CORBETT'S MILL BRIDGE
(Eby's Mill Bridge)
Iowa Bridges Recording Project
Spanning Maquoketa River,
3 miles Northeast of Scotch Grove
Scotch Grove Vicinity
Jones County
Iowa

HAER No. IA-60

BLACK & WHITE PHOTOGRAPHS

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WRITTEN HISTORICAL & DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
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HISTORIC AMERICAN ENGINEERING RECORD

CORBETT'S MILL BRIDGE
(Eby's Mill Bridge)

HAER No. IA-60

Location:	Spanning Maquoketa River on abandoned country road, 3.0 miles northeast of Scotch Grove, Jones County, Iowa UTM: 15.660410.4673415 USGS: Scotch Grove, Iowa quadrangle (7.5 minute series, 1980)
Date of Construction:	1871
Designer/Contractor:	Miller and Jamieson (Buckeye Bridge Company), Cleveland OH
Present Owner:	Private
Present Use:	Roadway bridge (closed)
Significance:	The Corbett's Mill bridge is an example of what was once a common bridge form: the bowstring arch-truss. In the 1860s and 1870s bowstring arch-trusses were used extensively because of their great structural efficiency and relativly low construction costs. During this period many thousands of bowstring arch-trusses were built in the nation. Because the development of Iowa's transportation system coincided with this period, the number of bowstrings built in the state numbered in the many hundreds. Most of these were built by the large Ohio bridge companies, such as the King Iron Bridge and Manufacturing Company, the Massillon Bridge Company, and the Wrought Iron Bridge Company. The Corbett's Mill bridge is an excellent example of a bowstring arch-truss that was built by a smaller company: the Buckeye Bridge Company, also of Ohio.
Historian:	Geoffrey H. Goldberg, engineer August, 1995
Project Information:	This document was prepared as part of the Iowa Historic Bridges Recording Project performed during the summer of 1995 by the Historic American

Engineering Record (HAER). The project was sponsored by the Iowa Department of Transportation (IDOT). Preliminary research on this bridge was performed by Clayton B. Fraser of Fraserdesign, Loveland, CO.

The period during which iron bowstring arch bridges proliferated in Iowa is an interesting episode in the history of bridges. Following the exceptional growth in Iowa's population in the wake of its admission to the Union in 1846, there was a need for a basic transportation infrastructure within the fledgling state. Now that Iowa's boundaries had been defined and the Native Americans had been displaced there was a plethora of land to be developed. State and local officials encouraged settlers to the new state. Settlers came from the eastern states and from Europe - Germany was the greatest supplier of these early immigrants, followed by Ireland, England, Scotland, and Scandinavia. They wrote home telling of the rich soil and readily available land, encouraging others to follow. During the 1850s Iowa's population more than tripled.[1]

The development of the state's agricultural industry was highly successful. By 1860 Iowa was the tenth largest producer of grain in the nation.[2] Major markets for Iowa's agricultural products were Chicago and the large eastern cities as well as the overseas markets of England, Scotland, and Ireland. This development could only be sustained if a sufficient transportation infrastructure were present. Where the transportation systems were most developed, hogs were raised. Where populations were less dense and transportation systems undeveloped, cattle were raised.[3]

The need to reach large out-of-state markets was met by the development of the railroad system in the state. This coincided with out-of-state interests to have the key hub of Chicago linked

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[1]Leland L. Sage, *History of Iowa*, Ames, IA: Iowa State University Press, 1974, p. 92. In 1850 the population was 192,214. By 1860 the population had risen dramatically to 674,913.

[2]Thompson, William H., *Transportation in Iowa: A Historical Summary*. Ames, IA: Iowa Department of Transportation, 1989, p.43. The major grains produced were(in order of decreasing significance): corn, wheat, oats, buckwheat, barley, and rye.

[3]Thompson, p.43.

with the Mississippi and Missouri rivers which define Iowa's eastern and western boundaries. In 1856 the United States Congress granted land to establish four railroads across the state. By 1866 rails had made it to Des Moines; one year later Council Bluffs on the Missouri River was reached.[4]

Although the railway system was vital to the economic development of the state, the intense concentration on the rail system did little to help development of the road systems. Roads were crude affairs. There was very little grading, and improvements were limited to filling in low spots to keep the roads above the water level during the rainy season.[5] Although little effort was put into developing road surfaces, the need to cross streams, rivers, and gullies was given great attention, leading to the need for a great number of bridges.

