WHETSTONE CREEK BRIDGE
(The Trestle Bridge)
Township Road 127 spanning
Whetstone Creek
Mt. Gilead
Morrow County
Ohio

HAER No. OH-90

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

WHETSTONE CREEK BRIDGE
(The Trestle Bridge)

HAER No. OH-90

Location:	Township Road 127 over the Whetstone Creek, Mount Gilead, Morrow County, Ohio
Date of Construction:	1879
Fabricator:	Wrought Iron Bridge Company
Present Owner:	County of Morrow (County Commissioners), County Courthouse, 48 E. High Street, Mount Gilead, Ohio
Present Use:	Vehicular traffic
Significance:	The Whetstone Creek Bridge may be the only surviving example of a tubular bowstring based on the patent of William Laird of Canton, Ohio. It was built in 1879 by the Wrought Iron Bridge Company, one of America's largest and most important bridge companies in the late 19th century.
Project Information:	The Ohio Cast- and Wrought-Iron Bridges Project was cosponsored by HAER, Dr. Robert J. Kapsch Chief; the Instute for the History of Technology and Industrial Archaeology, Dr. Emory L. Kemp, Director; the Ohio Historical Society, Gary Ness, Director and David Simmons, Historic Bridge Specialist; and the Department of Architecture, Ohio State University, Jose Obrerie, Chairman.

Wm. Michael Lawrence, Historian

The Whetstone Creek Bridge, sometimes known locally as "the Trestle bridge" due to its proximity to a railroad bridge that once spanned the creek,[1] is a bowstring arch truss bridge in which the arch is an octagonal tube constructed of iron plates riveted together. The bowstring arch bridge, especially those with tubular arches, was a popular bridge type during the late 19th century. This arch was probably based on a design by William Laird, patented in 1874. The bridge was built by the Wrought Iron Bridge Company, one of the largest and most important bridge building companies in the United States during the late 19th century.

The Whetstone Creek bridge is a 103' bowstring arch truss bridge. The bow or arch, the main compressive member, is an octagonal tube constructed of four semi-hexagonal iron plates with flanges along their edges. They are rolled in such a manner that the flanges are riveted together in the middle of four of the octagon sides at 45 degree angles to the vertical and horizontal. The ends of the tubes bear on cast-iron shoes resting directly on stone abutments.

Bridge loads are transferred to the arch by diagonal braces and nine verticals. The diagonals are round rods with threaded upper ends passing through the arch and eyes at the lower ends. Nuts and blocks retain the upper ends and through bolts hold the eyes between the parallel plates of the lower chord.

Four of the verticals are cruciform in section, each consisting of four angles. Three others have four angles each, but two angles taper out so that their lower ends reach the ends of the floor beams, which extend out from under the bridge to form an outrigger. The resulting triangular space is filled with a lattice work. These posts, with their lattice work, brace the arch against sidesway. Two lateral beams, which are clumsily attached to the tops of the arches and which are probably retrofits, serve the same purpose as the outriggers. At their ends, the angles form threaded rods that pass through the arch above, between the parallel bars of the lower chord below, and into loops at the ends of the floor beams. They are held in place by nuts and spacer blocks.

The ends of the two plates of the lower chord, the main tension member, converge at their ends and are inserted into slots in the cast-iron arch shoes. Pins hold the chords in place. It is at this point that the compressive forces of the arch and the tensile forces of the chord cancel each other out. The shoes rest directly on abutments built of ashlar limestone masonry.

Most floor beams are retrofits, but the three that extend beyond the bridge and connect to the lattice brace posts are original. The original floor system probably consisted of closely-spaced wood cross beams resting on the chords, with planks laid over them in a chevron pattern. Advertising literature distributed by the Wrought Iron Bridge Co. depicts such a flooring system in illustrations.[2] The bridge is in fair condition, with a cracked shoe and a numerous rivets replaced by bolts.

Bowstring arch bridges were very popular during the mid- to late nineteenth century, especially for small highway bridges. Bridge engineers experimented with a wide variety of designs, especially trusses with tubular arches of every possible section: triangular, oval, square, round, hexagonal, and octagonal.

