

**RESTORATION  
OF THE  
SUPREMELY IMPORTANT  
AND  
CHARMING  
SHAW BRIDGE**

**DR. IAN NITSCHKE  
CLAVERACK NY  
USA**

**lan.Nitschke@mac.com**

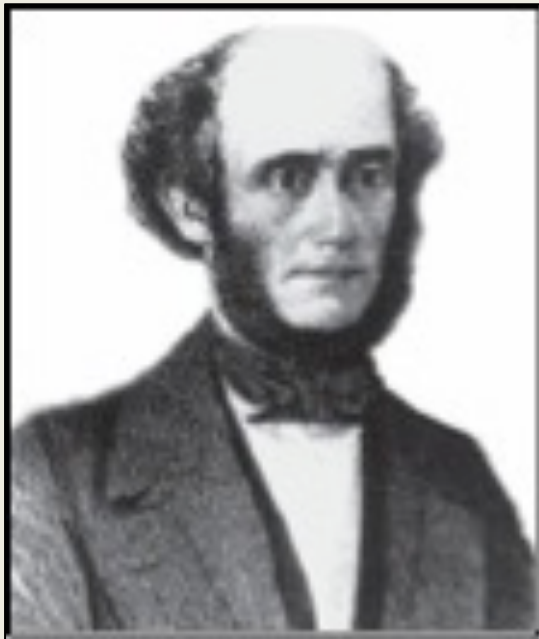
**DR. FRANCIS GRIGGS  
REXFORD NY  
USA**

**fgriggsjr@verizon.net**

# SQUIRE WHIPPLE

The Genius Who Designed the Shaw Bridge

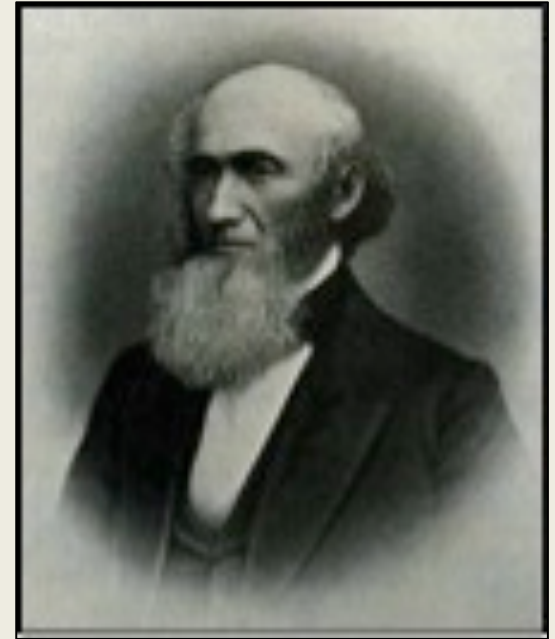
Young



Mature



Senior



# YOUNG SQUIRE WHIPPLE

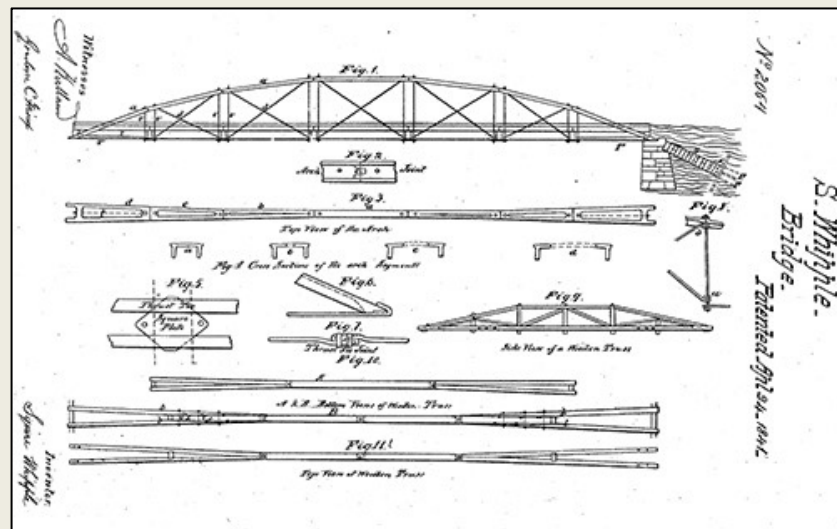
(1804-1839)

