

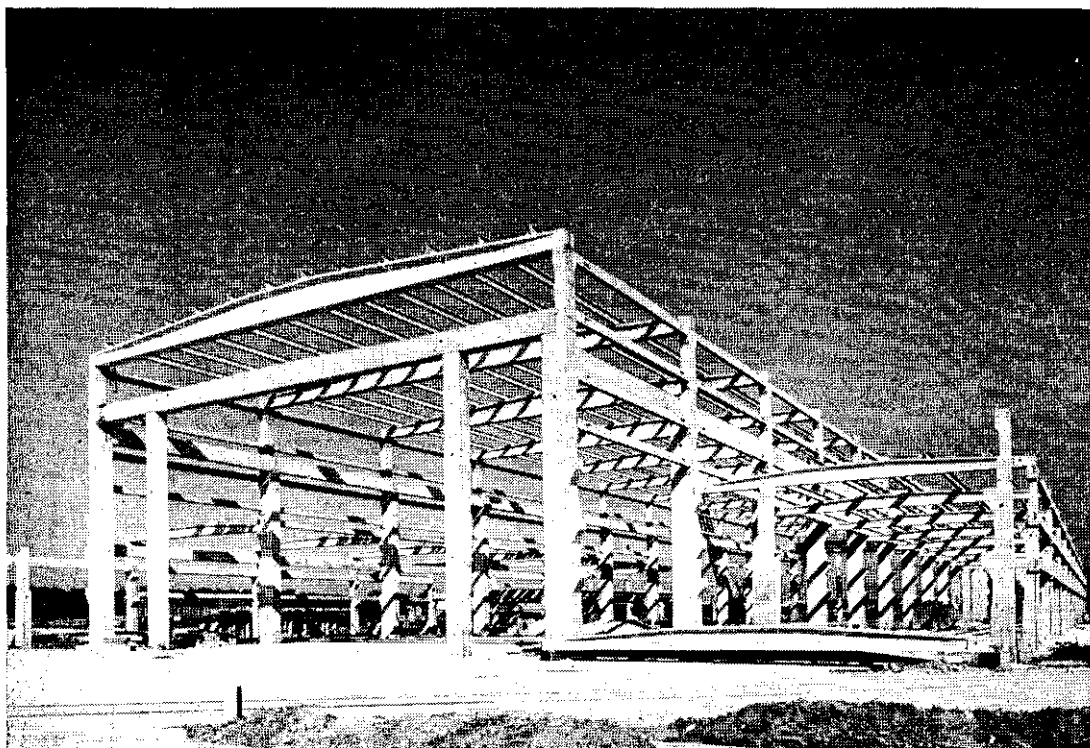
THE NEW SHIPYARD UNDER CONSTRUCTION

DESIGN OF A NEW SHIPYARD

This article recently appeared in 'Engineering', whose permission to reproduce is acknowledged. Messrs Dowsett Brooke Marine Ltd. supplied additional information, a plan, of which the one reproduced is a less detailed copy, and photographs, from which those published were selected.

A new shipyard for the construction of between 12 and 18 vessels per annum ranging in overall lengths between 200 ft and 280 ft, is being laid down in the South Shipyard of Brooke Marine Limited, Lake Lothing, Lowestoft. The yard has been planned for line-flow production, the steel being brought into the stacking yard, through the prefabricating shop (where units of up to 10 tons will be put together), and out to the construction berths; similarly the engineering supplies will be dealt with in a like manner, the engines being constructed in the shops before being transferred as large assemblies for installation at the fitting-out quay.

The feature of the civil engineering work now being undertaken is the extensive adoption of pre-cast concrete members, using both ordinary bar reinforcement and prestressed cables. Such members have been used throughout the yard for coping stones, conduit covers and paving slabs, and all the buildings, both principal and auxiliary, are almost entirely constructed of prefabricated concrete units. In particular, the two principal buildings, the prefabrication shop and the engine shop, are likely to be the largest framed structures ever to be built of this type of member; the two buildings, identical in dimension and layout, are the size of a fairly large power station and, until recent years, would have been constructed of steel or, alternatively, concrete cast *in situ*, when considerable quantities of expensive shuttering would have been required.



