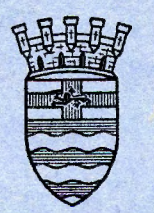


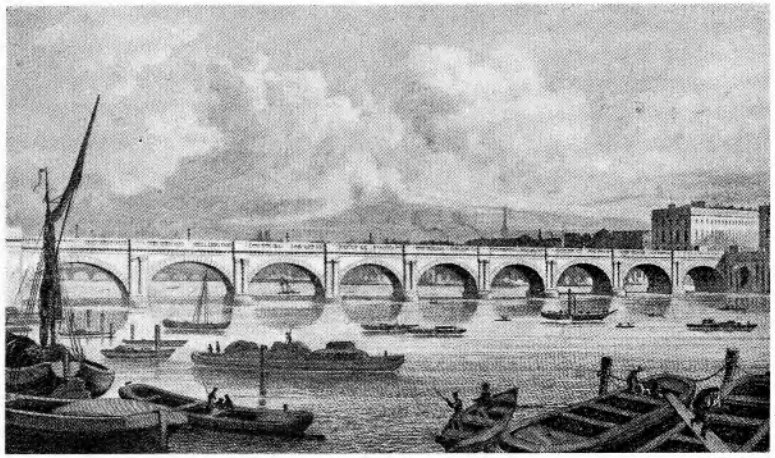
LONDON COUNTY COUNCIL

OPENING OF WATERLOO BRIDGE

by

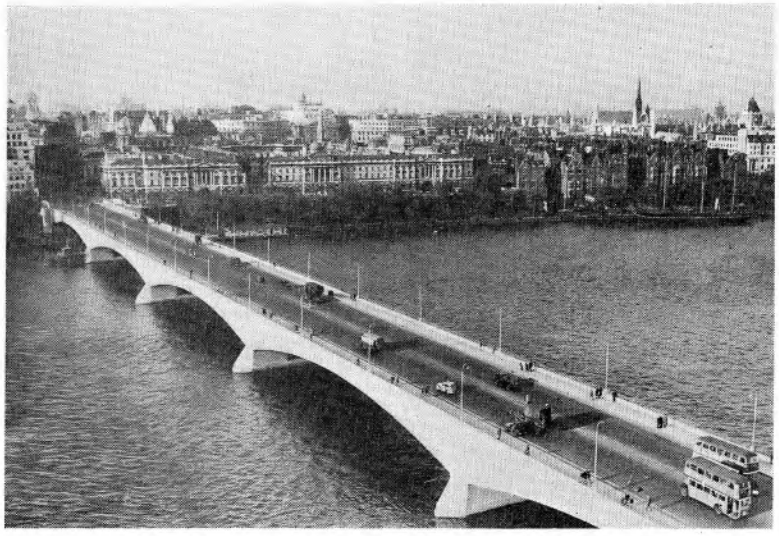
THE RIGHT HON. HERBERT MORRISON, M.P.
Lord President of the Council

MONDAY, 10TH DECEMBER, 1945



[*From a print in the Council's collection.*

OLD WATERLOO BRIDGE



[*Photograph by The Topical Press Agency, Ltd.*

NEW WATERLOO BRIDGE

LONDON COUNTY COUNCIL

OPENING OF WATERLOO BRIDGE

by

THE RIGHT HON. HERBERT MORRISON, M.P.
Lord President of the Council

on

MONDAY, 10TH DECEMBER, 1945

LONDON COUNTY COUNCIL

The Right Hon. The Chairman of the Council
MR. CHARLES ROBERTSON, M.A. J.P.

Vice-Chairman of the Council
MRS. E. M. NEWMAN, O.B.E.

Deputy Chairman of the Council
MR. F. W. DEAN, J.P.

Leader of the Council
THE RIGHT HON. LORD LATHAM, F.L.A.A. J.P.

Leader of the Opposition
MR. HENRY BROOKE, M.A.

