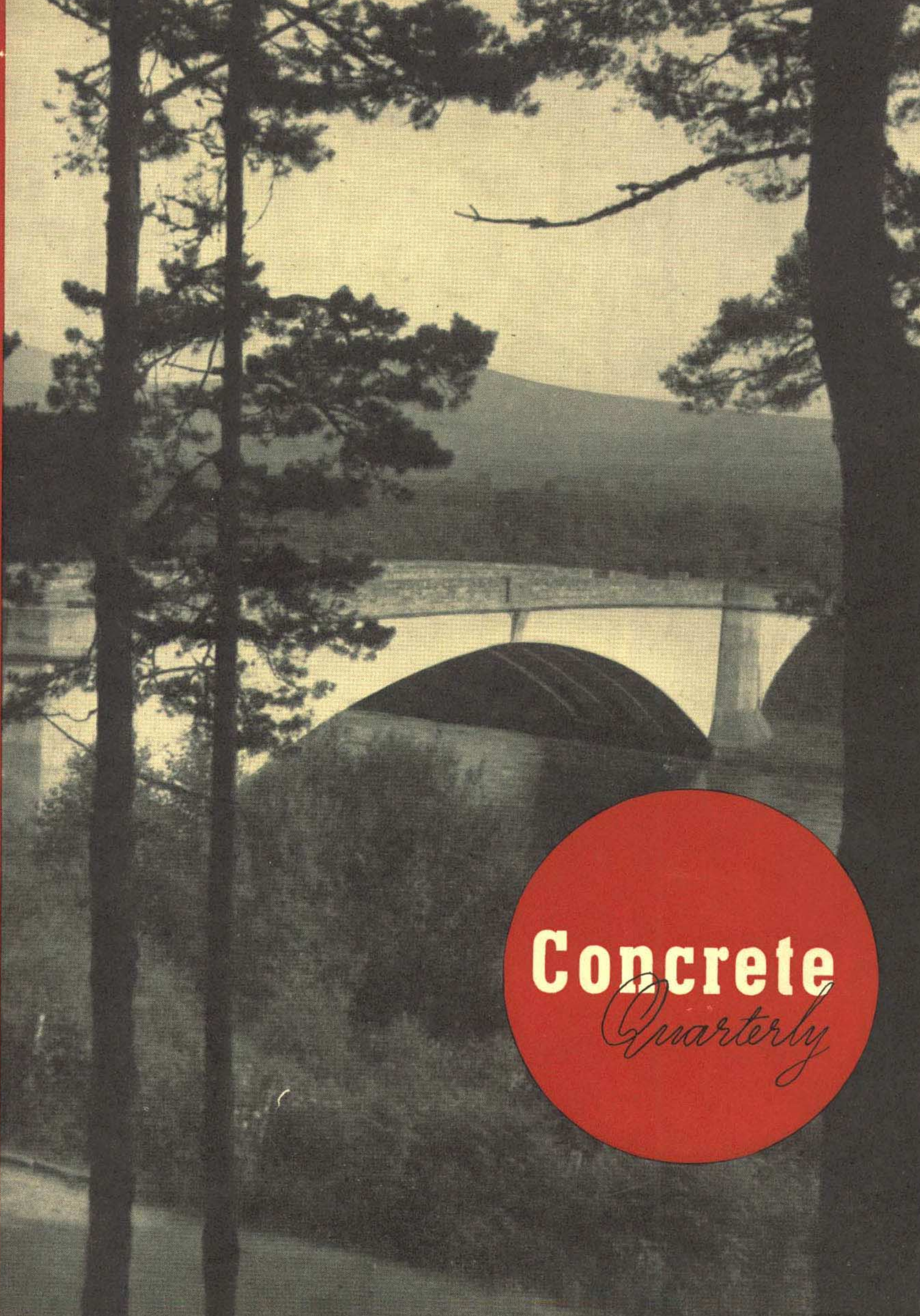
CONCRETE QUARTERLY NUMBER ONE : JULY 1947 : PRICE ONE SHILLING



Concrete Quarterly

NUMBER ONE : JULY 1947

Concrete

Quarterly

CONCRETE BRIDGES IN SCOTLAND

The Dunglass Bridge, which spans the Dunglass Gorge. Engineers: Blyth & Blyth, MM.I.C.E.

IN A LAND WHERE RIVERS ABOUND and flow fast, bridges are naturally a prime concern. Scotland, indeed, might almost be called a country of bridges, and the experience of Scottish local authorities in getting their roads across rivers and streams where the mechanics and the aesthetics of the situation are both unusual should be a useful guide to local bodies elsewhere.

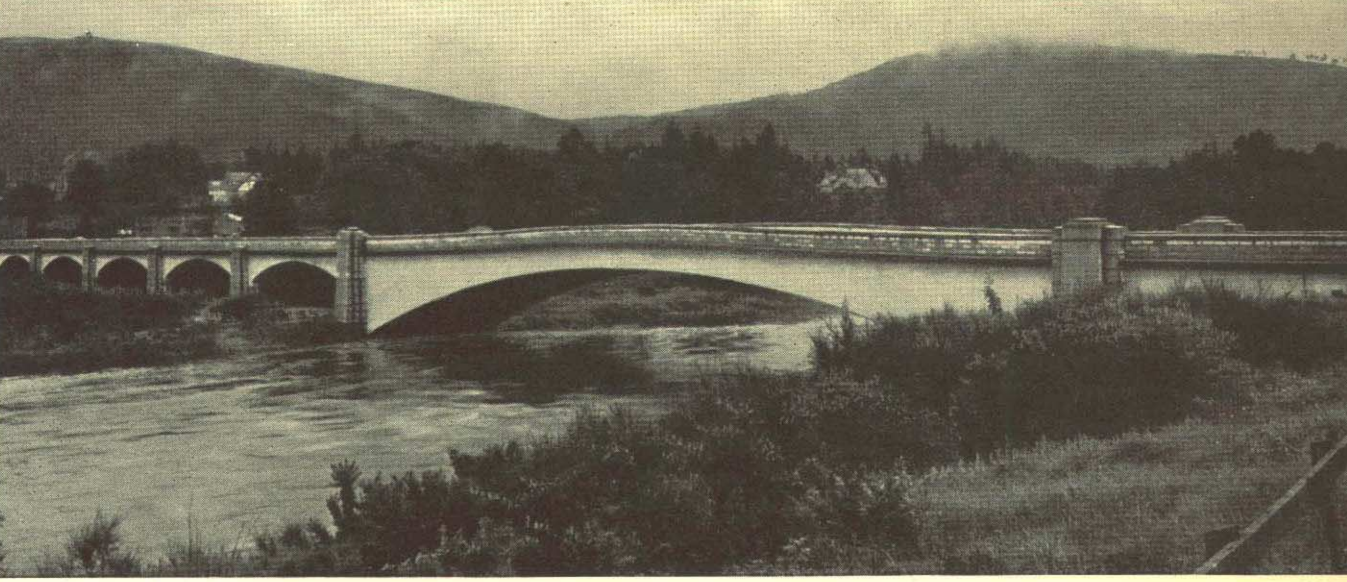
Many of the Scottish bridges are of reinforced concrete and are excellent examples of the uses of this material in surmounting the difficulties which confront designers of bridges in all parts of this country. But we have space in this article to glance at only a few of them.

The Spey, for instance, is not only the swiftest river in the British Isles but carries a big volume of flood-water at certain times of the year; the Spey Bridge, which links Moray to Inverness-shire at Grantown, gives it free passage under a three-hinged reinforced concrete arch with a span of 240 ft. The bridge was built to the designs of Blyth & Blyth, MM.I.C.E., of Edinburgh. There is only one larger reinforced concrete arch in Great Britain: the main arch of the Royal Tweed Bridge at Berwick.

At Newtonmore there is another interesting bridge across the Spey, which Sir E. Owen Williams designed. Its three arches and concave abutments give an impression of strength which is far from being superficial.

For the Aboyne Bridge over the Dee in Aberdeenshire, the consulting engineers, F. A. Macdonald & Partners designed a unique three-hinged arch. It has a span of 170 ft. and five flood-arches carry the approach road on the south side of the river. All the abutments and piers are of reinforced concrete. The parapets are of precast concrete blocks which tone with the landscape.

The Spey Bridge at Grantown which links Moray and Inverness. Engineers: Blyth & Blyth, MM.I.C.E.



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About 20 miles south of Edinburgh, on the main road to Berwick, the Dunglass Bridge spans the Dunglass Gorge and is a good instance of arch-rib construction. It has a clear span of 157 ft. and was built in 1932, Blyth & Blyth of Edinburgh being the engineers. Another example of this arch-rib construction is the Glen Bridge at Dunfermline.

Finally, we come to a more recent one: the King George VI Bridge across the Dee in Aberdeen. The bridge, which was opened by Her Majesty the Queen in 1941, was built about half a mile below the famous 400-year-old Bridge of Dee to provide a new main road from Aberdeen to the South. This is a triple-span bridge, the main arch covering 120 ft. and the smaller arches 100 ft. each. It is 75 ft. wide, with two footways and two carriageways and is faced with granite to conform to local tradition in building material. The cost was £150,000.

1. Reinforced concrete bridge over the Dee at Aboyne, Aberdeenshire.

2. The George VI bridge over the Dee at Aberdeen. Designer: T. F. Henderson M.C., M.I.C.E., F.R.San.I., City Engineer of Aberdeen, in collaboration with Considere Constructions Ltd.

3. Bridge carrying the Cupar—St. Andrews road over the river Eden at Guardbridge.

4. Glen Bridge, Dunfermline.

5. General view of the Newtonmore bridge over the Spey. Designer: Sir E. Owen Williams, K.B.E., B.Sc., M.I.C.E.

6. Beam bridge over the river Feugh near Feughside Inn on the Aboyne-Fettercairn road. The bridge has a white cement finish.

7. Bridge over the Dee at Aboyne.

8. Reinforced concrete single track bridge at Dalwhinnie, built in connexion with the Grampian Electric Power Scheme.
F. A. Macdonald & Partners were the engineers for the bridges illustrated in figures 1, 3, 4, 6 and 7.

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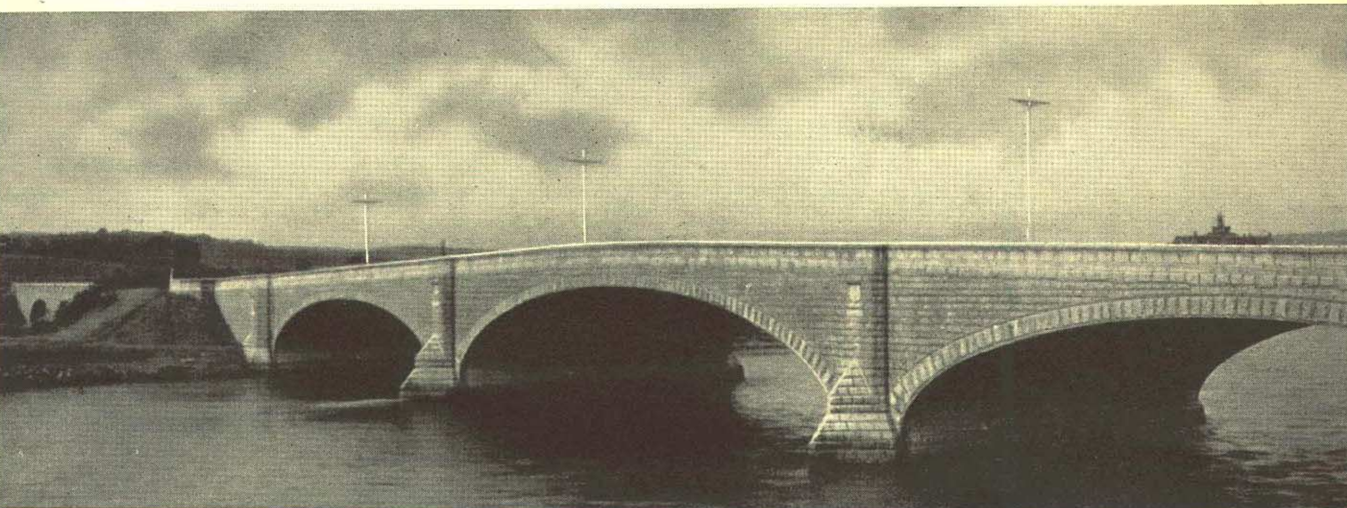

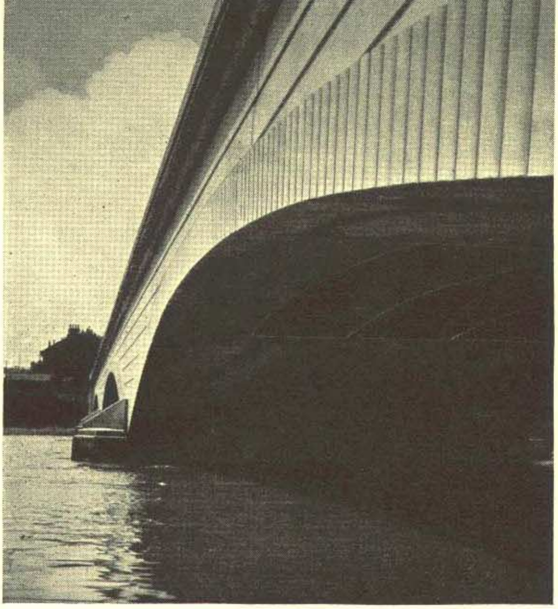

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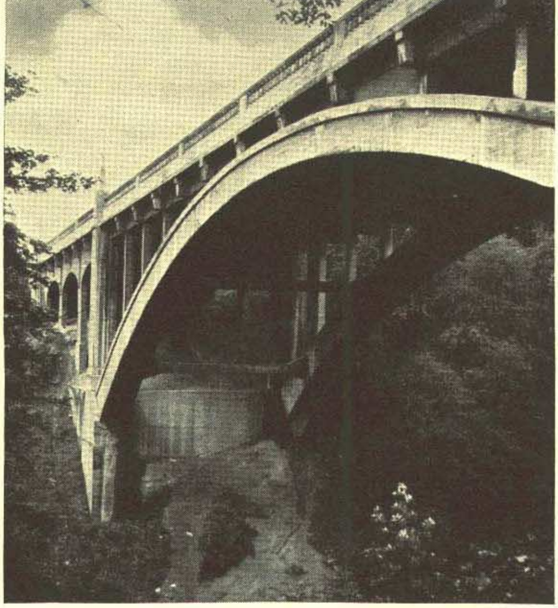

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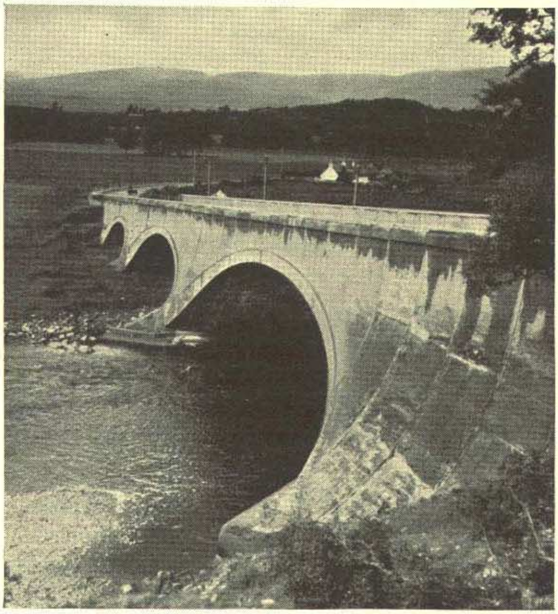

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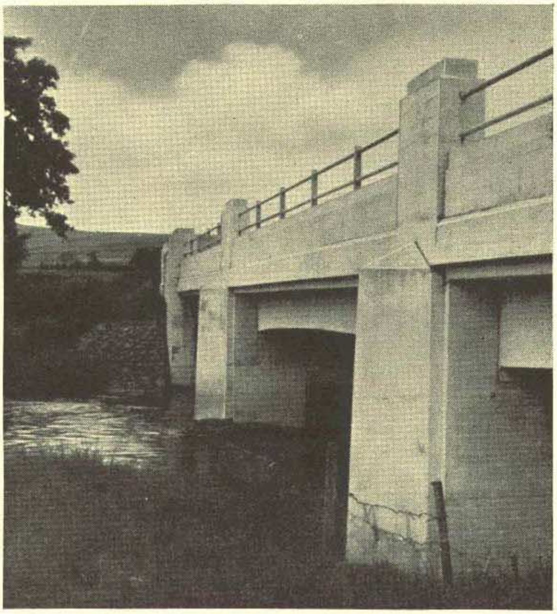

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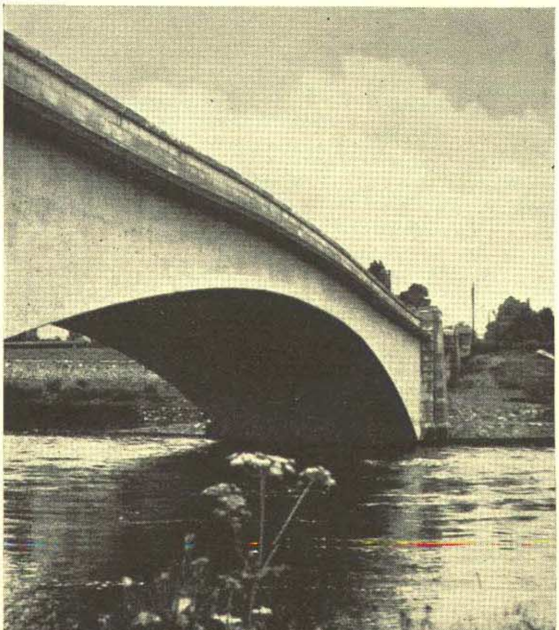

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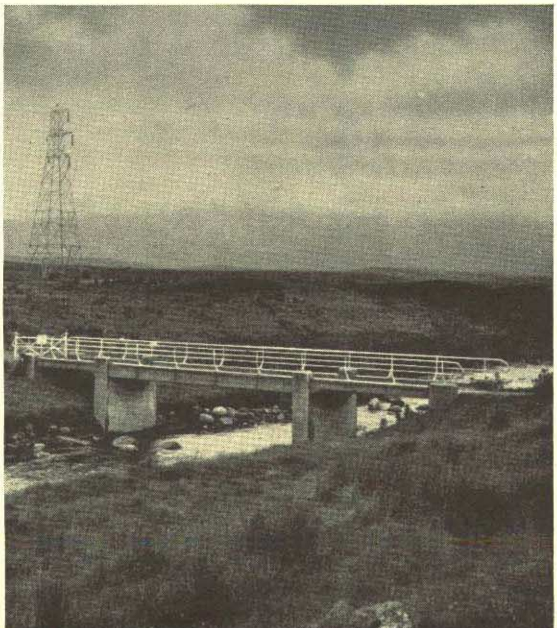

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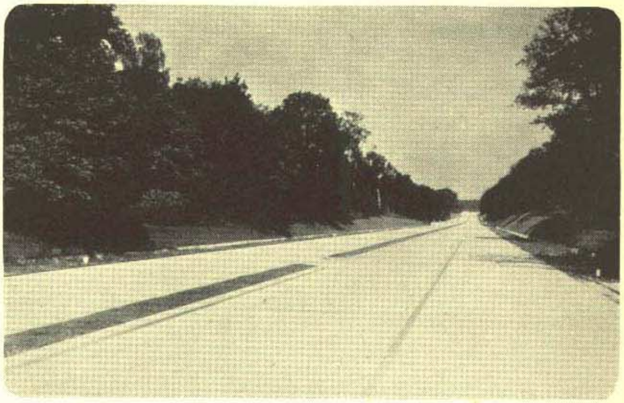
The motorway passing through the Forest of Marly.
Photograph : H. Baranger



NEW PARIS MOTORWAY TO THE WEST

THE FRENCH HAVE ALWAYS had a genius for engineering. They apply their aesthetic faculties to it with verve and imagination. Their imprint on motor-cars remains from the earliest days, and it is no surprise that they should have built, lately, one of the finest motorways in existence.

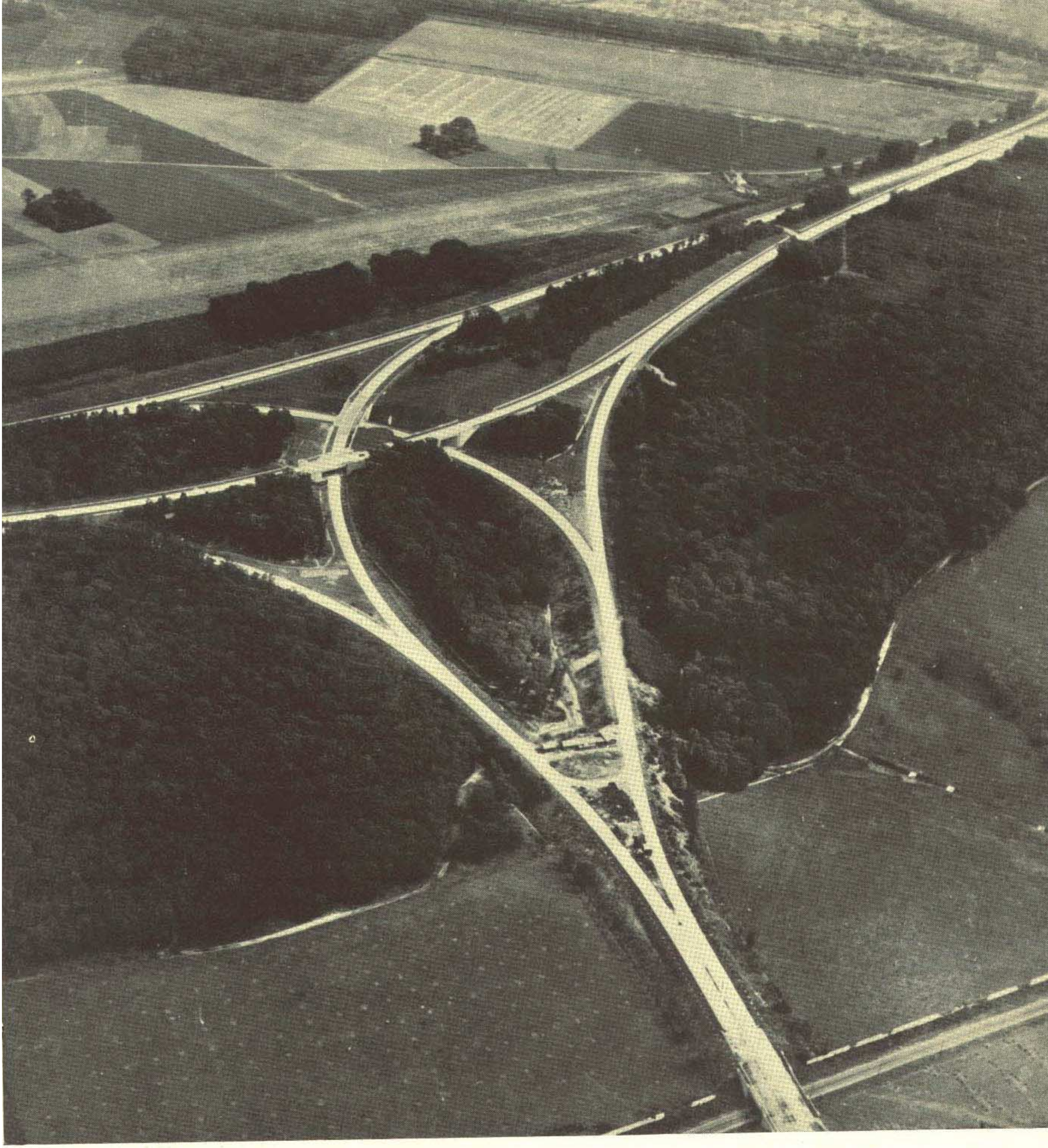
The Western Motorway—20 miles of reinforced concrete—was begun in 1936 to ease the very heavy pressure of traffic leaving Paris for the west. The motorway runs from St. Cloud Bridge by way of the Avenue du Palais and a tunnel under the Park at St. Cloud to Rocquencourt, where it forks south-west to join Route Nationale 10 (the Loire Valley and Brittany) between St. Cyr and Trappes, and north-west through the Forest of Marly to meet Route Nationale 190 (the Seine Valley and Normandy) near Orgeval.

But for the war the road would have been finished and open to traffic some time in 1940. As it was, the trunk road, the crossings at Rocquencourt and the north-western branch to Orgeval were almost finished in 1941 ; only a shortage of materials kept them out of service.

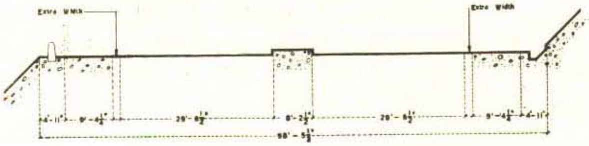
The motorway was one of the few things which the Germans, when they came to Northern France in 1940, decided for obvious reasons should be allowed to go forward, and the whole undertaking was finished in 1942.

The point at which the new motorway begins is, ostensibly, the tunnel under the Park at St. Cloud. Actually, a good deal had to be done to make the tunnel approachable from the Paris side for the volume of traffic which the motorway was to take. The real beginning is the Bridge over the Seine at St. Cloud. The Place Georges Clemenceau, into which the bridge leads, had to be completely replanned to sort out the various streams of traffic and the Avenue du Palais, from the Place to the new tunnel, was widened from 75 ft. to 130 ft. to give three lanes, two for local traffic and a central one for traffic to the tunnel.

