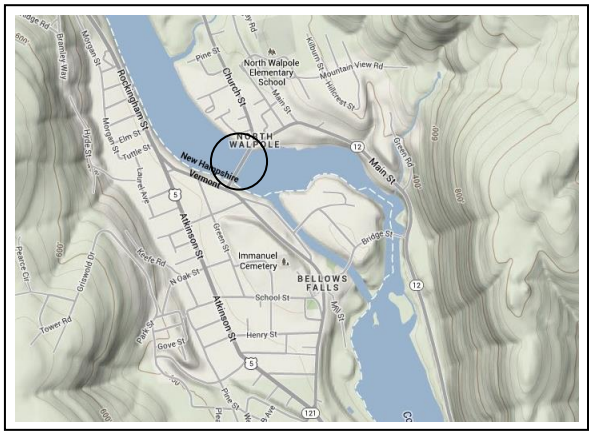
CONNECTICUT RIVER BRIDGE
06 WALPOLE – BELLOWS FALLS **NH Bridge ID:** Walpole 058/053

CARRYING: Church Street
PRESENT NAME: Church Street Bridge
DATE BUILT: 1983
LAT/LONG: 43.138213,-72.448225



CROSSING CHRONOLOGY

1905	Arch Bridge constructed, longest single-span highway bridge in the US
1936	Bridge closed for repair after ice damage
1971	Bridge unsafe, closed to vehicle traffic
1982	Landmark arch bridge demolished, commemorative stone monument erected
1984	Welded steel plate girder bridge completed

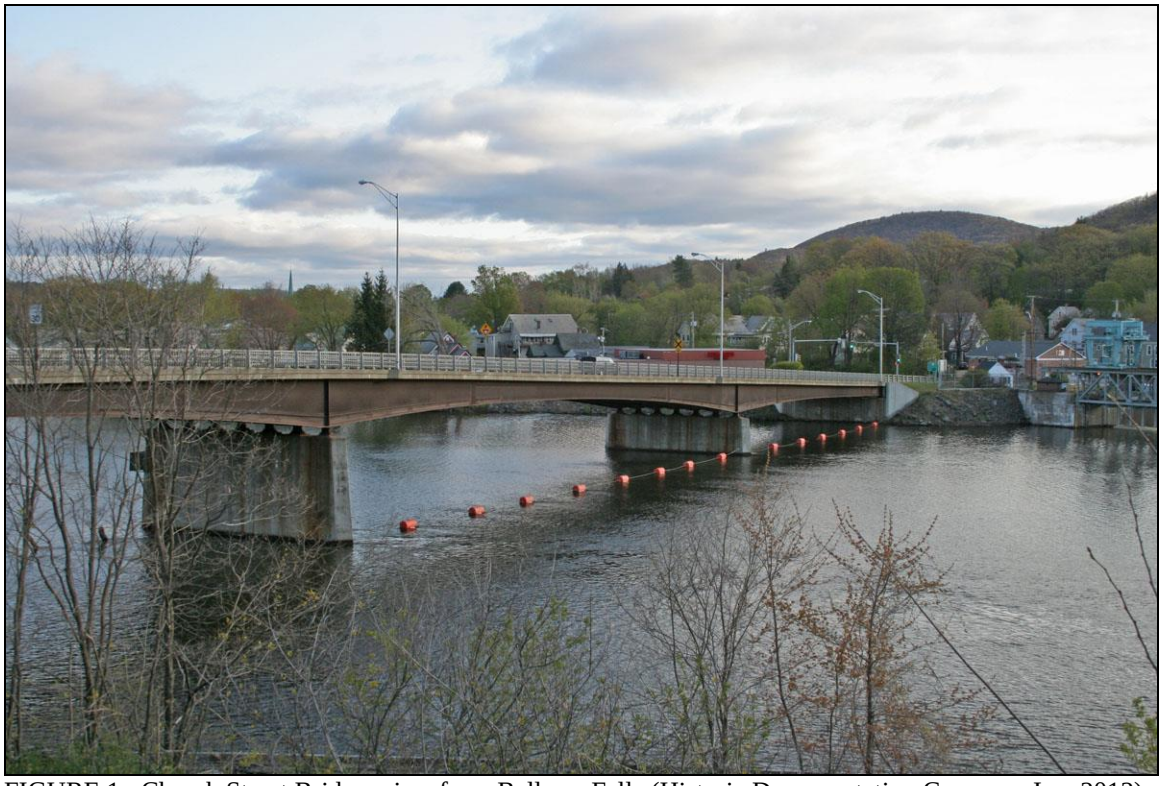


FIGURE 1: Church Street Bridge, view from Bellows Falls (Historic Documentation Company Inc. 2012).

