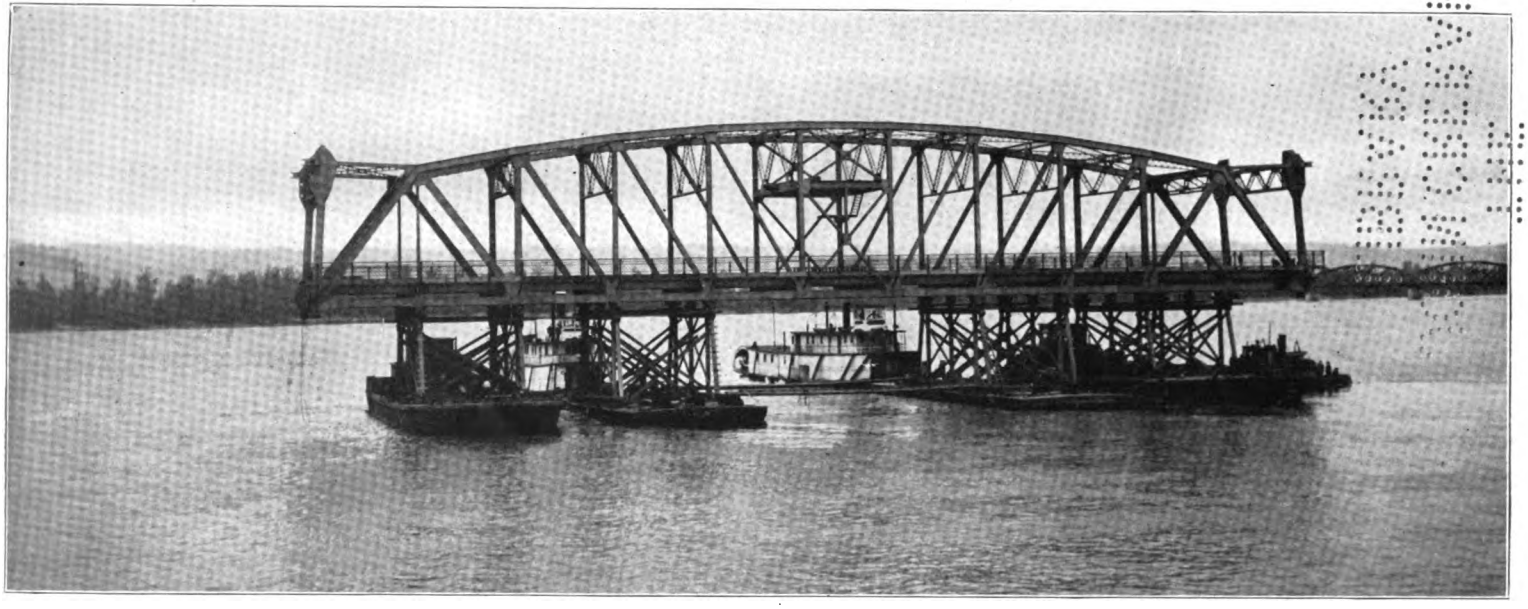
EMPLOYEES' BULLETIN

Volume 3 July, 1916 Number 9

ROBERT W. HUNT & CO.

Engineers - Chemists - Metallurgists - Inspectors

General Offices, Chicago



LIFT SPAN ON SCOWS, JUST AFTER LEAVING LAUNCHING WAYS, APRIL 26, 1916.

Interstate Bridge over Columbia River, Portland, Oregon.

Harrington, Howard & Ash, Engineers. **Robert W. Hunt & Co., Inspectors.**

Employees' Bulletin

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The aim of our Bulletin is to furnish a medium for the exchange of experiences and ideas and general co-operation among our employees, who are urged to send articles, photographs and news items for publication.

VOL. 3 JULY, 1916 No. 9

INTERSTATE BRIDGE OVER COLUMBIA RIVER PORTLAND, OREGON.

The Columbia River interstate bridge in course of construction with its approaches will extend from Vancouver, Wash., to Portland, Ore., a distance of about three and a quarter miles and will form one of the expensive and important sections of the Pacific Highway which proposes to extend from Vancouver, B. C., to San Diego, Calif.