- Born in Massachusetts 9th son of farmer and mill owner, moved to New York State at 13
- Work on father's mill provided skills of carpenter, tinsmith, blacksmith, joiner
- Played the violin and was a vegetarian – would not use animals as beasts of burden
- Voracious reader, good student, studied law, graduated from Union College 1830
- Worked on railways and Erie Canal
- Designed and built mathematical instruments

# MATURE SQUIRE WHIPPLE

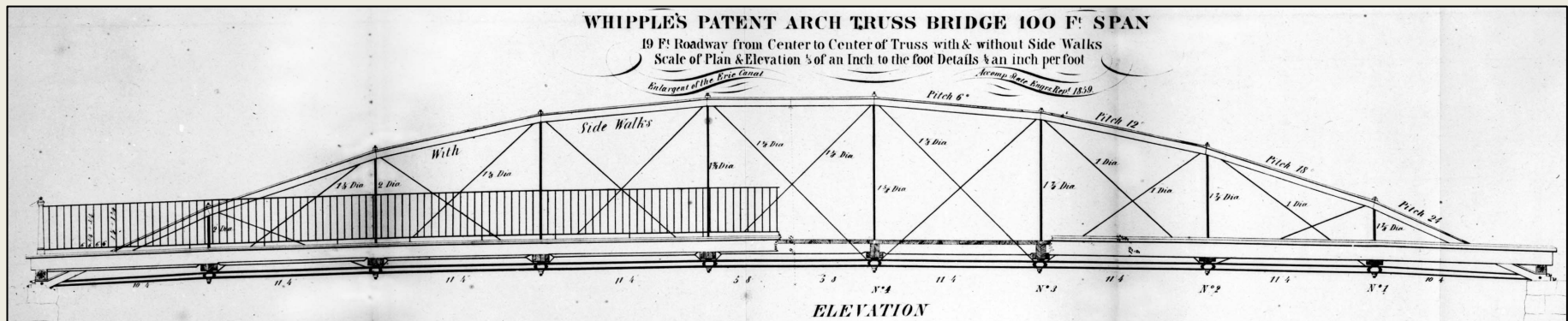
## (1840-1860)

- Designed and built a 300 ton weigh lock scale (1841)
  - Largest weighing device at the time
- Designed and patented bowstring truss bridge (1841)



# MATURE SQUIRE WHIPPLE (1840-1860 – Continued)

- Whipple's Bowstring truss design adopted by the NYS Canal Commission as standard



- Hundreds of Whipple bowstring bridges built on Erie and its branch canals by Whipple or to his patent



Clinton Square, Syracuse NY (1878)

- Hundreds of Whipple bowstring bridges built on Erie and its branch canals (continued)



Bouckville



Memphis



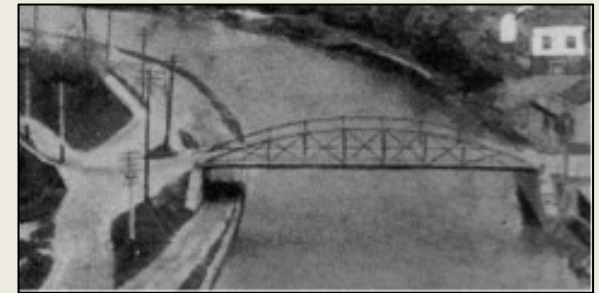
Ilion



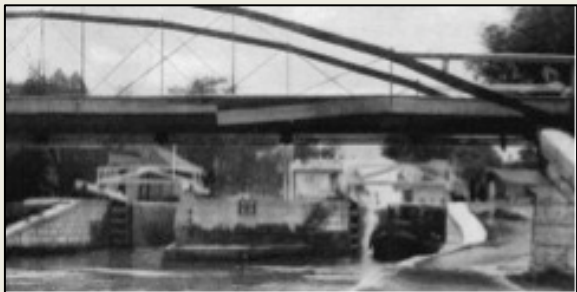
Lockport



Lyons



Medina



Newark



Starks Landing



Weedsport

- Other Whipple bowstring bridges (like the Shaw Bridge) were built over waterways



