photograph: Richard Einzig

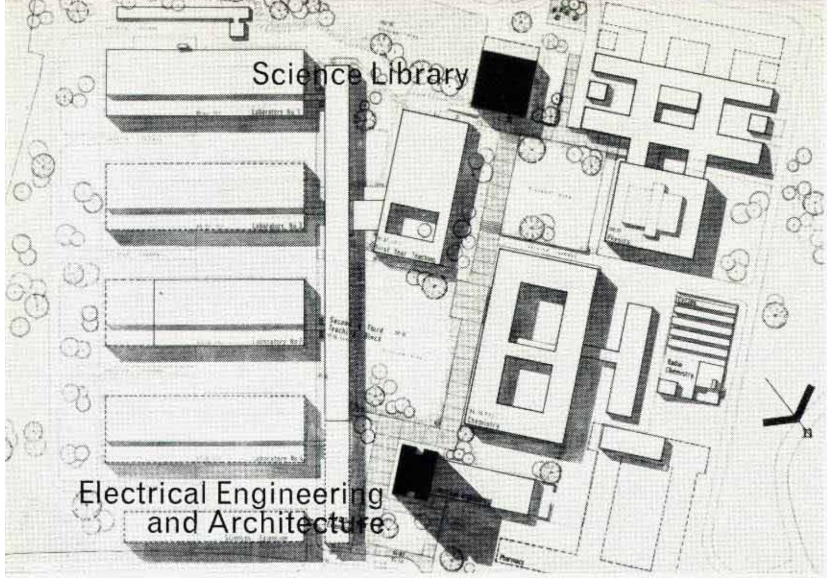
against dished fibreglass moulds, giving a glazed finish to the concrete.

Courtaulds Technical Services designed the whole building, acting as architects, structural, mechanical and electrical engineers. W. F. Johnson, FRIBA, was the Chief Architect, and J. T. Alliston, MA, FRIBA, Assistant Chief Architect. H. F. Seward, ARIBA, was the Principal Architect responsible for the scheme. H. W. Thrower, MIStructE, was the Chief Structural Engineer, assisted by E. Bednall, MIStructE. The general contractors were Holland & Hannen and Cubitts Limited. The precast concrete structural members were made by Charlton Concrete Limited and the cladding panels by Calverley Concrete Limited and Charlton Concrete Limited.

UNIVERSITY OF NOTTINGHAM

IN *Concrete Quarterly* 54 Sir Basil Spence's master plan for the Pure and Applied Sciences area of Nottingham University and the progress made to date (1962) were described. Some of the buildings designed by Andrew Renton and Associates were referred to then. Two more by these architects have now been completed – the Science Library, and the Electrical Engineering and Architecture block. These buildings, planned at the same time, hold key positions in the architectural setting. They each provide an important visual focus at either end of a broad walk.

Although very dissimilar in form – the Library is a three-storey square building, the Electrical Engineer-



Site plan


Photograph: Henk Snoek

Detail of the vigorous texturing of the external precast elements in the tall Electrical Engineering and Architecture block (see also opposite).

MORE FROM THE UNIVERSITIES: *continued*

ing and Architecture block is a fifteen-storey tower with single-storey laboratory extension – they are visually linked by the same 4 ft. 6 in. module and by the same vigorous texturing of the external concrete.

The Library really contains three separate libraries– those of the Departments of Biological, Applied and Physical Sciences – each on a different floor. Each floor is virtually an open area 90 ft. square, the book-stacks, stairs and lifts forming a central core. This ensures that movement is concentrated in the centre, and the reading areas round the perimeter get minimum disturbance and maximum natural light. In addition there are the normal library complement of catalogue hall, periodical rooms, book processing areas and staff rooms. The basement, which extends over most of the building's area, houses the reserve bookstack and the University's collection of rare scientific books. The retaining wall of this basement, which is faced in blue brick, forms a plinth above ground level from which the library rises.

Structurally the Library has a reinforced concrete frame. Flat slab floors with drop panels are supported internally on in situ columns. Precast storey-height concrete mullions 18 in. by 6 in. in cross-section provide the external support, spaced at 4 ft. 6 in. centres. The spandrel walls were cast in situ except on the south-west elevation, where they were precast and demountable because it is intended to extend the building on this site at some future date. Similar provision has been made to permit bridge links to a further second stage extension to the south-east. Internally, natural timber and white plaster walls provide an effect of quiet and restful simplicity.

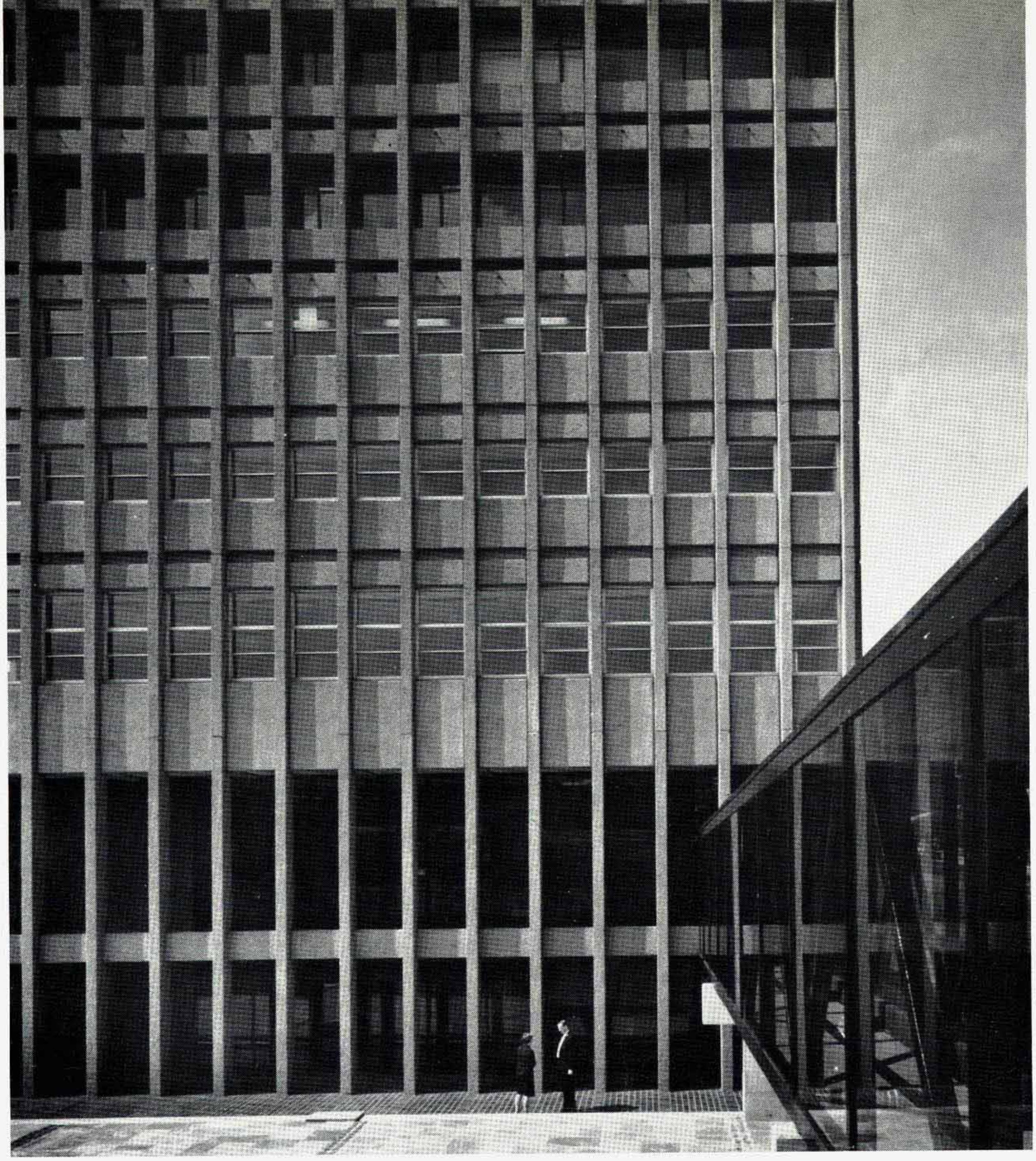

The three-storey Library, related to the tower block by the same module and the same textured concrete externally.

Photograph: Henk Snoek

The 190 ft. high tower block houses the Department of Architecture on the top five floors, and the Department of Electrical Engineering on the floors below, with the heavy engineering laboratories in a largely single-storey, blue brick extension. The basic requirements on the Department of Architecture's side were for large open areas, and on the engineering side for plenty of laboratories and smaller research rooms. Complete freedom for the erection of partition walls was therefore stipulated. To meet these requirements the building was designed round a central structural core for lifts and services flanked on each floor by two open areas 81 ft. by 21 ft. This arrangement varies on the top studio floors where fewer services were required, and larger open areas could be created more easily.

The structure is based on the same 4 ft. 6 in. module as the Library, and, with the exception of the 9 in. thick in situ concrete walls to the core, is wholly of precast concrete – incidentally a similar system to that used by the same architects for St. Katharine Dock House, London (*Concrete Quarterly* 64). The two main elevations are window walls with the 20 in. by 9 in. mullions linked by spandrel panels. The solid gable walls provide additional structural stability, and these are clad with floor-height panels acting as permanent formwork. The flat planes of these walls

Photograph: Richard Einzig



Part elevation of the Electrical Engineering and Architecture building: the arrangement of precast concrete elements on the façade results in a formal simplicity with a marked vertical emphasis.

are relieved by glazed recesses for the escape staircases, and by narrow slot windows which run the full height of the building.

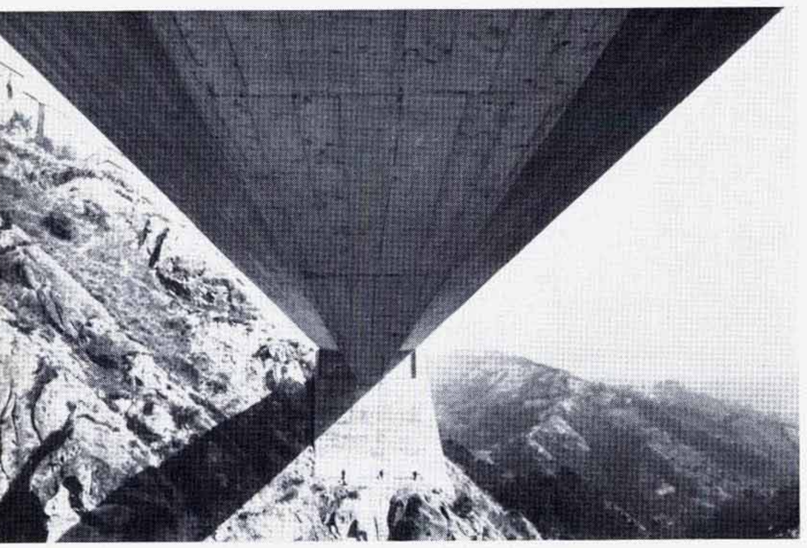
Internally finishes have been kept to a minimum and are of the simplest. Considerable use has been made throughout of exposed concrete straight from the forms on columns, floor slabs and the central core. Texture of the concrete faces has been achieved by pinning and gluing $\frac{1}{8}$ in. thick strips of plywood to the internal faces of the plywood forms. Walls in the Electrical Engineering Department are plastered and in the Department of Architecture are of wallboard faced with hessian to provide pin-up surfaces.

The kinship of these two quietly elegant buildings is not only visible in their structures. Identical external materials have been used on them and the external faces of the precast concrete have the same treatment throughout. The crushed Cornish granite used for the coarse aggregate – with Leighton Buzzard sand for fine aggregate – was exposed to $\frac{3}{8}$ in. depth. The result is a strong, well defined texture, matching the clarity of expression of the buildings.

The principal architect in charge of the buildings was Andrew Renton. The associate architect was Peter Howard. Job architects were John Kennett, Gordon Price and Derek Dredge. The structural engineers were Ove Arup & Partners. W. J. Simms, Sons & Cooke Limited were the general contractors. The precast concrete was made by Girlings' Ferro-Concrete Company Limited.

Vallone La Rocca Bridge

a prestressed concrete bridge over a rocky Italian gorge

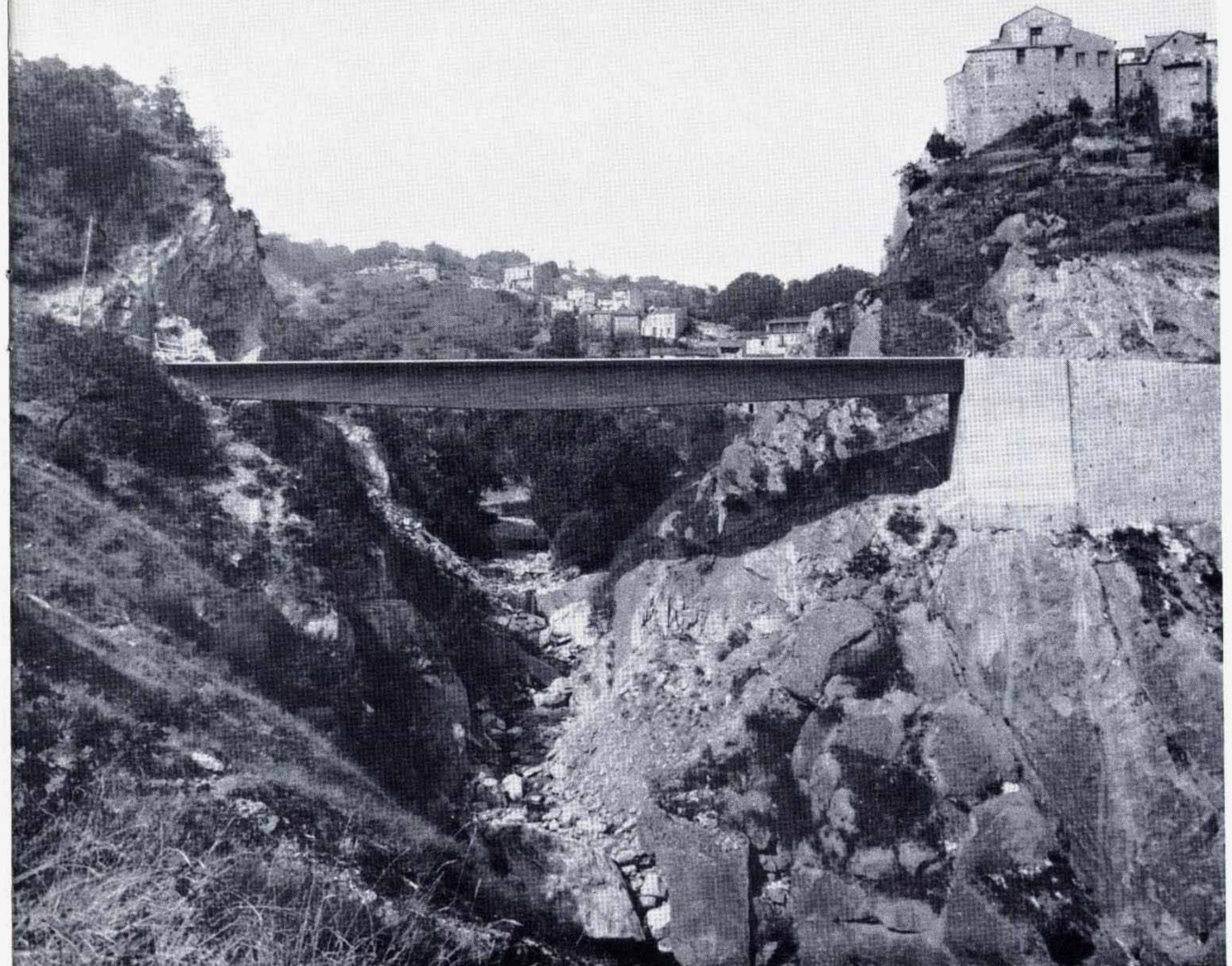


IN THE southern central part of Italy, in the middle of the Apennine range, there is a prestressed concrete bridge, strikingly simple in appearance, across a rocky gorge – the Vallone La Rocca at Castelverrino, Campobasso. As might be supposed, the bridge looks a good deal simpler than it really is (remembering Ove Arup's recent remark that it is extremely difficult to make a complicated thing look simple, but fairly easy the other way round). It appears to be simply a concrete beam, subtly curved on its soffit, with positively no trimmings – not even a handrail. And here we must admit to a certain disappointment, having supposed that the top edge of this structure was the parapet, with no need for a rail, the whole thing being neatly built in (back to Arup again and the Kingsgate Bridge, Durham, where precisely this happens).

