Whipple's 1841 Bowstring Truss – World's First Scientifically Designed Truss Bridge

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ABSTRACT: The Whipple Bowstring Truss bridge (patented in 1841), was the first bridge truss design in the world that used scientific principles, by Squire Whipple, who published them in the 1847 book: A Work on Bridge Building. Designed for the Enlarged Erie Canal in New York State (1836-1862), hundreds of Whipple Bowstring Truss bridges were built for the canal and other waterways. One such bridge was the Shaw Bridge, built in 1870, for the New York City to Albany Post Road over the Claverack Creek, in the idyllic Hudson Valley. This bridge is one of only eight of the vintage Whipple Bowstring Truss bridges left, the lone one in its original location and the only double span. It clearly exemplifies the robust original design, including the use of cast iron for compression members, wrought iron for tension members, and a wooden deck that could be replaced without affecting the strength of the bridge. Since the Shaw Bridge is uniquely in its original location, it also has its original masonry abutments (and pier). Despite being used for 120 years and closed for over 25 years, the bridge is in remarkably good condition, which speaks well for its original design and materials (19th century cast and wrought iron being more rust resistant than most modern steel). Whipple's importance cannot be overstated. Besides clearly documenting theoretical principles for bridge design for the first time, he promoted the use of prefabricated components, life-cycle costing, and was important for the Enlarged Erie Canal and early railway industry, helping make New York City become a world leader. The bridge is clearly eligible for Historic Civil Engineering Landmark status and this paper argues it is a World Heritage Bridge candidate. The meticulous restoration of the Shaw Bridge to its original specifications will be a fitting tribute to the genius of Squire Whipple.

1 INTRODUCTION

In a quiet picturesque area of Columbia County, in the renowned Hudson Valley of New York State, there is a charming double-span iron bowstring truss bridge over a scenic trout stream – the Claverack Creek. Currently it is neglected and closed, but this bridge, the Shaw Bridge, was designed by the famous 19th century engineer, Squire Whipple, and was once an important bridge on the main Post Road that connected America's financial centre (New York City) to New York State's capital (Albany). This paper tells the story of the world-renowned Shaw Bridge and the modest gentleman who designed it.

2 SQUIRE WHIPPLE – THE GENIUS BEHIND THE DESIGN OF THE SHAW BRIDGE

2.1 *Young Squire Whipple's Inspirations, Education, and Training (1804-1839)*

Squire Whipple was born in Massachusetts in 1804, the ninth son of a farmer and mill owner. The young Whipple was exposed to the latest construction techniques and materials and methods used to power mills of all kinds. When he was 13, his family moved to a farm in New York State. Whipple was a voracious reader who had a passion for learning but little or no interest in farming. He was a good student and at an early age became a schoolteacher at the local one-room schoolhouse. He became a vegetarian and would not use horses or oxen as beasts of burden. Fortunately, his father had developed another water-powered mill that kept Squire occupied and gave him the skills of a carpenter, tinsmith, blacksmith, and jointer. He experimented with electricity, played the violin every day, and attended nearby Hartwick Seminary and Fairfield Academy for several terms in the mid 1820s. In 1828 he studied law in a local lawyer's office while also working on his father's mills.

After receiving the best common school education available, in 1830 he graduated from Union College in Schenectady, New York after one year of study. He spent the decade of the 1830s working on various railroads and the Erie Canal enlargement. When work was slow, he designed, built, and sold mathematical instruments such as transits and engineer's levels and drafting equipment (Griggs 1988, 2002, 2005, 2015).

2.2 *Mature Squire Whipple's Productive Years (1840-1860)*

In 1841, Whipple designed and built a weigh lock scale with a capacity of 300 tons to weigh the enlarged canal boats in Utica, New York, which was adopted elsewhere. This was the largest weighing device in the country at the time.