Croton Falls



Port Henry



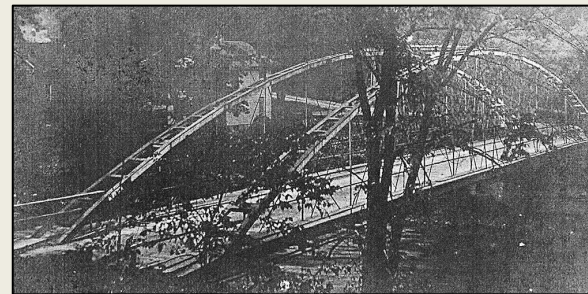
Le Roy



Wilt's Mill



Lexington

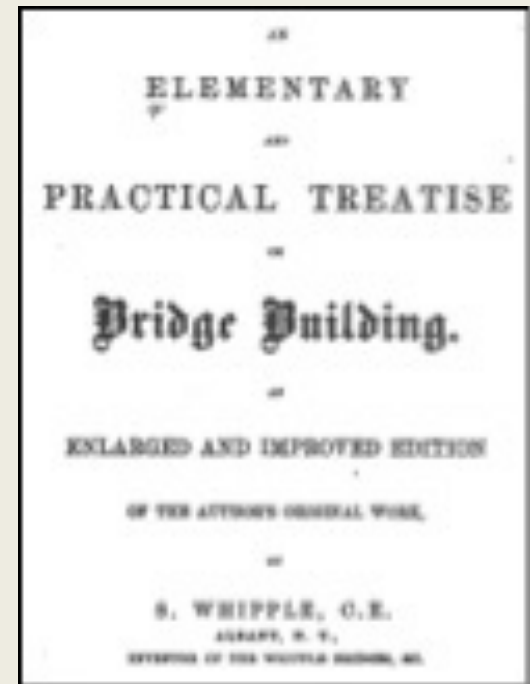
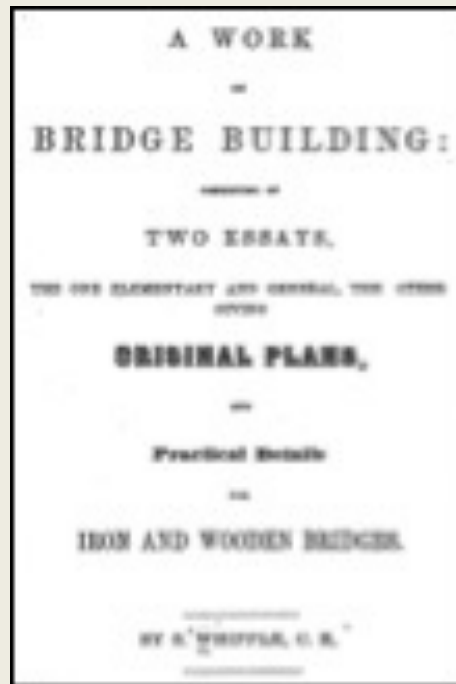
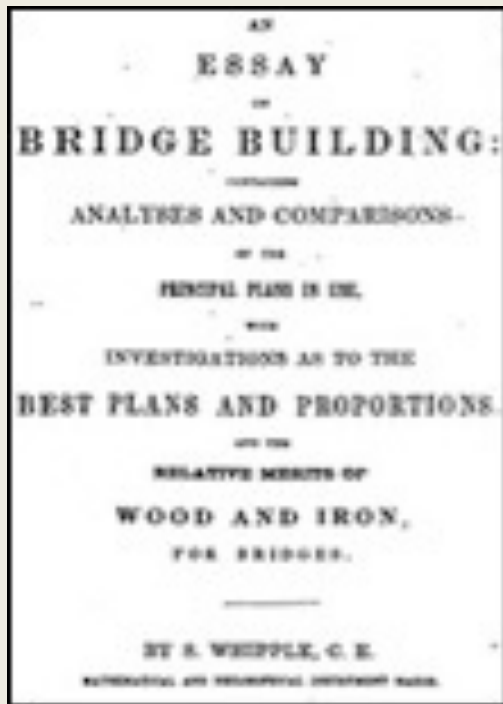


Rossman

# MATURE SQUIRE WHIPPLE

## (1840-1860 – Continued)

- Wrote *An Essay on Bridge Building* (1846)
  - Compared bowstring with other trusses
  - Marked beginning of rational truss design