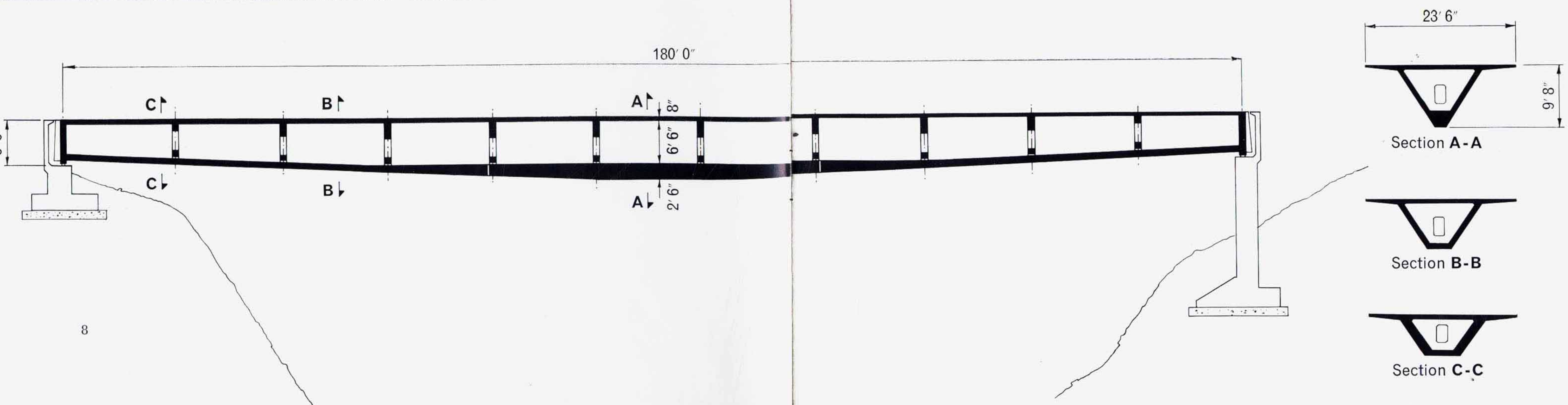
On closer inspection, and the receipt of drawings, we find that the cross section is a triangle which does not, in fact, include a parapet. All the same, the whole still adds up to a refreshingly – if deceptively – simple statement, even with the addition of a simple rail.

As to the details, the span is 180 ft. and the width of the structure 24 ft. with a depth of 9 ft. 9 in. at mid-span and 6 ft. 3 in. at the abutments. The bridge is a hollow V-section, the profile changing throughout its length – a subtle point this – and it is stiffened internally with 12 cross-diaphragms. The deck slab thickness at the centre is 7.8 in. The structure is prestressed longitudinally on the BBRV system with 11 cables in each of the side walls, each cable being made up of forty-two 0.23 in. (6 mm.) diameter wires. The initial tension of the wires was 70 tons per sq. in. and the working tension 57 tons per sq. in. The maximum compressive stress in the concrete was 2,200 lb. per sq. in. at the time of prestressing, and the maximum design stress under load is 1,600 lb. per sq. in.

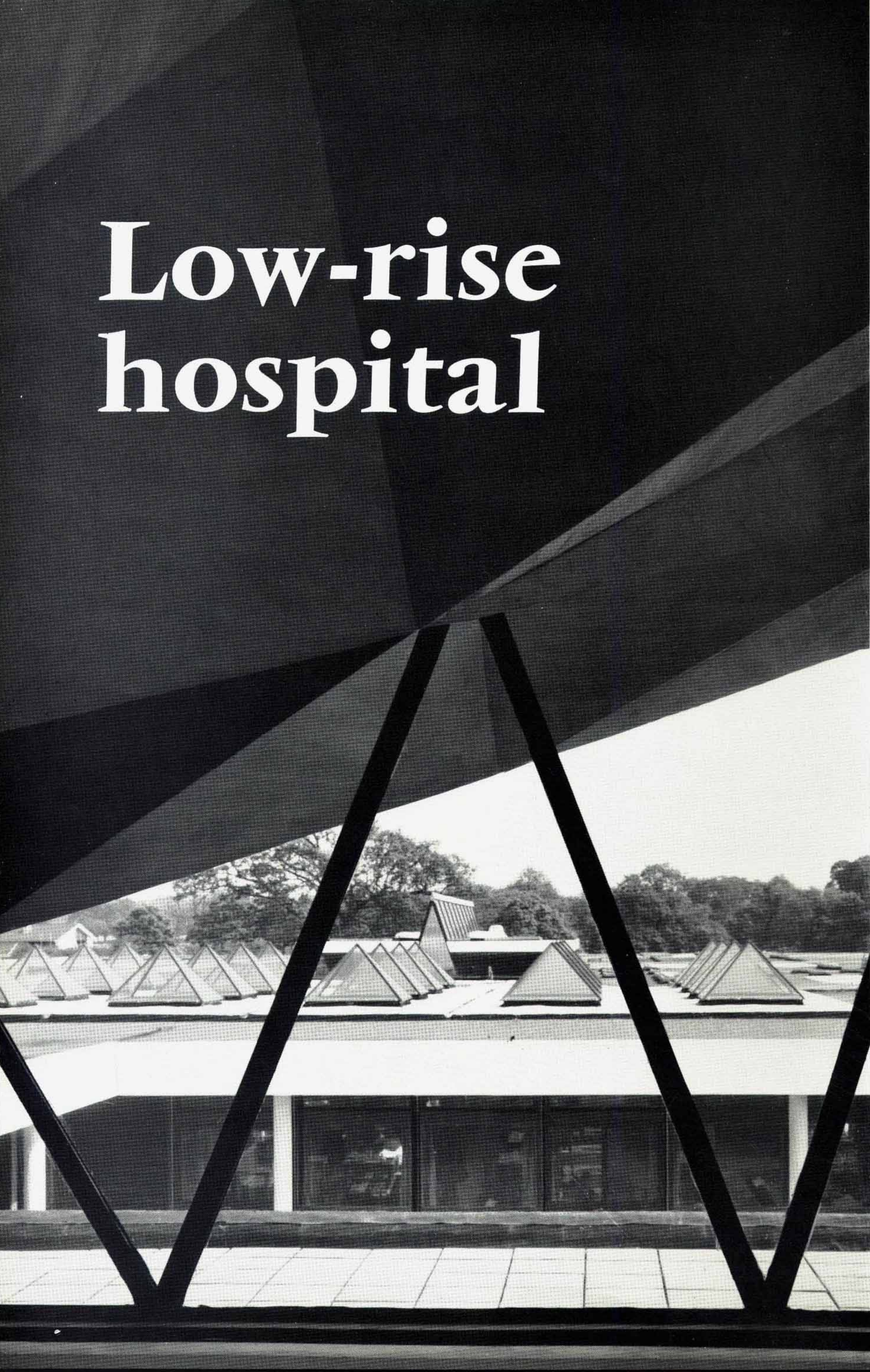
The bridge is of exposed board-marked concrete throughout and was designed by Dott. Ing. Ennio Russo Ermolli.



Opposite: The board-marked soffit of the bridge, showing the subtle change in profile.
Above: The bridge crosses a rocky ravine – typical of this part of the Apennines – in what appears to be a delightfully simple manner.



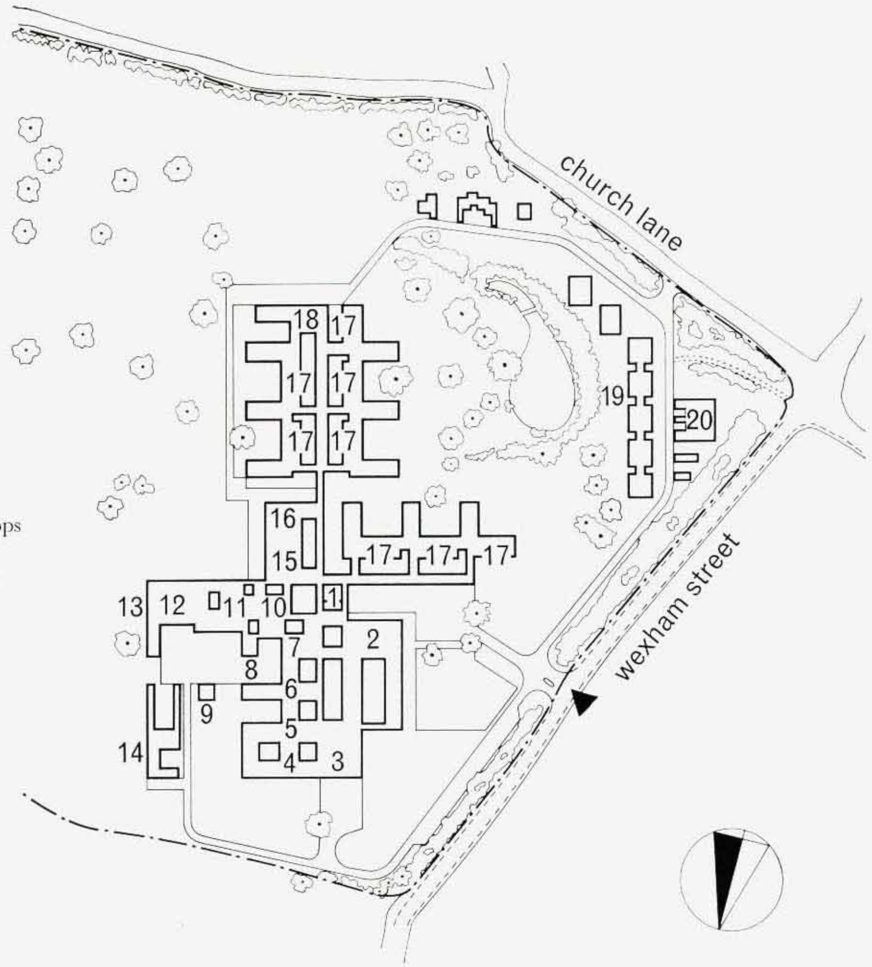
Low-rise hospital



Site Plan

KEY:

1 Administration
2 Outpatients
3 Casualty
4 Physiotherapy
5 X-Ray
6 Pathology
7 Pharmacy
8 Mortuary
9 Animals
10 Dining
11 Kitchen
12 Stores
13 Linen
14 Boiler and workshops
15 Sterile supply
16 Operating
17 General ward
18 Children's ward
19 Hostels
20 Nurses' training



Left: A glimpse from a stair landing in the administration block of the single-storey buildings at the rear. The faceted in situ concrete ceiling, with glazing fixed into the concrete, occurs over the entrance hall.

Photographs: Colin Westwood

Wexham Park Hospital, near Slough

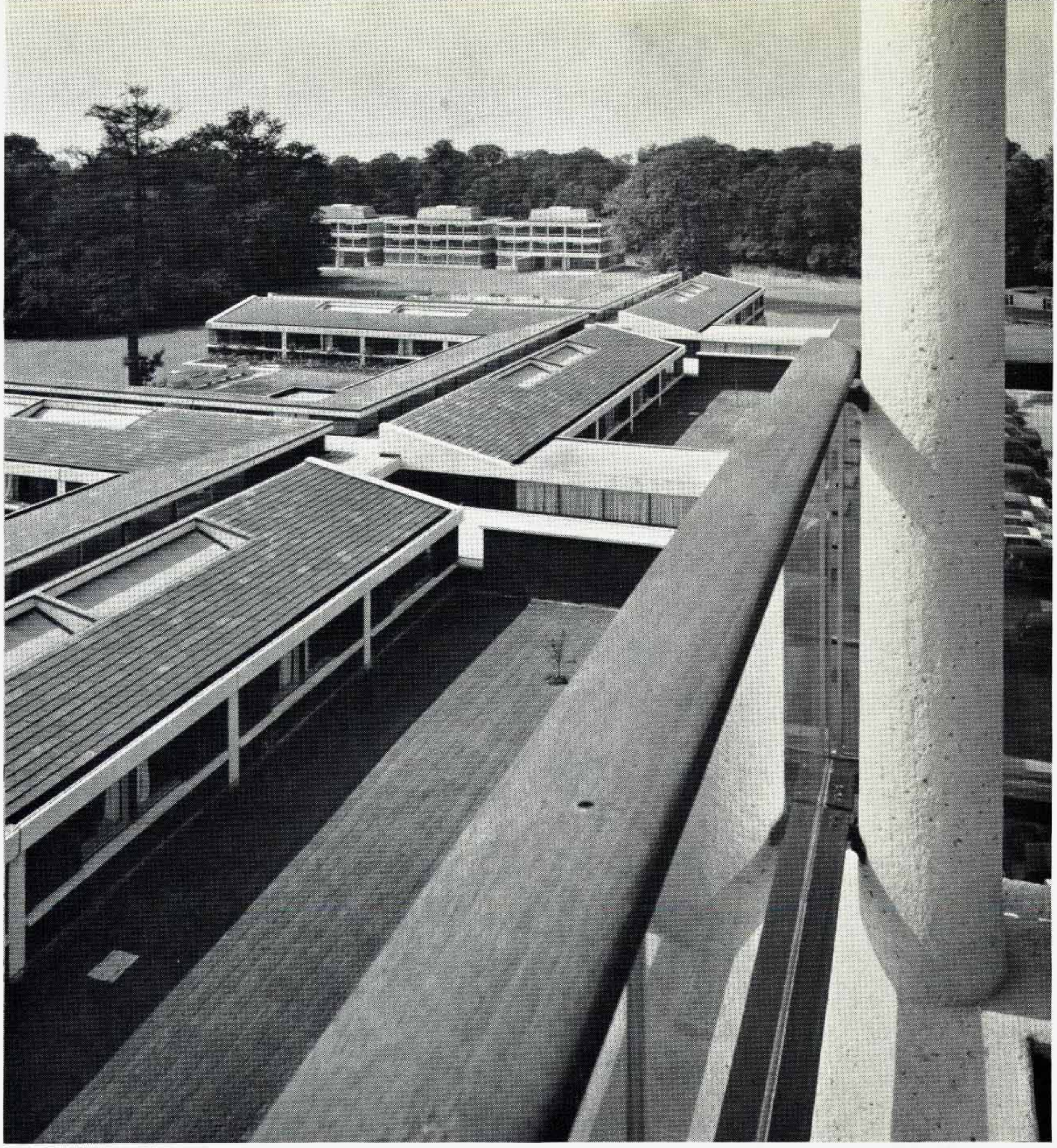
FOR MOST OF US, the hospital is a place to be approached with awe and some trepidation. And if it is designed in a certain impersonal idiom, the total effect can reduce some people to mere shadows. All credit, then, to the architects Powell and Moya, who have done the reverse, and produced a new hospital, stretching its limbs into the leafy green of Buckinghamshire, which makes you feel—if not exactly welcome—at least at home directly you pass through the gates. No white tiles and whiff of formaldehyde here. Quiet domestic efficiency seems nearer the mark, particularly when you get into the hospital proper with its glimpses into green garden courts, its friendly near-private wards subdivided into bays for never more than four beds (sometimes only one bed), and its low ceilings. And all—apart from the tall administration block—reassuringly hugging Mother Earth in single-storey wings. Somehow, one could be doing with more hospitals of this kind.

And indeed, according to Mr. Kenneth Robinson, Minister of Health, who last summer opened this new Wexham Park Hospital near Slough (also, as it happens, down the road from the C & CA), there is no reason why not. One and a half million pounds a week, he said, were being spent on modernizing our woefully backward hospital amenities—part of it, as here, on completely new hospitals on virgin sites, or on reconstruction and remodelling. Taking this group of reconstructed or completed new hospitals, Wexham Park forms one of 15, with 68 others partially completed, and work in progress on a further 63 major schemes.

The flattish 66½-acre site on which the hospital is built was once occupied by a Victorian country house with fine trees and an ornamental lake in the gardens. These natural features have been treated as an integral part of the scheme.

The hospital is the result of a requirement by the North West Metropolitan Regional Hospital Board for a 300-bed hospital, built in one stage, complete with out-patients, casualty, operating, diagnostic and ancillary departments, all capable of serving a population of 145,000 people and also of expanding to about 500 beds at some future fate.

The planning approach to this low-built hospital has been to consider it not as a finite building but as a village or small town which can grow and where each sector, while being unmistakably part of the same organism, has its own individual character. The result is a criss-cross of covered, enclosed walkways



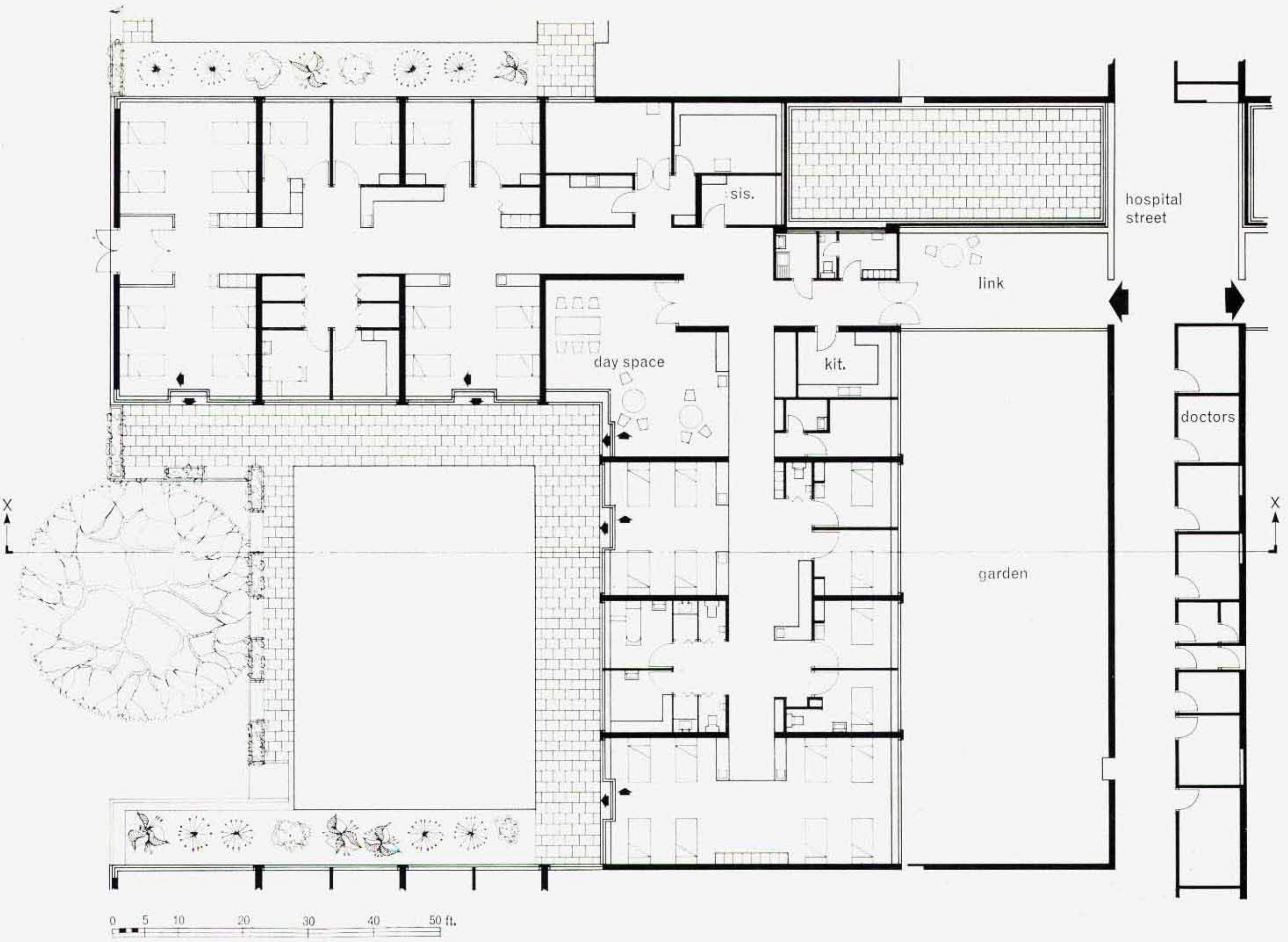
The single-storey wards, divided by garden courts, seen from a balcony in the administration building, with the nurses' residential blocks in the background. External columns surrounding the balconies (right) are of white bush-hammered concrete.