CROSSING HISTORY

First bridge: The Arch Bridge was completed in 1905 as the first bridge at its specific location. This site was a half-mile upstream from an existing bridge location, where a series of bridges had spanned the Connecticut since 1784. The New Hampshire end of this crossing is at the village of North Walpole, a community that had developed from 1872 onward as a residential area for employees of the Boston and Maine Railroad and the Fall Mountain Paper Company, both businesses located on the Vermont side of the river. The working people did not want to pay the toll required at the older or lower bridge and the railroad management feared that the workers' custom of crossing on the railroad bridge represented a persistent safety hazard. Town meetings in Walpole and Rockingham in March 1904 both passed resolutions calling for the erection of a new bridge, and allocated $45,000 ($30,000 from Walpole and $15,000 from Rockingham) for the bridge project. The authorities of the two towns subsequently appointed a bridge committee with five members from each town, and held a competition for engineers to submit designs. The Bellows Falls Canal Company, proprietors of the waterpower canal located just south of the proposed bridge location, came forth and successfully maintained that no bridge abutments should be placed near their canal. An additional factor governing design was that the river was 25 feet deep in this area and the riverbed did not provide a firm footing for a central bridge pier. For these reasons, the bridge crossing the river would have to be a single-span structure. But the many designs proposed for suspension bridges and deck trusses were all too expensive.

Finally, at the recommendation of the Boston & Maine, the committee recruited Boston civil engineer Joseph R. Worcester to devise an inexpensive design. Worcester's final plan for a steel arch structure created a 540-foot three-hinged through arch with a suspended roadway, with a 104-foot auxiliary bridge of bowstring truss design crossing over the Rutland Railroad line on the Vermont bank, giving the overall bridge a length of 644 feet. The major element of the bridge consisted of two steel arches that were formed by trusses with parabolic chords. Forged steel hangers suspended the deck from the arches, supporting the vertical load of the deck and the traffic on the bridge. Lateral bracing provided resistance against horizontal wind stresses. Going further to make a visual impression than was typical, engineer Worcester exerted his creativity to enhance the bridge's aesthetic effect, devising an unconventional design for a three-hinged arch that supplanted the central hinge with a compression joint, with the result that the top and bottom chords of the arches appeared continuous throughout their entire length. As Worcester informed the bridge committee, "Whatever beauty it may possess is due to the fact that construction lines are satisfying to the eye." His plan was unique within the United States; it had no North American precedent, though Worcester was aware that there were then two bridges of this type spanning the Rhine in Germany.

Construction took place during November 1904 to March 1905, with the opening ceremony held on March 20. Joseph A. Ross and Sons of Boston built the concrete abutments for the bridge and erected the timber falsework for the construction project. Louis A. Shoemaker and Company of Philadelphia assembled the prefabricated structural steel sections.

In the great flood of March 1936, the bridge suffered severe damage from ice floes that struck both ends of the structure, bending some of the lower steelwork and knocking the bridge off balance so that it leaned northward. Worcester's design proved its merit in that his horizontal bracing between the arches helped keep the structure from collapse. The bridge was closed and during November-December 1936 repair was conducted. The extensive repairs to the bridge required nearly as much work as the initial construction. The steelwork damaged at either end was not replaced, instead the repair enlarged the size of the abutments to compensate, and hence the length of the span was decreased by 54 feet. In 1961, the town of Rockingham replaced the

bowstring bridge over the tracks with a steel girder bridge. In 1971, consulting engineers recommended to New Hampshire that the major arch bridge be closed to vehicle use due to its deteriorated condition, which recommendation was accepted. The historic bridge, a symbol of innovation in American bridge engineering, remained in pedestrian use until 1982 when it was demolished despite national public protest. The "unsound" bridge required five attempts at explosive demolition to bring it down.