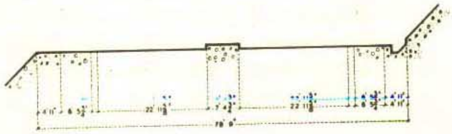
The tunnel itself is the most important piece of work of all. It is $\frac{3}{4}$ mile long, 55 ft. wide and 21 ft. high. Inside it is 49 ft. wide and just under 20 ft. above the roadway in the centre. There are five traffic-lanes defined by four rows of studs. The two central lanes are marked with luminous studs which can be lighted in red or white in order to allot, at need, three of the five lanes to certain traffic in rush hours. There are two sidewalks, each a yard wide, with safety-niches every 25 yards or so. By levelling the road out through the high



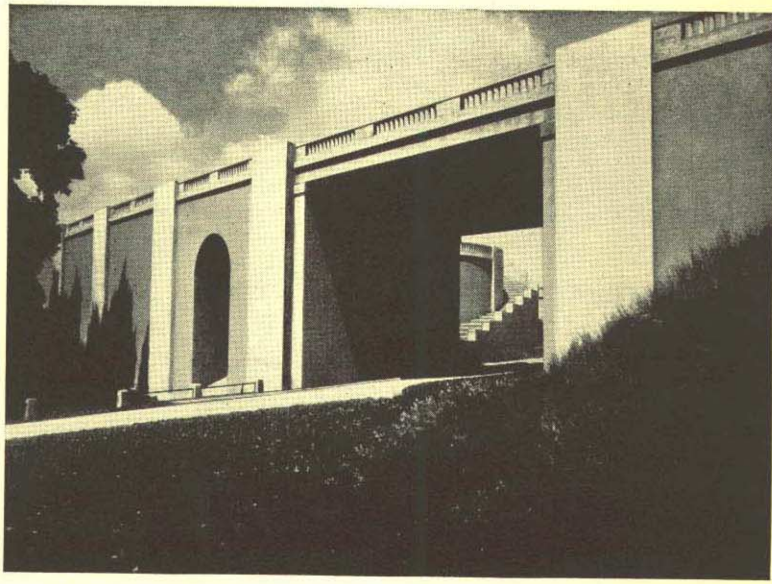
The Rocquencourt triangle. The three reinforced concrete bridges which carry the traffic on the inner roads at three different levels can be seen in the centre of the triangle.



Section of the main motorway.



Section of the southern branch.



Reinforced concrete fly-over at the Rocquencourt triangle, showing the well designed retaining wall which has a maximum height of over 50 ft. (Photograph : H. Baranger.)

ground at St. Cloud the tunnel does away with gear-changing and delays which tend to set up traffic jams just at the point where drivers scent the open road ahead and are beginning to find patience difficult.

The next feature, in order of importance and interest, is the Rocquencourt triangle, where the motorway forks north-west and south-west. It was essential at this point that the various streams of traffic should have clear means of changing direction without crossing or impeding one another. This was achieved by duplicating the traffic-lanes and building three reinforced concrete bridges in the centre of the big triangle formed by the outside routes, in order to give access at three different levels to the inside routes. In the result, a change of direction simply amounts to forking from a one-way traffic-lane.

A characteristic finishing touch to this effective plan is the provision, towards the extremities of the triangle, of little arc-shaped connecting roads which, in the words of the Chief Engineer's Report, " allow the erring driver to correct, in time, a mistake that was hardly excusable."

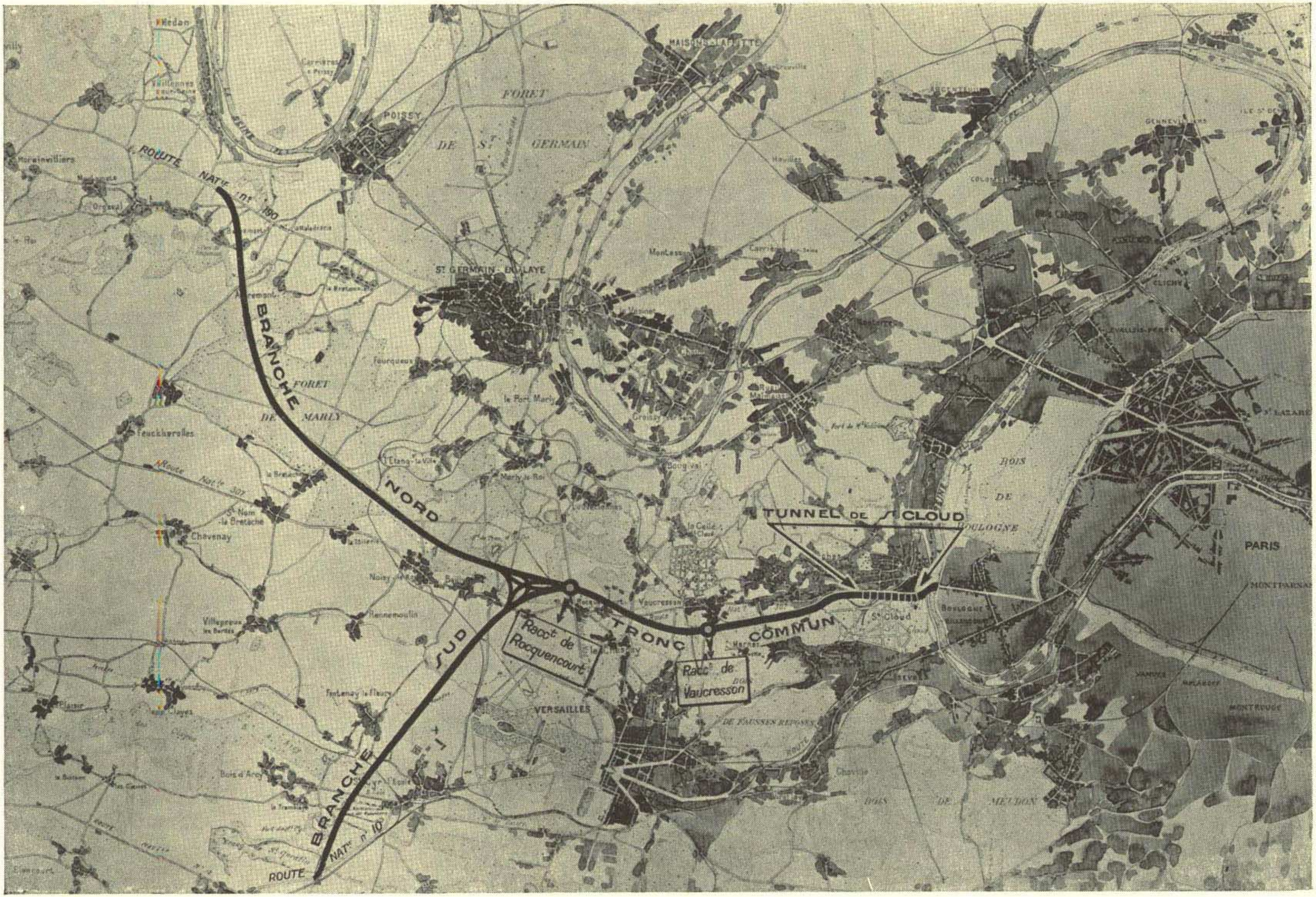
Access to the motorway, except where the two branches link with the national road system, is strictly limited. Between Paris and Rocquencourt there are only two points at which roads join it—one, a departmental road, at Vaucresson ; the other, Route Nationale 184 from Versailles to St. Germain, at Rocquencourt. At each of these points the motorway runs below the level of the incoming roads which join it by means, at each junction, of four one-way ramps with very easy gradients, two ramps for incoming and two for outgoing traffic.

The trunk road has two well-cambered lanes each 29 ft. 6 in. wide divided by an 8 ft. wide strip of kerb-lined grass. The two lanes on the branch roads, beyond Rocquencourt, are each 23 ft. wide with slightly over 7 ft. of grass between them.

The roadway is of 9 in. concrete laid in two courses. The foundation course is a 7 in. layer of gravel concrete, surfaced with a 2 in. layer of concrete, the coarse aggregate consisting of crushed basalt. Where the road passes from cuttings to embankments, or at other places where the nature of the foundation changes, the slabs are reinforced with a steel mesh placed in the lower course. At intervals of a little over 40 ft. there are transverse joints with dowel bars and bitumen filling.

There are petrol and repair stations at the three extremities of the motorway and in the annexes of the tunnel at St. Cloud ; there are telephone boxes at intervals of a little over a mile and first-aid services at all the approaches and at the intermediate junctions.

The materials used included 200,000 tons of cement, 700,000 tons of stone and nearly 9,000 tons of steel. The whole undertaking cost about £4,000,000.



General plan of the new motorway, showing the St. Cloud Tunnel, the Vaucresson junction and the Rocquencourt triangle.

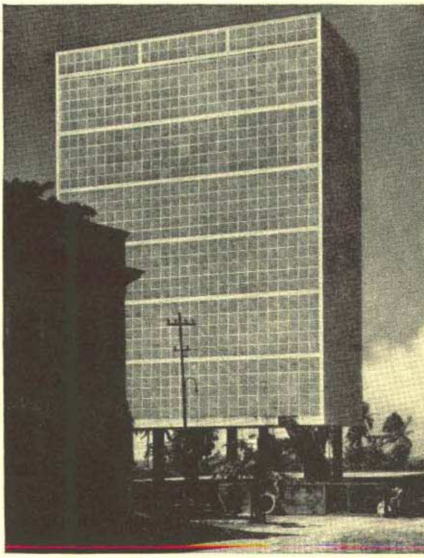
REINFORCED CONCRETE IN

Brazil

Brazil is one of the progressive and expanding countries of the New World which has taken up the use of reinforced concrete with remarkable and stimulating results.

Brazilian architecture, of which we had a photographic exhibition in this country not long ago, shows a strong appreciation of the free and imaginative use that an architect may make of this modern building material ; the Brazilian technique of construction is bold and ingenious, as one would expect of a country of three million square miles where steel is scarce and expensive.

The quality of modern Brazilian architecture is demonstrated in Government



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1. Water Tower at Olinda, Pernambuco.

2. Raul Vidal Elementary School, Niteroi, Rio de Janeiro. Architect : Alvaro Vital Brazil.

3. The Ministry of Education and Health, Avenida Graca Aranha, Rio de Janeiro, shown during construction. Architects: Lucio Costa, Oscar Niemeyer, Alfonso Reidy, Carlos Leao, Jorge Moreira and Ernani Vasconcelos. Consultant: Le Corbusier.

4. Brazilian Press Association Building, Rio de Janeiro. Architects: Marcelo and Milton Roberto.

5. Vital Brazil Institute, Niteroi, Rio de Janeiro. Architects: Alvaro Vital Brazil and Ademar Marinho.

6. Building of the National Portland Cement Company, Niteroi, Rio de Janeiro.

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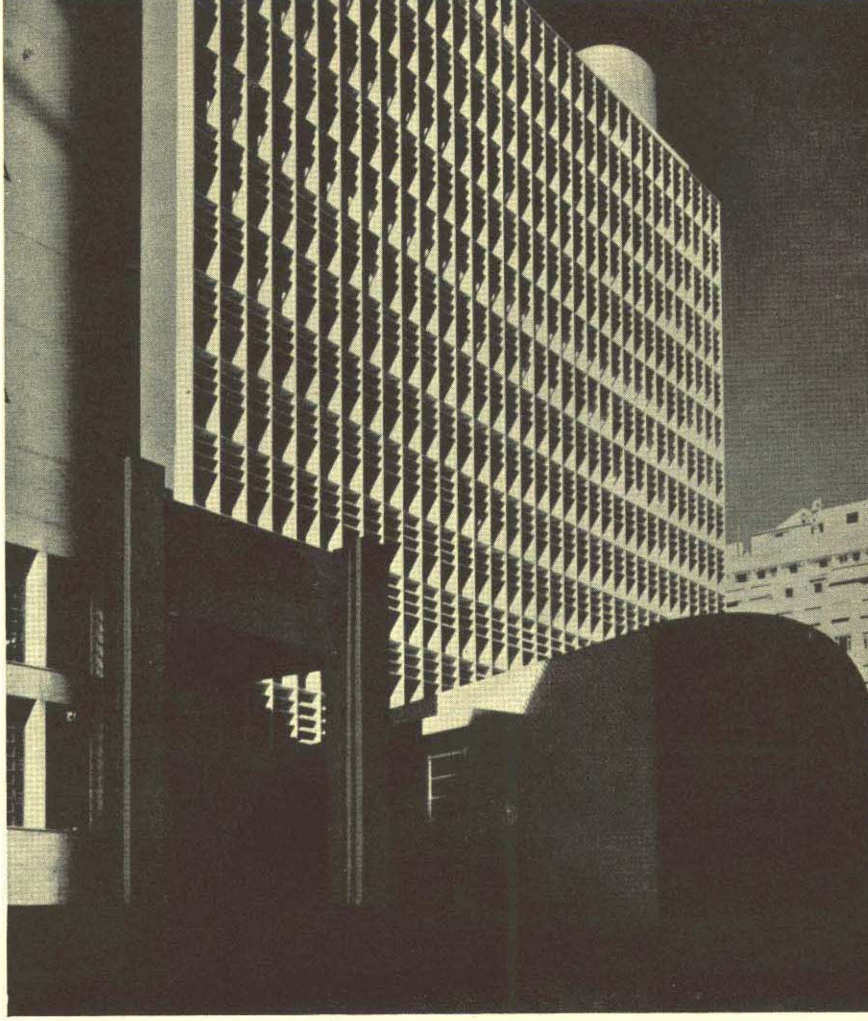

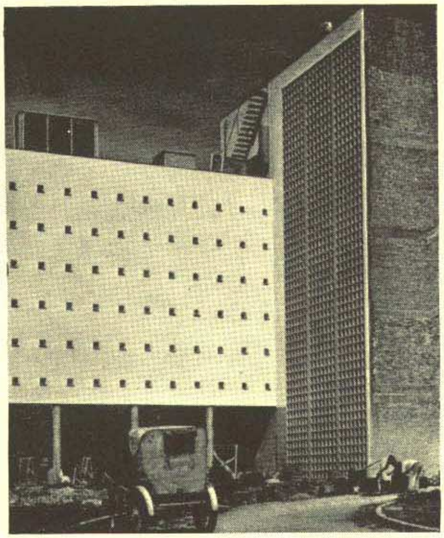

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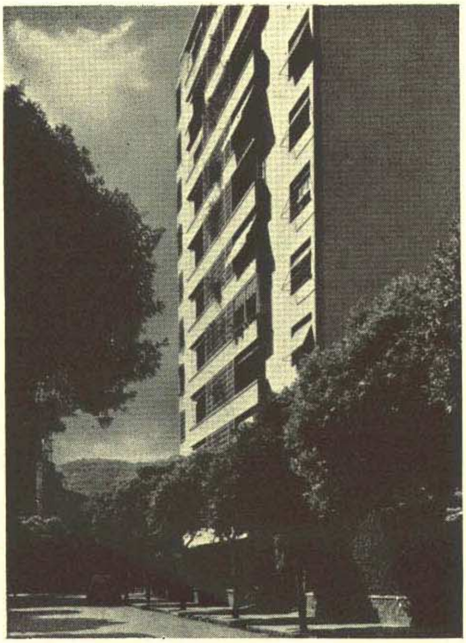
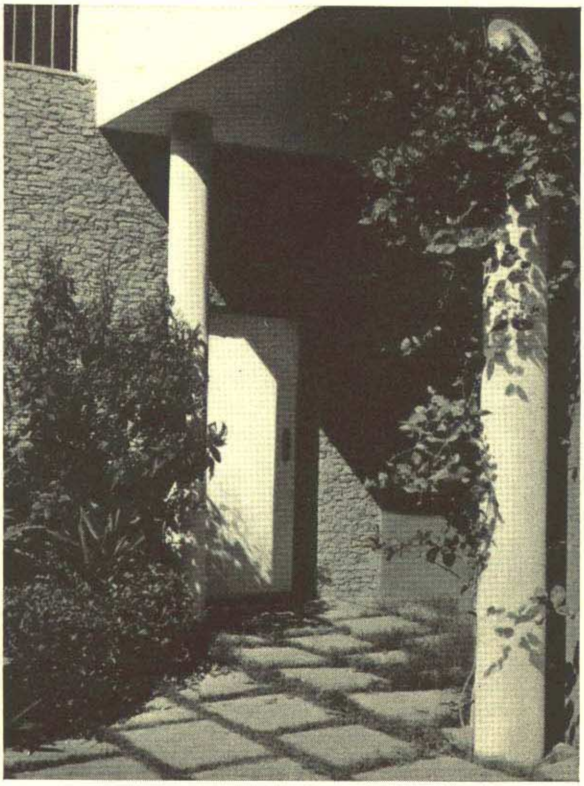
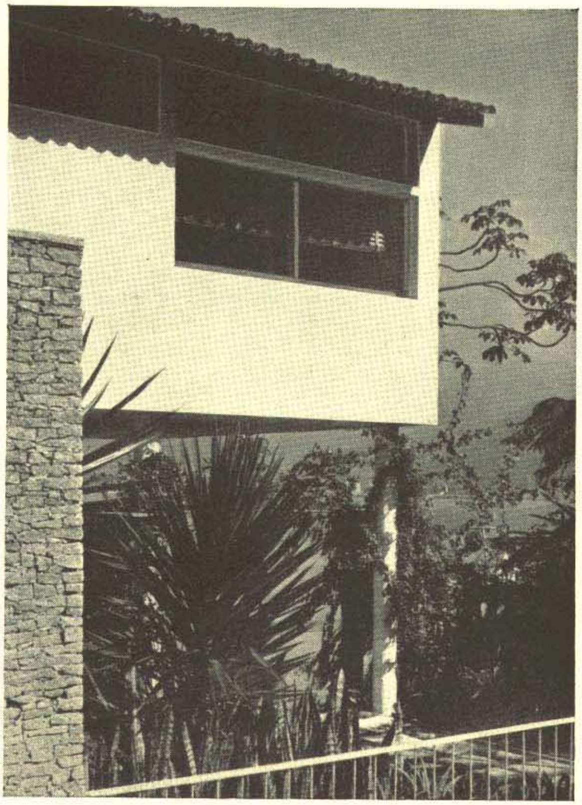


Flats in the rua Bolivar, Rio de Janeiro.
Architect: Dr. Saldanha

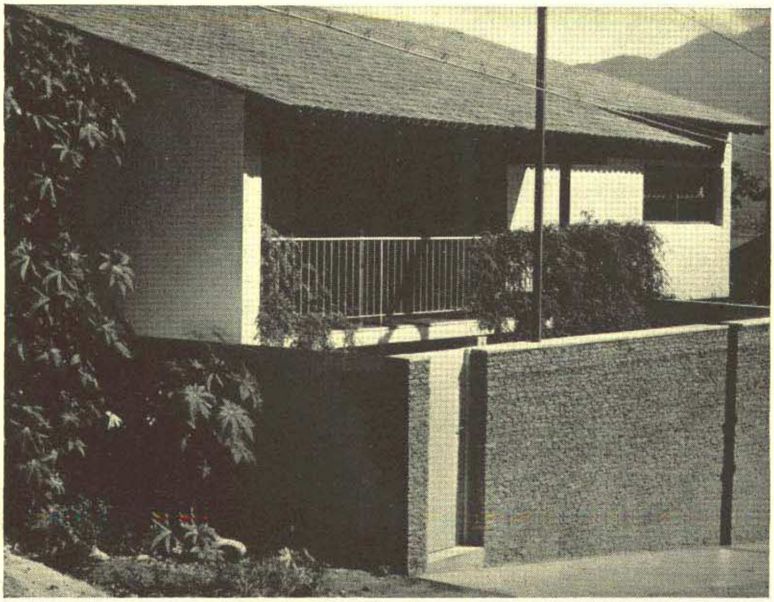
offices, industrial buildings and private homes alike. Among a number of outstanding buildings, all interesting and individual in design, the Raul Vidal Elementary School at Niteroi, Rio de Janeiro, calls for special remark.

Situated above Rio Bay, the main part of the school has been raised on columns, to take full advantage of the view across what is perhaps the most beautiful harbour in the world. The school was built in 1942. The architect was Alvaro Vital Brazil.





Three views of the Cavalcanti House, 42, rua Sacopa, Rio de Janeiro. The illustrations show the decorative use of concrete allied with traditional building materials and tiles.



Left: The "Edificio Esther," a block of flats at Sao Paulo. Architects: Alvaro Vital Brazil and Ademar Marinho.

Photographs by courtesy of Museum of Modern Art, New York, U.S.A

CONCRETE BLOCKS

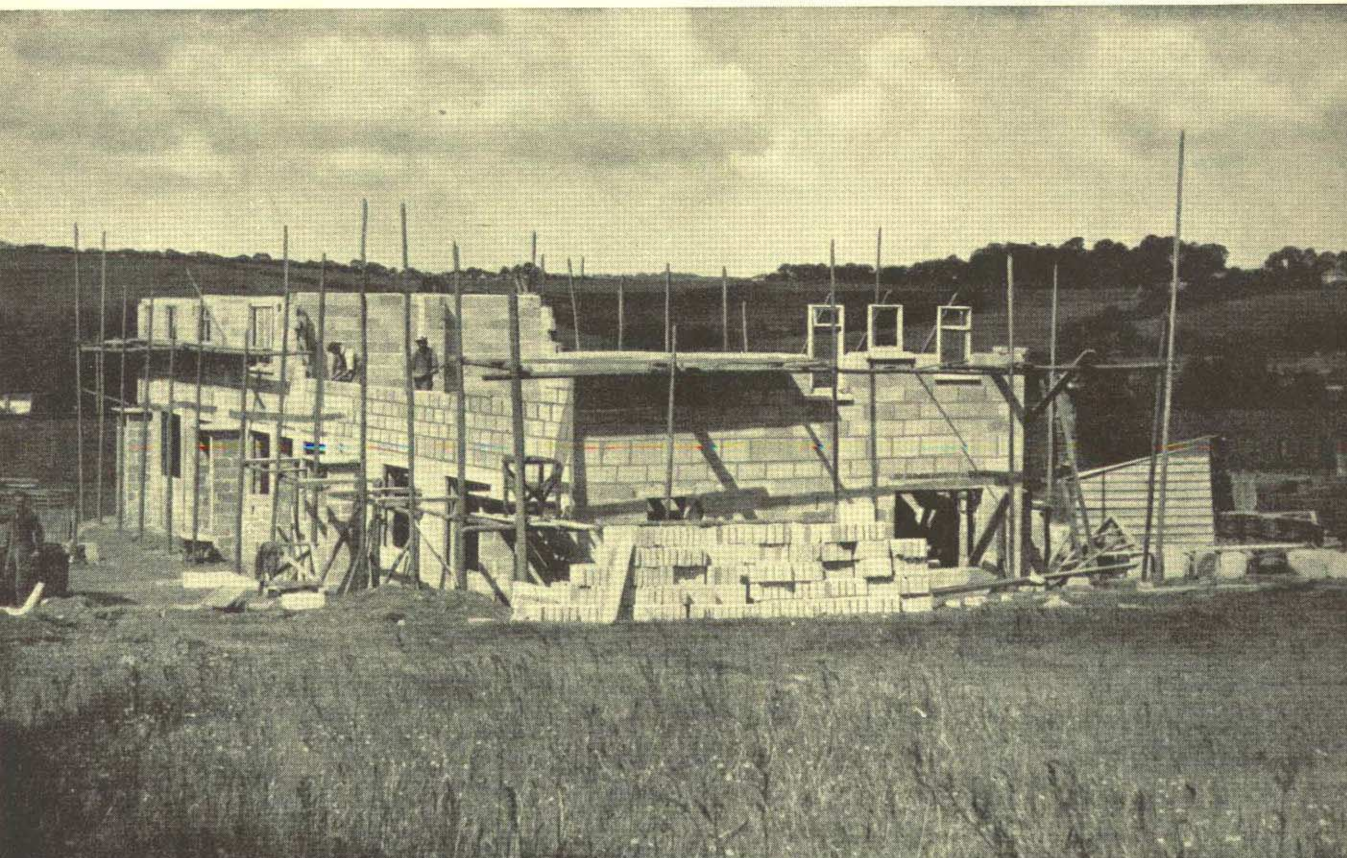
help to solve a housing problem in

SOUTH DEVON

CONCRETE BLOCKS are perhaps going to modify some of the popular and traditional views on house-building materials. We need more houses than we have ever needed and we need them more quickly than ever before. Even if bricks were plentiful, instead of being scarce, there would still be the shortage of labour for laying them—bricklaying is a craft which has not become much less laborious since bricks were first used.

Pomphlett Gardens Housing Scheme: house nearing completion. The outer walls are of white roughcast, chimneys are white and tiles brick red.

Pomphlett Gardens Housing Scheme: Plympton St. Mary R.D.C., Devon. The estate comprises 30 houses, all constructed in 4 in. concrete hollow block work. Contractors: W. Squire & Son, Newton Ferrers, Devon.



Pomphlett Gardens Housing Scheme: houses under construction. The concrete blocks used were supplied by F. Moore (Products) Ltd., Plymouth.