This bridge was designed by and is being erected under the supervision of Messrs. Harrington, Howard & Ash, Consulting Engineers of Kansas City, Mo. The steel for the entire bridge was inspected in mill and shop and foundry by Robert W. Hunt and Company, as was also the machinery for lift span, which was given special attention by one of our mechanical engineers in addition to the regular shop inspection. The structural material that was fabricated at the Gary plant of the American Bridge Co. was inspected by our Mr. C. W. Hines, and the machinery by Mr. Wm. E. Graham.

We are indebted to Mr. Wm. E. Graham, our chief inspector at the Gary plant of the American Bridge Co., and to our Mr. Wm. MacDonald, who inspected the structural material at the Northwest Steel Co. plant, for general description of the bridge and the work that was inspected at the shops, also to Mr. Frank M. Cortelyou, resident engineer, Vancouver, Wash., representing Messrs. Harrington, Howard & Ash, from whom we received the details of the interesting and unusual methods of erection and the fine illustrations.

This bridge with approaches as described in this article will extend from Vancouver, Washington, to Portland, Oregon, across the Columbia River, Haydens Island, the Oregon Slough, the Columbia Slough, and certain lands within Multnomah County, Oregon.

The bridge over the main channel of the Columbia River consists of a series of truss spans, three having a length of 275 ft. and ten of 265 ft., with a small deck girder span at the Vancouver end, making a total length of 3,531 ft., $5\frac{1}{8}$ in. between end shoes. Provision for river navigation is made by a vertical lift span, the center of the three 275-ft. spans being arranged to lift between towers on the two other spans so as to afford a channel of 250 ft. at right angles to the current of the river and about 150 ft. above ordinary high water. The lift span will be operated by electric power and will have a gasoline engine, connected through a speed reducer, for use in emergencies.

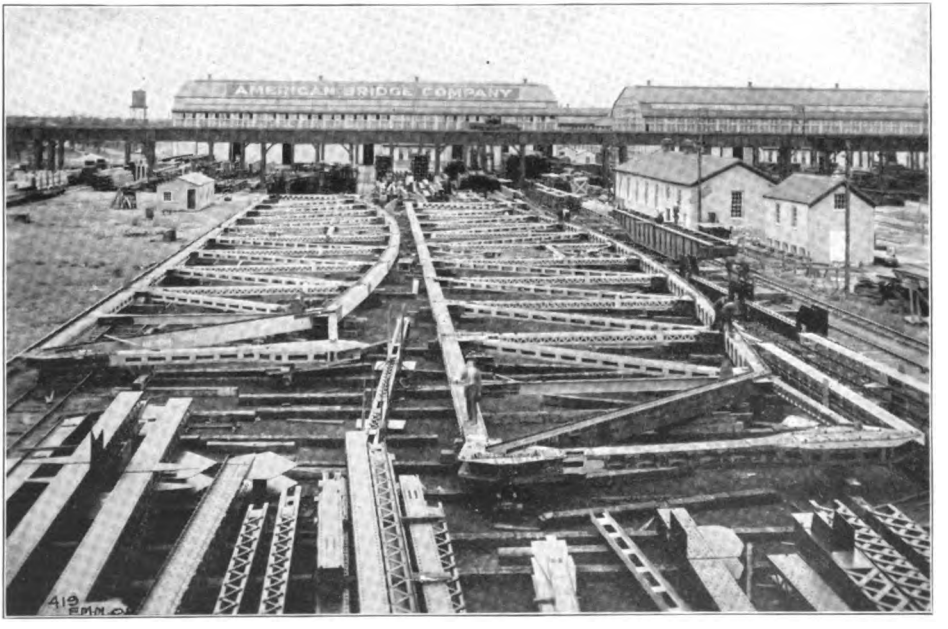
The trusses are spaced 41 ft. center to center, with the roadway between and the sidewalk beyond one truss.

The roadway is 38 ft. wide between curbs and the sidewalks 5 ft. wide.

