

Squire Whipple

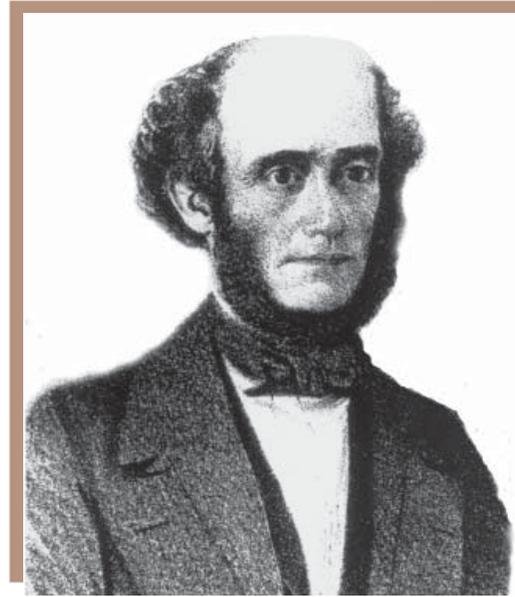
By Dr. Frank Griggs, Jr., P.E., P.L.S.

Whipple was born in Hardwick, Massachusetts in 1804 the son of a farmer. Between 1811 and 1817, his father designed, built and ran a cotton-spinning mill in nearby Greenwich, Massachusetts. The young Whipple was therefore exposed to construction and materials at an early age. The family then moved to Otsego County just north of Cooperstown, New York to take up farming again. After receiving the best common school education available he attended Hartwick Academy and Fairfield Academy located in central New York near his home. In 1830 he graduated from Union College in Schenectady, New York after one year of study. He spent the decade of the 1830s serving his apprenticeship working on the Baltimore and Ohio Railroad, the Erie Canal Enlargement, the New York and Erie Railroad and several other railroads. When work was slow, he designed, built and sold mathematical instruments such as transits and engineer's levels and drafting equipment. He married later in life and had no children.

In 1841, he designed and built a weigh lock scale with a capacity of 300 tons to weigh the canal boats on the Enlarged Erie Canal in Utica. This was the largest weighing device in the country at the time.

Whipple became interested in the design and construction of iron and wooden bridges. Having worked on the enlargement of the Erie Canal, he knew that wooden bridges that crossed the original canal had a short-life. He also knew that the new, wider canal would require longer span bridges and must be made of a modern material-iron.

After some thought, he designed his bowstring iron truss arch and was issued patent No. 2,064 on April 24, 1841 for the "construction of iron truss bridges". Whipple's patent, unlike previous patents, with the exception of Long's, shows an understanding of structural behavior of the diagonals and verticals and the need to size them to handle their loads as either tension or compression members. Like Long, he had crossing