WEXHAM PARK HOSPITAL: *continued*

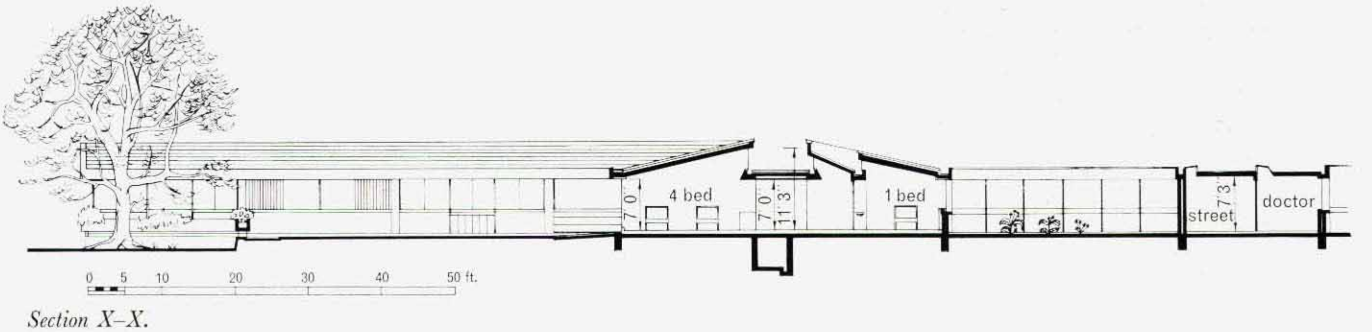
intersecting below a central tower—the walkways representing the streets of the town, the hospital departments its buildings. Apart from the administration department and resident doctors' accommodation, which are housed in the eight-storey tower at the hub, the whole hospital is on one floor. This arrangement allowed flexible planning, and was economical for this level site with ample room for expansion. Also, compared with an alternative design for a hospital on this site with a multi-storey ward block and the same number of beds, it has been calculated that the time taken for journeys by staff is less: delays waiting for and getting in and out of lifts are eliminated; also the compact arrangement of the wards is an advantage.

A typical 32-bed ward is L-shaped, each arm containing 16 beds in four single rooms and three four-bed bays, with a nurse's station, w.c.s and bathrooms. There are eight of these wards altogether, and a paediatric unit of 40 beds. Most of the rooms have a pleasant outlook into garden courts set between the departments. The wards themselves open out onto these gardens, and on the day that the photographs for this article were taken patients were being wheeled out into the autumn sunshine.

Obviously without due architectural care the different parts of such a building could become disparate and straggling. Here, however, they have been related and unified by emphasizing the main structural elements and by the adoption of a common structural material and finish—concrete either in situ



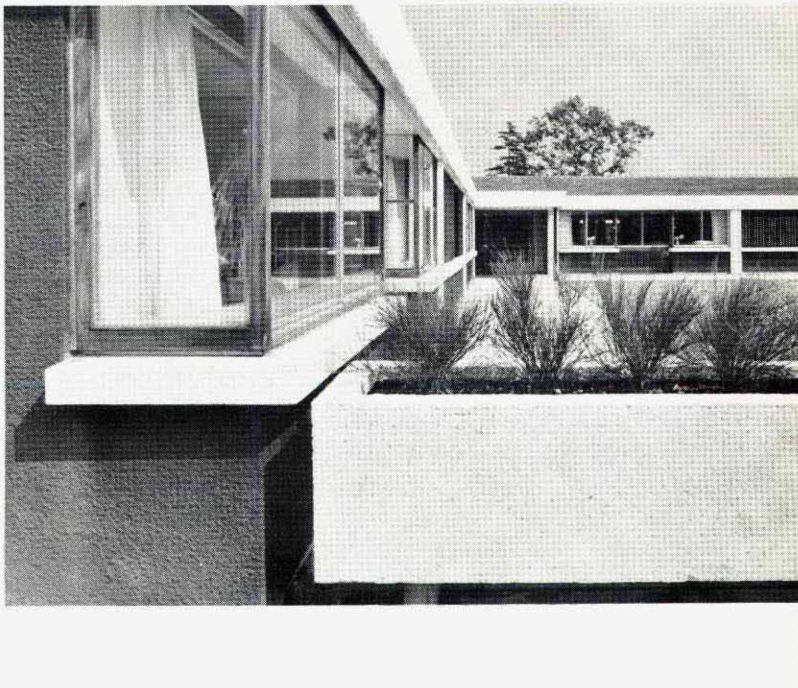
Typical ward layout.



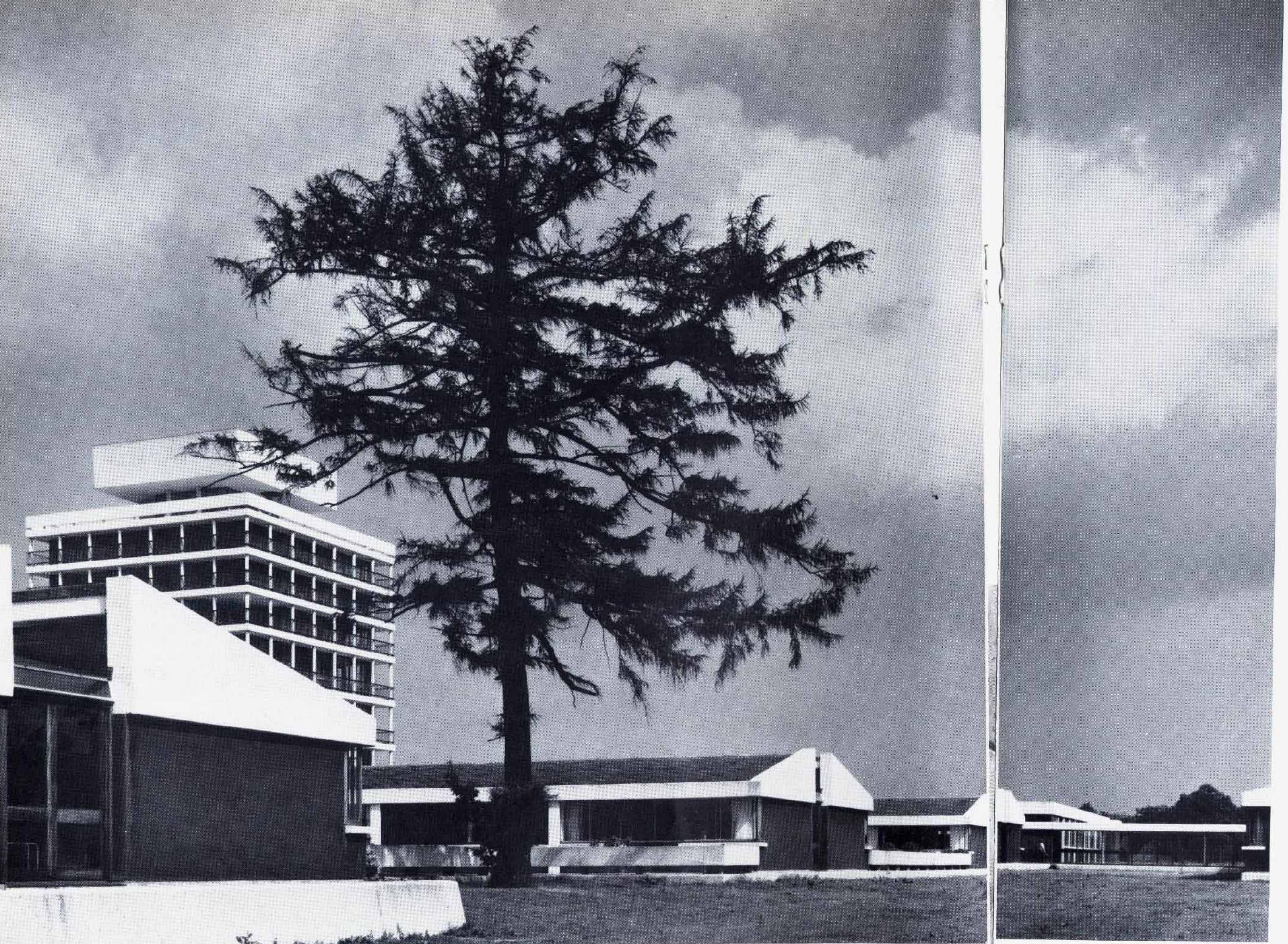
Section X–X.

or precast, mostly reinforced but sometimes prestressed. In principle, the superstructure has been expressed and the exposed members are of white concrete made with white cement and calcined flint aggregate, bush-hammered externally. The same material and finish are also used for the combined precast concrete flower boxes and seat units which enclose and define the garden courts. Externally, this textured white concrete of edge beams and gable ends looks crisp and lively against the dark coffee-coloured rendering of the walls below.

In the main, two forms of in situ concrete construction have been used. The wards (and nurses' hostel blocks on the site boundary) have in situ concrete floor and roof slabs supported on brick or concrete block cross walls. The tall administration



View into a typical garden court showing the white concrete edge beams, sills and flower boxes.



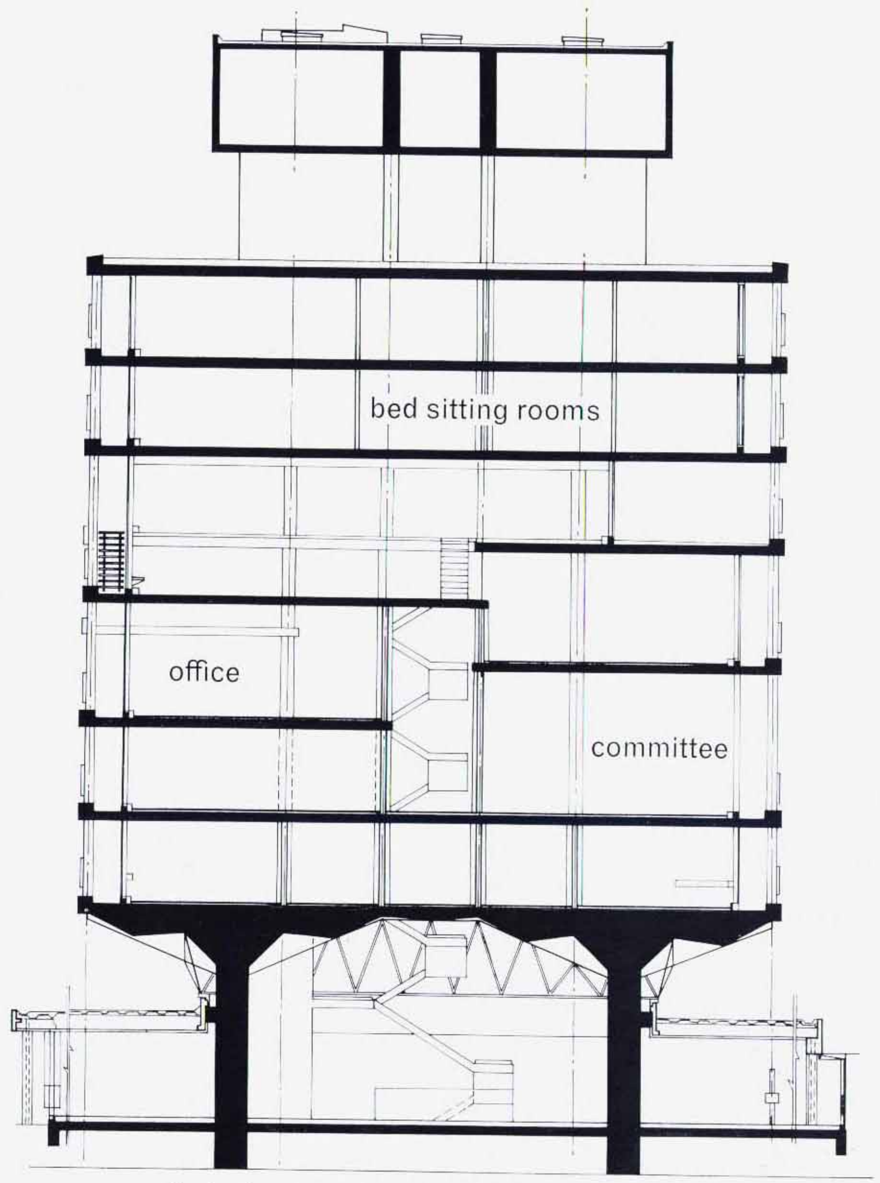
The value of textured white concrete elements, contrasted with deep coffee-coloured rendering, can be seen in this view of the wards, with the administration block in the background.

WEXHAM PARK HOSPITAL: *continued*

tower and operating department structures are of reinforced concrete column and slab construction. The cross walls in the wards are at 21-ft. centres and are capped externally with white precast concrete bush-hammered facing units. These walls support sloping reinforced concrete roof slabs, so arranged as to allow cross-ventilation and extra light through high-level clerestory windows. The roof slabs terminate in expressed edge beams and deep gable end beams of bush-hammered white concrete.

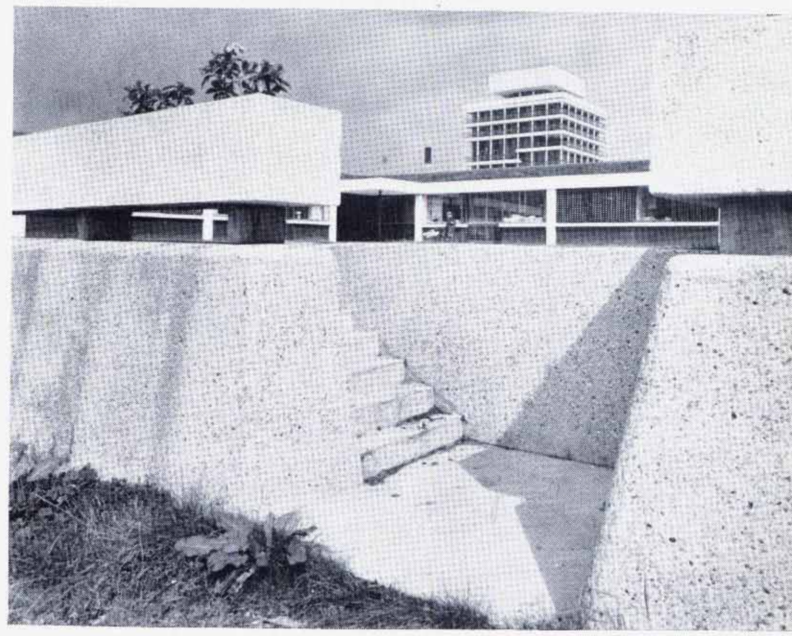
By contrast with these low buildings, the dominant eight-storey administration tower is all lightness, springing in to the air like a fountain from four tapering columns on to which the entire building appears to be cushioned by a 'quilting' of faceted in situ concrete which forms an undulating ceiling to the entrance hall. These exposed concrete members in the hall were cast against wrought softwood boards and left as they came from the forms. Their profiles provide a fascinating study in the plasticity of concrete construction. Elsewhere, circular columns are used for the column and slab structure. Above first-floor level the columns are expressed externally on the front line of the continuous balconies at every floor level and, as with the balcony edge beams, are of white bush-hammered concrete. Internally, the exposed columns are polished.