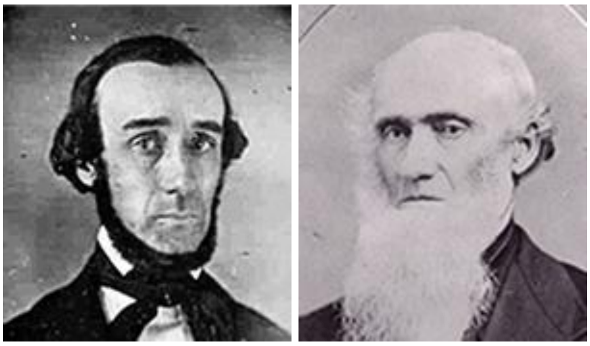

Figure 1 Squire Whipple (a) Young (b) Senior

Whipple became interested in the design and construction of bridges. He knew that wooden bridges on the original Erie Canal had a short life and the new, wider canal would require longer span bridges. So he devised methods to study bridge designs using various materials including iron. These investigations led to his design of the elegant bowstring truss that used cast iron for compression members, wrought iron for tension members, and a wooden deck that could be replaced without affecting the strength of the bridge. He applied for and was issued a patent, April 24, 1841. See Figure 2.

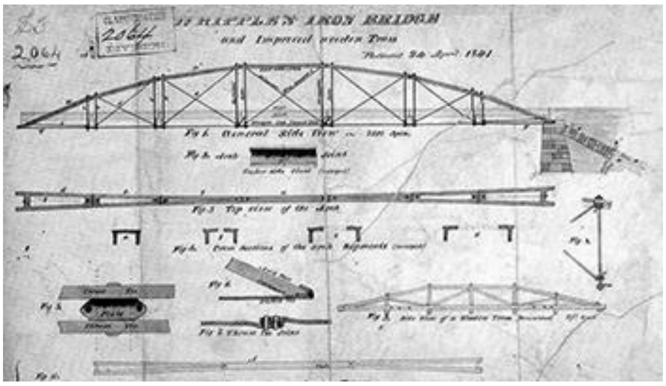

Figure 2. Whipple's Patent Drawings 1841

Whipple tried to convince the Canal Commissioners that a bridge built of iron was a good long-term investment (thus becoming a pioneering advocate of life-cycle costing), but they were reluctant to trust a new material for their bridges. To illustrate the stability and strength of his bridge, Whipple had one built at his own expense on a vacant lot in Utica, New York near the offices of the Canal commissioners, and when the wooden First Street Bridge in Utica fell, they finally approved the construction of his bridge. Between 1842 and 1870, hundreds of Whipple Bridges were built over the Erie and its branch canals, either by Whipple or to his patent, as his design was eventually adopted by the Canal Commissioners as the standard bridge to cross the canals of the state. See Figure 3 for an example.

Figure 3. Lithograph of Whipple's Bowstring Bridge in Syracuse NY, one of hundreds built over the Enlarged Erie Canal.

Others (like the Shaw Bridge) were built over waterways in the United States and one was even built in Japan (devised by Socichirro Matsumoto a Japanese 1876 graduate of Rensselaer Polytechnic Institute in Troy, New York). Frequently, contractors would build to his patent without paying patent fees, so he never received large sums of money from builders using his patent (Griggs 1988, 2002, 2005, 2015).

Whipple wanted to share his discoveries with the world and to bring credibility and respect to bridge building, so in 1846 he wrote *An Essay on Bridge Building: containing analyses and comparison of the principal plans in use with investigations as to the best plans and proportions and the relative merits of wood and iron for bridges*. It included an analysis of the bowstring truss and other bridges, including the trapezoidal form. Whipple's decision to write this essay was probably based on his intention to show that his bowstring truss was the best form available in terms of efficient use of material but he found instead "each of the three forms – the arch, and the trapezoidal with and without verticals, possessed certain practical advantages entitling each to preference in respective cases". The 47-page essay marked the beginning of analytical truss design, and the following year it was made part of his 1847 seminal book *A Work On Bridge Building*: *consisting of two essays, the one elementary and general, the other giving original plans and practical details for iron and wooden bridges* (Whipple 1847). For the first time anywhere in the world, this book presented the correct methods of analyzing and designing a truss using the properties of the latest appropriate materials. His technique, now known as the method of joints, is still the way that truss analysis is taught. He used both trigonometry and geometrical construction – the force polygon method – to find his member forces.

