

THE SCOTSMAN

Tay Bridge Souvenir



Crossing the Tay

by

IAN NIMMO

August 18, 1966

The Tay Road Bridge

Officially opened by

Her Majesty The Queen Mother



MESSAGE FROM THE LORD PROVOST OF DUNDEE.

It is with particular pleasure and pride that I make a contribution to this brochure. The dreams and efforts of many people through the years have been fulfilled by the completion of the Road Bridge across the River Tay. There can be no doubt as to the influence of the Bridge on the future prosperity of the East of Scotland.

The Counties of Angus and Fife will benefit in many ways, particularly in industrial, commercial and tourist developments. Our own city—already flourishing and prosperous—welcomes this splendid Bridge as another "Road to Dundee" which will increase our status and importance and make a worthy contribution to the trade and prosperity of Dundee.

Maurice McManus.

THE Fife *Abercraig* was bucking like an old Dundee shooglie tram let loose down the Hilltown when I made my last trip on the Ferry from Newport across the Tay. I had to stand, feet apart, hands gripping the side to keep balance as I studied the dramatic monster stabbing across the river into the heart of the city. One of the deckhands clutched his way over beside me to share my fascination. "Is it no' a dream," he roared against the wind. "I just canny keep my eyes off it."

The dream has become reality. The wonder is accomplished. The Tay Road Bridge is in business. And what a bridge! What a story in the building of it, in the people who fought for its conception, in the workmen who faced the storms and tides to erect it piece by piece. It exalts there, striking whitely in concrete across grey Tay, a gay, virile, masculine bridge, a contrast to that other marvel spanning the Forth, spidery, curving and feminine. It reflects Dundee and the character of the Dundonian, the tenacity of the battle to win it, the strength of argument the city and its county neighbours, Fife and Angus, put forward for its creation. A bridge of personality and personalities, men of ability who rose up to meet the need of the moment, men who were to prove themselves of outstanding quality: Garnet Wilson, Hughes, Lyle, McManus, Logan, Fairhurst.

The Tay Road Bridge, a new attraction for Scotland, the savour of achievement, striding the estuary in 42 easy steps, one of the longest bridges in Europe, only a little short of its famous twin, the railway bridge, two miles upstream, over the longest river in Scotland, the first road linking Dundee and Fife across the water and probably the last great bridge of such proportions ever to be built in this country.

But the story of the Tay crossing goes back further than the three years it took to build the bridge, back before the years of campaigning, before the disaster of the railway bridge. It is a dramatic story. This is how it all began. . . .

The story goes back into the misty days before the wisdom of recording events had yet been learned, when men came down from their mountains, seeking the road to progress and a fairer living. They marched their uncertain way until brought to an abrupt halt where Tay rolls her waters into the North Sea. As was natural, they climbed the tall hill, that was to become The Law, looked around, and nodded approvingly. To the east the ocean, rolling away to the end of the world, inland the green hills rising higher and higher, tiering away into the distance. Below, the land lay rich, and broad Tay spread her shield against attack from the south. So these men looked at each other and nodded again. With toil and hope, they fashioned their shelters, rough and ready as suited the times, then created the virile root that was to grow Dundee.

The years blinked by and the plant grew and prospered, tended by wise councillors, nourished by far-seeing men of business. Dundee grew in stature, rose and cast her eager look beyond the confining boundaries of Angus—of Scotland. Dundee saw Tay, not as a defender, but a barrier. From that moment the Tay crossing was under attack.

Boats plied between Dundee and Fife from earliest times. Where a man can pass, trade can go, and trade is life to any town. The first evidence we have that Dundee magistrates were thinking along those lines lies in an Act of Parliament of 1485, authorising ferries to run between Dundee and Tayport in Fife. It was a precarious passage, at the mercy of storm above, and the pitiless sweep of Tay below. The service grew, however, and even as the Auld Pretender made a last, desperate bid for power in 1715, the magistrates had piers and granaries built on the Fife side, and spent money to improve the tracks, and smooth the passage of goods essential to Dundee.

Perth, thirty miles upriver, dealt that scheme a sore blow in 1766, by building an "elegant bridge" across the Tay, drawing the East Coast trade away from the stormy Dundee crossing. Despite the setback, Dundee magistrates persevered. Disaster speeded their mission. In May 1815, the ferry boat, *Nelson*, foundered with a loss of eighteen lives. Parliament stepped in and decreed that a steam boat was essential for this uncertain passage. Six years later, the *Union*, an odd craft even for those days, churned her laborious way across the Firth, and started the first regular ferry service.

It was a beginning, but the urge to wipe out that watery gap soon became a necessity to such a healthy, progressive town. "The Northern Lights of Old Aberdeen" shone with promise and the riches of the North-East were there for the tapping. Two miles across the water lay Fife with all her wealth of coal and produce, so tantalisingly near, so expensively far if one has to fetch and carry the long way round via Perth, at the pace of heavy cart-horses. Beyond Fife—Edinburgh, and the teeming markets of the south.

The sea highways were not neglected, of course. Harbours were created, tall ships came beating up the Firth under full sail, laden with the goods of many lands. Then the town played her master stroke. She sent out her greatest export, the Dundonian, the Man from Dundee.

It paid. Into Dundee came a bale of rather mysterious fibre, taken from a plant grown in steamy Bengal and rejected as useless by London. Dundee studied, and experimented, studied again, and found the secret—whale oil, the magic touch to charm that fibre into good Dundee jute that would serve the world in a thousand ways. That fact established, and the Men from Dundee were heading for Bengal, while a fleet of whaling ships went hurrying down to their chilly hunting grounds. The factories broke into a roar and the need for that bridge became urgent.

But something was stirring down in the south. Railways were firing public imagination, and the lines were speeding north from distant London, heading for Glasgow and the Capital. And Edinburgh, with Forth on her doorstep, faced exactly the same problem that Dundee had been struggling with for generations.

Enterprise did not wait for London. Railways took shape in all directions, and from the Fife side of Forth, the Edinburgh and Northern Railway reached up to Leuchars, hesitated, then moved on to Newport, the eyes of the men behind it fixed firmly on Dundee and the North-East.

With the railway came their manager and engineer, Thomas Bouch, a man of vision. He studied the problems of Tay and Forth, produced the solution—and was denounced for his foolishness. Nevertheless, Bouch saw further and deeper than railway stockholders. In due time came the bigger company, The North British, to swallow the pioneers, but retain their engineer. Hopefully, Bouch produced his plans once more, and was told abruptly that it was “the most insane idea” ever put forward.

The main obstacle was not the Tay, but money. Men, busy calculating profits and dividends, tend to look coldly on costs. So the years went on, argument and counter-argument, till Bouch had a brainwave—why not step clear of the wranglings and spread his solution before the hard-headed men of Dundee? In October, 1864, Thomas Thornton, a Dundee solicitor, called a public meeting in the Council Chambers, with Bailie Yeaman in the chair. There, a very nervous Thomas Bouch once more produced his precious plan for bridging the Tay and, for the first time, found himself among friends.

Dundee moved fast. Just two months after that meeting, the Tay Bridge and Dundee Railway Undertaking had been formed, with a capital of £300,000 and Parliament notified that the Undertaking proposed to get on with the job. That thunderbolt shook London. The doors had been thrown open to a great national advance from an unexpected direction, and the obscure name “Dundee” was now ringing through the south.

It was a bitter pill. Provincial town councillors had instantly grasped what the “big men” of business had missed for years. The clash was on, a bitter clash fought out in Parliament for almost two years. Dundee lost, but her spirit stayed unconquered. She had learned her lesson. Back to battle in a new way, and this time—success.

In May, 1871, the North British Railway signed a contract, and the building of the Tay bridge began. Dundee had set the example, and the rush to share in the prizes became feverish. If Tay could be bridged, so could Forth. In 1873 the Forth Bridge Railway Company came into being, and the plan put forward by Thomas Bouch was accepted. But the Tay town was two years ahead. Out on the water workmen toiled, and eventually their task was over. The longest bridge in the world had been created at a

cost of £350,000 and twenty lives, and that southern barrier to Dundee's progress had been swept away.

On September 1, 1877, a long train came panting into Tayport and it seemed that all the world had come to see the opening. Conspicuous among the distinguished throng was General Ulysses Grant, ex-President of the United States; the Lord Provost of Edinburgh, Sir James Falshaw; and a very happy Mr. and Mrs. Thomas Bouch. The roar of cheering that went up as the first ever train puffed slowly across the water towards Dundee might have been heard at Perth. Thomas Bouch became Sir Thomas, and turned to his new love, the Forth Bridge.

