The Forth Road Bridge

THE OFFICIAL STORY

published by the ***Forth Road Bridge Joint Board***







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The Forth Road Bridge is the largest suspension bridge in Europe, and, together with the approach viaducts, is a little over 1½ miles long.

The new bridge has a spectacular central span of 3,300 ft. between its two main towers. The side spans, which carry the deck to the side towers, are each 1,340 ft. long, and are flanked by approach viaducts.

At the side towers the supporting cables turn downwards towards the anchorages which are, essentially, massive wedges built by tunnelling into the rock. The cables are 2 ft. in diameter.

The main towers extend 512 ft. above mean river level and the sag of the cables between the towers is approximately 300 ft., that is, the sag is 1/11th of the span. Under the deck of the main span there is headroom of 150 ft. close beside the piers, and this headroom increases to 163 ft. at mid-span.

The above dimensions of span, sag, tower height and shipping clearance give the bridge its basic sense of fitness for purpose, and result in a structure of slenderness and elegance combined with strength.

The dual 24 ft. wide roadways on the bridge are designed to carry the heaviest loading permitted on any roads in the world, including vehicles weighing up to 180 tons. In addition to the two roadways there are two cycle tracks each 9 ft. wide and two footpaths 6 ft. wide.

Some 39,000 tons of steel and 150,000 cubic yards of concrete were used in the bridge construction.

All the structural steelwork was cleaned by grit blasting, metallised with a coat of zinc and protected by four coats of paint. A considerable portion of this work was carried out at Drem, East Lothian, in disused aeroplane hangars, where new machines—the prototypes of their kind—were installed for the purpose. Approach roads to the bridge include $4\frac{1}{2}$ miles of dual carriageway on the southern side and $3\frac{1}{2}$ miles dual carriageway on the northern side. Minor access roads extend for 8 miles and there are 24 minor bridges.

The total cost of The Forth Road Bridge is	£19,500,000
The cost of The Forth Road Bridge project has been met by the Government and constituent authorities in the area. The Local Authorities, namely, Edinburgh Corporation, Fife County Council, West Lothian County Council, Midlothian County Council, Dunfermline Town Council and Kirkcaldy Town Council contributed the total sum of	£500,000
The grant by the Secretary of State for Scotland amounted to	£4,650,000
The balance of the sum required was borrowed from the Government. The amount of the loan was	£14,350,000
The loan repayment, and running expenses to be met by toll charges each year will be approximately	£1,000,000

The Queensferry Passage

The Forth Road Bridge spans the Firth of Forth, linking Fife and the North with Edinburgh and the Lowlands, carrying modern traffic over a waterway where, for more than eight hundred years, the ferry-boats have plied. The bridge was begun on November 21, 1958 when the Secretary of State for Scotland, the Right Hon. John S. Maclay, H.C., C.M.G., M.P., (now Viscount Muirshiel) drove the first pile; it was completed on September 4, 1964. Its roots, however, go much deeper into Scottish history.

A road crossing between North and South Queensferry was first mooted in 1740, but the proposal was shelved to be revived again in 1817 when the first well-documented plan was prepared by Mr. James Anderson, an Edinburgh civil engineer and land surveyor. This design for a chain bridge was also abandoned and with the development of steam power, and the railroad system as the main transport carrier, came the famous Forth Railway Bridge begun in April, 1883 and completed in March 1890.

By the 1920's road traffic had increased so much in Scotland that a new project for a Forth Road Bridge was considered at meetings in South Queensferry and Edinburgh in 1923 and 1924. On March 25, 1924, at a meeting in the House of Commons, attended by 30 Scottish Members of Parliament, a Committee was formed to urge the Ministry of Transport to agree to a survey.

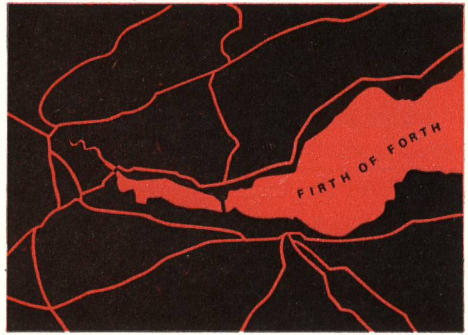
In January, 1926 the Ministry requested Messrs. Mott, Hay & Anderson, consulting engineers, to make a survey across the Forth in the neighbourhood of Queensferry. The survey was completed in September, 1928 and in May, 1929 an extensive report was submitted to the Ministry of Transport. It embodied the engineers' reports on three sites. One was for a bridge closely alongside the Railway Bridge and, like the Railway Bridge, was to utilise Inchgarvie for support; one was for a site more than a mile downstream of the Railway Bridge starting on the south side at Hound Point, Dalmeny Estate, and going northwards over Inverkeithing Bay; the third was for a site upstream of the Railway Bridge utilising the Beamer Rock, a small rock nearly awash at high water, for a pier foundation. Then, because of the national economic crisis, bridge building was

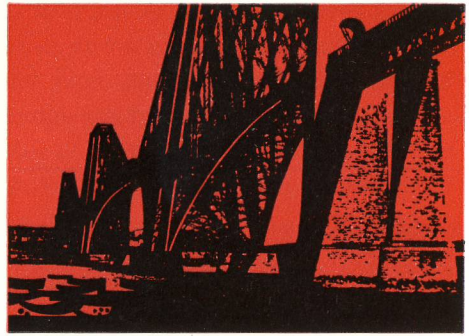
temporarily halted; but the engineers continued their investigations under the supervision of the late Sir David Anderson, whose zeal for the project never flagged.

In 1935 a mass meeting in Edinburgh declared unanimously in favour of the bridge being built. In that year the consulting engineers' report on the Mackintosh Rock site was published, and it was agreed to proceed with the proposals. No Government grant being available at the time, the scheme was postponed.

After the 1939/45 War the Local Authorities concerned then approached the Government and secured agreement both to the erection of a new road bridge on the Mackintosh Rock site and to the arrangements for meeting the cost. In 1947 The Forth Road Bridge Order approved the construction of the bridge and established The Forth Road Bridge Joint Board as the Authority.

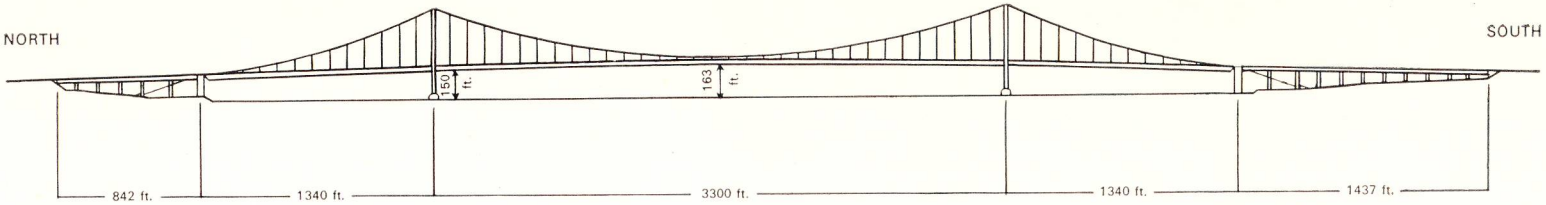
On February 10, 1958, the Government gave approval for work to begin. Thus began the great adventure—the construction of the largest suspension bridge in Europe, fourth largest in the world.



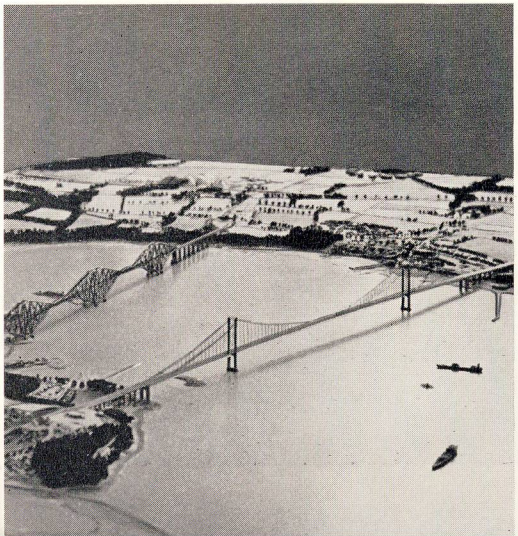


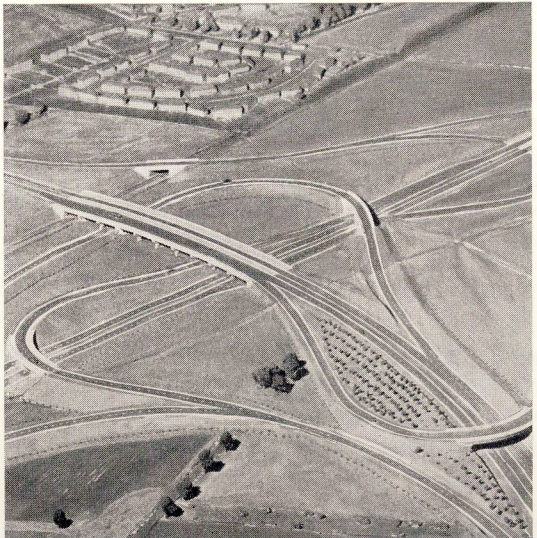


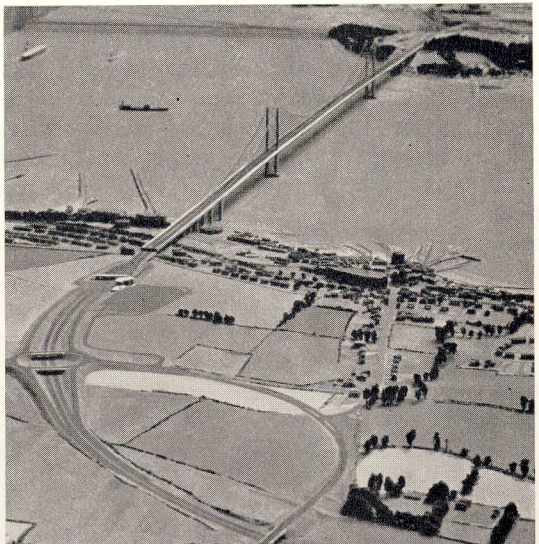


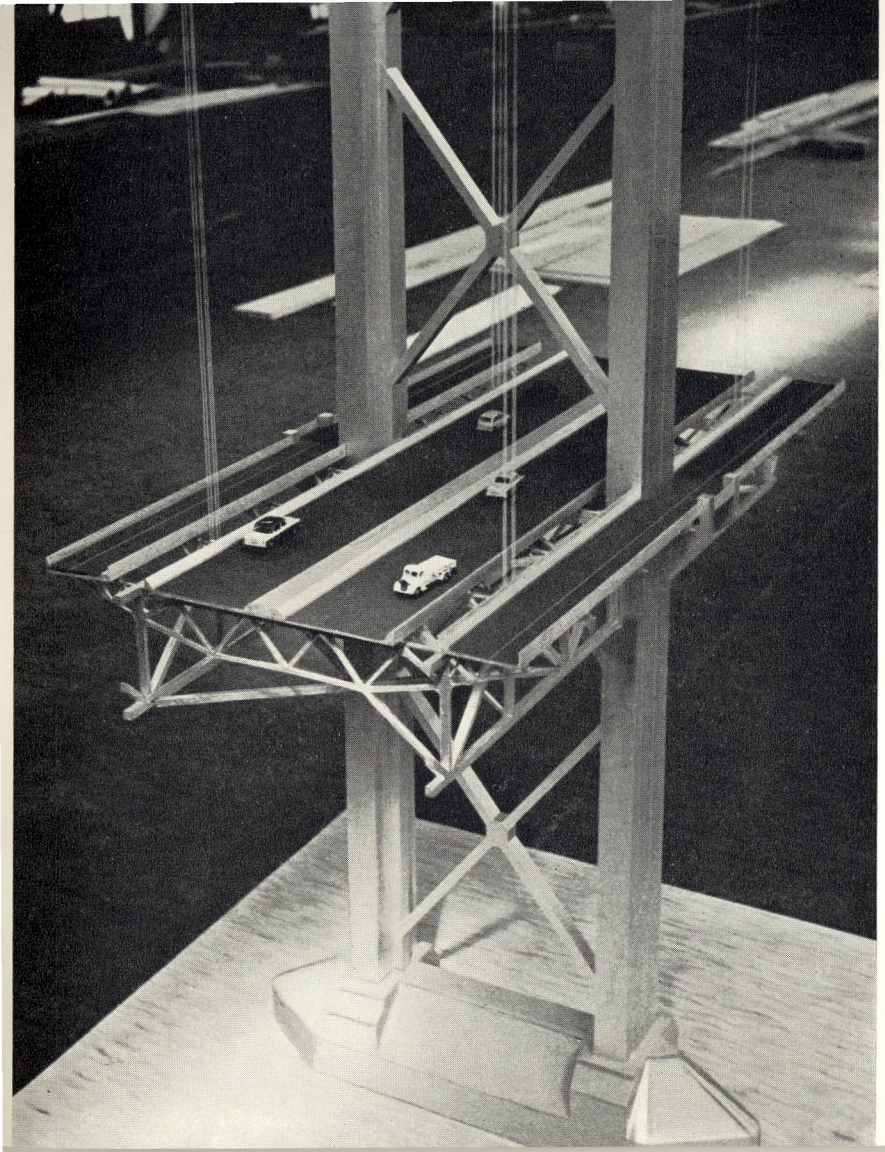


GENERAL ELEVATION









The plans are made

When the Mackintosh Rock site had finally been decided upon, detailed surveys of the river and approaches were made together with borings to determine the nature and depth of suitable rock for the foundations. With this information, it was possible for the engineers to draw up various schemes for the bridge and to arrive at the most economical form for the crossing. The next step was to make detailed designs for the bridge and to test models of the various components. Much of this work was aided by electronic computers, and a specially constructed wind tunnel was used to test models of the bridge. The long spans of suspension bridges make them unusually susceptible to oscillations caused by wind, and exhaustive tests are necessary to ensure that each particular bridge will be absolutely safe at all wind speeds.

As this phase of the work drew to a close and the final shape of the bridge appeared on the drawing boards, tenders were invited for the first part of the work on site—the construction of the foundations.