Between 1848 and 1850 Whipple designed and built several short span iron bridges for the New York and Erie Railroad. Though successful these bridges were removed after another iron bridge (not of Whipple's design) collapsed in 1850. Undaunted, in 1852-53 Whipple went on to design and build the first successful long span trapezoidal railroad bridges in West Troy and Utica, NY. This double intersection design was the most common railroad truss bridge until the 1890s, being built over western rivers with spans over 150 m (Griggs 1988, 2002, 2005, 2015).

2.3 *Senior Squire Whipple Continues to Make Major Contributions (1861-1888)*

About 1860 Whipple turned his business over to his nephew J. M. Whipple but took on a few jobs including designing and building trapezoidal bridges, swing bridges, and lift bridges. In December 1872, he designed and patented the first vertical lift bridge in the United States and built one over the Erie Canal in Utica.

Whipple continued to update and expand his first book with an Appendix in 1869 and wrote a more formal book on bridge building (first printed in 1872 then reprinted until 1899): *An Elementary and Practical Treatise on Bridge Building, An Enlarged and Improved Edition of the Author's Original Work.* (Whipple 1872). He contributed several articles to American Society of Civil Engineers (ASCE) Journals, and was the first person, after the post-Civil War rebirth of ASCE, to be named an Honorary Member of the Society in 1868.

Whipple died on March 15, 1888 at the age of 84 and was buried in the Albany Rural Cemetery leaving his widow Anna and no children. His obituary in *Engineering News* noted "The death of Squire Whipple… removes from the engineering world a man who by his individuality and originality practically created the modern art of bridge construction; not only in substituting iron for wood in bridges but in also pointing out the law governing the distribution of strain in framed structures and the proper proportioning of the various members in such structures".

3 THE IMPORTANT, CHARMING, AND NEGLECTED SHAW BRIDGE

3.1 *The Shaw Bridge, Built along a Main Highway, is Named, and Photographed (1870-1930)*

The vital Albany to New York Post Road changed paths over its 300-year history but by 1870 it crossed the Claverack Creek via a double-span bowstring truss bridge later named the Shaw Bridge. The bridge builder (J. D. Hutchinson) and construction date (1870) are clearly established by the inscription embossed along the top of each of the four cast iron trusses, see Figure 4. John D. Hutchinson (1842-1897) and his father John S. Hutchinson (1814-1870) built more than 50 bridges using the patented Whipple design but defaulted on paying fees to Whipple (after a small down payment), resulting in lengthy court cases that were settled with a paltry sum paid by New York State.

Figure 4. Shaw Bridge inscription: "J. D. HUTCHINSON, BUILDER TROY, N.Y 1870"

Figure 5. Postcard of the Shaw Bridge south portal, looking north

Traditionally, local bridges were named after the owner of the nearest farm. In 1879, William Shaw, having made a fortune from his import-export business in Brooklyn, New York, purchased the farm next to the bridge, and the bridge became known as the "Shaw Bridge".

Later, the bridge was photographed, featured on a postcard with caption: "Bridge at Claverack, near Hudson, NY", and widely distributed, see Figure 5. The back of the postcard has the Trade Mark Litho-Chrome, Germany, which dates the postcard to the period 1906-1909, so the photograph for the postcard was taken when the bridge was essentially in original condition. Note that the wooden deck reaches through the trusses. This is consistent with "New York State Canals –1871 – Specification of the Manor of Constructing Whipple's Patent Iron Arch Truss Bridge Superstructure" (reproduced in Allen 1973). The postcard and official Specification are the fundamental documents that will be used to carefully restore the Shaw Bridge to its original condition.

3.2 *The Shaw Bridge is Bypassed, Repaired, Celebrated, and Finally Closed (1931-1989)*

"When the present State Route 9H was constructed in 1931, this remnant of the Old Post Road…became a little used road belonging to the Town of Claverack…However, when the hurricane of September 21, 1938, struck, the Shaw Bridge was one of the few in all Columbia County that was passable". In 1956 the bridge was condemned then repaired and reopened. Ten years later (1966), measured drawings of the deck provided an accurate list of materials to replace the wood stringers and deck, the last time they were replaced. On September 6, 1980, a ceremony celebrated the Shaw Bridge's listing on the National Register of Historic Places. This event included speeches emphasizing the historical importance of the bridge and a parade across the bridge led by a horse-drawn buckboard, followed by 1922 Essex Speedster, 1923 Studebaker, 1924 Ford, 1922 White truck, 1929 Ford truck, and 1930 Ford truck. However, despite significant support, by June 1989 the bridge was closed to motorized vehicle traffic because of "structural deficiencies".