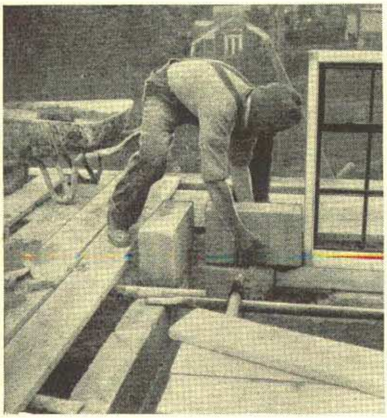
South Devon seems to be the setting for the use on a fairly large scale of concrete blocks for houses. At Saltash, Plympton and Tavistock 200 houses are being built with blocks of a standard size of 18 in. × 9 in. × 4 in.; the rapidity and ease with which the building is going on, and the excellent appearance of the finished houses, are attracting the attention of housing authorities in many parts of the country.

Saltash Corporation has placed contracts for 112 houses of this sort, which are being built to the design and specification of Mr. S. C. Drabble, the Borough Engineer and Surveyor. Another 60 houses, in two separate building schemes of 30 each, are going up fast at Pomphlett, near Plymouth, for the Plympton St. Mary Rural District Council.

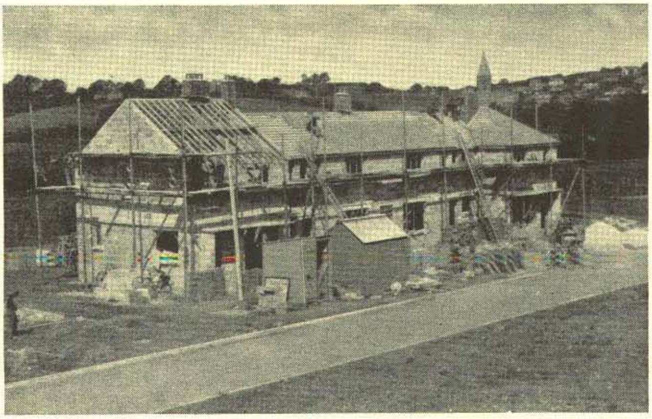
The pleasant design of the houses at Pomphlett is the work of Mr. G. H. Helson, L.R.I.B.A., the Town Planning Officer. The well-porportioned rooms have plenty of cupboard space and under the stairs in a roomy hall there is a place for keeping the pram. At the back of the house there is a utility room with a gas copper in it, a storeroom, a coal-bunker and a broom cupboard; a covered passage from the house to the out-houses keeps you dry in bad weather. The outside walls are finished in white roughcast, with a roof of red concrete tiles. There is a good-sized garden. Even the fences, gates and clothes-posts are to be of concrete, precast and made in Plymouth.

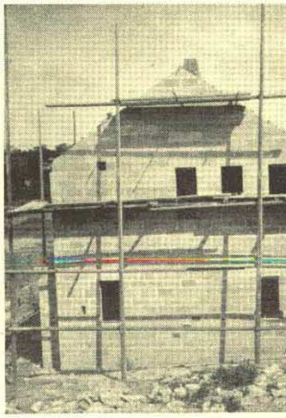
The cavity walling, made up of an outer wall of concrete blocks 4 in. thick, a cavity of $2\frac{1}{2}$ in. and an inner wall of 3 in. clinker blocks, will make these houses easy to keep warm in the winter. The builders are W. Squire & Son of Newton Ferrers.

At Tavistock the Urban District Council is having 28 concrete block houses built, in units of four, to the designs for M.O.W. types 3 and 8.



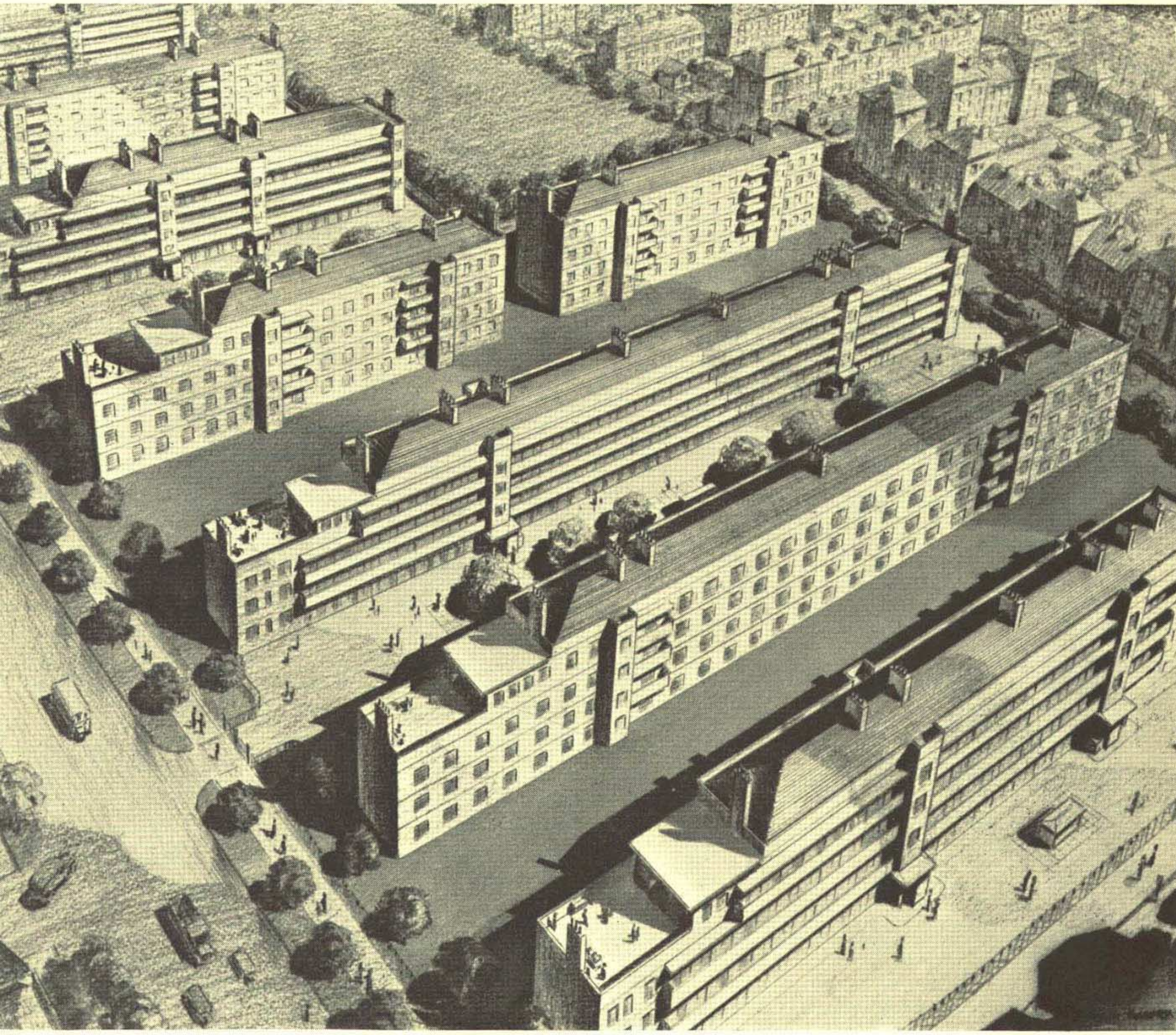
Pomphlett Gardens Housing Scheme: laying concrete block.



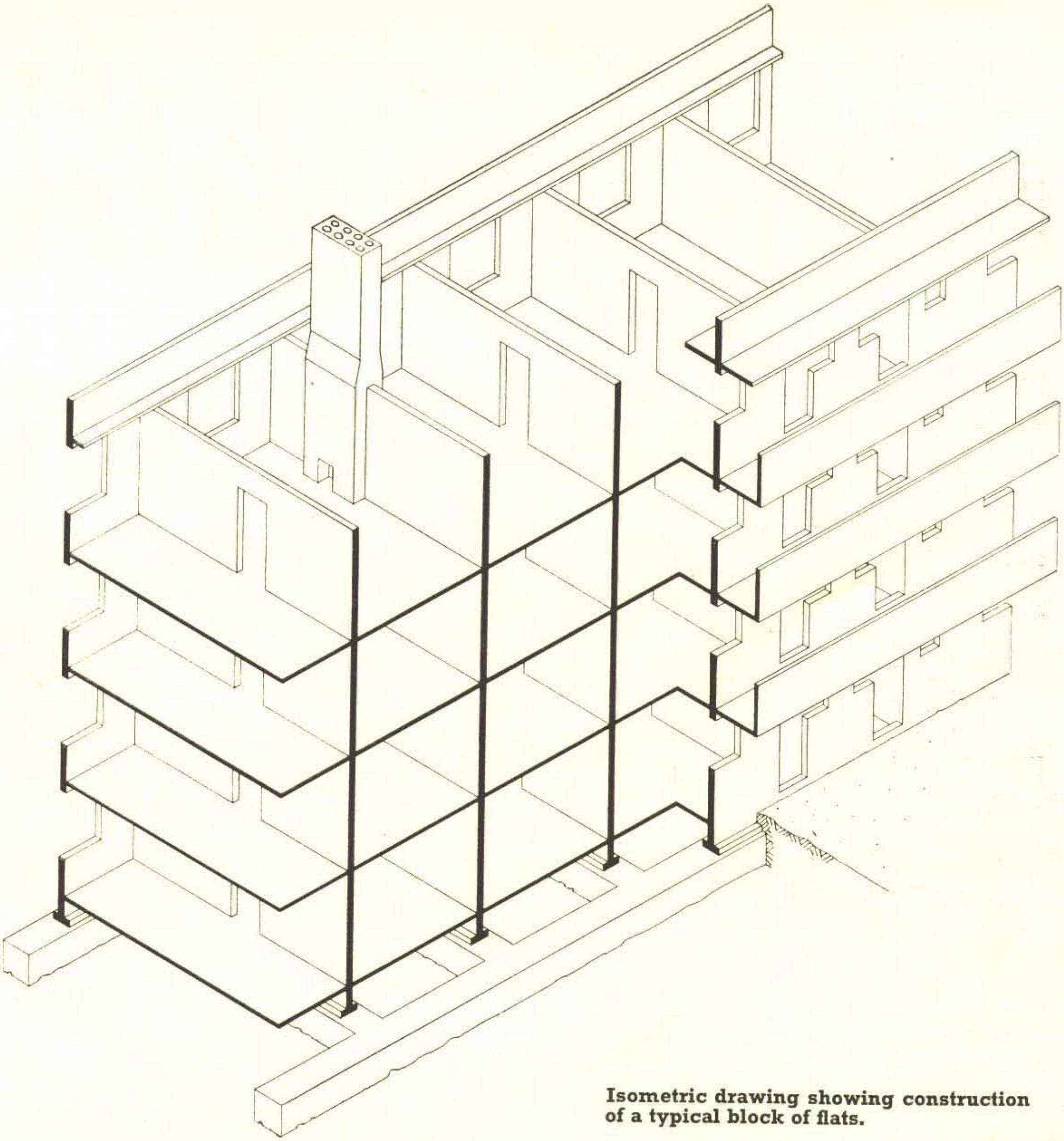


Tavistock U.D.C. Housing Scheme. Block of four houses, M.O.W. types 3 and 8, shown under construction.

Reinforced concrete flats for the LCC



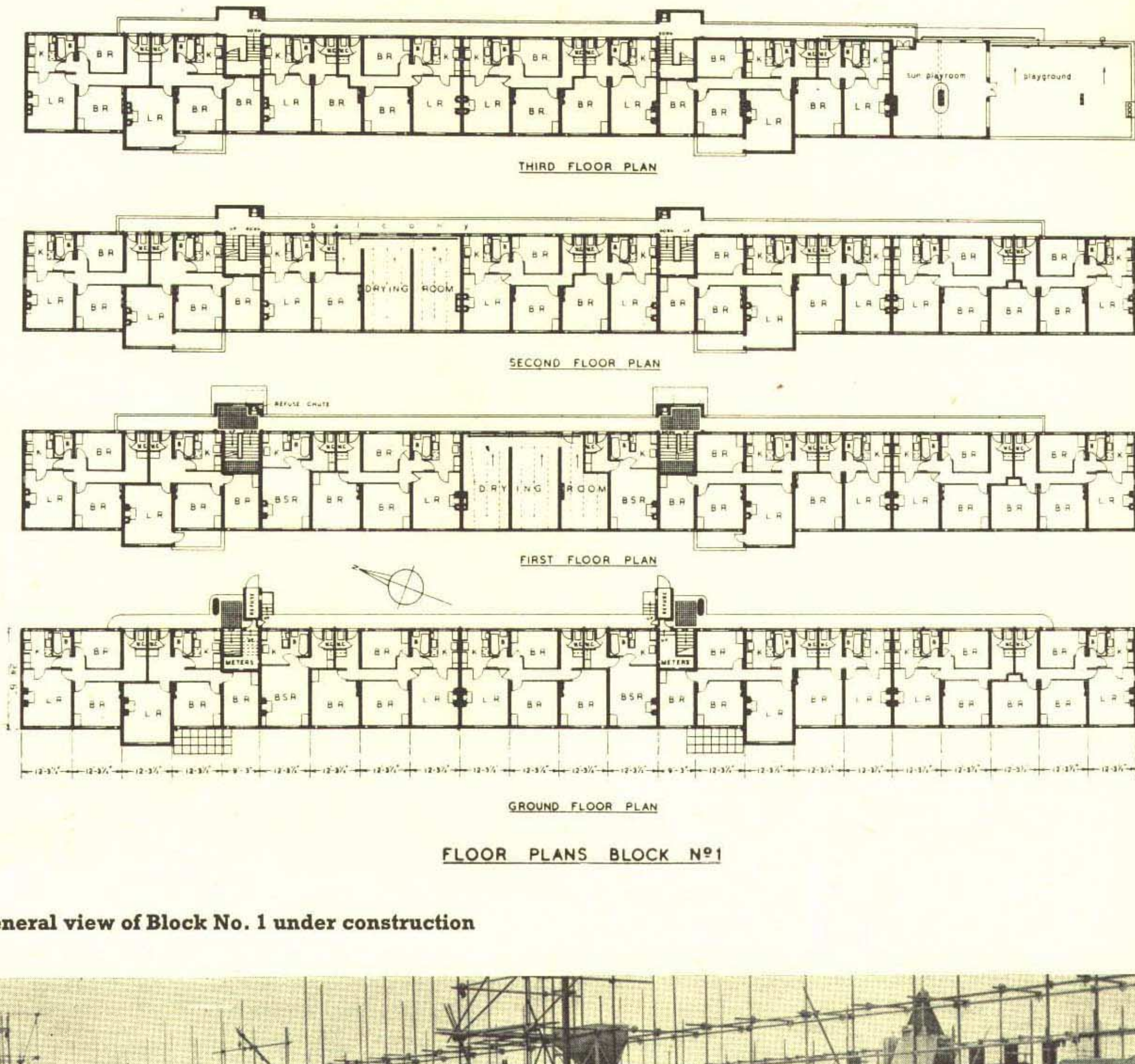
An impression of the completed scheme. The buildings will face one another across paved courtyards planted with trees and will back on to greens.



Isometric drawing showing construction of a typical block of flats.

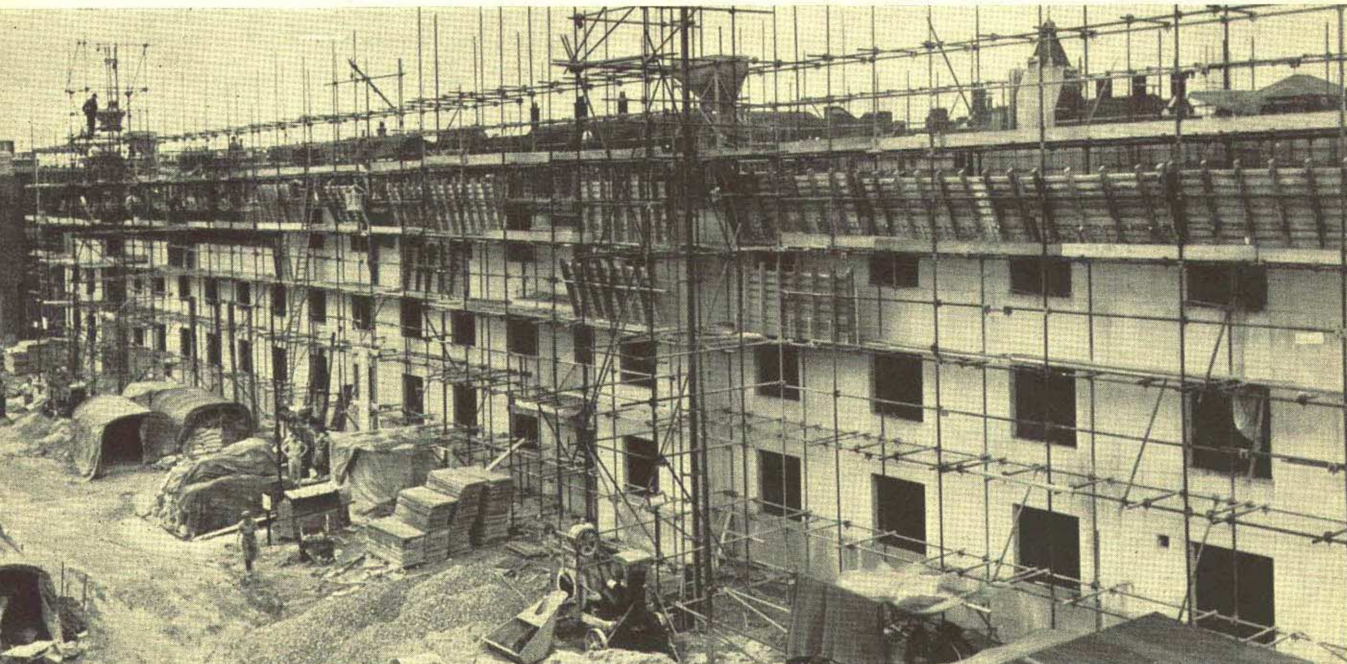
Eight blocks of flats four storeys high on a site of six acres, each of the 253 flats having from one to five rooms, with kitchen, bathroom and lavatory, are the outlines of the London County Council's housing scheme in Minerva Street, Bethnal Green. Staircases lead to balconies on which all the flats open. An acre of ground has been set aside for Community Centre buildings and open spaces.
Holland & Hannen and Cubitts Limited have studied and previously used the system of reinforced concrete construction employed. The floors are simple slabs spanning between load carrying walls, and projecting beams and columns are thus avoided.

This scheme is a striking result of successful collaboration and combined research by a local authority, the London County Council, and the contractors, Holland & Hannen and Cubitts Limited.



FLOOR PLANS BLOCK Nº 1

General view of Block No. 1 under construction



1. Section of Block No. 2 nearing completion, showing the access balconies.
2. Wall lining of wood wool slabs. The external walls are lined on the inside, and the transverse walls on both sides, with 1 inch thick wood wool slabs which are used as permanent formwork. The photograph shows the junction of transverse and external walls before concreting.
3. Placing sliding shutter in position. The external concrete walls are faced with a special mix 2 in. thick. This and the ordinary concrete are placed simultaneously and separated by sheet steel shutters.

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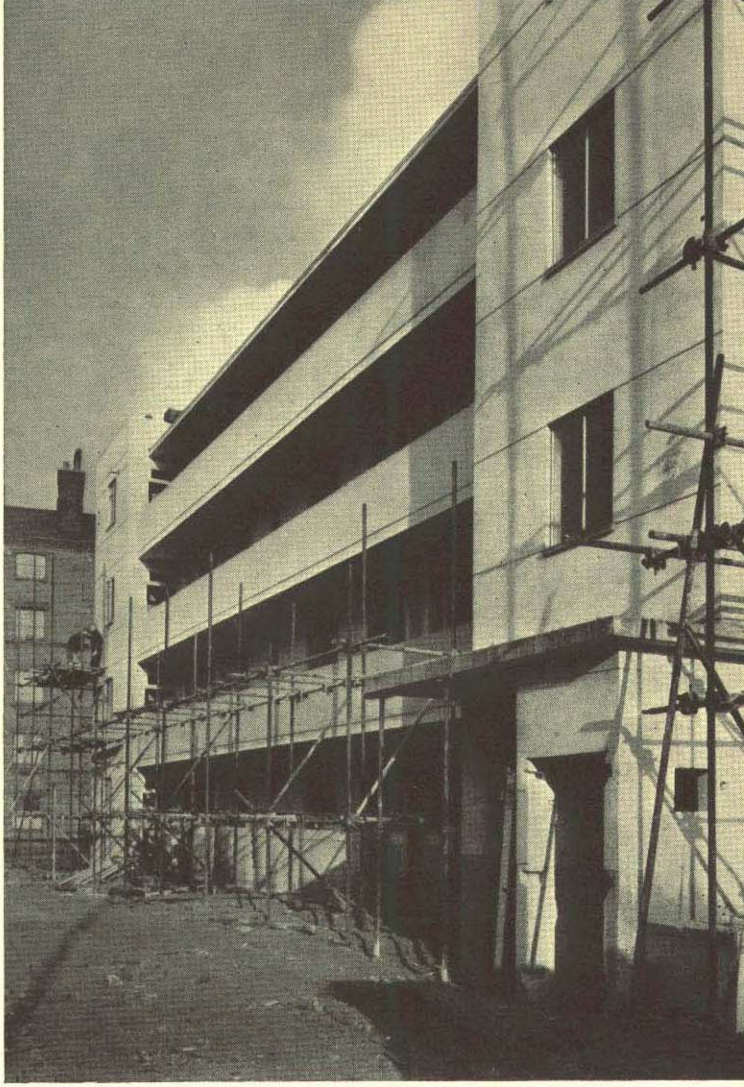

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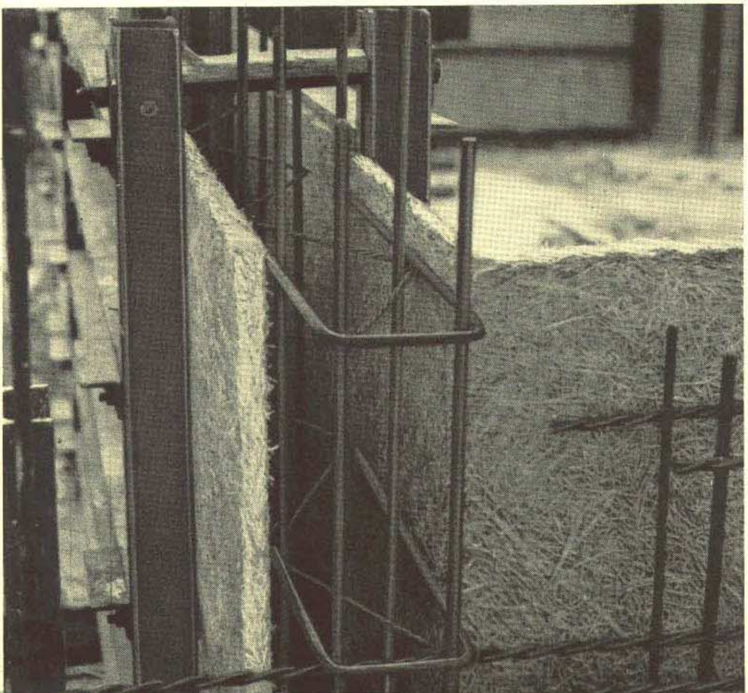

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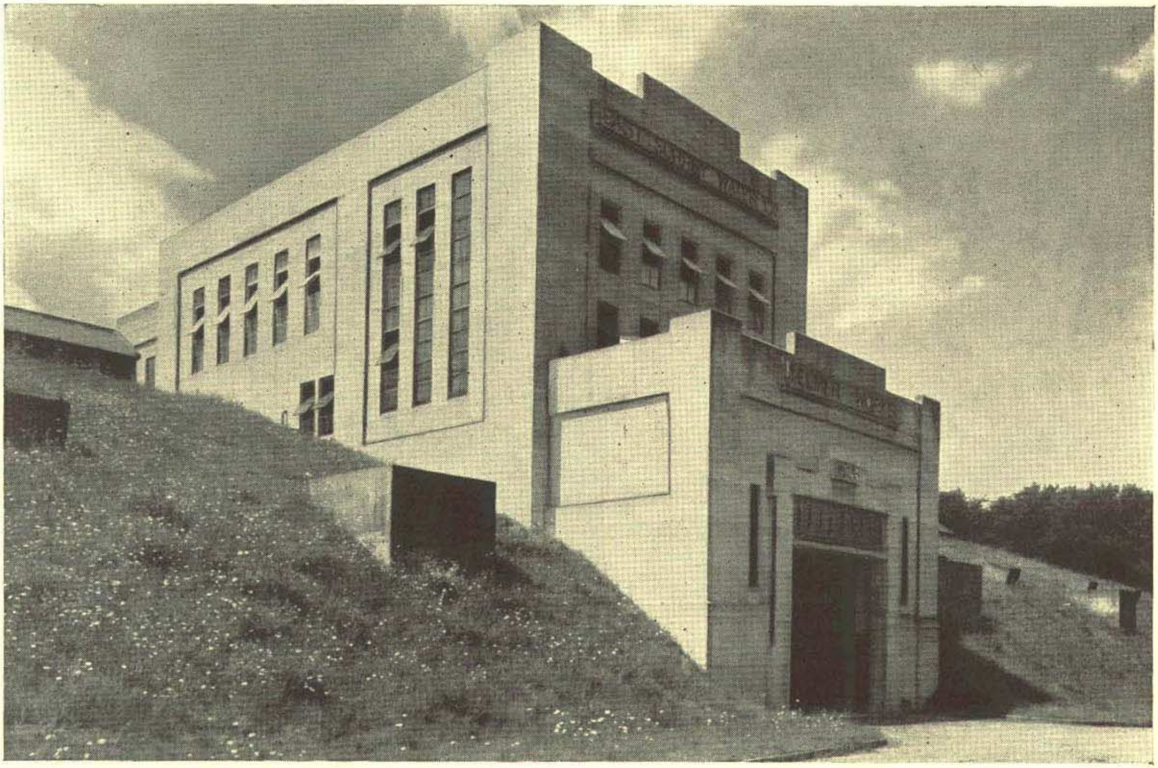


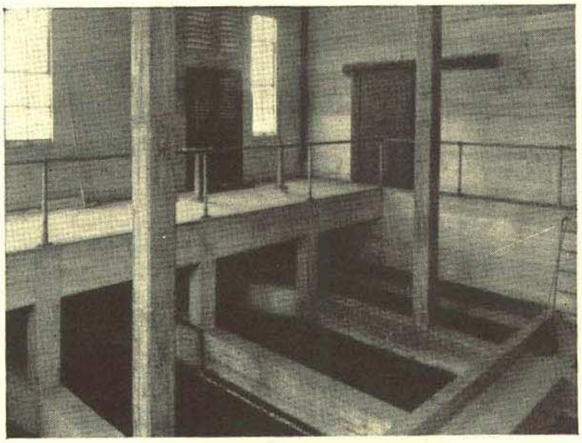
Main building, containing the lime handling plant.