Sunday, December 28, 1879, dawned wild and stormy. The grey, cheerless day brought no relief, and as darkness fell, the tempest howled across the land with awesome force. At 7 p.m., a train drew into St. Fort on the southern side of the Tay Bridge. Barclay, the signalman, handed the driver his authority to proceed, then crawled back to his cabin on hands and knees, unable to stand upright against the fury of the gale.

Over in Dundee, those waiting for the train saw the string of lights creep on to the bridge and draw nearer. Suddenly, there came a brilliant flash, and all lights vanished. Filled with dread, but hoping, one railwayman ventured into the darkness, crawling slowly across the bridge, the shrieking gale tearing at him. He groped forward, sleeper by sleeper, and then—there were no more sleepers. Only the wind and Tay roaring below.

Ill news travels apace. All night long Dundee folk crowded into the station, anxious, inquiring. The grey light of dawn brought the answer and confirmed their fears—a thousand yards of the high girder section of the bridge had gone, and the train with 26 passengers aboard was under the Tay.

The public inquiry opened in London. Had the bridge been wrecked by the gale, had the train been blown off the line and wrecked the bridge? So much hung on that inquiry. The finding, when it came, was most unsatisfactory. The Wrecks Commissioner admitted he could not give the answer. “What probably occurred,” he wrote, and made his guess. That guess killed Sir Thomas Bouch, his hair turned white almost overnight, and he died four months later, a broken man.

The Bouch plan for the Forth bridge was rejected, and Sir John Fowler and Benjamin Baker took over the project. They designed a great bridge on the cantilever principle, and handed the contract to William Arrol, later Sir William. Sir William also took on the task of restoring the Tay link.

Even as the bridge went up the first horseless carriage was on the way to wheeze and rattle a challenge to the mighty railways. Those carriages became less wheezy, grew bigger and stronger, four wheels became six—eight—to roll people to their very doors, comfortably and cheaply, to send goods along highways and byways beyond the reach of rail. So the precious

traffic, the strength of the railways, drained to the roads, and the Tay and Forth barriers began to pinch once more.

As early as 1878 came the “history and construction of a Tay Bridge” to reveal that the Town Council wanted a footway for pedestrians on the railway bridge. The railway company would have none of it but the thought remained. When the Forth bridge opened in 1890, the cry for a Tay bridge was again raised by a far-seeing council striving to keep that one step ahead.

As the First World War ended in 1918, while most people had other matters on their minds city engineer, James Thomson pressed the necessity of a bridge once more in a report on the city's development.

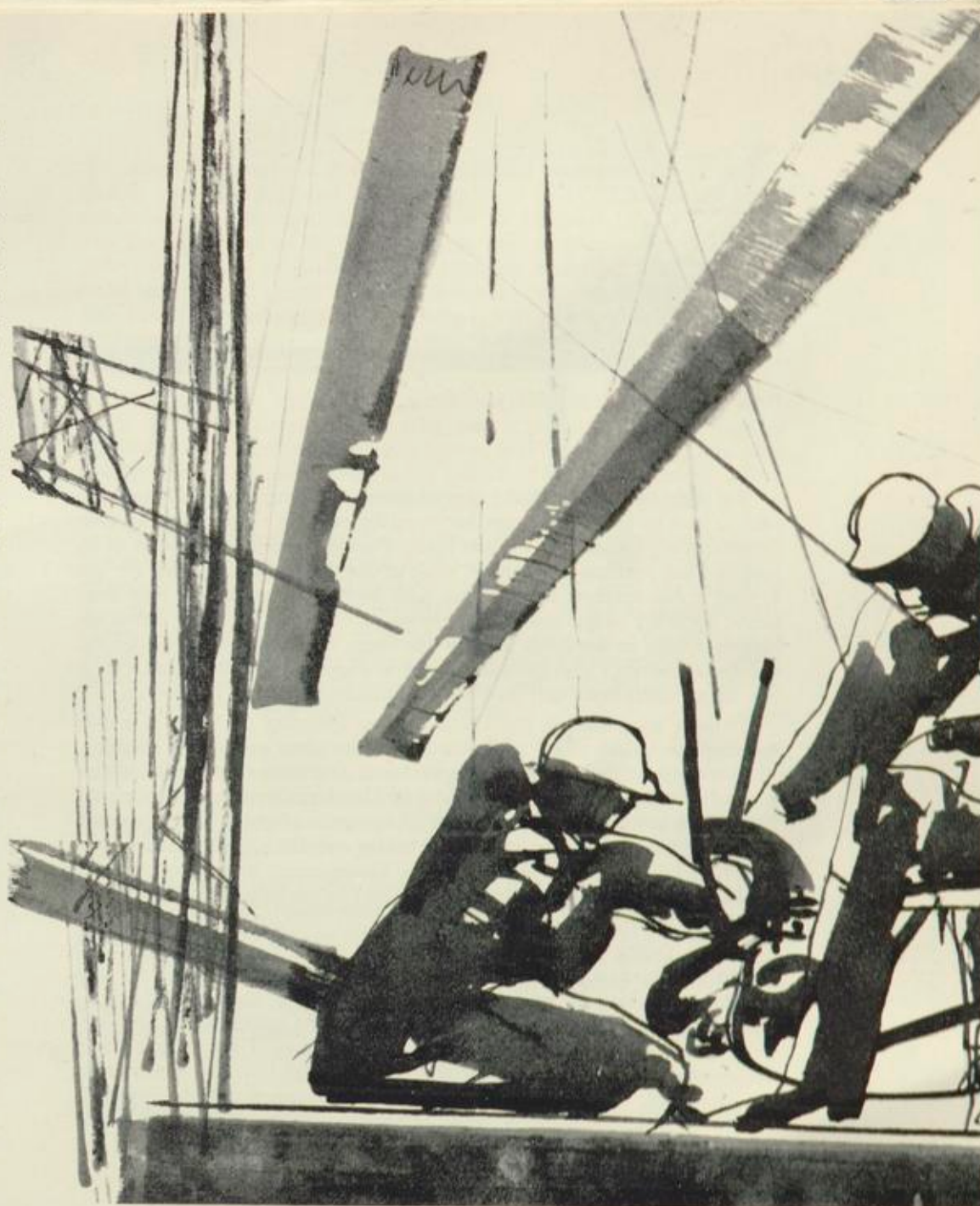
In December, 1921, the outlook was brightening. The Council thundered and by 1923, urged by the harsh argument of severe unemployment, not only in Dundee but throughout the whole country, Sir William Joynson-Hicks, Minister of Health, said in a speech at Hounslow that “the Government was prepared to construct a road bridge across the Tay which has long been demanded but has been waiting for money.” It was anticipated that the Government would promote the necessary Bill, undertake the responsibility of construction and contribute 75 per cent. of the cost.

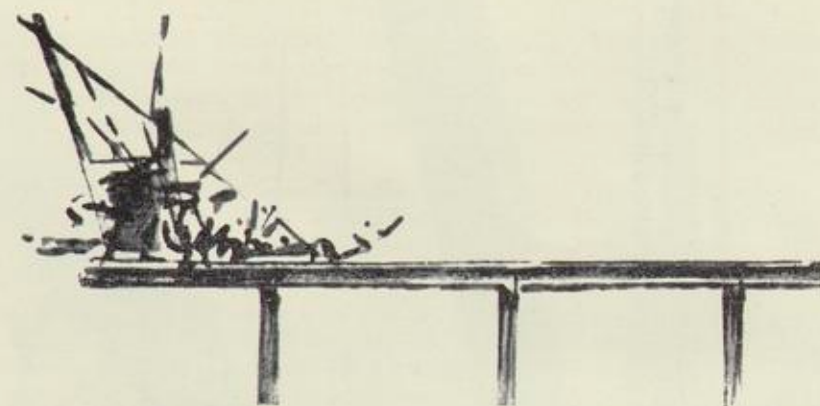
It was an exciting time. Preliminary work and test borings were completed by September, 1926. The design, produced by Messrs. Mott, Hay and Anderson, met with warm approval. The bridge was to be 8900 feet long with a 40-foot wide carriageway, and two 6-foot wide footways, carried by cantilevers on each side at a cost of £2,100,000. A tunnel was also suggested, but the idea was dropped once the costs were revealed—£5,250,000 if bored near the present site of the road bridge, £8,000,000, if sited at Invergowrie.