3.3 *Attempts to Open the Shaw Bridge are Initially Unsuccessful but Finally Begin to Succeed (1990-Present)*

During 1990, various newspaper articles reported that the Town of Claverack was seeking funds to repair the Shaw Bridge. Cost of the restoration could be as much as $330,000. Meetings were attended by Van Wyck Lane residents interested in seeing the bridge preserved. One neighbor suggested the span be rehabilitated and reopened only to pedestrian traffic in order to preserve "the tranquil character of our neighborhood". By August 1990 it was announced that the state would grant $146,650 for half the cost of repairs. However, the town and county failed to come to an agreement on matching the state grant and the grant expired. Meanwhile, in the summer of 1994, Jet Lowe, the famous Historic American Engineering Record (HAER) photographer, photographed the Shaw Bridge. However, in November 1995, the county engineer stated there are "no plans to re-open Van Wyck Lane over the Claverack Creek at this time". Thirteen years later, Wikipedia recorded how the famous bridge had become overgrown with vines and weeds. In 2010, several photos by Rick Ehrenberg (see Figure 6) conveyed the deplorable state of this important bridge to the Claverack Town Supervisor, stating "As the only known Whipple twin-span bowstring in the world, it would be a shame – no, crime, really – to NOT properly restore this bridge. It is a living piece of history, from a time when America's technical, engineering, and manufacturing prowess were just starting to bloom – and Squire Whipple was at the forefront".

Figure 6. Shaw Bridge. Photo by Rick Ehrenberg 2010

This led, in 2011, to clearing of the vegetation from the bridge by the Town Highway crew and photo documentation of the bridge by HistoricBridges.org, culminating in a proposal to the Preservation League to fund a Historic Structure Report, which, alas, was rejected. A second (this time successful) proposal was sent to the Preservation League in 2012, which resulted in the development of reports by engineering consultants Ryan-Biggs Associates and coauthor of this paper, Dr. Francis Griggs Jr. These reports were then used to prepare a New York State Consolidated Funding Application (CFA) to restore the bridge in 2014. Unfortunately, the 2014 application was rejected. In 2016 a revised application was submitted and this time it was successful. With CFA money ($170,000) now available, it is expected that matching money, material and in-kind services will finally result in the initiation of the restoration of the Shaw Bridge.

4. DESCRIPTION OF THE CURRENT STATE OF THE SHAW BRIDGE

4.1 *Overview*

Whipple had a fondness for the first bridge he designed – the bowstring truss. He wrote: “The arched truss, moreover, may, by some, be thought to have a more graceful and agreeable appearance than the cancelled truss. I will not take upon myself to decide on this point, except by remarking, that, to a person who comprehends the principles and properties of different kinds of structures, in a case where strength is the grand desideratum, that plan of structure which secures this in the greatest degree, with the least amount of material and expense, will generally excite the most pleasing sensations in the mind” (Whipple 1847). The charming Shaw Bridge closely follows the bowstring truss design patented by Squire Whipple. Despite being neglected for so long, the bridge is in remarkably good condition, which speaks well for its original design and materials (19th century cast and wrought iron being more rust resistant than most modern steel).

The two-span, single-lane bridge has an overall length of about 50 m and a roadway width of about 3.2 m. Each of the identical pony trusses spans 25.4 m over the Claverack Creek. The bridge is currently closed to both vehicular traffic and pedestrians.

Wrought iron or steel floorbeams (additional testing would be required to determine if they are wrought iron or steel) are 23 cm deep and span about 4 m between the centerline of the trusses. The floorbeams support wood stringers, which are spaced at about 0.5 m on center and support a 6.4 cm thick wood deck. The trusses and the ends of the wood stringers are supported on stone masonry abutments and on a single stone masonry pier between the southern and northern span. Claverack Creek at normal water levels flows entirely under the southern span of the bridge.