WATER SOFTENING WORKS AT LEATHERHEAD

THE ELMER WATER SOFTENING WORKS, built by the East Surrey Water Company in 1935, have rightly been described as one of the finest examples of reinforced concrete in the country. The clean and agreeable lines of the building are largely the result of the care taken in following closely the intentions of the designer. Maintenance costs over a period of ten years have proved negligible and there has been no deterioration in the quality of the concrete during this time.

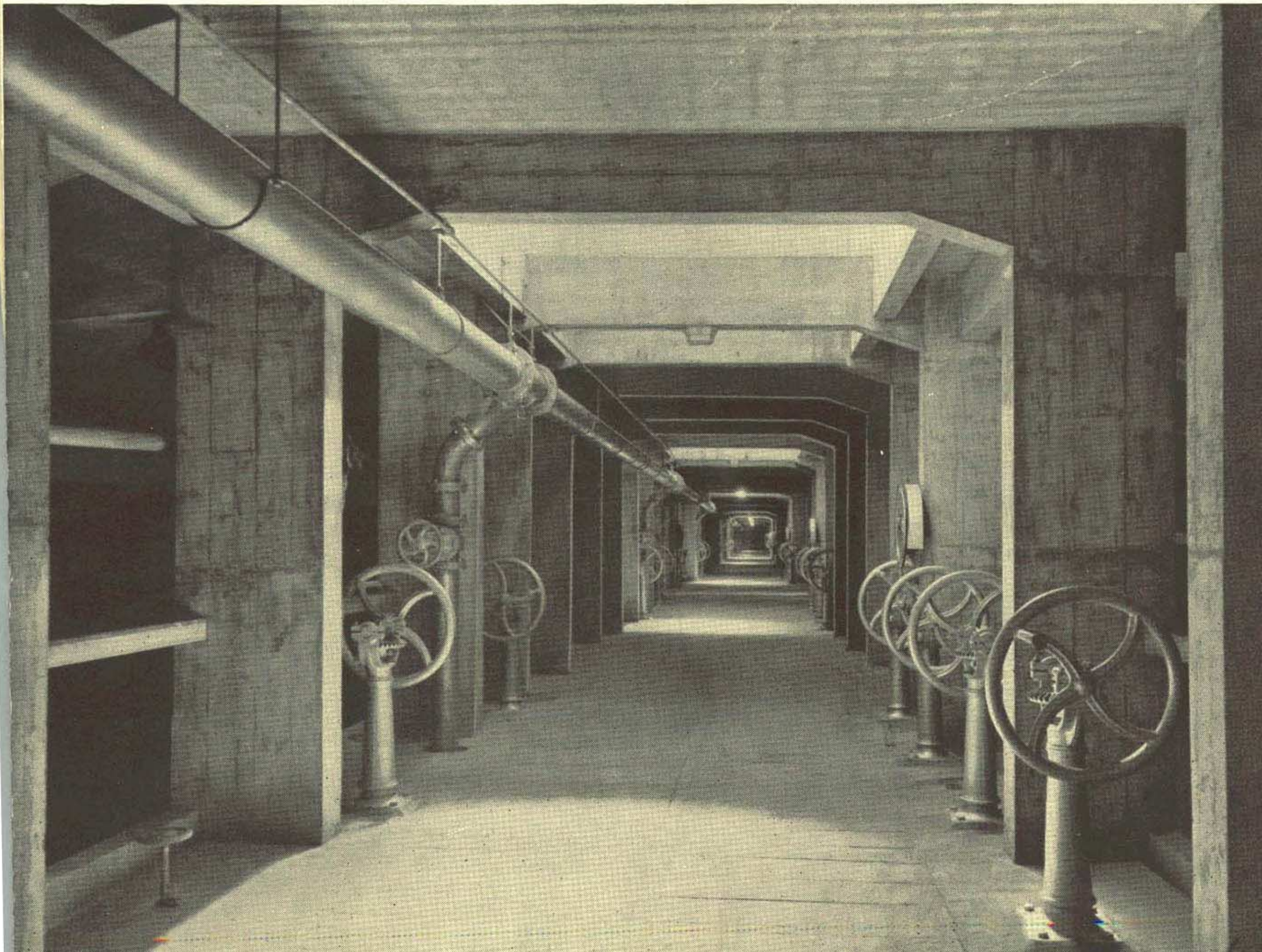
The plant was built to the design of Mr. A. E. Cornewall-Walker, M.I.C.E., who was the Company's Engineer at the time. Each of the ten softening tanks measures 136 ft. 6 in. by 49 ft. and has an effective capacity of 500,000 gallons. There are ten lime-water tanks, each of 38 ft. by 49 ft. and an effective capacity of 100,000 gallons. The daily output is 6,000,000 gallons.

L. G. Mouchel and Partners were responsible for the reinforced concrete design of the lime house, softening tanks and lime-water tanks, and Mr. J. P. Y. Dickey, A.M.I.C.E., was resident engineer for the construction of the works.



Interior of the carbonation house. The marks of the shuttering which can be seen in the concrete provide a very satisfactory finish.

Central corridor, showing penstock heads controlling the circulation of lime "milk" to the mixing tanks.



Sewage disposal works, Rochdale

THE TREMENDOUS ADVANCES made in sewage disposal methods in recent years are exemplified in the Roch Mill Sewage Disposal Works at Rochdale.

During the war the works were reconstructed and modernized to the designs of Mr. S. H. Morgan, M.I.C.E., and since May 1944 they have dealt successfully with the designed dry weather flow capacity of 3,200,000 gallons per day, and at times have even exceeded it.

The cost of installing a Kessener Brush Aeration Plant and of building aerating and separating tanks and other extensions in reinforced concrete was £61,000, which is about 60 per cent. of the cost of a filter plant of the same capacity. Messrs. L. G. Mouchel and Partners, of Manchester, were the consulting engineers for the reinforced concrete work.

The domestic flow to the works is from a population of 85,000 and the chief trade wastes are gas liquor and wool scourings. There is also some infiltration of surface water. Treatment costs work out at £11. 4s. 9d. per million gallons.

The works are fed by two main outfall sewers : Roch Valley, with a daily dry weather flow of 2,215,000 gallons, and Sudden Valley with 985,000 gallons.

Preliminary treatment

The combined flow from these two sewers goes through a three-channel detritus tank and the speed of the intake is kept constant by float-controlled electric motors which raise or lower penstocks at the entrance to the two side channels. Grit from the three channels collects in a central hopper and is dredged into Jubilee wagons for tipping.

The sewage flows through two 1-in. aperture screens which are controlled by a time-switch to work for 3½ minutes at intervals of an hour.

A scraper conveyor deposits the screenings in a sump which feeds a stereophagus disintegrator discharging in front of the screens ; the water then flows between the double sides of a storm water-weir 100 ft. long.

Sedimentation

Primary sedimentation takes place in a horizontal Dorr Clarifier with a nominal D.W.F. retention of 1·17 hours. Sludge is removed under hydrostatic head and a skimmer puts the scum into the sludge-sump at each revolution of the mechanism. Six secondary sedimentation tanks of the usual horizontal flow type have a nominal D.W.F. retention of 10½ hours.

Percolating filters

A portion of the tank effluent goes down a 36-in. main to a well at the back of the pumphouse. Then four centrifugal pumps, with two-float controls in the well, lift the water to a high-level tank. Each is capable of delivering 1,200 gals. a minute against a 20-ft. head and works in an interchangeable sequence, the third one working in heavy storms, the fourth being a reserve. The water goes through a measuring-flume to the filters.

The 13 filters installed in 1913 are 72 ft. in

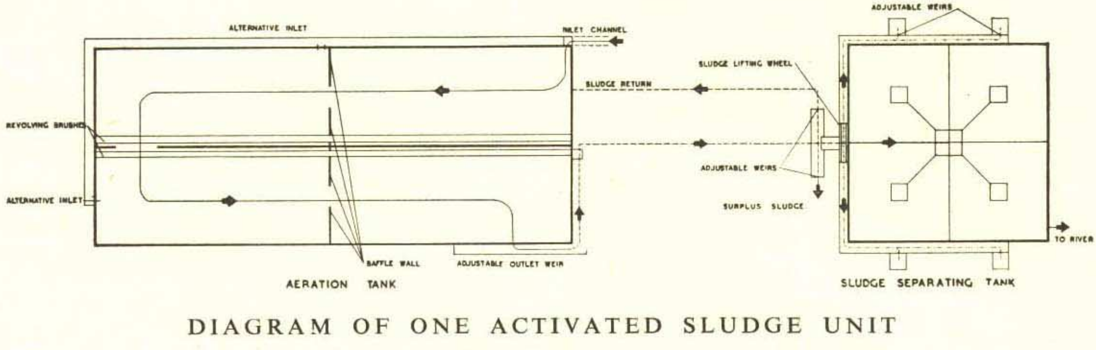
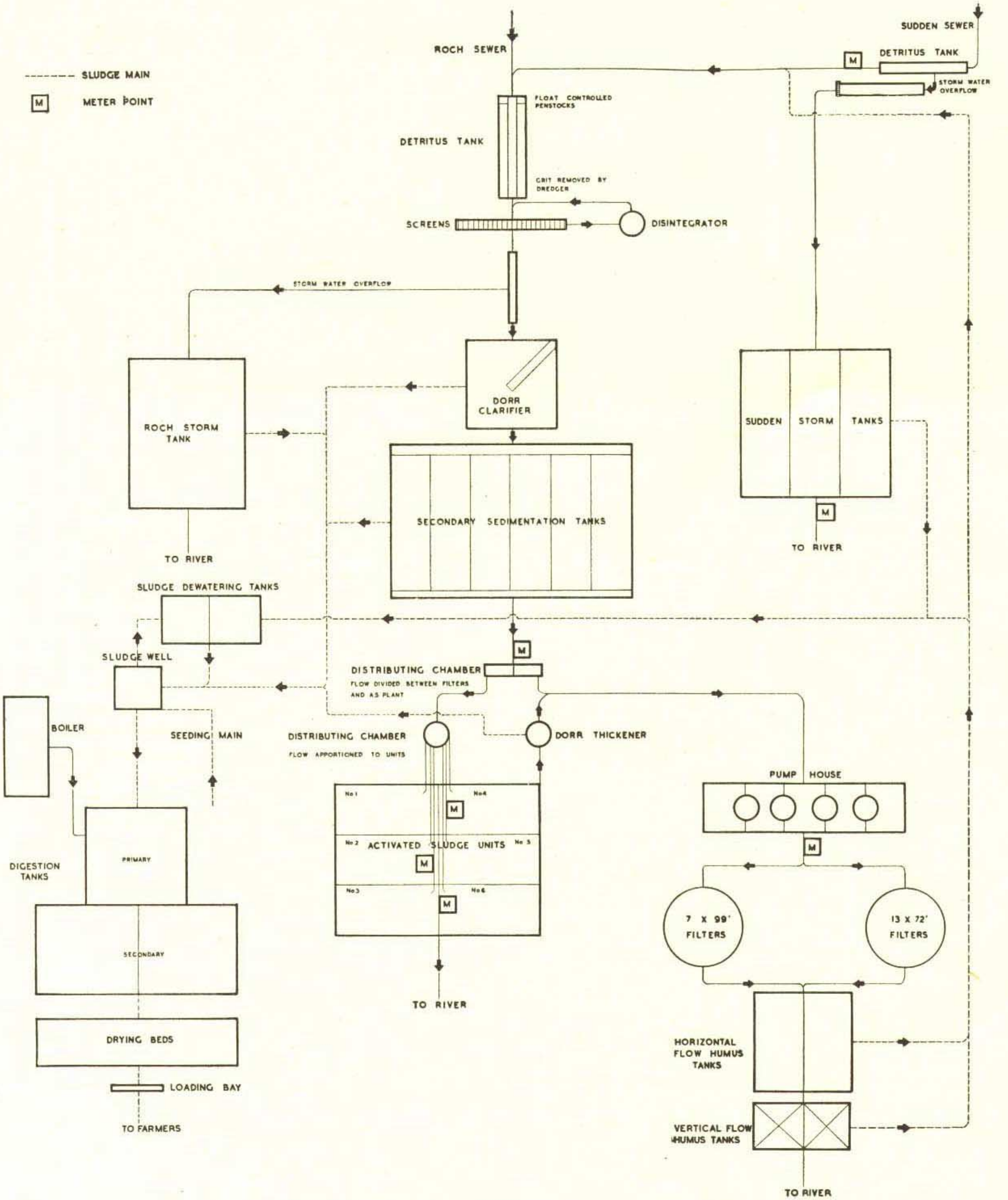
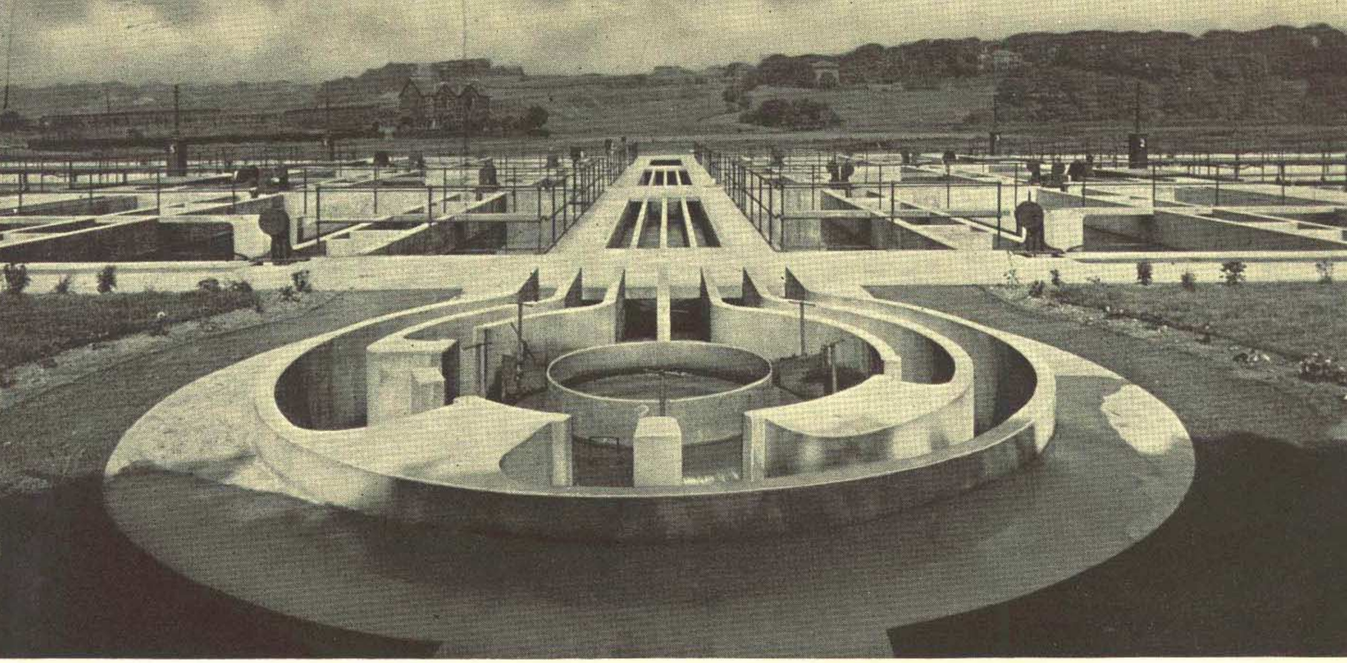


DIAGRAM OF ONE ACTIVATED SLUDGE UNIT



GENERAL LAYOUT OF PLANT



General view looking from the circular weir chamber down the distribution canals serving the tanks.

diameter, 9 ft. deep and filled with coke. The seven 1926 filters are 99 ft. in diameter and 9 ft. deep; six are filled with slag and one with clinker. Each set contains something like 17,500 cubic yards of media and has an area of about 1¼ acres. The distributors were completely overhauled a short time ago and the older ones modernized.

The humus is settled out in two horizontal-flow tanks with a nominal D.W.F. retention of 6¾ hours, then in two upward-flow tanks of 1 hour capacity at a vertical velocity of 9 ft. per hour. A centrifugal pump delivers the humus sludge to Sudden Valley sewer, or to the de-watering tanks or the sludge well at the outfall works.

Kessener Brush Aeration

After the Chairman of the Rochdale Highways Committee and the Borough Surveyor had examined methods of treatment on the Continent, a Kessener Brush Aeration Plant was set up at Roch Mills. The results led to the building of a plant of this type in six independent units, to treat half the flow. It was designed by the Borough Surveyor and his staff in consultation with Dr. Kessener and was put into operation in 1944.

The tank effluent discharges over a circular weir into an annular channel fitted with openings leading to the six units; the flow is apportioned to each of them by cutwaters fitted radially across the channel. The position of the cutwaters is adjustable and the flow to each unit is determined by the length of weir feeding it. The plant has open concrete channels instead of the more usual pipes.

Aeration tanks

There are two aeration tanks in each unit. Each tank is 96 ft. by 16 ft. and of 16 hours nominal D.W.F. retention. The water passes along one tank and returns through the second. The brushes, ten stainless steel combs caulked with lead strips into longitudinal grooves in a steel shaft, are fitted along the sides. Rotating at 140 r.p.m., they touch the surface of the water and throw it outwards. This movement, combined with the forward speed of the water, causes a spiral flow. Aeration takes place both by surface agitation and by entrained bubbles. The tank in cross-section is asymmetrical, with a curved bottom and a baffle to assist the circulation. Some of the water passes over and the rest under the baffle. At the inlet a baffle-box which directs the influent downwards also helps to set up a rotary movement.

Midway down each tank there is a cross wall with an opening at the top. The tank effluent may be fed in at the beginning or half-way down the first tank, or at the beginning of the second tank. This allows the sludge to be reconditioned, but tests in normal conditions have not shown that this method has any distinct advantages.

The liquid leaves the tank over a weir 30 ft. long, adjustable as to level over a range of 2½ in. The setting of this weir, plus the head over it, determines the depth of immersion of the brushes and, consequently, the aeration.

Sludge separating tanks

The liquid then passes through a distributing chamber into four square upward-flow settling tanks. Their nominal D.W.F. retention is 6 hours. The stilling boxes, of reinforced concrete, are suspended from cross-beams. The sludge is discharged under hydrostatic head into a small chamber and passes over a weir into the sludge channel. This weir can be raised or lowered through 5 in., thus altering the head discharging the sludge and controlling the rate of discharge. At its highest point it is above the level of the separating-tank weir. The sludge from the four tanks is returned to a channel where there is an elevating wheel, divided into six compartments which turns at 6 r.p.m. It lifts the sludge into a short channel which leads at one end to the beginning of the aeration tank and at the other to the surplus sludge channel. At each end there is a weir built up of brass strips. The discharge over each weir is controlled by building the strips up or lowering them. Each strip gives an increase in height of $\frac{3}{8}$ in.

In unit No. 6 sludge can be discharged directly into the surplus sludge channel without passing through the wheel, and sludge from the surplus channel can be fed into the unit.

Sludge thickener

The surplus sludge passes through a Dorr Thickener, and the rate of discharge of the thickened sludge is controlled by a telescopic valve. The top water runs into the mains leading to the filters.

Storm water

The storm water from Sudden Valley sewer is separated by a new doublesides weir and passes through a detritus tank and a screen. The detritus tank is emptied by hand with the help of an electric hoist and bucket. The screen is brought into and out of operation by "Noflote" control. The screenings are returned to the sewer to be removed and disintegrated at the outfall works. The storm water then passes into three tanks with a nominal D.W.F. retention of $7\frac{3}{4}$ hours.

A centrifugal pump with a vertical spindle sends the sludge to the well at the outfall works. At present there are two storm-water tanks at Roch Valley, but it is proposed to build a third. The present retention time is $5\frac{3}{4}$ hours.

Sludge disposal

All the sludge produced finds its way to the well at the outfall works. There it may be passed through one of two de-watering tanks or pumped to the primary digestion tank. Ripe sludge from half-way down the primary tank is returned from the well to inoculate the crude sludge. The primary tank has a capacity of 68,000 cubic feet, and there are two secondary digestion tanks of a total capacity of 112,000 cubic feet.

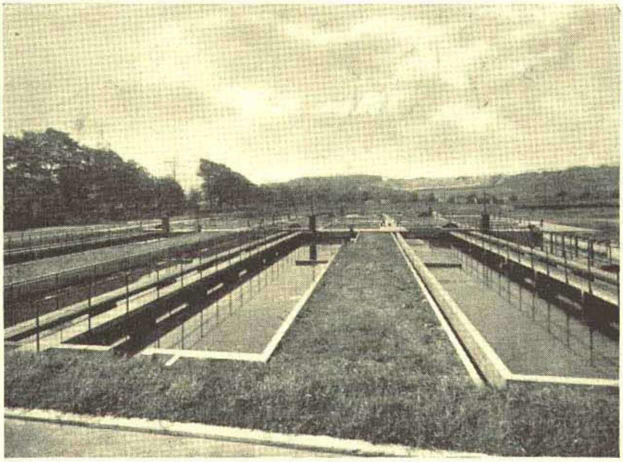
The sludge is heated by injecting steam from a vertical coke-fired boiler and dried on under-drained ashed drying beds. It is taken away in Jubilee wagons and a petrol loco and a loading-bay has been built for hauliers. All suitable sludge is sent to farmers.

Meters

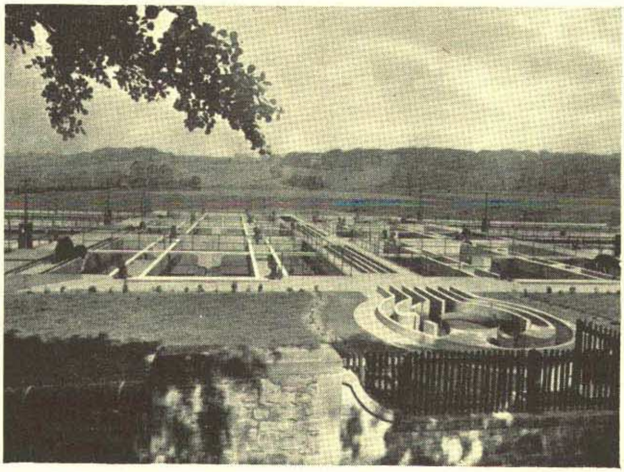
"Electroflo" meters are installed. At each metering point there is an indicator and two panels of grouped instruments: indicators, integrators and recorders. A noteworthy point in the Activated Sludge Plant is a weir and float chamber on each effluent channel and a meter-head and float for each pair of units. These can easily be changed over from one unit to the other, so that units 1 or 4, 2 or 5, 3 or 6 can be metered. There are three indicators and integrators for these on the main panel.

Finally, there is a fully-equipped laboratory where a chemist makes routine analyses. In the staff of thirteen there is a blacksmith and striker for general repairs and a full-time gardener.

Aeration tanks.



Circular weir chamber with aeration tanks beyond.