Second bridge: The New Hampshire DOT constructed the replacement bridge during 1983-1984. The bridge, 635 feet long, is a four-span variable-section steel plate girder structure carried on cantilevered abutments and piers of reinforced concrete. The consulting engineer was Hardesty and Hanover, the contractor was Reed & Reed of Woolrich, ME.

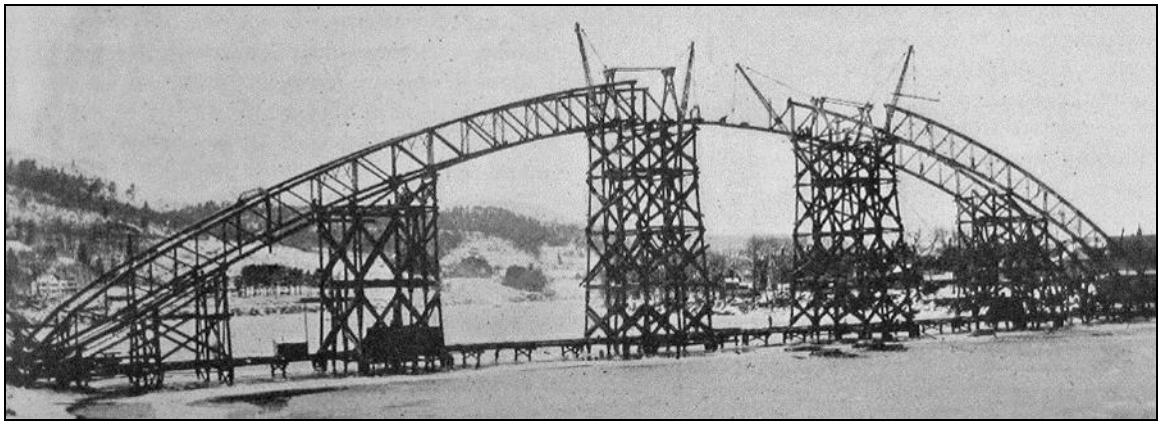


FIGURE 2: Arch Bridge under construction, winter 1904-1905 (*The Engineering Record* 1905).