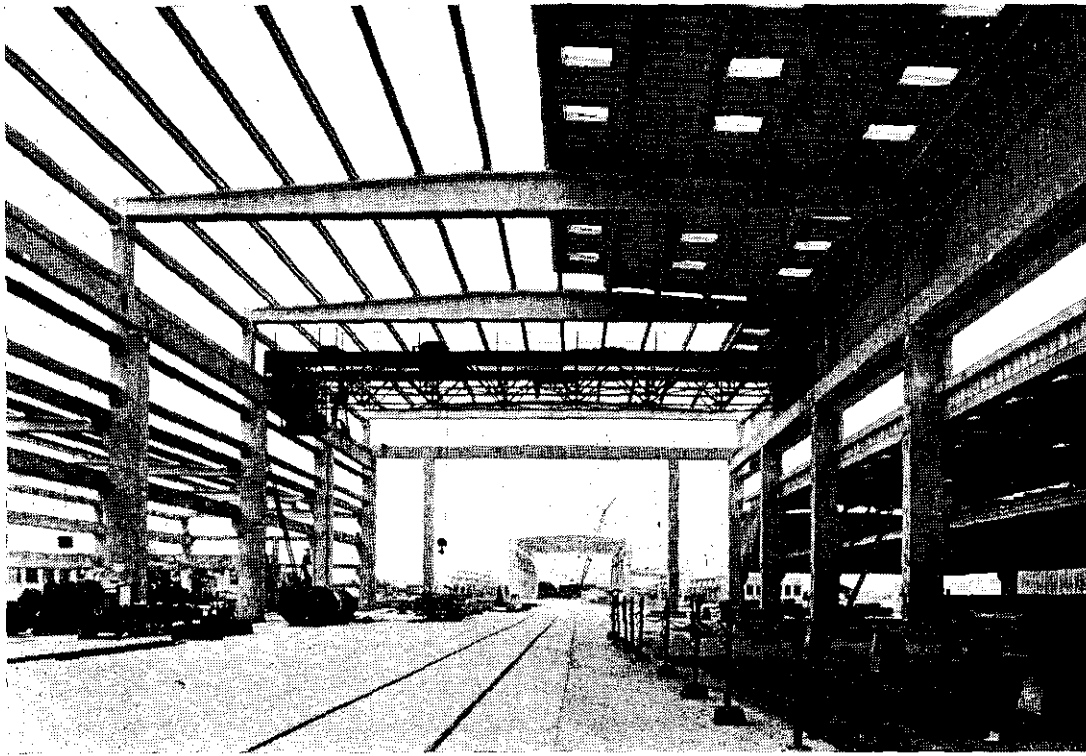
THE ENGINEERS' SHOP UNDER CONSTRUCTION, SHOWING THE PRE-CAST CONCRETE COLUMNS AND PRE-CAST PRE-STRESSED LONGITUDINAL AND TRANSVERSE MEMBERS

DEVELOPMENT OF THE PROJECT

The development of these new yards was based on the acquisition of the shipbuilding company, Brooke Marine Limited, by the Dowsett group of companies at the beginning of the last war. The facilities then taken over consisted of what is now only part of the North Yard (located on the opposite side of the waterway) and that yard was extended to the limit during hostilities. The freehold area of the new South Yard was bought during the war and additional lands acquired recently so that the total site on the south bank now covers an area of about 35 acres. This ground was mostly tidal swamp (overlying a coarse sand) and the whole of it was liable to flooding on the spring tides except for a small section which was developed soon after its acquisition. This previous development consisted of some slipways and steel sheds built about ten years ago, but their sorry state, in spite of regular painting, has been a significant factor in causing the new buildings to be built of concrete.

With the end of the war, and the cessation of Admiralty orders, Brooke Marine had to re-establish their yards for commercial construction and, about three years ago, the first tentative plans for the new South Yard were drawn up. These plans had been completed in detail when the company were successful in obtaining a substantial contract during the recent Anglo-Russian trade talks. The award of the contract has meant that the completion date for the yards has been brought forward as far as possible and, though certain preliminary work was actually carried out in the latter months of 1953, it was not until January, 1954, that construction was fully under way.