OPENING OF NEW WATERLOO BRIDGE

ON MONDAY, 10TH DECEMBER, 1945

THE OLD BRIDGE

Description and History

IN 1809 Parliament authorised the building, by a commercial company, of a bridge over the Thames from or near the precinct of Savoy. Mr. John Rennie was appointed engineer and the first stone was laid on 11th October, 1811. The structure was first known as Strand Bridge, but, by Act of 1816, its title was changed to Waterloo Bridge to commemorate "the brilliant and decisive victory achieved by His Majesty's Forces in conjunction with his Allies." The bridge was opened by the Prince Regent on 18th June, 1817, the second anniversary of the battle of Waterloo. The cost of the structure was £618,000 and the total cost of the bridge and approaches was £937,000. Under the provisions of the Metropolitan Toll Bridges Act, 1877, the bridge was acquired by the Metropolitan Board of Works (the Council's predecessor) at a cost of £474,200 and freed from toll.

The bridge was a grey Cornish granite structure of nine elliptical arches, the northernmost of which carried the bridge over the Victoria Embankment. The width of the bridge between the parapets was 42 feet 6 inches, divided into a carriageway 27 feet 6 inches wide and two footpaths each 7 feet 6 inches in width. The approaches extended for a considerable distance beyond the abutments, being carried as far as the Strand on the north and York road on the south. Steps were constructed at both ends of the bridge for the purpose of giving access to the river.

The simple austere style of the bridge harmonised with Somerset House in the background and the bridge formed a fitting foreground to the distant Dome of St. Paul's. It was this view which moved the Italian sculptor, Canova, to describe it as "the finest bridge in all Europe," worth coming from Rome to see.

In 1923 a settlement in the pier on the Lambeth side of the centre arch of Waterloo Bridge and certain subsidences in the parapet and carriageway gave warning that all was not well with Rennie's masterpiece. The Council was advised that the effective life of the foundations was coming to an end. Remedial measures were taken in the hope that settlement might be arrested.

The condition of the bridge rapidly deteriorated and it was closed to traffic from midnight on Sunday, 11th May, 1924; the construction of a temporary bridge was put in hand.

In view of the beauty and fame of the old bridge, the Council gave very serious consideration to the question of retaining the existing

structure by under-pinning the piers. The Council was, however, on the highest technical authority, advised against this course.

The Council also considered whether a new Waterloo bridge should be built to Rennie's old design, or to a new design to suit modern road and river traffic requirements. The Council, in February, 1925, came to the conclusion that a new bridge should be constructed with not more than five river arches and be of a width to take six lines of traffic.

Interested societies, including the Royal Academy, urged the preservation of the old bridge; but in view of the possibility that the bridge might collapse, block the river, and cause flooding of the neighbourhood, the Council resolved to proceed with its proposal for a new bridge.

The Council has to apply to Parliament each year, by promoting a London County Council (Money) Bill, for authority to borrow money for capital works.

The Council's Money Bill of 1926, which contained provision relating to the reconstruction of the bridge, was criticised in Parliament although it passed into law. In view of the public interest shown the Government appointed a Royal Commission to investigate the whole question of cross-river traffic in London. The Council suspended further action pending the inquiry by the Commission.

The Royal Commission reported in 1926, and, *inter alia*, recommended that Waterloo Bridge should not be demolished, but should be reconstructed and widened, and that a new bridge at Charing Cross should be erected.

Then ensued a long period of intense thought and discussion over the proposal for a new Charing Cross Bridge. The Council considered various schemes in detail, and promoted a Bill in Parliament in 1930 for necessary powers. Agreement could not be secured and the Bill was rejected. Meanwhile, pending the settlement of the Charing Cross Bridge issue, the reconditioning of Waterloo Bridge remained in suspense. On 29th July, 1931, the Government, in view of the national financial situation and other factors, informed the Council that 75 per cent. grant on the Charing Cross Bridge scheme could not be promised. In January, 1932, the Government indicated that a grant of 60 per cent. towards the cost of building a new Waterloo Bridge would be forthcoming. Accordingly, the Council, in February, 1932, decided to revert to its decision of 1925 and build a new Waterloo Bridge to take six lines of traffic. The relevant provision in the Council's Money Bill of 1932, was, however, struck out by Parliament.

In view of this the Council, although still strongly of opinion that a new bridge was needed, agreed to recondition and widen the old bridge, on the understanding that the Government would make a grant of 60 per cent. Tenders were invited.

