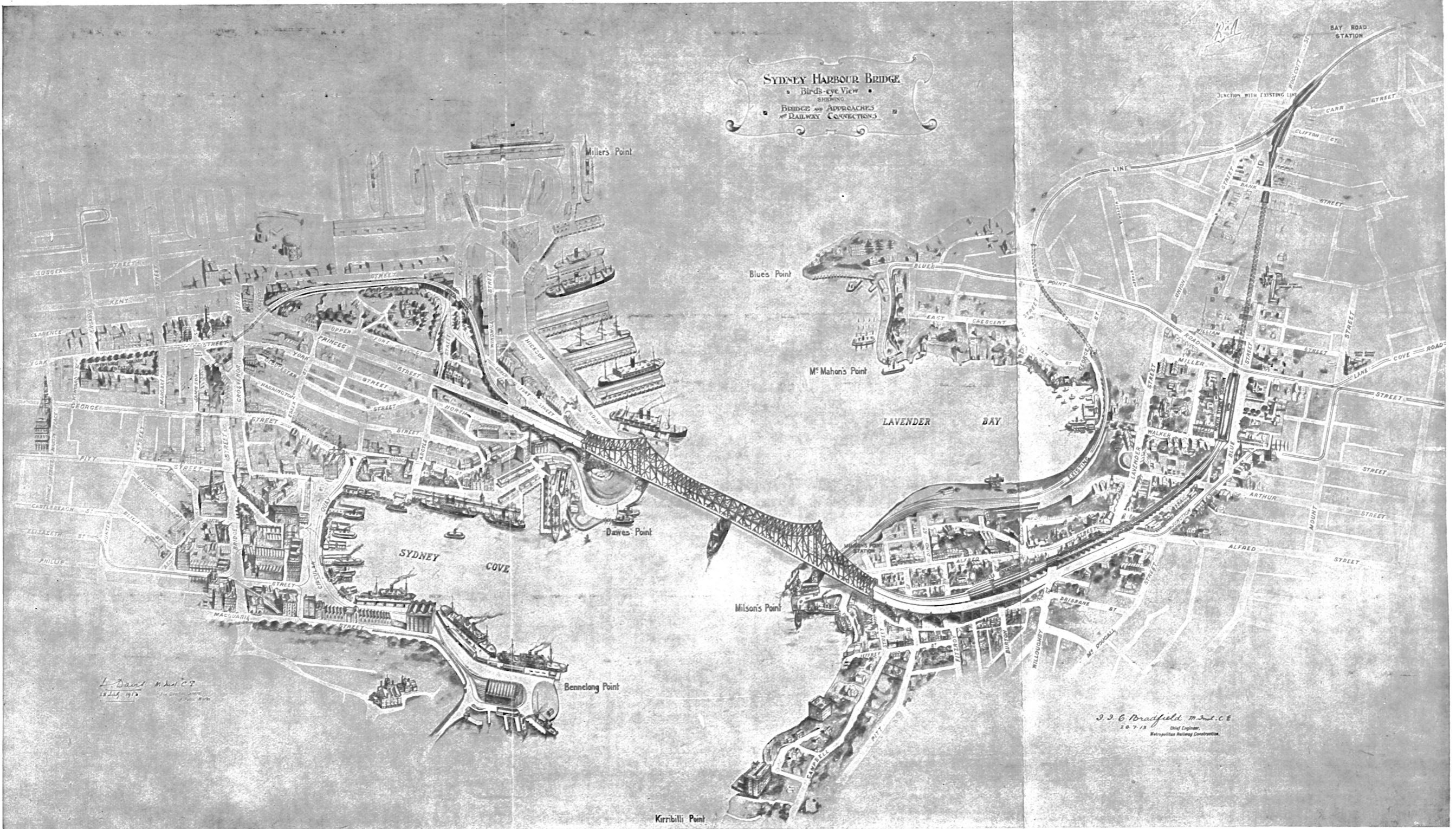


SYDNEY HARBOUR BRIDGE
 • Birds-eye View •
 SHOWING
 BRIDGE AND APPROACHES
 AND RAILWAY CONNECTIONS



*L. Daint M.A.I.C.S.
 1876-1912*

*J. J. C. Bradfield M.A.I.C.E.
 2.6.7.15
 Chief Engineer,
 Metropolitan Railway Construction.*

Eyebars will be used for tension chord members, which will, therefore, be much lighter than if built of plates and shapes, owing to loss of efficiency at the riveted joints, and the lower unit stresses allowed for built members. Eyebars will also be easier to erect than built up members, particularly near the towers. The cantilever method of erecting the suspended span precludes the possibility of constructing the suspended span with eyebar chords, since the tension chord will be in compression during erection.