As has already been stated, the yard has been planned to construct vessels up to the capacity of the berths by the shop fabrication of pieces which are then to be conveyed to the slipways. For the ready supply of materials, a direct link has been made with the main railway at Lowestoft and direct access is also



THE PREFABRICATING SHOP SHOWING THE PARTIALLY COMPLETED CLADDING AND THE 10-TON OVERHEAD CRANE, WHICH SPANS 72 FEET. THE ENGINEERS' SHOP, SEEN BEYOND, HAS A SIMILAR TRAVELLING CRANE

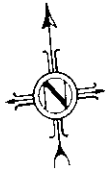
available by road. The site is located on the south side of Lake Lothing, with direct access to the sea through Lowestoft Inner Harbour for vessels of up to 60-ft beam and 18-ft draught. The layout, shown in the plan, is symmetrical about a centre line running approximately north and south through the vertex of a promontory in the shore line. Ships will therefore be launched both upstream and downstream, and not, as is customary, across the stream towards the opposite bank.

With prefabrication of the ships as the basis of construction, it was decided that a 10-ton unit should be worked as far as is possible, and crane capacity to this figure (with a factor of safety for overloads) has been provided for the whole yard. The engines for all the vessels are to be fitted at the yard and a 60/100-ton crane is to be installed at the engine quay for this purpose.

In order to cut down general handling of materials, a shunting locomotive crane has been obtained, and as may be seen from the plan, all rail trucks can be passed through both the major shops as well as to sidings alongside the main stores, the steel-stacking yard, the slipway and the wet-dock area. It was decided not to extend the rail tracks to the building berths themselves—in any case, track alignment would have been difficult and the turn-outs very tight—and greater flexibility will be obtained by the proposed use of 10-ton and 20-ton rubber-tyred trailers, pulled by tractors with pneumatic wheels. Two rail-mounted Monotower cranes serve the berths, wet dock and slipway.

So that the yard shall remain clean, tidy and safe for working, the amount of temporary electrical leads and air lines that will be required has been cut to a minimum by the construction of a central sub-station and a central compressor house, with the services laid in ducts to numerous tapping points in the berths