# MATURE SQUIRE WHIPPLE

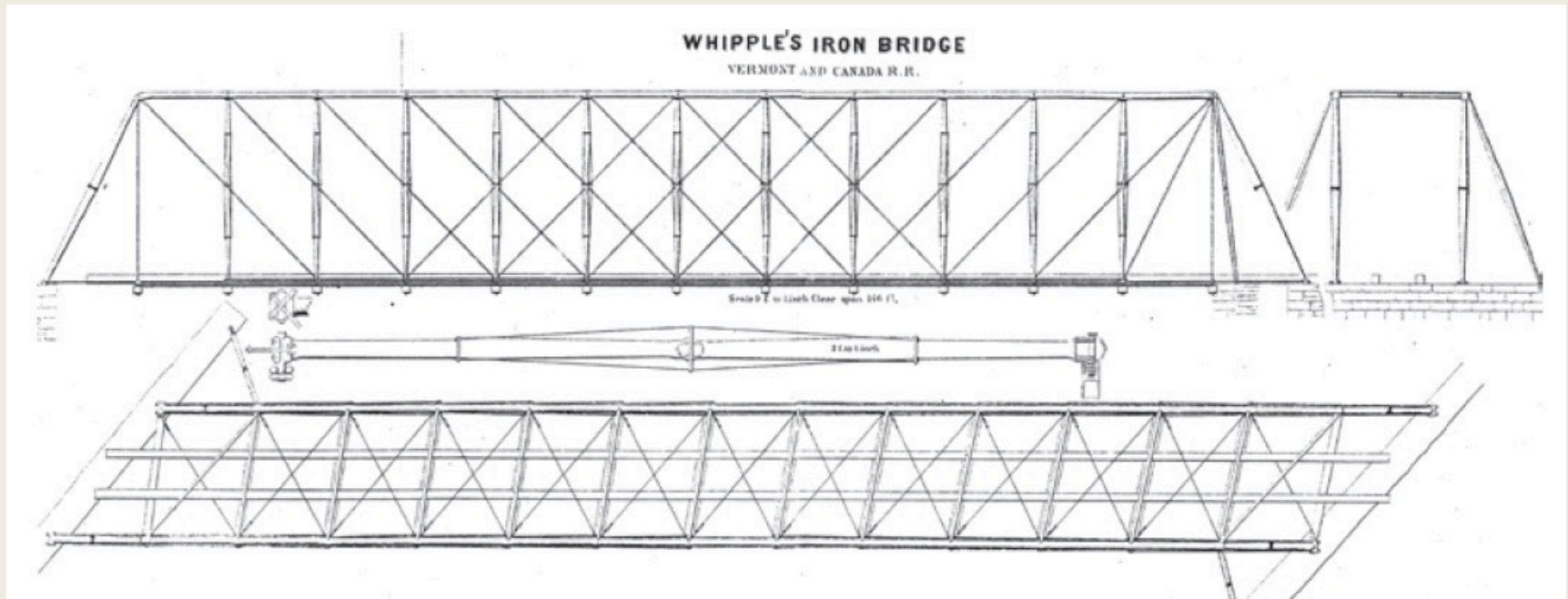
## (1840-1860 – Continued)

- Essay became part of seminal book *A Work on Bridge Building* (1847)
  - First time in the world, a book presented correct methods of analyzing and designing a truss – still taught today
  - Used graphic statics long before Karl Culmann introduced it in his book *Die Graphische Statik* (1865)

# MATURE SQUIRE WHIPPLE

## (1840-1860 – Continued)

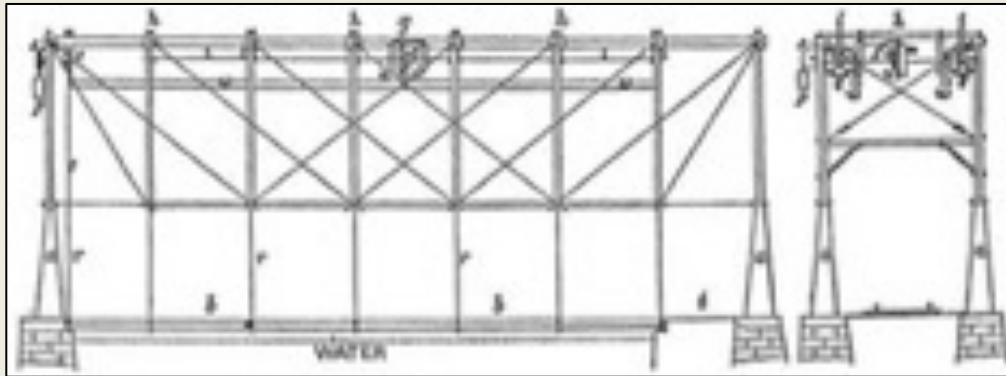
- Whipple went on to design and build the first long span trapezoidal railroad bridges that became the most common truss until 1980s