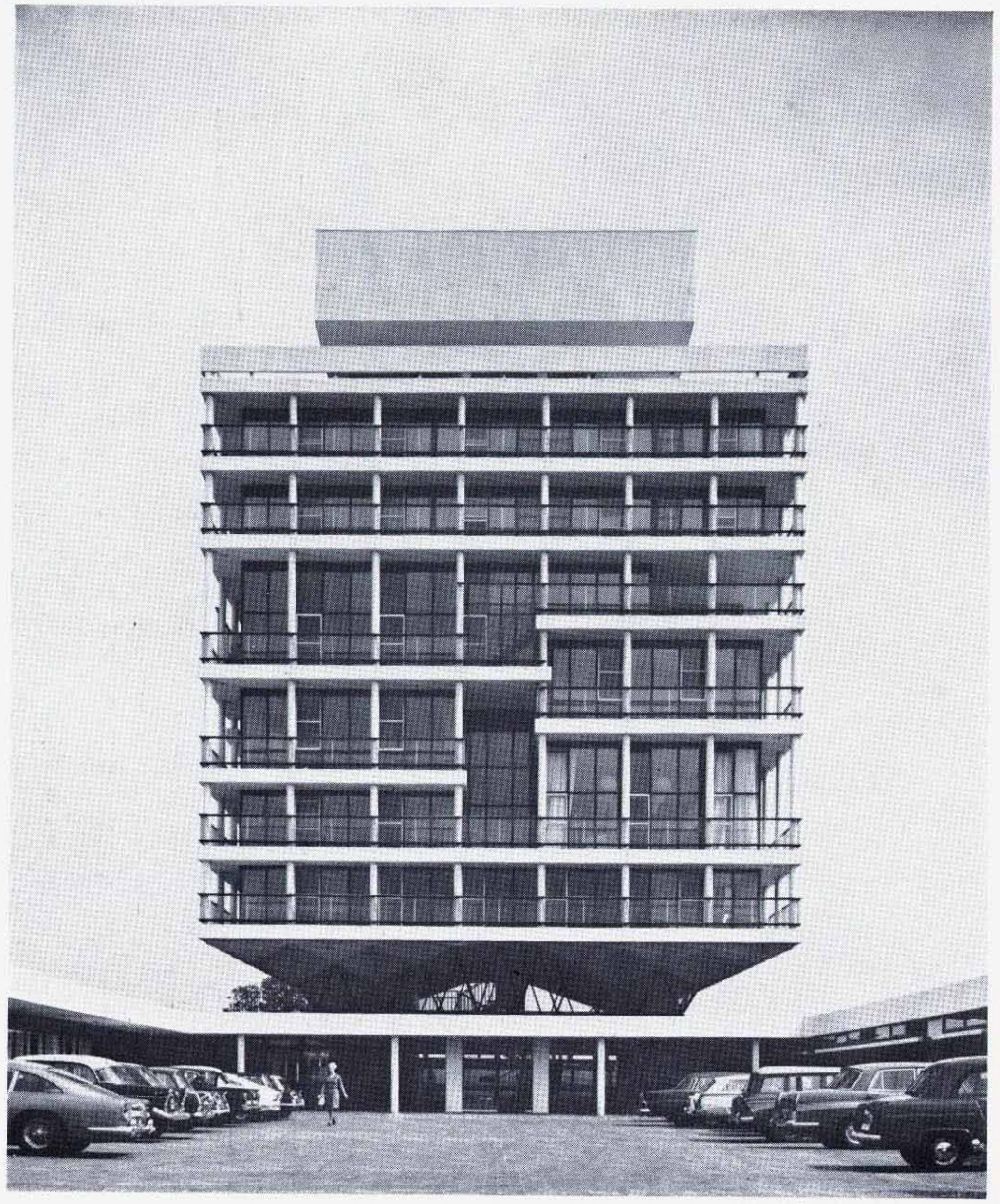
In the northern section of the hospital, which contains the diagnostic and consultative clinics, a variation in construction occurs with the use of precast prestressed concrete frames; internal cross beams span 25 ft. The columns are again circular, 9 in. in diameter, and externally they are set outside the windows, sometimes enclosing the rainwater pipes. As elsewhere, internal and external columns and



Section through the administration block.

Exit from one of the garden courts, by way of steps between sturdy retaining walls of bush-hammered concrete, with flower boxes above.





The administration block seen from the centre of the entrance court.

WEXHAM PARK HOSPITAL: *continued*

edge beams are of white concrete.

As the Chairman of the Hospital Board has said, this particular form of hospital planning and construction will be carefully studied in use, and will provide valuable experience for the building of future hospitals. One wishes it every success.

The architects for Wexham Park Hospital were Powell and Moya (in association with Llewelyn Davies and Weeks); the partners in charge were Philip Powell and Robert Henley, and the assistants in charge were Derek Stow, John Cantwell and Bernard Throp. Felix J. Samuely and Partners were the structural engineers. The general contractors were Humphreys Limited. The precast concrete structural elements were made by David Chaston Limited.

Board-marked concrete tapering columns and faceted ceiling, together with the airy spring of the cantilevered stair on the left, create a lively and welcoming entrance hall in the administration block.

Precast concrete linings for London's new

VICTORIA LINE

VIRTUALLY ALL tunnelling work on London's new underground Victoria Line—some 25 miles of deep-level tunnel, including siding tunnels, a spur tunnel to the rolling stock depot and extensive tunnelling at stations for pedestrian ways and escalators—has been finished. Stations have still to be completed, track laid, signal and control systems installed and rolling stock delivered, but trains should be running on part of the line late in 1968 and throughout by sometime the following year.

Building and equipping the line in that length of time is an impressive accomplishment—the construction time compares closely with that required for the first line of the Milan Metro, a far less complex civil engineering task (*Concrete Quarterly* 61). Unlike most underground lines elsewhere, for instance, the Victoria Line is in deep-driven tunnels throughout—the most difficult, expensive and time-consuming form of construction, but essential in Central London. Altogether there are about 132,000 ft. of railway tunnel driven through the London Clay, and other less hospitable soils.

In addition to the running tunnels, there are twelve stations from Victoria Station to Hoe Street, Walthamstow—a distance of $10\frac{1}{3}$ miles—each involving not only sections of large-diameter station tunnel to accommodate both track and platforms but a network of pedestrian escalator and service tunnels as well. Eleven of the twelve stations provide interchange with either British Rail services or other underground lines, calling for additional passenger access, and at four stations (Oxford Circus, Euston, Highbury and Finsbury Park) the engineering and construction of the line is further complicated by the need to bring the new tunnels alongside existing lines to provide easy same-level interchange. This has meant diverting existing lines at three places while trains continued to run.

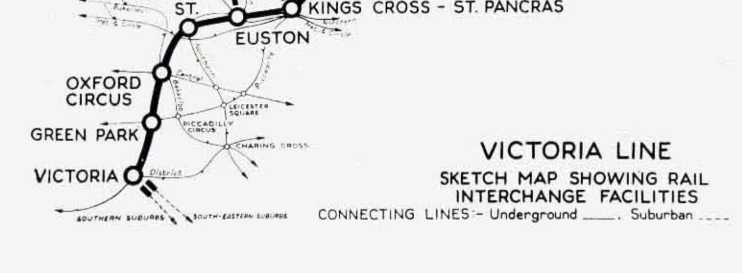
What will it all cost?

Plainly the final bill will be more than the £56 million estimated in 1962, and London Transport—perhaps understandably—is reluctant to make official statements on the final cost. But when all is said and done a figure of £7 million per route mile, including rolling stock, equipment, a fully automated control system and accumulated capital charges, should be fairly near the mark. The Victoria Line will have a capacity of 25,000 passengers per hour in one direction; in motor-age terms the same number of people in private cars would require a motorway with eleven lanes in one direction.

A key to the rapid and economical building of the Victoria Line has been the extensive use of mechanical tunnelling and boltless precast concrete lining—their first large-scale application on a transport project.

Precast lining is not new to London's tube railways. In 1937, faced with a possible shortage of cast iron for bolted segmental cast iron rings—traditional to soft-ground tunnelling since their introduction in Barlow's Tower Subway of 1869 and little changed since—a bolted, reinforced precast concrete lining, similar to the cast iron design, was developed for a short section of the Ilford extension of the Central Line. Ultimately this type of lining was used for some $2\frac{3}{4}$ miles of Underground tunnel, as well as for deep shelter tunnels built during the war.

Although the bolted lining produced economies of some 25 per cent compared with the cast iron lining of the time, it was the development of boltless, largely unreinforced lining, together with the mechanical digging shield, that has resulted in the Victoria Line being lined for some half its length in concrete.



VICTORIA LINE
SKETCH MAP SHOWING RAIL INTERCHANGE FACILITIES
CONNECTING LINES:- Underground ____. Suburban ----

Unlike bolted linings, which are erected in an outsize hole and then grouted solid, the boltless lining requires an accurately driven tunnel of the final size. Rings are erected 'loose' within the tunnel and then expanded against the clay to a tight fit by means of jacks or wedges.

The building of a running tunnel, as practised on the Victoria Line, is an impressive and highly mechanized process. The rotary shield itself, with an outside diameter equal to that of the tunnel, chews its way through the clay, its rows of steel teeth moving at a rate of up to four complete revolutions every minute, pushed forward by hydraulic rams at the rear of the shield acting against the completed lining while conveyor belts carry away the spoil.

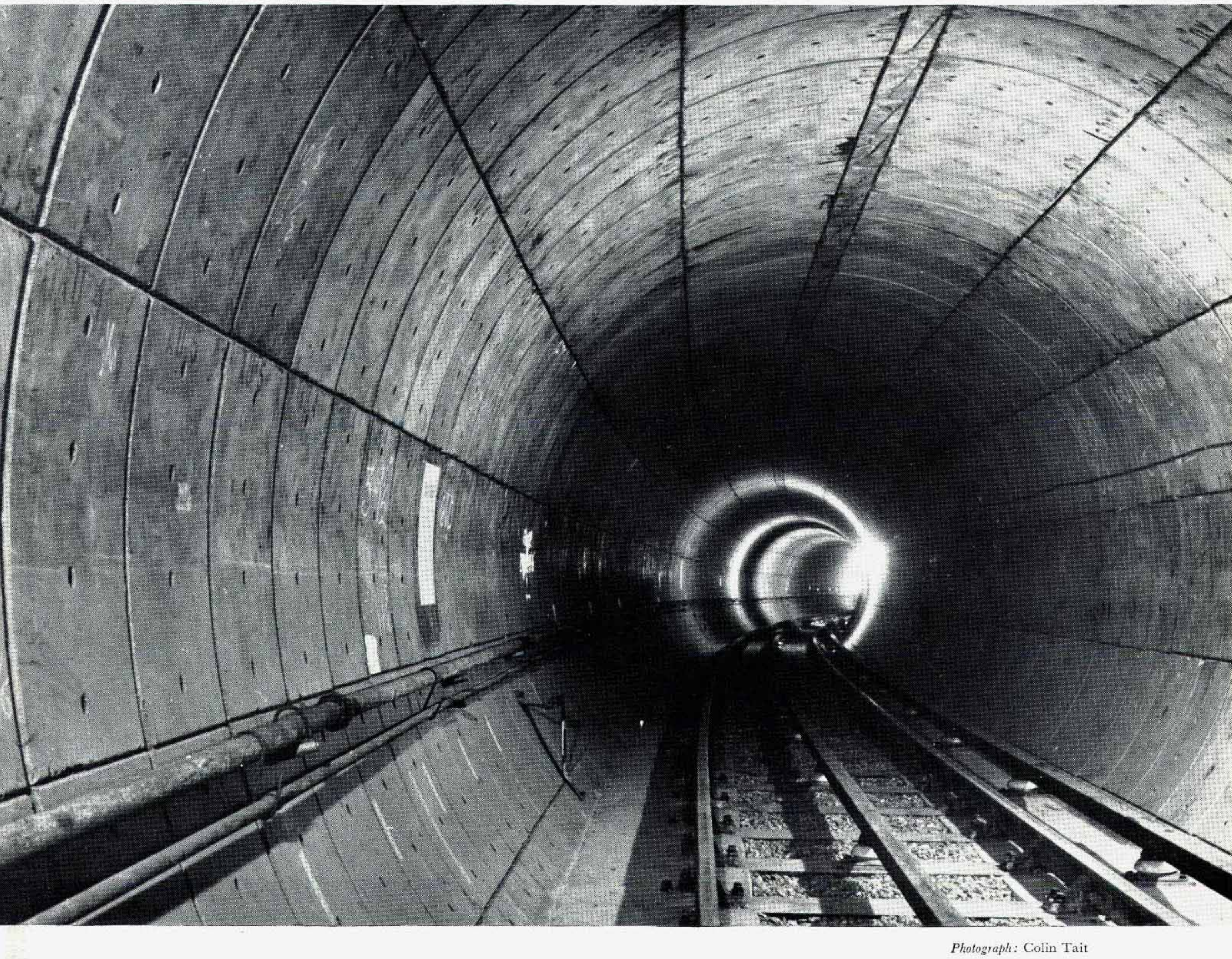
When cutting has advanced the width of one ring (2 ft. in the case of the concrete linings used for the Victoria Line) the rams are withdrawn; hydraulic erecting gear places and holds the ring segments in place while hydraulic jacks expand the lining and packing pieces are inserted.

On the Victoria Line, once crews were experienced, erection of a 12 ft. 6 in. internal diameter ring was regularly carried out in as little as 7 minutes, and on one drive, crews set a world record for soft-ground tunnelling of 476 ft. of completed tunnel in one week.

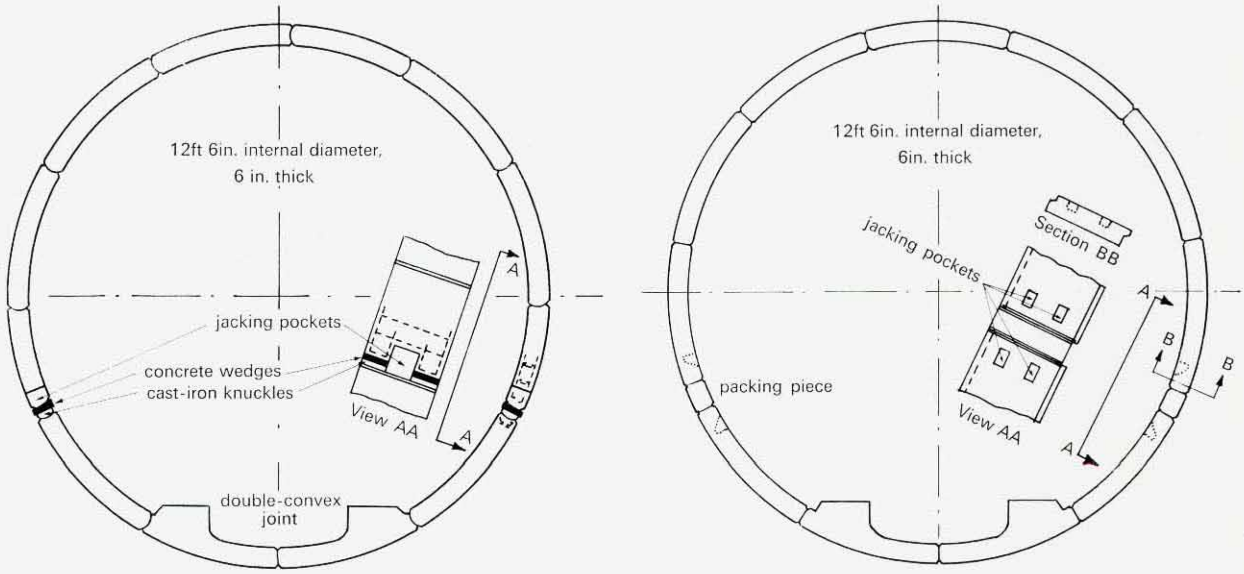
When trains begin to operate over the Victoria Line, they will for part of their journey be using a mile of twin tunnel completed over a year before final authorization for the line was received. It was on this mile-long experimental stretch, from Finsbury Park to Netherton Road, that practical trials of the new tunnelling and lining methods were carried out. From Finsbury Park to Manor House the tunnels were lined with boltless precast concrete linings; from Manor House to Netherton Road, with an experimental boltless cast iron lining. During the construction of these experimental lengths of tunnel, the practicability of mechanical tunnelling and of boltless linings was amply proved, and the basic form of the linings to be used for the main work established although detail changes were made as a result of experience on the concrete-lined section.

For the main Victoria Line construction two

The Finsbury Park southbound tunnel showing the precast concrete lining.



Photograph: Colin Tait



Left: The Mott Hay lining for the Victoria Line. Right: The Halcrow lining.

VICTORIA LINE: *continued*

types of precast concrete lining were used. Both have an external diameter of 13 ft. 6 in. and a thickness of 6 in., and incorporate a shaped invert.

In the 'H' lining, designed by Sir William Halcrow and Partners, there are eleven segments with double-convex joints.

The 'MH' lining, designed by Mott, Hay and Anderson, has twelve segments with knuckled male and female joints except for a double-convex invert joint and with reinforcement in the female joint to reduce the risk of spalling.

In both linings, expansion is by jacks on both sides of the tunnel (roughly at 'four o'clock' and 'eight o'clock'). In the 'H' lining, the resulting gaps of about 8 in. are filled with precast concrete distance pieces selected from a range of sizes, while the 'MH' lining is held by a cast iron knuckle piece and a wedge-shaped concrete packing, the jacking pocket itself being filled with a precast filler block and expanding mortar. Altogether some 20,000 rings of 'H' lining (220,000 segments and 40,000 packing pieces) and 8,000 'MH' rings (96,000 segments, 16,000 jacking pocket fillers and 64,000 wedge blocks) were produced for the line, in addition to the 33,000 segments used in the experimental section.