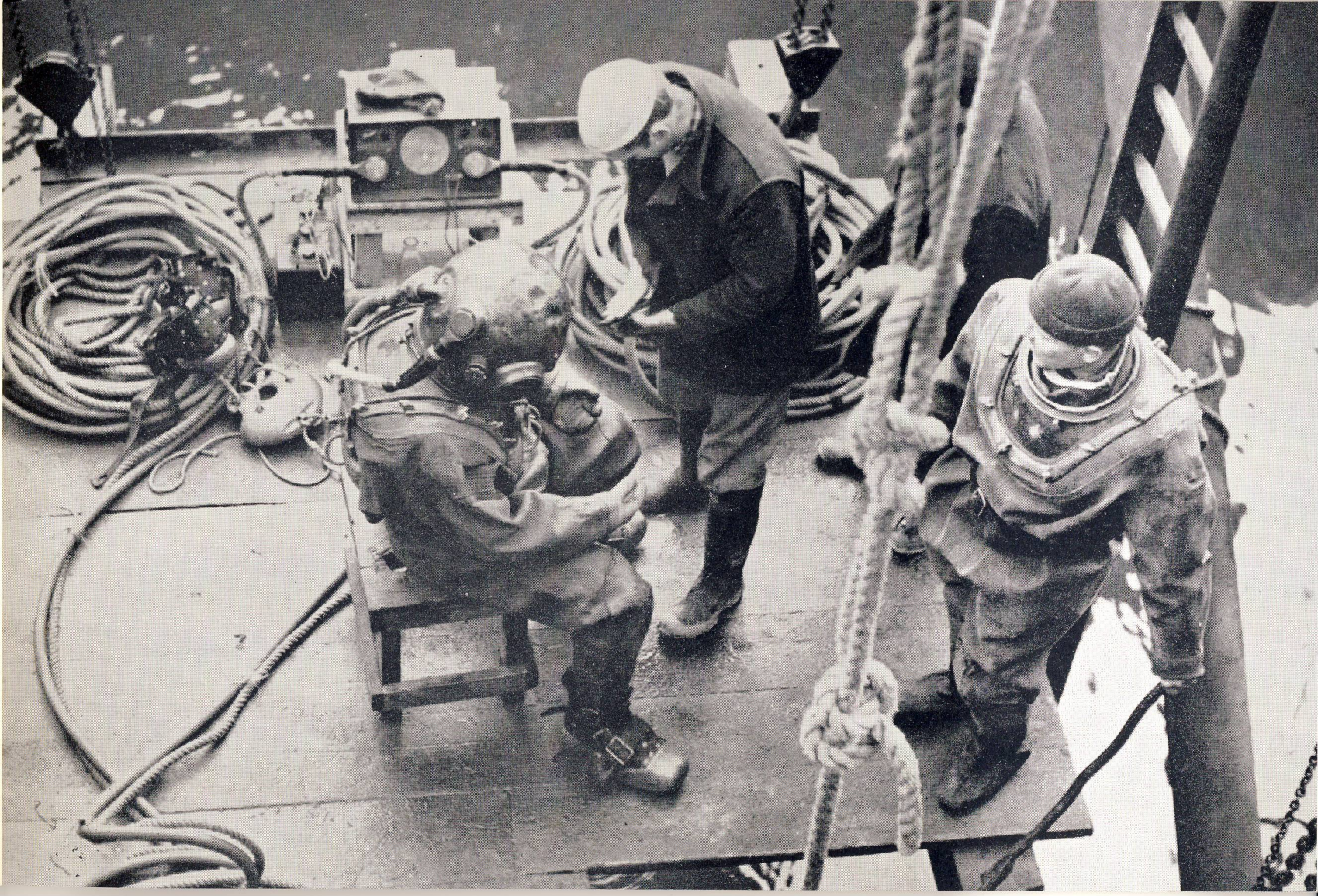
Work begins

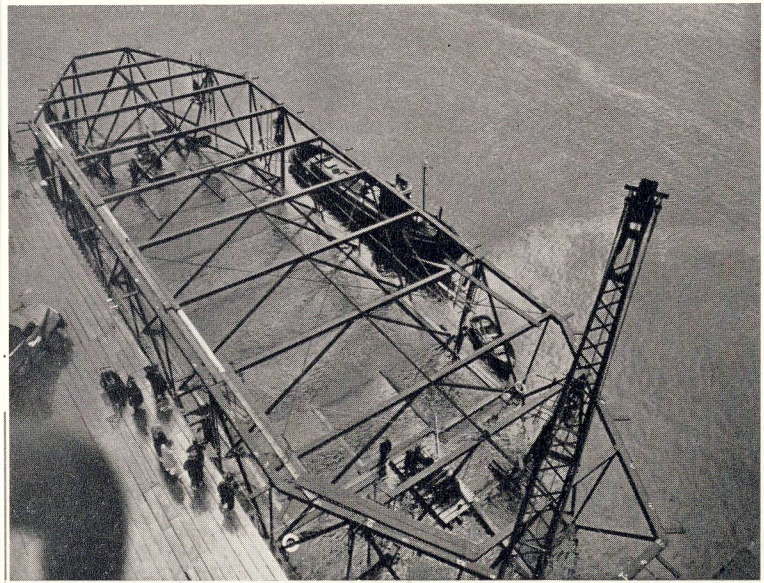
The first phase of the bridge construction consisted of the piers for the main towers, the side towers and the cable anchorages. This work, which was begun late in 1958, was completed on schedule two years later. The greatest achievement was the penetration of the bed of the Forth to a depth of 100 ft., without recourse to compressed air working, to lay foundations as secure as the bedrock itself.

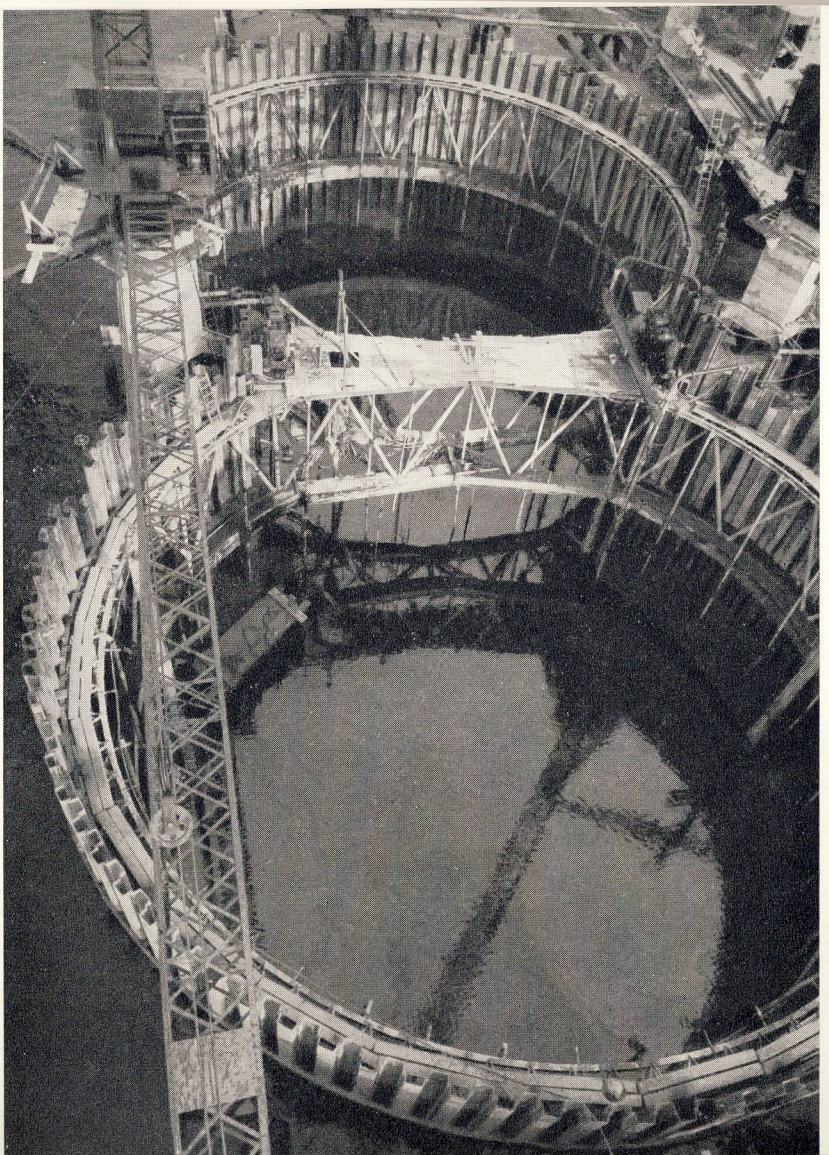
For the pier on the north side, the Mackintosh Rock was utilised. In order to do this, the rock was removed by underwater blasting to a level 30 ft. below mean river level. A large steel frame was floated on to the site and steel sheet piling was placed around its periphery. The piling was sealed at its junction with the rock by constructing an underwater wall of concrete and, with the piling made watertight, the cofferdam was dewatered and the foundation on the river bed completed in the dry. The pier is 168 ft. long by 55 ft. wide and rises 30 ft. above mean river level, this portion being faced with pink Corennie granite.

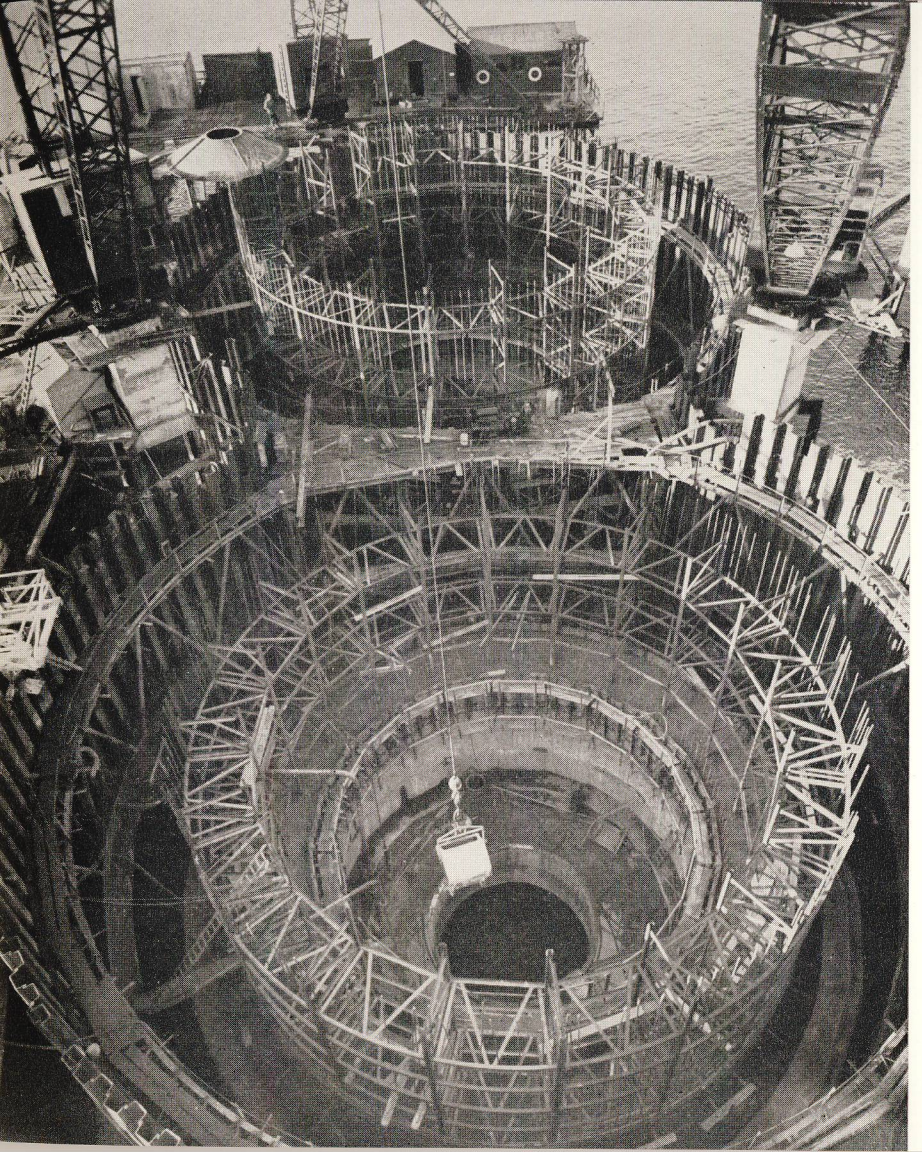
Unlike the north pier, the south pier had to be carried down to a very considerable depth, approximately 100 ft. below mean river level. This meant excavating in the bed of the Estuary through silt, then gravel, then boulder clay until rock was encountered.











For this purpose a gigantic figure-of-eight steel frame was prepared on a staging on the north foreshore. The two circles of the figure-of-eight were each 85 ft. in diameter.

The completed frame was towed across the river and positioned on its site. Steel sheet piling was driven in to the boulder clay all round the frame and much of the silt and gravel was removed by grabbing. The cofferdam so formed was then dewatered and two 60 ft. diameter caissons were built inside it. The weight of the caissons was sufficient to allow them to sink through the boulder clay as excavation continued inside them. Much of the excavation was done by machines, and, as the caissons sank, more concrete was added to them to increase their weight.

Fortunately the boulder clay was watertight and it was not necessary to cap the caissons with air locks and use compressed air to keep them dry. The caissons eventually were founded on sandstone rock and they were then filled with concrete up to low water level. The upper section of the pier, which bridges the two caissons, is identical to the North Pier.

The side towers are in themselves massive structures of reinforced concrete 150 ft. high. The foundations for the tower legs were comparatively simple, those for the south tower being constructed in steel sheet pile cofferdams and those for the north being made in the whinstone rock on the foreshore. The legs are

of hollow cellular construction and are joined towards the top by two arch ribs and a deep box beam.

The side towers have several functions ; they have to support the ends of the approach viaducts, the ends of the side spans and the two main cables which pass over the steel saddles at this point. As traffic will run directly on top of the side towers, their completion represented the first sections of the bridge decking.

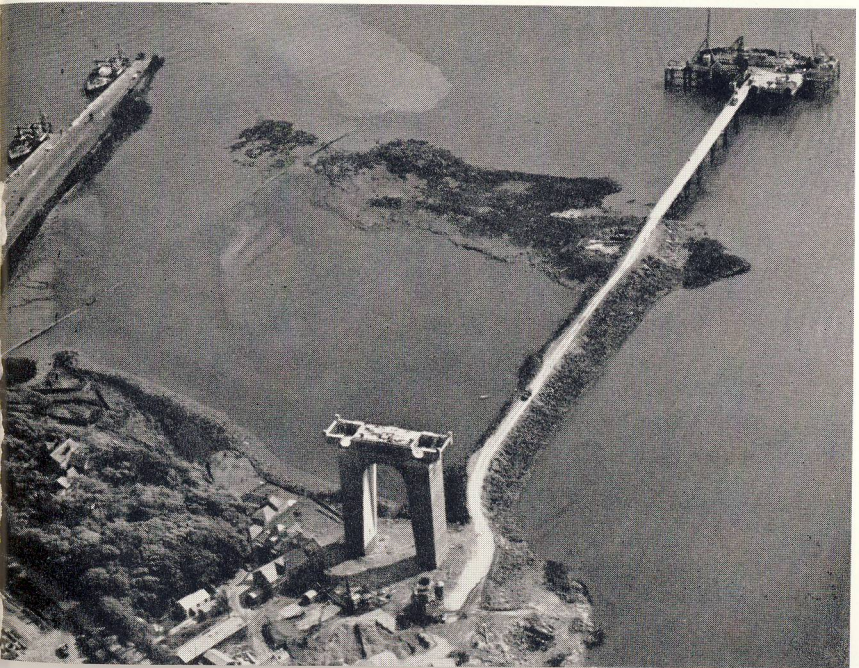
The third major item of the foundation work was the construction of the four cable anchorages, two on each side of the river. These anchorages have to secure the ends of the main cables, and in doing this each one resists a pull of about 14,000 tons. This is achieved by filling large wedge shaped tunnels with concrete.