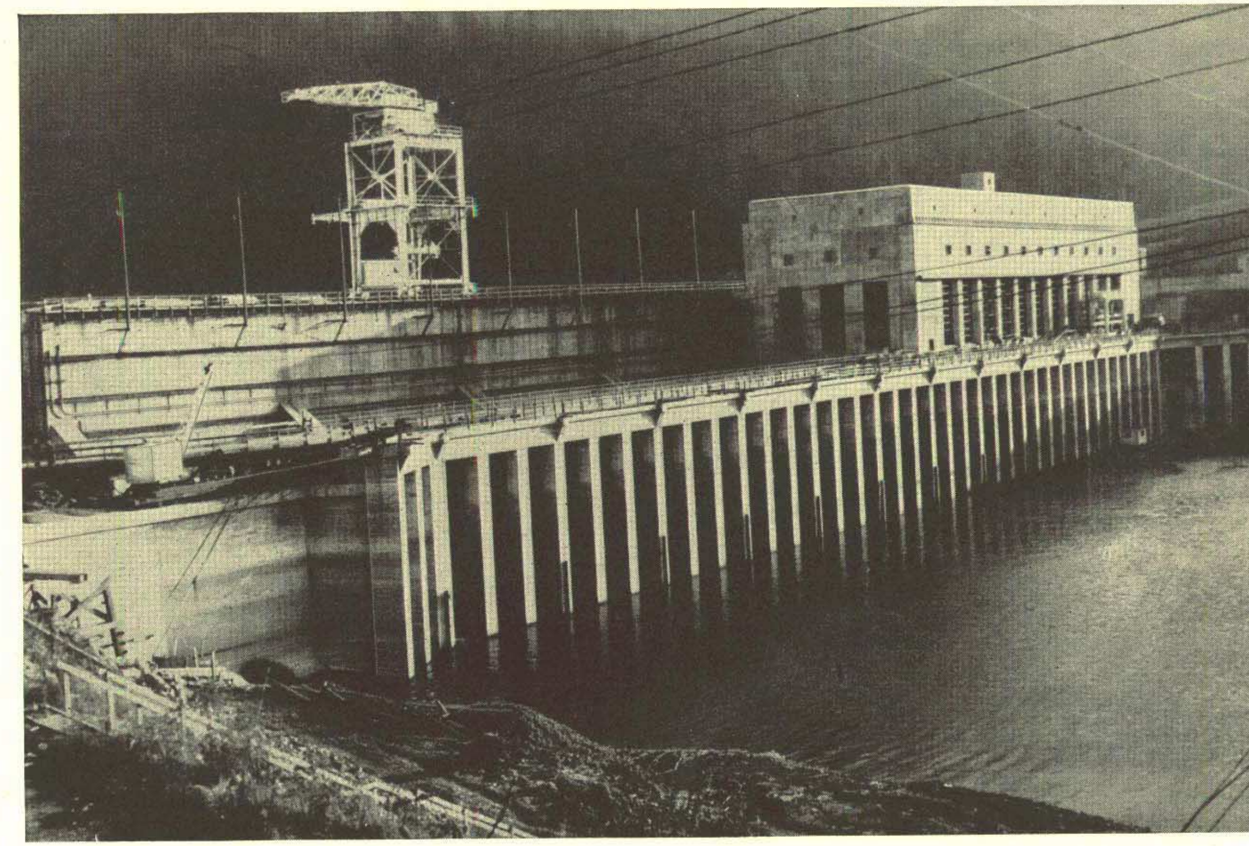
THE BONNEVILLE PROJECT

MANY MAJOR HYDRO-ELECTRIC schemes were carried out in the U.S.A. in the ten years from 1930. We now reproduce a series of photographs of two of the dams built on the Columbia River, Oregon, as part of the gigantic Bonneville Project.

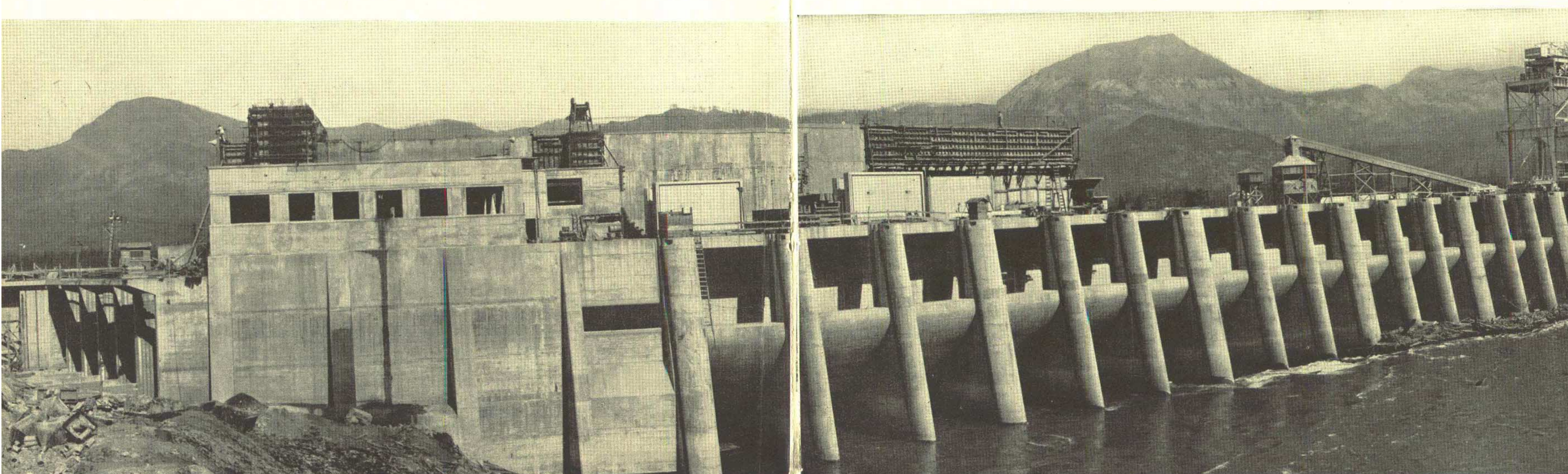
The Columbia River flows for 1,400 miles from British Columbia before falling into the Pacific at Astoria, Oregon.

For its last 250 miles it forms the boundary between the States of Washington and Oregon. The Bonneville scheme included the building of ten dams along this important stretch. The object, of course, was to improve the river for navigation, to control floodwater and to irrigate, and to provide hydro-electric power.

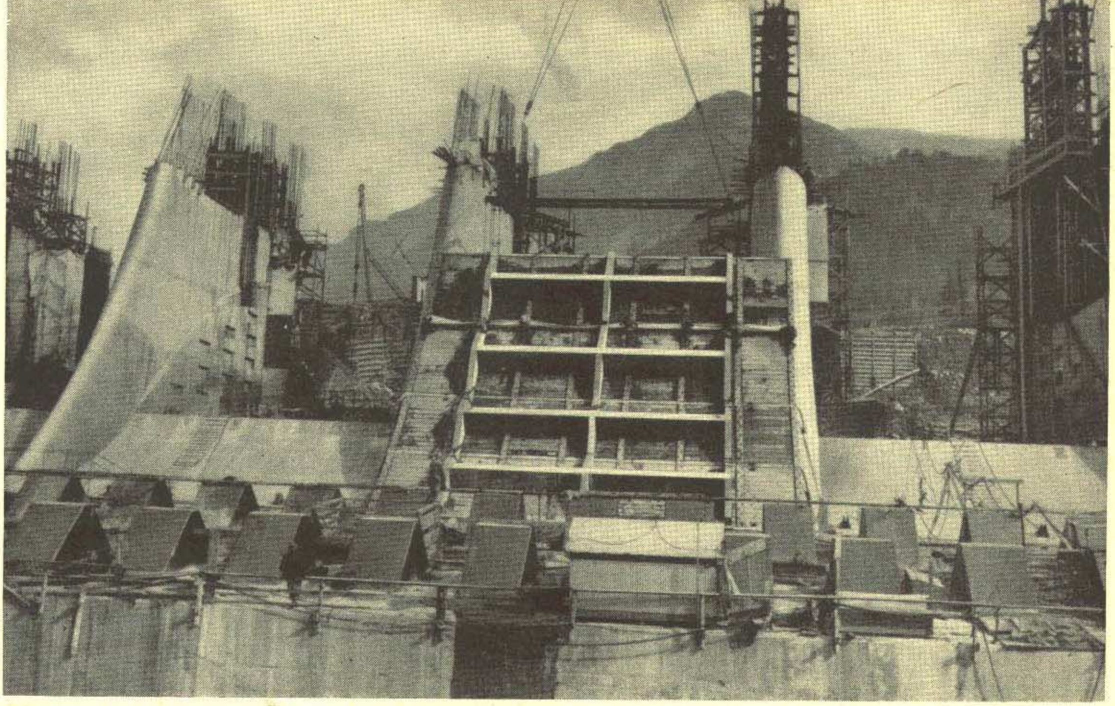
Our photographs show various stages in the building of two of the ten dams.



Above: An upstream view of the same dam. A navigation lock at the southern end has an extreme lift of 66 ft. which is claimed to be the biggest single lift in the world. The lock is 500 ft. long and 76 ft. wide.



The downstream side of the huge Bonneville power house dam. The structure is 608 ft. long, 180 ft. high, with an overall width of 207 ft. The superstructure was designed to take 10 generating units of 43,200 kw. each, and one 4,000 kw. house-unit.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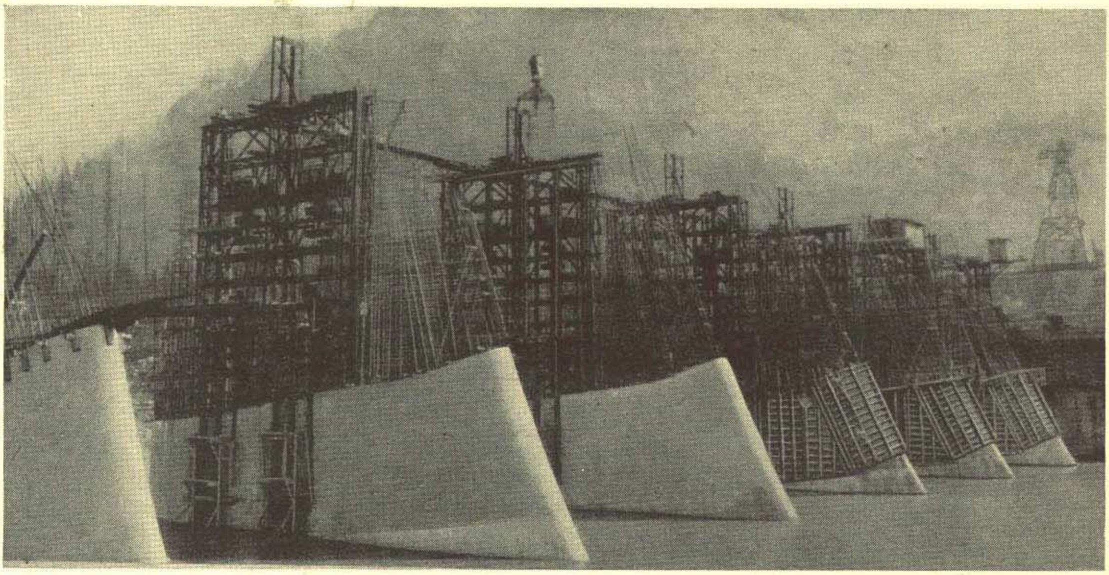
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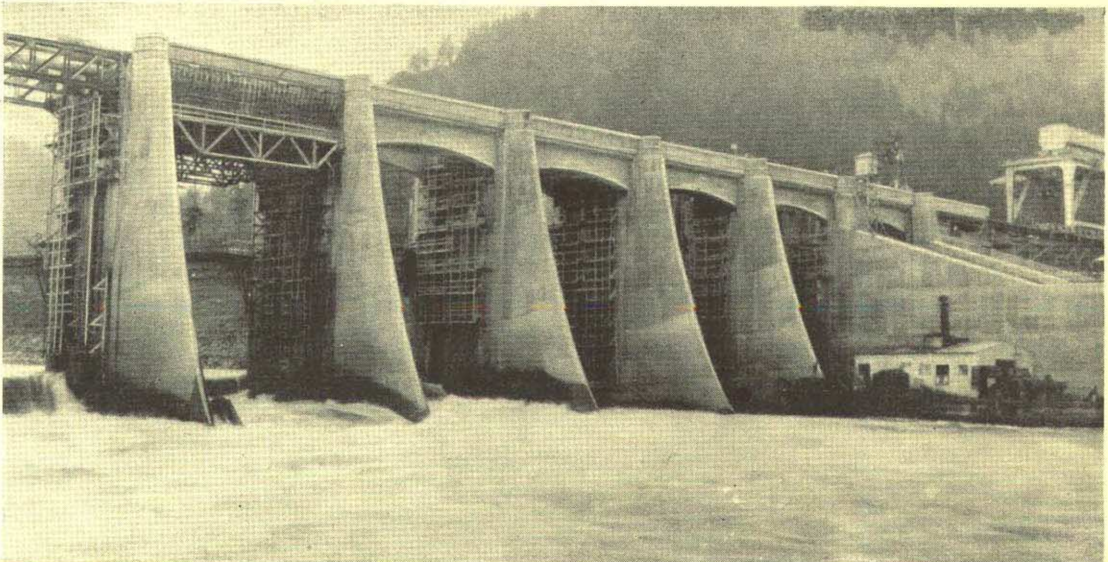
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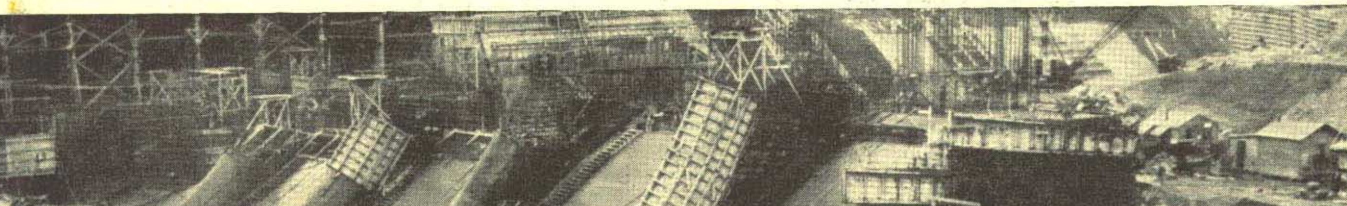
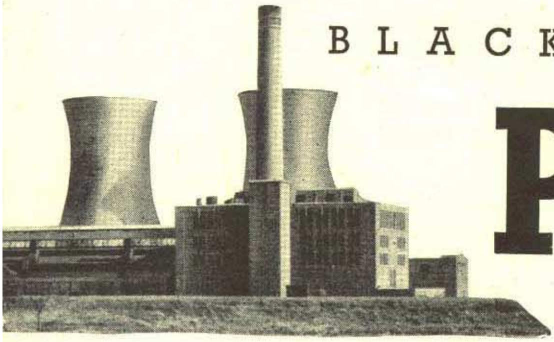
1. Fitting a timber bulkhead on the downstream side of the spillway dam, which was built in two parts by closing half the river at a time with coffer dams. The southern half was built first and, to leave free passage while the northern half was being built, the gate-sills were not carried to their final height. When the northern half had been built the southern gate-sills were finished by closing each bay in turn with a portable caisson and timber bulkhead.

2. Building the 10-ft. thick reinforced concrete piers for the spillway dam. They were specially reinforced with steelwork designed to withstand both the direct and the side pressure which occurs when some gates are opened and others left closed. Part of the reinforcement consists of the supports for the gate-guides, which are concreted in.

3. Bonneville Dam spillway nearing completion. The 17 columns are set at 60-ft. centres ; in the 50-ft. wide openings there are 18 lift gates operated by one of two travelling gantry cranes. Reinforced concrete counterfort wing walls run 120 ft. upstream at each bank to protect the ends of the dam and control the flow to the gates. The spillway was designed to pass a flood of 1,770,000 cusecs.



Above : The apron, baffle deck, gravity section and beginning of the piers for the spillway dam. The apron, in the foreground, is 77 ft. 6 in. wide and the baffle deck 63 ft. wide. The reinforced concrete baffles and the wide concrete apron at the toe give protection against the scouring effect of the water as it passes over the Spillway. The wedge-shaped baffles are 6 ft. high and 2 ft. wide at the top, with the front and rear faces included at 45 deg. The two rows are in staggered formation across the whole length of the dam.



BLACKBURN Power STATION

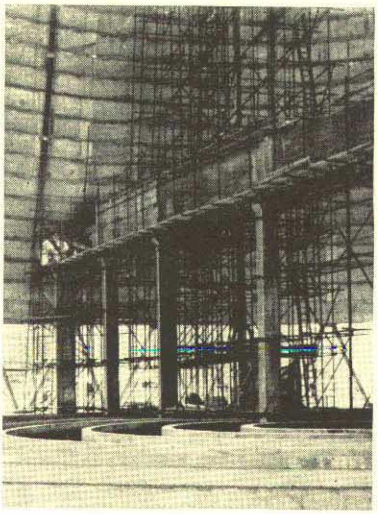
EXTENSIONS TO THE BLACKBURN power station have increased its capacity by 70,000 kw. and brought it the name of " the Battersea of the North ". They were begun in August 1940, and except for some sections of flooring and some inside decorations, have been finished at a cost of £2,000,000. The station is in the Whitebirk district, just outside the eastern boundary of the Borough of Blackburn.

For the two Davenport hyperbolic concrete cooling towers, Mr. R. H. Harral, M.I.E.E., chief electrical engineer and manager of the Blackburn Electricity Undertaking, designed an entirely new structural feature. Within 20 ft. of the top of each tower, on the inside, an annular trough has been constructed to catch the water which condenses on the walls at the tops of the towers and store it for the " Mulsifyre " fire-fighting installation. Each trough holds 10,000 gallons. With this arrangement the fire-fighting system does not need a pump, though a stand-by pump is installed.

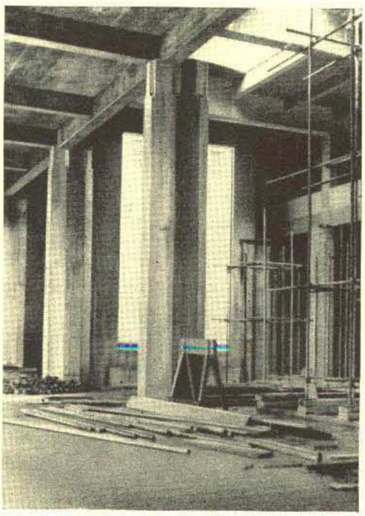
Each of the cooling towers has an hourly capacity of 1,800,000 gallons. The towers are 250 ft. high with a sill diameter of 165 ft. and are equipped with 940 sprayers which receive the returned circulating water direct from the condensers. The circulating water pipes, 48 in. in diameter, are also of reinforced concrete cast on the spot.

Different methods were used in building the two extensions of the turbine house. The first extension is an encased steel frame with brick infilling. In the second there is a reinforced concrete frame with brick panels and a concrete

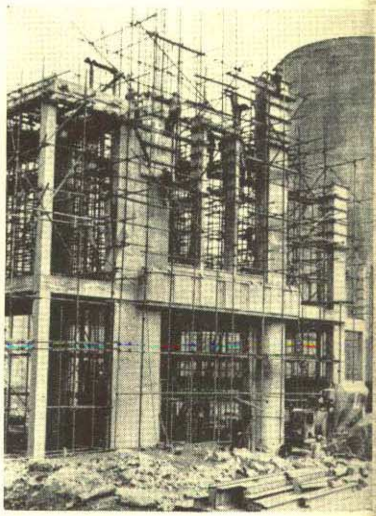
Interior of cooling tower, showing reinforced concrete distribution channel across the diameter of the tower.

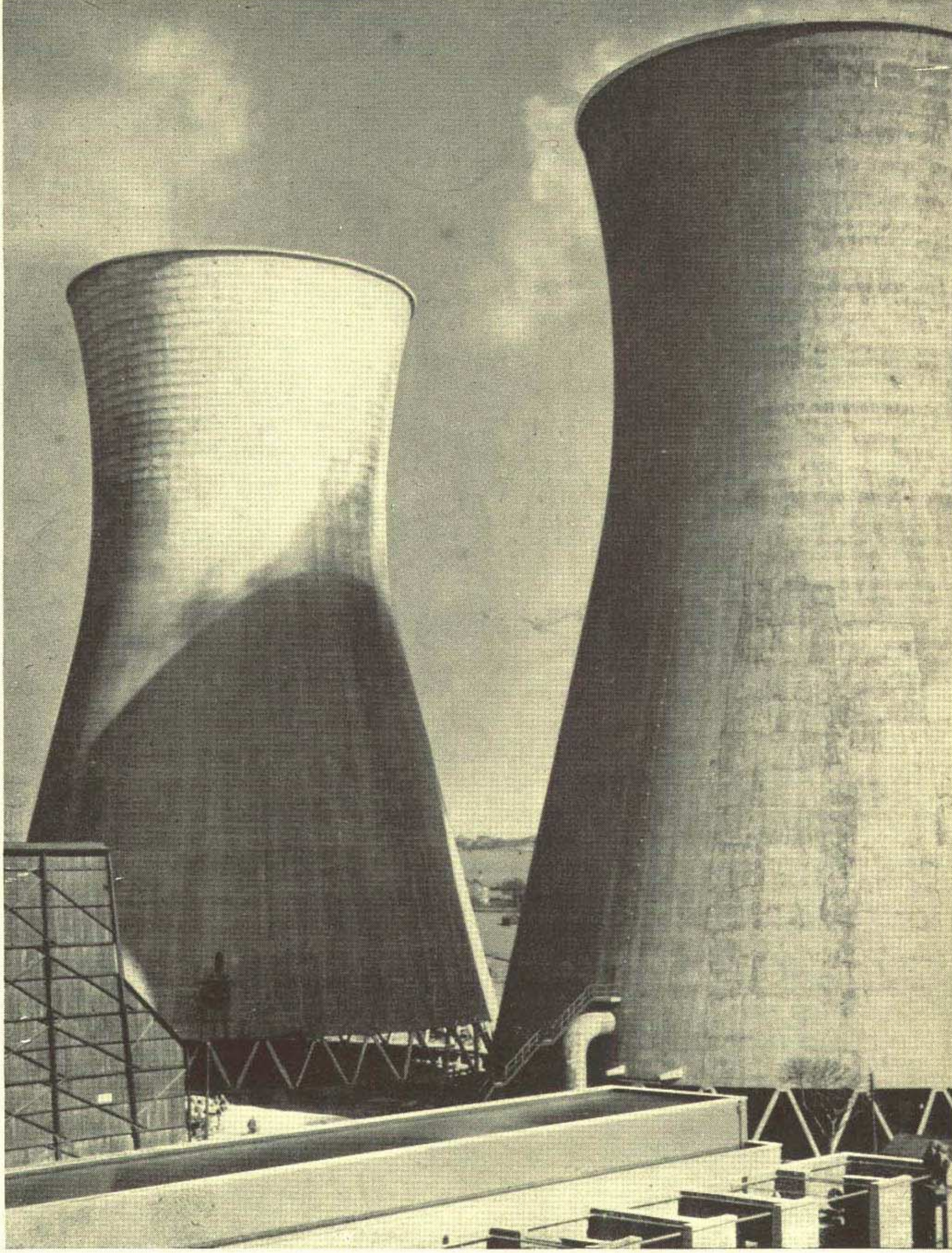


Concrete columns in turbine house, immediately after removal of the shuttering.

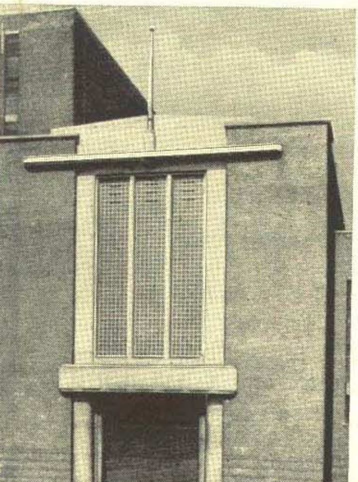


Reinforced concrete power house under construction.





Cooling towers. Note the reinforced concrete rising main feeding the channel shown in the first picture opposite.



Western end of new turbine house showing exterior view of Lenscrete windows in concrete setting.

Interior of turbine house showing Lenscrete roof lights.

roof of beam and slab design. The concrete here saved more than 100 tons of steel. Special lights of " Lenscrete " glass are set in the raised central part of the roof of each extension.

Reinforced concrete without a steel frame was used for the turbine blocks, which are insulated to reduce vibration. The expansion gaps between the blocks and the floor are filled with Mascolite. The floors in both the boiler and the turbine house have granolithic surfaces.

The architectural design of the new turbine house is impressive. There is a central turbo-alternator bay lined with massive concrete pillars. Beyond it are open annexes for the boiler feed-pumps and feed water-heaters on one side and for the auxiliary switch gear on the other. The flooring is concrete with a terrazzo surface and the walls and pillars are in agreeable pastel shades. Set most effectively in the western end of the building is a large " Lenscrete " window.

A single 250 ft. concrete chimney serves all six boilers. It is 25 ft. square at the base and has an acid- and heat-resisting loose lining. On three floors below the main flue it houses sub-stations for auxiliary plant. It was built of concrete to save time and cost.

Ashes and grit from the boiler furnaces are washed by a low-pressure sluice system down a concrete channel lined with metal to a central sump, where the ash is lifted in a perforated grab on a telpher. It is allowed to drain, then transferred to an elevated concrete hopper to be put into lorries. The water circulates continuously through the system.

Other interesting points in the enlargement scheme are full automatic control of the six stoker-fired boilers, a separate boiler control-room, and direct generation at 33,000 volts.

Coal can be brought into the station by three means of transport: road, water and rail. The L.M.S. Blackburn-Yorkshire line and the Leeds-Liverpool Canal run along two boundaries of the site. Coal by rail is handled by a wagon tippler at the siding and carried to the boiler-house bunkers on belt-conveyors standing on three concrete towers. At the first tower it can be by-passed down a chute to a storage ground which holds 100,000 tons and distributed from there by a drag-line scraper, the return block to which is mounted on a concrete ballasted bogie on rails laid on east and south-east boundaries. Water-borne coal can be delivered either to the storage ground or to the belt conveyor, for there is a crane on the east bank of the canal near the second conveyor-system tower.

Holst & Co. Ltd. were the chief contractors for the second extension and sub-contractors for the cooling towers. Simon-Carves Ltd. were the contractors and Tileman & Co. the sub-contractors for the chimney, the boiler house, the turbine house and the coal-handling plant in the first extension.