Bitter disappointment followed. Although local authorities had reached agreement on individual contributions, the financial crises of 1931 saw the Government scrap the bridge idea entirely. This kind of frustration was an affliction Dundee was to suffer only too frequently during the next 35 years.

An attempt was made in 1934 when the question of a Forth Road bridge was revived, but Hitler intervened in 1939. Yet in 1942, with the war in full fury, Dundee was still doggedly engaged in its own private hostilities and when suggestions of post-war development cropped up another attack was pressed home. This time the Government's answer was quite disheartening. The discouraging statement from the Ministry of Transport emphasised that any bridge across the Tay at Dundee had a very low priority, and added depressingly, “if any at all.”

The city took the news like a boxer riding a punch. It hurt, but the battle was hardly lost. It was to be a long campaign, so the tactics were adjusted to suit. While the war of armies clashed on, Dundee's personal struggle was put aside to concentrate on winning the bigger conflict first.





But after the war! When a city of almost a quarter of a million people takes it into its head to get together to strike hard for a common goal, then mountains are moved and bridges built. Dundee is unique. Because of its geographical position in a cut-off neuk of Scotland (the very need for the bridge) it has retained its character, city loyalty and pride lost to a large extent by other major towns over the years. Dundee has been called the biggest village in Scotland, and for the cause of winning their bridge the people united with a single-mindedness of purpose and vehemence that is normally encountered only in a small community with its dander up.

It came to a head in the Caird Hall on February 5, 1954. A public meeting was called. The resolution passed was clear and rang a warning. "That this meeting, representative of Local Authorities, Industrial, Commercial and other interests in the city of Dundee, Counties of Angus and Fife, being convened in the interests of economic planning of that eastern portion of Scotland to construct a road bridge over the river Tay at Dundee, EARNESTLY PRAYS Her Majesty's Government to promote all the necessary measures for the erection of the said bridge so that its construction may be commenced at an early date."

Public feeling ran high. The campaign gathered momentum, 35,000 signed a petition, a traffic census was taken, committees were formed and £10,000 was raised for preliminary work. Consulting engineer, Mr. G. A. Maunsell, produced a plan which heartened by its indication of low cost. Lord Dundee made a vigorous appeal in the House of Lords demanding decision and action; the Secretary of State for Scotland became sympathetically interested. No opportunity was missed in hammering home Dundee's cause to anyone of influence who would listen—and even to those who would not—stressing the economic benefits which would flow, how the Tay and Forth bridges were complementary and necessary for development.

It worked.

In 1958, the traffic census showed that more than a million vehicles a year would use the bridge. The cost of the project could be recovered in a relatively short time by tolls. This was a breakthrough. Pressure was piled on the Government. They could not shirk it. Decision came in January, 1961. It was victory.

Reluctant officialdom yielded at last. The bridge was in sight. The campaign had been fought magnificently. A bridge in any other place is just a bridge. Not in Dundee. This was their bridge, with every forward step a struggle.

Lord Hughes, Lord Provost of Dundee at the time, gave inspired leadership throughout the campaign, backed by the tireless Robert Lyle, the Town Clerk. In 1958, Lord Hughes gave an insight into the determination that brought the bridge. "Today, I received a letter on the subject of the Tay Road Bridge," he said, "perhaps the most remarkable epistle that has ever come from St. Andrew's House. I do not know who wrote the letter to the Corporation, but hundreds of meanings have been taken from it, and no two are the same. But if it was the idea of anyone in St. Andrew's House that the bridge could be pigeon-holed or forgotten about, they have another think coming." Such is the way that great deeds are accomplished.

Talk was over—almost as great a volume of words as water had flowed past Dundee since the first skirmishes—now it was time for action. Dundee folk began to look even more closely at their great wild estuary, the longest river crossing in Britain, wind-swept, fast-flowing, the barrier to progress. What kind of bridge? Where? How much? When? How long would it take to build? What would it look like?

The quiet, almost retiring genius selected to answer these questions was William A. Fairhurst, head of a consulting engineering firm in Glasgow, a man with one of the most analytical brains in the country. He has won world-wide respect, as much the artist as engineer, one of the world's great chess players, an Englishman who has captained Scotland at chess for more than 30 years.

The first time I met William Fairhurst in his expansive Glasgow West End offices, he motioned me towards a well-cushioned armchair. We chatted about his bridge for almost two hours, and it is significant that during that time I sat in the chair for no more than five minutes.

He was up and off round his office like a schoolboy, this small, bald man with the bright blue eyes, high forehead and cropped grey moustache, enthusing over the fine grace of his columns, hauling photographs out of cupboards and drawers, admiring them with obvious tender affection, explaining and confiding, dashing to the other side of the room to illustrate a line on his model, producing more books and sketches to elaborate an argument, complimenting the contractors for the splendid way they were

putting the product of his brains into substance, thoroughly enjoying just talking about his great love.

In January, 1960, Dundee Town Council approved his appointment as engineer for the bridge. There was much to be done. The preparation necessary for a major construction of this nature can take years. The forlorn stumps of the old railway bridge piers are grim reminders of the homework not done in 1879. Professor Jack Allan of Aberdeen, went to work on tidal model experiments, borings were taken to ascertain the depths of water and the changing pattern of rock and sand on the river bed. The shortest crossing is not necessarily the best or most economic. The experiments and reports had to be studied in context of cost, design, and utility before even one pile could be driven.

"Once we had chosen a line it was essential to concentrate on designing a bridge which could take advantage of every favourable physical feature of the site, keep down the cost, and produce an interesting and even beautiful bridge," Mr. Fairhurst told me, the long vowels of Manchester still well forward after his long stay in Scotland. "The comparatively shallow depth of water across most of the river indicated that maximum economy could be achieved by using short spans and a large number of supporting piers. Unfortunately, it is not easy to obtain a pleasing appearance in a bridge of many spans.

"Navigation spans were needed in the deepest part of the channel, which meant that the piers would have to be spaced at greater intervals, and deeper girders used. The problem was to obviate this difficulty and provide an economic solution at the same time.

"We provided clearances for navigation by supporting the southern end of the bridge with an abutment on the high ground in Fife, sloping the bridge down to a point twenty feet above the lower ground. We managed this by filling in the tidal harbour and the Earl Grey Dock in Dundee. This unbroken descent from Fife to Dundee, with a slow uniform gradient, would provide a dramatic entry into the heart of the city. It was mainly round this idea that the bridge was designed.

"The most important early decision was to use a central pavement which could help create a dual carriageway at minimum cost. There was no precedent for such treatment. Of course, now that it has been done, the advantages are obvious. The idea of the pavement came to me while I was planning how the bridge could be constructed. I had thought of using a temporary bridge running between two twin permanent columns, which would also make it easier to heave up the bridge girders."

Here is the mind of the artist at work. He cannot afford mistakes. He must think of everything, even of the people who will use his bridge merely for a Sunday stroll. He went on: "I realised that the people who walked

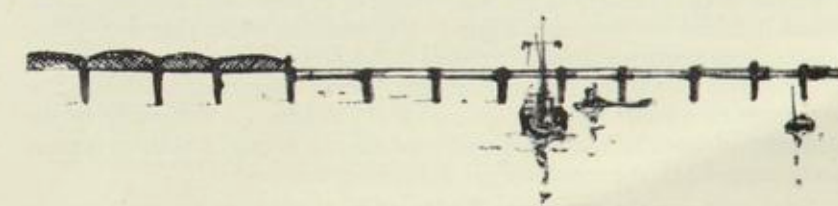
the central pavement would be denied that time-honoured pleasure of just leaning over the bridge and watching the water go by. I had to give them something in compensation, and it had to be good. So I chose the very finest positions on the bridge for my two observation platforms. The views over the Tay are splendid at any time, but from these perches they are really magnificent. People will come from miles around to have a look. In fact, I can't keep away myself. My bridge is a friendly bridge. It extends an invitation to walk out and enjoy yourself. I think it is a bridge for Dundee to live up to."

It is a gay bridge. An attractive aluminium railing of a "slightly frivolous character" gives it a dash of vivacity, and it is not coincidence that by following the squares on the pavement of multi-coloured slabs you find yourself proceeding over to Fife in the pattern of the classic Knight's move in a game of chess. It is the personal signature of William Fairhurst.

The most striking aspect of all is the design of the parabolic columns. It was here the artist found scope for his genius. They are the ultimate in refinement. It was no small problem that Fairhurst faced. In the early drawing stages it was soon seen that the shortest of the pillars would be only 17 feet high, while the tallest would rear 100 feet over Tay. Yet they had to wed in symmetrical harmony to be successful. It is the answer to a problem like this that makes a man famous—or ruins him. The Fairhurst solution is acknowledged to be a brilliant achievement.