The method of erection will be to construct the anchor arms on falsework after the main and anchor piers are completed, then build out the cantilever arms, making direct use of the anchor arms for support. The suspended span would also be built out by the cantilever method, the construction from both sides would meet at the centre of the bridge. On completing the suspended span, the cantilever connections will be freed, so that the span will act as an independent truss, supported on the ends of the cantilevers.

It would be practicable to construct the suspended span on staging on a large pontoon, float the span into its correct position at high water, and lower it to its final resting place on the ends of the cantilevers as the tide fell.

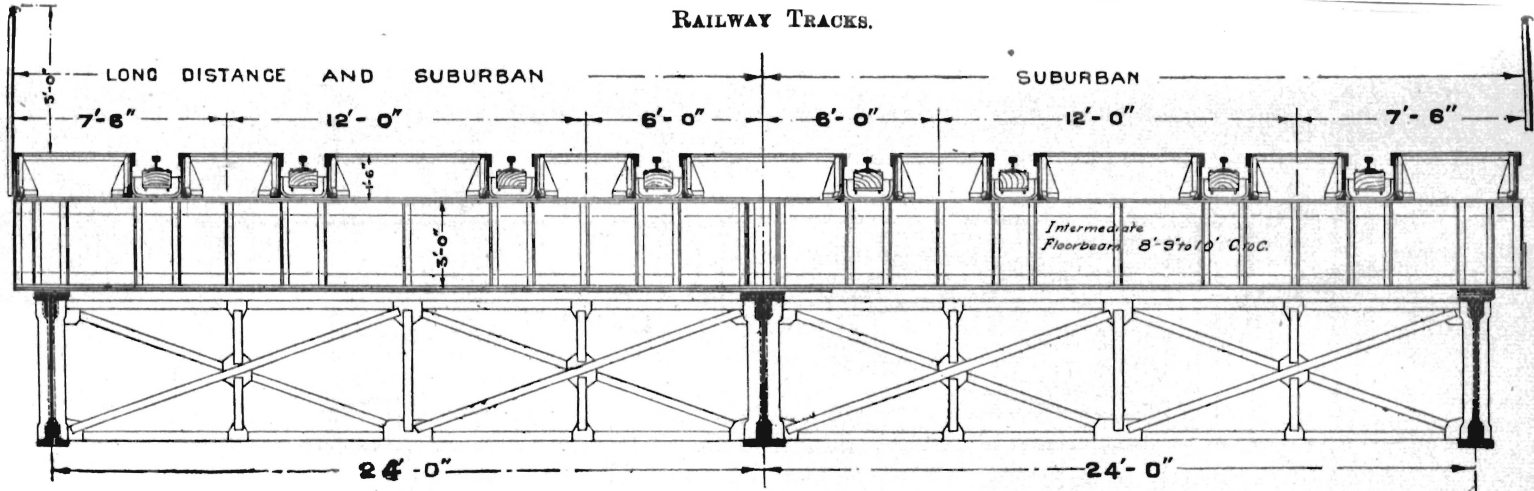
The floor systems, with the exception of the main cross girders are to be constructed of carbon steel. This was found desirable in order to minimise secondary stresses, due to the deflection of the various girders, &c. The higher unit stresses of nickel steel would cause greater deflections than would be the case for carbon steel members, other things being equal.

Since the size of webs, &c., of most of the girders is decided by minimum allowable thickness of metal rather than from stress considerations, the use of nickel steel would in this case be an unwarranted expense.