4.2 *Condition of Cast Iron Top Chords & Junction Blocks*

Top chords are in excellent condition. The joints between segments are generally full bearing. Evidently in the past it was thought the segments were shifting with respect to one another and three retainer plates were added (on the east and west trusses of the south span and the west truss of the north span). It would be preferable to remove the retained plates in the rehabilitation of the spans. A small hairline crack was observed on the east truss of the south span where someone had attached a railing bracket and connected a steel bar across the crack. This is not a serious structural problem but it would be desirable to repair the crack in a less obvious way. Where non-historic railings have been welded or dowelled to the cast iron between the two spans, these will be removed and the holes repaired. The largest unknown is the condition of the ends of the chords that have been encased in concrete at the abutments and pier. It is unlikely that the cast iron has been damaged by the encasing (but the lower wrought iron chords could be, see below), but, in any case, all the top chords will be examined after the concrete is removed.

Junction blocks appear to be in a solid, uncracked, condition.

4.3 *Condition of Wrought Iron Lower Chord Loops, Vertical Rods, & Diagonal Rods*

Lower chord loops appear to be in good condition and in full contact with the cast iron junction blocks as there were no observed loose members. The largest unknown is, again, at the ends where they have been encased with concrete and where they enter the top chord casting. This area will be investigated closely when the concrete is removed and when the structure is cleaned and any cake or pack rust is removed.

Vertical rods appear to be in good condition except in areas where they have been bent, probably from some vehicle crossing the bridge. In other Whipple Bridges there has been some necking from corrosion where the vertical rods pass into the cast iron junction blocks. All of these areas will be reexamined after the structure is cleaned and any cake or pack rust is removed.

Diagonal rods are in good condition except, in a few cases, where they are severed or bent. Many of the diagonals are loose and will need to be tightened. As with the verticals, necking down of the section can occur where the diagonals enter the cast iron junction blocks, so it is probable that some of the ends of these elements may have to be replaced. All of these areas will be reexamined after the structure is cleaned and any cake or pack rust removed.

4.4 *Condition of Metal Beams, Metal Diagonal Cross Bracings, Wood Stringers, and Wood Deck*

Beams appear to be in fairly good condition. Some rusting on the top flanges is apparent. It is believed that after cleaning they will be reusable.

Diagonal cross bracings are in good condition. The turnbuckles will have to be cleaned and restored to operating condition.

Wood stringers and decking must all be replaced. The non-original deck structure (designed to be replaced) was last installed in 1966. The new deck will more accurately reproduce the original, referencing the circa 1900 Postcard and the New York State Canals – 1871 – Specification (Allen 1973).

5. TREATMENT RECOMMENDATIONS

5.1 *Historic Preservation Objectives*

The U.S. National Parks, Secretary of the Interior, Standards for the Treatment of Historic Properties will be followed (Weeks & Grimmer 1995). These common sense historic preservation principles are intended to promote historic preservation best practices that help to protect irreplaceable cultural resources. The four treatment approaches of the Standards are: Preservation, Rehabilitation, Restoration, and Reconstruction. The treatment for the Shaw Bridge will follow the Restoration approach, which focuses on the retention of materials from the most significant time in the bridge's history (circa 1870 to 1900), while permitting the removal of materials from other periods (like guardrails, non-original wooden deck and stringers).

5. 2 *Standards for Restoration of Historic Properties*

A property will be used as it was historically or be given a new use which reflects the property's restoration period.

Materials and features from the restoration period will be retained and preserved. The removal of materials or alteration of features, spaces, and spatial relationships that characterize the period will not be undertaken.

Each property will be recognized as a physical record of its time, place, and use. Work needed to stabilize, consolidate and conserve materials and features from the restoration period will be physically and visually compatible, identifiable upon close inspection, and properly documented for future research.

Materials, features, spaces, and finishes that characterize other historical periods will be documented prior to their alteration or removal.

Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize the restoration period will be preserved.