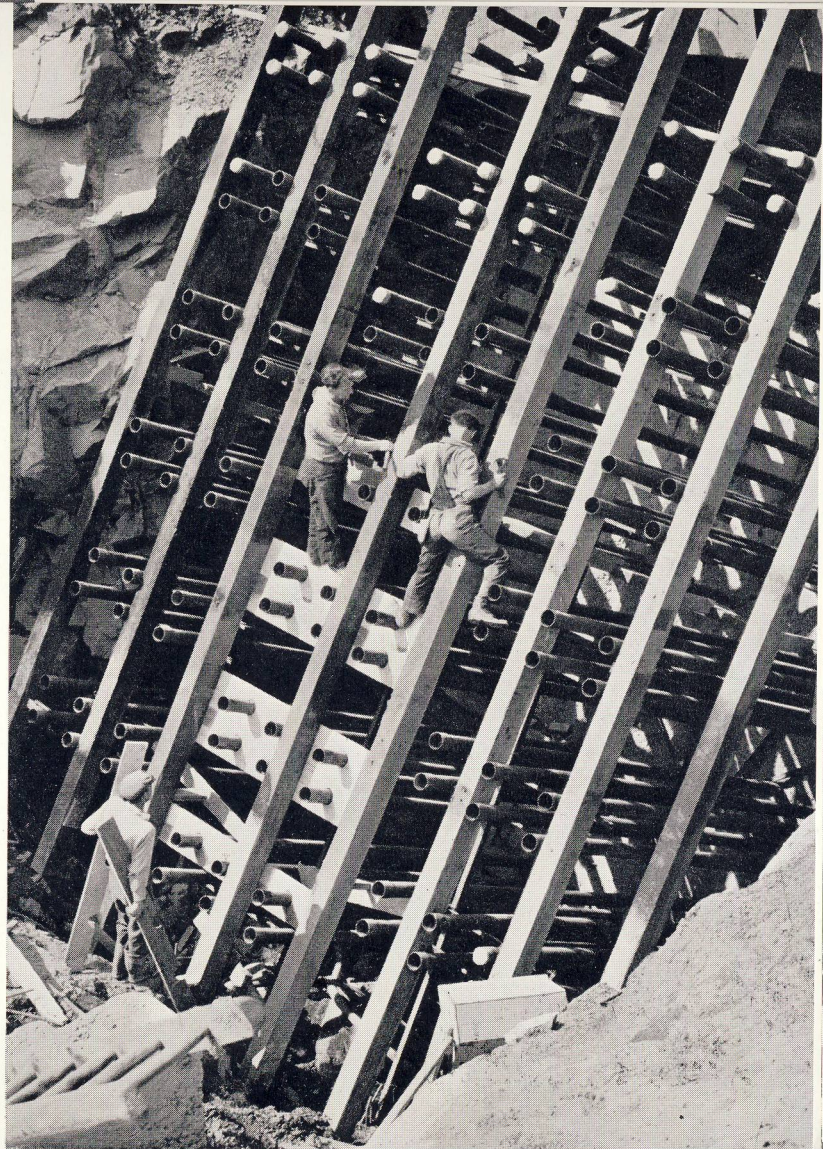
On the north side of the river, the tunnels were excavated in whinstone rock and tapered from about 20 ft. square at the front to 40 ft. square at the back, some 180 ft. into the rock. Because the south tunnels were driven into shale and sandstone they had to be made circular with a 25 ft. diameter, and enlarged at their lower ends to 45 ft.

All the tunnels were driven at 30° to the horizontal and as each one was completed it was filled with some 10,500 tons of concrete. Tubes were left in this concrete through which high tensile steel ropes were passed and tensioned. At their front ends, the ropes retain semi-circular shoes around which the wires of

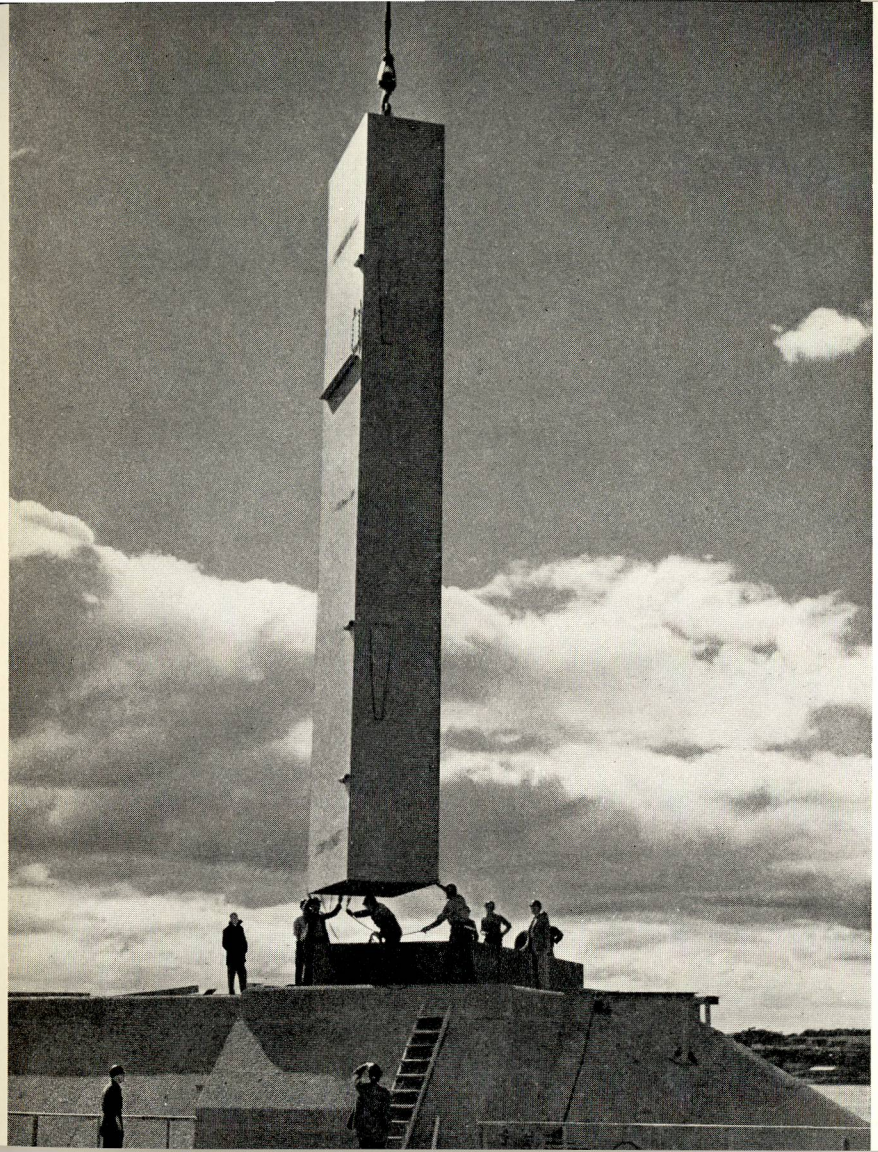












the main bridge cables pass.

Public interest in The Forth Road Bridge, manifest from its earliest days, quickened as the two tall steel towers rose above the river, dwarfing the concrete side towers. Visitors from many countries came to view the steel giant slowly rising from the river.

Each tower consists of two legs joined together by diagonal and horizontal bracing and rising 512 ft. above the river. The cross section of each leg is made up of three steel boxes connected together by four cover plates. Each box is about 40 ft. long, weighs up to 30 tons and the total height of the leg is made up of eleven sets of boxes and plates stacked one above the other.

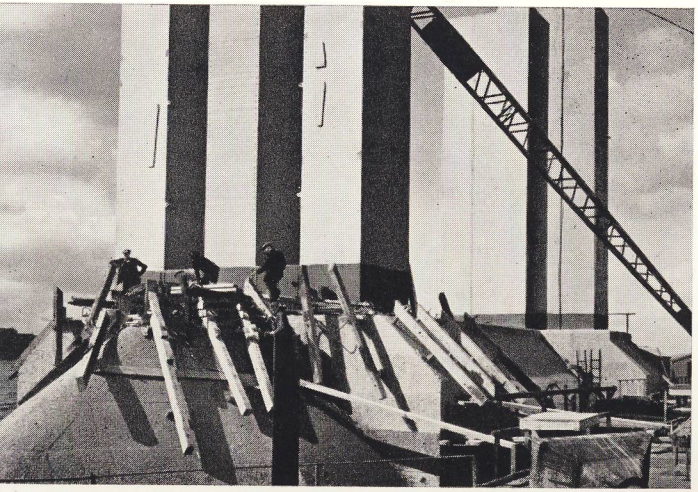
The first stage in their construction was the positioning of the bases which are embedded in the tops of the piers. These bases had to be levelled accurately as any error would cause the pre-fabricated towers to be out-of-plumb. When the bases had been concreted, the first set of boxes and plates was erected on them by a crane at pier top level.

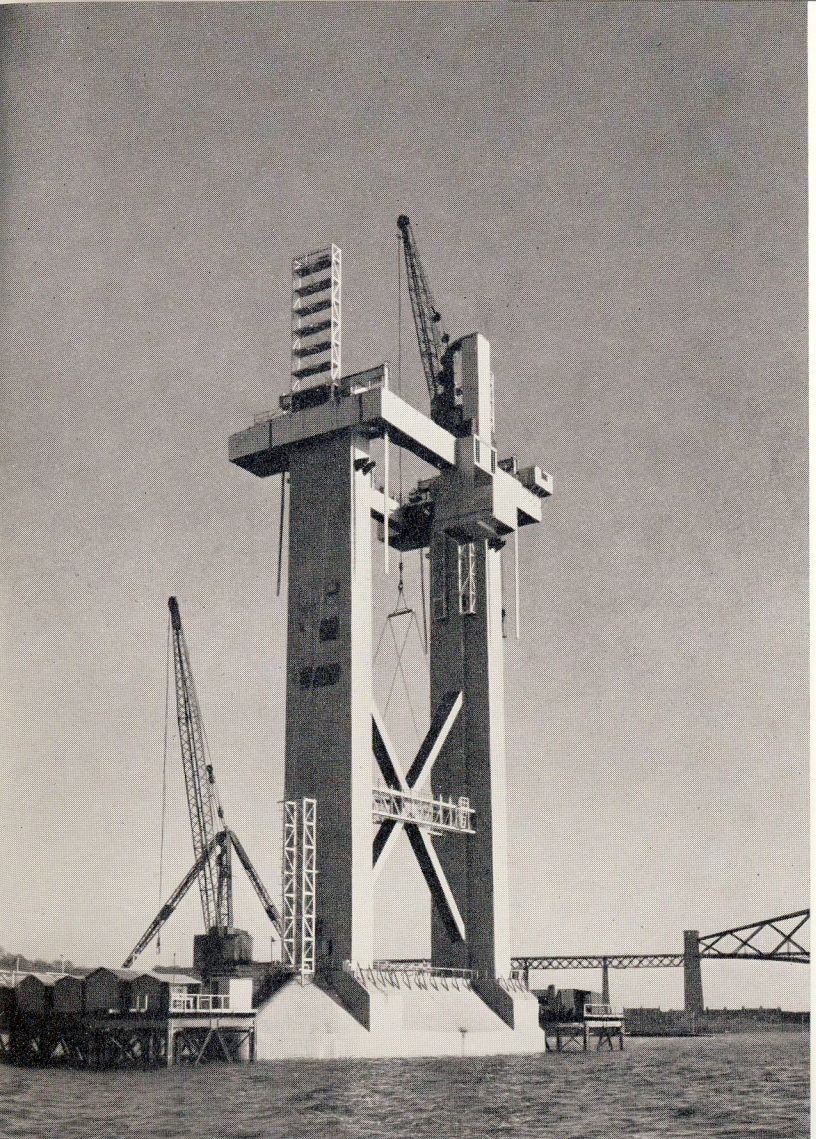
The next problem to be faced was the erection of 10 more sets of boxes on top of the first ones, and this was achieved by building a climbing ring structure around the tower legs and mounting a large crane on it. The crane was able to lift the boxes into position and when a section was complete, the ring structure, which weighed 230 tons, could be raised to the top

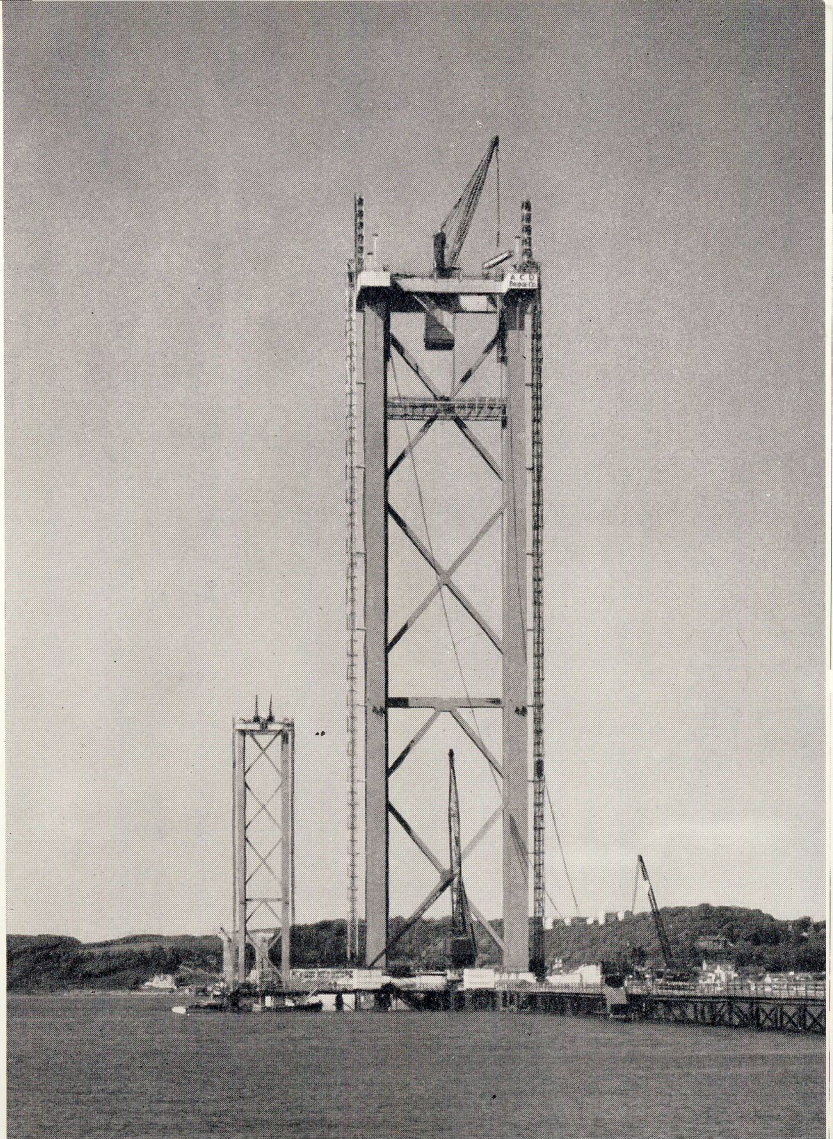
of that section ready for work on the next one.

This cycle was repeated until the last sections, the cable saddles at the tower tops, had been positioned. The ring structure was dismantled by smaller cranes and replaced by platforms in readiness for cable spinning.

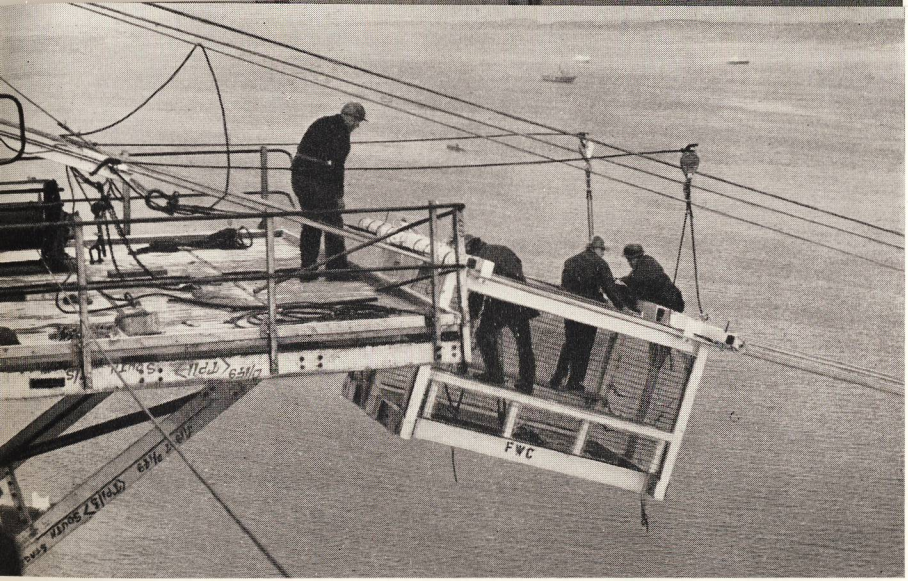
All steelwork in the towers was pre-fabricated and the sections were assembled together in the workshops to ensure good alignment and to check that the machining of the ends would provide a truly vertical tower.













