

Standing the Test of Time

Theodore Burr's Wooden Bridge Designs

By F. E. Griggs, Jr.

Theodore Burr was born in Torrington, CT August 16, 1772 the son of John Burr and Jael Markam. His father served in the Revolutionary War as a Lieutenant. After the War he became a millwright, building dams and water-powered mills. Theodore was their first-born child and followed his father in the millwright trade. He married Asenath Cook and in 1793, with two young children, moved to Oxford, NY, north of Binghamton. He and an associate built a dam across the Chenango River and built the Fort Hill Mills in 1793 and 1794. In addition to running the mill, Burr built many dams and mills in the area.

He entered the bridge business in 1800 when he built a pile bridge across the Chenango in order to provide access to his mill, which was on the easterly side of the river, while the village was on the westerly side. His water-powered mills consisted of a gristmill, a planing mill and a sawmill. His home is now the Village Library, and is a beautiful piece of architecture and construction.

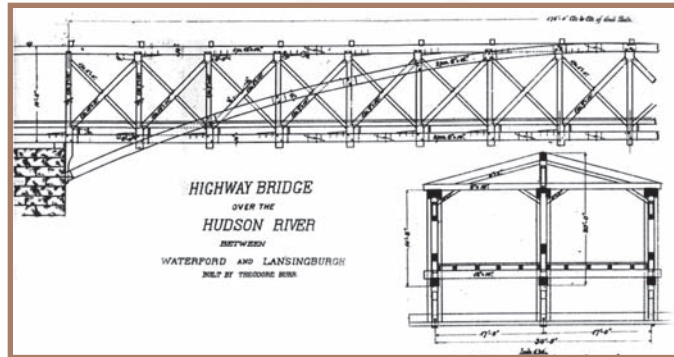
In 1803, he became more involved with bridges when he built one across the Catskill in Catskill, NY just above its intersection with the Hudson River. His first major bridge, however, was in Canajoharie, NY where he built a single span arch 330 feet long across the Mohawk River. No bridge anywhere in the United States or in Europe was near this span. In 1807, however, the bridge began leaning after a herd of cattle bunched up on one side of it. Burr attempted to correct this lean with supports near the abutments, but the bridge failed shortly after. Unfortunately the only illustration



Canajoharie 330' span bridge 1807

of the bridge is a painting made after it collapsed.

His next bridge was perhaps his most well known, and was built as a toll bridge across the Hudson River between Water-



Cooper Half Truss

ford and Lansingburg, NY in 1804. The key feature of it, which originally was not covered, was the arch that started below the deck at the abutments and ran near the top of the top chord at mid span. This was the first time in the United States



Model of Burr Truss built well into the 20th Century.

that anyone used an arch in combination with a truss in order to provide both stiffness and strength. The deck was nearly flat to accommodate wagon traffic.

This bridge, with repairs and covering in 1814, lasted until 1809 when it burned as an electric trolley car ignited a gas line that had been attached to the deck.

While working on his Waterford Bridge, Theodore also was working on another across the Delaware River south of Trenton, NJ. The Delaware was a turbulent stream in flood and no one before successfully built a bridge to cross it, although Timothy Palmer was soon to open his Easton Bridge in 1806 just upstream from Burrs'. Once again, Burr developed an entirely new approach to bridge building when he developed a tied arch with the deck hung from the arches by iron chains, similar to those used by James Finley on his suspension bridges that were

being built in the same period.

There were five spans of 203, 198, 161, 186 and 203 feet, with variation in length due to pier locations based upon the



Interior of double barrel bridge showing arch and truss work.

The wood was sold to local farmers to use in building barns.