In 1934, however, the Council tried again for a new bridge, and included in its Money Bill of that year the necessary capital provision. This provision was struck out of the Bill by Parliament. Thereupon, on 12th June, 1934, the Council decided to demolish the old bridge and to proceed with the construction of a new bridge, at an estimated

cost of £1,295,000 and to pay it out of the rates. The Joint Report of the Highways and Finance Committees recommending this course was signed by Mr. G. Russell Strauss and Mr. Charles Latham, Chairmen of these Committees respectively. As a visible sign of this decision the Right Hon. Herbert Morrison, then Leader of the Council, lifted the first stone on 20th June, 1934.

The work of demolition was commenced forthwith. Subsequently, in 1936, Parliament at last gave the Council authority to borrow money for building the new bridge. In 1938, the Government indicated that a grant would be made from the Road Fund of 60 per cent. of the cost of the new bridge. No grant was given, however, towards the cost (£263,093) of demolishing the old bridge.

DEMOLITION OF THE OLD BRIDGE

The removal of Rennie's massive bridge, containing some 100,000 tons of material, presented the problem of "unbuilding" the structure without upsetting the balance of the arches or interfering unduly with river traffic.

The scheme adopted consisted in the removal of the superstructure above the level of the arch masonry, then erecting four lines of girders bearing on the piers and spanning over the arches. These girders carried electric travelling cranes. Suspender rods from the girders were passed through the masonry and were attached to steel centering erected from below and fitting closely under the arch stones. The arches were then demolished simultaneously by working inwards from the sides and remained self-supporting until only about a quarter of the original width of 45 feet remained in the middle. The weight of this middle strip was then transferred to the centering by tightening the suspender rods, the arches broken and the stone removed. All the arches were dealt with on suspended centering in this manner except the centre one which had previously been propped with timber after its piers had sunk 30 inches and 14 inches respectively.

When all the arches and girders had been removed, the piers and their foundations were removed, two at a time, within steel sheet-piled cofferdams. The whole work was in this way carried out in safety and with the minimum inconvenience to river traffic.

The exposure of the foundations showed that they had become generally overloaded. The footings, which should have spread the load over the full designed area, were too shallow and had in many cases broken off and ceased to function. That Rennie realised later the defects in the design of the footings is evidenced at London Bridge, for which he designed a much stronger form of construction.

In the course of demolition of the old bridge the foundation stone was uncovered with a lead plate bearing a description of the foundation ceremony, and under it a glass container with a set of the coins of the day.

The contractors for the demolition of the old bridge and for certain preparatory works on the approaches were Sir William Arrol & Co., Ltd. These works cost £331,135, the contract being let on a "value-cost" basis.

The foundation stone of the new bridge was laid on 4th May, 1939, by the Chairman of the Highways and Main Drainage Committee (Mr. F. C. R. Douglas, M.A., F.R.A.S.) in the presence of the Right Hon. the Chairman of the Council (Mrs. Eveline M. Lowe). Part of the foundation stone of the old bridge was used, and in a copper cylinder were placed a set of daily papers issued at the time of the Council's Jubilee and a set of current coins and postage stamps.

General description of the new bridge

The new bridge affords much better road and navigation facilities than the old.

The principal dimensions of the new and the old bridges are as follows :—

	NEW	OLD
Number of spans	5	9
Clear width of spans	About 240 ft.	120 ft.
Headroom above Trinity High Water	30 ft.	26 ft. 8 in.
Width between parapets ...	80 ft.	42 ft. 6 in.
Width of carriageway	58 ft.	27 ft. 6 in.
Width of each footway ...	11 ft.	7 ft. 6 in.

At the north end the entrance to the Kingsway tramway subway on the Victoria Embankment has been diverted for about 240 feet to bring the entrance under the centre of the new bridge.

The bridge is at a sharp bend in the river ; the south side is shallow, river traffic generally therefore keeps towards the north for depth of water, but on account of the curve must not get too near the embankment. Two spans exactly cover the main navigation section of the river. The northernmost span leaps the Victoria Embankment to a pier well out in the river and opens up with striking effect an uninterrupted view of the sweeping lines of the Embankment.