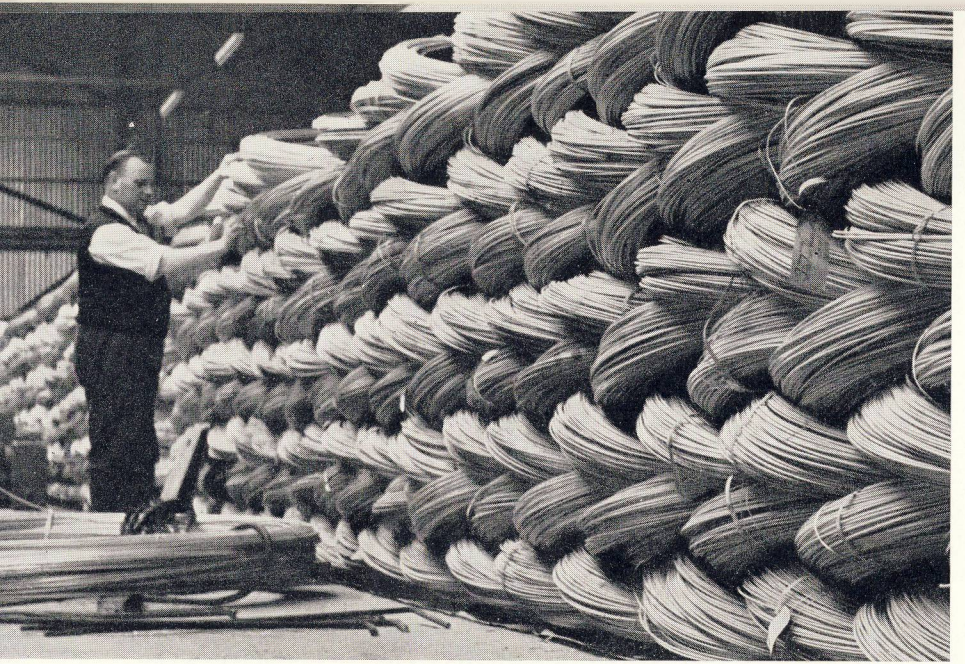
Spinning the cables

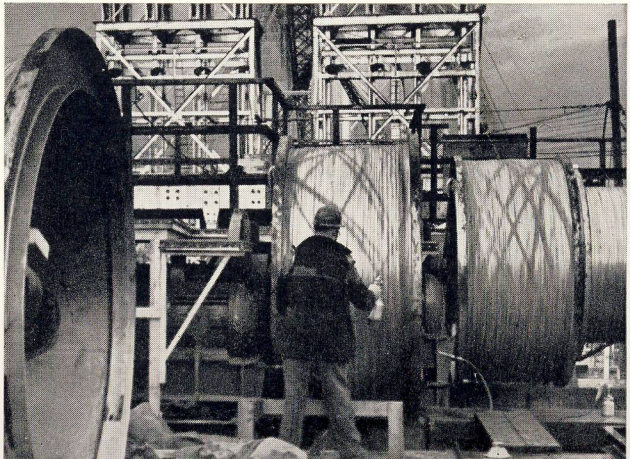
On November 17, 1961, the first four wires of the cables of The Forth Road Bridge were hauled over the tops of the 512 ft. high towers and anchored on either shore. Thus was inaugurated a crucial phase of the six years of the bridge construction, the spinning of the main cables across the river.

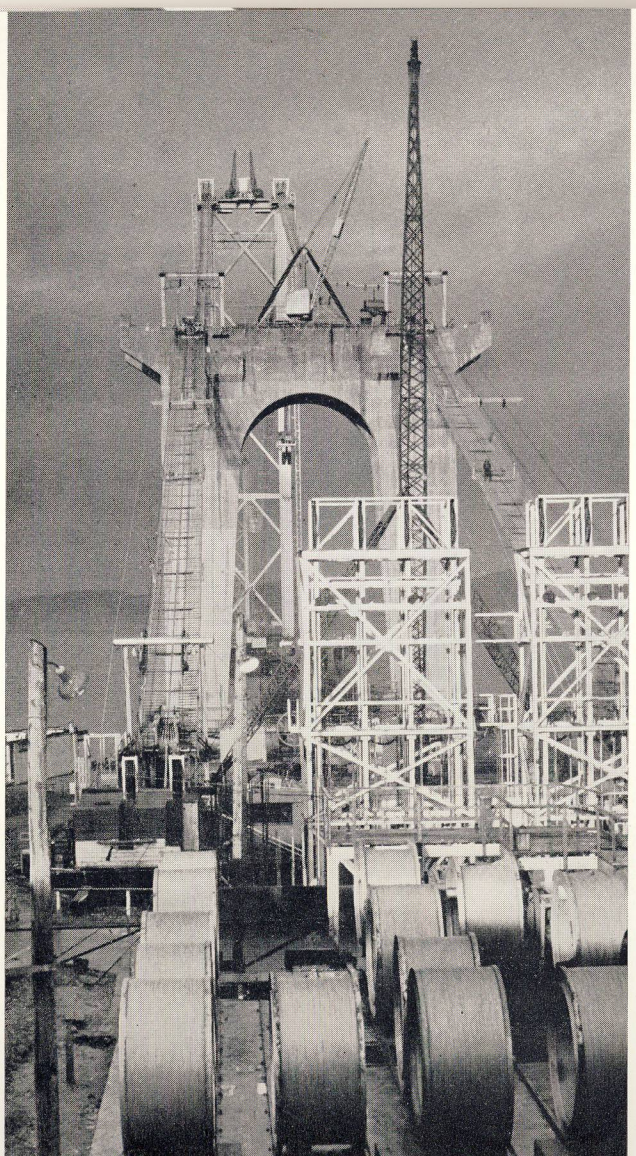
In a suspension bridge the weight of the deck and traffic is all carried by the cables. The cables are made of 11,618 parallel high tensile steel wires, 0.196 in. in diameter with an ultimate strength of 100/110 tons per sq. in.

Before spinning could start, temporary footbridges or "catwalks" had to be erected about 3 ft. below the level of the future cable. The catwalks were formed by laying wire mesh panels on strands stretching across the river from anchorage to anchorage via the tower tops. These strands were laid across the river from a barge and lifted into position at low tide in order that there should be the minimum amount of interference with shipping.

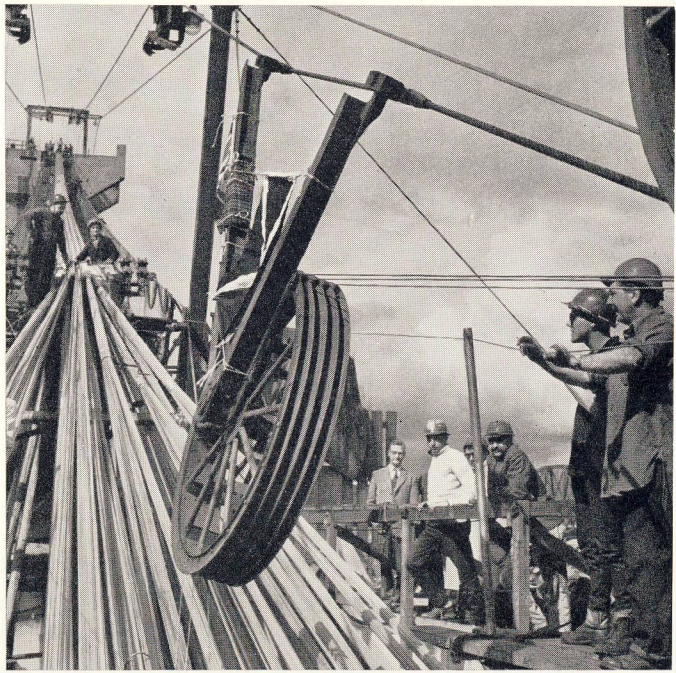
When the catwalks had been completed, the tramway system which consisted of an endless wire rope carrying two "spinning wheels" was erected above them. The tramway was driven electrically and by placing loops of wire in the grooves of one of the

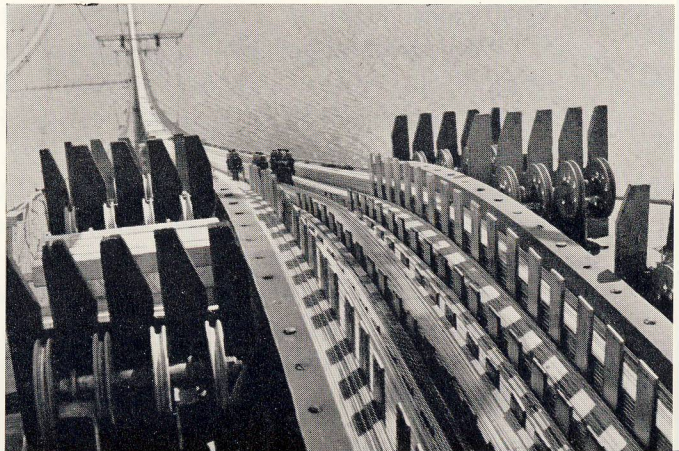


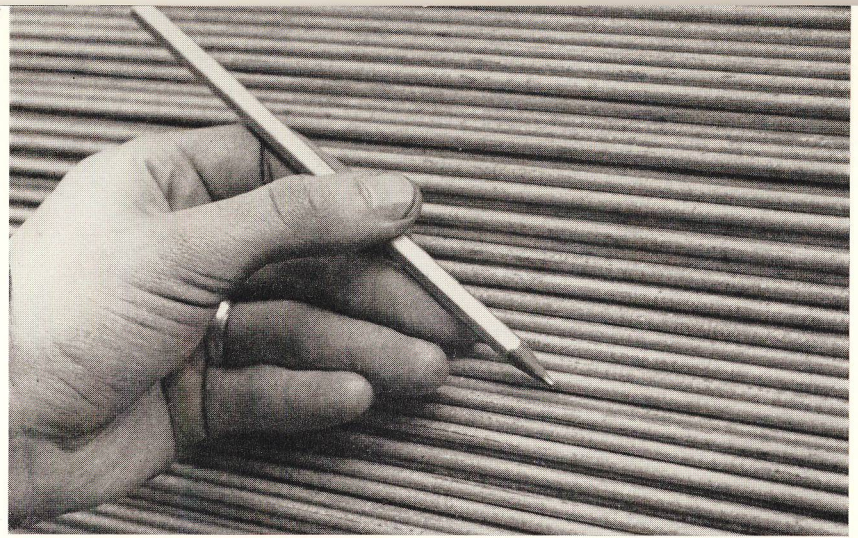








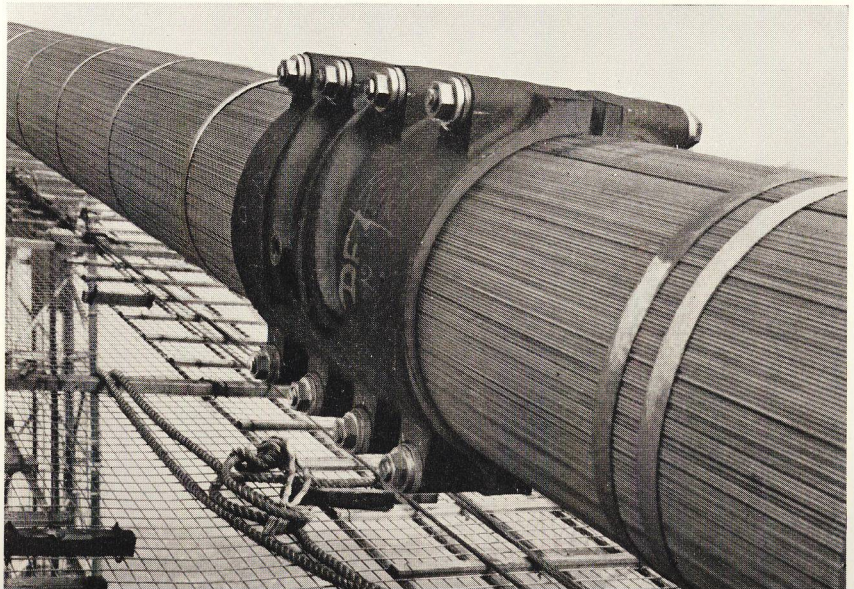




spinning wheels it was possible to carry wire across the river from anchorage to anchorage.

The spinning wheel travelled at a speed of 8 miles per hour, which enabled 8 wires to be placed every 15 minutes when the weather was good. But above the stormy waters of the Forth spinning had to proceed in very difficult weather conditions, persistent gales, snow and ice hampering the work and often cutting production to a few wires placed in a day.

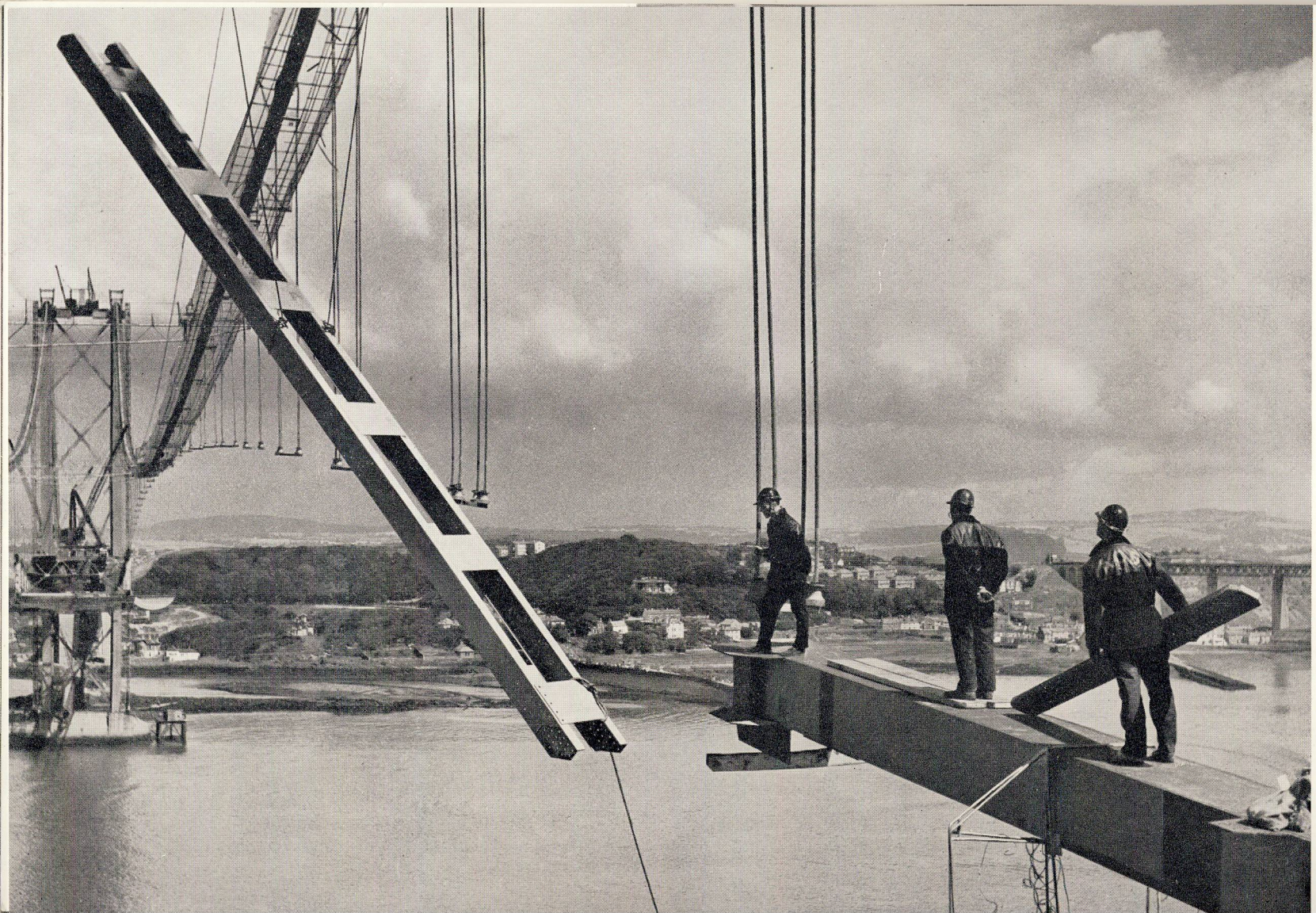
Lights were installed throughout the length of the catwalks. At this time the bridge, festooned with lights across the river, made a striking spectacle by night. Telephone lines were laid along the walks and there were electric control signals for use in adjustment of the wires.





