



Historic Bridge Foundation Facebook Archives

Focus Bridge: Bismarck Railroad Bridge

March 2018

Bismarck, North Dakota, is home to a railroad bridge that features the engineering of arguably the greatest 19th Century bridge engineer (George Morison) and the greatest 20th Century bridge engineer (Ralph Modjeski).

The first railroad bridge at Bismarck was completed in 1882 for the Northern Pacific Railway. Originally known simply as the Bismarck Bridge, this crossing consisted of three 400 foot steel pin-connected Whipple through truss spans erected by the Detroit Bridge and Iron Works of Detroit, Michigan. The bridge also included two 113 foot inverted bowstring approach spans. It was designed by George Morison, a famous engineer who built many large metal truss bridges over the Mississippi and Missouri Rivers. His bridges were many of the first bridges over these large rivers, and they also were some of the earliest long-span metal truss bridges in the country. Many of his bridges used steel instead of wrought iron and were among the first bridges in the country to do so. Many of his bridges had spans that were record-breaking at the time they were completed. Morison's bridge at Bismarck was a typical example of his engineering efforts, with its Whipple truss spans incorporating a large lattice portal bracing with an ornamental name and date plaque and portal casting at the top. The bridge was supported by stone piers. Constructing these piers required the dangerous work of sending men into pressurized caisson chambers to dig deep into the ground. The erection of the truss spans was not done using traditional timber falsework because the bottom of the Missouri River had "a very unstable character" according to engineering periodicals of the time. Instead, timber Howe trusses supported on intermediate temporary piers were erected between the stone piers to facilitate the erection of the metal truss spans.

In the early 1900s, a decision was made to replace the bridge. However, the piers were in good condition, so these were retained and reused for the new bridge. The replacement bridge was completed in 1906. Famous engineer Ralph Modjeski was the chief engineer for this project. Because the former piers were reused, the replacement bridge has the same span lengths as the original bridge with one exception: the eastern approach span was lengthened to 140 feet to accommodate an issue with the bank sliding toward the river. The new truss spans were fabricated at the Ambridge,

Pennsylvania, factory of the American Bridge Company of New York, New York. The bridge consists of three metal pin-connected Pennsylvania through truss spans. The 115-foot western approach span is a Warren deck truss, while the 140-foot eastern approach span was a Pratt deck truss and, in modern times, this span has been replaced with shorter concrete spans. Unlike the first bridge, this bridge was erected using traditional timber falsework. The construction schedule was designed to avoid the seasons with the worst river conditions. The new bridge was built to minimize railroad traffic disruption. As such (with the falsework in place), the new truss was gradually erected and the old trusses removed by the traveler (which provided the same function as a crane on modern jobsites) all while the bridge remained open to railroad traffic. The approach spans were assembled next to the bridge and moved into place during times when trains were not using the bridge.

The bridge, sometimes known as the Missouri River High Bridge, has continued to serve active railroad traffic through to the present day. However, the current owner of the bridge, BNSF Railway (Burlington Northern and Santa Fe), is planning to build a new replacement bridge. This has left the future of the historic bridge in question. A Section 106 Review is currently in progress. The bridge is appreciated by many in the Bismarck area and beyond, and there is an interest in preserving the historic bridge as a pedestrian bridge next to the proposed replacement railroad bridge. A decision to preserve this bridge would mean that this unique bridge, noted for its large truss spans and association with two famous engineers, remains in place for future generations to appreciate. Because the bridge seen today reuses the piers from the 1882 bridge, the Bismarck Railroad Bridge can be said to feature the engineering of both George Morison and Ralph Modjeski in a single bridge. Each was one of the greatest engineers of his century, and this bridge remains as a record of their contributions to bridge design.



Elevation view of bridge in 2017. Photo Credit: John Marvig (<http://johnmarvigbridges.org/>)



Oblique view of bridge in 2017. Photo Credit: John Marvig (<http://johnmarvigbridges.org/>)



Caisson – This photo shows a rare view: workers inside the cramped space of the pressurized caisson chamber where the ground was dug out for a pier of the original bridge.