An unusual effect results from the use of twin curved box girders with a flat deck between, enabling a view to be obtained underneath the bridge along its whole length, so that from the south abutment one can see the trams entering the subway on the other side of the river.

The bridge is constructed of reinforced concrete throughout and its design is modern ; the keynote is simplicity. The spandrels are faced with Portland stone which will weather in the same way as the neighbouring buildings and blend with them. An interesting feature of the design is the 1,200-ft. length of moulded stone cornice extending in an unbroken line from end to end of the bridge.

Four staircases are provided, two at the north end leading to the Victoria Embankment and connected by a foot subway, and two at the south end leading down to the foreshore and so arranged as to fit in with a future embankment.

There is a memorial to Rennie (the engineer of the original bridge) consisting of columns and balustrading from the old bridge which have been re-erected at the south abutment.

The present temporary handrails and lamp standards will be replaced, when conditions permit, by new ones in keeping with the structure. The four stone blocks at the ends of the bridge are intended for appropriate sculptured figure groups.

Constructional details

The bridge consists of girders, continuous over spans 1 and 2 and 4 and 5, with a suspended section, 94 feet long, carried by cantilevers in the centre of span 3. At the landward ends short cantilevers extend towards the approaches.

To give the maximum headroom for navigation the depth of the members of the superstructure was kept as small as possible. This was achieved by adopting a highly scientific design and a very high standard of workmanship.

The bridge piers are founded in hard London clay at a depth of about 35 feet below Ordnance Datum, or about 20 feet below the river bed at the deepest point. This allows for future dredging to deepen the navigation channel. The foundations are of solid concrete, 117 feet long by 27 feet wide and 6 feet deep. The piers are of reinforced concrete, with a facing of Portland stone except between high and low water levels, where they are faced with Cornish granite taken from the old bridge. The spans are carried on bearing walls 83 feet long and 2 feet 3 inches thick, which pass down the centre of the piers and are rigidly connected to the foundation. The spans merge into these bearing walls without any intervening rollers or other form of joint.

The piers that are visible are shells, 106 feet long by 14 feet wide, surrounding the bearing walls and protecting them against damage by shipping. They also limit the movement of the bearing walls by means of stops.

The bearing walls are flexible, and are equivalent to articulated supports. Means of controlling the horizontal movement of the bridge are provided by substantial stops at each end of the bridge and by the subsidiary stops at the tops of the shells encasing the piers. Changes of length due to temperature are taken care of at expansion joints at the ends of the bridge and at the suspended part of the centre span. These expansion joints are indicated in the road surface by sliding plates and allow for a total change in length, between winter and summer, of $5\frac{1}{4}$ inches.

Construction of the new bridge

The construction of the new bridge began (apart from certain preparatory work) with the building of a temporary gantry, 40 feet in width, across the river on the upstream side of the bridge site. This working platform was equipped with seven large derrick cranes and a light railway. Cofferdams of interlocking steel sheet piling were driven into the river bed for the construction of the piers, and timber piles driven for supporting the centering on which the spans would be built. In all about 1,200 temporary timber piles were driven, including those for the gantry across the river.

The piers and abutments were built in open cofferdams, the enclosing sheet piles being driven to 10 feet below the foundation level into the London clay. The cofferdams enabled the permanent work to be carried out in the dry. After completion of the piers and abutments the steel piling was cut off at the level proposed for future dredging.

The spans were supported, during construction, on timber centering except over the navigation channel (spans 2 and 3), where steel girders provided two 130-ft. openings for river traffic, and over the Victoria Embankment, where a special arrangement of steel supports was provided to maintain the necessary clearances for the trams and other traffic. The 130-ft. openings gave width sufficient for the passage, on the bend of the river, of the large colliers and long tows through what was in effect three adjacent bridges—the gantry, the new bridge works and the temporary bridge.