After completing the Schenectady Bridge Burr built one over the Schoharie Creek at Esperance, NY in 1812 that lasted until 1930, and bridges at Utica, NY over the Mohawk and another one over the Delaware at New Hope, PA. He moved

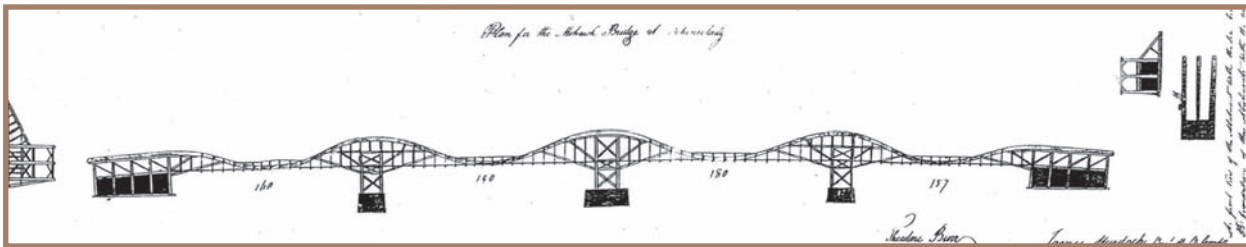
presence of shallow rock across the riverbed. He built a roof over his arches, and roof and wall covering over his piers and abutments. The first covered bridge built by Palmer in Philadelphia was over the Schuylkill in 1805 followed by his Easton Bridge in 1806. It seems clear that Burr's bridge probably was designed not to be covered. After seeing the success of Palmer's bridges, the owners probably instructed Burr to cover the bridge. It opened in 1806 and later started carrying railroad traffic in 1835 simply by converting one carriage lane to a rail track. It was remodeled to carry expanded railroad traffic in 1848 and lasted until 1876 when it was replaced with an iron bridge.



Trenton Bridge 1806

Burr next applied his genius to a bridge over the Mohawk River in Schenectady, NY. He originally proposed and built a twin arched structure with each arch in excess of 450 feet to span the 900 foot wide river. The spans were probably based upon his Canajoharie span, which had not collapsed at the time, but were 50% longer. Near the end of construction, however, in

to Pennsylvania when he received contracts to build four bridges over the Susquehanna River at Berwick/Nescopek Falls, Northumberland, Harrisburg and McCall's Ferry. These were all major bridges built between 1812 and 1817. It was a real accomplishment, but one that stretched his finances very thin and resulted in many unhappy bridge companies. All the timber for these bridges was sawed at his mill in Oxford and floated downstream on the Susquehanna to the bridge sites, where he would pull it from the river and build his multiple span arched bridges similar to this Waterford Bridge.



Schenectady Bridge

1807, the bridge collapsed into the river. The owners retained Burr as their builder, and he developed a suspension/cantilever bridge using wood cables. Instead of two abutments and a single pier at mid span, he now had three piers.

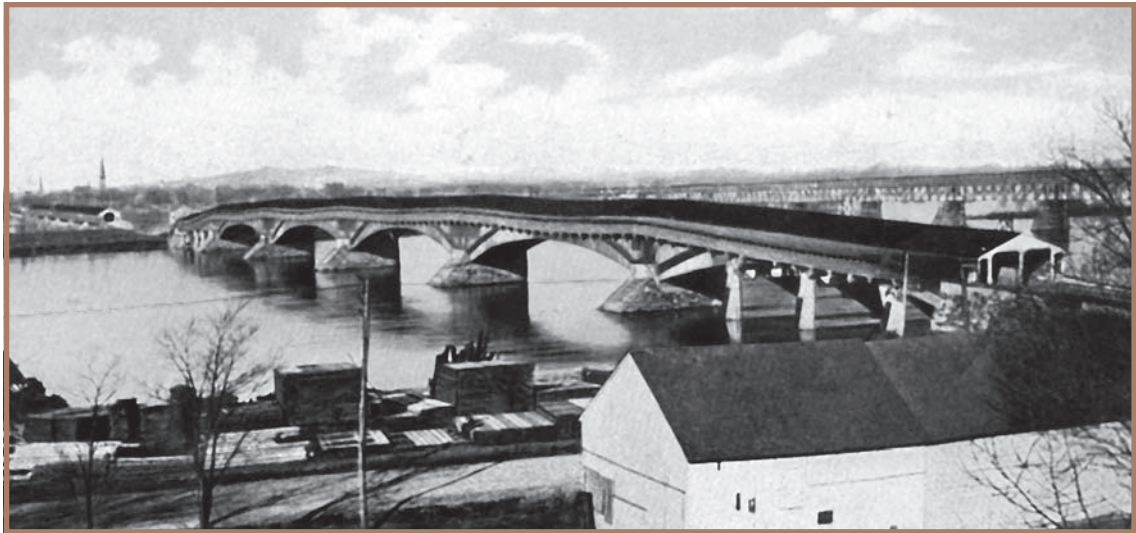
The bridge was originally covered over the piers and abutments, but in 1817 it became necessary to add additional piers under the outer spans. The remainder of the bridge was covered. The following year, piers were added under the two central spans. When the covering was added there was no attempt to make each span have a common ridgeline, so the bridge looked like a series of different height barns attached end to end across the river. The bridge was never well maintained, and residents of the region expected it to collapse every spring when the ice broke up or when the Mohawk flooded. The bridge lasted until 1873 when it was replaced by an iron bridge.