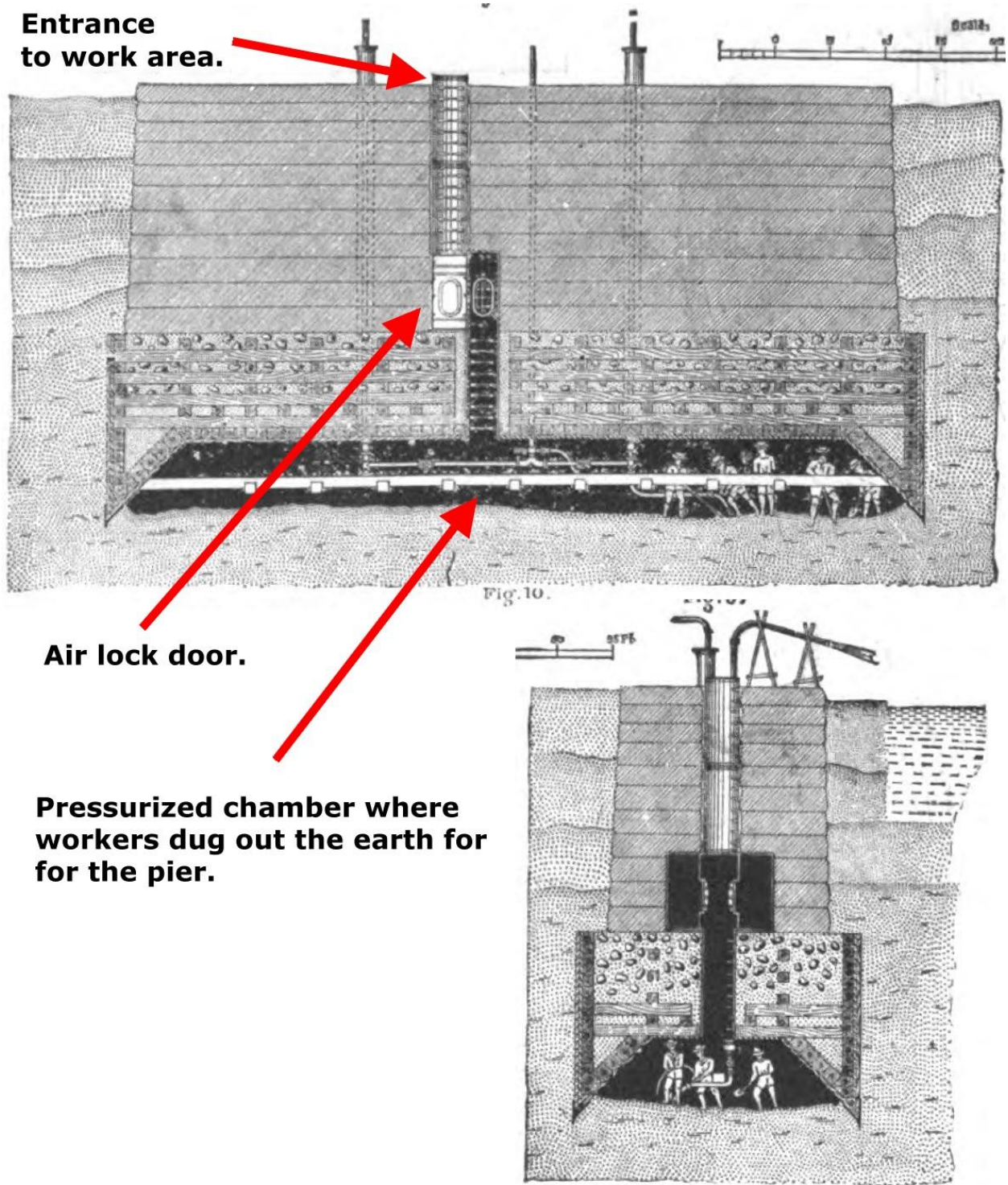


Diagram – This diagram shows where the pressurized caisson chamber was located and how workers had to pass through an air lock to enter the work area.

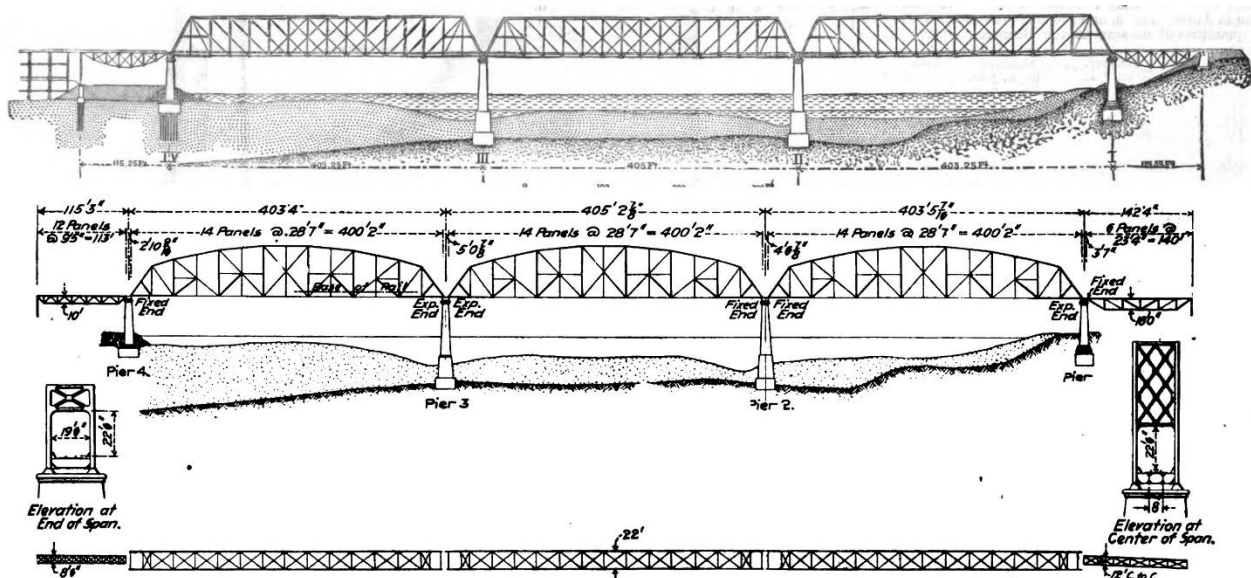


George Morison



Ralph Modjeski

Engineers – The engineer of the first bridge, George Morison (left), and the engineer of the second bridge, Ralph Modjeski (right).



Drawing – Two drawings from engineering periodicals that compare the appearance of the first bridge (top) and the second bridge (bottom).



Original construction – This photo shows the nearly completed construction of the first bridge. Clearly visible under the middle truss span is the unique temporary support system which included temporary timber bents and a Howe truss system spanning between the actual stone piers and the timber bents. Note that on the furthest truss span, a Howe truss was only needed under half the bridge, since the other half was not over the unpredictable Missouri River waters and could instead be supported by traditional timber falsework.