As each group of wires (about 300) was completed they were bundled into a strand and the whole group adjusted at night so that its sag between the towers was exactly right and each strand would then carry its allotted share of the load.

On August 6th, 1962, the last wires were carried across the river and the two huge cables containing enough wire to stretch $1\frac{1}{4}$ times round the Equator were complete. For the bridge builders, however, this was only half way; they now had the means of supporting the trusses and roadways over the Forth. The hangers, loops of wire rope placed in special steel bands on the cable, were lowered into position and the sockets at their lower ends were ready to receive the steel of the suspended structure.





The suspended structure

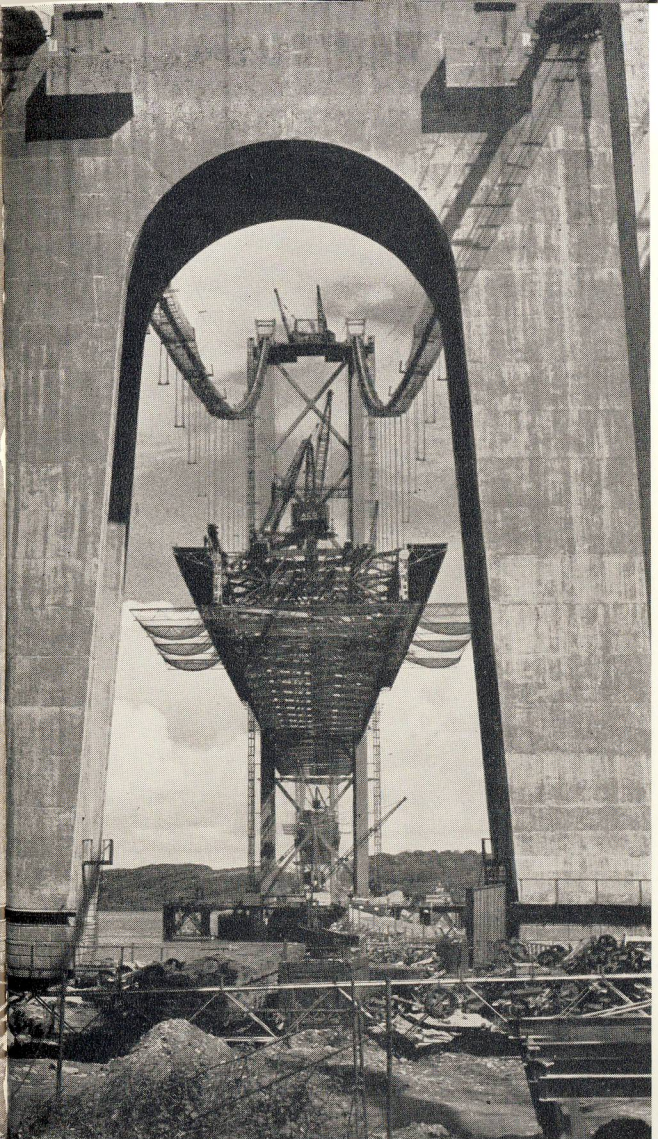
Early in October, 1962, the shape of the bridge began to assume a more positive form when the main steel decking slowly reached out on four fronts from the main towers. Cranes were mounted on each front in readiness for cantilevering more steel forward from suspender to suspender.

The main cables are substantial, but owing to their great span they are very flexible and would easily deflect if heavy loads were hung directly from them. The function of the steelwork is to stiffen the cable and distribute the loads more evenly along its length. The stiffening truss—to give the steelwork its proper name—is in effect a large open box with diagonal bracing on all four sides and cross girders spanning across the box to support the road deck itself.

All the steelwork for the stiffening truss and roadways, some 15,000 tons, was delivered to Drem Airfield for storage as it was fabricated in Glasgow, Darlington and Middlesbrough. From Drem it could be brought to the site as it was required and taken out to the main piers along the causeways. Cranes on the tower legs lifted the sections on to bogies at deck level so that they could be run out ready for erection.

In the main span the decks are of steel plates on which asphalt has been laid. In the side spans there







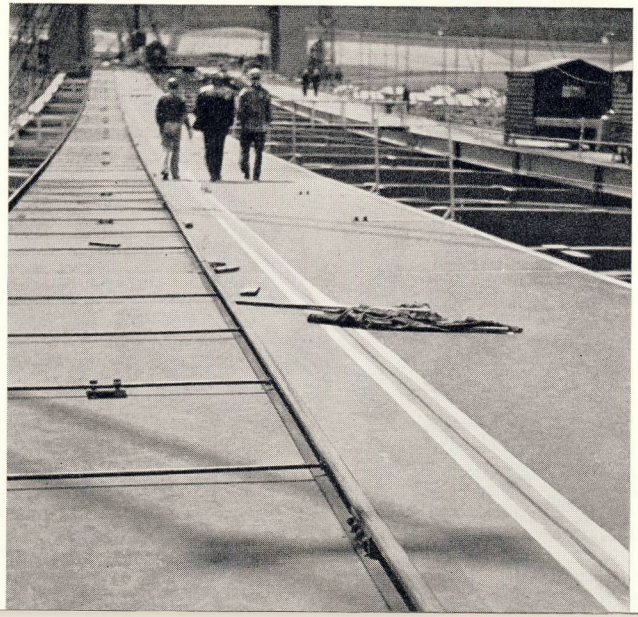
are also asphalt surfacings but, there, the asphalt was laid on reinforced concrete slabbing. This important difference in construction was planned to minimise imbalance of loading on the main towers; the weight of the 3,300 ft. length of main span is naturally greater than the weight of the two lengths of the 1,340 ft. spans.

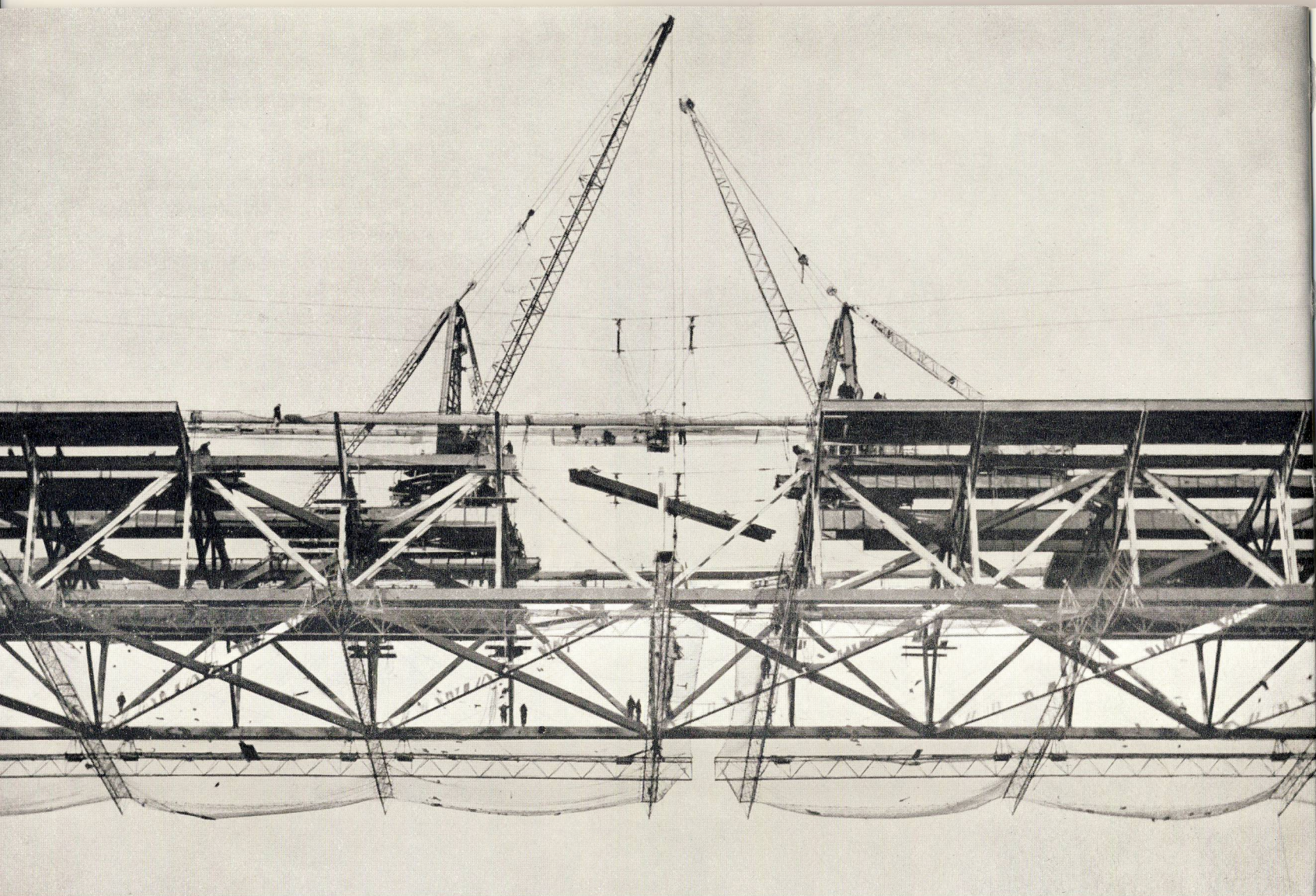
The steel was erected piece by piece to make up a 60 ft. panel between suspenders. As each panel was completed it was attached to the suspenders and the



crane moved forward on to it ready to commence work on the next panel.

The initial shapes of the steelwork were surprising to many onlookers. There seemed to be an unsightly sag in each of the four fronts, but this was due to the fact that the cables were not yet fully stiffened and with loads concentrated at their ends they deflected downwards and subsequently upwards. As erection progressed the sag disappeared and the final shape was realised.





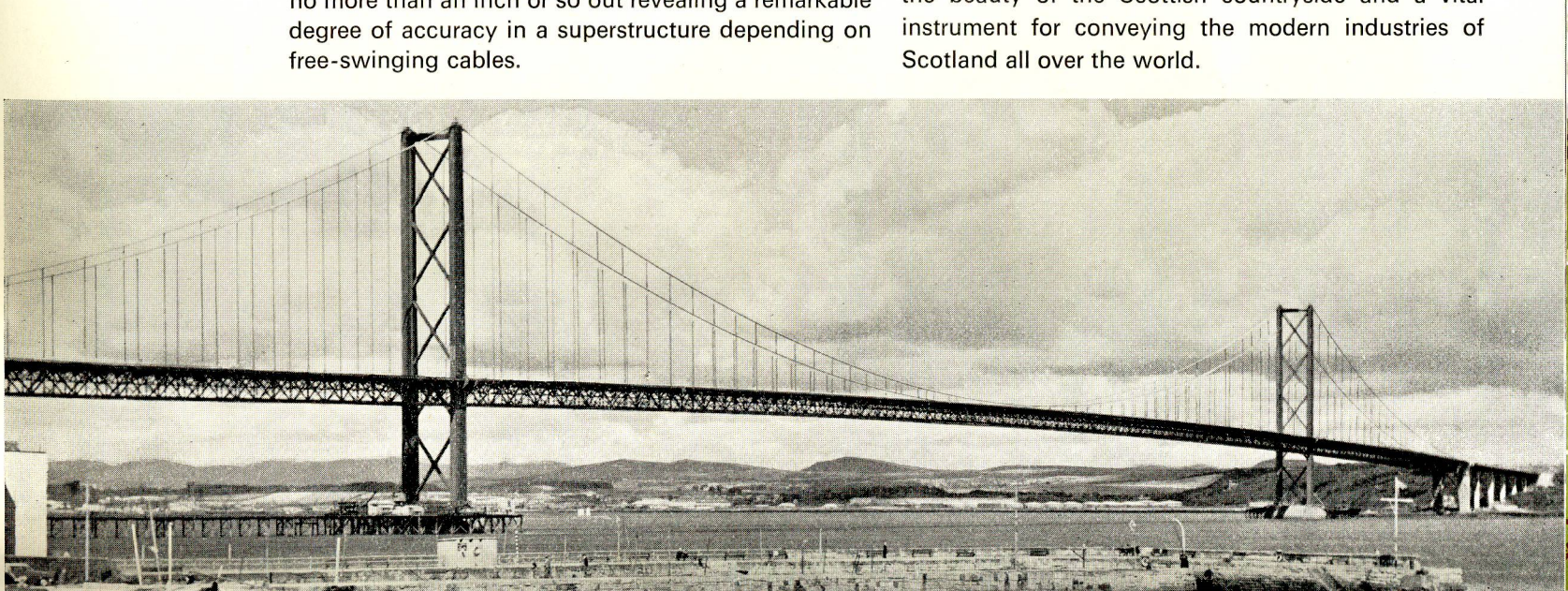
The closing of the gap

There was a dramatic development in the construction of the bridge on December 20, 1963, when, on a crisp winter morning while the bridge glowed in the light of a fitful sun and a freezing wind swept over the deck, the two parts of the suspended steelwork carrying the roadway met at the middle of the main span.

Two box girders, each 60 ft. long, draped with the Union Jack and the Lion Rampant, were swung into position by cranes to join the ends which had gradually been extending from the north and south shores of the Forth. The halves of the bridge came together with no more than an inch or so out revealing a remarkable degree of accuracy in a superstructure depending on free-swinging cables.

After the closing of the main span, the roadway and footpath decking was completed, asphalt surfacing laid and numerous other items of work done, such as the installation of lighting, telephones etc. The erection cranes and catwalks were dismantled and the bridge achieved its full stature on September 4, 1964, when it opened for traffic.

The new bridge, slender and gracious in line but strong and massive in power, is a symbol of the new age, a glorious highway for the traveller, a gateway to the beauty of the Scottish countryside and a vital instrument for conveying the modern industries of Scotland all over the world.