His Harrisburg Bridge, built in two parts separated by an island, lasted until 1902, being repaired after a flood in 1848 and fire in 1866. Due to its roofline, the locals called the bridge the Old Camelback Bridge. Despite its appearance and dark, drab interior, it was admired by many who fought against its replacement by an iron structure in 1903. The Nescopek Bridge lasted from 1814 to 1836 when a flood destroyed it, and the Northumberland Bridge lasted from 1814 to 1840 when a flood took it out.

His McCall's Ferry Bridge was perhaps his most difficult bridge. The Susquehanna, which is normally a wide, shallow river, narrows down at the bridge site and as a result had worn a very deep channel with water over 150 feet deep. This meant that falsework was not possible, and the closest that the easterly abutment and adjacent pier could be located required a span of 360'.



Schenectady Bridge fully covered with additional four piers



Old Camelback Harrisburg

He decided to build the bridge with one span of 360 feet over the deep water and another 247 feet over shallow water. He planned on building the long span on floats, and drawing the entire bridge upstream and setting it on the stonework. The winter of 1814/1815 came early and the river froze before he could float the span upstream. He had, after the arches were complete on his floats, to change the floats to skids so as to slide the bridge over the ice back up to the bridge site. In order to do this, he cut his bridge in half. Using local farmers and capstans, they slid each half to the site and then connected them together before setting the arches on the stonework. He completed this work sufficient to permit travel in December 1815, and continued work until the bridge was formally opened for travel on November 18, 1817. Tragically, in early March 1818, the entire span was taken out by an ice jam that was reportedly the highest in history. Burr had taken much of his fee in stock and since the bridge was never rebuilt the stock was worthless, thus further straining his finances. This bridge was the longest span in the world when built, and was the first to be built in segments and hauled into place over river ice.

Burr's last major bridge was over the Susquehanna River at Rock Run in Maryland. It was a major one with 18 spans. It was

begun in 1816, with the superstructure built in 1817 and the bridge opening in January 1818. This bridge, like his McCall's Ferry Bridge, seemed to be cursed. On January 1, 1826 several spans of the bridge burned and were rebuilt by Lewis Wernwag. Not much is known of Burr and his work after Rock Run.

He received two bridge patents, one in February 14, 1806 and one on April 3, 1817 that was probably an extension or modification of his first one. A fire at the patent office in 1836 destroyed many of the patent paperwork and models that were frequently submitted along with applications. The patent of 1817, however, was reconstructed and apparently

was for his Waterford style bridge. He died a mysterious death on December 21, 1822 while supposedly working on another bridge in Middleton, Pennsylvania. His burial site is unknown and some think he died a pauper. No painting or sketch of him is known to exist. After his death the most common wooden bridge built, with the possible exception of the Town Truss, was the so-called Burr Arch. Many of the surviving wooden bridges were built to Burr's Patent or a modification of it. Burr, however, never received patent fees for many of the bridges built to his plan.

His bridge building between 1800 and 1818 was prodigious. While it did not make him wealthy, he was recognized by his contemporaries for his innovative design and construction methods. The fact that his design lives on is testimony to his engineering skill, and that several bridges lasted as late as 1930 is testimony to his skill as a builder. ■

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.