SG100007183
Listed - 11/29/2021

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

1. Name of Property
Historic name: Zenas King Bowstring Bridge
Other names/site number: Brandewie Bridge (SHE-4-4-OHI-B); Loramie Creek Bridge
Name of related multiple property listing:
N/A
(Enter "N/A" if property is not part of a multiple property listing

2. Location
Street & number: Benjamin Trail, Amos Lake, Tawawa Park
City or town: Sidney State: OH County: Shelby
Not For Publication: n/a Vicinity: n/a

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,

I hereby certify that this _X_ nomination ___ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property _X_ meets ___ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

___national _X statewide ___local
Applicable National Register Criteria:

___A ___B _X_C ___D

Barbara Powers **DSHPO Inventory & Registration** October 14, 2021

Signature of certifying official/Title: **Date**

Ohio State Historic Preservation Office Ohio History Connection

State or Federal agency/bureau or Tribal Government

In my opinion, the property ___ meets ___ does not meet the National Register criteria.

Signature of commenting official: **Date**

Title : **State or Federal agency/bureau or Tribal Government**

Zenas King Bowstring Bridge Sidney Shelby OH
Name of Property County and State

4. National Park Service Certification

I hereby certify that this property is:

___ entered in the National Register

___ determined eligible for the National Register

___ determined not eligible for the National Register

___ removed from the National Register

___ other (explain:) _____

_____
Signature of the Keeper Date of Action

5. Classification

Ownership of Property

(Check as many boxes as apply.)

Private:	☐
Public – Local	X
Public – State	☐
Public – Federal	☐

Category of Property

(Check only **one** box.)

Building(s)	☐
District	☐
Site	☐
Structure	X
Object	☐

Zenas King Bowstring Bridge Sidney Shelby OH
Name of Property County and State

Number of Resources within Property
(Do not include previously listed resources in the count)

Contributing	Noncontributing	
		buildings
		sites
1	0	structures
		objects
1	0	Total

Number of contributing resources previously listed in the National Register 0

6. Function or Use
Historic Functions
(Enter categories from instructions.)
Transportation; Sub: Road-related (vehicular)

Current Functions
(Enter categories from instructions.)
Transportation; Sub: Pedestrian-related)

7. Description

Architectural Classification
(Enter categories from instructions.)
Other: Tubular Bowstring

Materials: (enter categories from instructions.)
Principal exterior materials of the property: Iron

Narrative Description

Summary Paragraph
The Zenas King Bowstring Bridge is a 72-foot tubular bowstring design defined by three primary components: a wrought iron tubular arch, essentially square in cross section; cruciform verticals with diagonal rod cross bracing; and lower chord eye bars with square, "clipped-corner" eyes.

These three components required distinctive iron castings along the length of the lower chord and on the abutments that are, therefore, also characteristic of the King bowstring design. All five components, with a high percentage of originality, are present in this bridge. It crosses a central narrowing of Amos Lake, an approximately two-acre body of water fed from Tawawa Creek and one of two lakes in the 220-acre recreational and natural area known as Tawawa Park operated by the City of Sidney. Removed from its second location and restored in 2020 by Bach Ornamental & Structural Steel of Holt, MI, it retains a high percentage of historic fabric. Furthermore, while on its third location, the current location is compatible with the natural setting of the original rural settings near Ft. Loramie and allows the bridge to convey its historical significance.

This bridge was originally one of two spans built in 1879 for Shelby County where the main highway north from Fort Loramie a small village in the northwestern corner of the county, crossed Loramie Creek adjacent to an aqueduct on the Miami & Erie Canal (figures 1, 2). When the disastrous statewide flood of March 1913 damaged the original bridge abutments, both spans were sold to Bernard Brandewie and moved to lanes on his livestock farm in McClean Township west of the village. Width alterations were made at this time but without impacting the bridge's structural significance. The nominated property is the only surviving bridge of the original pair.

Narrative Description

The Zenas King Bowstring Bridge consists of a 72-foot, eight-panel bowstring bridge (photos 1, 2). The two bow arches are tubular and were fabricated from two curved channel beams on top and bottom that were connected by riveted sides of iron boilerplate (photos 3, 17). The arch tubes' cross-sections are 6 x 8½ inches. The ends of the tubes rest on special skewback castings designed to receive the arched tube and connect with the forged and threaded ends of the iron bar lower chords (photo 6), which consist of pairs of 5 x ¾-inch eye bars (photo 5). The eyes of the lower chord bars feature square, "clipped corners" and are connected by pins (photo 7).