The Wrought Iron Bridge Company in 1874 published a piece of sales literature, The Book of Designs of Wrought Iron Bridges, describing several bowstring arch bridges that the company marketed, including the "Hexagon Plate and Channel Arch Bridge." In this bridge, the arch or tube was octagonal, fabricated of two bent "semi-hexagonal plates," each with flanges and two channels fitting between the plates so that the flanges of the channel fit against those of the semi-hexagonal plates. These were riveted together at the flanges. The channels were omitted in bridges with the relatively short spans of 40 to 80', resulting in the "Hexagon Plate Arch Bridge." The Book of Designs, after describing the standard design, the "Column and Channel Arch Bridge" with curved plates and channels, explains that

> (t)he Column and Channel Arch Bridge, so extensively manufactured by us, requires the column iron to be curved while red hot from the mill rolls, and hence requires a special order to the Iron Mills for every span, so that we cannot make this plan of a bridge on as short notice as is sometimes desired.
>
> We have at length succeeded in getting an arch of suitable form to allow of the iron being curved cold, and offer the Hexagon Plate Arch Bridge and the Hexagon Plate and Channel Arch Bridge...as being well adapted to spans of 50 to 150 feet, which we are now prepared to furnish in from two days to a weeks notice, as we keep in stock all the iron required for the construction of spans of any length within the above limits.
>
> The form of the arch iron is such that it can be easily rolled without danger of having weak angles or crooked web, a feature not heretofore attained in any two-plate

> arch, and when constructed with our Lattice Brace Posts, Side Tension Rods, and overhead Lattice Girders, with our Arch Shoe and Chord details, it forms a very economical and stiff bridge, which we guarantee to give satisfaction in every case.[3]

It is rather doubtful that county commissioners or highway departments would need to order a bridge on such short notice, unless a bridge was destroyed by a great natural disaster such as the flood which devastated Ohio in 1913. The appeal of this bridge must have been that it was more "economical" than the column arch bridge.

These bridges were undoubtedly based on a very similar design patented by William R. Laird in 1874.[4] Laird was a native of Canton, Ohio, and may have sold his rights to the design to the Wrought Iron Bridge Co.[5] If this was the case, the Company was very aggressive in approaching him; the Book of Designs was published the same year the patent was issued. He may have been involved in the company.

The tube of the Whetstone Creek bridge differs from these designs in that semi-hexagonal plates are substituted for the channels and the flanges of the semi-hexagonal plates are bent at a sharper angle. Although such a configuration does not appear in the Book of Designs, the illustrations in the catalog depict such a variety of combinations of channels and curved or semi-hexagonal plates that it is not surprising that the company might produce such a configuration. It may also be regarded as a cross between the Hexagon Plate Bridge and the Column Arch Bridge. In the latter, the arch was a round tube constructed of four curved plates with flanges. The Mill Road bridge in Knox County, Ohio, is a classic example of the type.[6]

The Book of Designs made it clear that the lattice work, which appears in all of the company's bowstring bridge designs, was not a decorative element but, quuite the opposite, had a very practical function. The critical problem with the bowstring bridge was the tendency of the arches to sway under moving loads, a problem engineers struggled to solve.[7] The Wrought Iron Bridge Company had its own unique solution:

> The Lattice Brace Post, which is used only in the Hammond and Abbott Bridges, is the most perfect and economical plan for accomplishing this result, as it forms a solid lattice between the brace beam and arch, and prevents any motion of the arch, as no movement can take place laterally without breaking the lattice, thus obviating the independent and unreliable action of the

> post and brace which were formerly used for this purpose, and which really had no more effective strength for holding the arch than was due to the crushing capacity of the brace, which was usually made of a round bar iron, and had very little strength in this direction.[8]

Manufacturers could also install rectangular Lattice Overhead Girders between the arches (the Whetstone Creek bridge, ironically, has ordinary beams instead). The lattice brace post and girder were invented by David Hammond, Michael Adler, and Job Abbott, of the Wrought Iron Bridge Company, and the design was patented in 1873.[9]

The company readily downplayed the wide variety of designs available fromn competitors: Whipple's use of an arch that was wider at the ends; Moseley's triangular arch; King's arches that were deeper in the middle than at the ends; Hammond's use of a wide top-plate over two or more rolled I-beams; Morrison's arch consisting of I-beams with the webs horizontal;[10] the simple brace from the top of the arch to the end of the lateral beam; and connecting the heads of the arches with simple beams. The Wrought Iron Bridge Company undoubtedly competed successfully in the bridge industry through the use of such hyperbole.