Plan No. 14 shows a cross section of the railway tracks and of the main roadway. The railway tracks are carried on three stringers throughout the bridge. An intermediate system of floor beams is placed upon the stringers. On these floor beams rest built troughs, which carry the rails. The rails are fastened to longitudinal wooden sleepers inside these troughs. The upper flanges of the troughs are braced at appropriate intervals, and there is a general covering of $\frac{1}{4}$ in. steel plate over the whole floor.

The flooring of the main roadway will consist of wood blocks or rock asphalt, carried on coke concrete, having a minimum thickness of three inches above the buckle plates. The buckle plates are $\frac{3}{8}$ in. thick, and are carried on 15 in. x 5 in. rolled joists, placed on longitudinal plate girder stringers.

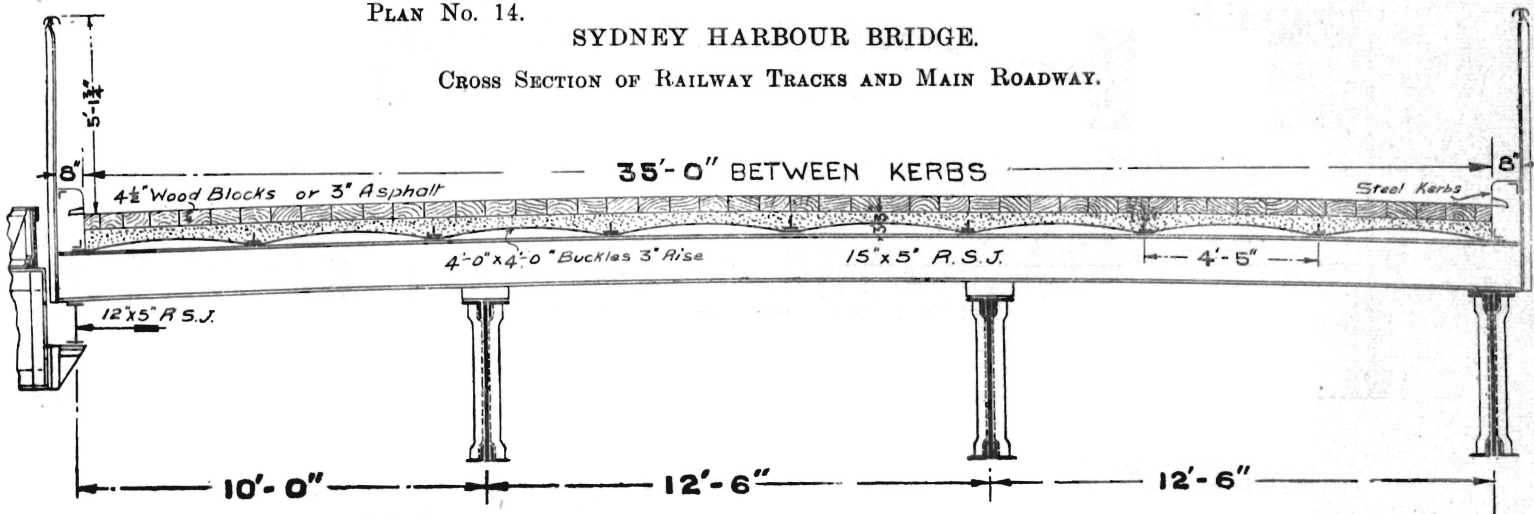
RAILWAY TRACKS.



PLAN No. 14.