Deteriorated features from the restoration period will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials.

Replacement of missing features from the restoration period will be substantiated by documentary and physical evidence. A false sense of history will not be created by adding conjectural features, features from other properties, or by combining features that never existed together historically.

Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

Archeological resources affected by a project will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

Designs that were never executed historically will not be constructed (Weeks & Grimmer 1995).

5.3 *Rationale for Using Standards for Restoration of the Shaw Bridge*

Restoration is warranted because the Shaw Bridge is a nationally significant resource – a rare survivor of the revolutionary design by engineering genius Squire Whipple – and it was constructed during a period when the road it carried was the most important main highway between New York City and New York State's capital, Albany. The Shaw Bridge's historical importance was recognized in 1980 when it was listed on the National Register and, it is generally agreed, it is eligible for Historic Civil Engineering Landmark status and possibly a potential World Heritage Bridge (see Section 6). Other considerations for the Restoration choice are the remarkably good physical conditions of the bridge with excellent original material that is largely intact with few alterations to the historical structure. The proposed pedestrian, bicycle, (and occasional horses and horse-drawn vehicles) use is also consistent with the original use before automobiles. Other sensitive issues are code requirements that need to be taken into consideration, but if hastily or poorly designed, code-required actions may jeopardize the bridge's materials as well as its historic character. For the Shaw Bridge, expensive abatement of lead paint requires particular care if important historic finishes are not to be adversely affected. One of the first investigations will be to assess how much of the iron is covered by actual lead paint and explore alternatives to paint removal, especially in the unlikely event that the paint does not contain lead. Finally, the need to meet accessibility requirements (like handrails) under the Americans with Disabilities Act of 1990 will be designed to minimize material loss and visual change to the historic bridge (Weeks & Grimmer 1995).

5.4 *Work Recommendations*

The project will be guided by recommendations from the Historic Structure Report outlined in the New York State Proposal to restore the Shaw Bridge and overseen by New York Office of Parks, Recreation and Historic Preservation using the following tasks:

Task 1: Supervise & Administer the Project
Task 2: Re-Point Stone Masonry Abutments & Pier
Task 3: Remove Concrete Encasements At Truss Bearing, Highway Railing, Wood Stringers, & Decking & Replace With Temporary Planking
Task 4: Remove & Dispose Of Lead Paint & Rust
Task 5: Repair & Paint All Metal Truss Members & Beams
Task 6: Fill Pier Scour Hole & Protect With Stone
Task 7: Replace Wood Stringers & Deck

6. DISCUSSION & CONCLUSION THAT THE SHAW BRIDGE IS A POTENTIAL WORLD HERITAGE BRIDGE

The first Whipple Bowstring Truss bridge was designed, built, and patented by New York State engineering genius Squire Whipple in 1841, using scientifically based mathematical principles. In 1846-7 Whipple put these ideas into print in the book A Work on Bridge Building, the first time in the world that a scientific work correctly analyzed the stresses in a truss. Whipple is recognized as the father of iron-bridge building in America and has had a profound influence on the history of American civil engineering. The majority of the hundreds of Whipple Bowstring Truss bridges that were built were along the Enlarged Erie Canal, opening up the west and playing a key role in the rising dominance of New York City as America's most important city. They were essential to the success of the Erie Canal since they reconnected cities, villages, hamlets, and farm fields that grew up around the canal without impeding canal traffic. Similarly, the well-placed double-span Shaw Bridge (that extended over a wide part of the Claverack Creek) on the Albany New York Post Road provided a vital link, especially during winter months when the Hudson River was frozen and during periods of flooding when other bridges were closed.

Of the hundreds of original Whipple Bowstring Truss bridges built, only eight* are known to survive. Six are in New York State (Shaw Bridge, Black River Canal Bridge, Ehrmentraut Farm Bridge, Normanskill Farm Bridge, Union College Bridge, and Vischer Ferry Bridge); one is in Ohio (Rodrick Bridge); and one is in Japan (Hachiman Bridge). Coauthor Francis Griggs Jr. has been involved in the restoration of three of the eight historical Whipple bowstring truss bridges: Black River Canal (2001), Union College (1980), and Vischer's Ferry (1997).