The construction history of the Whetstone Creek bridge is rather curious. Apparently, the County Commissioners had the abutments built for the bridge before accepting bids for the iron superstructure. Their Journal indicates that they authorized a partial payment of $225 to James Armstrong for stonework on August 2, 1879[11] and a payment of the balance of $525 on September 1.[12] The Journal reported a discussion during a special session on August 9 on

> (t)he matter of contracting Iron Superstructure for Bridge South of Mt. Gilead - This day after careful examination of several bids the board awarded the contract to Canton Wrought Iron Bridge Company for the Iron Superstructure for a Bridge over Whetstone south of Mt. Gilead for the sum of Two Thousand Dollars to be paid as follows: $ 300.00 on delivery of finished iron work, $ 700.00 on the completion of said superstructure ready for travel and the balance of $ 1,000 on or before January 1st 1880. The structure to be 90 feet long roadway in the clear 18 feet and 2 foot _____? 5 foot _____? to be ready for travel on or before Sept. 15th 1879.[13]

The Journal does not list the other bidders. The Commissioners authorized payment of $300 on September 3[14] and the balance of $1700 on October 4.[15]

The future of the bridge is uncertain. The county has not demolished it due to its historic significance, but the usual fiscal restraints may prevent the Commissioners from moving or restoring it.[16]

The Wrought Iron Bridge Company, of Canton Ohio, was one of the most important bridge building companies in the United States during the late 19th century. It was said to have built more highway bridges than any other such company during the time of its existence from 1866 to

ENDNOTES

1.Gerald E. Neptune, vice-president of the Board of County Commissioners for Morrow County, interviewed by Wm. Michael Lawrence, 31 August 1992.

2.Wrought Iron Bridge Company, Canton, Ohio, advertising literature. Printed by the Krebs Lithographing Co., Cincinnati, Ohio, c. 1876. Copy at the Ohio Historical Society Library, Columbus, Ohio and in the Bridge Files at the Ohio Historical Society (compiled by David A. Simmons, OHS).

3.Wrought Iron Bridge Company, Book of Designs of Wrought Iron Bridges Built by the Wrought Iron Bridge Co (Canton, Ohio: Hartzell & Saxton, Printers, 1874), 23-24. Copy at the Ohio Historical Society Library and in the Bridge Files.

4.Patent No. 146,916, 27 January 1874. Copy in the Bridge File.

5.David A. Simmons, "Uncommon Wrought-iron Bridge in Morrow County," Ohio County Engineer, Spring 1992, 13

6.See: HAER OH-91, Mill Road Bridge, Bladensburg vicinity, Knox County, Ohio.

7.David H. Simmons in "The Risk of Innovation: Bridge Patents in the 19th Century," in The Proceedings of the First Historic Bridge Conference at Columbus, Ohio (Columbus, Ohio: Ohio State University and Ohio Historical Society, 1 November 1985): 119.

8.Wrought Iron Bridge Company, The Book of Designs, 21.

9.Patent No. 135,802, 11 February 1873.

10.See HAER No. OH-88 for a discussion of Morrison's arch.

11.Morrow County, Ohio. Journal of the County Commissioners of Morrow County, Vol. 3, p. 180, 2 August 1879.

12.Ibid., p. 182, 1 September 1879.

13.Ibid., p. 180, 9 August 1879.

14.Ibid., p. 187, 3 September 1879.

15.Ibid., p. 195, 4 October 1879.

16.Gerald E. Neptune.

17.For a history of the Wrought Iron Bridge Co., see HAER No. OH-39.

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HAER No. OH-88, Mallaham Bridge, Columbus Grove, Putnam County, Ohio.

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Ibid., p. 180, 9 August 1879.

Ibid., p. 182, 1 September 1879.

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Patent No. 135,802. 11 February 1873. **

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Wrought Iron Bridge Company, Book of Designs of Wrought Iron Bridges Built by the Wrought Iron Bridge Co. Canton, Ohio: Hartzell & Saxton, Printers, 1874.**

Wrought Iron Bridge Company, Canton, Ohio. Advertizing brochure. Printed by the Krebs Lithographing Co., Cincinnati, Ohio, c. 1876.**

Bridge Files at the Ohio Historical Society (compiled by David A. Simmons, OHS).

**Indicates materials taken from the Bridge Files.

ADDENDUM TO
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Cast and Wrought Iron Bridges Project
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