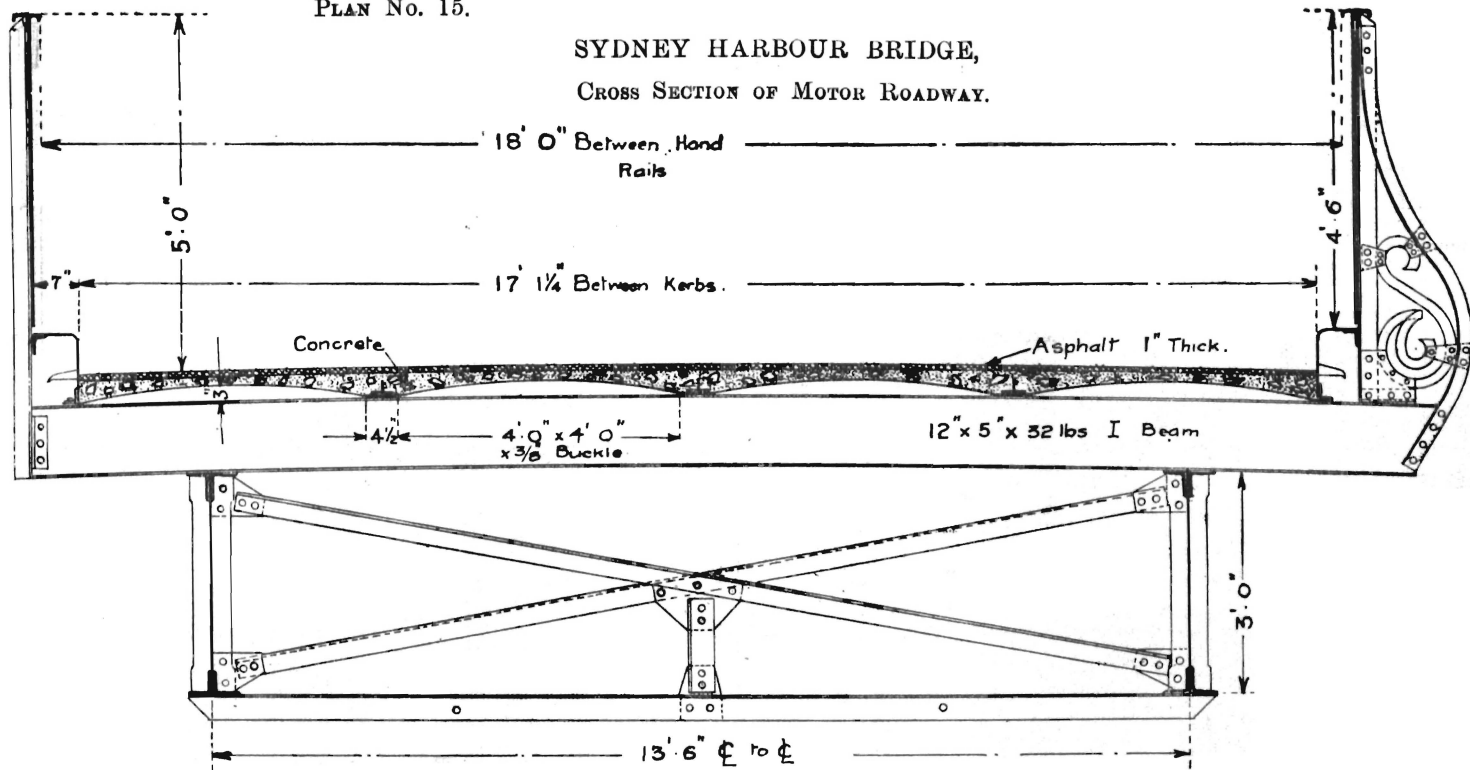
SYDNEY HARBOUR BRIDGE.

CROSS SECTION OF RAILWAY TRACKS AND MAIN ROADWAY.



PLAN No. 15.