The exceptional facilities for securing piles of great length at reasonable cost was a factor in determining the type of piers to be used. These are of concrete, resting upon wooden piles sunk to a depth of about 105 ft. below low water.

Fabrication and Inspection. The American Bridge Company who had contract for the Columbia River spans in fabricating divided the contract into six separate orders. This bridge, consisting of 14 spans, as described above, included 10 duplicate spans, separating five into the first division, and five into the second division. The second order included the two tower spans, and a third, the lift span. Under the fourth order, the two towers, the fifth order, the machinery, and the sixth order, the hand railing and street car rails.

All truss members, with floor beams, stringers, etc., were punched 3/16 inch in diameter less than the diameter of the rivet used, and reamed to size after each span was assembled in shop. Each member as assembled was matchmarked both in paint and steel stencil. The transverse bracing connecting the main columns of the towers and the longitudinal bracing connecting the main columns to rear columns were also assembled, reamed and matchmarked. The detail material, such as lattice bars, laterals, sway bracing, etc., was punched full size, and all holes, including rivet holes, were filleted, to remove the sharp edges. The floor beams and stringers were milled on both ends, after the connection angles were riveted in place, and not more than a 1/16 inch taken off the angles at their roots. Stiffeners were made a driving fit between the flange angles. The machinery was also assembled and matchmarked, and the boring of the boxes, fit of shafting, scraping of brasses and bronze bushings, and the grinding and polishing of all running surfaces of all bearings, was supervised by a Robert W. Hunt and Company in-



Trusses for lift span temporarily assembled in Bridge Co. yards for reaming.

spector. Especially is this true of the journals for the large sheave pins.

The number of drawings made and used for this bridge, are as follows: 26 erection diagrams, 192 structural sheets, 95 sketch sheets, and 45 machinery sheets.

Approximate weight, 7,400 tons, and the time consumed for fabrication was from May until December of 1915.

Painting.—Three entirely different kinds of paint were used on this bridge, namely, Lowe Bros. Red Lead Lute, being applied on spans 5, 6, 7, 8, and 9, and National Lead Company's Dutch Boy Red Lead on spans 10, 11, 12, 13, and 14, and Toch Bros. Tocholith on lift span and remainder of bridge. This was done by order of the Engineers, Harrington, Howard & Ash, in order to compare their wearing qualities in the coast climate.

Oregon and Columbia Slough Bridges.

The Oregon Slough, 1,000 ft. wide and 25 ft. deep, is separated from the main channel by an island 1,500 ft. wide and forms an important secondary channel. This bridge consists of ten through plate girder spans, 100 ft. long and one 115 ft. long, and the Columbia Slough will be spanned with four 75 ft. through plate girder spans.

The Northwest Steel Co. had contract for these two slough bridges which were fabricated at their Portland, Oregon, plant.

Fabrication and Inspection.—The girders for the 100 ft. spans were made up of 8 in x 8 in. x $\frac{7}{8}$ in. angles, 7/16 in. webs 9 ft. deep with milled tight butted splices.

Material for the girders was laid out and stitch drilled; the girders were then assembled, transferred to the drill beds and drilled from the solid.

After completing the drilling the girders were transferred to the riveting skids, where the holes were filleted, bolts retightened and the work riveted up.

The 75 ft. girders were made up of 8 in. x 8 in. x $\frac{5}{8}$ in. angles, $\frac{1}{2}$ in. webs and cover plates; they were fabricated the same as the larger girders. The floor system is composed of plate and angle floor beams and cantilever brackets made of plates and angles. The roadway extends outside of the girders and is carried over the cantilever bracket, one sidewalk extending the full length of the bridge on the up stream side. This material was all sub-punched 11/18 in. and reamed to size with twist drills.

The stringers were made of Bethlehem and standard beams with end connections all drilled from the solid.

The Oregon and Columbia Slough bridges weigh approximately 1,731 tons, and time consumed for fabrication extended from June, 1915, to January, 1916.