Seven cruciform iron verticals (photos 4, 8, 18) with threaded ends for nuts pass through each arch and are clamped to the lower chord with special castings (photo 10). They divide the bridge into eight panels. Each panel (except the end panels) includes diagonal tension rods that also connect through each arch and to the lower chord castings (photo 9). The end panels feature a single diagonal.

Flat iron scrollwork was originally attached to the four ends of the bowstrings (figure 6) to serve as approach railings. A wooden 2 x 8-inch rail is today attached to the verticals to replicate the original railings. A 3½ –foot open, steel cable railing was installed on both sides of the deck to keep modern pedestrians away from the deck's edges (photos 2, 15).

Three iron rod outriggers are bolted to the outside of each bowstring tube to brace against the lateral sway of the two arches (photos 10, 13). The lower ends of the outriggers are bolted to 6-inch I floor beams that rest on top of the lower chord. New 2 x 8-inch wooden floor beams, also resting on the lower chord, support the new wooden deck.

When relocated in 1913 for use on the farm lane (figure 3), the 16-foot roadway was narrowed to 12½ feet. This reduction in width required that the original 6-inch I floor beams connected to the six outriggers also be shortened (photo 13). About 3 feet were removed from the center beam and 1½ feet cut from the other two floor beams. Nonetheless, the shortened floor beams were reattached to the sway bracing in a fashion that duplicated the original connections. No other iron floor beams were present when the historic bridge was first identified in the statewide inventory in 1976. All told, none of these changes to the floor system and its bracing impacted the significant components of King's design.

The bridge was relocated to Sidney, OH in 2020, and Bach Ornamental & Structural Steel of Holt, MI, completed an in-kind restoration. This firm was responsible for two other major King bowstring restorations—the McIntyre Bridge, Poweshhiek Co, IA; and Paper Mill Bridge, New Castle Co., DE. The firm's work on the Sidney bridge included the replication of some historic fabric. In general, modern hex-shaped nuts were used for the Sidney bridge where necessary to maintain structural integrity, although an effort has been made to restrict their use to places that can be concealed or at least be less conspicuous (photos 8, 14, figure 15). The major exception to this was on the field assembly plates on the sides of the bowstring tubes where modern bolts were used because structural viability was the overriding concern (photo 16).

The work done in 2020 required additional changes to the 1913 sway bracing fabrication in order to facilitate the bridge's relocation and restoration. The extent of work required suggests that the early twentieth-century work was done using steel because of the heavy corrosion that was evident. In removing the sway bracing, the bolts connecting the bracing to the sides of the tubes had to be burned off (photo 10). Furthermore, the threaded ends of three of the six sway bracing rods had to be cut and new rod welded on and rethreaded (photo 13). Finally, the U-bolts that helped connect the iron floor beams to the lower chords that formed part of the sway bracing were replaced (photo 14).

All fourteen distinctive verticals in this bridge are original (photo 2). A total of fourteen distinctive lower-chord-clamp castings were used to connect the verticals, diagonal bracing, lower chords, and cross bracing under the deck (photo 7). Only two had to be replaced, and an original casting was used as a pattern (photos 19, 20). The replacements are on the first (photos 8, 18) and third verticals at the southwestern corner of the bridge and do not display the pitting evident on the surface of the originals.

Only one of the original iron scrollwork approaches was still intact in 2020. It was used to fabricate replacements at the other three corners (photo 11). A close inspection of the original member (NE corner) reveals the pitting that distinguishes it from the replacements (photo 12).

All of the lower lateral cross bracing of rods beneath the deck could not be salvaged and were replaced in 2020 (photos 8, 14). These elements are largely out-of-sight and are not part of King's distinguishing features. Modern hex-shaped nuts were used to secure the bracing to the original lower cast clamps. In general, these modern nuts identify the replacement work done in 2020. Everywhere else, the original square nuts were retained.

The modern deck consists of floor beams of treated timbers that rest on the lower chords. Board decking running at right angles to the floor beams is attached to these beams. Historic photographs (Figures 1 and 2) indicate that this is a duplication of the original deck system.

One of the characteristic King components was modified in the restoration work completed in 2020: the side plates of the two bow arches. The original tubes consisted of three primary elements: top and bottom channel beams, two 1/8" wrought iron boilerplate sides, and chain rivets to create a hollow rectangular tube (photo 4). The tubes for each arch of this particular bridge were originally fabricated in the shop into three separate segments (photo 5). These shorter segments facilitated transport to the original construction site. The connections between adjacent segments were staggered so that none of the joints in each of the four sides of the tube aligned, in order to avoid a structural weak spot in the arches. This design required some hand field riveting and careful observation of an unaltered King bowstring reveals the physical differences in the rivet heads done in the shop versus those done in the field (figure 12).