What he did was to invent a whole new family of columns. They are unique. No matter what the size, in every case the column top is of constant shape, with the same graceful elegance, almost like an elongated human body. They are Fairhurst's masterpiece. They took him two years of constant improvement and purification before he was satisfied.

The blueprint was ready. Now to implement it. Nine tenders were received for the main bridge works, and six for the steel sub-contract. There was a wild dash at the last moment to get one of the tenders to Dundee before the deadline on January 17, 1963. With throttle at full roar a tiny Piper Aztec, piloted by Captain Duncan McIntosh, of Loganair, took off from storm-bound Renfrew and came in fast and low to Riverside Park. He made it with only 15 minutes to spare. Although this dramatic last-minute bid



won the contract in typical fairy-tale style, it was not entirely surprising. Already the name of Duncan Logan had gone into history as one of the great romantic stories of industry.

With their sprawling headquarters in the village of Muir of Ord, Ross-shire, the most unfashionable situation for one of the biggest contractors in the country, the Logan success story started as a one-man business 68 years before. Inspired by the quiet tycoon, Willie Logan, a non-smoking, non-drinking member of Dingwall Free Kirk, the firm had built its way up with government contracts from a £500 start, made a name for itself constructing hydro-electric schemes in the Highlands, then expanded into major building contracts all over the country.

The Logan tender for the Tay Road Bridge was the epitome of Highland canny. It was estimated to a penny. The exact figure was £3,823,153 17s. 9d., beating the nearest English rival by £47,000.

"You name it, we'll build it," Willie Logan once told me. He might have added, "faster than anyone else." He drove himself to the limit and expected total effort from his employees in return for shared loyalty. When a section of the temporary bridge began to sink during construction, he hurried to the spot to direct operations, working for hours waist-deep in icy Tay water, toiling with the rest of his men. He began work as a lorry-driver, he knew his men, and they respected him. "When I had any hair it used to be red," he joked with me. "You could call me a red-haired Highlander, and perhaps that has something to do with our success." He was never heard to swear, he attended kirk twice on Sunday and banned Sunday work on the bridge, unless it was absolutely essential. That was the Logan way.

When Willie Logan was killed in that tragic air crash on January 24, 1966, on Dunain Hill, Inverness, it was a sore blow to Scotland, as well as Dundee. His was the dynamism needed so much in developing the Highlands. He was one of its greatest champions.

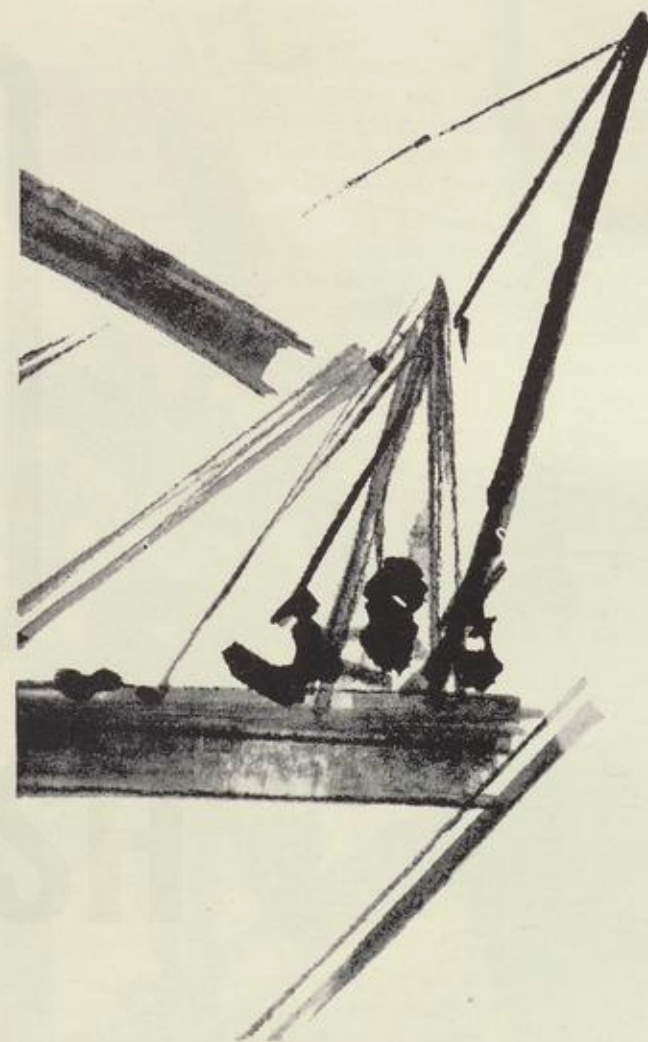
Two months after winning the contract, Logan was ready. On March 29, 1963, Lord Hughes gave the signal for the first pile to be driven. The Tay Road Bridge was under way.

Think what that meant. In an age when we are accustomed to spacemen flashing across the heavens, building a giant bridge is much less glamorous. But think of the enormity of the job. Think of all that water and airy space. Where and how do you make a start? The deciding factor that won Willie Logan the contract was almost certainly his idea of constructing a temporary bridge rather than using the conventional floating equipment. Although the cost was itself initially high—in the region of £270,000—it was repaid by the continuity of work in bad conditions, especially in winter, and there is some recoupment when the materials are withdrawn and sold.

Steel piles for the temporary bridge were driven into the river bed to



depths of up to 68 feet, with an average penetration of 20 feet. The longest pile used was a monster 133-footer. They were lengthened as required by butt welding after they were in their places. So the bridge began to move out across Tay like a long slender finger pointing to the green fields of Fife. When it came to pier 32, work had to be halted while the span was built between piers 30 and 31 to allow shipping to pass. The permanent foundations were put in place here, those classic columns and steel girders to take the



stress of the 230-foot North Navigation Span. The columns had to be strengthened by pre-stressed steel bars to take a load of 480 tons, as this span in its isolated position took even more strain. Electrically-powered winches slowly heaved the two giant navigation leaves, each weighing 45 tons, into position, to give a clear width of 196 feet and a masthead clearance of 80 feet above the mean tide level. When Tay waters are wild with storm, even the smallest boat will want all the room it can get.

There are 42 spans on the bridge, and each supporting column sunk into the river bed had its own personal problems. Some were situated above solid rock, others on shifting sand yards deep. When it looked as if one might be relatively uncomplicated, a storm would suddenly blow up in the hills to come shrieking down the Firth to make work impossible. The erection of every column has a personal memory for the bridge builders. They began to know them individually like people.

Each span of the bridge consists of a pair of welded steel box girders spaced 20 feet apart, and braced together at the ends and third points. On top of each girder is placed a reinforced concrete slab to carry the two-lane carriageway. The road deck is at a gradient of 1 in 81 for the whole length. The foundations were constructed inside watertight compartments called cofferdams, although in deeper water the initial concreting was carried out under water by an injection process where skilled divers played an important part.

Dorman Long of Luton handled the steelwork, and the fabrication was done locally in a new venture for the Caledon Shipyard of Dundee. The steel came up from Middlesbrough in large, flat sheets, and welded into long boxes with a standard width of 12 feet and 10 feet high. The design demanded such quality of work that gamma-ray photographs were required to check for the merest flaw in a weld, and an ultra-sonic crack detector, which cost about £900, went to work in a near-fruitless search. The inspector was a skilled welder from Dounreay.

So the bridge took shape, slow to watch day by day, but at a sprint in terms of months. It was the bridge of Dundee and its neighbouring counties, and the people took a special interest in it. When the day was rain-dark, the Firth gully grey or the trees above Newport began to mist out as the clouds loured lower, thoughts would turn to the bridge folk out there on the water, taking the full snarl of the weather.

They are an interesting race, the bridgebuilders. An international set who flit around the world to whatever strange neuk their knowledge might be needed. To them a bridge is not merely a forging together of skill, steel and toughened concrete to fashion something useful, attractive and neuter; it may be indefinable, but for them there is personality, vitality and intrinsic life.

Ian Gow was one of the inspectors of works for the bridge. A local man at one time, he studied at Dollar Academy, Dundee and Glasgow technical colleges. Then he became a bridgebuilder and was exported. He built his bridges in the steam of Bengal and the elephant country of Assam, then the call came again and he was off to another bridge in the gay Bahamas. "But I'd have taken a job as a teaboy to have worked on this one," he told me as we walked over the nearly-completed bridge.

