KERN TRUSS BRIDGE
Township Road, over
LeSueur River
Skyline vicinity
Blue Earth County
Minnesota

HAER NO. MN-45

PHOTOGRAPHS

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, D.C. 20013-7127

ADDENDUM TO:
KERN TRUSS BRIDGE
(Yeager Bridge)
(Bridge L5669)
Spans Le Sueur River (formerly carried Ivywood Lane/Township Road 190)
Skyline vicinity
Blue Earth County
Minnesota

HAER MN-45
HAER MINN,7-SKY.V,1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

KERN TRUSS BRIDGE

(Yaeger Bridge)

(Bridge L5669)

HAER NO. MN-45

Location: Located in the southeast corner of South Bend Township, Blue Earth County, Minnesota, approximately 2 miles south of Skyline, Minnesota. The bridge historically carried Ivywood Lane/Township Road 190 over the Le Sueur River.

The Kern Truss Bridge (also known as the Yaeger Bridge or Bridge L5669) is located at latitude 44.109798, longitude -94.042102. The coordinates represent the center of the structure. They were obtained in 2016 by plotting the bridge's location in Google Earth. The location has no restrictions on its release to the public.

Present Owner: Blue Earth County

Present Use: This bridge is currently closed to vehicular and pedestrian traffic.

Significance: This bridge is listed in the National Register of Historic Places (National Register) under Criterion C in the area of Engineering as the only example of a bowstring arch through-truss bridge in the state of Minnesota. The bridge is also nationally significant under National Register Criterion C in the area of Engineering as the longest example of a bowstring arch through-truss bridge in the United States, and the second longest in North America.

Historians: Rebecca Hoehn and Saleh Miller, The 106 Group Ltd.; 2017.

Project Information: This study, which is the third phase in the Minnesota Department of Transportation's (MnDOT) multi-phased Local Historic Bridge Study, was developed and executed in partnership with representatives from the Minnesota Historic Preservation Office (MnHPO); Federal Highway Administration (FHWA); MnDOT's State Aid for Local Transportation (SALT); the Corps of Engineers (Corps); local public works and highway departments; county and township boards, and city councils; the preservation community; and the general public. MnDOT's SALT is the project lead and is jointly administering the program with MnDOT's Cultural Resources Unit (CRU) and Bridge Office. This study

prepared Historic American Engineering Record (HAER) documentation for bridges that are unlikely to be rehabilitated; are rare, unusual, and the first or only known example; or that are candidates for relocation. Documentation is being prioritized for bridges in a state of severe deterioration or subject to loss. The Minnesota Department of Transportation retained LHB, Inc.; Mead & Hunt, Inc.; and The 106 Group Ltd to prepare this documentation. Rebecca Hoehn and Saleh Miller wrote the history. Dietrich Floeter completed the photography.

PART I. HISTORICAL INFORMATION

A. PHYSICAL HISTORY

Date(s) of Construction: 1873.

Architect/Engineer: Unknown.

Builder/Contractor/Supplier: Wrought Iron Bridge Company; John Mahowald.

Original plans and construction: Original plans and perspectives are not available for this bridge. However, according to historical photographs from 1948, 1962, 1967, and post-1973 the bridge had not undergone any cosmetic changes prior to ca. 1973.

Alterations and additions: This bridge was repaired in 1973 by Blue Earth County, and included concrete repairs to the limestone abutments, replacement of some of the original bolts with hex-head bolts, and the addition of a steel support column to the bottom cord at the southwest corner.[1] Also in 1973, an independent support of the bottom chord was installed in the southwest corner of the bridge; it consisted of a steel H-pile section supported on a concrete pad poured on the bedrock.[2] The railings consist of non-historic wire rope affixed to the truss verticals at regular intervals and anchored to the top chord member near the ends of the truss; the date of this change is unknown.[3]

B. HISTORICAL CONTEXT

The Kern Truss Bridge is located in South Bend Township, which is located in the southeastern corner of Blue Earth County. The bridge is known as such because it was originally built on land owned by

[1] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669." Prepared for the Minnesota Department of Transportation, August 2014.

