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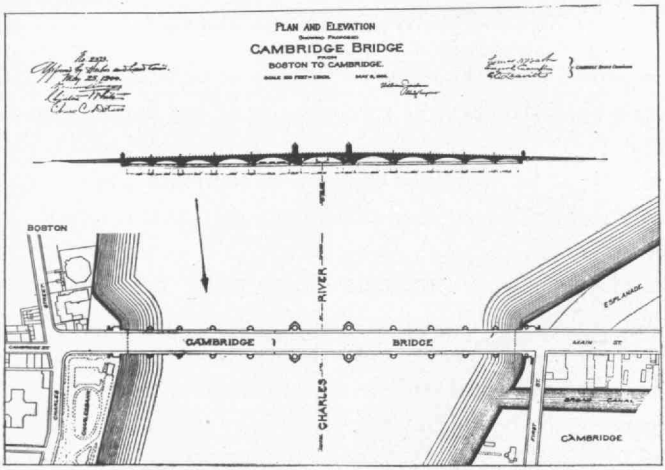
THE CAMBRIDGE BRIDGE

Few people realize that there is now being built across the Charles River a bridge which will be not only one of the finest structures of its kind in this country, but will be a rival of any in the Old World. It is of particular interest to the readers of the REVIEW, not only as marking another step in advance in the proper recognition by municipal authorities of æsthetic considerations in the design of public works, as well as in a hearty co-operation of the engineer and the architect, but also because of the large number of Technology men connected with the work.

The new bridge replaces the old West Boston Bridge, a wooden structure first built in 1792–93, which for some time has been inadequate for highway travel. This old bridge was made famous by Longfellow's poem, "The Bridge," written in 1845, the opening lines of which, "I stood on the bridge at midnight," are so widely known.

The question of a new bridge at this point has been agitated for a number of years. It first received legislative consideration by the Legislature of 1897, in connection with the general act to promote rapid transit in Boston and vicinity. The matter took definite shape in 1898, when the Legislature authorized the construction of the bridge by a commission consisting of the mayors of Boston and Cambridge, *ex officiis*, and a third permanent member, who is expected to serve throughout the life of the commission. Mr. E. D. Leavitt, of Cambridge, a well-known mechanical engineer, was chosen as third commissioner.

It was recognized that a bridge on this site should be more than a structure built merely for utility, along the lines of strict economy. The Charles River is unique among American rivers owing to the fact that its banks for more than twenty miles are public reservations. The river broadens at the lower end of this park system into a beautiful basin, which will be crossed by the new Cambridge bridge, and the day is probably not far distant when the Charles will become one of the best water parks of the world. It

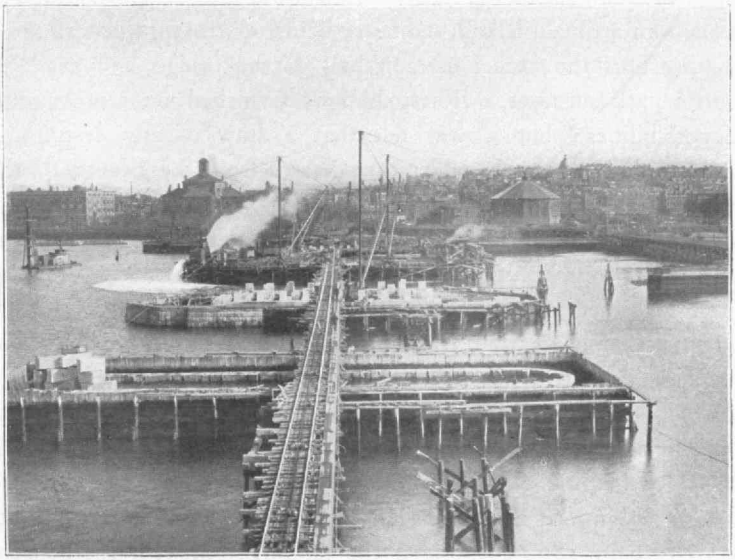


General Plan

is for this reason that it was determined at the outset that the bridge should be of a dignified and monumental character.