Harold Street, one of the resident engineers, tall, lanky, bespectacled, came originally from just outside Glasgow, but has worked all over the country. Now local affiliations are unspecified. In fact, his home could be any part of the world where his talents are required. Like William Fairhurst, he never seems to sit down.

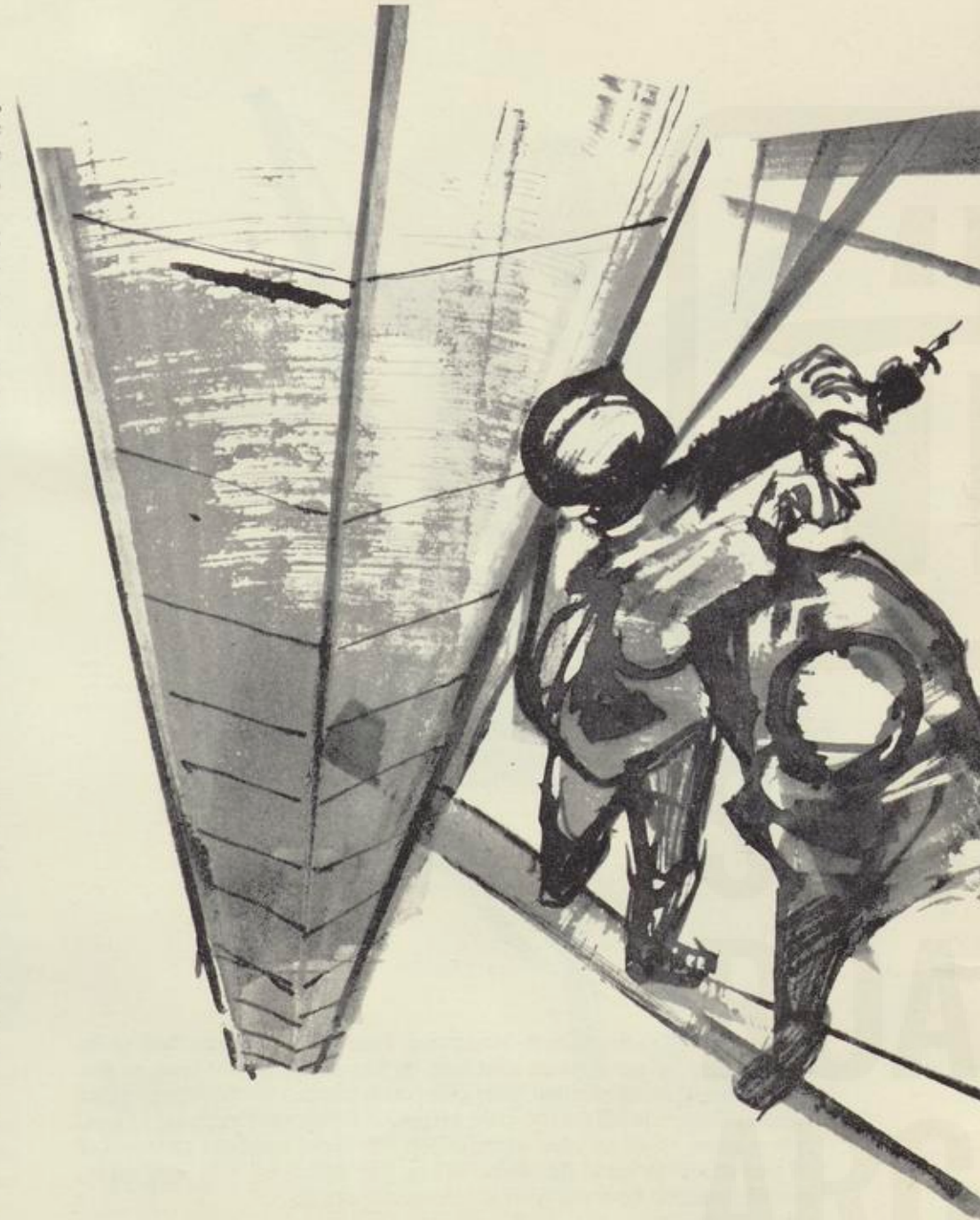
There is pride, too, among that salt of the manual force, the labouring bridgebuilders, the chaps who face the weather to grapple the bridge with their hands. To them it is not just another housing scheme, a demolition job or a factory project. This is the Tay Road Bridge, and they are caught up in the thrill as they watch it grow out of their sweat. They are a mixer-maxter breed. Like shepherd Bob Webster, from Glenisla, who forsook the silent loneliness of a hill shieling at £13 a week for the average pay of £24 and better company than the baa-ing of a lamb. Or Alasdair Watson, from Kippen, who now knows as much about putting a bridge together as he did about farming.

Blethering to these lads slowly the stories that are never published leak out. Jackie McGuire, a welder, had much to say about the weather: "Aye, it's bad right enough at times," he said. "The wind's the worst. Even though it's a good, still day in Dundee, out here it's always gusting or moaning or screaming. Ye canny work after it reaches 34-40 miles an hour. Once we used a windgauge to try to find the speed of it. But as soon as we put it up, the wind fairly blasted it away. It has never worked since. I've seen the whole bridge iced up at times, too, although that didn't keep us from the job. The wind is the worst. It deafens ye after a while."

Davie Crawford, of Broughty Ferry, had something worth saying about falling: "If you are going to do it, fall off the seaward side," he said seriously. "You won't hit the temporary bridge then." Davie should know. He hit the water three times during his work as a concrete ganger. "Once for every year I've worked here. But you've no idea of the horrible feeling as you feel yourself going. I'll never become an addict." The boat saved him twice, and he swam back to the bridge on the other occasion with a broken rib.

David "Sunny" Cunningham had a tale to tell about the night the *Abercraig* had engine failure in a storm and hit the bridge with a fearful dunt. More than 200 yards of the temporary bridge were ripped away. "The wind was tearing down about 70 m.p.h. You couldn't see or hear a thing. I was driving my puggy train out with a load with the waves very nearly breaking over the engine. Suddenly, right in front of me up pokes the funnel of the Fife between the rails. I clapped on the brake and jumped for my life." Sunny landed on an inch-wide steel support, and clung to it like a monkey on a stick until help came. He laughs at it now, but in time his grandchildren will listen round-eyed.

In the pubs around Dundee's Bridgeland the talk for years to come will be of the balmy days of bridge overtime. Hours and glorious days of it.



Never had there been such overtime, and sadly perhaps for them it may never come again. They instance the case of six shifts worked without stopping, and there is still talk in awe of the man who clocked in and clocked out seven days later. They have all gone now, their separate ways, along with their income tax problems, and their memories. For them Dundee will never be the same again.

Indeed, Dundee will never be the same. Today it is a city of change. Industrially and socially it is the fastest-moving city in Britain. An unprecedented building explosion has razed the old town to its foundations, the new Dundee flowering up in its place, creating a new image and industrial climate as the city girds itself and prepares for the future. The bridge is the symbol of that new city.

There is no change behind the blue curtains in that panelled room above the City Square as it looks out on one side to the last ruin of the Overgate development and on the other to the pigeons strutting before the 14 fine pillars of the Caird Hall. Behind the glass-topped desk sits Maurice McManus, Lord Provost of Dundee. He is small of stature, his face lined and intense, the hair white but still with copper tinges, his eyes are alight. He it was who continued the campaign for the bridge, and was in at the finish. I know him as a super-optimist, a proud man where his city is concerned. I asked him to talk about Dundee and the Tay Road Bridge. This is what he said:

"We are on the threshold of great things now that the bridge is up. Don't look for sudden dramatic changes, but the Tay Bridge is the gateway to a Dundee unimagined a few years ago. We have the right kind of industry here, and the bridge opens up completely new doors. In a year or two we might even be selective. I'm a firm believer in controlling the size of a city. We are the right size. Perhaps we could take a few more thousands, but I don't believe in cities over a quarter of a million population. They become unwieldy.

"I've travelled the world and I've not seen another city to match Dundee for potential and position. Seattle caught my eye, but we are better sited.

"Already I see the shadows of things to come in small ways. Only today I had a telephone call from Germany on an industrial matter and a call from France asking for a pipe-band. In the old days you were lucky if you got a postcard from Tayport. Of course, things have changed. I defy you to tell the difference between a school teacher and a mill girl as they walk down Reform Street today.