Each span, after it was completed, was first carried by the centering alone and its weight had then to be transferred from the centering to the piers. An interesting feature is the way in which this was effected, by jacks inserted in the bearing walls of the piers in gaps specially constructed for the purpose. The bearing walls were in effect built in two parts, the lower with the pier and the upper with the superstructure, separated by a gap about 2 feet high. In this gap twenty 300-ton hydraulic jacks were fitted and the superstructure was lifted by the jacks until the spans concerned were clear of the centering, which could then be released. The jacking was done at each pier in turn and the gaps in the bearing walls then made good.

To provide a satisfactory surface to all exposed concrete, the formwork was lined with specially-prepared plywood until this became unobtainable during the war. The available substitutes did not enable the northern end of the bridge, the last part to be constructed, to have the attractive finish which was intended.

A feature of the construction was the use of electric arc welding for all junctions of the main steel reinforcing bars instead of the usual lapping or splicing. The proportion of steel reinforcement was high, in order to achieve the desired slimness of the structure, and the saving of weight and space afforded by welded joints was an important factor.

The concrete was of high grade, scientifically proportioned and mixed at a main batching and mixing plant on the south bank and conveyed directly to the work by way of the gantry. When in position the concrete was vibrated to ensure full compaction and density.

Although the construction of the new bridge was begun in October, 1937, even the pre-war period was a very unsettled and difficult one. At the outbreak of war the superstructure of the bridge was resting on timber supports and was a danger under war conditions, as its collapse would have blocked the river. It was necessary to make the structure self-supporting as early as possible and it was given priority as a work of national importance; but priorities in the early days did

not altogether overcome difficulties of supply of labour and materials. There were over twenty air-raid "incidents" on the bridge, causing damage to permanent work and to the temporary bridge, and destroying some of the contractor's plant and material. The worst incident occurred at the north end when a large H.E. bomb penetrated the north cantilever and exploded over the tramway subway.

The cumulative effect of war conditions, the shortage of labour and materials, the blackout, and the situation in a heavily-bombed area, caused the work to occupy nearly five years from the commencement until road traffic was able to use the bridge, instead of the expected 2½ years. The bridge came into partial use in August, 1942. Since then the temporary bridge has been removed and finishing touches have been put to the new bridge. The temporary bridge girders were carefully taken down piece by piece and are now spanning rivers in Holland.

In November, 1944, all six traffic lines were made available for public use. There was no accompanying ceremony.

Personnel

The engineers responsible for the demolition of the old bridge and for the design and construction of the new bridge were Messrs. Rendel, Palmer & Tritton, Chartered Civil Engineers, Westminster, in association with the Council's Chief Engineer, Sir Peirson Frank, M.Inst.C.E. (now President), F.S.I. The collaborating Architect was Sir Giles Gilbert Scott, O.M., R.A.

The Resident Engineer was Mr. H. F. Nolans, M.A., B.A.I., Assoc.M.Inst.C.E.

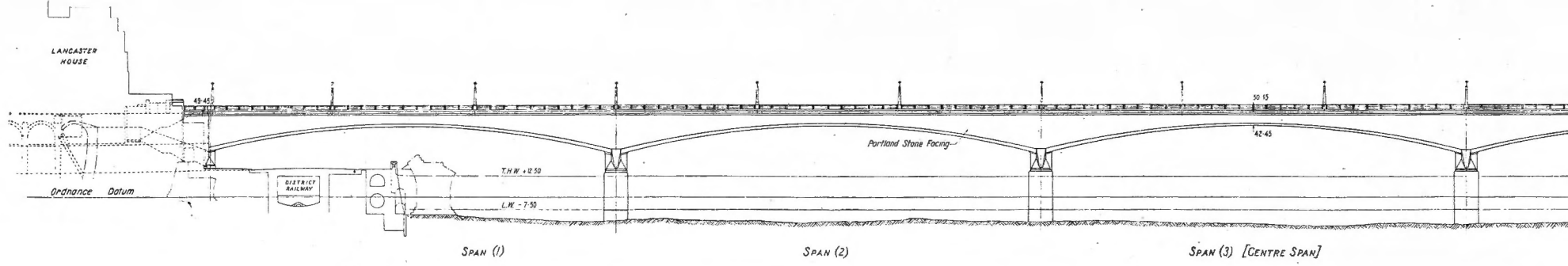
The negotiations in connection with the acquisition of property needed for the approaches to the new bridge were conducted by the Valuer to the Council, the late Mr. Herbert Westwood.