The extent of section loss in the side plates of the arches on this bridge as found in 2020 seriously compromised the structural integrity of the bridge (figures 4, 5). An alarming number of rivets had pulled through the boilerplate, making it necessary to replace the original iron side plates with new steel plates. Although of the same gauge plate, important historic fabric was, therefore, removed in this process. All of the historic rivets, both done in the field and shop, were also removed in that process. The replacement work (figure 8) precisely duplicated the original King design, including details that might have escaped a less careful or thorough restoration contractor. King originally used threaded, square-headed bolts to temporarily assemble his arches in the field and hold them in place while the field riveting was being completed. Unfortunately, they could not be salvaged and were replaced with modern, hexagon-headed bolts (photo 16). So, while original fabric has been removed and replaced, it was done in a sensitive manner that still allows a detailed explanation of how this bridge was assembled in the field.

The Zenas King Bowstring Bridge derives its significance from its distinctive design. It retains historic integrity that represents this design and sufficient historic materials and workmanship that illustrate the design. The bridge has been moved twice as described. The current location is compatible with its original rural setting, crosses an active waterway and maintains the appropriate association with the waterway. The majority of the characteristic King elements in this bridge, verticals, lower chord, lower chord castings, and cast skewbacks, are largely or entirely original, and only the tubular bowstrings have been altered, but in a manner in keeping with their historic integrity. And in the latter case, the tubes retain half their original fabric and replicate important assembly techniques.

Each of the two historic locations of the bridge was rural in character, crossing small waterways, and both were elements of a roadway system, originally public and then private. The new location duplicates the rural character of the historic environs and use in crossing a waterway. While the use has been adapted from a roadway to a pedestrian and biking path, it is compatible in a way that does not change the bridge's essential function.

Form liners that imitate coursed masonry were used to fabricate new concrete abutments that duplicate the configuration of the originals—short walls and angled wing walls—(photo 15) at the new Tawawa Park location but are not included in the nomination.

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [ ] A. Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] B. Property is associated with the lives of persons significant in our past.
- [x] C. Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] D. Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

- [ ] A. Owned by a religious institution or used for religious purposes
- [x] B. Removed from its original location
- [ ] C. A birthplace or grave
- [ ] D. A cemetery
- [ ] E. A reconstructed building, object, or structure
- [ ] F. A commemorative property
- [ ] G. Less than 50 years old or achieving significance within the past 50 years

Zenas King Bowstring Bridge Sidney Shelby OH
Name of Property County and State

Areas of Significance
(Enter categories from instructions.)
Engineering

Period of Significance
1879

Significant Dates
1879

Significant Person
(Complete only if Criterion B is marked above.)

Cultural Affiliation

Architect/Builder
King Iron Bridge & Manufacturing Company

Statement of Significance Summary Paragraph (Provide a summary paragraph that includes level of significance, applicable criteria, justification for the period of significance, and any applicable criteria considerations.)

The Zenas King Bowstring Bridge is significant under Criterion C in the area of engineering as representative of the distinctive characteristics of the patented tubular bowstring bridge designed by Zenas King in the 1860s and fabricated by the King Iron Bridge & Manufacturing Company of Cleveland, Ohio, until about 1880. It features the rectangle-configured wrought iron tubular arch, cruciform verticals and rod cross bracing, distinctively shaped eye bar lower chords, and related cast iron components necessary to connect all the elements. Tubular bowstring bridges were introduced just prior to the Civil War and became especially popular for highways in the fifteen years after the conflict. Simple to fabricate, King's tubular design was inexpensive and highly successful and was often the first iron bridge that county commissions and municipalities built throughout the state (figure 13). As a result, the design set a standard which competitors, like the Wrought Iron Bridge Company of Canton, Ohio, quickly emulated. An indication of King's success was the selection of his patented bowstring design at the Centennial International Exposition grounds in Philadelphia's Fairmount Park in 1876 (figure 14). Erected in 1879 on a major north-south highway in McClean Township in western Shelby County, the Zenas King Bowstring Bridge was repurposed in 1913 to cross a small stream running through a farm lane in the same township. In this fashion, it demonstrates the common reuse of bridges during the late 19th and early 20th centuries, especially examples short enough to be readily transported to a new location using animal power (figure 3). Its second relocation to Sidney, Ohio, is therefore, in

keeping with this historic pattern and does not impact the structural or design significance of the bridge as it stood on its original site (photo 1). As one of only two known King bowstring bridges extant in Ohio, this bridge is of state level significance. The other example is located at the Ohio History Center in Columbus and has also been relocated.

The Zenas King Bridge meets the requirements of Criteria Consideration B as moved structure as it retains its significant design features and historic materials to represent King's workmanship as a bridge designer and builder. The current location is within an environment compatible to the original bucolic rural setting.