Complete Improvement.—The main bridge of 14 separate spans, with an entire length of 3,531 ft. 5$\frac{1}{4}$ inches, the Oregon Slough spans of 1,137 ft. 6 inches, and the Columbia Slough measuring 307 ft. made a total length of steel structure over 5,000 lin. ft. The steel structure will have reinforced concrete slab floors, 5$\frac{1}{4}$ in. thick asphaltic pavement, one concrete sidewalk and track rails for both narrow and standard gage electric railways.

In the main approach on the Oregon side there will be about 12,000 ft. of embankment and in the secondary approach about 6,000 ft. These embankments will be of sand dredged from the Oregon Slough and will be 42 ft. wide at the top, with side slopes of two to one, and will average 20 to 25 ft. high. The upstream side will be protected by 4 inch reinforced concrete slabs. Adding the total length of the embankments and the steel spans will make the entire length of improvement about 23,000 ft.

View No. 1—April 22, 1916—Shows arrangement of tracks in steel storage yard and spans 2, 3, 4, 10, 9 on launching ways.

Erection.

The chief feature of interest in regard to this work is the method of erecting the spans on falsework on shore, transferring to barges and floating them to place on the piers, instead of the usual practice of building falsework in the river and erecting with a traveler. Spans 2 to 13 inclusive of the Columbia River crossing was handled in this manner. Span 14, however, was erected in place over the piers on falsework, as it was not possible to float it in owing to the presence of a ferry landing, which is located so as to pass under this span.

The storage and erection yard are shown in view 1. The track at the left is a Northern Pacific switch track running to the freight house which is just back of the spans. Two tracks are led off of this switch track in such a manner that one track is on each side of the falsework on which the spans are erected. This switch track was used at the time of beginning work on the bridge for unloading a large quantity of logs for the saw mills farther down the river. In order to provide for the unloading of these logs the track curving off to the extreme right was built. This track also serves for the loading on barges of the material for Oregon and Columbia Sloughs, span No. 14 and the towers, as all the steel work for the bridge was received through this yard. The maximum amount of metal stored in the yard at any one time was about 5,200 tons.

The equipment consisted of two derrick cars, each 30 tons capacity, at a 55 foot radius and a chain drive to one pair of wheels for moving, one locomotive crane, capacity 20 tons at 12 foot radius, one stiff leg derrick mounted on wheels to run on the outside rail of each track, one stiff leg derrick on a scow, the usual compressor plant, small tolls, etc.

There is nothing of especial interest in the falsework on which the spans were erected in the yard. It consisted simply of two piles under each panel point of each truss, suitably braced and capped, but independent of the tracks alongside of it.

Both derrick cars were used to erect, while the crane sorted the material in the yard and placed it where the cars could pick it up easily.

The floor system was erected first and then the trusses. Before the placing of the top bracing in the span, the trusses were riveted. The top bracing was then erected, and the span swung and rolled out on the launching ways, so as to clear the falsework for the erection of the next span. The floor system and bracing were then riveted during the erection of the succeeding span.

The launching ways are located at right angles to the erection falsework and extend out into the river far enough to permit of getting barges under the spans at the outer end. They are 270 feet long and are composed of pile bents spaced five feet centers. Each bent is made up of five piles, capped with a 14 in. x 16 in. timber 16 ft. long, and suitably braced. On top of the cap a 12 in. x 14 in. x 6 ft. 0 in. block is placed to help distribute the load from the track stringers. There are four track stringers, each 10 in. x 20 in. and on top of the track stringers and spiked directly to them eight lines of rails 2½ in. high. The carriage, on which each corner of the span rests, is composed of four 10 in. x 24 in. x 14 ft. 0 in. timbers, with eight lines of rails on the bottom similar to the lower beam. The spans are moved on the launching ways by a line at each end from one of the derrick cars, which passes through a single sheave block at the end of the ways to a single sheave block attached to the span and back to the end of the ways. No trouble was experienced in moving the spans on the ways.