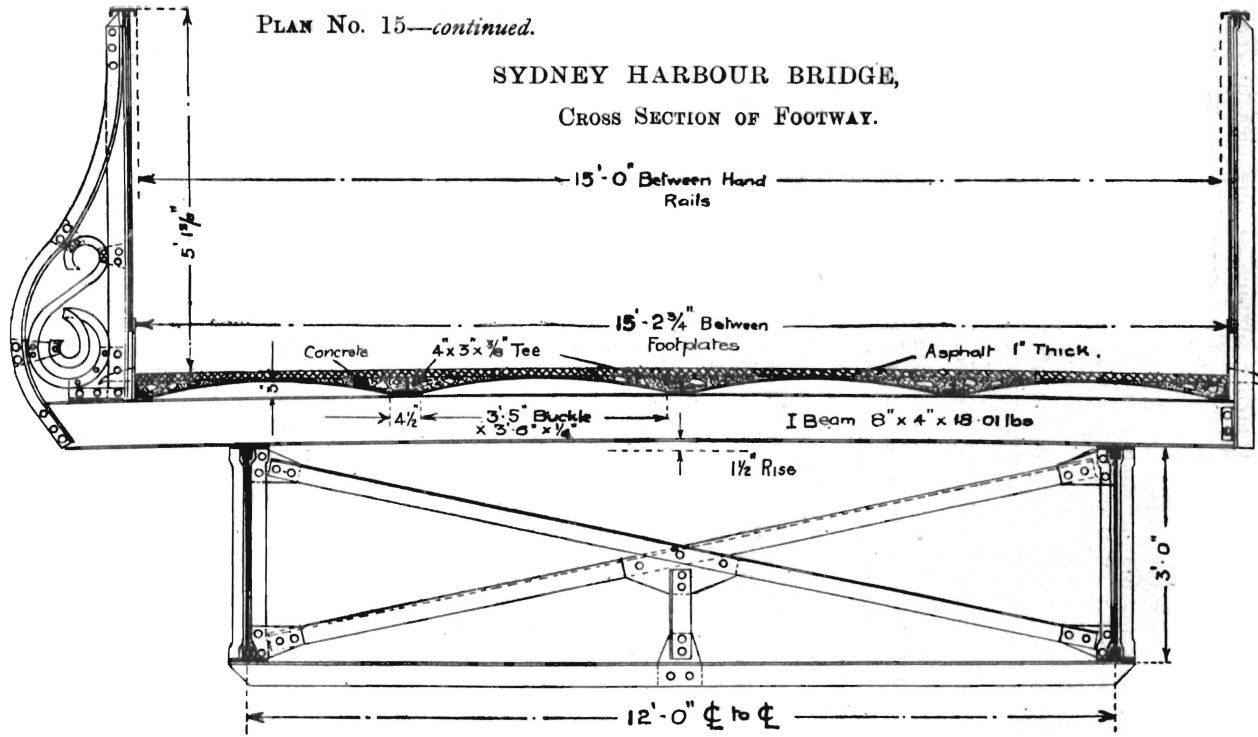
SYDNEY HARBOUR BRIDGE,
CROSS SECTION OF MOTOR ROADWAY.



PLAN No. 15—continued.

SYDNEY HARBOUR BRIDGE,

CROSS SECTION OF FOOTWAY.



Plan No. 15 shows the general arrangement of motor roadway and footway. The motor roadway is designed for lighter motor traffic, and has a wearing surface of one inch of rock asphalt, carried on coke concrete, with buckle plates, as in the main roadway.

The footway also has buckle plate flooring, with a wearing surface of one inch of rock asphalt, there being a filling of coke concrete level with the top of buckle plates. The kerbs of main roadway and motor roadway consist of steel plates and sections, the handrails are also of steel, and are latticed with $1\frac{1}{2}$ in. x $\frac{1}{4}$ in. bars, leaving openings about 6in. square.

DESCRIPTION OF NORTHERN APPROACH.

The northern approach commences at the northern anchor pier of the main bridge in Campbell Street, and consists of steel arch spans with piers of varying widths, as the spans are on an 8-chain curve. These arches are of the three-hinge spandrel braced type, about 180 feet span on centre line.

The steel arch spans continue to Fitzroy Street, thence onwards the construction is steel girder viaduct. Between Fitzroy Street and Willoughby Street the first railway station, "Kirribilli" is situated; Burton Street passes under the station, about the centre of platforms.

The 15 feet footway on the bridge reaches natural surface at Burton Street, the same steps being used for access to the bridge or "Kirribilli" station.

From Burton Street the main and motor roadways are carried on filling between retaining walls, and reach natural surface at Willoughby Street. The roadways continue and junction with Alfred Street between Lavender Street and Junction Street.

A double line of railway crosses Willoughby Street on skew-plate girder spans, continues on viaduct to Alfred Street, which is crossed by a through truss span, thence on viaduct to Arthur Street, which is crossed by plate girder spans, and reaches the natural surface on the southern side of Walker Street, which is closed to vehicular traffic.