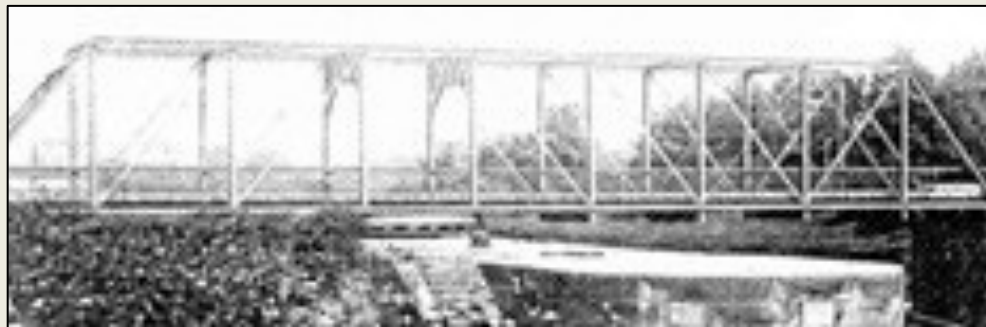
# SENIOR SQUIRE WHIPPLE

(1861-1888)

- Designed and built first vertical lift bridge



- Designed and built swing bridges



# SENIOR SQUIRE WHIPPLE

## (1861-1888 – Continued)

- Updated his first book with an Appendix (1869)
- Wrote a more formal book *Treatise on Bridge Building* (1872 reprinted until 1899)
- Contributed several articles to American Society of Civil Engineers (ASCE)
- First person after the post-Civil War rebirth of the ASCE to be named an Honorary Member (1868)

# SENIOR SQUIRE WHIPPLE

## (1861-1888 – Continued)

- Died 1888 leaving widow Ann and no children
- 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.

# WHIPPLE'S IMPORTANCE CANNOT BE OVERSTATED

- First to document theoretical and mathematical principles for bridge design
- Promoted use of prefabricated iron components for mass production
- Promoted life-cycle costing
- Critically important for the development of the Enlarged Erie Canal
- Critically important for the development of the early railway industry
- Helped make New York State and New York City become world leaders in the 19th century

# THE STORY OF THE CHARMING SHAW BRIDGE



- The Shaw Bridge is a double-span iron bowstring truss bridge
- Crosses Claverack Creek, a sparkling tributary of the Hudson River
- Built in 1870, along the important New York City to Albany Post Road

# SHAW BRIDGE DESIGNER (1841)

- Designed by Squire Whipple
- As noted before, Whipple patented the design in 1841
- In 1846-47 Whipple published the design principles in the important book: “A Work on Bridge Building”

# SHAW BRIDGE BUILDER

## (1870)

- Built in 1870 according Whipple's patented design by John D. Hutchinson from Troy NY (embossed in cast-iron trusses)



- John D. Hutchinson and his father John S. built more than 50 bridges to Whipple design but defaulted on paying fees to Whipple (after a small down payment) resulting in lengthy court cases

# SHAW BRIDGE NAME

(Circa 1870)

- Traditionally, local bridges were named after the owner of the nearest farm, in this case William Shaw, so the bridge became the “Shaw Bridge”
- William Shaw’s House Still Stands



William Shaw House 1892



William Shaw House 2016

# SHAW BRIDGE SPECIFICATIONS

(Circa 1870)

- *New York State Canals – 1871 – Specification of the Manner of Constructing Whipple's Patent Iron Arch Truss* provides construction detail

~~NEW YORK STATE CANALS.~~

1871.

SPECIFICATION

Of the Manner of Constructing Whipple's Patent Iron Arch  
Truss Bridge Superstructures,

# SHAW BRIDGE PHOTOGRAPHED

(Circa 1900)

- The bridge was photographed and featured on a postcard (published 1906-1909 in Germany) documenting the original state of the bridge



# SHAW BRIDGE

## MOST SIGNIFICANT PERIOD

(1870-1900)

- Postcard photograph of the Shaw Bridge clearly shows that the wooden deck reaches through the trusses (current non-original deteriorated deck reaches only to the inside of the trusses).
- The *New York State Canals – 1871 – Specification of the Manner of Constructing Whipple's Patent Iron Arch Truss* provides guidance on exactly how the wooden deck goes through the trusses.