[2] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[3] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

local farmer John Kern.[4] Recently, the local population has started referring to the bridge as "Yaeger Bridge" after a more recent owner of the land.

While metal was employed for bridge construction along the east coast starting in the mid-nineteenth century, Minnesota continued to use wood for bridge construction up until the 1870s due to the cheaper cost of wood compared to wrought-iron. Advocates of wrought-iron knew that the cost advantage of wood was only temporary because wrought-iron, though more expensive initially, was stronger and more durable. Many argued that the increased initial cost for wrought-iron would be offset by its increased length of service.[5] Government officials in Blue Earth County played a notable role in bringing metal bridges to Minnesota.[6] Due to the numerous rivers that flow through the county, the population required an exceptionally large number of bridges to carry goods and other items from markets and railroad centers. Starting in the late 1860s, officials embarked on a county-wide program to build "high quality, permanent bridges," which led them to accept a contract proposed by the Wrought Iron Bridge Company to construct the Kern Truss Bridge over the Le Sueur River for a total cost of $6,000 in 1872.[7] This bridge, which was constructed in 1873, was one of the first all-metal crossings built in the state and initiated a three-decade program of constructing wrought-iron, and later, steel bridges across Blue Earth County.[8]

The Kern Truss Bridge was based on a design by Squire Whipple and constructed by the Wrought Iron Bridge Company of Canton, Ohio.[9] The abutments were designed and constructed by John Mahowald, for which contextual information is limited.[10] Squire Whipple, a surveyor and bridge designer, was born in Hardwick, Massachusetts, in 1804.[11] A graduate of Union College in New York State, Whipple patented his design for a bowstring arch through-truss during the 1840s. While the bowstring arch design was popular throughout the United States during the mid-nineteenth century, it is not recognized as Whipple's most popular bridge design. He is better known for his work designing the double-intersection through-truss, commonly known as the Whipple truss, which became a popular option for railroad spans.[12]

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[4] Denis Gardner, *Wood, Concrete, Stone, and Steel: Minnesota's Historic Bridges* (Minneapolis: University of Minnesota Press, 2008), 51.

[5] Gardner, *Wood, Concrete, Stone, and Steel*, 50.

[6] Frederic L. Quivik and Dale L. Martin, "Iron and Steel Bridges in Minnesota," July 1988, National Register of Historic Places Multiple Property Documentation Form, E-7.

[7] Quivik and Martin, "Iron and Steel Bridges," E-8.

[8] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[9] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[10] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[11] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[12] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

Even before Whipple's patent expired in 1869, bridge builders copied his design, some with slight variation to avoid infringement, and many without any respect of the patent. During the last quarter of the nineteenth century it was one of the most generally adapted truss forms in bridge design. The bowstring bridge type proved very popular over the next 40 years and was used to construct train sheds, other curved vault structures, and short highway and canal spans of approximately 50' to 100', although some bowstring trusses were much longer."[13] It appears that Bridge L5669 is a variation of Whipple's patented design. As noted in the 2014 management plan for the Kern Truss Bridge, "One particular variation is the use of the six-sided riveted top chord. It is uncertain if the columns are Phoenix columns, after designer Samuel Reeves's fabrication company the Phoenix Iron Co., or Keystone columns, after the Keystone Bridge Company. Both columns feature a four-, six-, or eight-sided segmented beam and were used in many applications, including in bridge, building, and mine construction as structural supports due to their ability to support heavy loads. The iron top chord of this bridge has no manufacturer's stamps, so it is uncertain if the Phoenix Co. or the Keystone Bridge Company provided the top chords for this bridge. Other bowstring trusses nationally are known to have used Keystone columns, such as the Dubuque & Dunleith Bridge in Iowa. However, it is more likely that the Wrought Iron Bridge Company simply copied or made a slight variation on the patented column designs."[14] The multi-sided chord design has come to be described as a Phoenix column.[15]