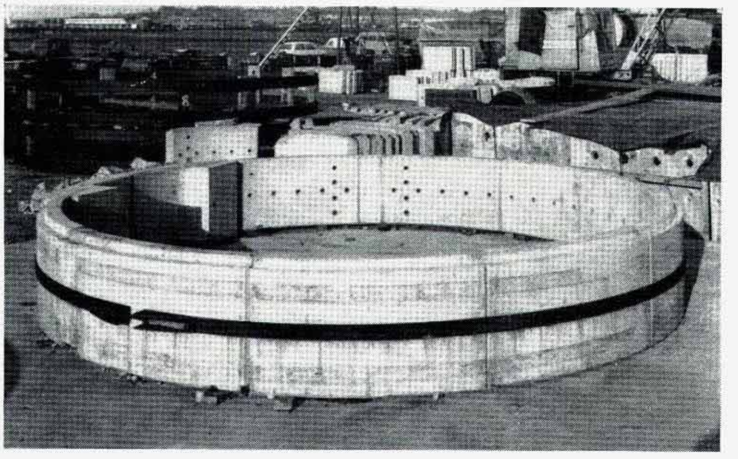
Specifications for the two types of lining were exacting. Minimum 28-day cube strength for both was set at 7,000 lb. per sq. in. with a maximum cement content of 175 lb. per cu. yd.

Tolerances were unusually fine: for the 'MH' segments, for instance, the width of the segments was held to plus or minus $\frac{1}{16}$ in., as was the thickness of the segments. Tolerances came down to $\frac{1}{32}$ in. for the radius of the knuckle surfaces, while holes in the segments were required to be no larger than the $1\frac{3}{8}$ in. specified diameter nor more than .005 in. undersize. 'MH' segments were cast in moulds with a granolithic core and wooden side pallets; moulds, rubbed down and polished after casting, were produced by casting against master segments. 'H' segments, on the other hand, were cast in specially made steel moulds.

In spite of its lower cost, boltless concrete lining has by no means entirely replaced traditional bolted cast iron; boltless linings, requiring a precisely bored hole, are practicable only for mechanically excavated tunnels and while mechanical diggers were used wherever possible on the Victoria Line (a total of eight were used, four built by Kinnear Moodie and four by McAlpine) the difficulty of setting up the mechanical diggers ruled out their use on short drives and oversize station tunnels, which were dug with hand shields. In addition, poor ground conditions between Oxford Circus and King's Cross, and at various other points on the route, called for hand excavation (3,300 ft. of it under compressed air) or for the use of bolted lining in mechanically dug tunnel, and as a result about 32,000 ft. of running tunnel are conventionally lined in bolted cast iron. Of the remainder, suitable for boltless linings, approximately three quarters—about 60,000 ft., mainly between King's Cross and Walthamstow—are lined with precast concrete. Boltless cast iron lining was recommended by the consulting engineers for the Oxford Circus–Victoria section in spite of its appreciably higher cost, largely owing to the fact that the design and the erection procedures used on the experimental section could be employed without modification.

Detailed comparisons of tunnelling costs using different types of lining are difficult if not impossible to make, especially since traditional cast iron lining on the Victoria Line has had to be used on sections that present special tunnelling problems. It seems, however, to be generally accepted—and to be confirmed by experience on the Victoria Line—that for normal tunnel in good blue clay, boltless precast concrete lining produces a saving of some 50 per cent compared with traditional cast iron, while the time required for erection is a quarter.

The most dramatic improvement of all is the increase in overall tunnelling speed and the saving in labour made possible by the combination of mechanical digging and boltless lining either of concrete or cast iron: since the last major pre-war tube extension —Baker Street to Finchley Road, using hand shields and bolted cast iron lining—the maximum progress per week has increased from 86 ft. to 180 ft. on the smaller Thames–Lee water tunnel using hand shields and an early form of boltless concrete, to 360 ft. on the concrete-lined section of the Victoria Line experimental tunnels of 1961 using mechanical diggers, and finally to 476 ft. on the Victoria Line itself—an increase of more than five-fold. In the 25 years between the Baker Street extension and the Victoria Line experimental tunnels the volume of tunnel completed per man hour rose even more markedly, from 9.5 to 92.4 cu. ft. per man hour.



A 12 ft. 6 in. internal diameter ring of precast concrete tunnel-lining segments under test for the Victoria Line.

Inevitably, with tunnelling on the Victoria Line virtually complete, a question of major importance is 'Where next?'.

Parliamentary powers have already been secured for the extension of the Victoria Line to Vauxhall, Stockwell and Brixton, tapping important British Rail services and London Transport's own Morden line short of Central London. There is mounting pressure for early Government authorization; indeed, it has been estimated that, if a start is delayed too long and the specialized engineering and constructions teams and plant organizations from the Victoria Line are allowed to break up, the cost of the extension would be increased by about one million pounds in one jump, and advocates of an early start point to the Minister of Transport's announced policy of 'continuity of contract' on motorway construction as a precedent.

Another short extension for which parliamentary powers exist would carry the Holborn–Aldwych shuttle line to Waterloo, easing pressure on existing cross-river transport and giving a purpose in life, after more than half a century, to this little-known and least-used appendage of the Underground.

As transport planners see it, however, these two extensions, important as they are, are merely preliminaries to a much bigger project, equal in scope to the Victoria Line itself. If, as London Transport hopes, early starts can be made on both short extensions, their construction would keep men, machinery and suppliers occupied until work could begin, in 1969 or 1970, on the Fleet Line, a second new cross-London link extending south-eastward from a junction with the Stanmore Branch of the Bakerloo Line at Baker Street by way of Bond Street, Green Park, the Strand, Fleet Street and Fenchurch Street Station to the New Cross–Lewisham area, not only relieving congestion in the central area of the Underground network but bypassing the Southern Region bottleneck at London Bridge—grossly overloaded now and likely to be still working to maximum capacity even after massive improvement works already proposed.

The speed and economy of boltless precast concrete lining, in conjunction with mechanical tunnelling, has been solidly established on the construction of the Victoria Line. There is no doubt now that it will play a major role in the further extension and rationalization of London's transport.

Construction of the Victoria Line is being carried out under the general direction of the London Transport Board's Chief Civil Engineer, H. G. Follenfant, OBE, TD, BSC(Eng), MICE, AMInstT; New Works Engineer for the Victoria Line is E. W. Cuthbert, MSC, MICE, ACGI. Consulting engineers to the Board are Sir William Halcrow and Partners, and Mott, Hay and Anderson.

Main contractors for the running tunnels are John Mowlem and Company Limited (Victoria to Oxford Circus), Mitchell Brothers Sons and Company (Oxford Circus to King's Cross), Kinnear Moodie and Company Limited (King's Cross to Finsbury Park), and Charles Brand and Son Limited (Netherton Road to Walthamstow Hoe Street). Contractors for the two twin half-mile experimental sections between Finsbury Park and Netherton Road, complated in 1961, were Kinnear Moodie and Company Limited and Edmund Nuttall Sons and Company (London) Limited.

Precast segments for the concrete tunnel lining, worth £700,000, were manufactured by Kinnear Moodie (Concrete) Limited, and mechanical digging shields by Sir Robert McAlpine and Sons Limited (four machines) and K.M. Tunnelling Machines Limited, a member of the Mitchell Construction Kinnear Moodie Group (four machines).

Chapels in concrete

Coverdale and Ebenezer Congregational Church, Stepney

built of white textured in situ concrete

Photographs: Crispin Eurich

JUST ROUND THE CORNER from Shadwell Underground station, in London, E.1, is a small white concrete church—a simple angular building in keeping with this tough, friendly part of dockland with its strong sense of community. The church is just off Watney Street—a typical Stepney street with a hint of exotic spices in the air, a market full of cheap clothes and vegetables, two or three pubs and—still—a few lingering houses of the kind that used to typify the East End. The new Coverdale and Ebenezer Congregational Church in Bigland Street has, however, been built as much in the shadow of tower blocks as terrace houses.

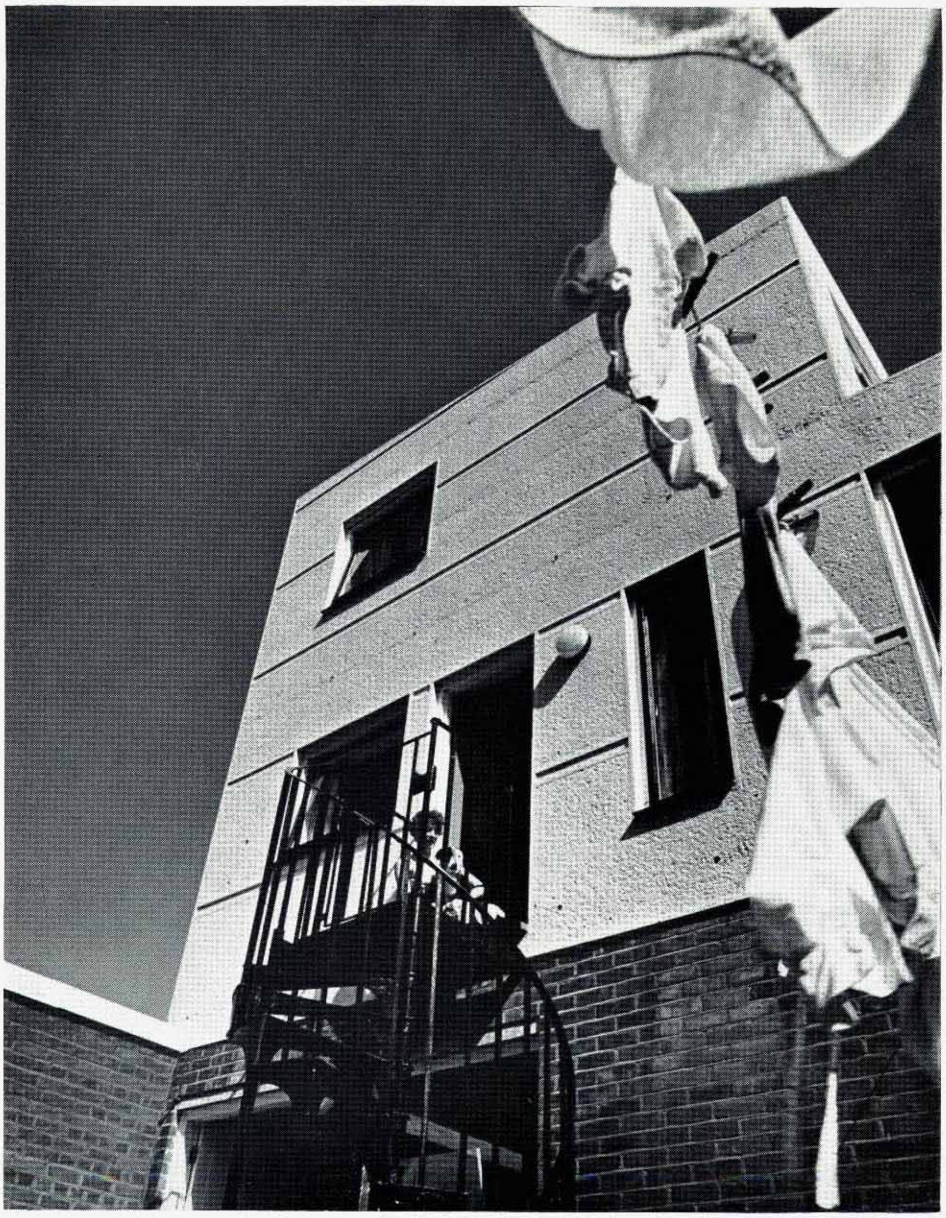
The original church was bombed early in the war, and its siting changed to Bigland Street. The new site is small—no more than 65 ft. by 85 ft.—and into this cramped space has been fitted a large and small church hall, a vestry, common room, a manse, lavatories, basement storage and garage space—all on three floors. And because this neighbourhood has its quota of small boys, large areas of glass were definitely out: the exterior walls have few windows, and to compensate for this a small internal garden courtyard has been contrived as a lung for the whole building. This is 4 ft. below pavement level and has been turfed and planted with silver birch and climbers.

The large church hall holds 100 people at the main floor level and 75 in a stepped gallery—a traditional arrangement. The seating plan is also traditional. The most striking aspect of this space is the skilful arrangement of natural lighting which is mostly concealed and floods down the walls around a steeply raked ceiling, throwing a freestanding timber cross (brought from Cornwall) into dramatic silhouette. The cross is, in fact, lit from above and behind by a strip of patent glazing.

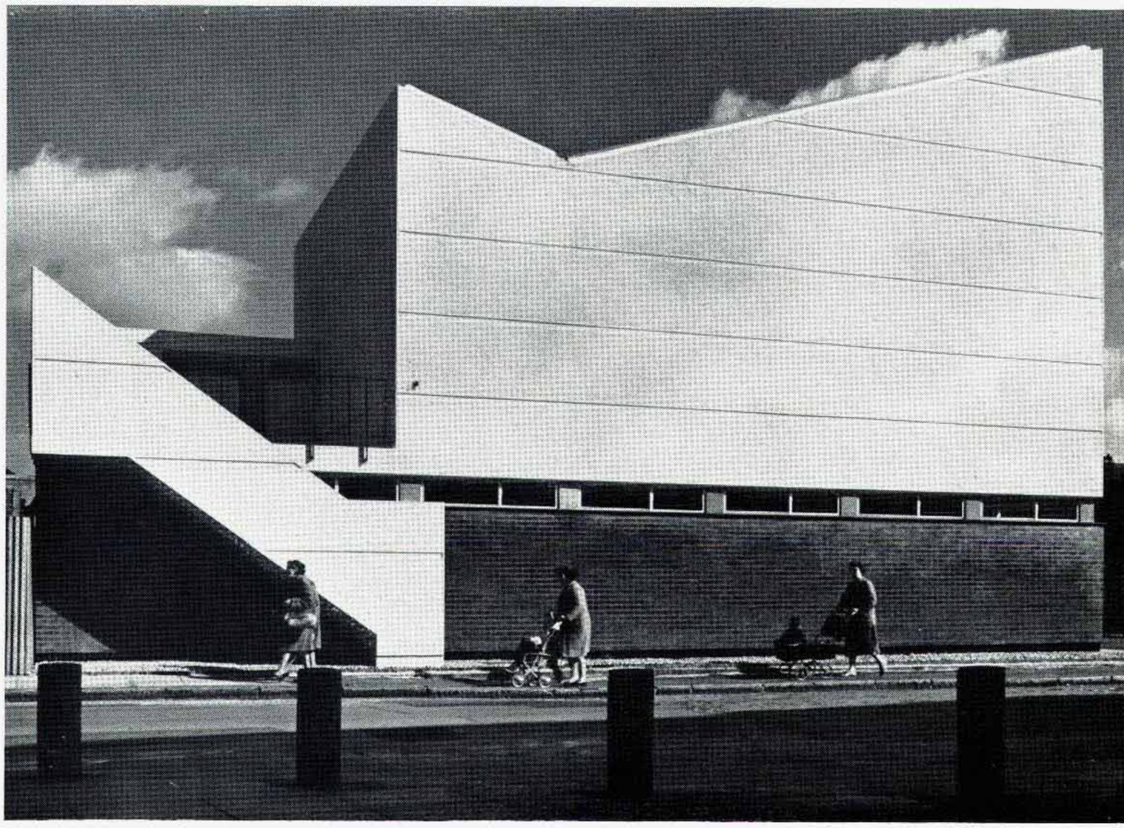
The structure is a combination of in situ reinforced concrete columns, beams, floor slabs and walls—the whole covered by a series of lean-to roofs. The concrete walls and roof slabs are in some cases carried by frames and in other cases by brickwork.