"The bridge will make its own changes, and some of them will bear watching. More than the Royal Arch will go. I remember when we made our first big slum clearance in Dundee. A whole way of life was under pressure then. There was much good there, too, you know. If old Grannie

Brown fell ill there was always someone to come round with a bowl of soup or do her stairs or washing. This was tradition in Dundee. When they moved into their new houses, people began to throw up fences and stand aloof from their neighbours. This was not good. I made it my business to tour all the schools and factories and lecture them on what was meant by being a citizen of this city and the responsibilities that went with it. We have settled down fine now. The bridge will bring problems like this, but I think we are astute enough to accept the best that comes and resist what we don't want. Our individual character as a city will be at stake, and this is something that must never go.

"The bridge is not part of a trunk road plan, otherwise we would not take it through the centre of the city. It will certainly increase our employment prospects, and give us a closer link with Fife for industry and commerce. Better facilities to the Fife coalfields and factories might bring new industries, and the shoppers from Fife who go to Edinburgh, may now come here instead."

The bridge is open. As the Queen Mother cuts the tape, so the traffic flows. Dundee has well earned her bridge. It was created by the city, with the aid of Fife and Angus, from its own efforts against years of rebuffs from successive reluctant governments. It was accomplished by fighting, and without the will to win there would have been no bridge. It stands as a memorial to the men who guided Dundee through the centuries. Its success is a heartening lesson to every local authority in the country.

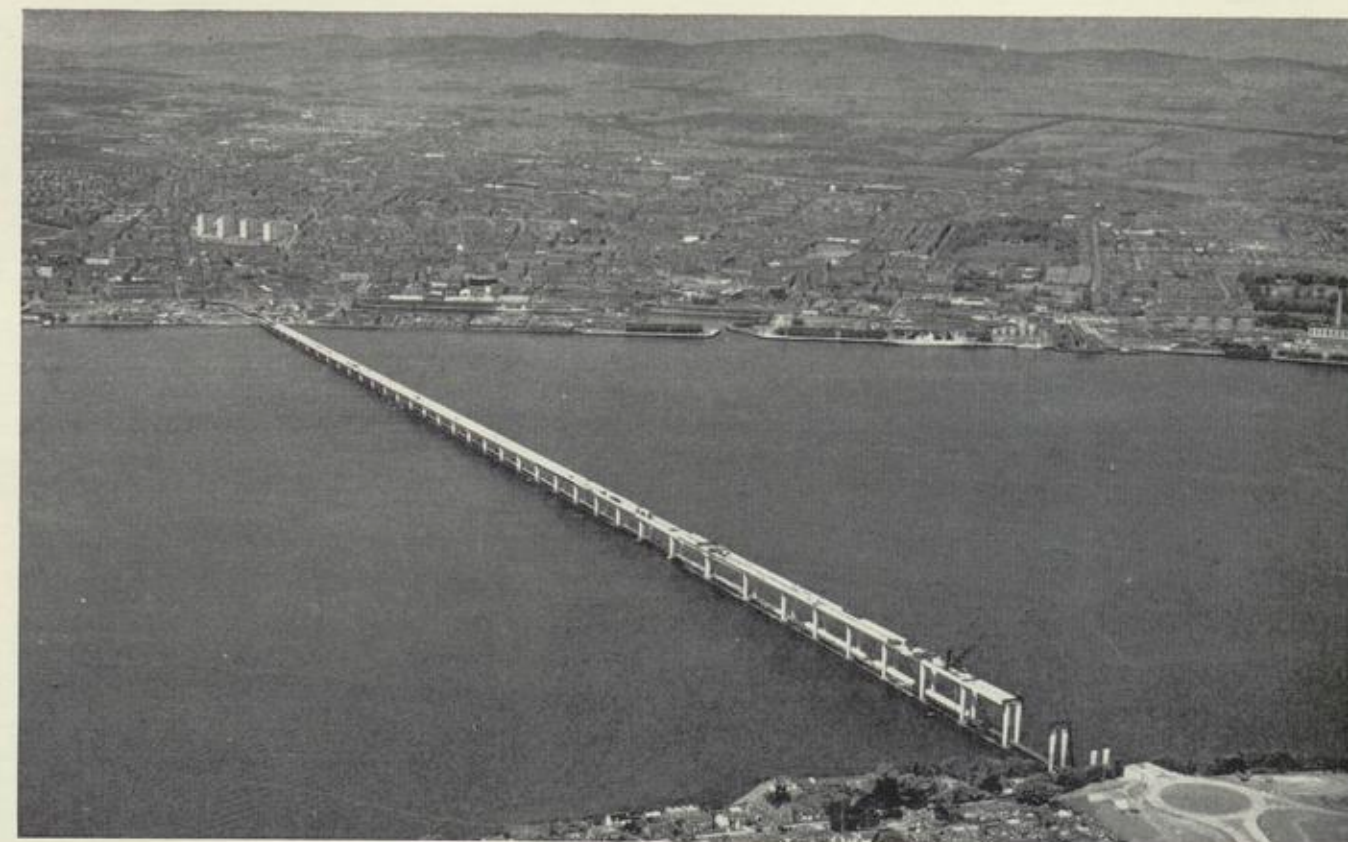
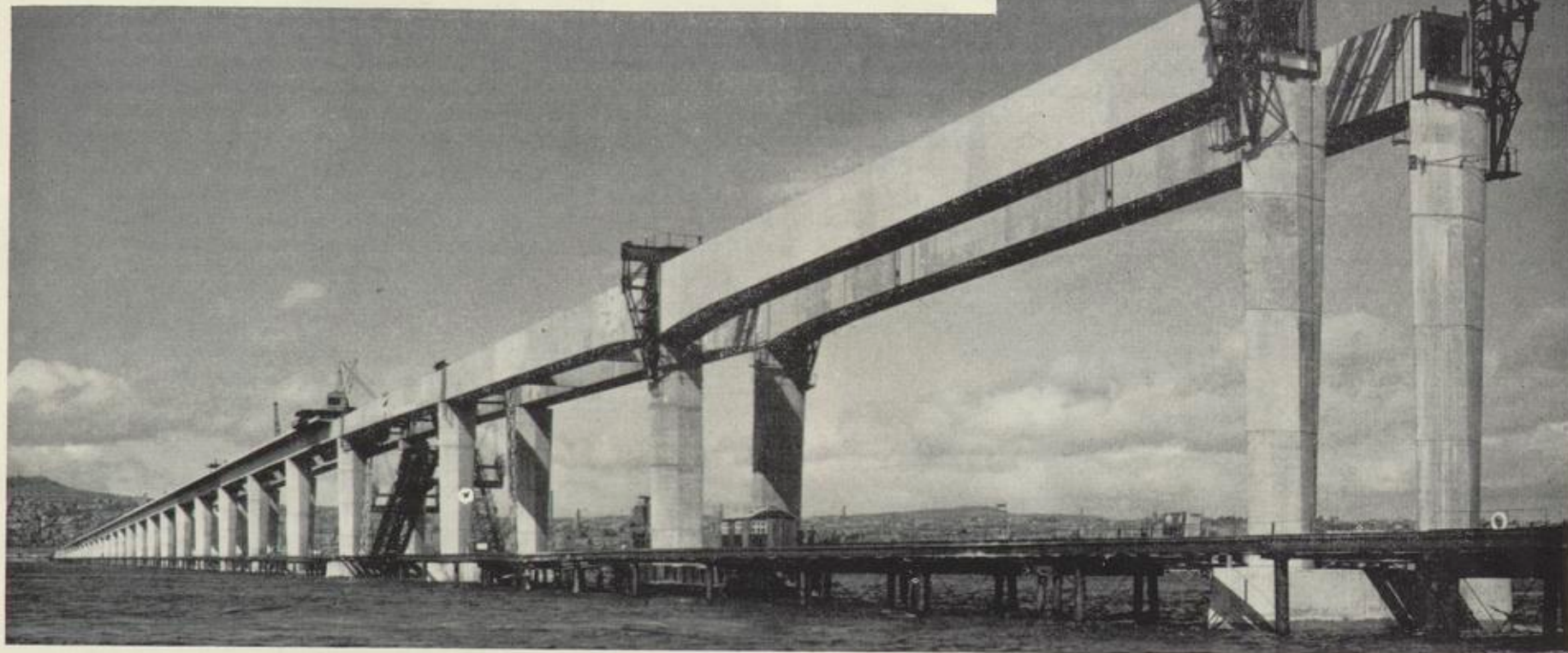
One of the sincerest tributes I heard came from that grizzle-haired old seaman I met on the Fifie. Murdo McLean was his name, a Gaelic-speaking fisherman and merchant sailor from Stornoway, who had spent most of his life at sea. When the bridge opens, he would be out of a job, he told me sadly. The ferries had been going for two hundred years, and although the *Abercraig* was just about the size of a lifeboat on some of the ships he'd sailed in, he had grown an affection for it. In his travels he had seen some braw bridges, but never one like this. He lifted his eyes and scanned the whole white length of it: "What a beauty," he said reflectively. "You know, it's worth losing my job just to make way for it."