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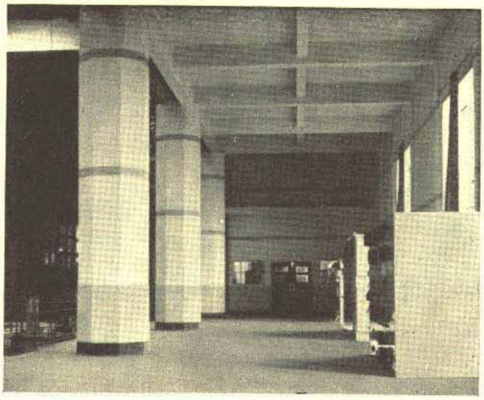

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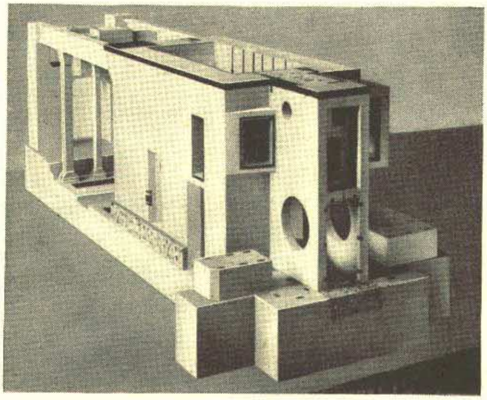

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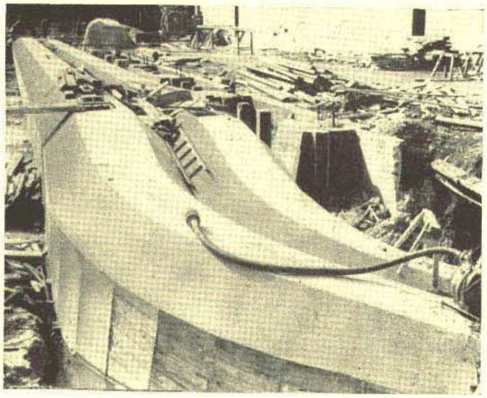

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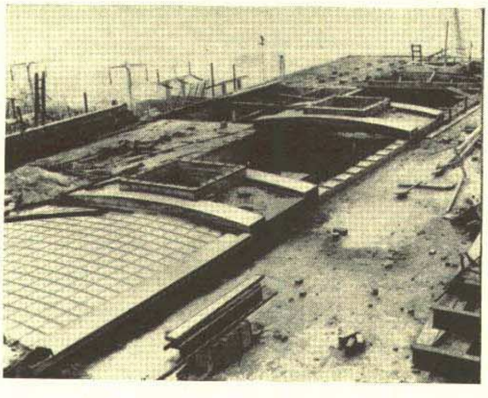


1. *Switch-room floor, showing treatment of the reinforced concrete columns.*
2. *Scale model of reinforced concrete foundations to the turbo-alternator.*
3. *Reinforced concrete pipes,* 48 *in. diameter, which carry circulating water from the condenser to the cooling towers.*
4. *Lenscrete roof lights under construction.*

Reconstruction

AT MOSTON COLLIERY

IT IS BELIEVED THAT A BIG SCHEME for the complete reconstruction of Moston Colliery pit-head will put the daily production of the pit up from 500 to tons 1,500 tons and cut down pit-head labour by 80 per cent. The first stage of the scheme, the new reinforced concrete pit-head gear and air-lock on No. 4 shaft, is almost complete. But in order to keep up production, reconstruction work has been suspended during the present shortage of coal.

Simon-Carves Ltd. built the new headgear round the old steel-and-timber frame without closing the shaft. It has very high doors, which will make cage-changing a matter of hours instead of days ; there is an internal staircase to give access to the cage if there is an "over-wind" and for inspection and maintenance, and arrangements for experimenting with 4-ton and 6-ton tubs instead of the 10-cwt. tubs which have been in use for many years.

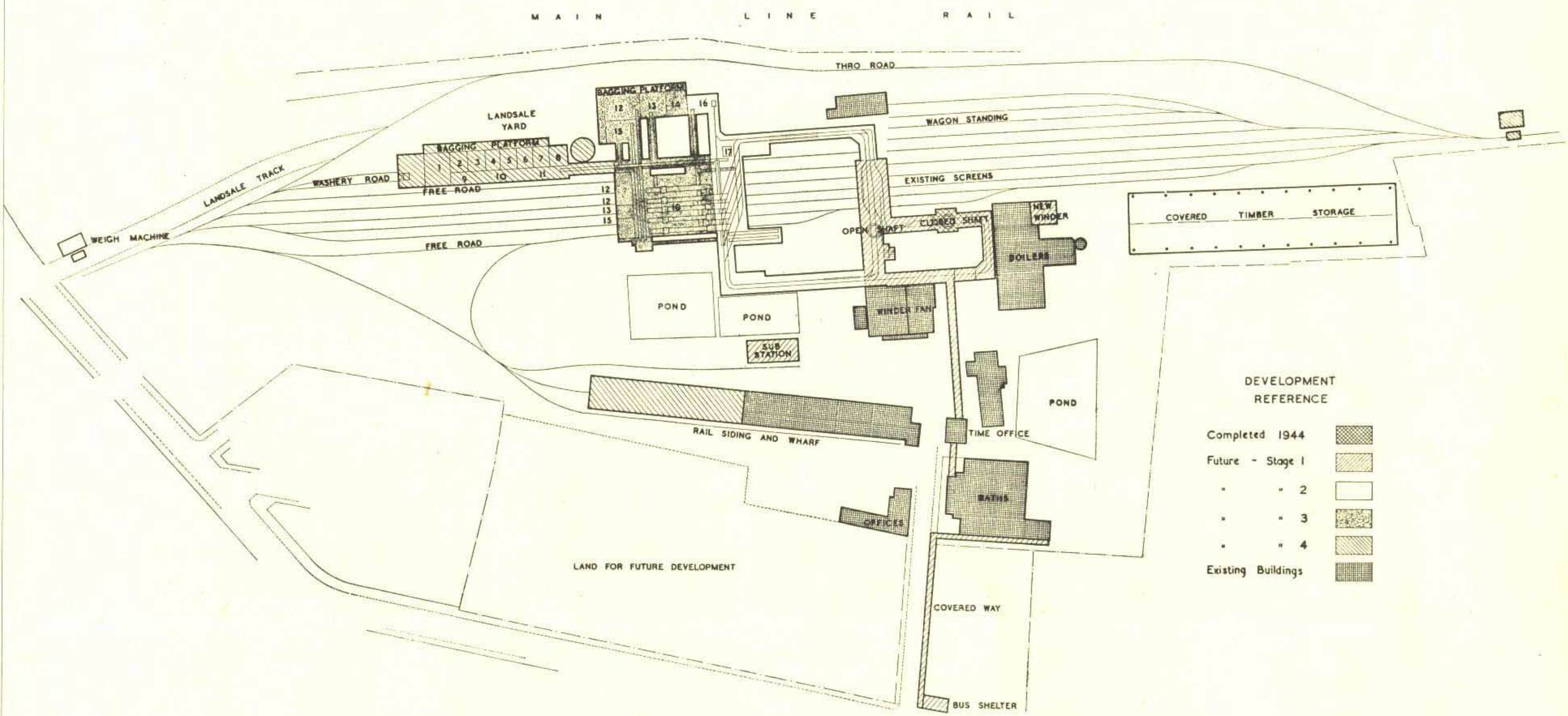
The Moston pit, it seems, has another 300 years of life, and proved reserves of more than 61,000,000 tons of coal are still untapped. The new pit-head gear has therefore been designed to have a long life, and in places the foundations of the tower go down as far as 30 ft. below ground-level. It has also been designed with an eye to easy conversion to skip-winding. When the full plan has been carried out the colliery will be mechanized to an extent that will make it the most modern in the country.

For instance, from the time the tubs are filled at the working face until they return empty they will be controlled automatically. From the pit-head they will travel by gravitation or by creeper-elevator to the weigh-house, where not only the weight of the coal in them, but its quality and the working face it came from, will be recorded by a pre-selector device. They will then pass on through automatic switching gear to their respective screens where mechanical tipplers will empty them. On their return to the mine the automatic points gear will bring them to their correct positions and the doors to and from the air-lock will be opened and closed by Westinghouse Control.

Mr. John H. Morris, formerly general manager of the colliery, perfected a belt-conveyor which will save a lot of labour at the sorting screens. The sorters will pick out the stone and dirt as the coal passes them on the upper surface of the conveyor and put it on the returning under surface. From there it will be tipped on a crossing belt and carried to the waste dump. At present the sorters throw the waste on the ground, which makes double work and carting.

The mine now has its own power supply, but it will get power from the mains when a new reinforced concrete electricity sub-station has been built. Much of the motive power for ventilation and other purposes will then be changed over from steam to electricity.

An innovation which may turn out to be a great deal more than an enterprising experiment is the use of radio telephones or "walkie-talkie" sets which



Surface layout of Moston Colliery, Manchester, showing the existing buildings and proposed future development. The new constructions are planned to ensure improved working conditions for the men.

New headgear and airlock, showing the struts supporting the old steel and timber headgear and the winding rope of the original pulley leading through the walls of the new tower.

the mine officials will carry underground. Instant communication at any time, between the head office and any part of the workings, as is important in underground operations as in those above ground. Very likely the time will come when we shall talk of the days of mining without such things as these as " dumb " indeed.

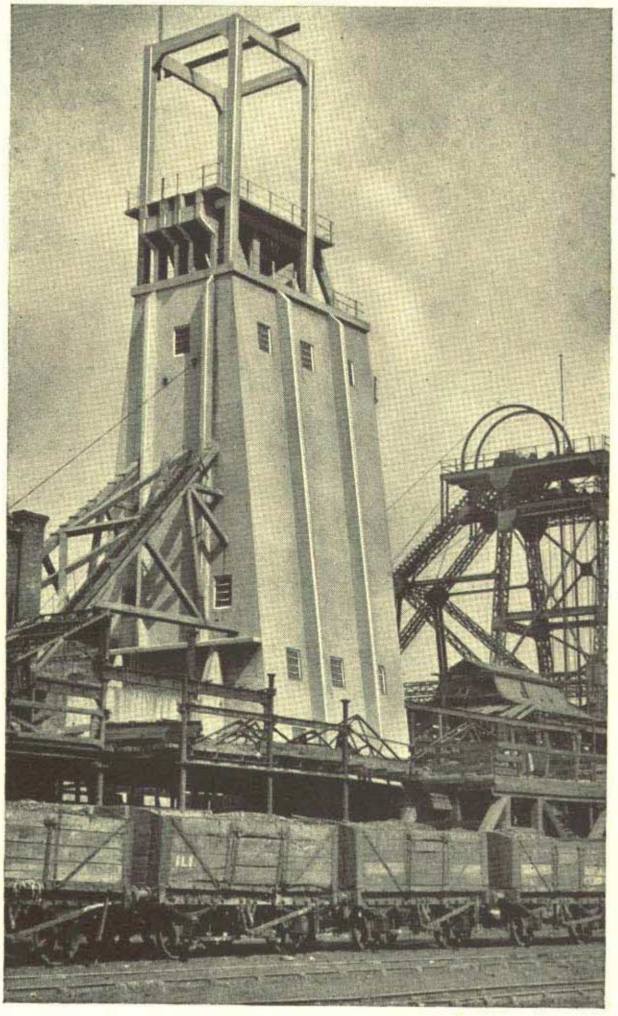
On the subject of mining in general and of this scheme in particular, Mr. Morris remarked that it had long been realized that if an adequate labour force were to be kept in mining the pits would have to pay higher wages than any other industry. This could only be done if mining were highly mechanized and efficient. It would also have to offer the best possible working conditions in order to attract labour which might otherwise go to modern factories.

The improvement of working conditions has been considered very carefully in planning the new layout of this pit-head. The men will be under cover from the time they arrive to begin their shifts. An enclosed and covered walk will run from a bus-shelter to the canteen and pit-head baths, then on to the self-servicing lamp-room and the head of the shaft. Additions to the pit-head buildings are to be entirely in concrete, and the present brick structures will be clothed in concrete to save the cost of repointing and other maintenance. The steel-frame head-gear to the open shaft is also to be re-modelled in concrete, with the steel members as the main reinforcement.

Among other improvements are pit banking and screen platforms, a 50-ton bunker and landsale with an automatic filling, weighing and bag-sealing plant, a modern washery with a closed water-circuit and its own purifying plant, new roads, concrete fencing round the whole area, and a covered timber store with portable electric saws.

When the improvements we have described have been carried out, there are more to come, the first of them being a concrete by-products plant which will be able to handle not only Moston coal but coal from " foreign " pits. A modern office building will also be put up.

The monthly production figures at this pit are well above the target set by the Ministry of Fuel and Power, while the pit band, the members of which are all mine-workers, has set up its own record by twice winning the Belle Vue 100-Guineas Gold Cup Championship, open to top-grade bands only.

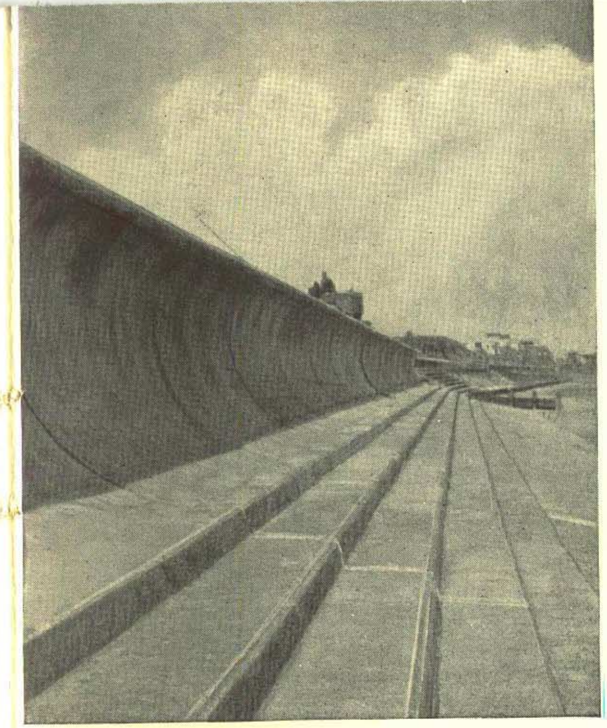


New headgear contrasted with the older structures which remain. Under the new scheme the old steel frame and timber "bank" in the foreground will be replaced by a modern reinforced concrete structure and the steel frame of the headgear on the right will be encased in concrete. Simon-Carves Ltd. are responsible for the reconstruction work.

The foreshore from the top of the new sea wall south of Sutton-on-Sea, looking north.

New LINCOLNSHIRE *Coast Resort*

Sand dunes and the northern limits of the sea wall at Mablethorpe.

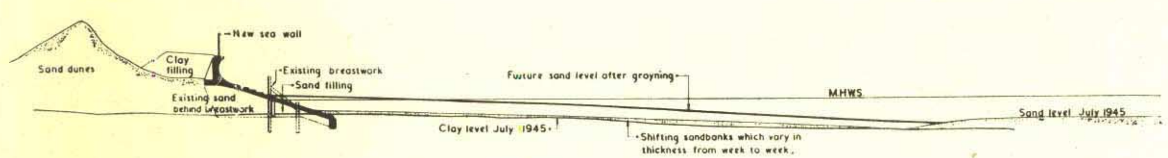


The new reinforced concrete sea wall under construction at Sutton-on-Sea. Engineers: Lewis and Duvivier for Alford Drainage Board.

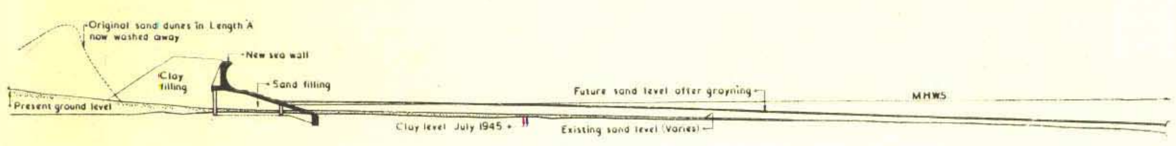
AS EARLY AS 1932 a small urban district council on the Lincolnshire coast began acquiring the whole stretch of the foreshore in its area. It has now acquired it all, at a cost of £40,000, and the outcome of its foresight is a five-year plan for turning six miles of seaside between the Humber and the Wash into a holidaymakers paradise.

The plan, which comes from Mablethorpe and Sutton-on-Sea, twin towns with a resident population of only 6,000, was exhibited at the Royal Empire Society Hall in London on the 2nd and 3rd May 1946, and was prepared by Mr. G. A. Jellicoe, F.R.I.B.A., M.T.P.I. There seems to be everything in it that seaside holiday-makers of all classes and ages could wish for.

Mr. Jellicoe based his layout on the 3½ miles of reinforced concrete wall built by the Alford Drainage Board as part of the sea defences, and he has succeeded in transforming the scene without lessening the natural beauty of the coastline. The six miles of sand dunes which are believed to have been put up by the Romans to keep the sea out are to be planted and used as informal gardens with raised walks, from which there will be splendid views both inland and out to sea.

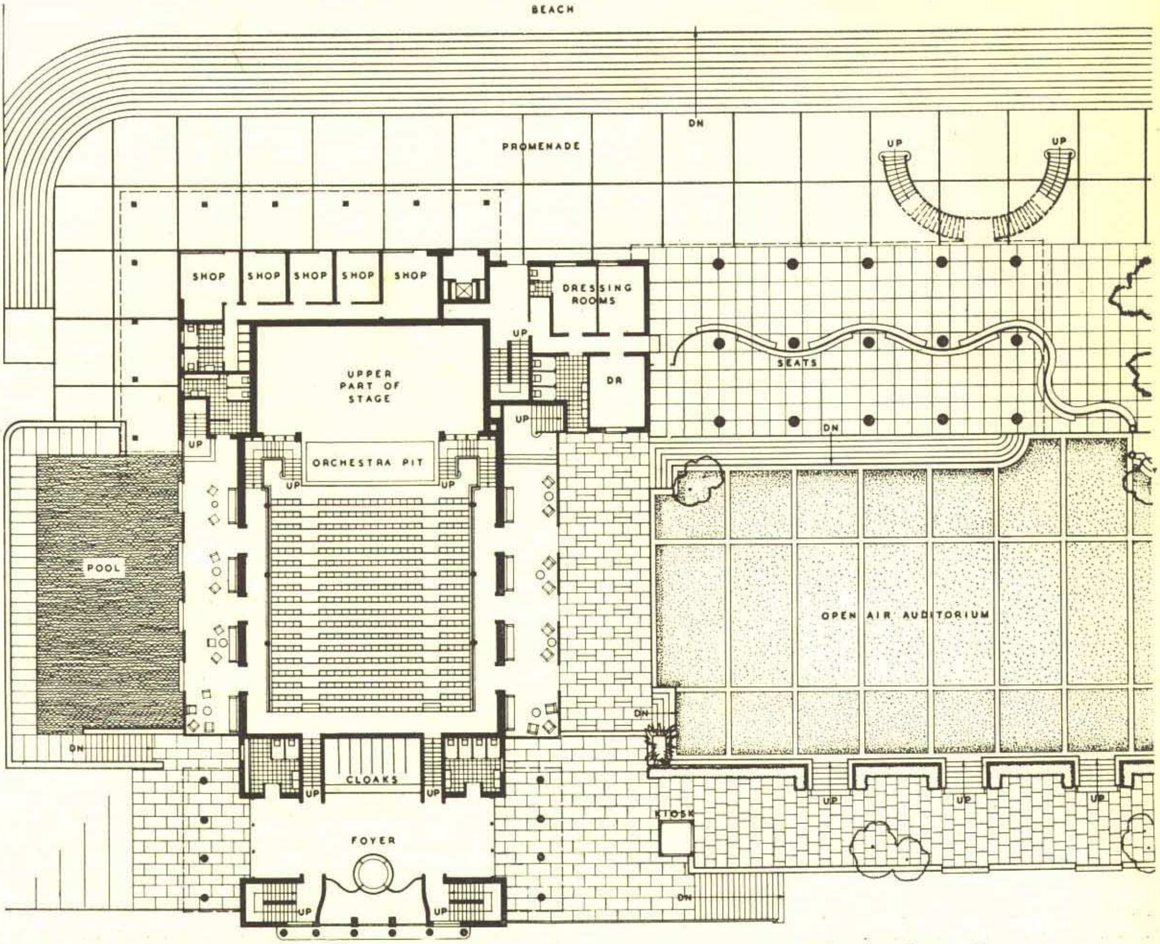


TYPE SECTION THROUGH SEAWALL & FORESHORE. LENGTH 'B'



TYPE SECTION THROUGH SEAWALL & FORESHORE. LENGTH 'A'.

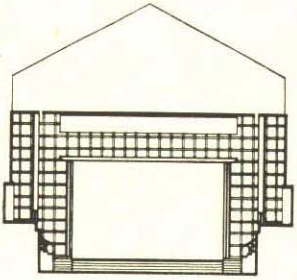
Lewis and Duvivier. Consulting Engineers.

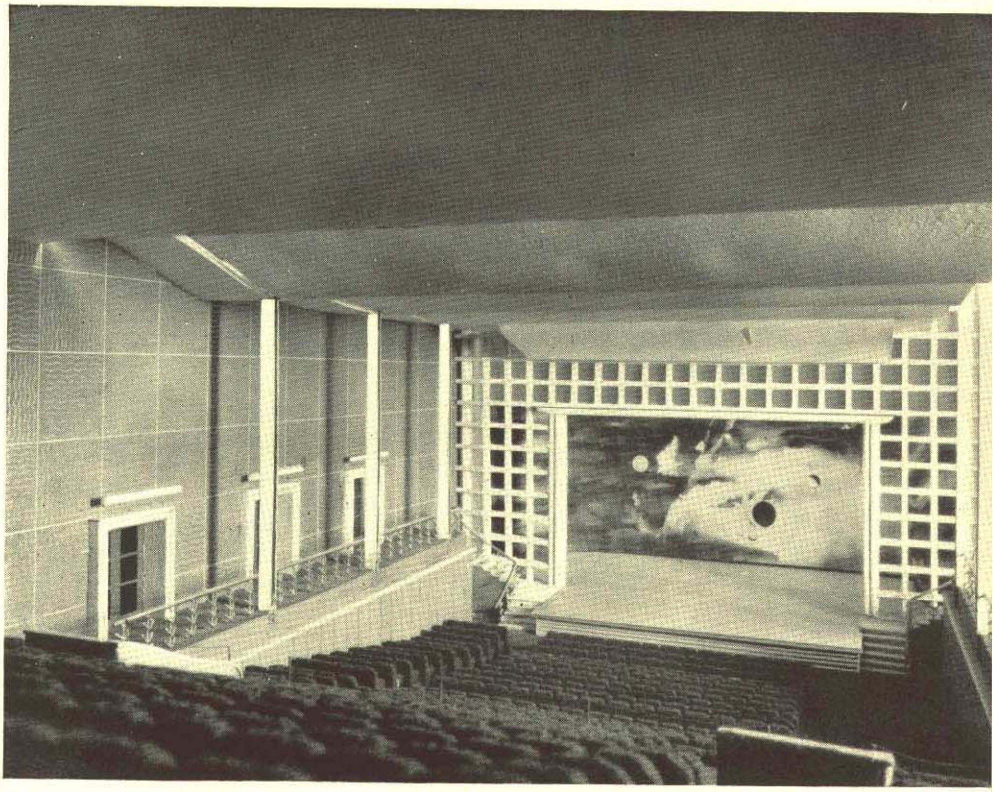


Ground floor of the pavilion, showing the indoor and outdoor theatres, the terraces and swimming pool.

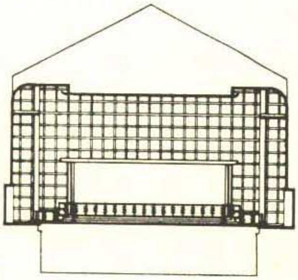
He designed the reinforced concrete pavilion in collaboration with the Arts Council of Great Britain. It will house a theatre, planned for alternative use as a modern dance-hall, also a restaurant, two cafes, lounges and cocktail bars. The theatre auditorium, seating 725 people, will be converted into a dance-hall in a matter of seconds merely by the turn of an electric switch, and will be the first of its kind in Britain. The theatre ceiling, supported by a system of counter weights similar to an ordinary sash window, will be lowered into place above the seating accommodation by means of a small electric motor, revealing on its upper surface a perfect modern dance floor. An open-air theatre in the pavilion grounds will seat 2,000 people and its stage will be built into the sand-dunes.

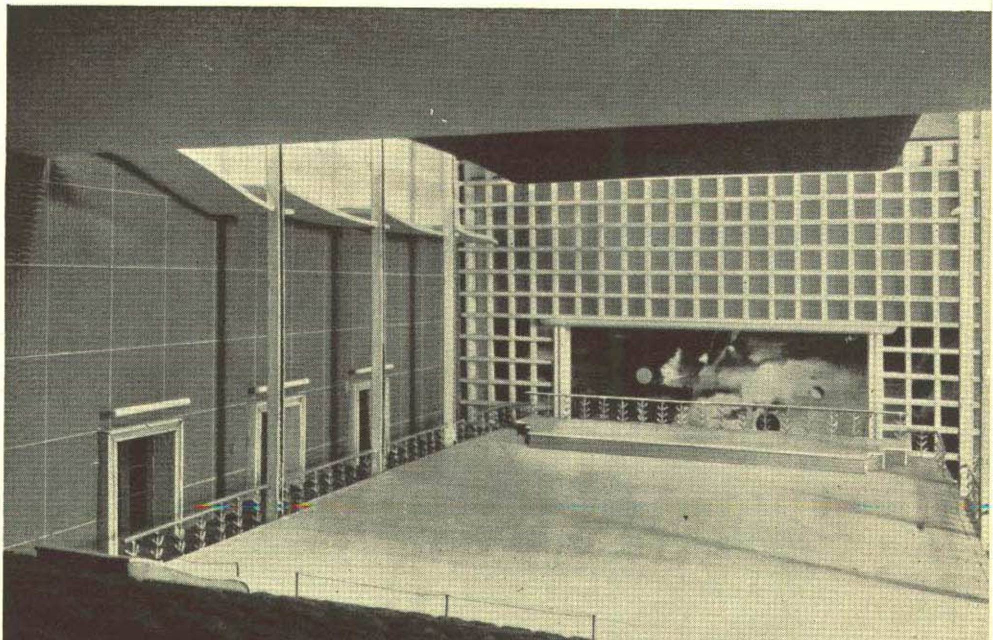
Model of the pavilion, which comprises theatre, shops, restaurants and cafes.