The whole of the work was carried out under contract. The contractors for the new bridge were Peter Lind & Co., Ltd., whose competitive tender amounted to £647,922 14s. 3d.

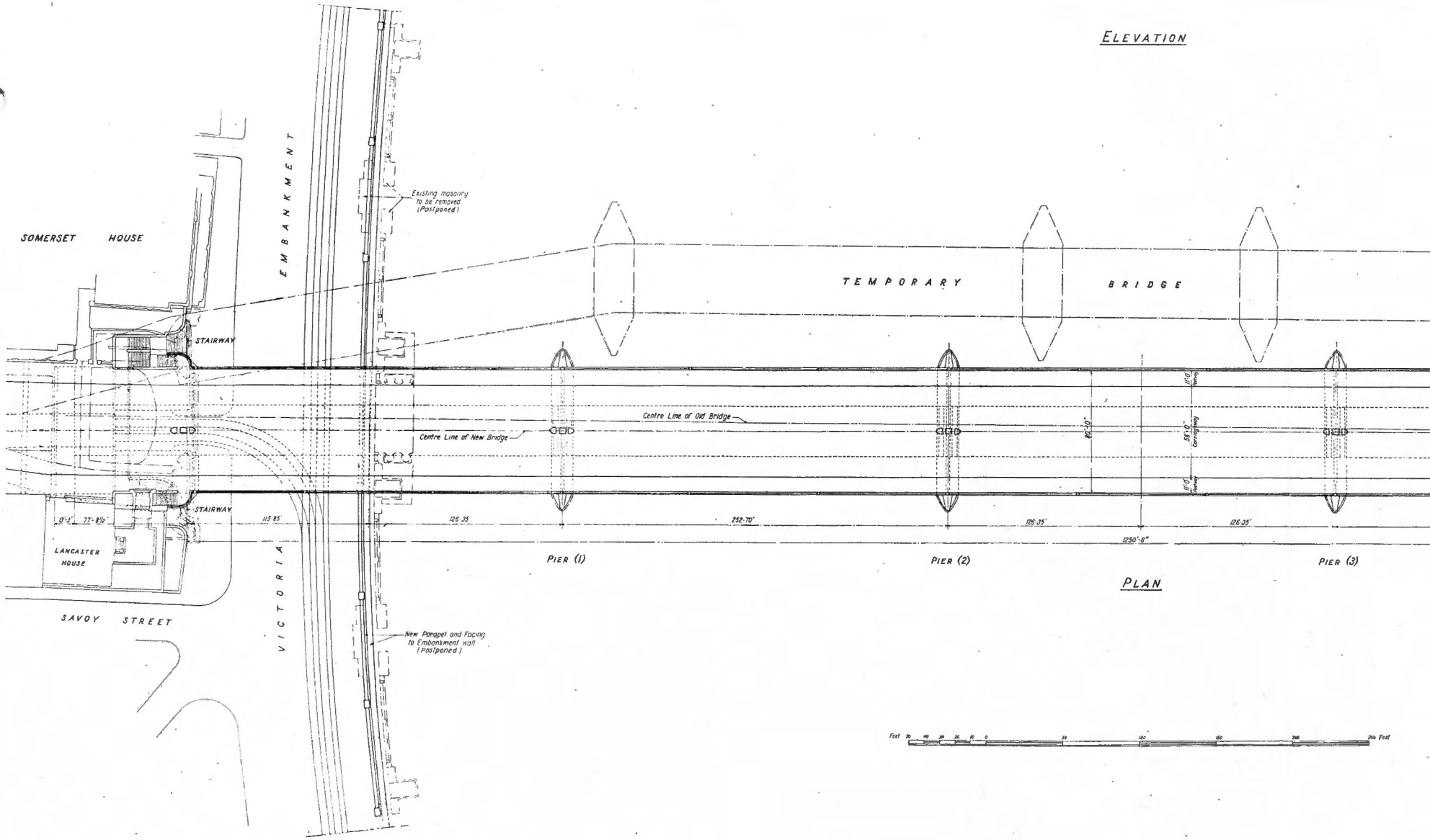
ERIC SALMON,
Clerk of the Council

The County Hall,