# SHAW BRIDGE BYPASSED

## (1931-1980)

- Post Road straightened and modernized in 1931 bypassing the Shaw Bridge which became little used Town of Claverack road
- However, during the 1938 hurricane, Shaw Bridge was one of few that was passable
- 1966 was the last time wooden deck structure was replaced

# SHAW BRIDGE CELEBRATED (1980)

- 1980 ceremony celebrated Shaw Bridge's listing on National Register of Historic Places with parade of antique cars over the bridge led by a horse drawn buckboard and T Model Ford



# SHAW BRIDGE CLOSED

(1989)



# SHAW BRIDGE RECENT HISTORY (1990-2017)



Jet Low 1994



Rick Ehrenberg 2010



Ian Nitschke 2017

- 1990 unsuccessful attempts to restore bridge
- 1994 Jet Lowe (HAER) photographs bridge
- 2010 Rick Ehrenberg photos initiate new activity
- 2016 grant for half restoration funds (\$170,000)

# STATE OF THE SHAW BRIDGE (2017)

- Despite neglect, bridge is in remarkably good condition and can be restored to original 1871 specifications and circa 1900 photograph
- Speaks well for Whipple's design and materials
  - 19th century cast & wrought iron more rust resistant than most modern steel
- *Secretary of the Interior's Standards for the Treatment of Historic Properties* will be followed
  - Will use **Restoration** approach to retain materials from most significant period (circa 1870-1900)

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

- Of the hundreds of Whipple Bowstring Bridges built, only eight\* historical bridges survive
  - Shaw Bridge NY (double span in original location)
  - Normanskill Farm Bridge NY (moved twice)
  - Ehrmentraut Farm Bridge, NY (moved twice)
  - Vischer Ferry Bridge, NY (moved twice)
  - Union College Bridge, NY (moved twice)
  - Black River Canal Bridge, NY (moved once)
  - Rodrick Bridge, Ohio (moved once)
  - Hachiman Bridge, Japan (moved once)

\* Note:

- Four completely new Whipple Bowstring Truss bridges were built in Buffalo NY (2008-2015)
  - Cost millions of dollars
  - Bridges were factory-made and assembled differently than the way Whipple designed them
  - Not in original locations
- The bridges are major tourist attractions on the Buffalo waterfront “CANALSIDE”, which has the stylized Whipple Bridge logo:





Shaw (double span in original location)



Normanskill Farm (moved twice)



Ehrmentraut Farm (moved twice)



Vischer Ferry (moved twice)



Union College (moved twice)



Black River Canal (moved once)



Rodrick (moved once)



Hachiman (moved once)

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

- Shaw Bridge is the best example of a Whipple Bowstring Truss Bridge
  - The only double-span
  - The only one in its original location with all the original metal structure, stone abutments, and stone pier
  - 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*.

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

- 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/> )
- The Shaw Bridge satisfies four of the selection criteria: (i), (ii), (iv), and (vi).

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

(i) *Represents a masterpiece of human creative genius*  
[Squire Whipple]

(ii) *Exhibits an important interchange of human values,  
over a span of time or within a cultural area of the world,  
on developments in... technology* [Whipple's 1847 book "A  
Work on Bridge Building" was the first to document  
scientific design principles for bridges and compares his  
first design (Bowstring Truss Bridge) with other bridge  
designs including the long span trapezoidal railroad  
bridges]

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

(iv) *An outstanding example of a type of ... technological ensemble which illustrates a significant stage in human history* [Whipple Bowstring Truss – World's First Scientifically Designed Bridge]

(vi) *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)* [Whipple's Bowstring Truss contributed to the success of the Erie Canal and the prominence of New York City and New York State in the 19th century]

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

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

- First, the Shaw Bridge included in the book *Great American Bridges and Dams* by Donald L. Jackson with a foreword by renowned historian David McCullough
  - 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).

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

- Second, in a 1996 article “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.

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

- 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, unlike the Shaw Bridge, which was not known at the time of the 1969 study.
- As noted above, the Shaw Bridge is in its original location. The relocation of the Normanskill bridge 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 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.

# SHAW BRIDGE – A POSSIBLE WORLD HERITAGE BRIDGE?

(Continued)

- Third, in the oversize book of photos *Bridges, A history of the world's most famous and important spans* by Judith Depre with an introductory interview by celebrated architect Frank O. Gehry
  - 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.

# THE SHAW BRIDGE IS SUPREMELY IMPORTANT & CHARMING



- But there is still a need to match the New York State \$170,000 grant with cash, in-kind services, and/or materials to restore the bridge.
- But we are making progress with the help of Dr. Griggs