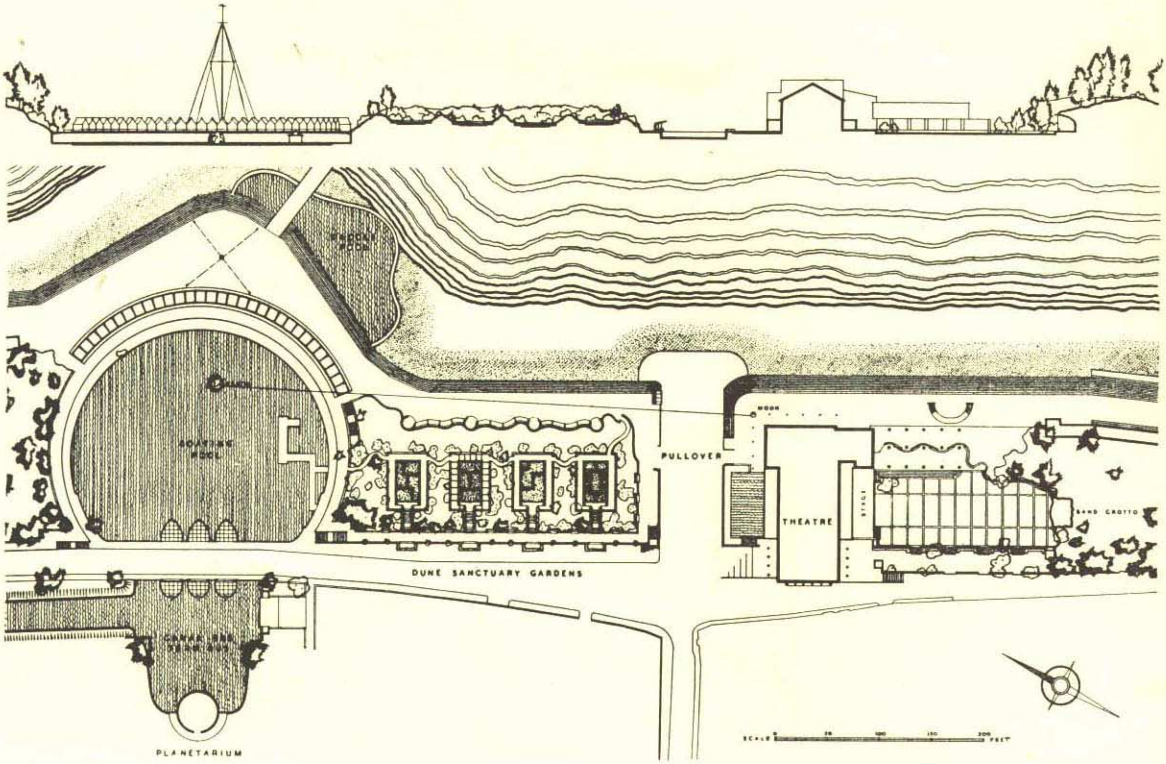


Interior of the Pavilion Theatre, showing the adjustable dance floor in its raised position as a false ceiling.



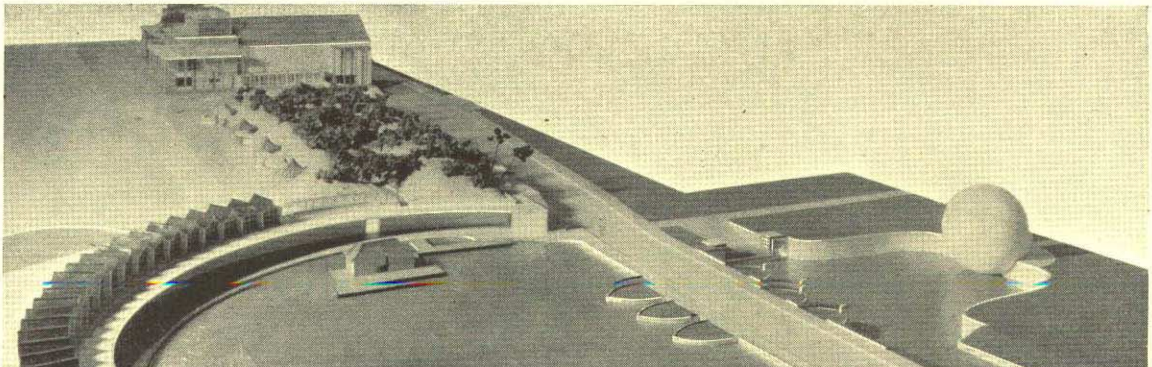


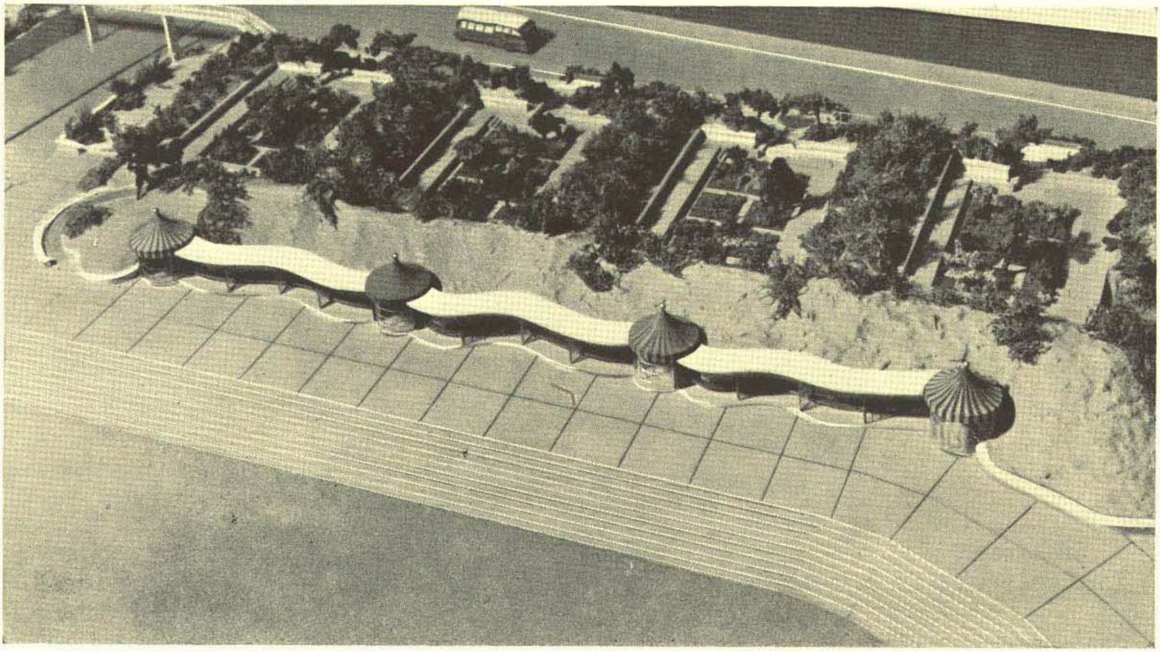
The Pavilion Theatre in use as a dance hall, showing the dance floor in its lowered position, covering the seats in the auditorium.



Section and plan of Mablethorpe central area.

Model of the reinforced concrete boating pool, showing the planetarium and canal boat terminus, with a section of parkway road, kiosks and chalets. The pavilion and Dune Gardens are seen in the background.





Model of the Dune Sanctuary Gardens with kiosks along the foreshore. The gardens are planned for warmth and shelter and each one will be differently laid out.

The reinforced concrete boating pool, of about an acre, has a covered colonnade, a paddling pool and an upper esplanade. It will be at the Mablethorpe end of $1\frac{1}{2}$ miles of the main drainage channel, which is to be widened and converted into a boating canal.

Work has already begun on 1,000 permanent beach huts which are to be set out along the sea wall. They are being built of brick, with concrete roofs and cement-rendered outside surfaces, and will be supplied with water, gas and electricity.

All these attractions converge on Mablethorpe, which has been chosen as the chief seat of amusement; it will also have a nine-hole golf course, the first planetarium to be built in this country, shopping centres and arcades on the sea front, gardens, cinemas, band-stands and a 2-acre amusement park. Sutton-on-Sea is to keep its quieter residential character, but even so it is to have an open-air swimming pool, a new theatre, ornamental lakes and a shopping centre and restaurant.

A tree-lined concrete coastal road, with plenty of parking places along it, will make it easy to get to any part of the beach, and there will be restaurants, kiosks and cafes among the beach huts.

Apart from this comprehensive plan for entertaining visitors there is a town plan for the complete rebuilding of Mablethorpe itself with a view to housing them. It is aimed, in the main, at providing hotels, boarding-houses and holiday camps, and although it is a separate project it fits in, of course, with the other.

At the opening of the exhibition at the Royal Empire Society, Mr. F. Marshall, M.P., Parliamentary Secretary to the Ministry of Town and Country Planning, spoke of the need for seaside resorts of this kind for the millions of people who would be spending holidays-with-pay. The Mablethorpe and Sutton-on-Sea venture, he said, had the whole-hearted support of his Ministry.

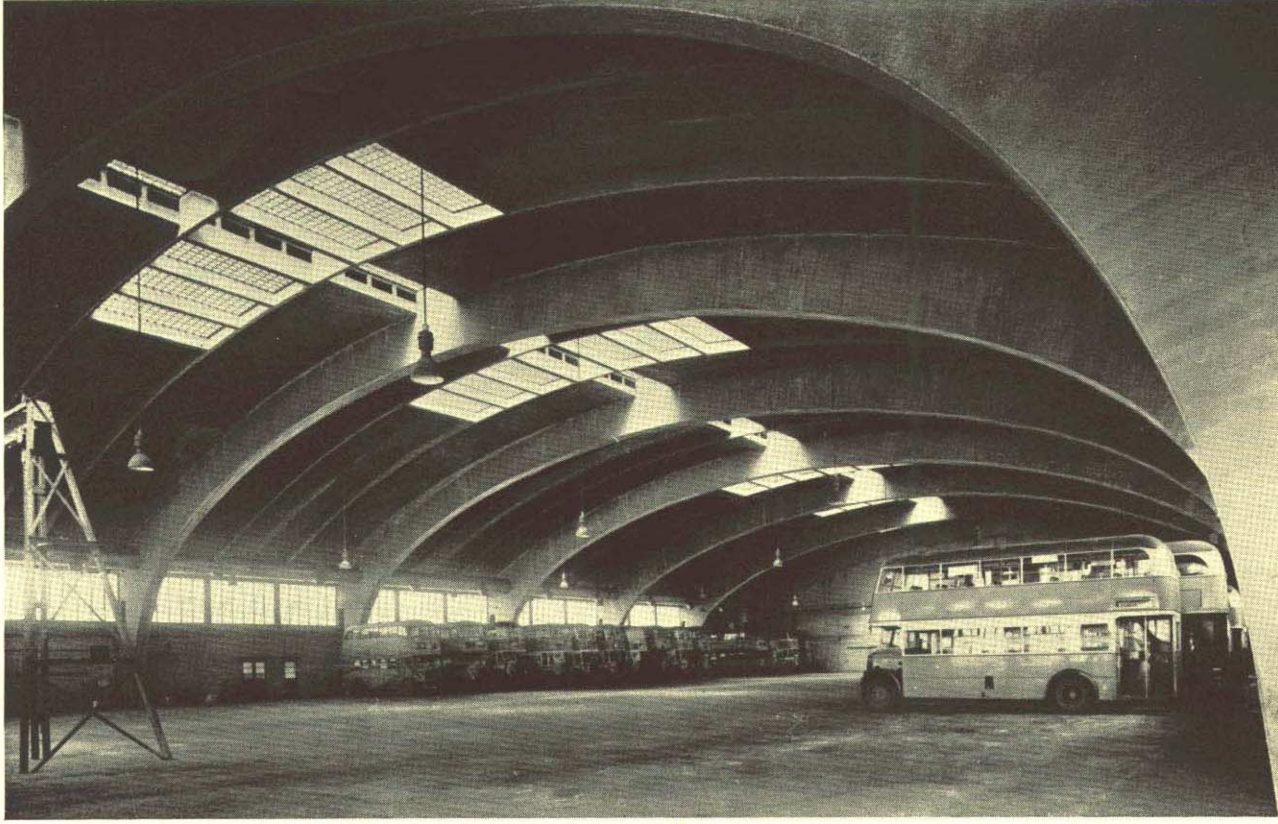
MANCHESTER BUS GARAGE

EARLY IN 1939 work was begun on the Wythenshawe Bus Garage in the expectation of finishing it before the end of the year. But 1939 was a year of delayed expectations and this huge reinforced concrete building was not structurally complete until the latter part of 1941. The Ministry of Aircraft Production at once took it over and A. V. Roe & Co. Ltd. used it in the making of Lancaster aircraft, for which the enormous clear span made it especially suitable.

It is now serving the purpose for which the City of Manchester Transport Department intended it—a depot for the Corporation bus services to the Wythenshawe Housing Estate, and it has room for 100 double-decker buses.

At the time it was built it embodied some features of design which were new to Manchester. The most notable of these is the "Chisarc" roof. It has a clear span of 168 ft. with arched roofing-slabs only $2\frac{3}{4}$ in. thick, and there are no

The main exit, giving drivers a clear view of approaching traffic.



ABOVE: *The unobstructed garage floor, providing accommodation for* 100 *buses.*

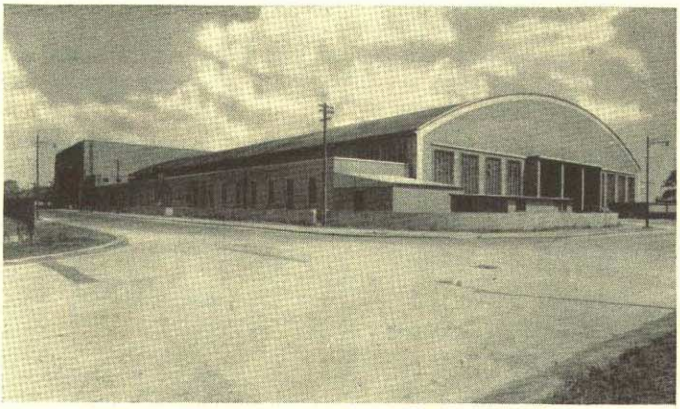
ties, braces, or inside column supports. Consequently, every foot of floor-space can be used.

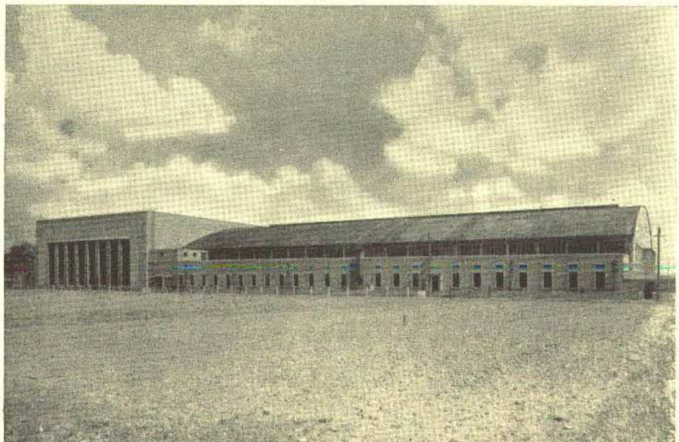
SAVING IN MATERIALS

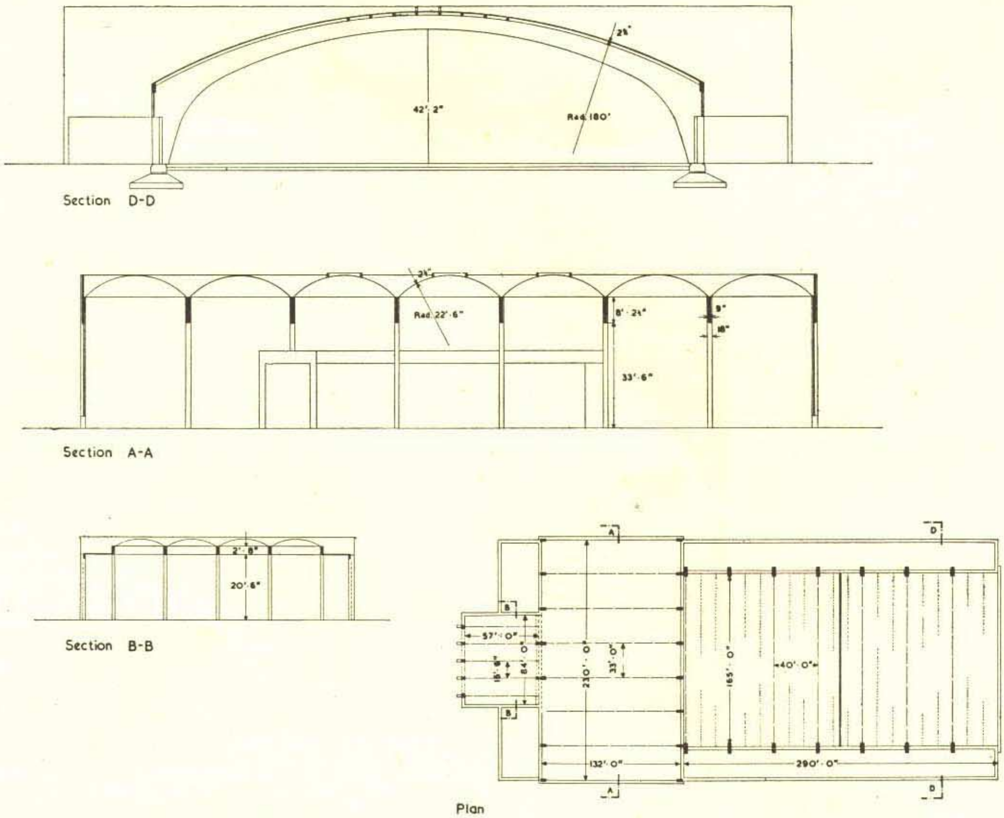
Shell-roof construction is based on the natural laws which give strength to the shell of an egg, the " stressed skin " being the structural element. The application of these laws to a building of this sort amounts, very briefly, to an extension to three dimensions of the two-dimensional methods used in arch design. By arch construction the depth that would be needed at mid span for a girder is greatly reduced. In shell construction the thickness of concrete needed for a slab design is greatly reduced by the thrust or tensions in the curved surface, which are in turn carried by the stiffening beams at the edges. This not only saves material but means that there is less weight to be carried, with considerable resulting economies.

In the main garage a single barrel-vault, $2\frac{3}{4}$ in. thick, with a radius of 160 ft., spans between

BELOW: *Two views of the garage with washing and repair halls behind. The single-story annexe in the foreground accommodates offices and staff recreation rooms.*

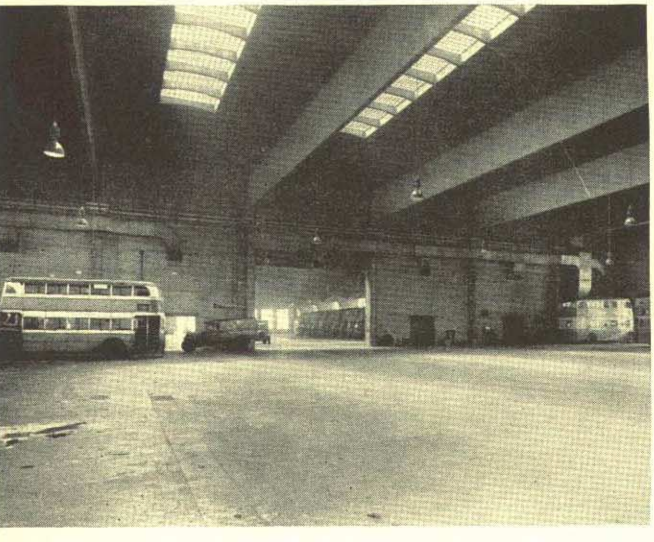






General plan and sections through the building.

1. *The testing and repair shop, lighted by day through glass lenses in the simple barrel type of roof.*
2. *View through the main garage, showing ventilation ducts and service structure.*
3. *Interior view of washing room, with high-level washing platforms.*
4. *The main garage under construction, showing stiffening framework in the south wall.*



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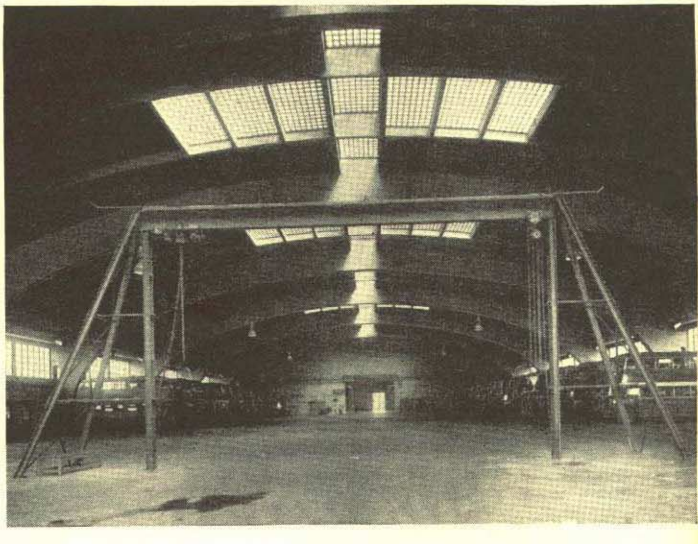

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two hinged arches at 42-ft. centres, which also resist wind and temperature stresses. These hinges are just below ground-level and rest on lead plates.

The washing-room forms a wing at right angles to the main building. It is roofed with four barrel-vaults, each of them 16 ft. in radius and 16 ft. 6 in. wide. They span a distance of 58 ft. between the continuous beam end-frames.

In the repair hall, which is separated from the main garage by expansion joints, the roof has seven vaults, each of a radius of 22 ft. 6 in. and a width of 33 ft. They give a clear span of 132 ft. The end-frames are 232 ft. long and expansion joints are provided to allow for movement due to changes of temperature. There are special roof-lights throughout.

These methods have provided nearly two acres of unobstructed floor-space in the three sections of the building, and are an impressive example of the merits of this type of reinforced concrete construction with its very low maintenance costs.

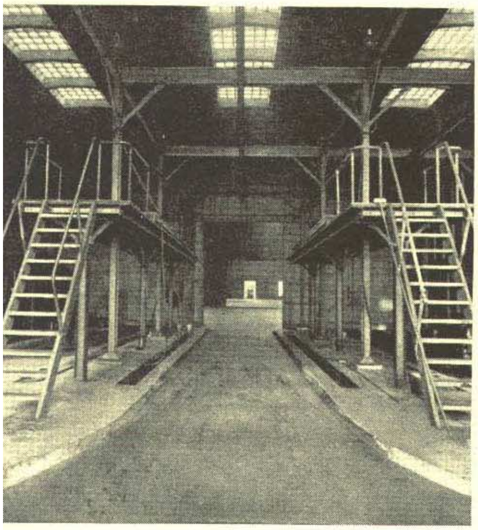
SAVING IN LABOUR

Labour-saving was the keynote in planning the layout of the building. Incoming buses first pass through washing-bays with high-level platforms and are cleaned from the tops downwards. Ladders are not needed. There are sumps for extracting oil and grease from the waste water and sludge before it goes into the the drains. The buses then go through the testing-shops before entering the main garage.

Among the usual devices for bus maintenance there is a new one for keeping radiators hot during off-duty hours. Flexible pipes which connect to adaptors on the radiators send a constant flow of steam through the cooling-system of each bus so that the water is kept at a temperature which makes for easy starting. This not only gets the buses off the mark quickly but prolongs the life of the engines by doing away with the hard wear of starting a cold engine every day. Another innovation is the arrangement of the inspection-pits, which are lined with glazed tiles and have lighting which shows up the engine and chassis without dazzling the mechanics at work.

The garage is heated by the "Plenum" system and there is a low-level extractor for removing the heavier-than-air fumes which come from the engine exhausts. And there are staff dining-rooms, social and rest rooms, a milk bar and administrative offices.

The building was designed by the City Architect, Mr. G. Noel Hill, F.R.I.B.A., M.T.P.I., and J. A. King & Co. were the contractors. Chisarc and Shell "D" Ltd. prepared the reinforced concrete design for the "Chisarc" roof; their consulting engineer was Mr. H. G. Cousins, B.SC., M.I.C.E.