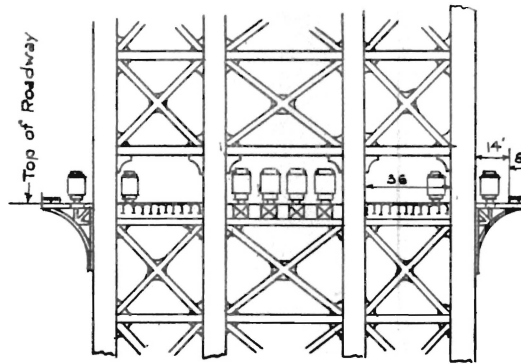
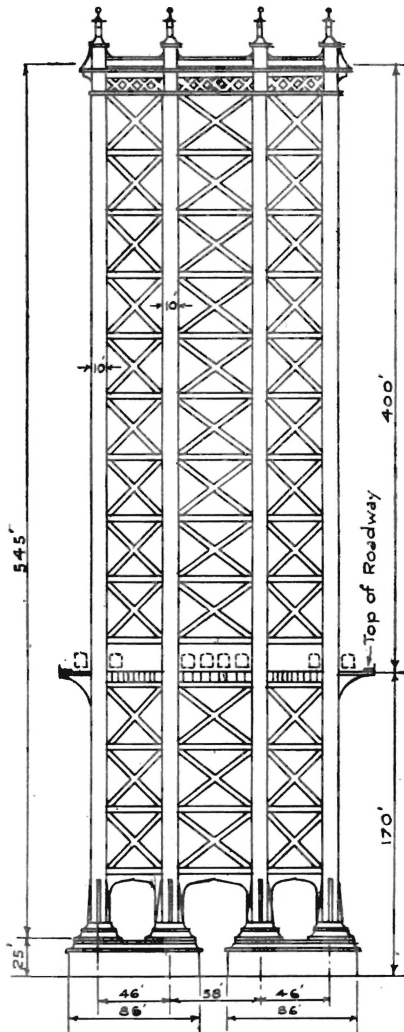
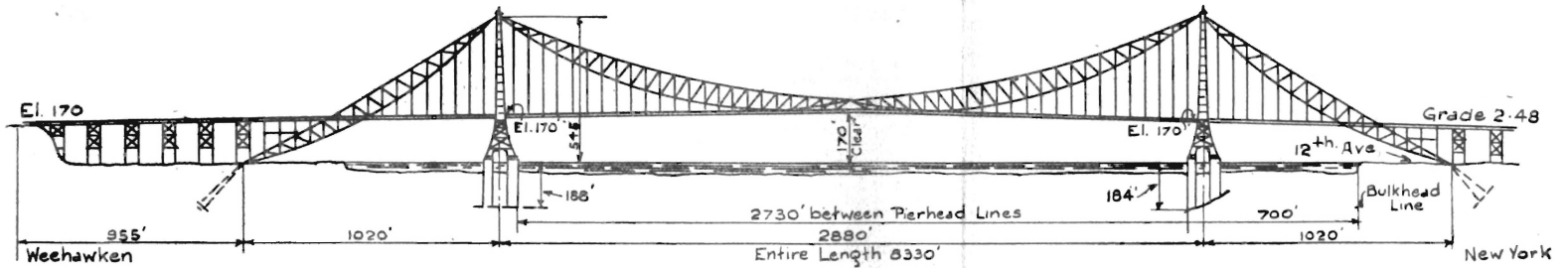
"North Sydney" station is situated parallel and adjacent to Blue Street, between Walker Street and Miller Street. Access to this station is provided by an overhead bridge from Walker Street. The main entrance is in Blue Street, the station offices and bridge leading to platform being on the existing level of the street. This station will probably be the terminus of the North Sydney tramway system.

On leaving North Sydney station, the double line of railway passes in cut and cover under Blue's Point Road, and

Plan No. 16.

