The History and Construction of Railroad Bridge over Potomac River at Washington, D. C.

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Summary

This thesis shows the evolution of bridge building from 1809, when the first bridge built on this site was a simple pile structure. This bridge soon failed and had to be bought by the Government and rebuilt. The Government bridge was but little better than the first bridge. The event of the Civil War saw the crossing of the Potomac River by railroad tracks on Old Long Bridge. After the War, Congress gave the bridge to the railroad company. The railroad company had to rebuild the bridge a number of times until the building of the modern steel bridge in 1904. The Old Long Bridge was one of the last of the era of large wooden bridges. The efficiency of steel bridges is shown by the fact that the bridge built in 1904 is still in use and has not failed since it was opened.

The old Long Bridge connecting Washington with Virginia, or rather the series of bridges which rose on the same site are not only of interest to the historian, but also to the engineer.

Early Bridges

The importance of this site for the location of a bridge was recognized soon after location of the capital in the new city of Washington. In 1808 , after many protests from merchants of Georgetown, Congress granted a 60 day charter to the Potomac Bridge Company. The bridge was constructed in 1809 by the Washington Bridge company and soon became the main route of travel between the North and South. As the Potomac is swift at ordinary times, during freshets and floods sepecially when there is ice in the river, the force against the bridge was great. As the bridge was probably constructed on pile foundation and offered considerable resistance to floating ice, ice caused the bridge to act as a dam. As a result the bridge was damaged to such an extent twenty years later that the bridge company was financially unable to repair the bridge. July 14, 1832 Congress passed an act buying the bridge and franchise from the Washington Bridge Company for $20,000. Examination showed that to repair the old bridge was uneconomical so Congress appropriated $135,000 to build a new bridge, which was completed in 1835 and formally opened by President Jackson, October 1, 1835.

It was about a mile long with the draw. The builders of the new bridge had learned no lesson from the failure of the old bridge; so the new bridge was nearly destroyed February 10, 1840. The bridge never had sufficient area of waterway and every few years it was nearly destroyed or seriously damaged. This fault was not corrected until the building of the present bridges many years later.

Civil War Period

At the outbreak of the Civil War April, 1861 Long Bridge immediately became very important. The bridge was one of the main connections between the North and South. Over this bridge was to pass the supply and the personnel to carry on the war. As the bridge was the most important entrance into Washington the control of the structure by the Union Army was necessary. So on 23 May 1861 Major Heintzelman crossed over the bridge taking possession of Alexandria and prepared to defend the south end of the bridge. After the Battle of Bull Run defenses were constructed on the wooded ridge at Four Mile Run to cover the bridge and to destroy it if necessary for the defense of Washington.

Long Bridge formed, for land traffic, the main link of communication with Alexandria and the principal southern routes. It was one mile in length ; nearly two thirds of which, over the wide shoals of the Potomac, was solid causeway, and the rest on piles.

There were two draws, one near either shore. The immense transportation for the Army over the bridge imposed the speedy necessity of an entire rebuilding of the wooden structure and draws. This was done in the fall of 1861 by the Quartermaster's Department. Subsequently it was judged necessary to connect the railroad route from the North with those from the South terminating at Alexandria and in 1864 an entire new railroad bridge was constructed on piles parallel to the one just described. After reaching the Virginia shore the latter was prolonged by a causeway over a flat and a marsh until it reached the more elevated ground at Fort Runyon.

Use as a Railroad Bridge

On March 3, 1863 Congress authorized the Washington and Alexandria Railroad Company to extend its tracks down Maryland Avenue and across the bridge if it did not interfere with the traffic over the bridge. The Railroad Company took advantage of the authority given it by Congress and the following year completed a bridge 50' below and paralleling the original structure. The new bridge subdivided the old spans by piles driven at a distance of about 11 to 18 feet. This was built as a pile trestle and used for seven years. In doing this the design, of the original bridge was altered from a truss to pile structure. Great indignation ensued but nothing was done as the only cure was to built a new bridge and this was not done until many years later.

In 1870 the causeway and the south draw were washed away.