Even McGonagall could not have paid it a finer compliment.

TOP: A gay, virile masculine bridge built to resist all that the Tay and the weather can throw at it. This photograph shows the navigation spans. It was taken in June, 1965.

BOTTOM LEFT: An early picture of the old railway bridge before the disaster of 1879.

BOTTOM RIGHT: Evening on the Tay . . . the railway bridge is silhouetted against a red sky and in the foreground the "Fifie" Scotsraig makes one of her last trips across the estuary.

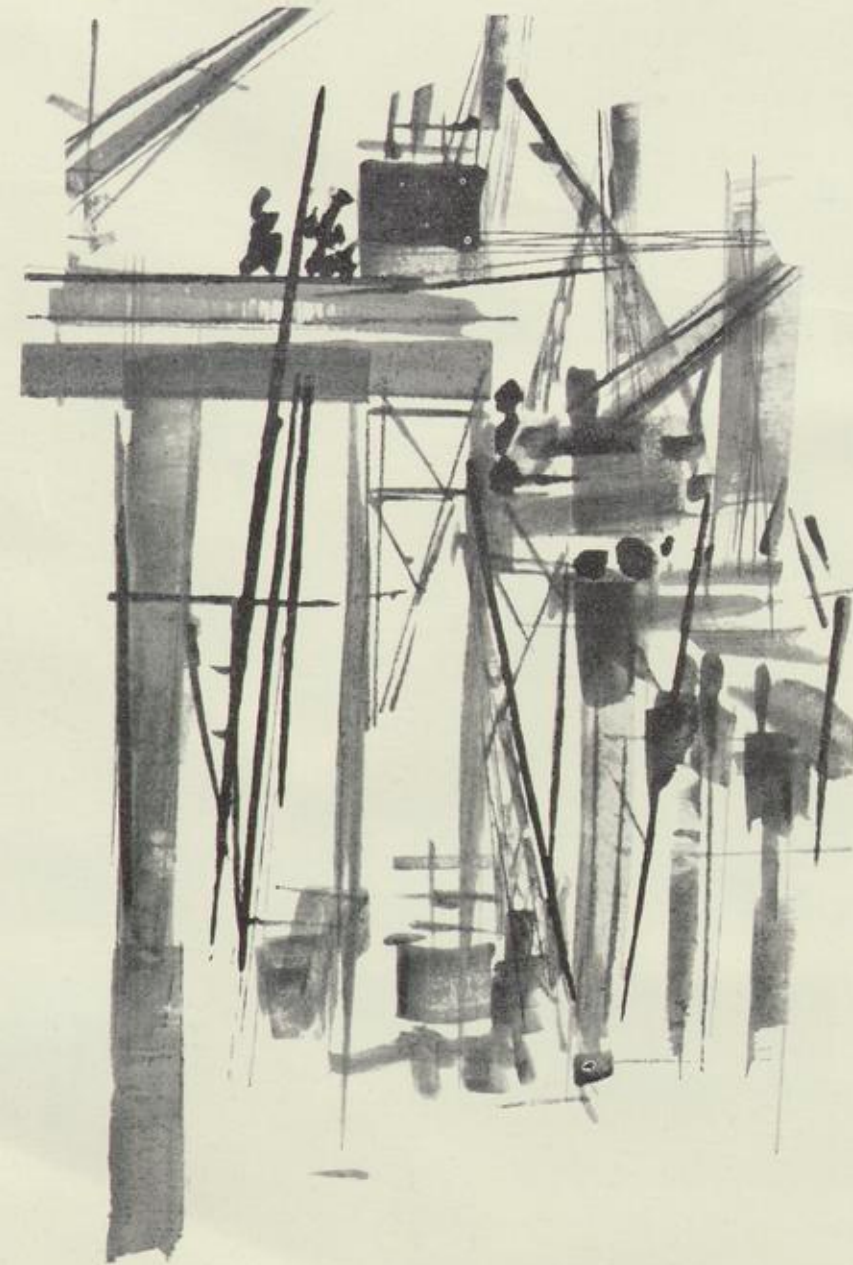


ABOVE: Almost there! Like a finger pointing over to Fife the Tay Road Bridge is almost complete. The picture was taken in May, 1966.

LEFT: The twin columns. They are of unique design and took Mr. W. A. Fairhurst two years of refinements to reach perfection.

RIGHT: Old Tay railway bridge after the disaster. Note the break in the high girder section which collapsed. It was at this point that the train plunged into the river.





Page Twelve

FACTS AND FIGURES

Employing Authority: Tay Road Bridge Joint Board, City Chambers, Dundee.

Engineer: W. A. Fairhurst, C.B.E., M.I.Struct.E., M.Con.E., M.Inst.H.E., 11 Woodside Terrace, Charing Cross, Glasgow, C.3.

Main Contractor: Duncan Logan (Contractors) Ltd., Great North Road, Muir of Ord, Ross-shire.

Sub-Contractors:

Structural Steelwork—Dorman Long (Bridge & Engineering) Ltd., Luton.

Fabrication of Structural Steelwork—Caledon Shipbuilding & Engineering Co. Ltd., Dundee.

Road Surfacing—William Briggs & Sons Ltd., Dundee.

Main Contractor for Approach Roads in Fife: A. M. Carmichael Ltd., Edinburgh.

Starting Date: 29th March, 1963.

Opening Date: August 18, 1966.

Cost: £6½ million.

Description. There are 42 spans, 31 of 180-ft., 2 of 230-ft., 2 of 250-ft., and 7 shorter spans from 80 to 150-ft. at ends of crossing. Length: 7365 ft. long, with 42 spans, including 4 spans for shipping, 2 of 250-ft and 2 of 230-ft. The remaining spans are 180-ft., except for the first 5 on the Dundee side and the last 2 on the Fife side, which are shorter, to improve the appearance of the structure from either shore.

The deck rises at a constant gradient of 1 in 81 for the whole length. Each span consists of a pair of welded steel box girders spaced 20-ft. apart and braced together at the ends and third points. On top of each girder is cast a reinforced concrete slab to carry a two-lane carriageway connected to the box by stud welded shear connectors.

Between the carriageways there is a walkway for pedestrians with a duct for services slung below. The superstructure is carried on twin reinforced concrete columns of developing double parabolic shape, which vary in height from 25 to 110 ft. above mean tide level. The columns are built on concrete piers set within sheet piles and on bearing piles driven into the river bed, except for a few piers close to the shore where the concrete is placed directly on the rock. Access to the work was by a temporary bridge designed and built by the main contractor. This bridge is of steel and comprises 4 no. 90 lb./yd. rails at standard gauge secured to 4 no. 30"×10½"×116 lb./ft. U.Bs. spanning 45-ft. and secured to transoms of 2 no. 27"×10"×102 lb./ft. U.Bs. welded to the top of 4 no. 20" outside diameter 5 g. thick steel tube piles. These were driven into the river bed for depths ranging from 4-ft. to

68-ft. with an average penetration of 20-ft. The average length of pile used was 60-ft. and the longest was 133-ft., the piles were lengthened by butt welding in situ. This part of the temporary works required 900 tons of steel piles and 5000 tons of structural steelwork.

