



MEMORIAL BRIDGE 1923-2012



Historic: Memorial Bridge, constructed 1923. Courtesy of John White and Steven Smith, Portsmouth Preservation

The first Memorial Bridge was constructed between 1920 and 1923 and demolished in 2012. It was the second bridge built across the deep and fast tidal waters of Portsmouth Harbor.

The 1923 bridge was the first major vertical lift bridge constructed in the eastern United States. When it was completed it had the longest lift span and highest lift towers in the nation. It was the prototype for many later and longer vertical lift bridges throughout the country and inspired the 2013 lift bridge.

Funded in equal parts by the federal government, Maine, and New Hampshire, the construction of the 1923 bridge was the culmination of a long campaign to replace a dilapidated wood 1822 toll bridge, located upstream. The vertical lift design was selected as the least expensive type of moveable bridge design that could accommodate the large ships that needed to pass upstream of the bridge. The new free bridge provided direct access to the Portsmouth Naval Shipyard (in Kittery, Maine) for New Hampshire workers. It was dedicated on August 17, 1923, as a memorial to those who served in World War I.

A KEY TRANSPORTATION CORRIDOR



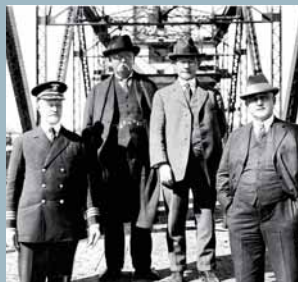
Map showing the Piscataqua River bridges between Portsmouth, NH and Kittery, ME. Map: City of Portsmouth

The opening of the original Memorial Bridge brought the newly created U.S. Route and its interstate traffic through the center of Portsmouth. As Memorial Bridge became a vital Eastern Seaboard transportation link, additional bridges across Portsmouth Harbor became necessary.

Another vertical lift bridge was completed upstream in 1940 as part of the Route 1 Bypass and farthest upstream, the high-level I-95 Piscataqua River Bridge was completed in 1972.

J. A. L. WADDELL AND VERTICAL LIFT BRIDGES

Memorial Bridge was designed by J. A. L. Waddell (1854-1938), the preeminent bridge designer of the era who claimed over 1,000 bridges worldwide to his credit. He was the developer of vertical lift bridges in the



J.A.L. Waddell (second from left) with Capt. Ernest Brownell (U.S. Navy) left, W. H. Norris (State of Maine engineer) third from left and William A. Crover (bridge superintendent) right. Courtesy of William A. Crover

United States and the holder of patents on most aspects of the operation of these bridges. Based on the success of Memorial Bridge and two other contemporary bridges, Waddell's design was adopted for locations throughout the world where spans of greater than 300 feet were required.

BRIDGE PLAQUES

In 1924, bronze plaques and sculptural elements were added to the south portal of the 1923 Memorial Bridge. These included a plaque honoring World War I sailors and soldiers, United States and New Hampshire seals, and an eagle with outstretched wings. They were reinstalled on the 2013 bridge.



Plaques and sculpture in their original location on the south portal of the 1923 Bridge, c. 2003. Photo: Corinne Parsons, NHDOT

Three other plaques formerly located on or adjacent to the original Memorial Bridge have been moved here. The plaque to the left lists the members of committees associated with the construction of the 1923 bridge. To the right are a plaque listing Waddell's vertical lift bridge patents and the bridge manufacturer, and a plaque listing the Portsmouth officials associated with the 1922 construction of the Portsmouth approach to the bridge.

1923 BRIDGE CONSTRUCTION AND OPERATION

The extreme tides and currents of the Piscataqua River made the construction of Memorial Bridge particularly challenging. Contractors for the substructure, Holbrook, Cabot & Rollins, used watertight caissons for the extensive underwater excavation necessary to construct the deep bridge piers.



Launching of caisson for north pier, 1921. Photo: Maine DOT

The American Bridge Company, contractors for the bridge's superstructure, assembled the spans on the Boston & Maine Railroad's Market Street wharf in Portsmouth. When complete, the spans were floated in at slack tide on barges pulled by tugboats. Ninety years later, the trusses for the 2013 Memorial Bridge were moved into place in the same manner to rest on the original 1922 piers.



Floating in the South Span, 1922. Courtesy: Portsmouth Preservation

To permit the passage of tall boats, Memorial Bridge's center lift span rose between its flanking towers. Steel pulleys, or sheaves, at the tops of the towers carried steel cables which connected the ends of the lift span to counterweights that exactly balanced the weight of the span. Electric motors raised and lowered the counterbalanced span using a separate set of cables.



"The New Bridge." Charles Woodbury magazine print, 1925. Courtesy: Portsmouth Maine Sevens

2013 MEMORIAL BRIDGE



2013 Memorial Bridge. Photo: NHDOT

The 2013 Memorial Bridge was designed by Theodore P. Zoli III of HNTB Corporation and constructed by Stephen A. DelGrosso of Archer Western Contractors. Like the 1923 bridge it too introduced important design, engineering, and construction innovations.

It is the first truss bridge built without gusset plates connecting its major members—instead using identical steel sections that are spliced together. It also introduced cold bending of steel to truss bridge construction, a submarine building technique pioneered by the U.S. Navy. Its zinc coating, which provides a longer-lasting protective surface than paint, is also innovative. Finally, the original 1922 granite piers were rehabilitated using new micropile technology.