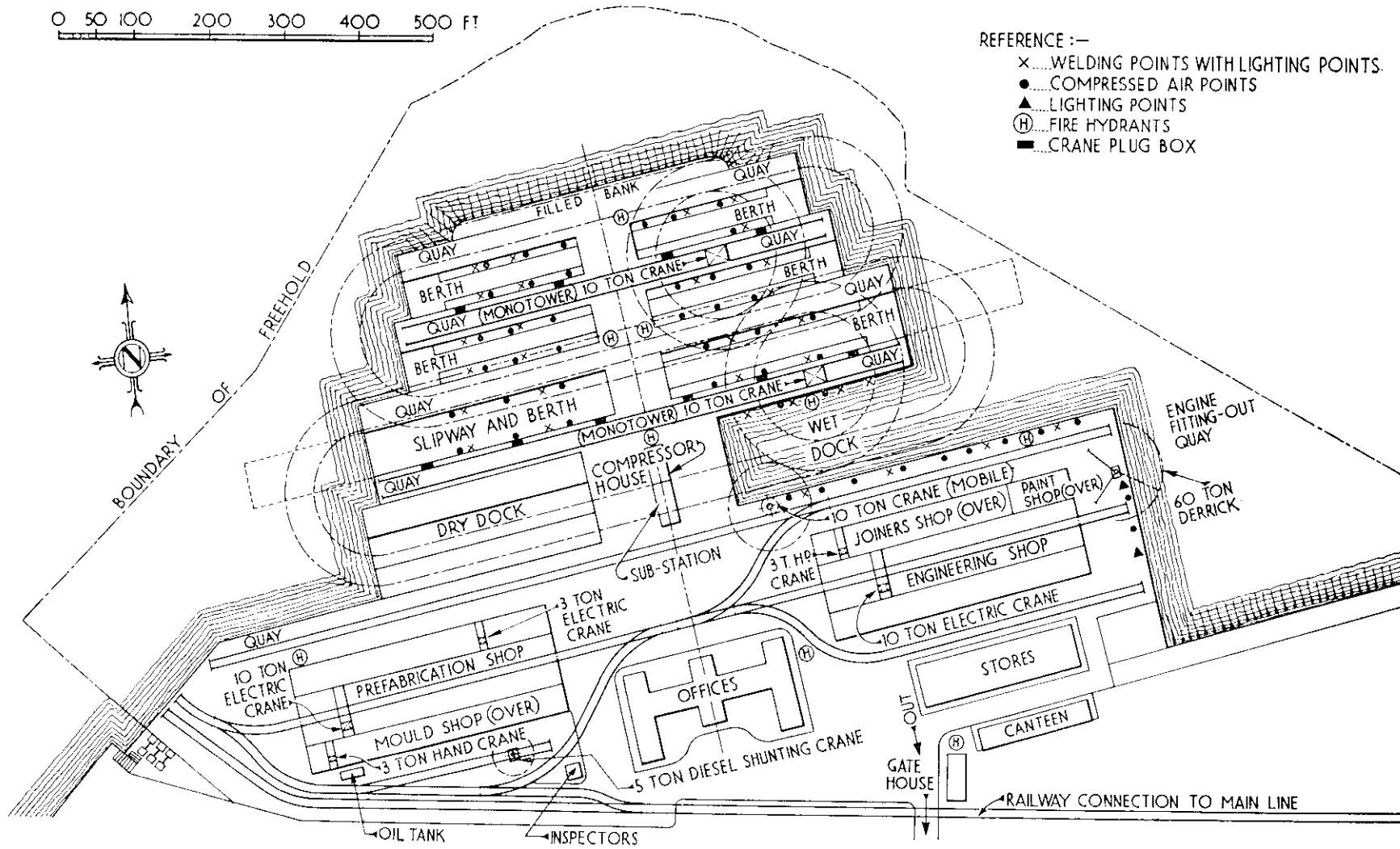
0 50 100 200 300 400 500 FT



BOUNDARY OF FREEHOLD

REFERENCE :-

- × WELDING POINTS WITH LIGHTING POINTS.
- COMPRESSED AIR POINTS
- ▲ LIGHTING POINTS
- Ⓜ FIRE HYDRANTS
- CRANE PLUG BOX



and in the shops. Likewise, to prevent scrap being dumped indiscriminately, all spare areas not required for production have been arranged as grass or flower beds.

CONSTRUCTION FACILITIES

Construction facilities at the new yard comprise eight berths or docks and the engine quay, their relative location being shown on the plan. To exclude water from the berths and dry dock while construction is under way, floating caisson gates will be provided. The floors of the berths have been slabbed with reinforced concrete supported by piles below the keel line and with additional piles below the cill for carrying the load at the moment of launching.

The two short berths at the end of the promontory are 225 ft long by 50 ft wide and are designed for building and launching vessels up to 200 ft in length ; the depth of water at the end of the launchway will be 10 ft 3 in. at H.W.O.S.T., increasing to 20 ft at the cill. The next pair of berths, 255 ft long by 55 ft wide, are for vessels up to 230 ft in length, the depth of water at H.W.O.S.T. increasing from 12 ft 3 in. at the end of the launchway to 22 ft.