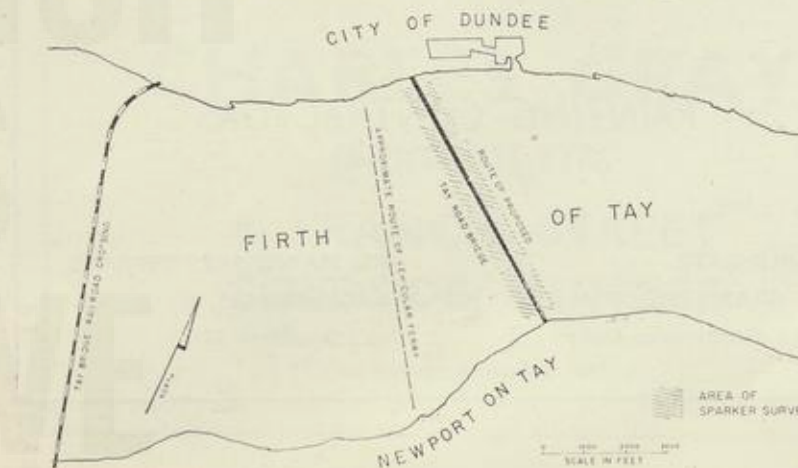
Foundations. When the temporary bridge had passed over the position of a bridge pier the permanent foundations could commence by forming a cofferdam about 60-ft. long and 17-ft. wide of Fredingham No. 3 section steel sheet piles driven to give not less than 20-ft. penetration into the river bed. When necessary piles were extended by butt welding on additional lengths and redriving. The sheet piles were cut off by a diver when construction of the upper pier had been completed. Bearing piles of 12"×12" Universal Column section were driven within the completed cofferdams.

When on rock the piles were driven to refusal, where the overburden was too deep to adopt this method piles were driven to a level giving maximum set as determined by driving one or more test piles at each pier. Sets ranging from 10 to 29 blows per inch with a DE30 hammer (ram weight 800 lbs., stroke 8-ft.) were obtained, although in some cases lower values were first recorded and a satisfactory value only achieved when redriving the pile some days later.

On completion of bearing piles, concrete was placed underwater round the heads of the piles and to a safe dewatering level by tremie or using an injected concrete process. The latter method was used for the deeper foundations and depths up to 45-ft. were concreted by grouting underwater. Divers assisted with all underwater work and made inspections, particularly to check for grout leakage when concrete was being placed underwater.

On completion of the concrete piers, holes were drilled into the lowest parts of the foundations and a pressure test made to check the concrete placed underwater, where necessary further grout was injected to complete the process.

The upper concrete pier was cast from level -10 O.D. within steel shutters generally to +8 O.D. but to 14 O.D. at the 4 navigation space.



Columns. The concrete columns are of developing double parabolic shape and steel shutters were made for this work. The columns are of increasing height from Dundee to Fife, but in every case the column top is of constant shape and indeed the design is such that one set of shutters could be used for all columns by starting in Fife at the maximum height and working towards Dundee.

Girders. The girders are of rectangular steel box section composite with the reinforced concrete decking. All the steel box sections are 13-ft. wide, but their depth varies. The depth increases uniformly from 5 to 10-ft. in the first 5 spans from the Dundee end, and then remains constant at 10-ft. throughout the standard 180-ft. spans.

The longer navigation spans are of varying depth, ranging from 10-ft. at the outer ends to a maximum of 20-ft. over pier 32. The 4 navigation spans are bolted together over the piers to form continuous construction, the remaining 38 spans are all simply supported.

The plates of the 180-ft. girders are of mild steel except the lower strakes of the webs and the bottom flange plates which are in high yield stress steel B8968 (1962).

In the standard spans the maximum plate thickness in the bottom flange is ½" and the web plates are generally ⅜" thick.

Traffic. It is anticipated that at the time of opening a usage of some 3,000 passenger car units per day is likely, and that this will probably treble over the next 10 years. The overall capacity of the bridge is some 20-25,000 passenger car units per day and it is not unlikely that the limiting factors will be at the approaches to the bridge rather than the bridge in itself.

The roadways on the bridge are 22-ft. wide and the walkway for pedestrians 10-ft. wide. No cycle tracks are provided, and cyclists will follow the same roadway system as all other vehicular traffic. The maximum gradient on the approach to the bridge occurs in the Dundee Terminal and is at a slope of 1 in 30.

On the Dundee side of the bridge are the toll installations and network of roads. On the Fife side are 3.6 miles of approach roads, which will connect up with the existing road system.

Distance from Dundee Terminal to Fife Abutment via Queen's Bridge at Perth: 50 miles.

Length of bridge from face of Dundee Abutment to face of Fife Abutment: 7,365 feet, 1.4 miles.

Weight of steelwork in box girders: 8,150 tons.

Weight of steelwork in temporary bridge: 2,400 tons.

No. of piles supporting temporary bridge: 800.

No. of piles in Dundee Terminal: 480.

Weight of steel sheet piling surrounding river foundations: 2,700 tons.

Length of precast work on bridge deck: 14 miles.

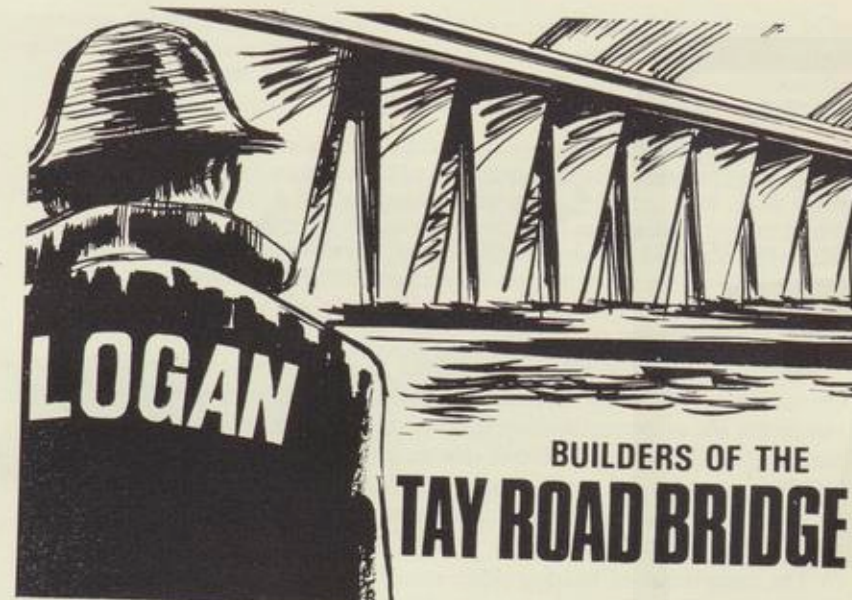
42 spans in sequence: 80', 90', 105', 125', 150'; 24 at 180'; 230', 250', 250', 230'; 7 at 180'; 150', 125'.

Page Thirteen

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Without the skill and the power men have brought with BP and Shell.

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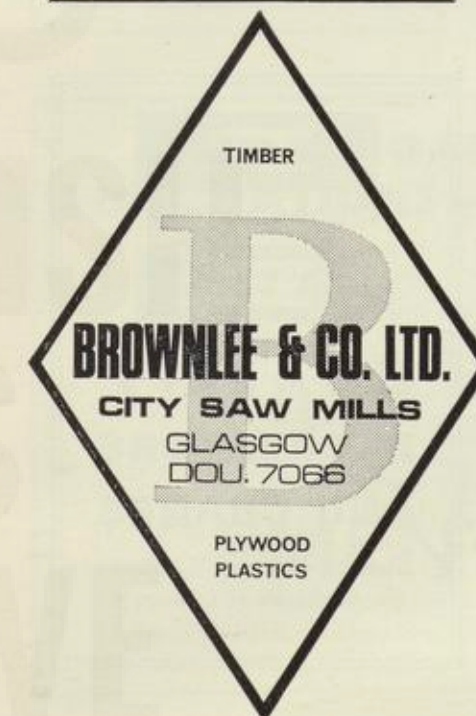
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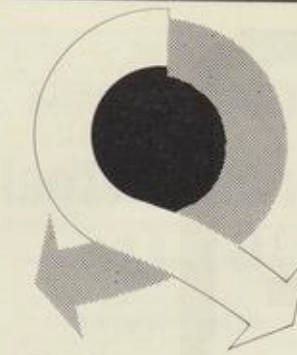
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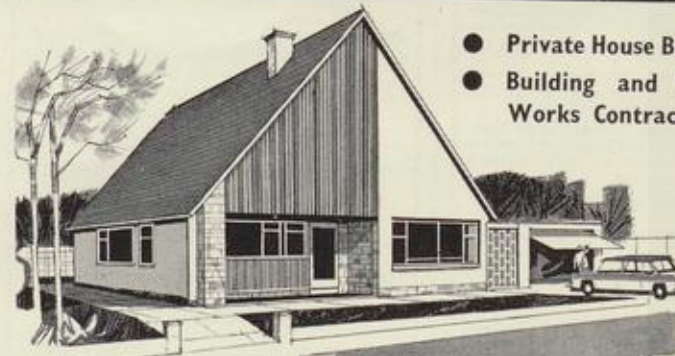
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