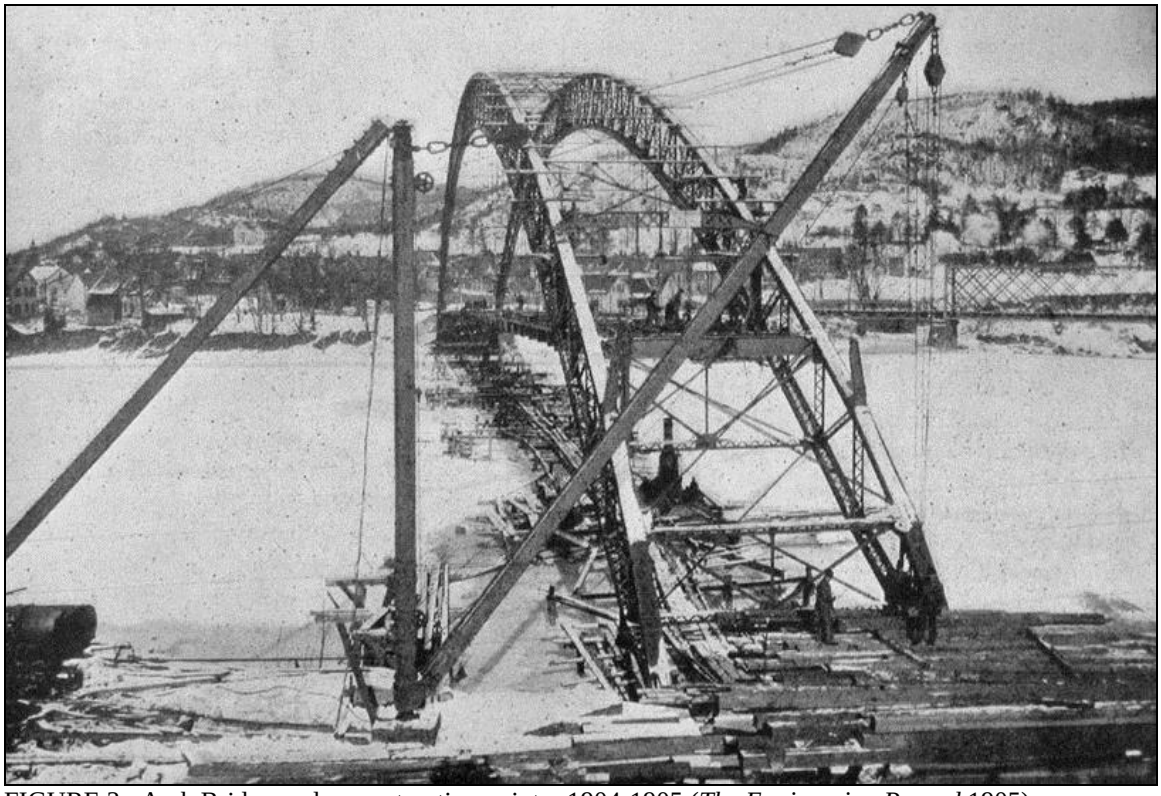


FIGURE 3: Arch Bridge under construction, winter 1904-1905 (*The Engineering Record* 1905).

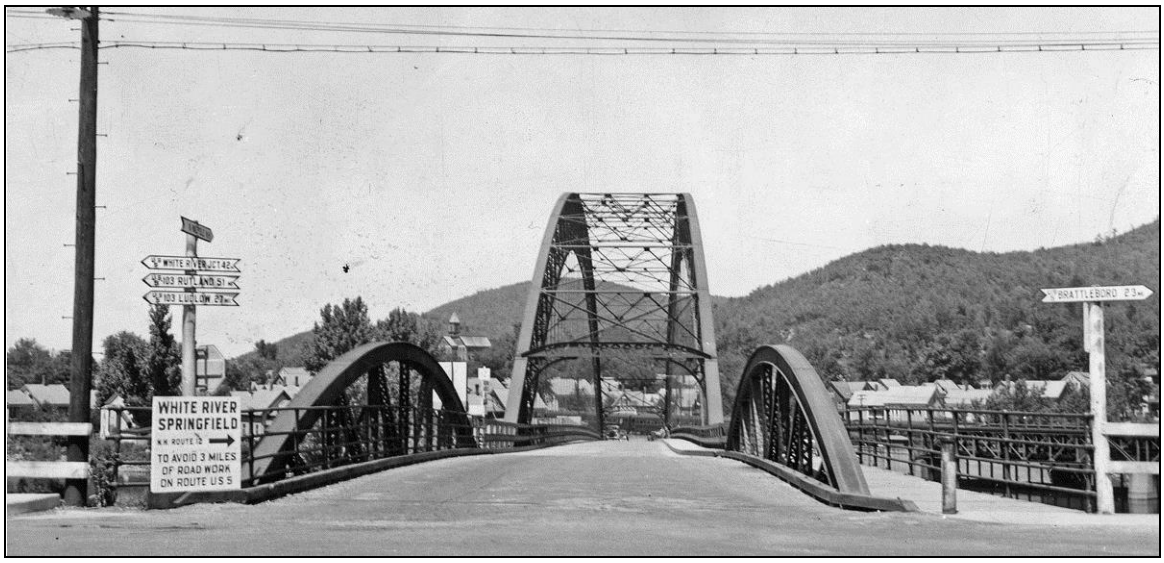


FIGURE 4: Arch Bridge, Bellows Falls end, showing bowstring truss span over the tracks of the former Rutland Railroad (NHDOT 1941).