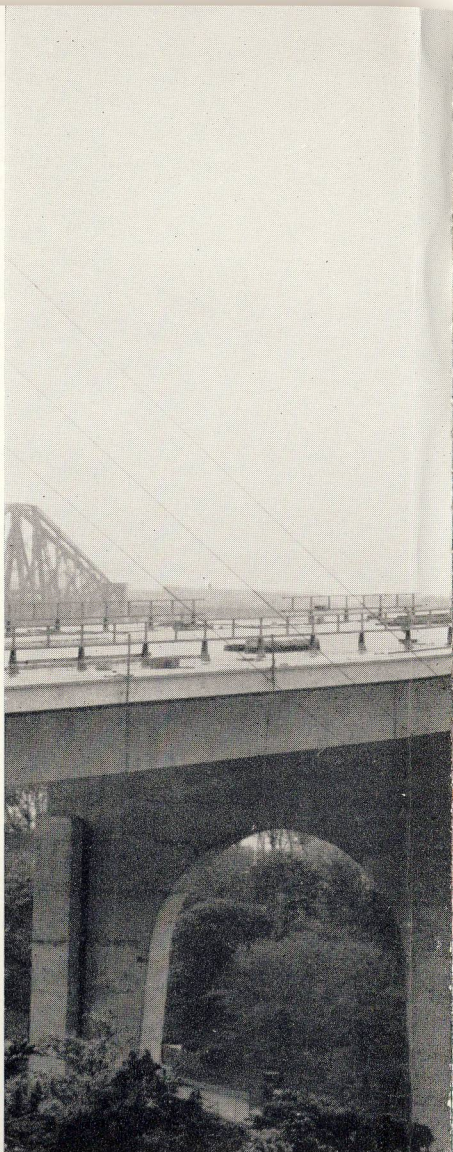
The viaducts

The viaducts for the new bridge are situated on both sides of the estuary and connect the suspension bridge itself to the new road works.

The south viaduct, which is 1,437 ft. long, is carried on 10 piers which gradually increase in height and span as the ground falls away to the river. The piers are similar in elevation to the side towers and with their arches joining the two legs form an impressive arcade below the bridge. Two continuous steel box beams span the piers and together with cross beams and outriggers carry the reinforced concrete deck slab.

A second viaduct on the north side of the bridge is of similar construction but only 842 ft. long, owing to the steep slope of the ground rising to the St. Margaret's Head cutting at North Queensferry.







The approach roads

The approach roads leading motorists smoothly and speedily to the new bridge are of the most modern design in keeping with the grandeur and importance of the Forth crossing.

The main approaches on each side of the river are 24 ft. (two-lane) dual carriageways, separated by a central reservation 15 ft. wide. The roads are designed to motorway standards, the maximum gradient being 1 in 25 and the smallest radius of curvature is 2864.8 ft. As on motorways, crossing of the central reservation is forbidden and all traffic joining or leaving the dual carriageway does so on the near side. Although some of the junctions follow the pattern of those in operation on the first British motorway, the M1, most of them are new to Scotland. On the north side of the bridge there is a unique junction, appropriately nicknamed the "Octopus", using eight different connecting roads.

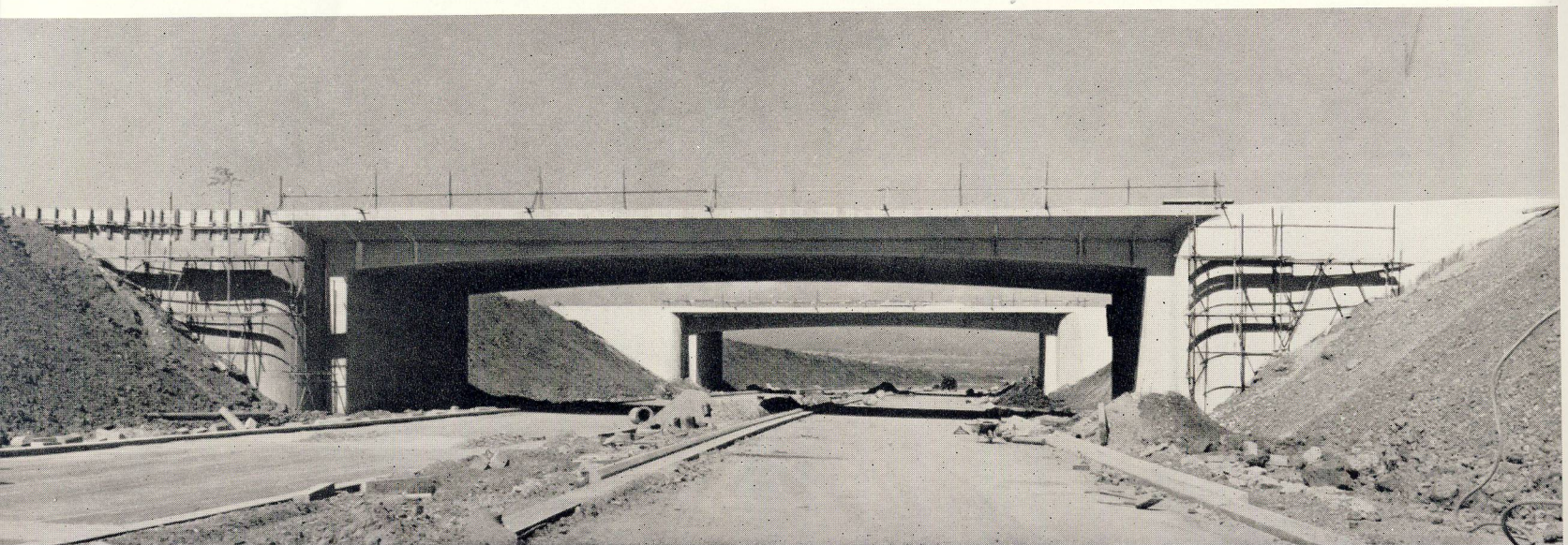
The southern approach roads extend from the bridge for a distance of $4\frac{1}{2}$ miles to the Edinburgh City Boundary at Cramond Bridge. The first $2\frac{1}{2}$ miles of the road are on a new line, the remainder being a reconstruction on the line of the old Edinburgh-Queensferry Road.

At Cramond Bridge the old eight-arch masonry bridge, built in 1823, was demolished to make way











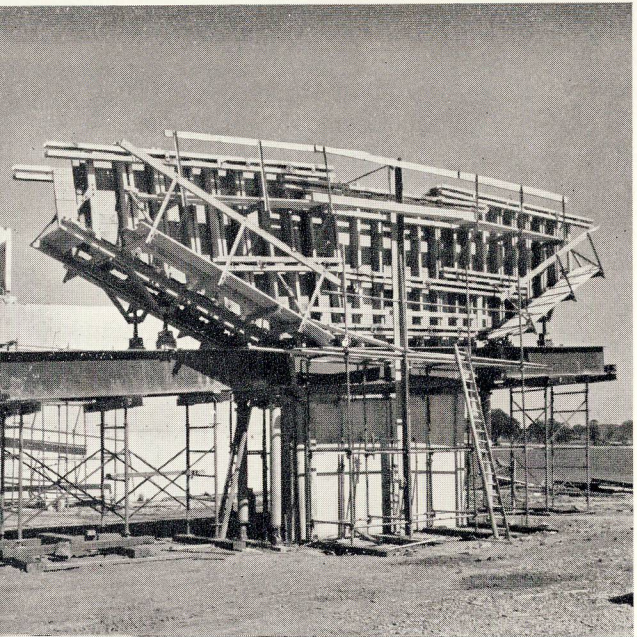
for the new three-span reinforced concrete bridge which is double the width of the old roadway. There are three flyover junctions on this section of the road.

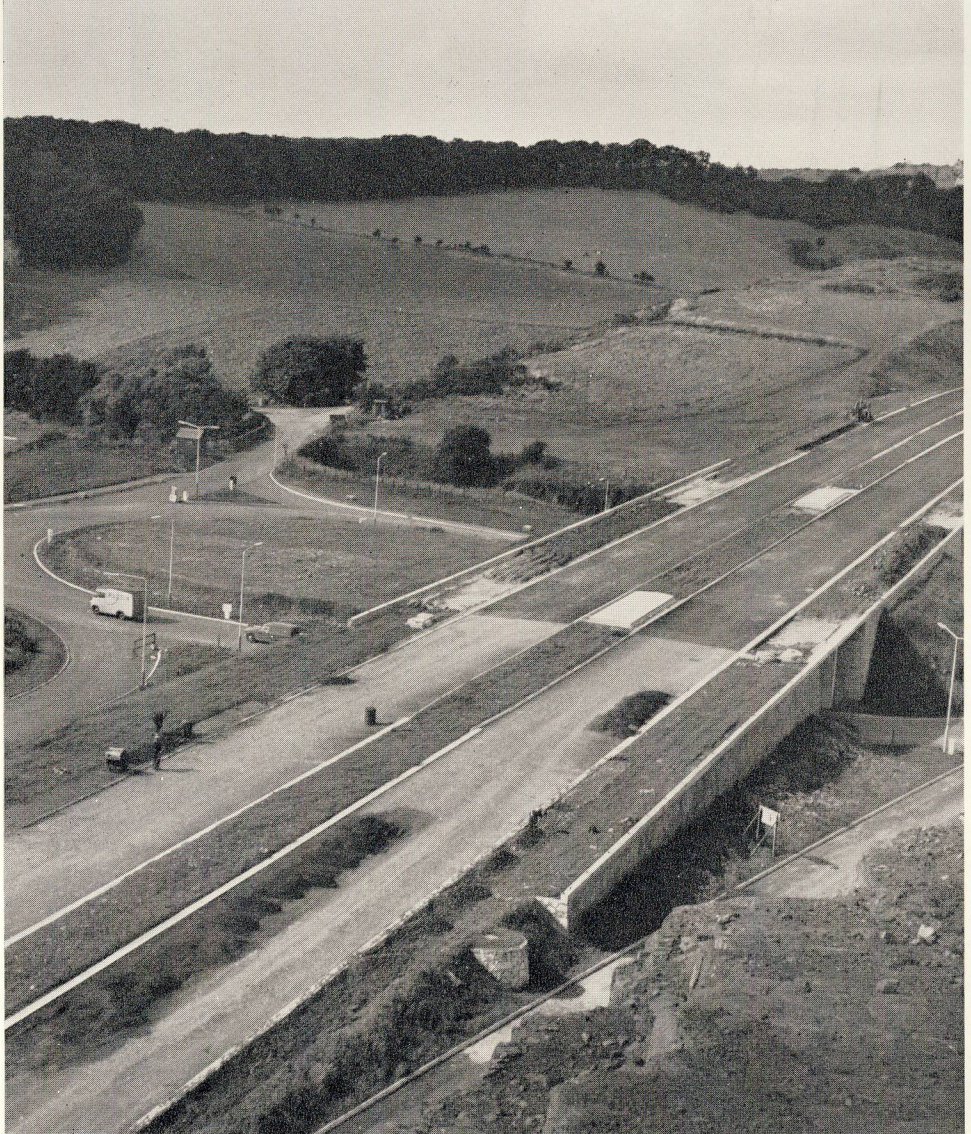
Where the new road skirts the south side of Dalmeny village it cuts through the side of a bing of oil shale residue. Approximately 1,000,000 cubic yards of material have been removed from this bing and used in the construction of the roadway. Before the decision was taken to use this material careful experiments were made to test the consolidation, compaction and strength of the shale, which had never before been used to such an extent in road construction.

At the immediate southern approach to the bridge, the roadway widens out to form the toll plaza across which are strung the tollbooths. Vehicles can be directed through the booths in either direction dependent on the balance of flow of traffic. The toll plaza has roadway heating to keep the area of accelerating and decelerating traffic free from ice and snow in winter.

The administration buildings are seen to the right of the toll plaza as one approaches the bridge from the south. This building houses the control equipment for toll registration, road heating, road and bridge lighting and also the workshop and other facilities for the maintenance and general routine running of the bridge. On the high level behind the administration









building a large car park is provided for visitors who wish to view the bridge or walk on to its footpaths.

The northern approach roads extend from the bridge to a point on the old A.90 approximately $1\frac{1}{2}$ miles north of Inverkeithing—about $3\frac{1}{2}$ miles in all. A further mile of dual carriageway links the north-south road with Dunfermline, and over one mile of three-lane roadway has been formed by reconstructing and realigning part of the A.92 trunk road to Kirkcaldy, Dundee and Aberdeen.

Three flyover junctions have been formed: at Ferry Toll, Admiralty and Masterton. In all, 14 reinforced concrete bridges have been constructed. Apart from the "Octopus" junction beyond Inverkeithing and Rosyth, prominent features of the northern approach roads are the rock cutting in St. Margaret's Head which one passes through after leaving the bridge, travelling north, from which approximately 1,000,000 cubic yards of material have been removed; a second deep cutting, this time in boulder clay, at Castlandhill some 80 ft. deep, and the Masterton Viaduct which is 600 ft. long and carries the new road across an area of very soft ground immediately to the north of the Forth railway line to Perth.

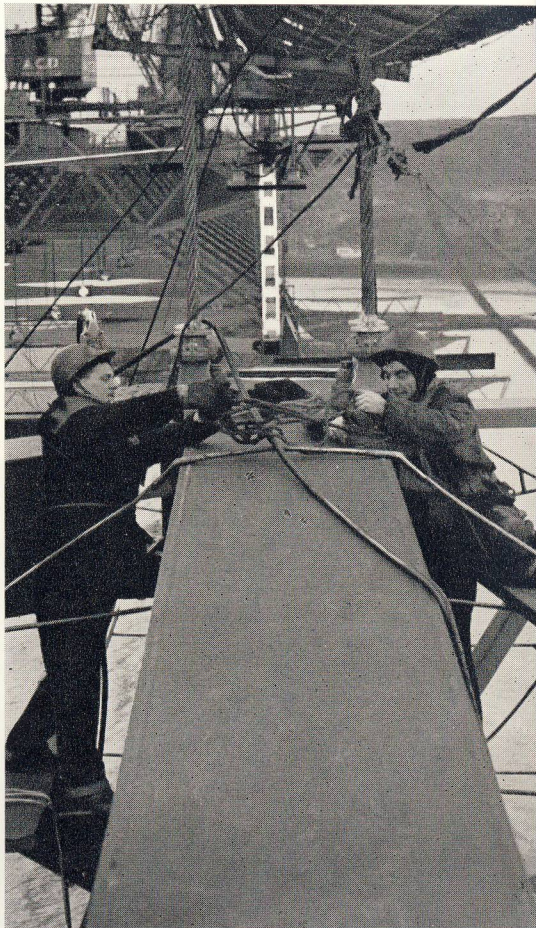
The men

To build a great bridge many men are needed, men who work with calculus and men who work with crowbars, men of skill and courage. They met, high above the Firth of Forth, in howling winds, in driving sleet and snow, or in the friendly sunshine of a summer morning, when the tall towers began to stretch gleaming, skywards. The men who planned and built the bridge were a team working with pride and with precision on a massive engineering project. The construction of the Forth Road Bridge called for skills not used in this country before. The men at work needed every ounce of brain, dexterity and physical courage they possessed. The majority were Scots, but many came from south of the Border. Modern instruments, new devices and engineering resources saved man-power and lightened labour, but still it was a big job—a dangerous task accomplished, happily, with very few accidents.













THE ENVIRONS OF THE BRIDGE



The Forth Road Bridge, a great modern highway linking Fife and the North with Edinburgh and the Lowlands, is shown on this map in relation to places of interest and importance to the road user.