The Wrought Iron Bridge Company of Canton, Ohio, which was founded and operated by David Hammon, incorporated in 1871.[16] Known as one of the leading builders and fabricators of wrought-iron superstructures, the company built bridges across the United States, with most of their work concentrated in the Midwest and on the East Coast.[17] In Minnesota, the company built a variety of bridges, including the third Hennepin Avenue Bridge in 1888.[18] Around the turn of the twentieth century the Wrought Iron Bridge Company, along with 25 other iron and steel bridge companies, consolidated into the American Bridge Company, led by J.P. Morgan.[19] The Kern Truss Bridge is the last surviving bridge in Minnesota constructed by the Wrought Iron Bridge Company.[20]

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[13] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[14] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[15] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[16] Gardner, *Wood, Concrete, Stone, and Steel*, 46.

[17]"Wrought Iron Bridge Co.," Bridgehunter.com, accessed April 18, 2016, https://bridgehunter.com/category/builder/wrought-iron-bridge-co/.

[18] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[19] Gardner, *Wood, Concrete, Stone, and Steel*, 46.

[20] "Wrought Iron Bridge Co.," Bridgehunter.com.

Heralded as "one of the oldest and rarest bridges still standing in Minnesota," the Kern Truss Bridge's bowstring arch through-truss design is unique among iron and steel bridges in the state.[21] According to the *Historic Context for Common Historic Bridge Types*, the bowstring arch truss was one of the most important bridge forms of the nineteenth century, with peak popularity dating from the 1870s and 1880s, and examples are highly significant.[22] The bridge holds exceptional significance as the longest bowstring arch in the state and the only known example ever to be constructed in Minnesota.[23]

Typical lengths for the bowstring truss range from approximately 50' to 130'. At 189'-0" long, this bridge exceeds the standard span lengths of bowstrings nationally. In North America, only the Blackfriars Street Bridge in Ontario, Canada (closed to all traffic in 2013) is longer at 225'-0". In the United States, the Freeport Bridge (also constructed by the Wrought Iron Bridge Company) near Decorah, Iowa, is second longest at 160'-0". As such, this bridge is the second known longest bowstring truss in North America and the longest in the United States.[24]

The Kern Truss Bridge is also significant for its wrought-iron construction. Wrought-iron is a nearly pure metal, containing only a small amount of slag. Much like steel, wrought-iron can easily be rolled to produce structural shapes, such as I-beams, channels, angle sections, and plates. Steel only became the preferred material after the creation of large-scale, open-hearth steel production plants in the mid-1890s, which made the cost of steel drop.[25] This bridge is one of only seven extant wrought-iron bridges in Minnesota, and one of only four that are trusses. The other six wrought-iron bridges are: Bridge 4846 in Le Sueur County (1875; LE-KST-004); Bridge 82524 in Washington County (1877; KC-UOG-042); Bridge L1393 in Winona County (1882; WN-WAR-015); Bridge 92366 in Hennepin County (1885; WR-HNC-006); Bridge 94246 in Hennepin County (1886; HE-PC-9006); and Bridge 27664 in Hennepin County (1887; HE-MPC-0276). The Kern Truss Bridge is also the oldest bridge in this group, with a construction date of 1873.[26] The former 1888 Steel Arch Bridge at Hennepin Avenue over the Mississippi was built by both the Keystone and Wrought Iron Bridge Companies, and documented for HAER in 1986. See HAER MN-18, http://www.loc.gov/pictures/collection/hh/item/mn0102/.

[21] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[22] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[23] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669.".

[24] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[25] Quivik and Martin, "Iron and Steel Bridges," E-6.