The responsibility for roads and bridges was for the most part strictly local. Initially townships, later the counties, took on the burden of developing and maintaining the roads. Typically, the cost of building a bridge would be funded by the county paying a large fraction (often 2/3) and the balance was paid by subscribers - that is, the adjacent landowners, merchants, and farmers who held a major stake in the bridge being built. The two principal rivers in Jones County - the Maquoketa and Wapsipinicon rivers were the major obstacles that required bridging. Spanning these two rivers, and their tributary creeks and streams, necessitated a sizable drain on the county coffers.[6]

The early bridges were made of wood and had very limited life expectancy. By the time that Iowa was admitted to the Union iron bridge technology was reaching a critical mass. The birth of iron bridges occurred in Britain following the development of industrial processes for the smelting of iron. The first iron bridge was built by Abraham Darby III in 1779 in Coalbrookdale, England. This was a cast-iron arch design which exploited the compressive strength of cast iron. Cast iron presented the early bridge designers with a problem, however, because it offered very poor strength when loaded in tension. In 1783 Henry Cort patented

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[4]Sage, p.112.

[5]Thompson, p.69.

[6]*History of Jones County, Iowa*. Chicago: Western Historical Company, 1879, p. 349-50 discusses the major bridge expenditures through 1878.

a method for shaping wrought-iron sections using rollers.[7] The following year he patented the puddling process for the conversion of cast iron to wrought iron. For the first time, wrought iron, capable of accepting compression *and* tension, was available in sufficient quantities in convenient shapes.

The first iron bridge in the United States was built in 1836 by Captain Richard Delafield of the Army Corps of Engineers in Brownsville, Pennsylvania. A decade latter, at the time of the creation of the state of Iowa, the railroads were beginning to build iron trusses. In 1841 Squire Whipple, of upstate New York, received a patent for a bowstring arch-truss.[8] This design consisted of a cast-iron arch with a wrought-iron lower chord, as well as diagonals and vertical rods of wrought iron. Many of these bridges were built in New York state, particularly for crossing the Erie Canal. Whipple's bowstring inspired many copies. In 1857 Thomas Moseley patented a bowstring design which used arches that were "built up of wrought plate iron...to give the whole arch transversely the form and strength of an arch, and to admit of very long spans without excessive weight, presenting at once the combined features of extraordinary strength and lightness."[9] The idea of building-up the upper chord was the key. Other patents would follow - all using built-up sections of one type or another.

The bowstring arch was the preferred design because of its efficient use of material. These bridges were prefabricated in the shop, broken down into parts for shippng and erected at the site. Moseley created the Moseley Bridge Company in Cincinnati and in 1861 one of his agents, Zenas King, along with a metalworker Peter Frees, took out their own patent for a bowstring bridge.[10] The company King created - the King Iron Bridge and Manufacturing Company of Cleveland, became a powerhouse in the iron bridge building industry. During the 1860s and 1870s they built hundreds of bowstring bridges throughout the nation. Other large bridge companies got in the act, including David Hammond's Wrought Iron Bridge Company of Canton, Ohio; and Joseph Davenport's Massillon Bridge Company of

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[7]Emory L. Kemp, "The Introduction of Cast and Wrought Iron in Bridge Building," *IA: The Journal of the Society for Industrial Archaeology* 19,no.2(1993): 5-16 presents an excellent discussion of the early use of iron in bridge building.

[8]Letters Patent No. 2064, April 24, 1841.

[9]Letters Patent No. 16,572, February 3, 1857.

[10]Letters Patent No. 33,384, October 1, 1861.

Massillon, Ohio. During this brief period thousands of bowstring arch bridges were built, spanning rivers, streams and gullies throughout the nation.

As intense as the bowstring building activity was, the bloom was short lived. Although the bowstring form is efficient in its use of material, it did suffer from some major problems. Because the upper chord members were bent to take the shape of the arch, each span length required a unique curve. This was a distinct manufacturability problem. The competing Pratt design, patented in 1844 by Thomas and Caleb Pratt, had straight upper and lower chords. Bridges of various spans could be accommodated by adding additional panels or simply selecting the appropriate element lengths, while the bowstring, with its fixed curved arch, could not. Probably, an even greater problem was the perception that the bridges were unsafe. The feelings of one Iowa state highway engineer from 1914 is indicative: "The bridges are light and flimsy. Everything about them is conducive to extreme and excessive vibration. Every man who has crossed one has noticed the trembling of the structure and the rattle of the rods and members of the bridge."[11]

The Corbett's Mill Bridge is an example of a bowstring fabricated by one of the smaller iron bridge building companies. In 1864, Peter Frees, who earlier had worked with King on the prototype bowstring of King's company, split from that firm. He established a partnership with Mahlon Miller, a boilermaker. Sometime in 1866 or 1867, Miller split with Frees and in 1868, formed a partnership with William Jamieson. Their facilities were located in Cleveland, literally in the shadow of the King Iron Bridge and Manufacturing Company plant.[12]

In 1870, Miller, at age 38, received a patent for his tubular arch design. In this scheme, the upper and lower plates have grooves on the edges and middle of their inner surfaces. The tube's vertical plates, along with a central plate, are received by the grooves. The tube is secured by the trusses' vertical members which clamp the top and bottom plates down on to the

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[11]"Treacherous Danger in Bow String Bridge," *Iowa Highway Commission Service Bulletin*. August, 1914, p.7.