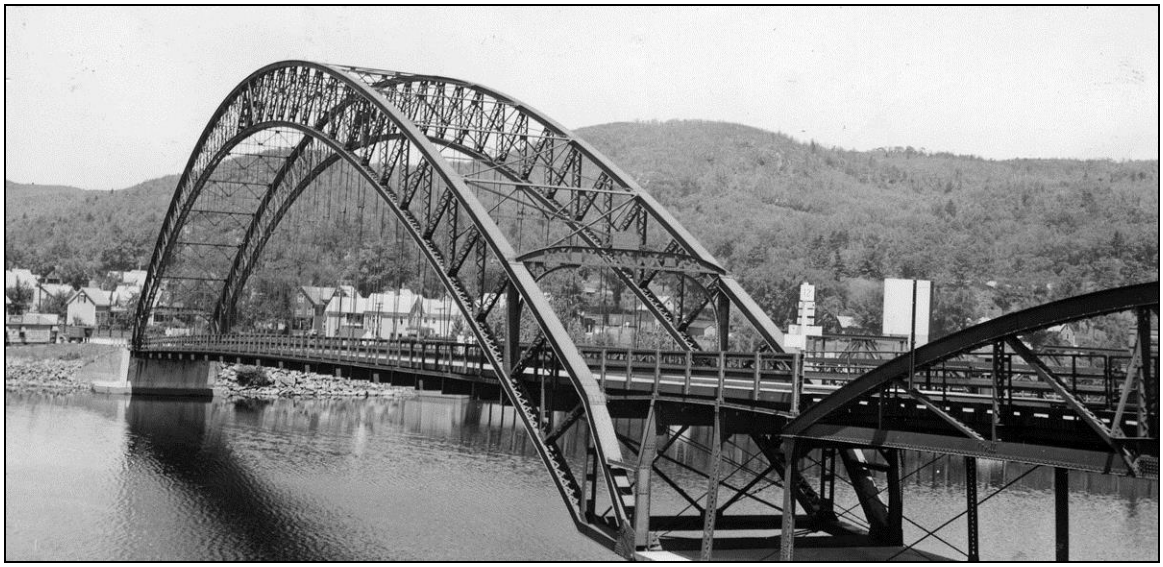


FIGURE 5: Arch Bridge, upstream side from Vermont (NHDOT 1941).

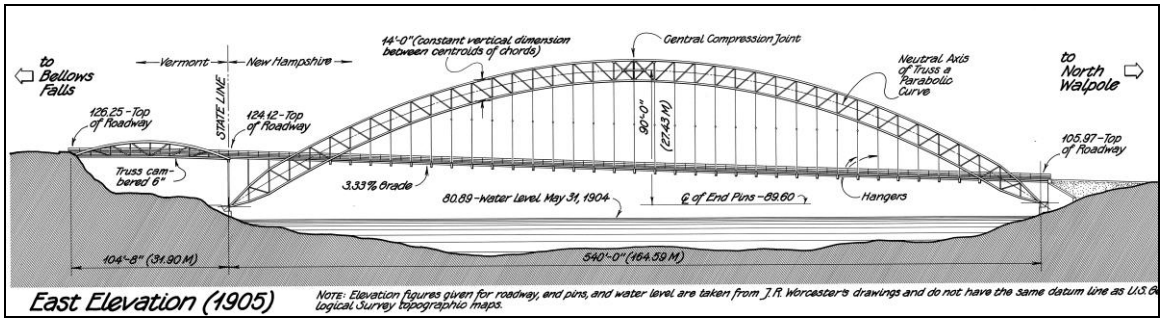


FIGURE 6: Documentation drawing of Bellows Falls Arch Bridge made prior to demolition (HAER 1982).

FIGURE 7: Arch Bridge, downstream side, from Vermont, c.1945, showing bowstring truss approach span (at left), replaced in 1961 with steel stringer span (Cheshire County Historical Society).