In 1870 Congress authorized Baltimore and Potomac Railroad Company to cross the potomac River on old Long Bridge, and the trestle at that time becoming useless, was dismantled. The Railroad Company had to keep the bridge in repair and maintain roadway on one side. When Long Bridge passed into the hands of the Baltimore and Potomac Railroad Company the bridge at this time consisted of four wood Howe Truss spans at south end remainder was a pile trestle, all in poor condition. The railroad company rebuilt the entire structure in order to pass trains over the bridge. This consisted of eighteen spans of wood, Howe Truss type, each 137 feet long, and two draw spans 136 and 123 feet long. Foundations were stone piers on piles.

At the time of the inception of the project for reclamation of the Potomac flats (1881), the total length of bridge was 4677 feet. The bridge consisted of three sections; a wooden bridge 700 feet long resting on masonary piers across the upper end of the Washington Channel; an earth fill 1980 feet long between masonary retaining walls across partially submerged flats; the bridge proper 2000 feet long across the main channel of the Potomac. The bridge proper consisted of thirteen fixed spans 135 feet in the clear and a pivot span 182 feet long with two 70 foot openings, only one however was open to navigation.

After reclamation of the flats the wooden bridge over the Washington Channel was replaced by a long fill and a two span plate girder. During the great flood which covered the lower part of the city in February 1881 the bridge was under the pressure of ice and water. When part of the bridge gave way the flood subsided. In 1881 the ice banked up at the bridge, the water level standing 2 feet above the lower chord. The gages above and below showed plainly the abstruction caused by this condition. In 1889 the water stood over 2 feet above the lower chord. The reason for these failures was the same as the reasons for the previous failures; i.e. the failure to allow sufficient area for the waterway. In 1884-5 the bridge was again rebuilt. This bridge was the oldest relic in America of a timber Howe Truss era.

With the exception of the draw the bridge consisted of three lines of trusses, the south ones supporting the railroad with timber arches. The extreme width out to out of trusses was 40 feet 5 inches, and roadway 19 feet 2 inches in clear with no sidewalk. The clear distance between trusses supporting the single track was 13 feet 2 inches. The masonary piers were of soft sandstone founded on piles with a timber grillage at low tide level and heavily riprapped, the riprap reducing the cross-section of the river by one-third. The axis of piers were not parallel to the current and the lower chord was 10.3 feet above mean low tide; also the draw was not placed in proper position for the channel.

All these things caused the bridge to be a serious obstruction to tidal flow, requiring constant dredging in order to maintain a navigable channel of 20 feet at low tide. The highway and the railroad occupied this same bridge until subsequent to 1901 when, by act of February 11, 1901 Congress passed the following.

"Section 11- That inasmuch as the present Long Bridge is inadequate for the accomodation of the largely increased railroad and vehicular traffic, is in a measure obstruction of navigation and needs to be reconstructed, the Baltimore and Potomac Railroad Company is hereby directed and required to remove the present Long Bridge across the Potomac River and, in accordance with plans approved by the Secretary of War, to build on practically the same line a new bridge in lieu thereof, said new bridge to be for railroad purposes only and to be adapted for two or more railroad tracks, the Long Bridge to be removed, and the new bridge constructed within four years from the date of passage of this Act. The said Baltimore and Potomac Railroad Company shall remove the old Long Bridge and shall keep in repair said new bridge at its own cost and expense, an shall maintain an efficient draw in said new bridge, operating same so as not to unnecessarily impede the free navigation of the Potomac River at any hour of the day or night, and shall give other railroad companies the right to pass over said bridge upon such terms as may be agreed upon between the companies or prescribed by Congress".

The railroads using the bridge abandoned it in July, 1904 and moved to the new bridge which they had constructed some distance up stream and in the spring of 1906 the electric railroad transferred their tracks to the new government bridge nearby. The structure was closed for traffic in the fall of 1906 and work was started toward its destruction. The Assistant Secretary of War granted a permit to W.H. Johnson Jr., of Philadelphia to remove the bridge, in accordance with his contract with the Pennsylvania Railroad, from which he bought the bridge for $175.