PERTH
CRIEFF
TO OBAN
THE TROSSACHS
PERTHSHIRE
CALLANDER
GLENEAGLES
DUNBLANE
CLACKMANNAN
STIRLING
ALLOA
BANNOCKBURN
LOCH LOMOND
STIRLING
DUMBARTON
GLASGOW
PAISLEY
HENFREW
COATBRIDGE
AIRDRIE
CUMBERNAULD
FALKIRK
GRANGEMOUTH
CULROSS
KINCARDINE BRIDGE
BRIDGES
TORPHICHEN
ARMADALE
BATHGATE
LINLITHGOW
WEST LOTHIAN
LIVINGSTON
WHITBURN
HAMILTON
EAST KILBRIDE
WISHAW
LANARK
TO CLYDE COAST AND PRESTWICK AIRPORT
MILNATHORT
KINROSS
LESLIE
GLENROTHES
FALKLAND PALACE
CUPAR
TO DUNDEE VIA NEWPORT
ST. ANDREWS
FIFE
CRAIL
ANSTRUTHER
ELIE
LEVEN
METHIL
BUCKHAVEN
KELTY
COWDENBEATH
KIRKCALDY
DUNFERMLINE
ROSYTH
INVERKEITHING
KINGHORN
BURNTISLAND
ABERDOUR
FORTH ROAD BRIDGE
NORTH QUEENSFERRY
RAIL BRIDGE
QUEENSFERRY
FIRTH OF FORTH
TURNHOUSE
EDINBURGH
MUSSELBURGH
DALKEITH
ROSLIN
MIDLOTHIAN
NORTH BERWICK
GULLANE
HADDINGTON
EAST LOTHIAN
TO BERWICK UPON TWEED AND THE SOUTH
TO CARLISLE AND THE SOUTH
TO GALASHIELS AND THE BORDERS
TO NEWCASTLE AND THE SOUTH
Places of tourist or historical interest
N
MILES
0 1 2 3 4



Edinburgh

Edinburgh, Scotland's beautiful Capital and International Festival City, is a short distance from the Forth Road Bridge, the pleasant drive to the famous thoroughfare of Princes Street being only nine miles. Dramatically spectacular in its natural beauty and rich in romantic and historical interest, Edinburgh has a population of 476,228 scattered over an area of 34,781 acres.

The city boundaries extend from sea level on the Firth of Forth to over 1,500 feet on the Pentland Hills. Within these boundaries there are proportionately more parks and open recreational spaces than are found in almost any other city in the United Kingdom.

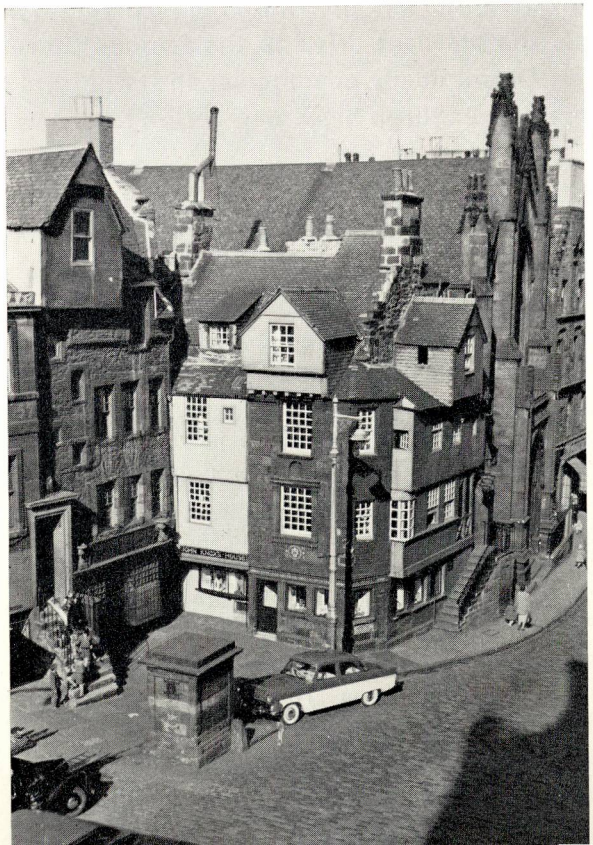
Edinburgh is the most frequently visited city in the British Isles outside London. People visit Edinburgh for many reasons. Some 900,000 arrive annually to enjoy themselves on holiday, whether to listen to Festival concerts, operas or plays or simply to roam around at leisure in the sunshine, savouring the historic, romantic, and natural beauty of the capital. Many others come to do business in Edinburgh, to buy her varied products, or to attend law courts or church courts, or because more committees meet here than in any similar area of European ground outside Geneva and the Vatican. It is a churlish soul indeed who does not enjoy the visit, whatever the reason, for Edinburgh is a city of very unusual beauty and interest.

No one can see the stupendous sight of the Castle on its volcanic rock dominating the gardens and thoroughfare of Princes Street without a thrill; no one can wander around the picturesque corners of the town and glimpse Arthur's Seat, the mountain in the heart of the city, or see "that auld claymore, the Firth of Forth" embedded in its scabbard of Fife and the Lothians, without a lift of the heart.

The city's unique thoroughfare, Princes Street, with the leafy gardens and the ancient Castle on one side, and modern shops and business

The City of Edinburgh.

John Knox's House.



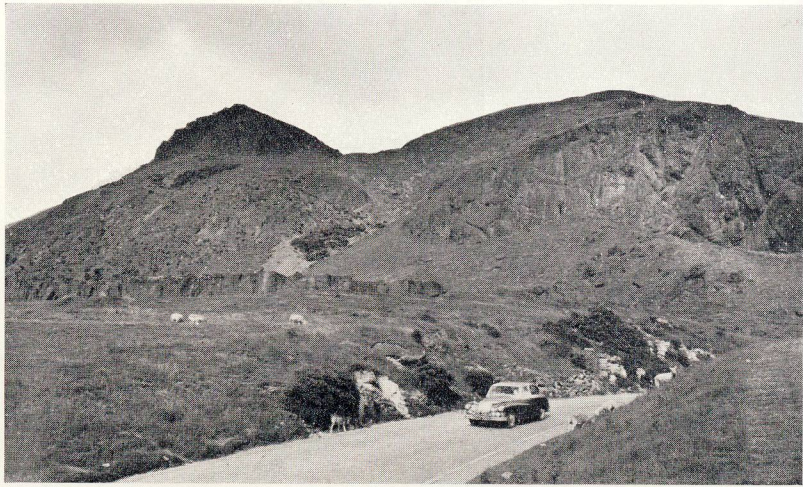
premises on the other, cuts the town in two. On the south, or gardens' side of Princes Street, stretches the Old Town with the Royal Mile linking the Castle at one end and the Palace of Holyroodhouse at the other. This is mediaeval, time mellowed Edinburgh, which until 1800 comprised the whole city. To the north of Edinburgh is the Georgian New Town laid out in broad avenues and crescents—the residential, the elegant and the big business side of the city. Here at one end of George Street is St. Andrew Square, reputed to be one of the wealthiest squares in the world, headquarters of many banks and insurance offices, and at the other end, Charlotte Square, where the Edinburgh Chamber of Commerce, the National Trust for Scotland, and other official bodies have their offices. The north side of Charlotte Square, designed by Robert Adam in 1791, is a feast of architectural detail.

There are numerous interesting places to visit in Edinburgh—to mention only a few—the Castle itself, the Palace of Holyroodhouse, St. Giles' Cathedral, Parliament Hall, the City Chambers, John Knox's House, and the 16th century houses in the Royal Mile and the Canongate Tolbooth now all used as museums. But Edinburgh also has much natural beauty and there are beautiful walks, around Arthur's Seat and its three lochs in Holyrood Park, or across the Pentland Hills,

Left: *The North side of Charlotte Square.*

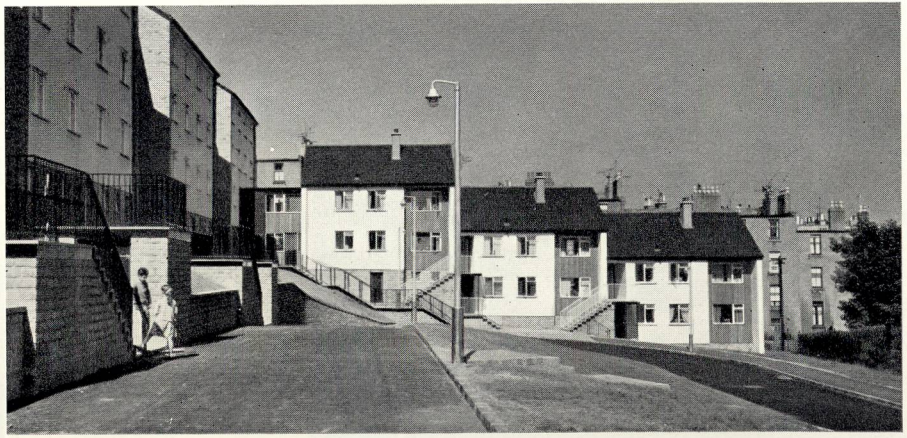
Right: *Arthur's Seat.*





Right: *Canongate Tolbooth.*
Below: *Modern housing at Newhaven.*



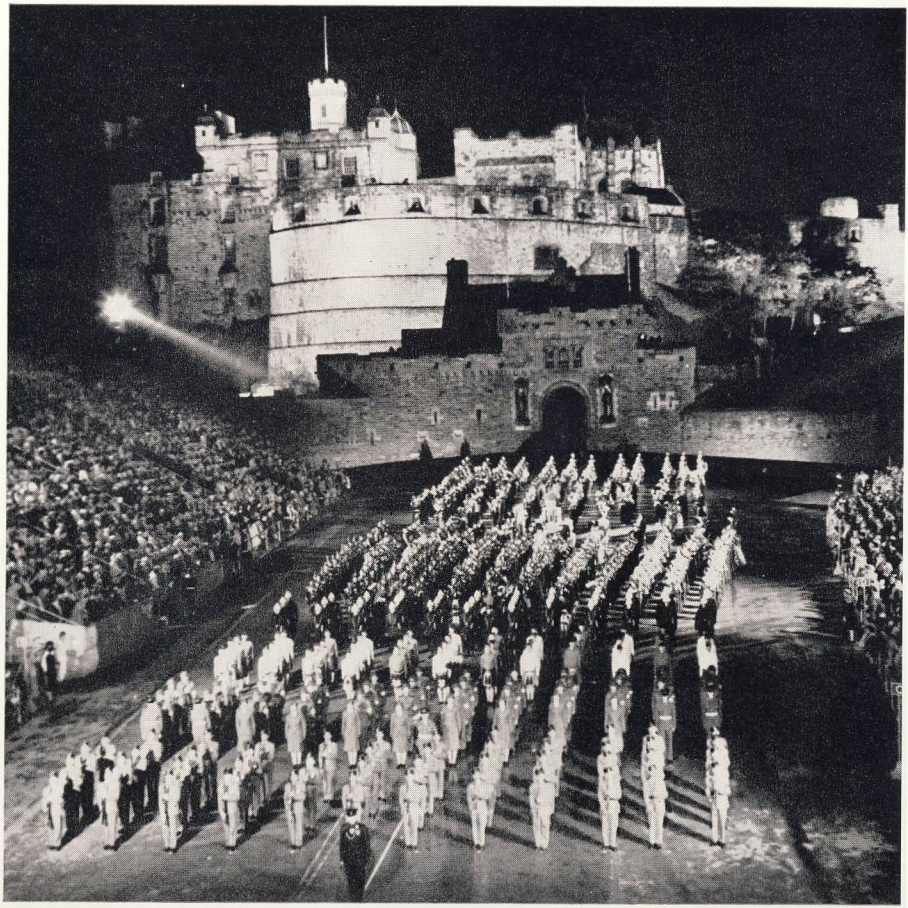


favourite haunt of the poet, Robert Louis Stevenson, or down to the picturesque village of Cramond by the shores of the Firth of Forth. Edinburgh's sea shore stretches for 9 miles, and in that distance there is the busy port of Leith, the old fishing village of Newhaven and the Promenade and swimming pool of Portobello. The pool, which has heated water and a wave-making machine, is the largest in Europe, with accommodation for 3,000 swimmers and 6,000 spectators.

While the main event of the year in Edinburgh is the International Festival, which attracts visitors from all over the world during its three weeks' season in August/September, there are many pleasant entertainments throughout the summer. In Princes Street Gardens, for example, there are Highland and Scottish country dancing displays and pipe band music; variety shows and special children's hours. Edinburgh Zoo, on Corstorphine Hill, which has the finest collection of Antarctic penguins in the world, is also very popular.

A cultural, artistic and beautiful capital city, Edinburgh is also a vital growing city, aware of her importance in the world. She is growing industrially and commercially as well as culturally. She has an industrial estate at Sighthill where some 38 firms make a great variety of products. Her port of Leith has an expanding trade with the Continent and many of the city's products, including flour, coal, beer, biscuits, whisky and

ropes, leave by sea as well as by road and rail. Edinburgh for centuries has been the home of printing, and there are many famous printing firms throughout the city. The most striking post-war development, however, has been in the sphere of electronics and light engineering, several firms being world famous in this connection. Other rapidly developing industries are hosiery and woollen goods, cardboard box making, glassware, pottery and leather goods.



The finale of the Festival Tattoo.



Midlothian

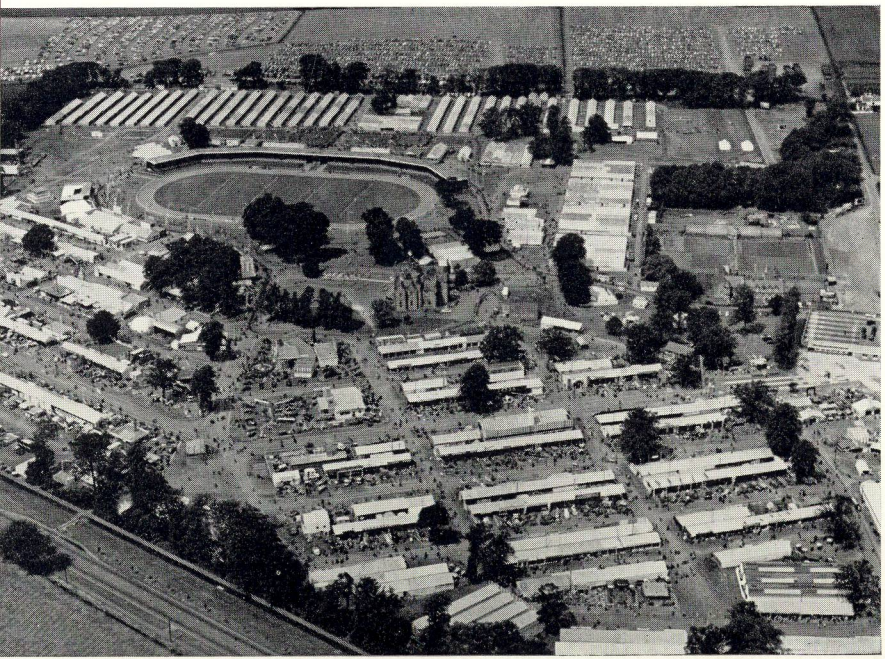
The approaches to The Forth Road Bridge from the south lie through the attractive wooded parklands of the Counties of Mid and West Lothian, the valley of the River Almond, through rolling wooded country, to the bare uplands of the central belt of Scotland. The gigantic spoil heaps of the former shale and coal workings are the only memorial to the chief industrial activity of the area which has now ceased. The area has, however, some of the largest level building sites to be found anywhere.

With the completion of The Forth Road Bridge and the projected motorways from Edinburgh to Glasgow, Stirling and the north, in conjunction with the existing parallel system of railway access to the ports of Leith and Grangemouth, and the development of Turnhouse Airport facilities, the eastern part of the area will have a system of communications unequalled elsewhere. These developments are being accelerated by the redevelopment of the central industrial belt of Scotland, and the transfer of activity from the west to the east.

An area of 6,692 acres of land straddling the River Almond and equally divided between the Counties of Midlothian and West Lothian has been designated as the New Town of Livingston. It will be a major industrial centre bounded on the north by the main Glasgow-Edinburgh A.8 road. A network of secondary roads will link up with the main arteries to give convenient outlets to any part of the country. Livingston is 15 miles from Edinburgh and 29 miles from Glasgow.

The new town is planned for a population of 110,000, and work on the erection of houses is now proceeding at about 1,000 dwellings a year. Already a considerable proportion of the future population is assured of employment at new factories under construction. The spoil heaps, or

Cramond and the River Almond.