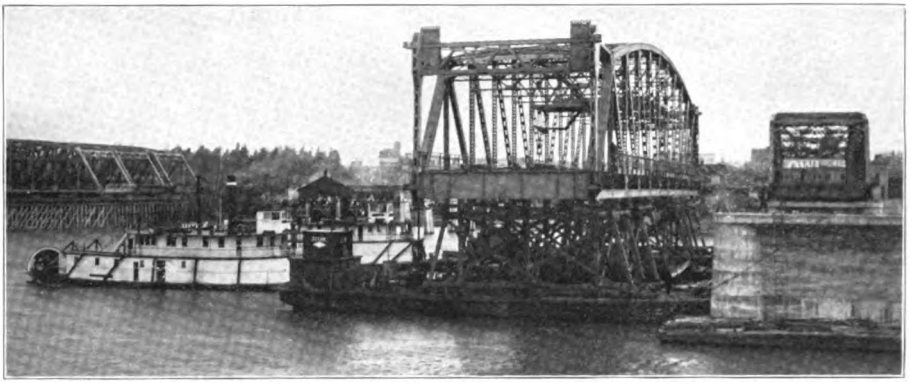
View No. 1 shows five spans on the ways ready to be transferred to the piers and view No. 2 shows the same five spans with the barges being assembled under the outer span.

For moving the spans from the ways to the piers four barges were used. These four barges were used for moving the five spans shown in view No. 2, being spans 2, 3, 4, 10 and 9, given in order from the end of the ways. The frontispiece and view No. 3 show the lift span during the moving. For moving spans 11, 12 and 13 all four barges were of the same size as the inner ones shown in the views. In moving the spans the method of proceedure was briefly as follows: Water was pumped into the scows and the scows placed under the span. Blocking was then placed between the falsework on the scows and the steel work, and the water pumped out of the scows to raise the span off of the ways. The spans were then towed out to position over the piers and water pumped into the scows to

View No. 2—April 22, 1916—Spans on launching ways ready to be floated to position on piers. Scows being placed under span No. 2.

track. Twenty-two rollers, 1½ in. x 3 ft. 4 in. are used under each carriage. The weight of the span is transferred to the carriage through the shoe and also by blocking under the end floor-

bring the span to rest on the piers and free the scows. About eight hours time was ordinarily required for the operations of blocking up the spans, pumping out the scows to raise



View No. 3—April 26, 1916—Lift span on scows just before reaching piers. Looking north from pier 4.

the span, moving the span to the piers and filling the scows to release them.

Span No. 2 in its final position is on a grade such that one end is about 6.5 feet lower than the other. The launching ways being level it was necessary to lower one end of the span this extra 6.5 ft. by means of the barges. This was done in two drops, the first drop landing the span at the high end on its pier and the lower end on blocking about 3.5 feet above its pier. The barges were then lowered to relieve them of the weight of the span, the blocking on top of the falsework removed, the weight of the span again transferred to the scows, the blocking on the pier removed and the span lowered to the pier. It was this operation that made it necessary to use the two larger barges on the last five spans floated than those used on the first three moved.

To date (May 9th) eight spans have been placed by the above method. Span No. 14 was erected in place on false work and span No. 1 was erected in place by the floating derrick. This leaves then four spans on the Columbia River yet to be placed. The erection of the first of these spans has been started and work will begin at once on the erection of the towers for the lift span.

On the Oregon Slough bridge all material was erected in place on the piers and then riveted. The girders were first erected the full length of the bridge by the floating derrick, assisted by the derrick used in the erection of Span 14, which was temporarily transferred to a scow for the purpose. For the erection of the 110 ft. girders a third derrick was secured to assist the other two. Following the erection of all the girders the one derrick was transferred to the track on top of the end span and the remaining material erected by it. The floating derrick was used also to assist in the erection of the floor system, erecting a small amount of the floor system on the downstream side, which it was able to reach, and plac-

View No. 4—April 29, 1916—Oregon Slough Bridge. Erection of steel completed. Looking downstream.

ing on top most of the remaining material to be erected by the top derrick. View No. 4 shows the Oregon Slough Bridge following the completion of the erection.

No work has been done to date (May 9th) on the erection of the Columbia Slough bridge. It is planned to erect all the material in this bridge with the traveling derrick on top.

Robert W. Hunt and Company have reason to be proud of their work in connection with this bridge. Reports that have come in to date state that the erection has fit together almost perfectly and no back charges to speak of for correction of shop errors have been made.