Westminster Bridge, S.E.1
26th November, 1945

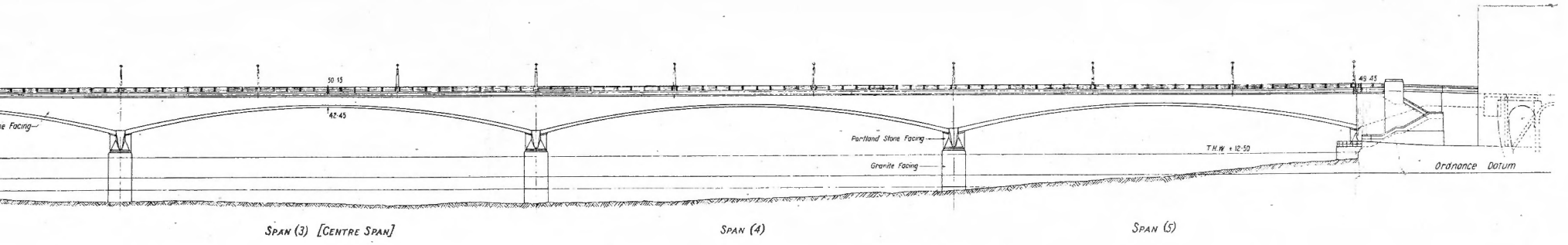
(51025).



ELEVATION



PLAN



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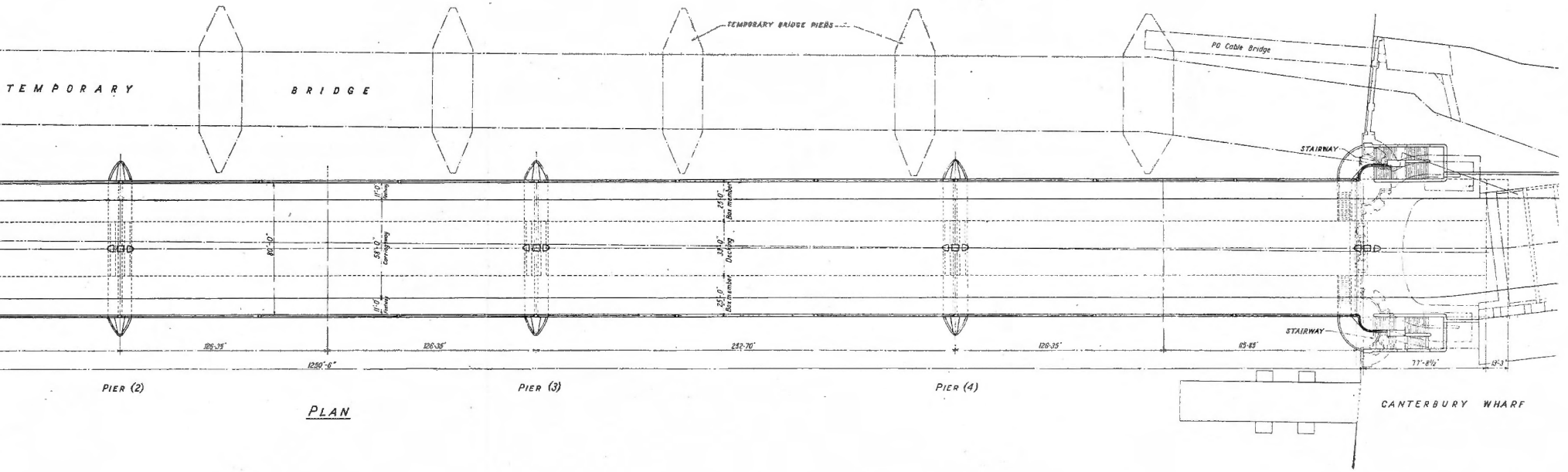

PLAN

Feet 50 40 30 20 10 0 50 100 150 200 250 Feet

THE NEW WATERLOO BRIDGE