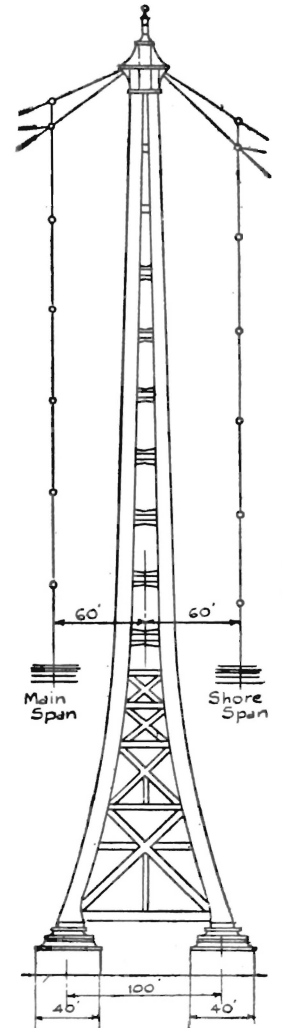
PROPOSED HUDSON RIVER BRIDGE.

57TH STREET, NEW YORK.



TOWER

- 4 LINES OF RAILWAY TRACKS
- 4 " " TRAMWAY "
- 2 ROADWAYS
- 2 FOOTPATHS



thence via a tunnel, emerging in the vicinity of Bank Street, and connects with the existing railway to the south of Bay Road station.

DESCRIPTION OF SOUTHERN APPROACH.

The southern approach commences at the anchor pier of the main bridge on the reserve at Dawe's Point, and consists of steel arch spans. These are of three-hinged spandrel braced type, about 185 feet span. At the end of the arch spans the roadway is carried on viaduct and between retaining walls until the natural surface is reached, at the intersection of Argyle Street and Princes Street.

At the end of the arch spans two lines of railway curve to the south and west; the two additional lines to be constructed when the traffic warrants their construction.

The footway is taken under the railway at the end of the arch spans, and then follows along the roadway. The railway is carried on steel viaduct, Upper Fort Street and Lower Fort Street being crossed by steel arch spans.

Argyle Place is crossed by steel truss spans. The railways are then carried by girder viaduct and on filling between walls till the natural surface is reached, a little before the junction of Crescent and Princes Street. Here the railways pass underground and connect with the Underground City Railway at Wynyard Square Station.

COMPARISON WITH NOTABLE BRIDGES PROPOSED, UNDER CONSTRUCTION, OR BUILT.

- (1) Suspension Bridge over the Hudson River at New York, Plan No. 16.

This bridge, if constructed, will quite eclipse the Forth and Quebec Bridges.

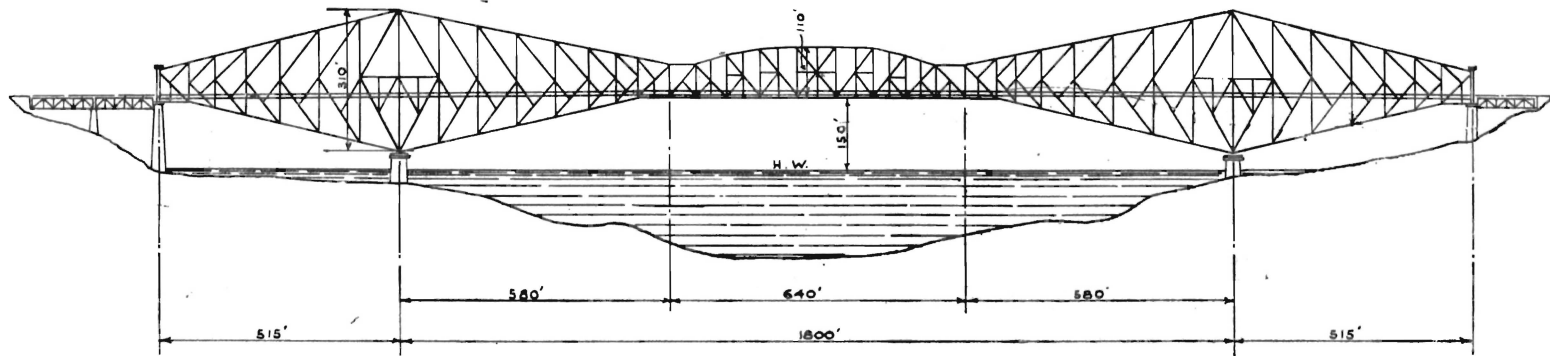
The design recommended by the Interstate Commission is a stiffened cable suspension bridge, the "cables" being formed of eyebars. The proposed clear span is 2,880 feet centres of towers; clear headway for shipping 170 feet. The bridge is to be designed to carry four lines of railway, four lines of tramway, two roadways and two footways. The total weight of traffic to be carried is 20,000lbs. per lineal foot of bridge. Estimated cost of bridge, £8,400,000.