CAPT. HUNT RECEIVES DEGREE.

It is with much pleasure and gratification that the Bulletin announces a merited honor that has recently been bestowed on Capt. Robert W. Hunt. We print below an extract from The Troy Record of June 14th in which was an account of the commencement exercises at Rensselaer Polytechnic Institute which says:

"Then came the conferring of the particular honor of the day, that of doctor of engineering upon one while not a graduate of the institute has honored it in many ways, and President Ricketts in referring to it spoke in high praise of the recipient, Captain Robert W. Hunt. With the degree went an interesting sketch of the man honored, an oldtime Trojan, and it was read by Professor Roussau.

Honorary Degrees.

To one of the two honorary degrees bestowed by the board of trustees is attached more than the usual significance. It was that of doctor of engineering, bestowed upon Captain Robert W. Hunt, formerly of this city, and long connected with the iron and steel industry here. He has not only won a distinguished place in the profession, but he has been a steadfast and very helpful friend of Rensselaer, and, in the sketch of his career given out when the degree was conferred, it is clear that the faculty appreciates his worth. The sketch read preliminary to conferring the degree speaks of Captain Hunt as follows:

Doctor of Engineering.

Robert Woolston Hunt—Metallurgical Engineer, expert in the manufacture of iron and steel. Beginning his career by learning the practical side of the manufacture of iron in rolling mills in Pennsylvania, he afterwards studied chemistry and established for the Cambria Iron Company, in 1860, the first laboratory in America forming an integral part of an iron or steel organization. Entering the United States military service in 1861, he was in command of Camp Curtin, Pennsylvania, as mustering officer with the rank of captain until he was mustered into the service in 1864 with the rank of sergeant. At the end of the war he returned to the service of the Cambria Iron Company and took charge first of the experimental Bessemer Steel Works at Wyandotte, Michigan, and afterwards at Johnstown of the rolling of the first steel rails made in America on a commercial order. He was afterwards successively superintendent of the Bessemer Works at Cambria, of the Bessemer Works of John A. Griswold and Company of Troy, N. Y., and of the Troy Steel and Iron Company, being one of the pioneers of the Bessemer steel industry in this country and becoming during this period one of the great experts in the manufacture of this product. Retiring from manufacturing nearly thirty years ago, he established the firm of Robert W. Hunt and Company,

New Columbia River Interstate Bridge Remarkable for Its Length

By Frank M. Cortelyou*

The Interstate Bridge over the Columbia River between Portland, Ore., and Vancouver, Wash., has a total length of about 23,000 ft., including all its approaches. At the Vancouver end approaches are provided on Washington St. and from Main St. by way of First St.; each approach is about 300 ft. long. The structure over the main channel of the river is 3530 ft. long, consisting of ten 265½-ft. truss spans, three 275-ft. truss spans, and one 50-ft. girder span. One of the 275-ft. spans is a vertical-lift draw which can be raised to give 150 ft. clearance above ordinary high water.

To the south of this bridge Hayden Island is crossed on an embankment 1480 ft. long, and the Oregon Slough by a plate-girder bridge 1140 ft. long, consisting of 11 spans. From the south side of Oregon Slough there are two approaches, one about 10,800 ft. long connecting to Union Ave., and the other about 5800 ft. long connecting to Derby St., Portland. These approaches are on embankments averaging about 24 ft. in height, with the exception of a four-span plate-girder bridge 307 ft. long over Columbia Slough in the Union Ave. approach.

*Resident Engineer for Harrington, Howard & Ash, Consulting Engineers, Kansas City, Mo.

FIG. 1. CHANNEL END OF INTERSTATE BRIDGE

The bridge provides a roadway 38 ft. wide from Vancouver to the south side of Oregon Slough. From this point to Portland a 30-ft. roadway is provided on the Union Ave. approach and an 18-ft. roadway on the Derby St. approach. On the steel portions there is also provided a sidewalk, 4½ ft. wide on the truss spans and 5½ ft. wide on the girder spans. Provision is also made for the future addition of a sidewalk on the approaches south of Oregon Slough.