[12]David A. Simmons, *Buckeye Bridge and Boiler Works*. Unpublished chronology, provided to author July 1995. Much of the history of Miller and the Buckeye Bridge Works presented here was derived from this source.

vertical plates "forming a strong and durable joint of simple and easy construction".[13]

In 1872 Miller and Jamieson took on a third partner to form the Buckeye Bridge and Novelty Boiler Works, which was renamed three years later to the "Buckeye Bridge Works". The name was changed again, in 1877, to the "Buckeye Bridge and Boiler Works".

In June of 1870, John Corbett, the owner of a Mill on the Maquoketa River in Scoth Grove township, petitioned the Jones County supervisors for a bridge to replace an existing timber bridge, spanning the river upstream from his millpond, with an iron one. The gristmill was built by James S. Applegate and his brothers Richard and John.[14] John Corbett purchased a quarter interest in the mill and formed a partnership with Applegate. They operated the mill together under the name "Applegate & Corbett" until 1868 when Corbett purchased the mill outright. He expanded and upgraded the facility by replacing the water wheel with a larger one and adding a sawmill and blacksmith shop. In September 1875, the mill was purchased by Samuel Eby, whose family continued operation of the mill for years.[15]

The supervisors were quick to act on Corbett's request. A committe of three was appointed to inspect the site, issue a contract, and oversee the work.[16] The existing abutments were ordered taken down and rebuilt of coursed ashlar limestone, some seven feet higher.[17] A contract was awarded to Miller for the erection of the 128 foot span. The bridge was completed in November 1871.[18]

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[13]Letters Patent No. 103,911, June 7, 1870.

[14]"Bridge May be Historic," *Anamosa (Iowa) Journal-Eureka,* 3 April 1985 p.10-A includes a history of the mill and bridge by local historian William E. Corbin.

[15]R.M. Corbit, *History of Jones County, Iowa: Past and Present* Chicago: S.J. Clarke Publishing Co., 1910. *vol 1.* p. 586-87. also "Bridge May be Historic,"

[16]Jones County Board of Supervisors' Records, Book B: page 224 (7 June 1870), page 240 (10 June 1870), Jones County Courthouse, Anamosa, IA.

[17]Supervisors' Records, Book B: page 264 (8 September 1870)

[18]"Bridge May be Historic,"

The bridge Miller built employs his patented built-up tubular arch for the upper chord in which the curved upper and lower plates are grooved to receive the side plates forming a strong and durable joint. The lower chord is composed of twin rectangular eyebars. The upper and lower chords are connected by paired verticals of star iron that also serve to clamp the tubular arch elements together. Cross bracing are provided by diagonals fashioned from round rod. Lateral stability is provided by a set of four round lateral struts which rise above the plane through the crown of the arch. Additional lateral stability is provided by an unusual arrangement of outriders. Unlike the typical outrider common to bowstrings of the era, where the brace extended from the upper chord to an extension of a lateral beam extending beyond the vertical plane through the truss, here Miller augmented the outboard brace with an inboard one that connects to the lateral beam *inside* the plane of the truss. A further interesting feature of these outriders is the manner in which the braces cross one another due to the fact that the inboard brace attaches to the *outboard* edge of the upper chord while the outboard brace attaches to the upper chord's *inboard* edge.

The bridge was bypassed by county road X73 in 1958, when a standard concrete girder was constructed a short distance downstream. The bridge then passed into private ownership. It stands as an interesting example of the once popular bridge type - the bowstring bridge.

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ADDENDUM TO
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Iowa Historic Bridges Recording Project
Spanning Maquoketa River at abandoned County Road
Scotch Grove vic.
Jones County
Iowa

HAER No. IA-60

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1849 C Street, NW
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This appendix is an addendum to a 9-page report previously transmitted to the Library of Congress.

APPENDIX: ADDITIONAL REFERENCES

Interested readers may consult the Historical Overview of Iowa Bridges, HAER No. IA-88: "This historical overview of bridges in Iowa was prepared as part of Iowa Historic Bridges Recording Project - I and II, conducted during the summers of 1995 and 1996 by the Historic American Engineering Record (HAER). The purpose of the overview was to provide a unified historical context for the bridges involved in the recording projects."