The commission organized in the spring of 1898, and appointed William Jackson (M. I. T. '68) chief engineer, and John E. Cheney (L. S. S. Harv. '67) first assistant engineer. Mr. Jackson and Mr. Cheney are respectively city engineer and assistant city engineer of Boston, and the latter is well known as a bridge engineer. Associated with them is Edmund M. Wheelwright, a leading Boston architect, and a Technology man of the class of '75. Before completing his course, however, Mr. Wheelwright left the Institute for Harvard College, from which he graduated with the

class of '76. Later he returned to the Institute, and took up special work in architecture. In the fall of 1898 Mr. Jackson made a trip to Europe to study noted bridges there. In Dresden he joined Mr. Wheelwright, and together they travelled in Germany, Austria, Russia, France, and England. A set of magnifi-



View of Piers, looking towards Boston, November, 1901

cent photographs of European bridges was secured by Mr. Jackson, and used for reference in the preliminary studies for the Cambridge bridge.

It is not so simple a matter to build a bridge over tide water as might be imagined. Although the bridge was authorized by the State Legislature, the details of the work were to a certain extent subject to the approval of the State Harbor and Land Commission and of the two cities interested; but, even with the approval of the state and municipal authorities gained, nothing could be done without the consent of the United States War Department, for the

Charles is a navigable waterway, and as such is under the control of the national government, through the Secretary of War.

The old West Boston Bridge had a draw which would allow the passage of any vessel of such size as could ascend the river. The earlier studies for the new bridge were made with the idea of using a draw; and several of the preliminary designs were for a bridge of stone or steel arches with a central draw channel running through an artificial island, the latter being of structural use to resist the thrust of the arches of each half of the bridge, and available also for park purposes. These designs furnished many architectural possibilities; but it was felt that a draw of any description would not add to, but would rather detract from the beauty of the bridge. Then the question of a drawless bridge began to be discussed, not simply from considerations of appearance, but from the standpoint of public utility as well. All admitted that a drawless bridge furnished far better accommodation to highway travel; and, as far as river navigation was concerned, it was pointed out that, as practically all the up-stream shore property was to be used for park purposes, the interests of the few remaining wharf-owners might be subordinated to the great number of people who would daily use the bridge.

After a long discussion and many hearings, the Massachusetts Legislature in 1899 authorized the commission, with the consent of the United States government, to build the bridge without a draw, provided it crossed the channel at a height sufficient to furnish a clear head-room of twenty-six feet above mean high water,— this height being sufficient to allow the passage of tugs and vessels without masts.

In the summer of 1899, however, matters were seemingly brought to a standstill by the action of the Secretary of War in disapproving both the proposed island in the river and the drawless bridge project. The objection to the island was that it would interfere with the tidal flow, and it was held that a drawless bridge would be an unreasonable obstruction to navigation.

This did not, however, end the agitation for a drawless bridge. The Massachusetts delegation in Congress was appealed to; and

Edgar R. Champlin, then mayor of Cambridge, and one of the commissioners, was delegated by the commission to go to Washington to advocate the drawless bridge project. As a result of Mr. Champlin's untiring efforts and as a precautionary measure, bills were introduced in February, 1900, in *both* branches of Congress, authorizing the Cambridge Bridge Commission "to construct a drawless bridge across the Charles River in the State of Massachusetts between the cities of Boston and Cambridge." The Senate bill, presented by Senator Hoar, passed both Houses of Congress, and received President McKinley's approval the following month.

Thus, after securing legislation by three successive State Legislatures, with concurrent action by the city governments of Boston and Cambridge, after complying with all requirements of State authorities, after numerous and lengthy hearings, and after a protracted controversy with the War Department, the adverse decision of which was finally overruled by Congress, the Cambridge Bridge Commission, at the end of the second year of its existence, was able to proceed with the final plans for the bridge.

During all this time the engineering and architectural staffs had not been idle. Some thirty or forty preliminary designs had been made and carefully considered, and from these came the final design shown in the accompanying illustrations.

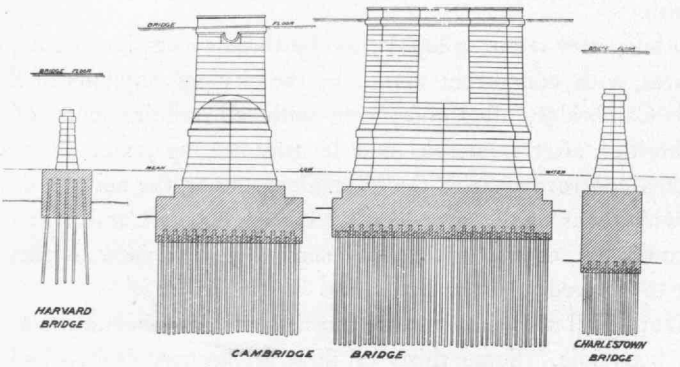
The length of bridge between abutments will be 1,767½ feet, comprising 11 spans of steel arches of 12 ribs each, with spans varying from 101½ to 188½ feet. The height of the bridge at the centre is to be 48½ feet above low water, which gives, in the centre span, the 26 feet of head-room at high water required by the Acts of Congress and the State Legislature.