An aerial view of the Royal Highland Show.

"bings" as they are called locally, so far as they cannot be removed for major civil engineering works, are being reshaped to fit in with the surrounding landscape and planted with grass and trees. The derelict industrial sites are being similarly cleared and landscaped to provide new industrial sites or amenities.

The industrial site established by Midlothian County Council at Newbridge promises to provide employment on a scale and of a diversity not hitherto found in this area. Multi-storey residential blocks providing residential accommodation and hotel facilities for visiting industrialists will be provided in connection with the general wide-spread development of Midlothian's industrial potential. South of the Almond Valley, in the foothills of the Pentlands, lie many delightful secluded residential sites which will be developed for private housing. This area is dominated at its eastern end by the Dalmahoy Crags near Balerno, which look down on the renowned golf courses of Dalmahoy and Ratho Park and the Almond valley. The bed of the River Almond is deep-cut and its sheltered course is bordered with woods and low crags. It is the aim of the local authorities to provide a riverside path giving continuous access through this beautiful area from Livingston to the Firth at Cramond.

The major event of the year in Midlothian is the Royal Highland Show, at Ingliston, near

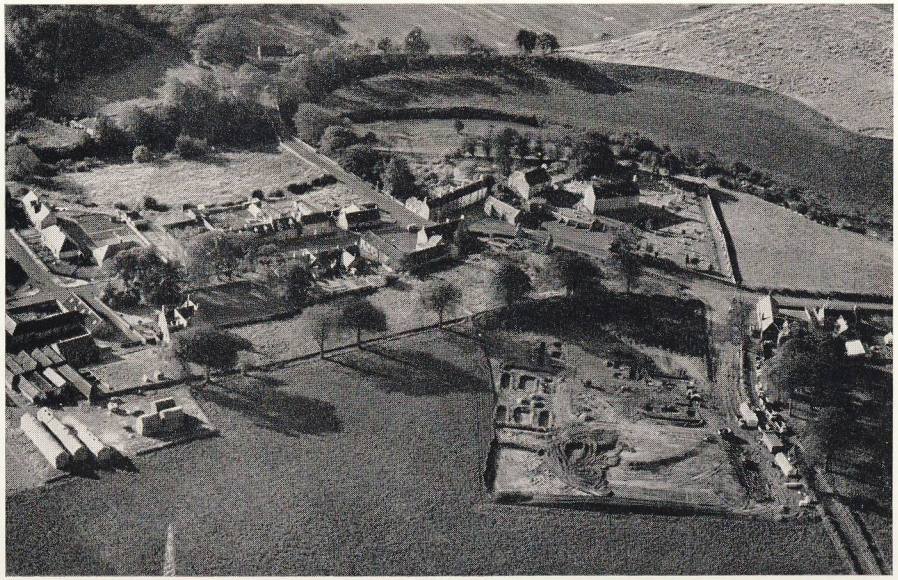
Edinburgh. This great agricultural display is held in the latter part of June. It attracts farmers, industrialists and tourists from many countries.

Places of interest to visitors in Midlothian include the beautiful Rosslyn Chapel, at Roslin; Newbattle Abbey (now a residential adult educational college) near Dalkeith; and the town of Musselburgh with its race course and one of the world's oldest golf courses.

Left: *Rosslyn Chapel.*

Right: *An aerial view of Livingston Village, heart of an area which will become the New Town of Livingston.*







West Lothian

The southern end of The Forth Road Bridge is in the County of West Lothian, near the ancient royal burgh of South Queensferry. The queen, who gave her name to the burgh was the saintly Queen Margaret, wife of Malcolm Canmore, who used its ferry on her numerous excursions between Dunfermline and Edinburgh in the 11th century.

South Queensferry, huddled at the edge of the Firth of Forth, is well worth visiting, not only to view the two major bridges on its doorstep, but also to see the buildings of historical interest. There are, for example, the Carmelite Priory Church of the Virgin Mary, dating from the 14th century, and Plewlands House, a handsome 17th century mansion, recently restored by the National Trust for Scotland. Near South Queensferry is the little village of Dalmeny with its tree-lined green and 12th century church, one of the finest churches of the period in Great Britain.

Two and a half miles west of South Queensferry is Hopetoun House, home of the Marquess of Linlithgow, and Scotland's greatest Adam mansion. Since the mid-eighteenth century Hopetoun House and its spacious lawns and policies have remained almost unaltered. There are many works of art in the house, which is open to the public on summer afternoons, except Thursdays and Fridays.

Linlithgow, the county town of West Lothian, is situated in a pleasant valley surrounded by hills with a loch on its northern boundary. By the lochside, on a terraced slope, stands Linlithgow Palace, birthplace of the ill-fated Mary Queen of Scots. The oldest part of the palace, which is open on weekdays and Sunday afternoons, dates from the early 15th century. Close to the palace is the parish church of St. Michael, one of the finest examples of Gothic architecture in Scotland.

About four miles north-west of Linlithgow, and

Hopetoun House.

South Queensferry



one mile from the Forth, stands the House of the Binns, historic home of the Dalyells, among them General Tam Dalyell, who defeated the Covenanters at Rullion Green and raised the Royal Scots Greys Regiment in 1681. The house, which was presented to the National Trust for Scotland in 1944, is open to the public on Saturday and Sunday afternoons. Near the Binns is the little village of Blackness, once one of the most important seaports on the east coast of Scotland. The ancient Blackness Castle dominates the village.

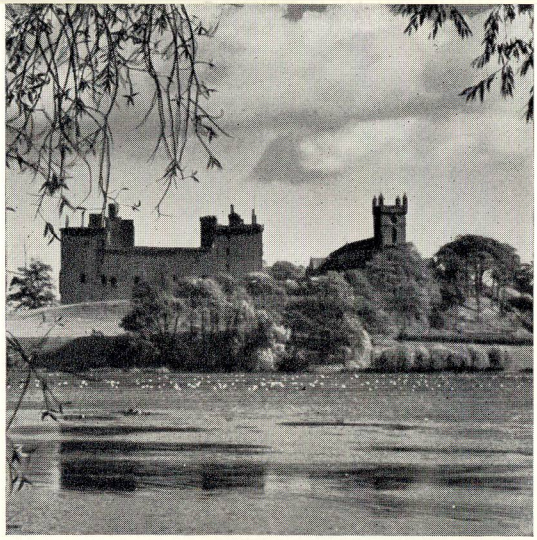
On the western perimeter of the Bathgate Hills is the pleasantly rural village of Torphichen with its ancient Preceptory founded in 1153 by the Scottish Order of the Knights of St. John of Jerusalem.

West Lothian, although 76,859 acres in size, has a population of 97,000 and one of the higher population densities in Scotland owing to its intense industrial background. Agricultural land is of good quality, but despite this, the majority of towns and villages have a predominantly industrial basis. The development of the county was due to the heavy industries in early days; but the modern trend is towards lighter industry and to manufacturing rather than extractive processes. While coal-mining is still an important industry, other activities include paper-making and packaging, whisky blending, knitwear, synthetic fibre

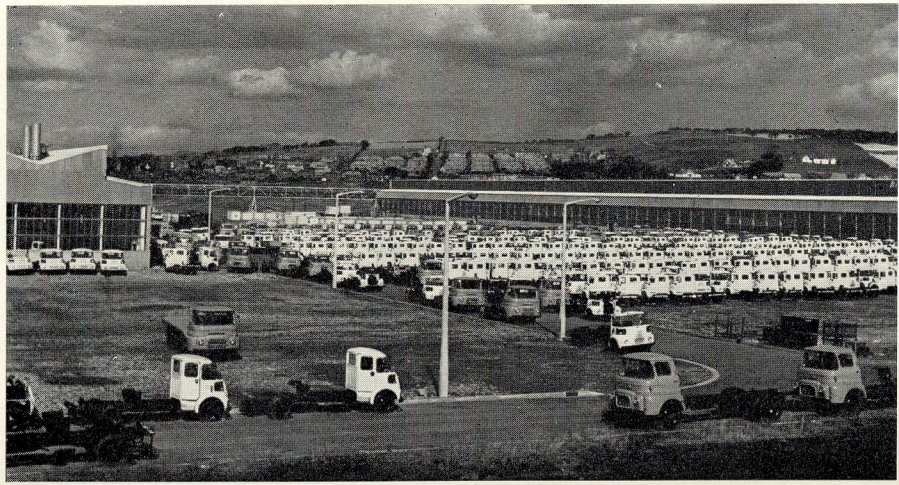
manufacture, the making of condensers, air-cooled heat exchangers and storage tanks, and brick, fireclay and concrete manufacture.

The establishment of a huge commercial motor vehicle factory near Bathgate in 1960 brought new activity to West Lothian, and now the services available for industry in the county have reached such a standard of convenience and efficiency that many other firms have established new factories or depots. The proximity to Grangemouth Docks, just over the county boundary, in Stirlingshire, has also led to industrial expansion. The oil refinery and associated petro-chemical firms at Grangemouth have acquired 450 acres of land in West Lothian. This will establish an industrial belt along the Forth foreshore between Grangemouth and Bo'ness, an old shipping town now rapidly developing.

A new technical college, new schools and new homes in West Lothian all indicate a forward-looking approach by the County Council to the county's industrial expansion.



Linlithgow Palace.



Lorries off the assembly line at Bathgate.



The County of Fife

Most of the people of Scotland live in a county, but not the 320,000 inhabitants of the peninsula at the north end of the Bridge who talk without embarrassment about the Kingdom of Fife. This was the name before Fife was providing the kings and queens of Scotland in the 11th century, and the Fife folk see no modest reason for changing it now. Pride, undiminished by time, meets the visitor to this ancient outcrop of land where a modernised industrial complex and a chain of tourist attractions lie easily beside each other.

The new Forth Road Bridge now spares the motorist the ferry-boat and provides a spectacular gateway to a county that can provide your idea of a holiday, whether that is fulfilled on the golf course, the beach, or rummaging around castles, abbeys and townships steeped in rugged and romantic history.

The golf links and the beaches of Fife leapfrog over each other round the county's coastline. From the trim attractions of Aberdour to St. Andrews, where beach and bunkers run to the horizon, the visitor can blend a sea-shore family holiday with golf on courses where he is welcome for a few shillings a round and where there are no caddy-car jams on the first tee.

On the county's northern edge, gliding men can have an hour aloft for 15/- in one of the club gliders at Scotlandwell, or book a boat well ahead and try to add to the 80,000 brown trout fished from Loch Leven each year. On three days a week in summer, water ski-ing visitors can whip three times round Loch Gelly for 7/6d. and in the little fishing ports of the lovely East Neuk yachting men mix among the nets and lobster pots.

In some of these little sea-side towns, history is trapped in the picturesque harbours, priories and cliff-side castles. At Culross, in the west of Fife,

Dunfermline.

Crail.



people still live in the superbly preserved beauty of a 16th century waterside village and at Lower Largo, to the east, you find the birthplace of the man who sailed away to find immortality as Robinson Crusoe.

The large Royal burghs of Dunfermline and Kirkcaldy provide the visitor with an ice rink, dance halls, cinemas and department stores, though outdoor types are assured of sunshine and rainfall averages that match the Kentish coast.

Dunfermline was the birthplace of Andrew Carnegie, who made millions from steel in the U.S.A. and gave back generously to his home town in a form that remains unique today. Parks, dells, foundations and buildings, built with Carnegie money, today blend with the ancient abbey ruins to make Dunfermline one of the most fascinating towns in Scotland.

Industrialists of the old mould grew rich in Kirkcaldy, too, and left their legacies in the shape of parks, art galleries and other public buildings.

These two burghs form the county's industrial base of traditional manufacture, on which is rapidly rising a new breed of industries spawned by an age of electronics.

In Dunfermline, a Dutch electronics giant is growing; in Cowdenbeath is the plant of the biggest telecommunications firm in Britain; and in the new town of Glenrothes, American electronics factories are all expanding beside

plants engaged in plastics, hydraulic gear, engineering and food processing. It was in Kirkcaldy, original home of the world's linoleum industry, that the first floor tile to resist the stiletto heel was produced. Other traditional industries of Fife are coal-mining, linen and agriculture.

Superbly geared to the attraction of more modern industries, however, Fife has laid out a string of industrial estates, offered financial inducements to industry, built key-worker housing and given 100% loans for incoming executives who want to buy homes in a county which has known neither smog nor traffic jam.

Most attractive are the Donibristle–Dalgety projects, where a large industrial estate is developing close to a new sea-shore township of executive-type homes.

Families settling in Fife are able to have the children placed in splendid modern schools. New technical colleges are within reach to round off the education of those who do not go to the Universities of St. Andrews or Edinburgh.

For those who come to play and those who come to stay the Forth Road Bridge is the gateway to happiness and opportunity.



Left: *The Open Golf Championship at St. Andrews.*

Below: *The Shopping Centre at Glenrothes.*



The consulting engineers for The Forth Road Bridge project were Mott, Hay & Anderson, London and Edinburgh; Freeman, Fox & Partners, London, were associated with them for the main bridge and main approach viaducts. The architect was the late Sir Giles Gilbert Scott, London.

The following engineers have been engaged on the project–the late Sir David Anderson LL.D., B.Sc., for nearly a quarter of a century until his death in 1953; the late Mr. Vernon F. Bartlett, B.Sc., M.I.C.E., Mr. J. Kenneth Anderson, M.A., M.I.C.E., Mr. John A. K. Hamilton, G.M., B.Sc., M.I.C.E., M.I.Mech.E. (as Resident Engineer of the whole project) all partners of Mott, Hay & Anderson; and Mr. Gilbert Roberts, B.Sc., M.I.C.E., partner of Freeman, Fox & Partners.

The principal contractors were
Main bridge substructure—John Howard & Co., Ltd., London.
Superstructure—The A.C.D. Bridge Co., London, a partnership formed by Sir William Arrol & Co., Ltd., the Cleveland Bridge and Engineering Co. Ltd., and Dorman Long (Bridge & Engineering) Ltd. The Agent on the site was Mr. H. Shirley Smith, O.B.E., B.Sc., M.I.C.E.
Main approach viaducts—Reed & Mallik, Ltd., Salisbury.
Northern approach roads—Whatlings Ltd., Glasgow.
Southern approach roads—A. M. Carmichael Ltd., Edinburgh.

The Authority for the whole project is the Forth Road Bridge Joint Board. The present serving members of the Board, representing their various authorities, are the Right Hon. Duncan M. Weatherstone, M.C., T.D., Lord Provost of the City of Edinburgh (Chairman), and Treasurer Herbert A. Brechin, C.B.E., Bailie Hugh Macpherson, and Councillors Archibald D. Jameson, James W. McKay, John Kane, Russell A. Fox, Alexander Sutherland, and G. A. Theurer (for Edinburgh Corporation); Mr. John McWilliam, Convener of Fife County Council (Vice-Chairman), Provost J. Maxwell, and Councillor Hugh Macfarlane (for Fife County Council); Mr. Peter Walker, Convener of West Lothian County Council; Councillor J. Hughes (for Midlothian County Council); Judge of Police John Allan (for Dunfermline Town Council); and Bailie John Cook (for Kirkcaldy Town Council). The Clerk to the Board is Mr. W. Borland, S.S.C., and the Treasurer, Mr. A. L. Imrie, C.B.E., C.A., F.I.M.T.A.

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This Book has been published by the Forth Road Bridge Joint Board.
The design and printing, on paper manufactured in Scotland by the Carrongrove Paper Co. Ltd. Denny, are by the Scottish Field.
Photographs are from W. Ralston Ltd., the Glasgow Herald, the Scotsman, Mr. Alan G. Simpson and Mr. John V. Dewar.