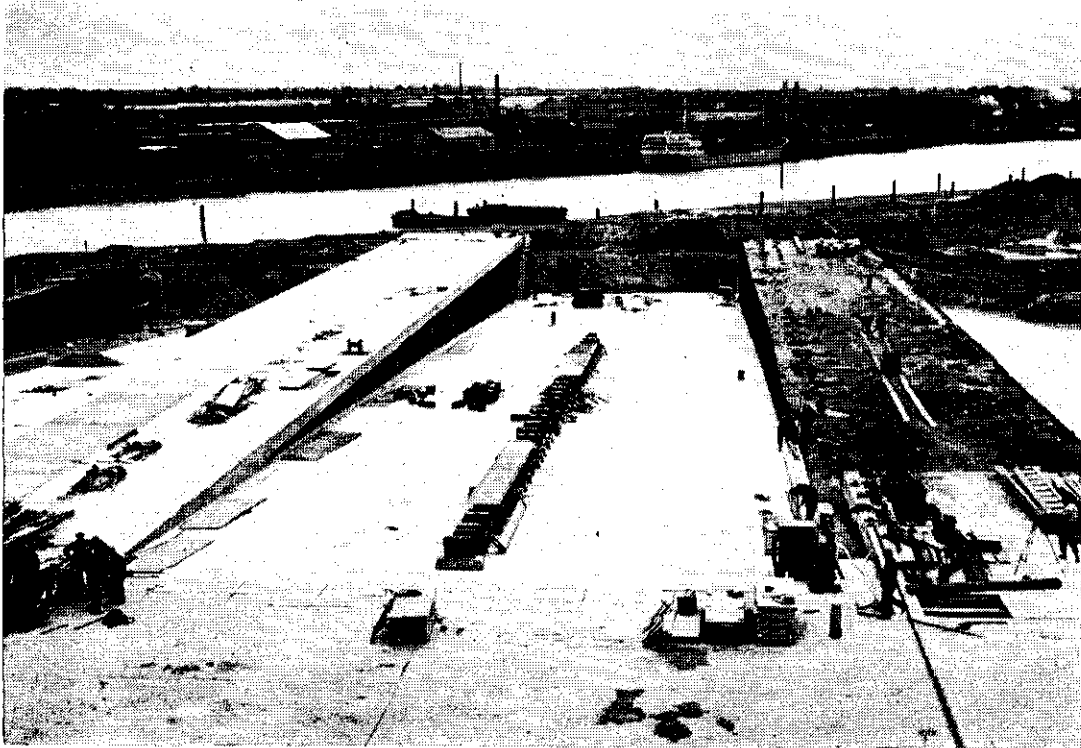
The third pair of berths are 322 ft long by 60 ft wide with a depth of water at the end of the launchway of 13 ft 6 in at H.W.O.S.T. on the cill increasing to 22 ft 6 in. They are designed for building and launching vessels up to 280 ft in length and are also suitable for use as slipways. The dry dock, whose keel blocks are 18 ft below H.W.O.S.T., can accommodate ships up to 300 ft in length and the wet dock, which has 780 ft of quay wall available for fitting out is dredged to a general level of 22 ft 6 in below H.W.O.S.T. and for 280 ft to 25 ft 6 in. This dock will float vessels up to 12 ft 6 in at any state of the tide and the bottom is to be kept soft so that, in the event of exceptional tides, larger vessels can settle in safety.

The two main buildings in the new yard are the prefabricating shop and the engineering shop. Each of these buildings is 360 ft long by 150 ft wide with a central bay 75 ft wide and two side bays 37 ft 6 in wide. The clear height to the soffit of the main roof beams is 41 ft 6 in and of the side bays, 20 ft. One of the side bays to each of the shops has an intermediate floor, used to provide a mould loft in the prefabrication shop, and a joiners' and paint shop in the other building.

The prefabricating shop is to be equipped for the fabrication of plates and sections necessary to form units of ships' structures, weighing up to 10 tons, and will be able to handle up to 300 tons of plate and bar per month. A double ended oil fired bar furnace, which can be arranged to accommodate plates, is provided for hot bending ships' frames up to 42 ft long and nearby is a 250-ton hydraulic joggling press.

The annexe on the north side will be used for the fabrication of the plates and consists of a marking-out bay and accommodation for punching, rolling as well as plate bending and folding machines, together with radial-drilling machines mounted on tracks. A 3-ton overhead crane is available for the full length of this annexe. Automatic submerged-arc welding machines will be laid down in the centre bay, which is served by a 10-ton overhead crane, and welding skids will be provided on which the prefabricated units will be built up before transport to the berths.

In the engineering shop, the southern annexe is equipped with woodworking machinery for handling all shipwrights' and joiners' timber. The north annexe has accommodation for fitters', electricians', plumbers' and coppersmiths' shops, each shop being equipped with the appropriate plant. Each machine tool is driven by a separate electric motor and, as in the prefabrication shop, the main



BERTH FOR BUILDING SHIPS UP TO 280 FEET OVERALL

bay is served by a 10-ton electric overhead crane. Machinery will be installed for the production of tail shafts, and covered accommodation will enable both main and auxiliary machinery to be built.