One of the most striking features of the design for the bridge is the great size of the two central piers, beside which the largest piers of the Charlestown and Harvard Bridges appear insignificant. The foundations of these two central piers are each 201 feet long by 67 feet wide; the total height from the bottom of the piles to the surface of the roadway, 100 feet. These centre piers will have at each end ornamental stone towers 40 feet high above the road-

way, and smaller stone towers will be placed at the ends of each bridge abutment.

The bridge will be 105 feet wide between railings, making provision for four lines of car tracks, flanked on either side by a broad roadway and sidewalk. The two central tracks will be fenced in for the Boston Elevated Railway trains, which, like the surface cars, are to cross the bridge at the level of the roadway.

An idea of the magnitude of the undertaking can best be given by stating that the work will require 80,000 cubic yards of dredg-



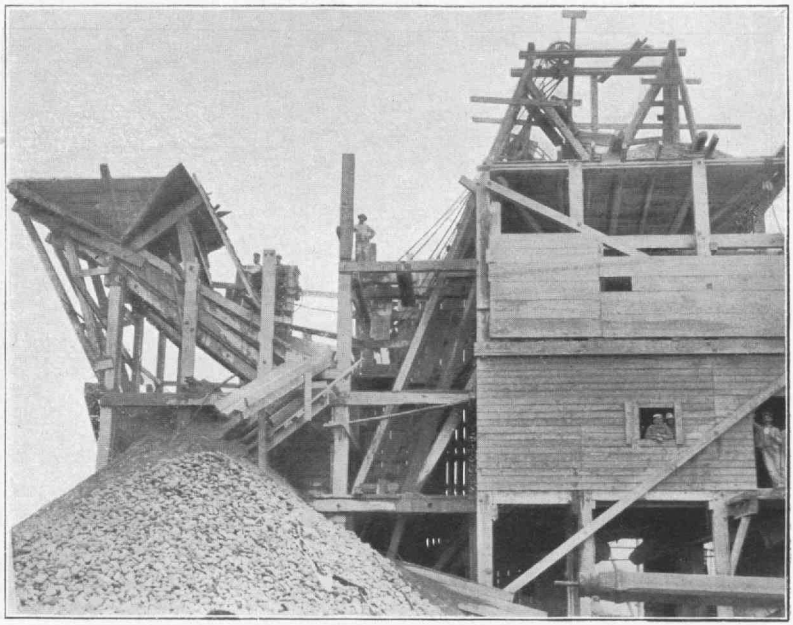
End Elevations of Piers

ing, 85,000 cubic yards of Portland cement concrete, 20,000 cubic yards of granite, 25,000 piles, 150,000 barrels of cement, and 8,000 tons of steel. These quantities are for the bridge only, and are exclusive of those required for its approaches.

The work of preparing foundations was begun in July, 1900, under contract with Holbrook, Cabot & Daly. James W. Rollins, Jr., a member of the firm, and a Technology graduate of the class of '78, has immediate charge of the work for the contractors.

The sequence of the work was as follows: A temporary wooden pile bridge of about the same capacity as the old West Boston Bridge was first built around the site of the new structure to accommodate travel during the construction of the Cambridge bridge. The old bridge was then demolished in the sections where

new piers were to be built. Next the mud, sand, and clay were dredged to a depth of from 18 to 24 feet below mean low water, carried five miles out to sea and dumped. Piles were then driven for the foundation, by a very heavy steam hammer and follower, to a depth of from 30 to 75 feet below low water, into gravel and hard pan. The piles, which were brought from Nova Scotia and



Concrete Mixer

New Brunswick, are of spruce from 20 to 50 feet long. They were driven in two sets, one being 2 feet higher than the other. After the first set was driven about 3 feet on centres, they were sawed off at the proper elevation by a circular saw mounted on a vertical shaft 60 feet long, which was driven from the deck of a scow by a belt, and so arranged that the saw could be set at any depth down to 40 feet under water. The second set of piles was then driven, and sawed off 2 feet above the first. A coffer dam of