* Note: Four completely new (2008-2015) Whipple Bowstring Truss bridges were built in Buffalo, New York, at the cost of millions of dollars. However, these bridges were factory-made and assembled differently than the way Whipple designed them, so cannot be considered true historical bridges. The bridges are major tourist attractions on the Buffalo waterfront, which has the stylized Whipple Bridge logo:

CANALSIDE

Of the eight historical Whipple bowstring truss bridges, the Shaw Bridge is the best example of this world-famous bridge: it is the only double-span Whipple Bowstring Truss left and the only one in its original location with all the original metal structure, stone abutments, and stone pier virtually intact. Only the badly rotted wooden stringers and deck (replaceable by design) are not original. The wooden stringers and deck will be reconstructed according to the circa 1900 color postcard photo and the New York State Canals – 1871 – Specifications. As such, the restored Shaw Bridge has the potential to become a world-class bridge.

To be included on the World Heritage List, sites must be of outstanding universal value and meet at least one out of ten selection criteria (see http://whc.unesco.org/en/criteria/ for the complete criteria list). The Shaw Bridge satisfies the following four selection criteria: (i) To represent a masterpiece of human creative genius; (ii) To exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in… technology; (iv) To be an outstanding example of a type of … technological ensemble which illustrates a significant stage in human history; and (vi) To be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (preferably used in conjunction with other criteria) … The protection, management, authenticity and integrity of properties are also important considerations.

The status of the Shaw Bridge as a world-class historic bridge is confirmed by three publications that follow.

First, before the Shaw Bridge closed, it was included in the book Great American Bridges and Dams by Donald L. Jackson with a foreword by renowned historian David McCullough (Jackson 1998). Several New York City bridges were in this book, including world famous 1883 Brooklyn Bridge, 1917 Hell Gate Bridge, and 1931 George Washington Bridge. Upstate New York was represented by three bridges: 1870 Shaw Bridge, 1855 Blenheim Covered Bridge (destroyed by the 2011 tropical storm Irene), and 1927 Peace Bridge (Buffalo).

Second, in an important article (DeLony 1996) "Context for World Heritage Bridges", Eric DeLony (former chief of the National Park Service, Historic American Engineering Record), listed five potential world heritage bridges for New York State: 1860 Central Park Cast-Iron Arches, 1867 Normanskill Whipple Bowstring Truss Bridge, 1883 Brooklyn Bridge, 1886 Poughkeepsie Cantilever Bridge, and 1917 Hell Gate Bridge. The reason for DeLony's choice of the Normanskill Bridge over the Shaw Bridge may have been the extensive documentation of the Normanskill Bridge by HAER in 1969 (Allen 1973), unlike the Shaw Bridge, which was not known at the time of the 1969 study. (Although DeLony would have been aware, in 1996, of Jet Lowe's 1994 photographs of the Shaw Bridge). As noted above, the Shaw Bridge is in its original location. But DeLony appears to contradict himself and make a special exception for the Normanskill bridge (which has been moved twice to the current location and does not have its original abutments) when he states: "A World Heritage bridge, like other properties, must meet the test of authenticity in design, materials, workmanship, or setting". The relocation of the Normanskill bridge from its original location and foundations negatively impacts the authenticity of its setting. The setting of the Shaw Bridge, still standing on its original abutments and pier, along the once vital Albany Post Road over the bucolic Claverack Creek, has a much greater authentic setting than the relocated Normanskill farm bridge. Besides, the Shaw Bridge has two spans while the Normanskill Bridge has only one.

Third, in the oversize book of photos: Bridges, A history of the world's most famous and important spans by Judith Dupré, with an introductory interview by celebrated architect Frank O. Gehry (Dupré, 1997) only four New York State bridges are photographed and listed: Brooklyn Bridge, Hell Gate Bridge, George Washington Bridge, and Albany (Normanskill) Whipple Bowstring Truss Bridge. Again, the Normanskill Bridge was probably chosen because of the extensive HAER documentation conducted in 1969, but the Shaw Bridge, when restored, has a much greater claim to fame than the Normanskill Bridge.

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