Mr. Johnson was to begin work at once, so as to complete the work by July 1, 1907. The bridge was to be taken down in sections, piles being driven under it to support the scaffolding for the work. The work of removal was to begin at the District end of the bridge and the material to be removed to the Virginia side. The piers were to be removed by use of barges.

The New Bridge

To meet the requirements of the Act passed by Congress requiring the Railroad Company to build a new bridge, the Railroad Company in 1902 started surveys, looking toward the construction of a new bridge across the Potomac River. The location finally adopted was approximately 200 feet upstream from the historic "Long Bridge".

The following is a history of the new bridge and its construction from the Pennsylvania Railroad Company:

"The new bridge was designed to carry steam operated trains only, two tracks being provided, and it consisted of 12 spans, varying in length from 169 feet to 281 feet, the latter span being the draw which was of the swing type, operated by steam power, The bridge is 2528 feet in length between the back walls and the length of the various spans is as follows: Three spans at 188 feet 6 inches, six spans at 201 feet 3 inches, two spans at 155 feet 3½ inches and one span at 104 feet. The distance from base of rail to mean low tide is 24 feet. Construction of the piers and abutments of this bridge was commenced during the winter of 1902 and the piers were completed the following fall. The piers and abutments consisted of Ashlar granite masonry, backed up with concrete. The masonry portion of the piers rests on a foundation of concrete from 6 feet to 10 feet in depth, which in turn is supported by a pile foundation carrying a timber mattress of 12x12 timbers, laid solid in four courses in opposite directions.

The center pier, supporting the draw span, however, does not rest on piles, but was constructed by pneumatic caisson process. The foundation for this pier was excavated by the pneumatic compressed air method, with workmen working under air pressure in a large timber caisson, which was built on the shore, launched and floated to the site of the pier, and then sunk to the river bottom by depositing on top of the caisson and within the timber walls, provided for this purpose, a sufficient weight of concrete to overcome the bouyancy of the timber and to sink the cutting edge of the caisson to the bed of the river. The water was then forced out of the working chamber at the bottom of the caisson by pumping compressed air in through pipes provided for the purpose. The workmen then went down into this working chamber and working under compressed air, maintained at a pressure sufficient to overcome the weight of the water, which otherwise would have forced its way into the caisson, proceeded to dig down into the bed of the river, the excavated materials being hauled up out of the working chamber in large circular buckets through 36 inch double airlocked tubes, extending from the working chamber to a point considerably above the surface of the water. After the river bottom had been excavated down to a very hard and compact gravel foundation, which process required continuous day and night work for several months, and during which time concrete was daily deposited on top of the caisson to force it further down into the bed of the river, the working chamber was gradually filled up with a rich concrete mixture, the workmen

being gradually withdrawn from the working chamber as the concrete approached the top of the chamber.

The superstructure of this bridge consists, as stated above, of 12 spans of various lengths of double track, through steel pin connected trusses, all of which, except the draw span and the northernmost fixed span were taken from another bridge of the Pennsylvania Railroad which in about 1902 had been replaced by a stone arch. The draw span and the northernmost truss were fabricated new for this bridge. The bridge was opened for traffic in 1904."

The bridge is still the main railroad connection between the North and South. The Baltimore and Ohio Railroad Company uses the bridge to carry its freights trains to the southern rail routes, also the Pennsylvania Railroad uses the bridge for the same purpose. The Richmond, Fredicksburg, and Potomac, Southern, Seaboard Airline, Atlantic Coast Line, Norfolk and Western, and Chesapeake and Ohio Railroads use the bridge for their Northern outlet into Washington, thus connecting the great rail nets of the North and South.

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This picture shows the two span plate girder over the Washington Channel.

View of bridge from Washington shore.

Floor of.bridge from north end looking south.

Last pier on northen end from up stream side.

Fill that replaced part of the old Long Bridge (1881).

One of the piers showing the pointed end to releive ice pressure.

Brady Pictures

These photographs were taken during the Civil War by Brady.

(The pictures shown here were properly taken after 1863,

and were obtained from the Signal Corps U.S.A.)


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