Outside and in, a special attraction of this building is the use of point-tooled white concrete walls with a very even texture. The walls were cast in lifts about

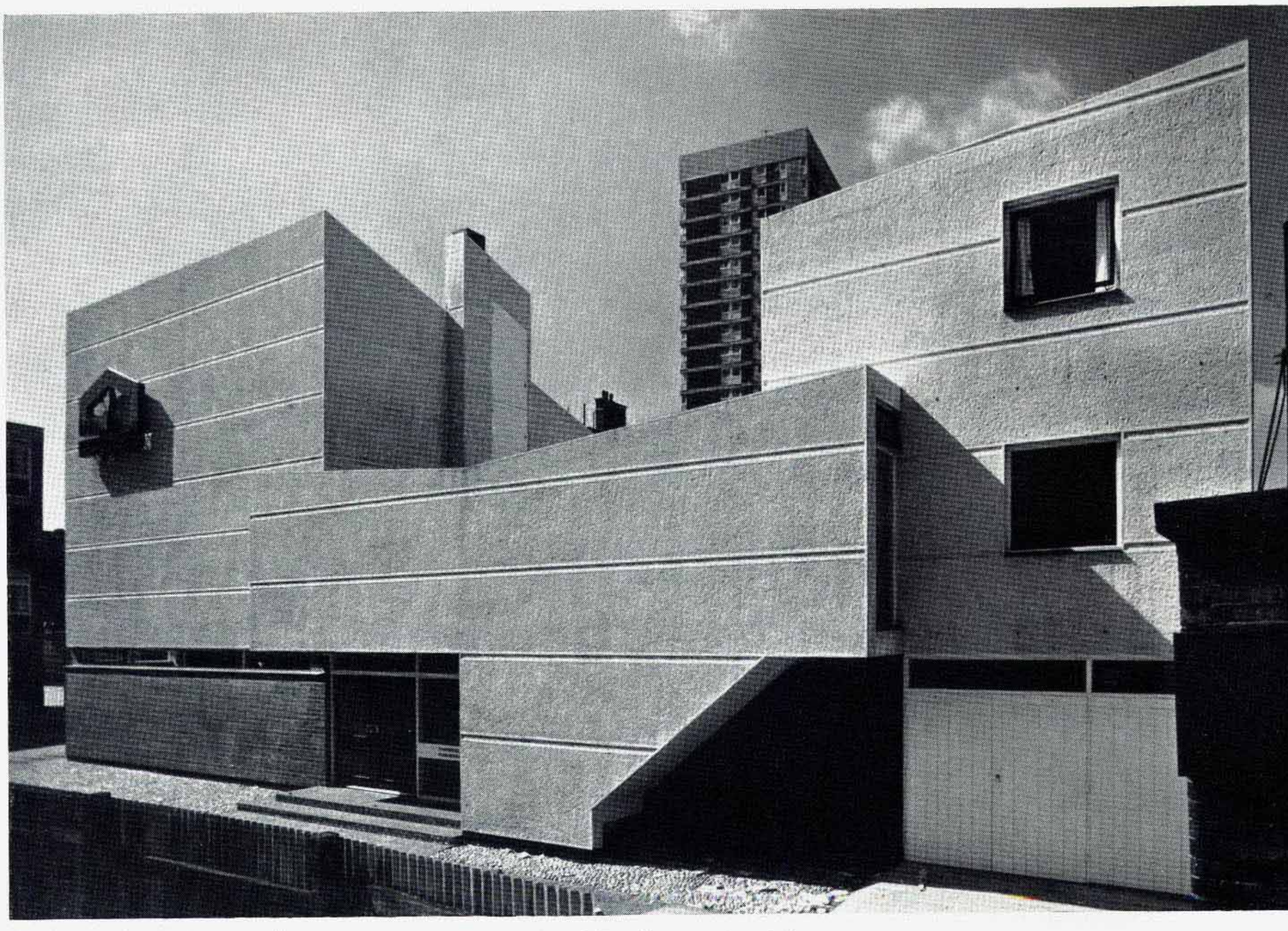
Interior of the main church hall, looking down from the stepped gallery, showing the way in which light floods down from the sides and behind the cross (see section).



White point-tooled concrete in the manse – an integral part of the church – with appropriate domestic trimmings.



The side of the church, from Bigland Street, showing the external stair, and the importance of the horizontal recesses to conceal lift marks: white point-tooled concrete is used for the main external walls, with dark blue brickwork at the base.



The front of the church, and main entrance, with the manse on the right and garage space below. The white concrete is carried round the entire building.

CHAPELS IN CONCRETE: *continued*

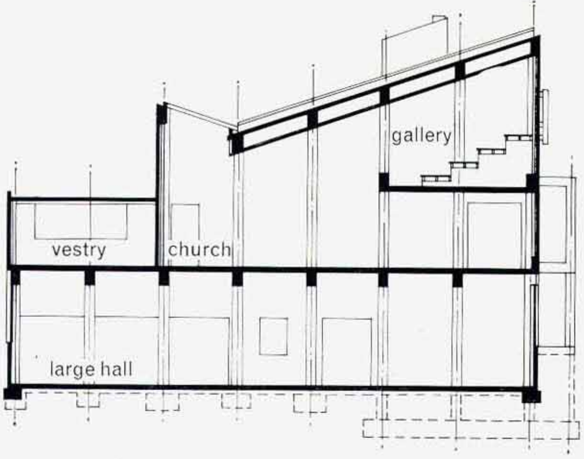
3 ft. high and each lift mark is concealed by a strongly marked horizontal recess made with a formwork liner. There are also $\frac{1}{2}$ in. square vertical rebates at the corners.

The columns adjoining the backs of the walls were cast first, with the necessary reinforcement projecting from the column outer face to fit around a single reinforcement layer in the wall. This face was roughened on removal of the formwork to provide a key, and the 4-in. concrete outer wall cast against it.

The mix for the white concrete walls comprised $2\frac{1}{3}$ parts 'Permwhite' $\frac{3}{8}$ in. aggregate, $\frac{2}{3}$ part 'Permwhite' $\frac{3}{16}$ in. aggregate, $1\frac{1}{2}$ parts 'Permwhite' aggregate passing $\frac{1}{16}$ in. down, and 1 part white Portland cement. The average strength of the concrete was 3,000 lb. per sq. in. at seven days.

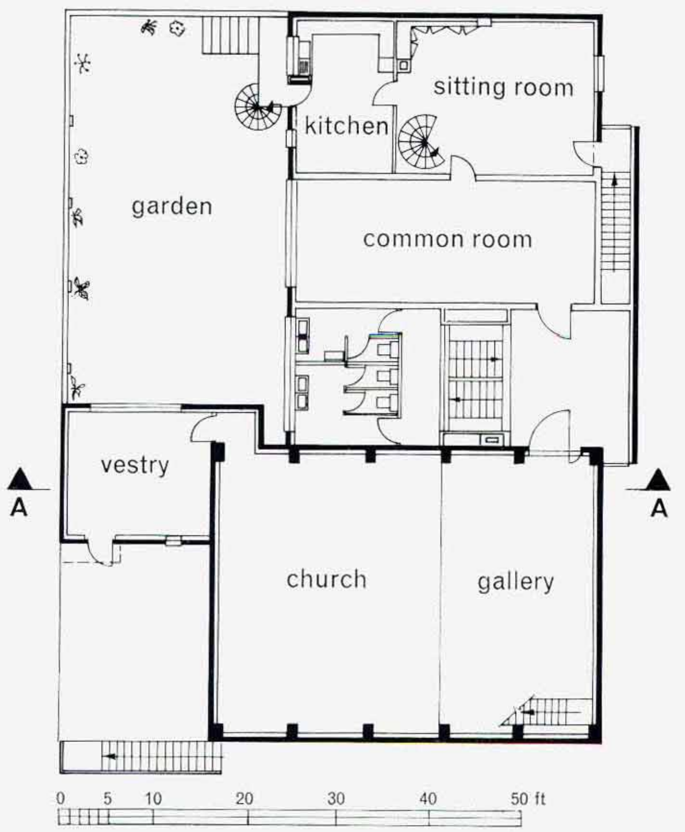
The decision to point-tool the walls was made at a pre-contract stage and was not a means of concealing blemishes. In fact, there was not one poor batch or lift of concrete anywhere in the building. Point-tooling was considered to be more suitable than bush-hammering over such large continuous areas, and certainly the texture achieved is remarkably even. A 1 in. wide smooth margin has been left around all openings in the concrete walls; the reveals are also smooth. Weep holes, to drain channels formed

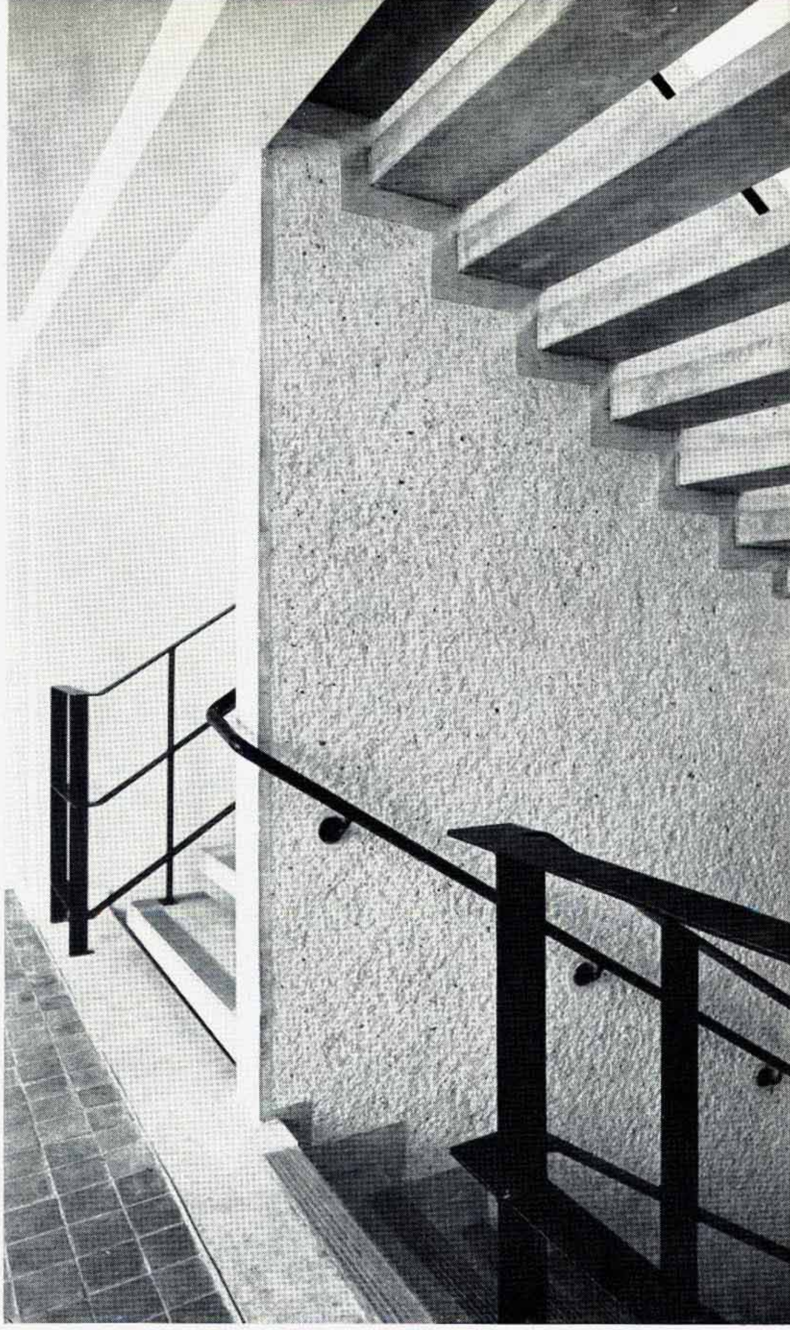
The font, immaculately made in smooth white concrete.



Section A–A.

First floor plan.





A particularly good example of point-tooled white concrete – in this instance carried out evenly and effectively on the staircase wall in the main entrance, and enhanced by the simple robust detailing of handrails.

on the inner faces of the concrete walls, have been provided at the bottom of the walls; these are inclined at an angle of 45° and are formed of transparent plastic tubing cast in with the concrete. The textured white concrete is contrasted with blue-black brickwork at the base of the building. Colour has been introduced on the soffits of overhanging parts such as the vestry, main entrance and the two external staircases.

Internally, the spine wall of the main staircase is also of point-tooled white concrete, whilst the cantilevered treads of the stair are in smooth concrete with cast-in non-slip nosings. All the internal surfaces of the building have been treated simply and the church halls are both finished with concrete brick-work between plastered columns. Elsewhere, internal walls are of brickwork or lightweight concrete insulating blocks. Woodwork is of iroko. Particularly successful are the font, lectern, side table and communion table—all simply detailed and beautifully made in smooth white concrete.

The paved forecourts to the east and south of the church are of coarse cobbles with a margin of blue engineering bricks.

The general standard of finish and workmanship in this church is excellent.

The ultimate cost of the contract, including such items as furniture and fittings, was in the region of £65,000—perhaps a surprisingly low figure.

The architect was Alan Cooke, ARIBA, with Anthony J. Matthes, ARIBA, as project architect and Roger C. Youngs as senior assistant in charge. The structural engineers were the Prestressed and Re-inforced Concrete Engineering Company Limited. The contractors were Field Davis Limited.

St. Michael's College Chapel, Kirkby Lonsdale

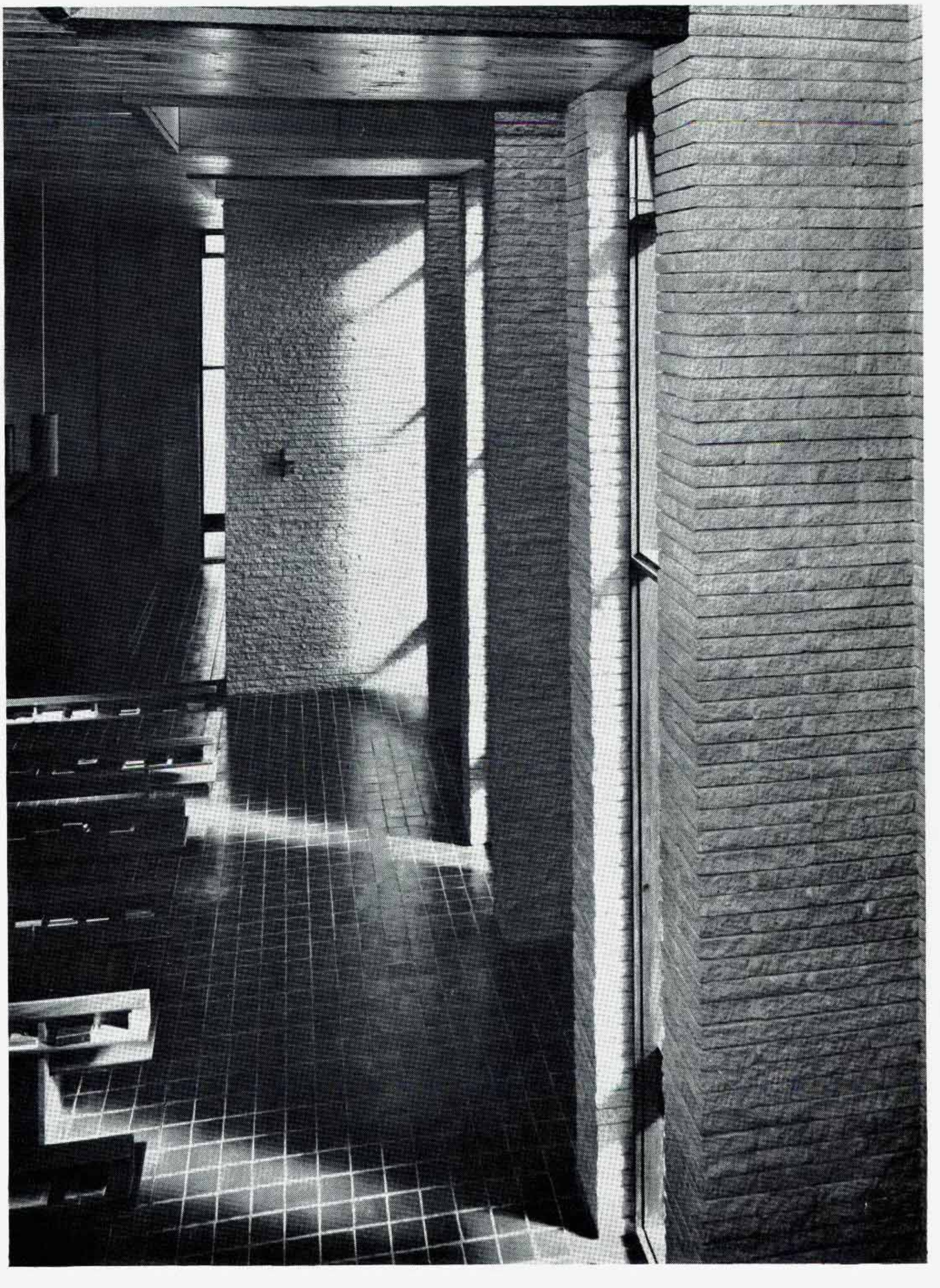
built with split slabs

A STRIKINGLY ORIGINAL method of converting standard-size concrete paving slabs to building blocks has been used for a chapel, in Westmorland – a technique with considerable architectural possibilities.

The hydraulically pressed slabs, formed with specially selected aggregates and $2\frac{5}{8}$ in. thick, were split longitudinally and transversely to form concrete blocks of different sizes to suit the various structural functions of the walls of the building. The splitting process produced blocks varying in size from 16 in. by 8 in. to 8 in. by 4 in. – and all $2\frac{5}{8}$ in. thick.