- (2) Cantilever Bridge over the St. Lawrence River, at Quebec. Plan No. 17.

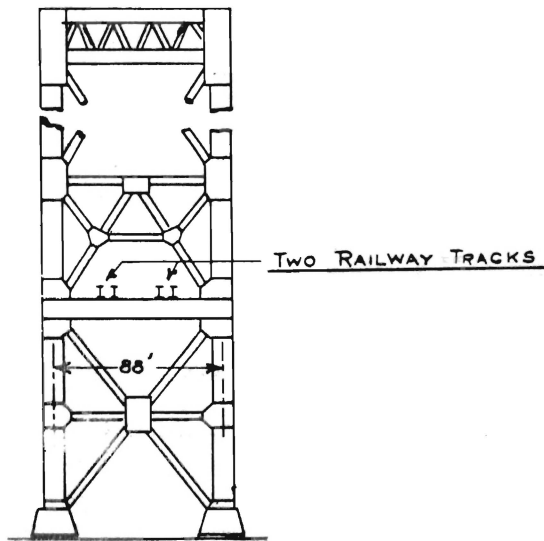
The first attempt to bridge the St. Lawrence at this site resulted in the collapse of the bridge, about half completed, in 1907; some 80 workmen lost their lives.

PLAN No. 17.

NEW QUEBEC BRIDGE—UNDER CONSTRUCTION.



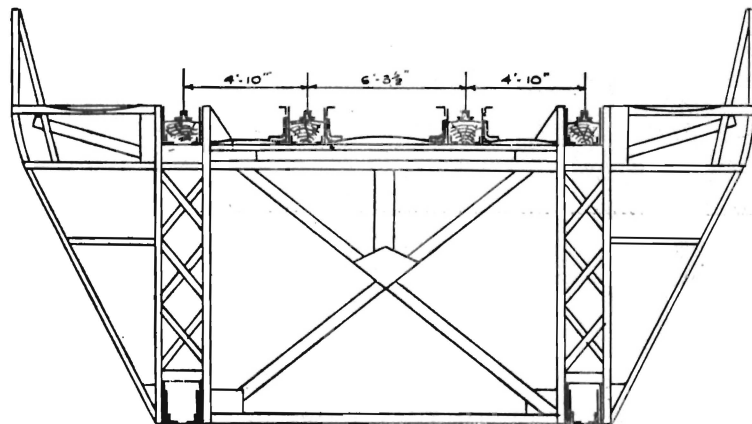
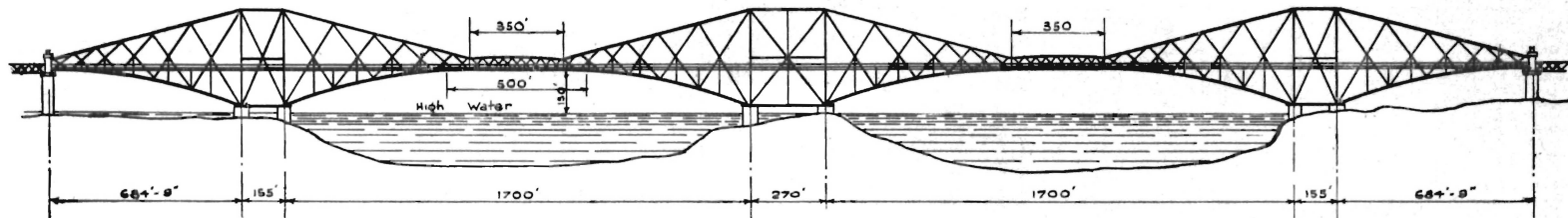
SECTION AT PIER.



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PLAN No. 18.

FORTH BRIDGE SCOTLAND—COMPLETED 1890.



SECTION OF INTERVAL VIADUCT.