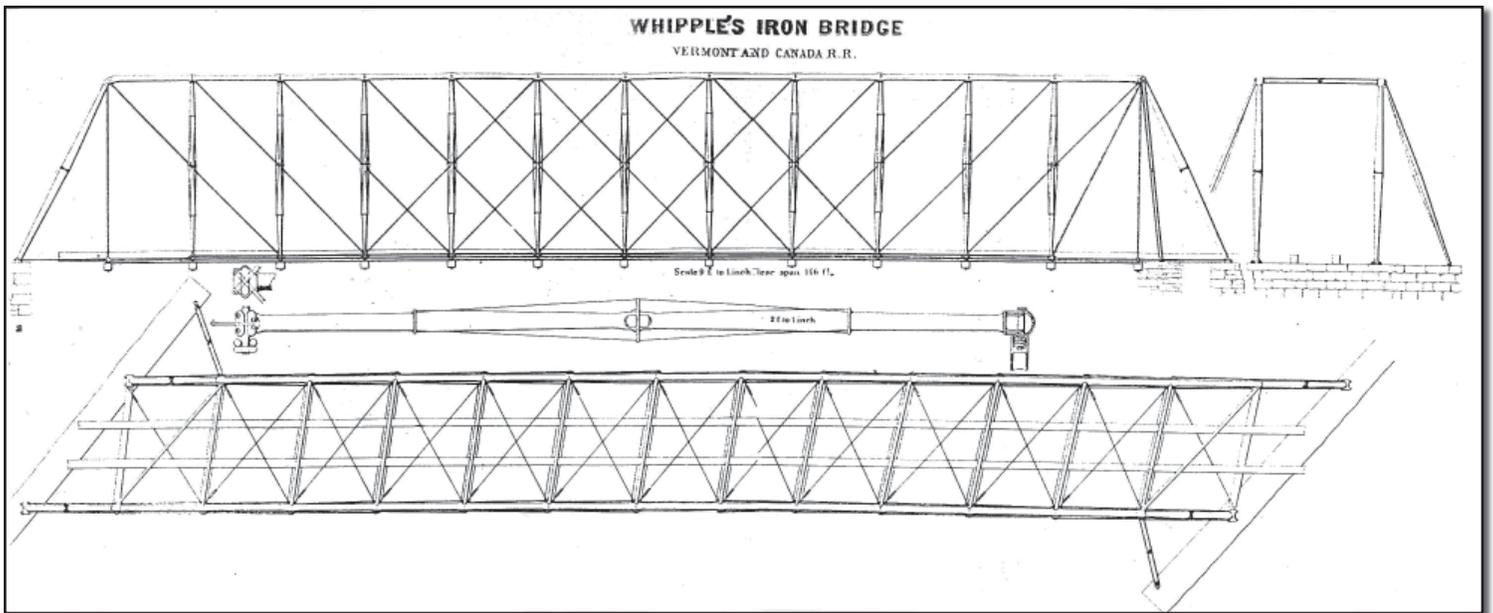
Squire Whipple, 1804 – 1888

diagonals in each panel (except the end ones) in tension with posts (verticals) in compression. He never used cast iron compression diagonals, and thus never used his verticals in tension.

Whipple got his first chance to build a bridge to his patent in 1841 when the wooden bridge across the canal at First Street in Utica fell. He tried to convince the Canal Commissioners that a bridge built of iron was a good long-term investment, but they were reluctant to trust a new material for their bridge. To illustrate the stability and strength of his bridge, Whipple had one built at his own expense on a vacant lot in Utica near the offices of the Canal commissioners. When the First Street Bridge fell, they approved the construction of his bridge. His



Vischers Ferry Bridge over Enlarged Erie Canal 1869 to date



West Troy Bridge for Vermont & Canada RR, 1853, 147-foot span

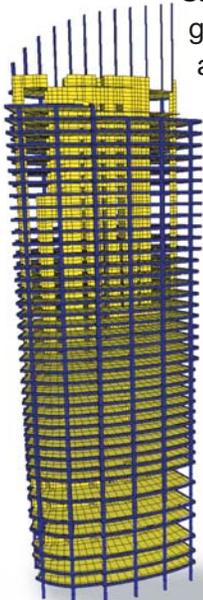
contract to build his first bridge over the canal was for the sum of \$1,000. This bridge lasted until September 16, 1922 when it was removed as the canal was filled in. Between 1842 and 1870, hundreds of Whipple Bridges were built over the Erie and its branch canals, either by Whipple or to his patent. Frequently contractors would build to his patent without paying patent fees, so he never received large sums of money from people using his patent.

Between 1848 and 1850, he designed and built seven short span iron bridges for the New York and Erie Railroad near Newburgh and Binghamton, New York. Most railroad bridges being built around that time were wooden arches, or combinations of wooden arches and trusses. The Howe truss of wood with wrought-iron verticals, patented in August 1846, was just becoming popular with the railroads. Squire built the first successful long span trapezoidal railroad bridges on New