The decision to split the blocks from relatively large slabs was influenced by two basic requirements: first, blocks with three split faces to form projecting

Photographs: Elsam, Mann & Cooper (Manchester)



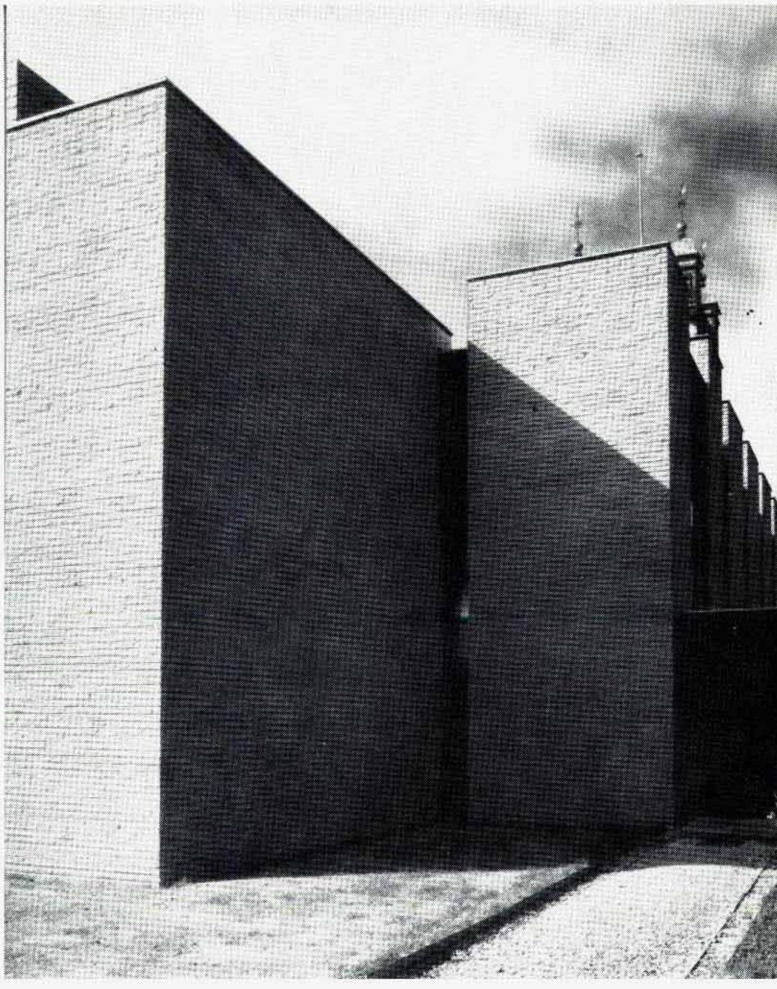
The side walls of the chapel, showing the way the light falls on the rough-textured concrete blocks, laid in 3 in. courses.

nibs were required; second, by using $2\frac{5}{8}$ in. thick slabs it was possible to reduce the height of courses to a desired 3 in. The use of standard blocks would have provided only two split faces and a minimum course height of 4 in.

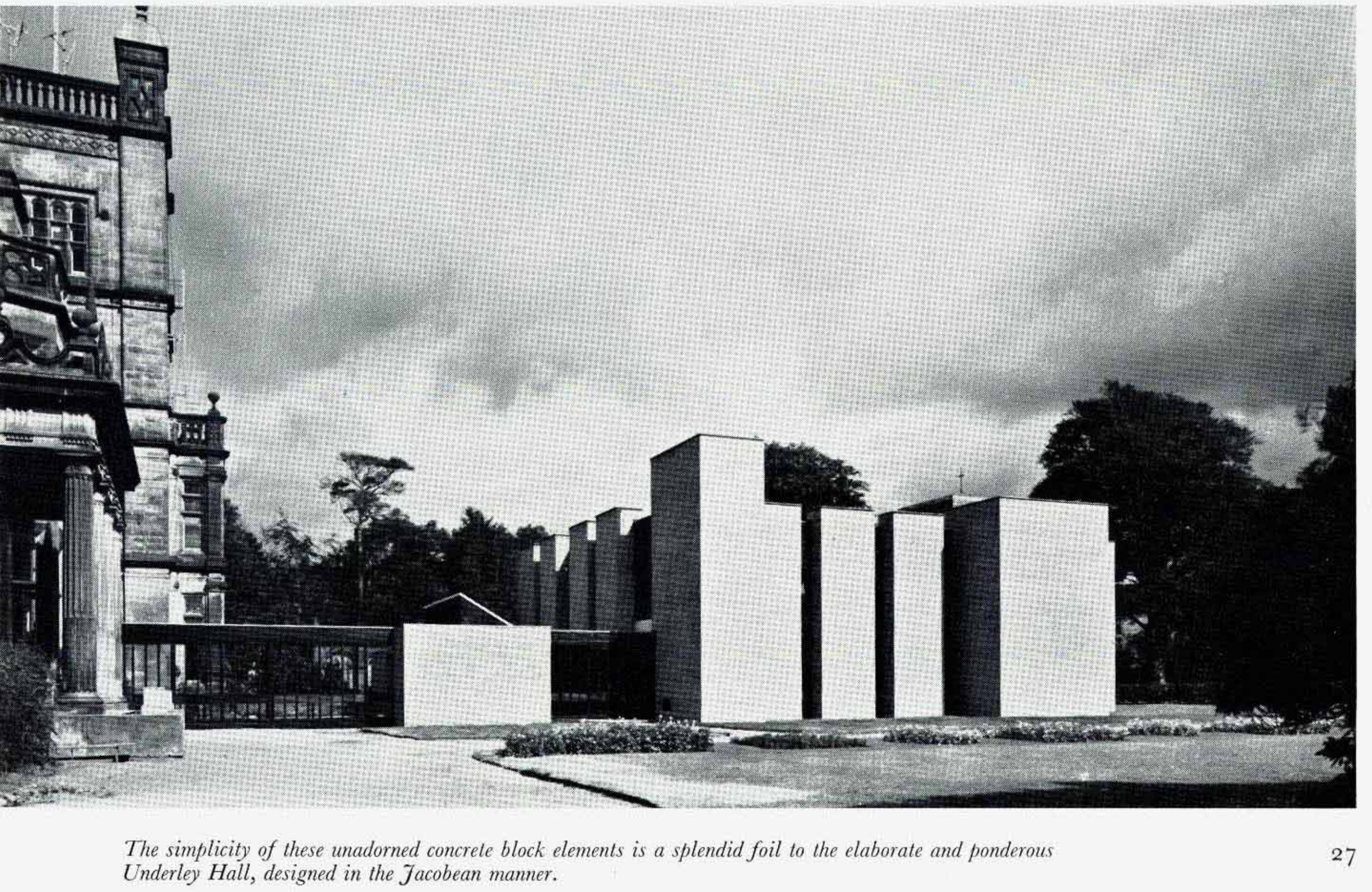
The chapel has been built as an adjunct to Underley Hall, a Jacobean style mansion, which was acquired by the late Dr. T. E. Flynn and converted for use as a Junior Seminary for the Roman Catholic priesthood. In an institution of this nature the chapel must, of necessity, be the focal point – not only for daily celebration of the Mass, but also for the training of potential priests in the ritual ceremonies of the Roman Catholic faith. For this reason the interior had to be designed so that the full attention of the congregation is focussed upon the celebrant priest; the building also had to afford facilities for confessionals, for robing and for the storage of vestments, communion plate, crosses and candelabra.

The interior views of the new chapel of St. Michael's College reveal how the architects have achieved a highly aesthetic solution to the functional problems.

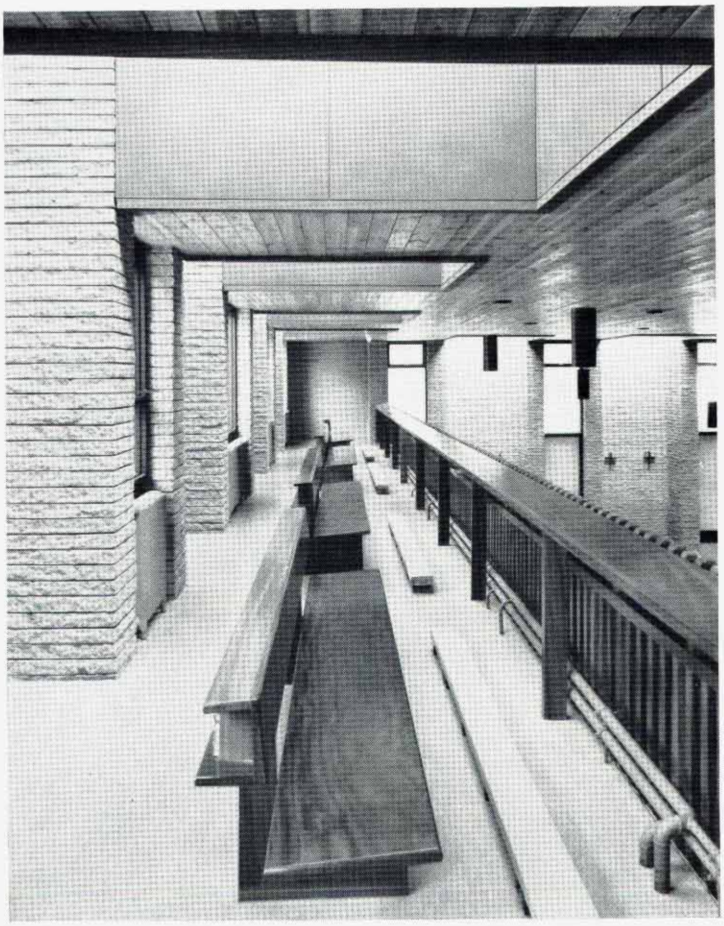
Soft light – much of it from above and from tall narrow windows – throws the textured concrete walls into high relief. There are no mural distractions – even the Stations of the Cross are simply represented by small timber crosses – so that the congregation of 180 students and 16 priest-tutors can devote full attention to the words and actions of the celebrant and his servers at the free-standing altar. Side-chapels and confessionals are placed behind the congregation



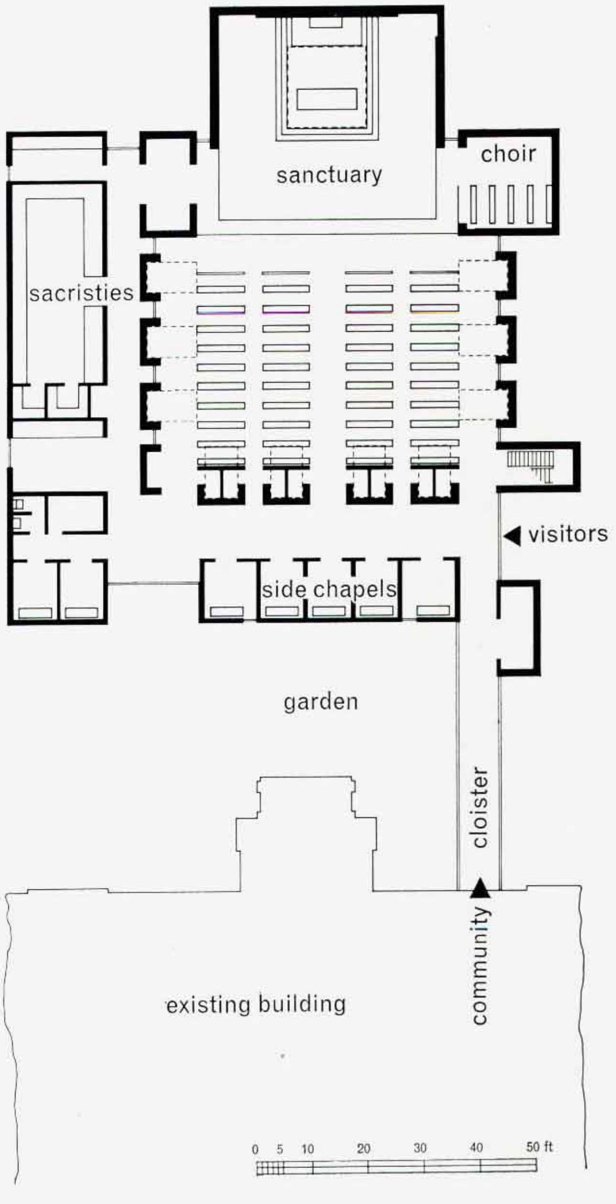
Externally, as well as internally, much depends on the texture, narrow coursing and crisp jointing of the blockwork.



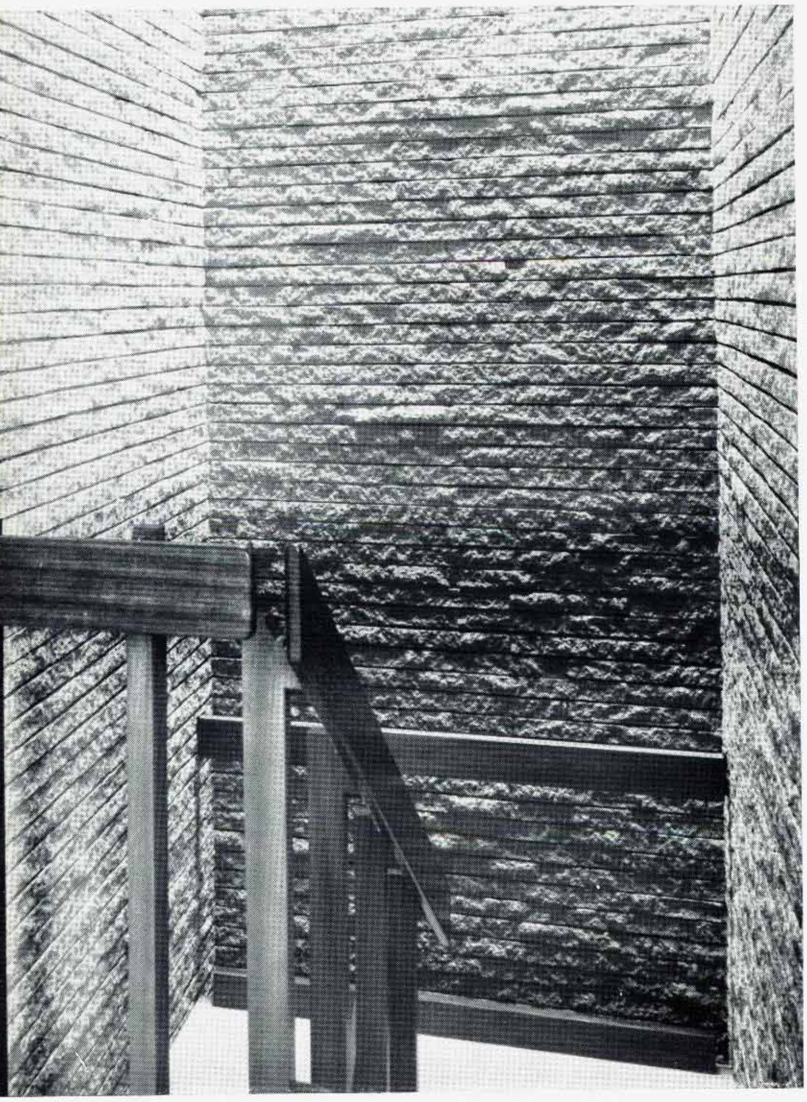
The simplicity of these unadorned concrete block elements is a splendid foil to the elaborate and ponderous Underley Hall, designed in the Jacobean manner.



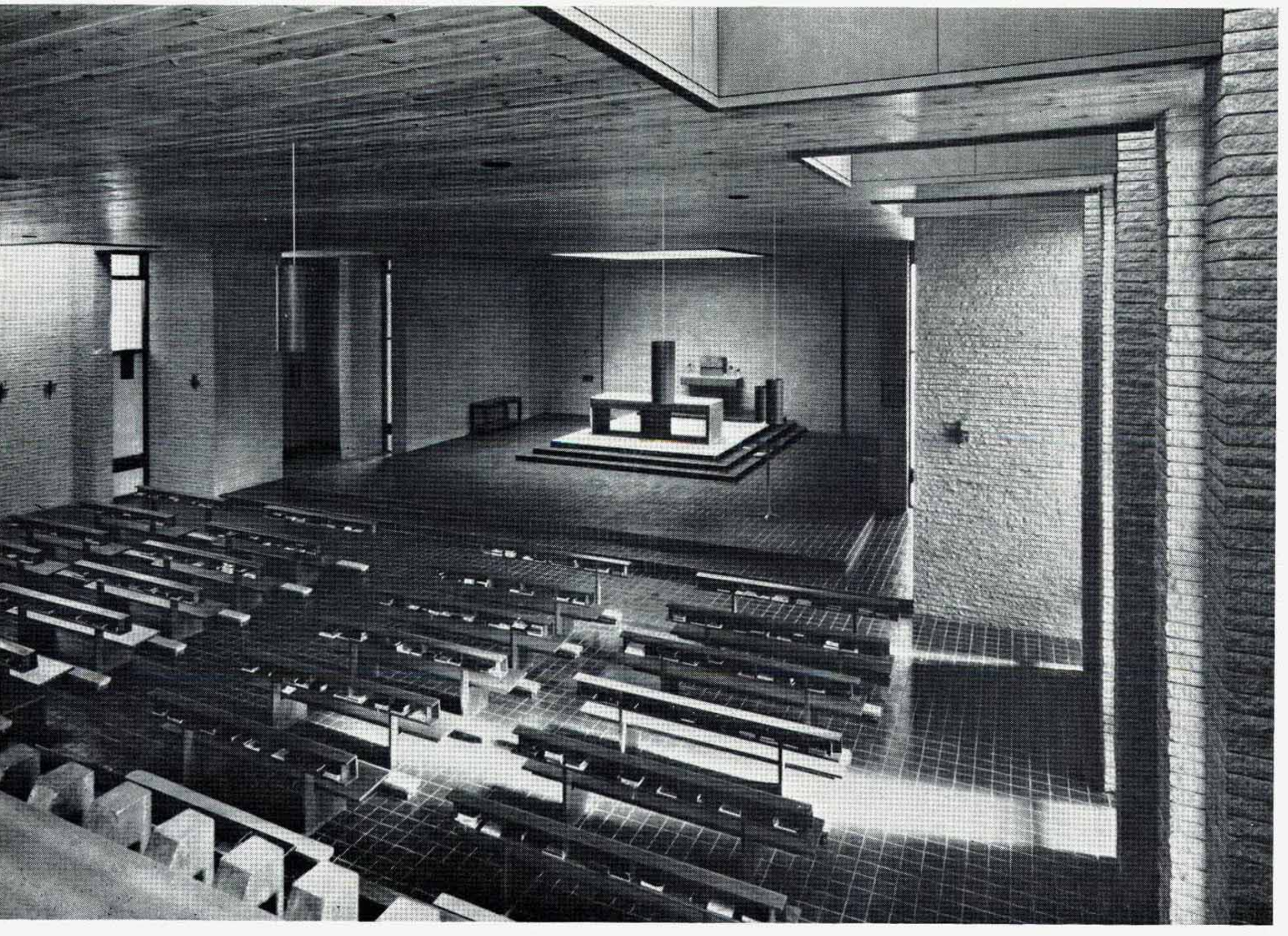
Left: The gallery.