AUXILIARY BUILDINGS AND SERVICES

Auxiliary buildings include the main stores, the compressor house and sub-station, canteens and kitchens, gatehouse, inspectors' offices and the main office block. Each of these buildings is built entirely of pre-cast concrete members.

Services in the yard include the cranes, electricity, compressed air, fresh water and gas. Apart from the cranes already mentioned (the Monotowers serving the berths and the overhead cranes in the shops) there will also be : a 5-ton rail-mounted Diesel shunting crane in the sidings ; a 60-ton derrick with a 40-ft radius on the engine-fitting quay ; and a 20-ton Coles travelling crane for general work.

Electricity is brought into the yard through a new substation which will have an eventual capacity of 1,500 kVA ; welding transformers of 350-ampere capacity for either 6 or 12 operators have been installed for each of the berths, quays, and main shops. Four 520-cu ft per minute compressor sets, electrically-driven, have been installed to meet initial requirements, with provision for increasing the capacity by 50 per cent.

All the service pipes are laid in pre-cast concrete ducts ; at the quays, tapping points have been made in the vertical faces of the coping stones so that duct covers will only have to be raised for major maintenance works or for new installations. This arrangement will also ensure the minimum of trailing cables, so leaving uninterrupted space for the passage of mobile cranes and for other operations.

CIVIL ENGINEERING AT SITE

The principal civil engineering work at the site has included : the mass excavation for the berths and docks, and the use of the spoil as fill ; the driving of 1,600 tons of sheet piling in the quay walls ; driving prestressed concrete bearing piles under keelways, crane tracks, foundations, etc. ; preparation of foundations for the main workshops and erection of the main frames ; laying of roads, service ducts and the railways. The rapid progress made, with a labour force that has at no time exceeded 180 men, has been made possible by the extensive use of prestressed and pre-cast concrete members and the high proportion of cranes available on the site.

Steel-sheet piling for the wet dock consisted of 45 ft and 41 ft lengths of No. 3 Frodingham and B.S.P. piles which were driven to an average set of 38 ft. A variety of plant was employed and piling proceeded in two 12-hour shifts (11 shifts per week) ; between the last week in November and April, 1954, 1,100 tons of sheet piling were driven. The concrete piles for the Monotower tracks, the launchways, supports to the building quays and main workshops consisted of 12-in by 12-in prestressed concrete piles, 25 ft, 30 ft or 35 ft in length. These have been driven by either a 24 RB or 37 RB, using either a timber frame or false leaders suspended from the jib. Bakelite dollies have been found to be extremely effective, giving less trouble and a longer life than ordinary timber.

The concreting of all the roads and floors has been done with three 14/10 Winget Weigh-batchers, the concrete gangs working single 12-hour shifts and using Dobbin barrows for distribution.

The choice of pre-cast concrete members for the main workshops was based primarily on the poor record of steel structures in the locality, it being believed that the concrete will weather and will require only a small amount of maintenance.

Throughout, the construction is of reinforced concrete columns with prestressed concrete stringers and cross-beams ; felt pads have been used as bedding for the main roof beams where they bear on to the column tops. The main design is based on the strength of the columns to resist the lateral wind loading and all vertical loading ; the foundations have been designed to resist the overturning moments, and ground-bearing pressures have been limited to 2 tons per square foot, bearer piles being used to increase the resistance where necessary. The main columns weigh 16 tons each and are suitably shaped to receive the crane-gantry rail bearers and the roof beams. The roof beams, fully prestressed with 100 wires of 0.2 in diameter, are 4 ft deep at the centre and 1 ft 9 in at the end with a constant width of 20 in ; each beam weighs 15 tons.

Roof cladding consists of ' Universal ' asbestos-cement reinforced troughing sheets with roof lights to augment the lighting from the Perspex glazing in the side walls. Side cladding, above the 9-ft dado line, is of asbestos-cement sheets and the Perspex glazing ; below the dado, to avoid damage, the walls are pre-cast prestressed-concrete slabs, 3 in thick.