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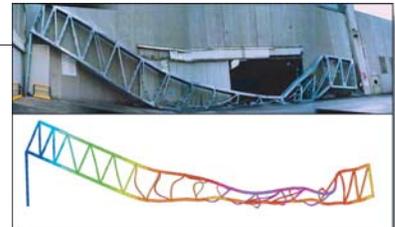
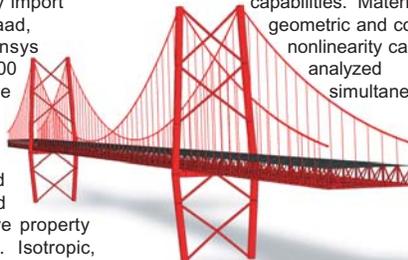
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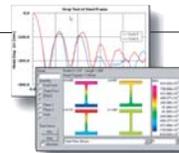
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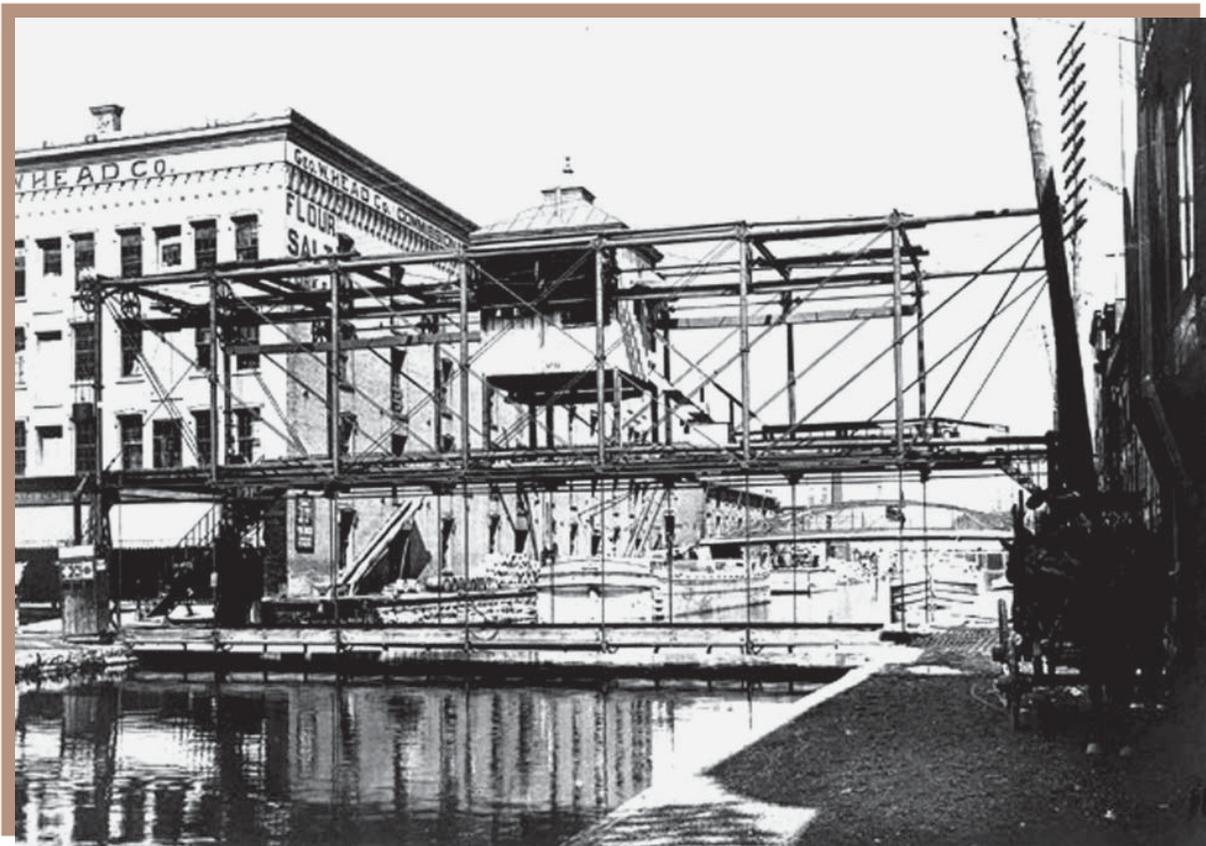
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Hotel Street Vertical Lift Bridge, Utica, NY 1874

York Railroads in West Troy and Utica, NY. This double intersection truss design was the most common railroad truss bridge until the 1890s, being built over western rivers with spans over 500 feet.

Perhaps his major accomplishment was *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*, which he wrote and published in 1847. For the first time anywhere in the world, this book presented the correct methods of analyzing and designing a truss and was much more than “a means of effecting one small step of advance” as he claimed in his book. It was a giant step, which later prompted several leaders of the profession to call Whipple “the retiring and modest mathematical instrument maker, who without precedent or example evolved the scientific basis of bridge building in America.”

Whipple retired around 1860 but continued to design swing and lift bridges, building many swing bridges over the Erie, Portland

and Welland Canals. In December 1872, he designed and patented, #134,338, the first vertical lift bridge in the United States and built it over the Erie Canal in Utica in 1874. The bridge lasted until the canal was abandoned.

Whipple updated his book in 1869, and in 1873 a new edition was published that was in print until 1899. He contributed several articles to ASCE Journals, and he was the first man after the resurrection of ASCE to be named an Honorary Member of the Society in 1868.

The writer has restored Whipple bridges at Union College in Schenectady, over the Enlarged Erie Canal at Vischer’s Ferry, NY, one at Boonville, NY over the Utica and Black River Canal and one in Central Park, Schenectady, NY. A Whipple Change bridge originally built in 1858 for the Erie Canal in Rochester has been recently restored in Palmyra, NY.

Jim Riddell restored a Whipple in Ohio and placed it on the Campus of Ohio University. Other known Whipple Trusses are in Claverack, NY, over the Normanskill Creek in Albany, NY, and one in Tokyo, Japan in an historic park.

Whipple died in Albany, NY on March 15, 1888 at the age of 84. 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.” ■



Whipple Change Bridge, Palmyra, NY 1858 to date

Dr. Griggs specializes in the restoration of historic bridges, having restored many 19th Century cast and wrought iron bridges. He was formerly Director of Historic Bridge Programs for Clough, Harbour & Associates LLP in Albany NY and is now an independent Consulting Engineer. Dr. Griggs can be reached by email at fgriggs@nycap.rr.com.