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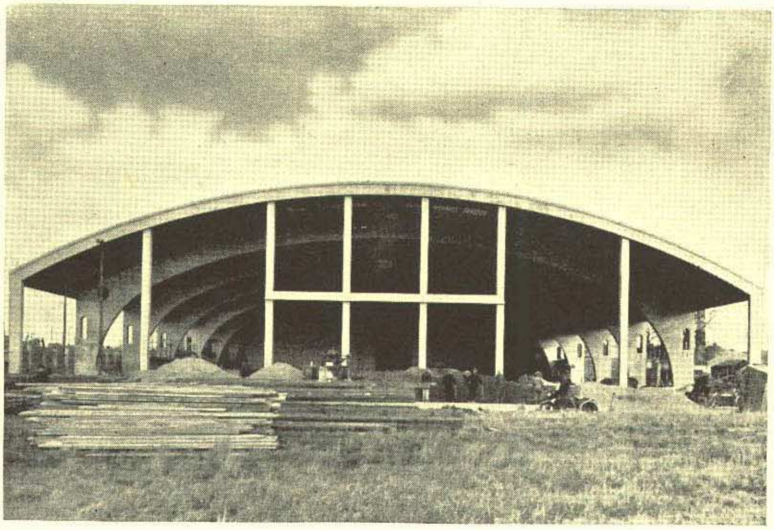

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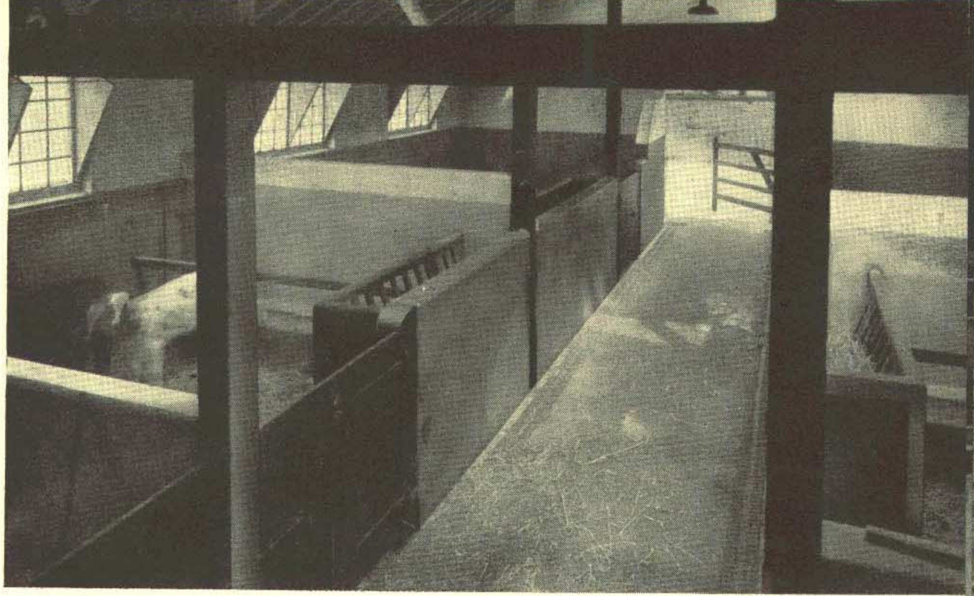
Re-designing In Concrete

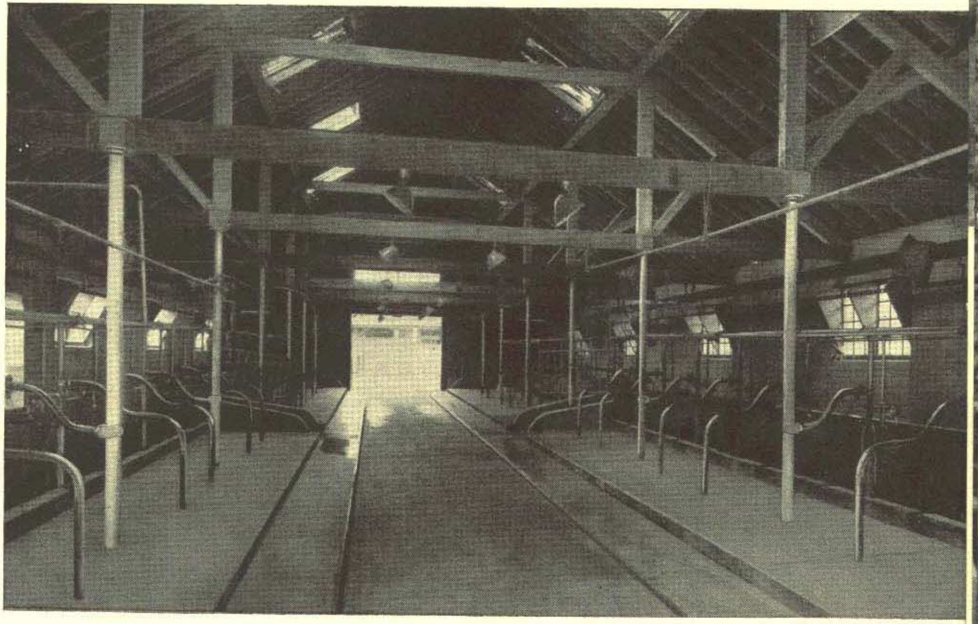
Farm buildings probably have to stand up to more wear and tear, while getting less repair, than any other class of building. Yet the need to keep them sound and hygienic, although with a minimum of labour, has never been so pressing.

Concrete, which requires no maintenance, has been used throughout in modernizing the farms illustrated. Roads, stock-yards and cow-house floors, milking houses, bottling rooms and calf pens, are all of concrete cast in situ, with concrete outside walls either cast in situ, or of pre-cast blocks. Stanchions, roof principals and purlins are built with pre-cast concrete units and roofs covered with asbestos cement sheets.

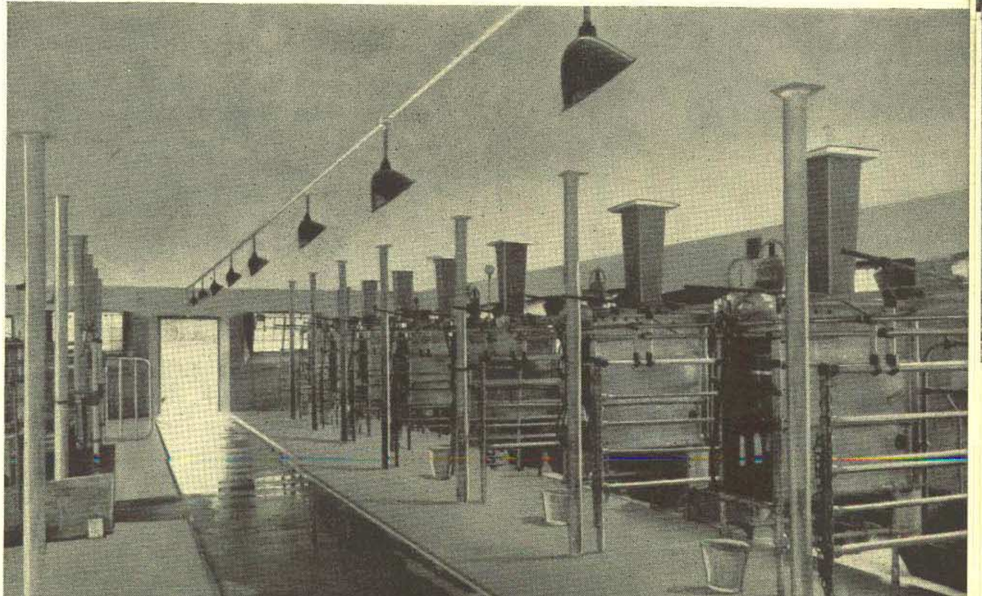
A paved area in front of the milking house, bottling and sterilizing room. (White Place Farm, Cookham, Bucks, property of Lord Astor.)



A calf pen building 60 ft. long by 40 ft. wide. The concrete floor has a cambered central passage 10 ft. wide with covered drain channels at either side. The external walls are cement rendered both sides and the calf pen walls are of poured concrete 4 ft. 6 in. thick. (White Place Farm, Cookham, property of Lord Astor.)

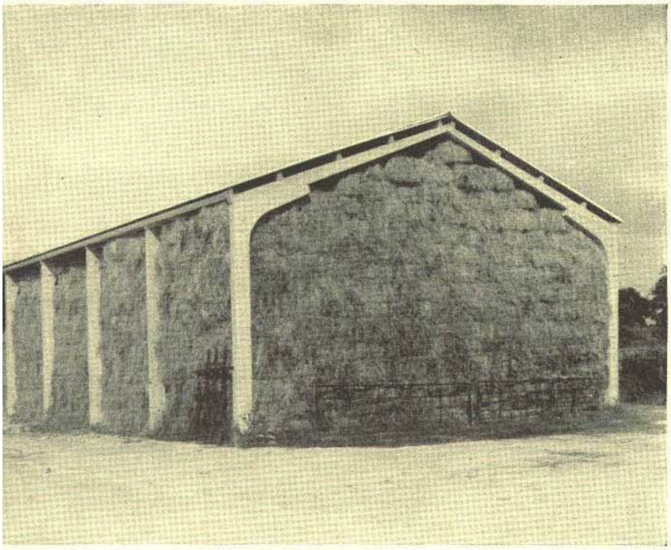


Reconstructed cowhouse with standings for 40 cows. The walls and floor are of concrete. The mangers are of concrete cast in situ and behind them is a feeding passage 3 ft. 6 in. wide. (White Place Farm, Cookham.)



Milking house in a converted building. The floor is of concrete and the interiors of the walls are cement rendered. There is a 6 foot wide passageway down each side of the building and a 4 foot wide passageway in the centre. Electrically-operated milking machines are on one side and washing pens on the other. Ventilation is provided by air bricks placed near the floor and just below ceiling level. (White Place Farm, Cookham.)

**Concrete road leading into a paved yard.
(The Home Farm, Thornborough, Bucks., property of Mr. C. D. Wilson).**



A dutch barn with a floor of 6 inch thick concrete; all columns, roof principals and purlins are precast reinforced concrete units and the roof covering is corrugated asbestos cement sheeting. (The Home Farm, Thornborough, Bucks.)

1. **A vermin-proof grain store constructed of precast concrete blocks ; the partition walls are lined on the inside with wood wool and rendered over. The roof is covered with corrugated asbestos cement sheets. The floor is concrete and all doors are metal. (The Home Farm, Thornborough, Bucks.)**

2. **Stock-yard divided by a partition of precast reinforced concrete posts connected by rails. The floor is 6 in. thick concrete.**

3. **An implement shed constructed from precast concrete blocks. The precast reinforced concrete roof trusses are supported by precast reinforced concrete columns. The roof and gables are covered with asbestos cement sheeting.**

4. **Paved area in front of an open implement shed. (Scotts Grove Farm, Thame, Bucks, property of Colonel S. E. Ashton.)**

A covered stock-yard 80 ft. long and 40 ft. wide. The roof is constructed with 20 foot span precast reinforced concrete roof trusses, supported on precast reinforced concrete columns. The centre columns have a protective casing, also of concrete, with rounded corners as a safeguard for the cattle rubbing themselves. The roof is covered with corrugated asbestos cement sheets. The concrete floor slab is 6 in. thick. (The Home Farm, Thornborough, Bucks.).

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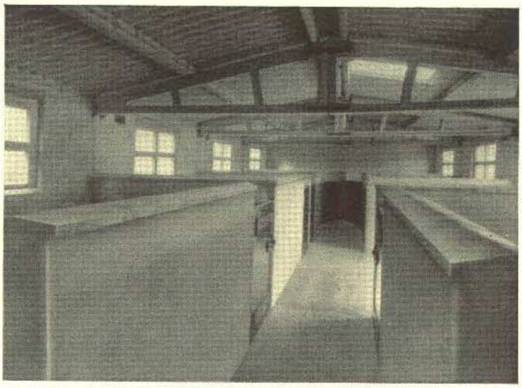

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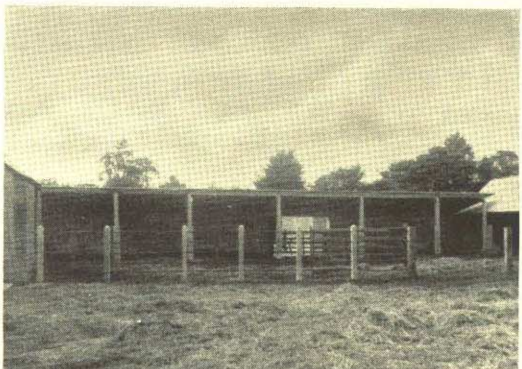


4

Fixing rails on Dowsett precast concrete sleepers on the L.N.E.R. line at Hitchin. (Photograph: L.N.E.R.)

Pre-stressed railway sleepers

Track on the L.M.S. Railway at Cheddington, Bucks. Owing to the high speeds reached on this stretch of line (as much as 95 m.p.h.) deterioration is three times as rapid as on the average track. After four years' use— equal to 12 years elsewhere—the concrete sleepers shown were found on test to be satisfactory in every way.

A RAILWAY SLEEPER which will last as long as the rails it supports is something new in railway construction, but is an obvious necessity in reducing maintenance charges. This is one of the reasons—probably the most important one—why pre-stressed concrete sleepers are likely to be universally adopted during the next few years.

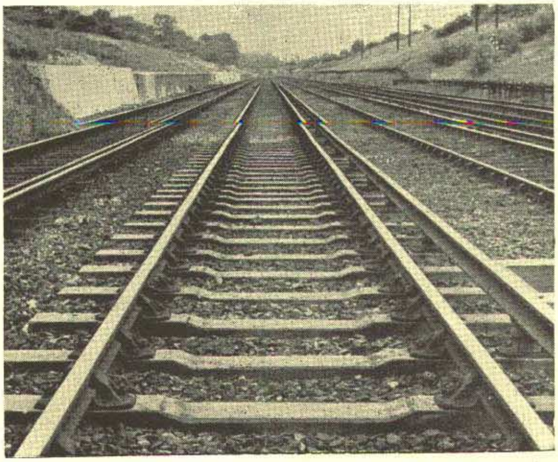
They were tested severely during the war and came through with flying colours. It was in 1941 that Dow-Mac Products Ltd. began experimenting at Colwell, in Worcestershire, in the pre-stressing of concrete for sleepers, and the Ministry of Works then tried out some specimens in sidings which they watched closely.

The first major test was carried out in 1942 on a section of L.M.S. down-track at Cheddington, where trains reach a speed of 90 m.p.h. The results were so good that the Government authorized the building of a factory at Tallington, Lincolnshire, for the mass-production of the new sleepers, and the three other main-line railway companies also laid lengths of track for continuing tests.

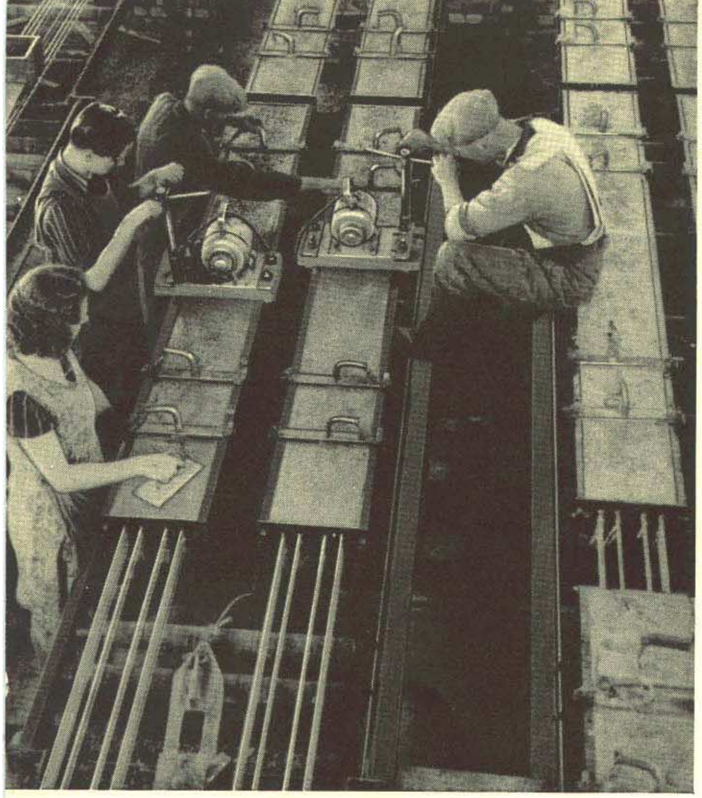
These successful results were the direct

ıtcome of the pre-stressing methods which ıw-Mac Products Ltd. worked out and brought their present stage of development in 1943, ıen the Tallington factory was ready.

Ordinary reinforced concrete sleepers when subjected to the various stresses brought about by their use, may develop small hair cracks which, under successive heavy loads, may widen with the result that the bond between concrete and reinforcement is destroyed through the effect of rain and frost. In pre-stressed concrete



Concrete sleepers in use on the Southern Railway at Forest Hill, S.E.23. (Photograph: Southern Railway.)

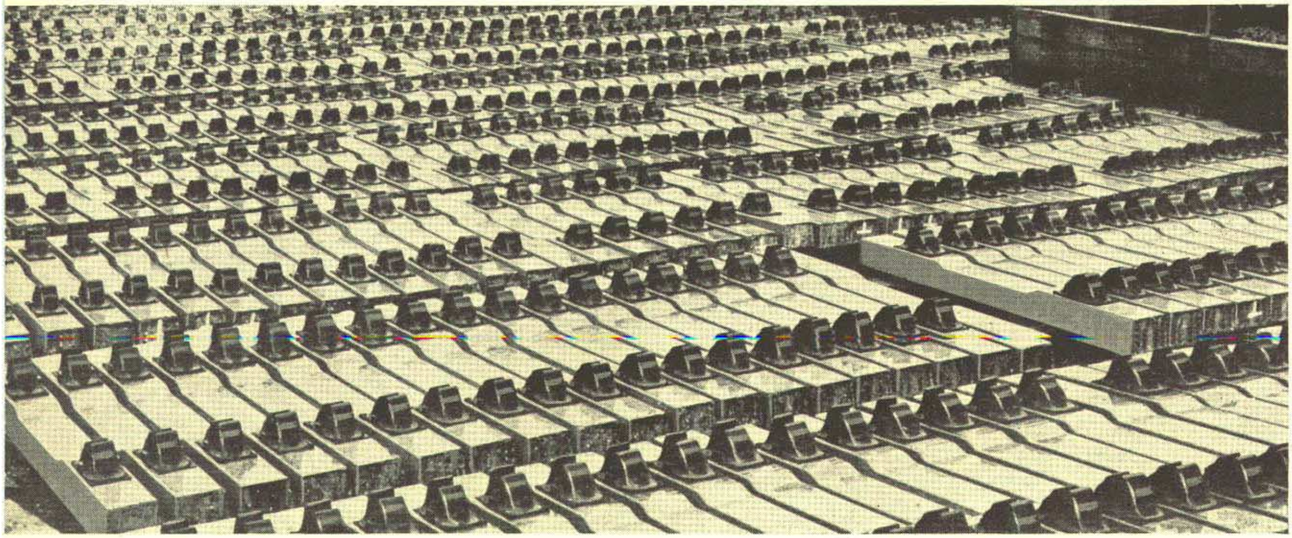


Dow-Mac Concrete Products works, Tallington, Lincs. Electric vibrators being fixed to sleeper moulds for the secondary vibration process. The towing attachment for moving sleepers into position along the production lines can be seen at the extreme bottom of the photograph. Four lines of tensioned wires can be seen top left.

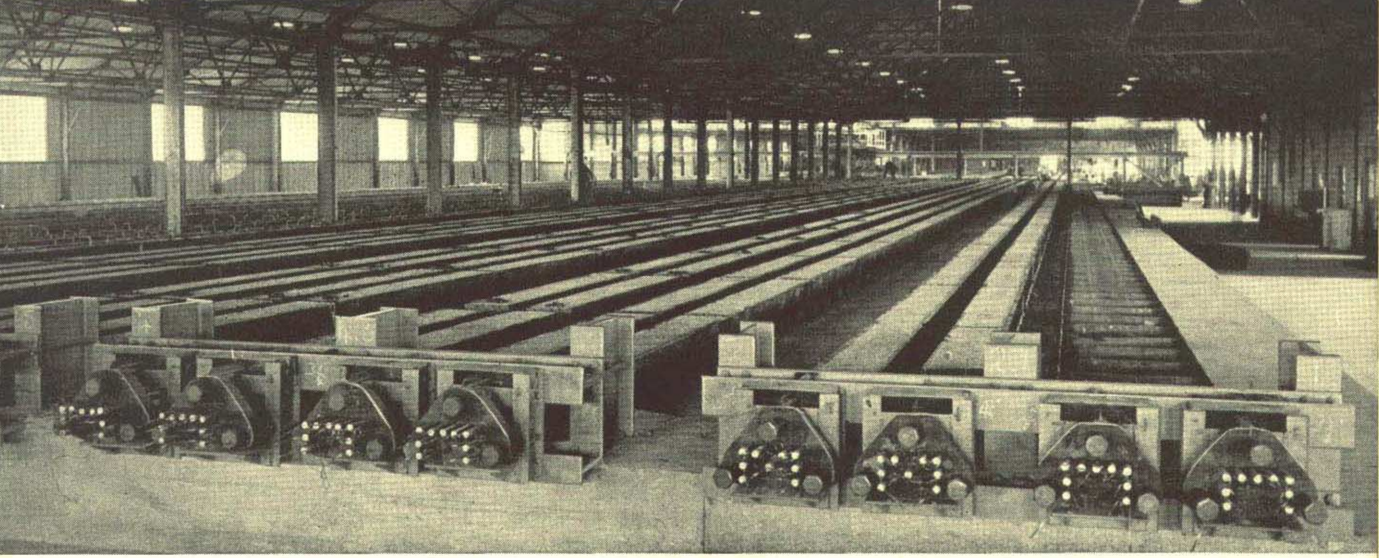
high-tensile steel reinforcement is used having a tensile strength of 100 tons per sq. in. It is stretched during manufacture and leaves the concrete with a permanent compressive stress. When a load is applied, this compressive stress has to be negatived before any cracking in the concrete can occur. Not even hair cracks can develop within the margin of safety allowed under the loads and conditions for which the track is designed. In short, a pre-stressed concrete sleeper is homogeneous.

In the factory at Tallington, which has a floor-space of 500 ft. by 140 ft., there are 20 production lines with a capacity of 100 main-line sleepers each. Each line consists of a conveyor of a comfortable height, and there is pneumatic apparatus for lifting moulds or sleepers. All movements of material in the factory are mechanically controlled.

The coils of high-tensile steel wire, which is 0·2 in. in diameter, are carried on a truck which runs along the head of the production lines. At each line the wire is drawn from the truck to the far end of the line under semi-tension, and passed at the same time through a scrubbing-box of carborundum granules which clean it thoroughly.



Finished concrete sleepers awaiting despatch.



Production area of Dow-Mac Works, showing cast sleepers curing. Note in the distance transverse mobile hopper which carries concrete from the batch mixing plant. Below the hopper, in each line, there is a vibrating table: this is the filling position.

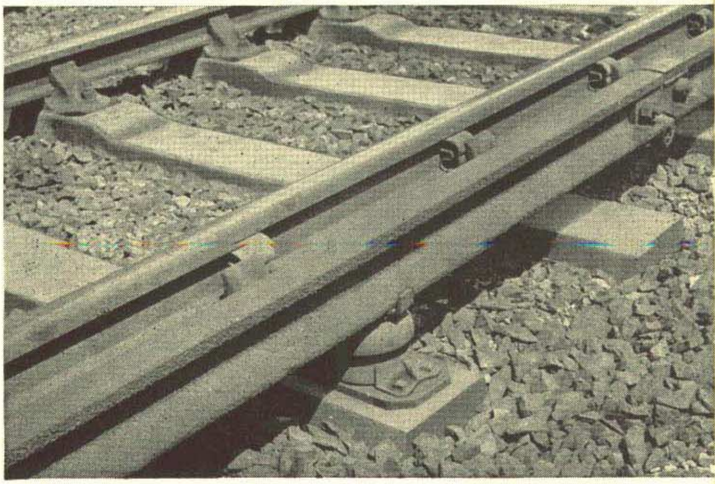
The moulds have removable end-plates with slots in them to give the correct position for the reinforcement. The wire is threaded through the slots and a machine then applies tension to a pair of wires at a time, until the pulling-force reaches 2·2 tons on each wire, which is equivalent to about 65 tons per sq. in. At that point a cut-out valve comes into operation and automatically stops the load. The moulds are then placed on the lines and the end-plates put in.

Filling is done at a fixed position so that a vibrating-table may be used. A winch pulls the filled moulds into the required position on to the conveyors, and in the final position the exposed surface is trowelled and the concrete given a second vibration to ensure its consolidation and a perfect bond with the reinforcement.

It is cured for from 10 to 14 days, according to the weather, and the tension on the reinforcement is kept up during this time. When the sleepers have hardened the end-plates are removed from the moulds and the 18 or 20 wires connecting them are burnt off close to the face of the concrete with an oxy-acetylene flame. In the concreting and transit stage the average time needed for each pair of sleepers is only three minutes.

Naturally, there is a growing demand for pre-stressed sleepers. There are orders in hand for approximately 300,000 of them for British railways alone. They have already been sent to India, Egypt, the Sudan, South Africa, Eire and Holland, and if they give as good an account of themselves in those countries as they are giving here, factories will be built there for making them.

One important aspect of pre-stressing is the economy in reinforcement: this method effects a very considerable saving of steel.



Section of the Southern Railway track at Forest Hill, S.E.23: concrete sleeper carrying conductor rail. (Photograph: Southern Railway.)