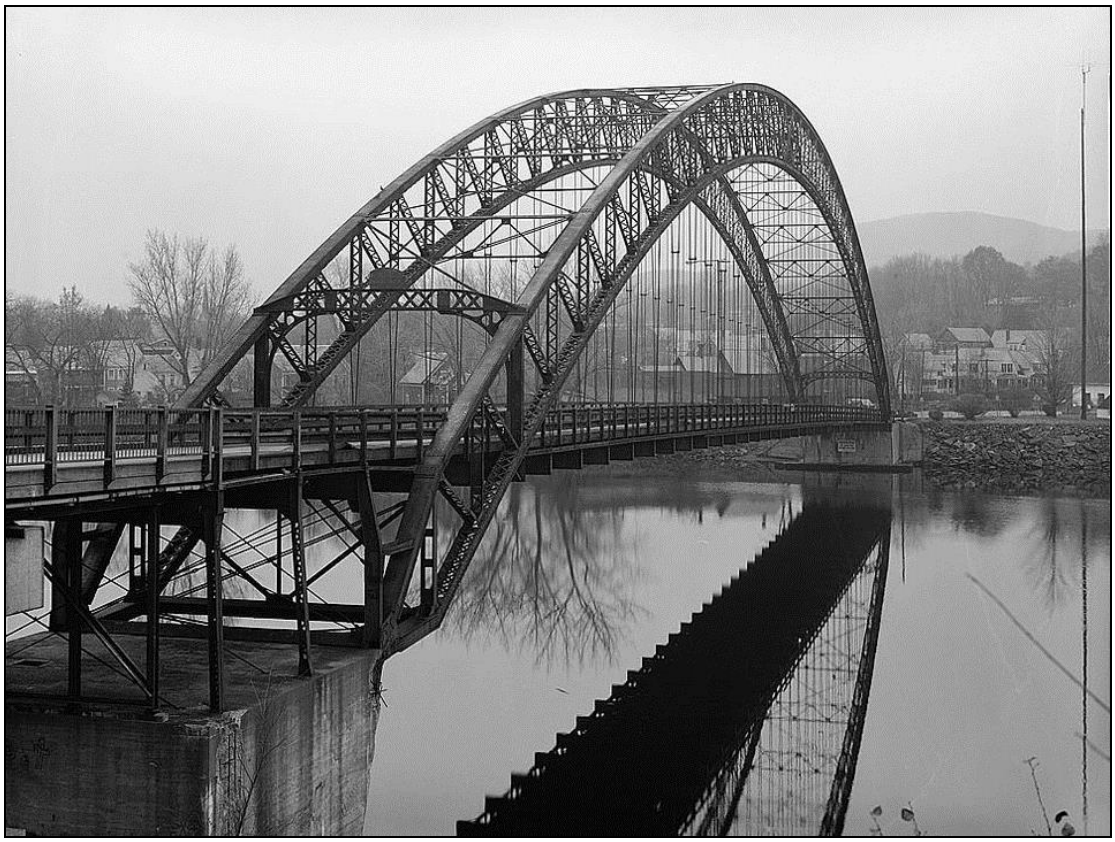


FIGURE 8: Arch Bridge in 1979, downstream side from Vermont. Documentation photograph taken prior to demolition in 1982 (HAER 1982).

FIGURE 9: Commemorative stone monument erected at North Walpole end of bridge; present bridge visible in background (Historic Documentation Company Inc. 2012).

BIBLIOGRAPHY

Bacon, Edwin Monroe. *The Connecticut River and the Valley of the Connecticut: Three Hundred and Fifty Miles from Mountain to Sea.* New York: G.P. Putnam's Sons, 1906.

Cheshire County Historical Society Photograph Collection. Cheshire County Historical Society, Keene, NH.

Engineering News. The Bellows Falls Highway Bridge. April 29, 1905, pp. 538-539.

NHDOT Bridge Cards. Walpole 058/044, 1941; Walpole 058/043, 1984. On file at NHDOT, Concord.

Historic American Engineering Record (HAER): *Bellows Falls Arch Bridge*, North Walpole, NH. 1982. See Library of Congress: http://www.loc.gov/pictures/collection/hh/item/nh0001/

Report of the Bridge Commissioners of the State of New Hampshire. Manchester: State of New Hampshire, 1906.

Rights, Lewis D. Erection of the Bellows Falls Arch Bridge. *Transactions of the American Society of Civil Engineers*, Paper No. 1083. March 1908.

The Engineering Record. Erection of the Bellows Falls Arch Bridge. April 29, 1905, pp. 480-481.

Worcester, Joseph R. Bellows Falls Arch Bridge. *Journal of the Association of Engineering Societies.* May 1910.