[26] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

PART II. STRUCTURAL/DESIGN INFORMATION

A. GENERAL STATEMENT

Character: The Kern Truss Bridge is significant for being the only example of a bowstring arch through-truss in Minnesota. This bridge also has exceptional national significance for being the longest known extant bowstring arch bridge in the United States, and the second longest in North America, second only to the Blackfriars Street Bridge in Ontario, Canada. The use of wrought-iron as the main building material for this bridge also made it one of the first all-metal crossings in the state.[27]

Condition of fabric: The majority of this bridge is in fair condition, with some elements in poor condition. Due to the failure of the paint system, active corrosion is present on the bottom chord and the built-up vertical truss members. The abutments are in poor condition, with significant settlement, cracking, and displacement seen on the east abutment. Some of the stones on this abutment are dislodged from their original position, particularly near the truss supports where non-functioning expansion bearings have transmitted unintended lateral forces to the masonry. In addition, the foundation on the abutment at the south end has settled, causing vertical translation of the bottom chord at this location. This condition may also be responsible for the broken sway brace connection in the southeast corner. Roughly 20 percent of the timber deck planks need to be replaced due to a combination of decay and wear.[28]

B. DESCRIPTION

The single-span superstructure consists of bowstring arch through-truss members. The truss members of the bridge vary in composition, with the arched top chord consisting of a built up "Phoenix Column" comprised of six angular iron segments riveted together along their flanges to form a hollow beam. The bottom chord is comprised of paired wide iron bars, connected end-to-end with riveted outside plates and an inside separator plate. The verticals are built up of latticed angle members and the diagonals are round bars. The latticed verticals narrow to a single rod to accept the horizontal lateral bracing members. The truss members are interconnected with bolts and threaded rods. Each truss has 13 verticals, consisting of alternating lattice girders and paired back-to-back angles, extending between the top and bottom chords. The verticals are bolted through the top chord. Latticed top horizontal bracing extends between the four central latticed verticals, and paired rods are used as laterals between the five central paired-rod verticals. The height varies on the lattice bracing. Diagonal bracing is utilized on both the vertical and the lateral members. The overall height of the truss is approximately 19' and the horizontal distance between the two trusses is 18'-6". The trusses support I-shaped floorbeams which in turn support sawn timber stringers and timber plank decking with timber running planks. The out-to-out width of the deck is 15'-10" and the clear width is 14'-9" between the timber curbs. The deck

[27] Gardner, *Wood, Concrete, Stone, and Steel*, 51.

[28] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

is approximately 30' above the riverbed. Two lines of wire cable have been strung across the verticals to serve as railings.[29]

The bridge substructure consists of stone masonry abutments. These abutments vary in height, with the west abutment being the shortest at approximately 5' and the east abutment measuring approximately 14'.

C. Site Information

This bridge carried Ivywood Lane/Township Road 190 over the Le Sueur River, connecting two major roads in West Mankato: the Cobb River Road to Beauford and the Indian Lake Road to Good Thunder and Rapidan. It is located in South Bend Township, Blue Earth County, Minnesota, approximately 2 miles south of Skyline, Minnesota. The one-lane bridge has an east-west alignment. It has been closed to pedestrian and vehicular traffic since 1991. The east approach is overgrown with brush and tree cover and is impassable by vehicles. The west approach is currently on private residential property and no discernible roadway approach exists.[30]

Part III. Sources of Information

A. Primary Sources

LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669." Prepared for the Minnesota Department of Transportation, August 2014.

Quivik, Fredric L., and Dale L. Martin. "Historic Iron and Steel Bridges in Minnesota, 1873-1945," National Register of Historic Places Multiple Property Documentation Form. Minnesota Historic Preservation Office, Minnesota Historical Society, Saint Paul, 1988.

B. Secondary Sources

Bridgehunter.com. "Wrought Iron Bridge Co." https://bridgehunter.com/category/builder/wrought-iron-bridge-co/.

Gardner, Denis. *Wood, Concrete, Stone, and Steel: Minnesota's Historic Bridges*. Minneapolis, Minnesota: University of Minnesota Press, 2008.

[29] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."

[30] LHB and Mead & Hunt Inc., "Local Historic Bridge Report. Bridge L5669."