Plan of the chapel.



Top-lighting throws the textured blockwork into high relief.



General interior view of the chapel, showing the serenity obtained by concentrating on textures, simple finishes and subtle lighting, much of it indirect, rather than wall decorations.

and, above these, is a gallery for visitors. The choir is also removed from visual attention, being placed in a wing at right-angles to the sanctuary. Two more small chapels and three sacristies for robing and preparations for the Mass, together with storage for devotional objects, are positioned beyond the north wall of the nave.

But it is the monastic atmosphere of the interior that is particularly striking, helped by the diffused light over rough-hewn walls formed from the split concrete paving slabs.

The slabs were produced to standard dimensions – 3 ft. long by 2 ft. wide by $2\frac{5}{8}$ in. thick and were then split transversely and longitudinally to form building blocks $2\frac{5}{8}$ in. thick.

The block manufacturers co-operated with the designers in experimenting with various aggregates to produce slabs which, when split, would reveal a colour and texture that would blend with the old weathered stone masonry of Underley Hall – yet, at a considerable saving in cost as compared with quarried stone. Eventually, a concrete mix was decided upon which consisted of 1 part sand, 4 parts Dyserth lime dust and 6 parts $\frac{3}{8}$ in. cream-coloured Breedon limestone aggregate.

Cavity walls are formed with an outer leaf of the 4 in. blocks, a 2 in. cavity and an inner leaf of the 8 in. blocks. In view of the unorthodox dimensions of the units the architects, at the design stage, prepared bonding sketches which were sent out with the invitation to tender, and full working drawings for the bonding pattern of each wall were subsequently supplied to the contractor.

As the ends of the blocks were, naturally, rugged – due to the splitting process – all vertical joints were made flush. The horizontal joints between courses were raked out and finally rounded with a finishing tool; these longitudinal shadowed recesses are a foil to the vertical emphasis of the shafts that form the principal features of the building.

The chapel was designed for the Lancaster Roman Catholic Diocesan Trustees by Building Design Partnership – the design team included William White, ARIBA, John Sheridon, ARIBA, and W. E. W. Brook, BSC, AMICE, AMISTRUCTE, the structural engineer. The general contractors were Arthur O. Thoms Limited and the split concrete paving slabs were made by Forticrete Limited.

Photographs: Kershaw Studios, York

York concrete 1912

by George Perkin

'Through the munificence of the President of the Yorkshire Philosophical Society, Dr. Tempest Anderson, there will be opened today a new wing . . . forming a commodious and up-to-date lecture theatre . . . it is claimed that the 46 ft. beams form the greatest span of ferro-concrete in Great Britain. The whole structure has been thoroughly tested for stability, and has stood the severe tests in the most satisfactory manner . . . the outer walls, floor and roof are constructed of ferro-concrete, and the whole structure is designed to harmonize with the existing building. The existing shrubbery effectively screens the lower part, while revealing the architectural ornament and detail near the skyline.'

The Yorkshire Herald, 6 June 1913

YES, THIS IS CONCRETE. Not, as you might think, stone. Of course, concrete has no business to be masquerading as stone, but this is not really the point. The point is in the weathering. What you are looking at is exposed in situ board-marked concrete 55 years old—the building was put up in 1912. And it has weathered—all those who worry about concrete growing old gracefully, please note—with distinction and even vitality.

The Tempest Anderson Hall in York is a structural concrete lecture hall, measuring some 79 ft. long by 47 ft. wide. It was added to the 1829 York Museum—a building designed with full classical rites, including a Doric portico, in the local buff-coloured stone. (The building is beautifully sited in parkland, among the ruins of St. Mary's Abbey where the mystery plays are performed every three years.)

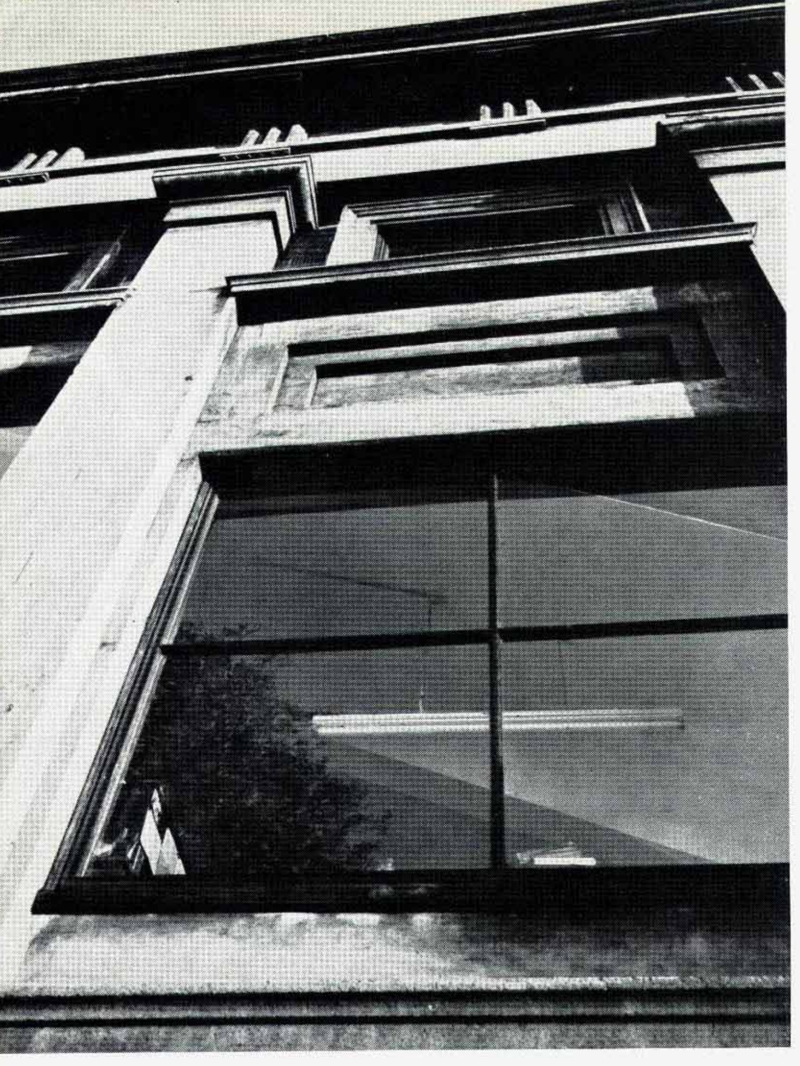
Apart from anything else, the fact that the façade

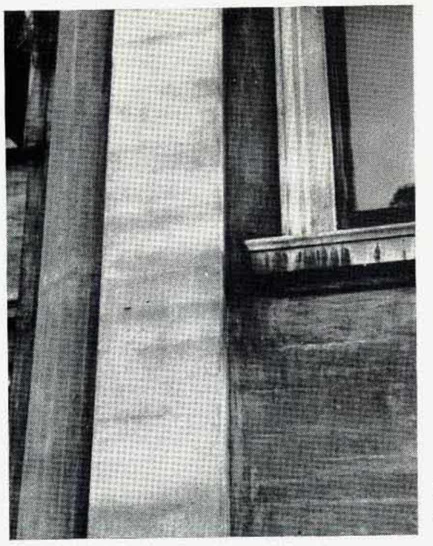
Left:
The main façade of the Tempest Anderson Hall, entirely carried out in board-marked in situ concrete. Articulation of the elements has been helped by weathering. The grilles below windows are more recent and the surrounding patches caused by making good.

The entrance porch, built with astonishing precision of formwork. Note the use of horizontal and vertical boarding – the latter is 2¼ in. wide on the rounded corner pilasters.

of the lecture hall is of concrete cast against what must have been astonishingly elaborate formwork—the whole to match in precise detail the existing stone front of the museum—is historically interesting. This is one of the very first examples of exposed concrete work in Britain, along with Christiani and Nielsen's oil works at Erith, built in 1913-17 (*The Architectural Review*, October 1966). The lecture hall was actually designed by E. Ridsdale Tate and built by the then Trussed Concrete Steel Company, now Truscon Limited. Records as to how this amazingly precise bit of concrete was achieved have, alas, disappeared into the dust, although we can read quite a bit about the building in a general sense in *The Architects' and Builders' Journal* (now *The Architects' Journal*) for 17 July 1912.

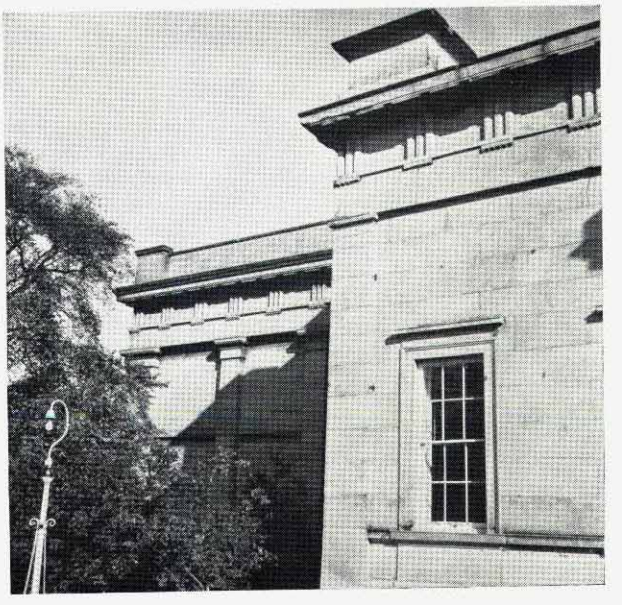
This may be an example of the bogus use of concrete, in so far as it imitates stone, but the lesson of the weathering is worth taking note of. It has weathered with lively variations and some subtleties of colour. The pilasters, architraves and projecting parts which receive most washing down are a warm yellowish-grey. The recessed and more protected panels, by contrast, are much darker and of a brownish colour. At the base, and on the plinths, there are drifts of silver, merging to black, with patches of algae—this part not at all unlike the behaviour of stone. The main faults in the concrete are where some ventilation grilles below windows have been renewed and the surrounding concrete hacked out and made good—nothing much can be done about this. Elsewhere, however, there is no evidence of making good, and the quality and workmanship of the concrete, not to mention the trouble taken over the formwork, seem to have been first class. Generally the surface texture has remained dense and even, and only on the





Corner detail of the porch.

Left: View looking up the façade, showing the sharpness and depth of modelling in the elements.



Concrete to the left, stone to the right: the point at which the 1912 Tempest Anderson Hall and the original 1829 York Museum meet.

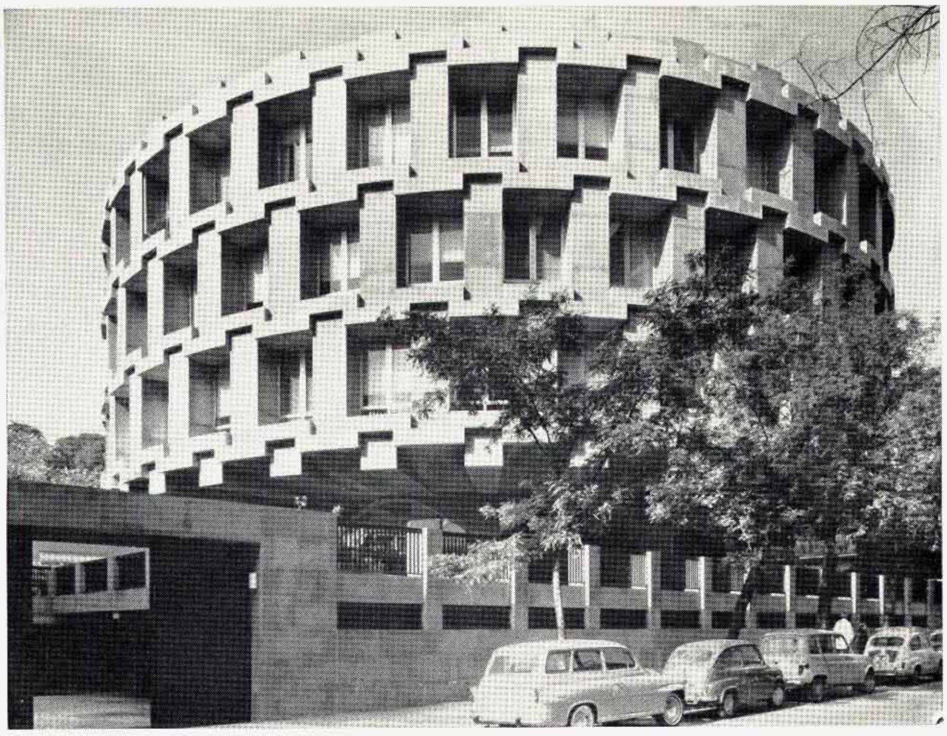
upper surfaces of the mouldings has the matrix slightly eroded.

Most of the board-markings are horizontal, with 4 in. wide boards. Perhaps something more might have been done with these and the different elements articulated, with vertical boards for the pilasters and horizontal ones for the panels—or something of the sort. On the small carefully detailed porch this has, in fact, been done and the rounded pilasters at the corners are cast against 2¼-in. vertical boards which have weathered very well indeed, contrasting with the horizontal wider ones elsewhere. These narrow boards have proved particularly worthwhile.

Perhaps one of the most important lessons of the whole exercise, however, is that the success of the weathering seems largely due to the mouldings, drips, projections, cornices, architraves, pilasters and full repertoire of classical impedimenta which comprise the front. It is these, of course, which break up the surfaces and control the stains, streaks and ravages of time which all facing materials are heir to. Thus it is not possible for a blemish to reach any size and get out of hand: it must inevitably hit a ledge or projection before it becomes an eyesore.

So we come back to the old question which has been taxing architects and others for so long: is discolouration due to weathering really only acceptable in stone and not in concrete? With stone, of course, the use of small units varying slightly in colour is a great help—from which one might deduce that large unbroken units of concrete are difficult to manage from the weathering point of view. But—to risk stating the obvious—the front of the Tempest Anderson Hall proves again beyond question that it's not so much what you use but the way that you use it that may count in the end. And if concrete is broken up into different planes, it is likely to weather every bit as well as stone—differently, of course, but quite as interestingly.

Also one might deduce that the trappings of classical fronts were not only connected with academic attitudes or sentiment or social vanity. They had a function as well. The function of weathering. Not that anyone in their right mind would suggest that we repeat the experiment, capital for capital. But there is still a principle here for us in the 1960s—to be applied after our fashion.



British Embassy, Madrid

THE new offices for the British Embassy in Madrid, opened last October, are housed in a circular building raised on stilts, in a congested part of the city. In the centre there is a circular court with a fountain pool which cools condensed water for the air-conditioning plant. The in situ reinforced concrete structure comprises solid slab floors spanning between inner corridor and outer wall columns. At first floor level there is a deep overhang beyond a ring of exposed concrete arches below. The heavily modelled concrete structure on the outer face, giving deep window reveals and shade to windows, is clad with a warm pinkish limestone and grey Spanish granite. The building cost about £400,000, accommodates 95 staff, and was designed by W. S. Bryant, MBE, ARIBA, Assistant Chief Architect to the Ministry of Public Building and Works. Associated architect: Senor Blanco Soler, Madrid. General contractors: Laing Iberica, an associated company of John Laing and Son Limited, who completed the building four months ahead of schedule.

Visits abroad (The Concrete Society)

FINLAND

AS A RESULT of a number of requests, it has been decided to repeat the visit to Finland that has proved so popular over the last two years. This will be a six-day visit, to give architects, engineers and others an opportunity of seeing something of modern Finnish architecture, including examples of industrialized building and town planning.

Members of the party will fly from London to Jyväskylä on Monday 17 July to see university work by Aalto and his nearby civic centre at Säynatsälo. They will then go on to Lahti and Helsinki, spending three days in the capital with excursions to Tapiola and Tampere to see, among other things, the housing schemes there. The party will return by air on the afternoon of Saturday 22 July. Inclusive cost is about £165, including hotel accommodation, all meals and transport.

FAR EAST

THE RESPONSE to the preliminary notice about the Far East visit for members of The Concrete Society has been so encouraging that detailed arrangements are now being made. All methods of air travel were considered and it was decided to use scheduled services of recognized air lines, because of the greater flexibility which this offers.

The party will depart from London on the afternoon of 26 October and arrive in Delhi next morning 27 October. It will then leave Delhi on the morning of 31 October arriving Hong Kong on the same night. Four days will be spent in Hong Kong, the party leaving in the evening of 4 November arriving Tokyo the same night.

This visit will coincide with the 13th World Road Congress, organized by the Permanent International Association of Road Congresses, which will be taking place in Tokyo from 5–12 November.

For members not wishing to attend this Congress an alternative programme of visits will be arranged to some of the best Japanese concrete structures built in recent years.

On the return journey from Tokyo to London on 12 November, members will have the choice of travelling back via Bangkok *or* via Honolulu and the United States *or* via the Polar route providing there are at least 15 people in each party.

With the special group fare the cost per person for the visit including hotel accommodation and meals will now be approximately £550 – a little more than the cost of the normal economy return air fare.

All enquiries about these visits should be addressed to: The Concrete Society (Meetings & Visits), Terminal House, Grosvenor Gardens, London SW1. Telephone: 01-235 6661.

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