Six lines of rail are provided on all the steel bridges, for double-track electric railways, both, standard- and narrow-gage.

The Vancouver approaches contain 25,000 cu.yd. of sand, the embankment over Hayden Island 105,000 cu.yd., the Union Ave. approach 820,000 cu.yd. and the Derby St. approach 515,000 cu.yd., making a total of 1,465,000 cu.yd. in all embankments.

The piers for all three bridges are of the open crib type, resting on piles. The concrete in the pier bases fills in around and over the tops of the piles, being retained during its placing by timber cribs which are left permanently in place. The concrete pier shafts extend from a point well below low-water mark to above high-water mark.

About 23,000 cu.yd. of concrete, 1,800,000 ft. of timber and 222,000 lin.ft. of piling were used in the construction of the piers.

In the bridge over the Columbia River channel there are 6875 tons of structural steel, 310 tons of steel rails and 180 tons of machinery, cables, etc. In the bridges over the Oregon and Columbia Sloughs there are 1600 tons of structural steel and 130 tons of steel rails.

The deck of the steel bridges is fireproof throughout, no timber of any sort being used as part of the permanent construction. The sidewalk is a concrete slab spanning from the curb of the roadway to a channel stringer near its outer edge. The roadway is paved with bitulithic pavement supported on a concrete slab, with concrete headers along the six lines of rails.

The bridge was opened to traffic on Feb. 14, 1917. Its total cost, including all approaches, will be 1¾ million dollars. The contractors for the main parts of the work were: For foundations, Pacific Bridge Co.; for steel, United States Steel Products Co. and Northwest Steel Co.; for erection of steel, Porter Brothers; for embankments, Tacoma Dredging Co. and Standard American Dredging Co.; pavements, Warren Construction Co.

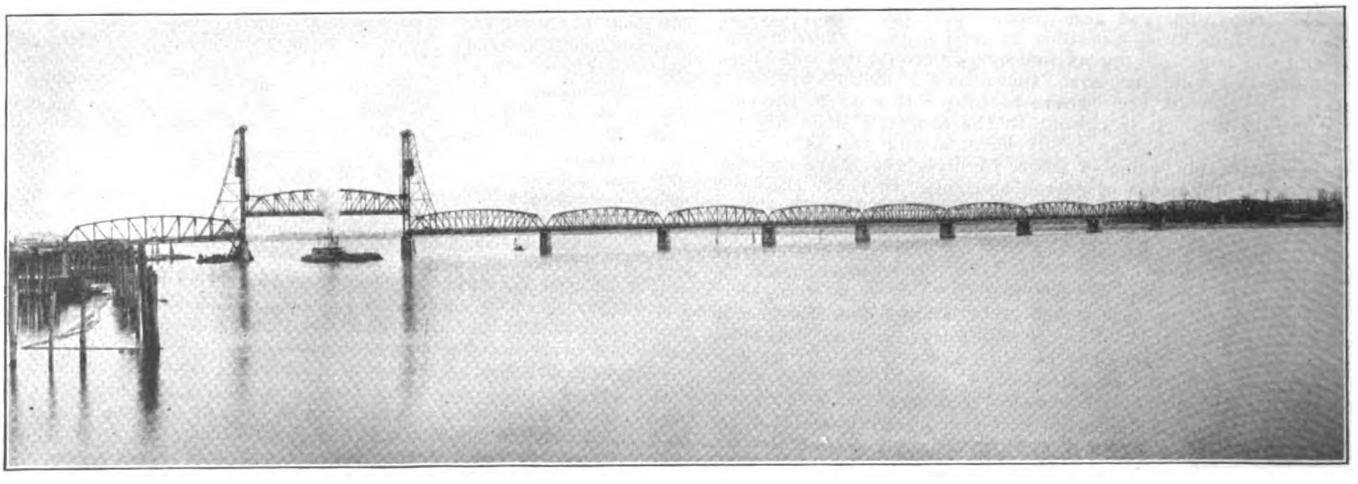


FIG. 2. ONE SECTION OF LONG STEEL BRIDGE ACROSS COLUMBIA RIVER AT PORTLAND, ORE.