Narrative Statement of Significance

Zenas King of Cleveland, Ohio, was one of a handful of 19th-century bridge builders who obtained a national reputation. Starting from a small boiler works and initially producing only a single iron bowstring design (of which the nominated property is an example, figure 13), King created a bridge-building concern—initially the King Iron Bridge & Manufacturing Company but soon shortened to the King Bridge Company—that was among the largest and most diversified in the continental United States by the time of his death in 1892 (Simmons, "National Scale," pp. 27-33; Darnell, *Directory*, Appendix A). A structure that reflects the culmination of the King Bridge Company's success is the Detroit-Superior High Level Bridge in Cleveland, a 3,112-foot-long through arch completed across the Cuyahoga River in 1917 and listed on the National Register of Historic Places in 1974. This all lay far in the future, however, when King developed his tubular bowstring design in the late 1850s.

One of the first American iron bridges of any kind was that patented in 1841 by Squire Whipple (figure 9). It used a system of separate, individual castings assembled like a stone arch to create a bowstring whose arch was the primary compression member. A series of wrought-iron links provided the primary tension member and held the castings of the arch together (Delony, p. 28). In 1857, Cincinnati-bridge builder Thomas W. H. Moseley was the first American to patent a wrought-iron bowstring with a continuous tube composed of boilerplate. It was triangular in cross-section (figure 10). Helping him market his bridge was a young man from Vermont named Zenas King. His work with Moseley introduced him to the bridge-building business (figure 11). When Moseley moved to Boston in 1860, King relocated to Cleveland to establish his own bridge-building firm (Simmons, "Bridges & Boilers").

The tubular bowstring design that King developed became the basis for his national bridge-building business. A metalworker named Peter Frees initially worked with King to build the prototype in 1859, and early the following year they filed an application with the US Patent Office. By the 1860s, the use of tubular compression members for bowstring bridges was not new; but the use of a practical and simple system for mass-producing them using wrought-iron boilerplate remained relatively novel. The King and Frees design employed a tube rectangular in cross section with parallel sides of wrought-iron boilerplate riveted to channel bars at top and bottom (photo 3). If the tube was large, as required for long spans, a third channel bar was riveted to the middle of the tube for additional stiffness and strength. Their patent, obtained in October 1861, proposed a tube that swelled in the center (none are currently known to exist). It

was "improved" in 1866 with a second patent that instead enlarged the two ends of the tubular arch (Simmons, "National Scale," pp. 24-25).

The circumstances and timing for the introduction of iron bridges varied throughout Ohio, but county commissioners made frequent trips to neighboring communities to view King patent bowstrings as they discussed the pros and cons of this new structural system. An ad prepared by the King company in 1866 (Figure 13) cited structures erected in 11 counties scattered across the state and in the city of Cleveland. King built so many patent bowstrings throughout the state that, in effect, he set a design standard. The efforts of other companies to meet King's competition undoubtedly promoted the popularity of the bowstring in Ohio during the 1860s and 1870s (Simmons, "Risk," p. 118).

A study of 19th-century bridge patents in Ohio (Figure 16) demonstrates King's fundamental role in promoting tubular bowstrings. As indicated earlier, a Cincinnati bridge builder with whom King worked received the first tubular bowstring design in 1857. The second tubular bowstring patent in Ohio was issued to King himself in 1861. The third and fourth tubular bowstring patents were issued to individuals associated with the Wrought Iron Bridge Company, a competing firm from Canton, Ohio, in 1864 and 1866. Both of these designs were repeatedly improved throughout the decade. Beginning the next year, Ohio bridge builders patented a steady stream of tubular bowstrings (Simmons, "Risk of Innovation"). In such a context, it would be difficult to overstate the importance and impact of King's patent bowstring in Ohio's engineering heritage.

After Cyrus Force, a trained civil engineer, joined King's company in the 1860s, a US Patent Office revision was filed in 1867 and again in 1874 that used a uniform cross section throughout the bowstring's tube (photo 2) (Simmons "National Scale," p. 26; "Memoir of Cyrus Gildersleeve Force"). This simplified the shop fabrication of King's bridge and substantially reduced production costs (Simmons, "Bridges & Boilers," p. 73). The length of the span determined each tube's cross sectional size.

In the absence of actual business records, historians must frequently depend on advertising prepared by the bridge companies themselves. The first known King catalog was published in 1875 and documented the firm's virtually exclusive construction of tubular bowstrings prior to that date. A total of 203 bridges were built, ranging in spans from 40 to 250 feet. They were erected in Ohio, New York, Illinois, Maryland, Pennsylvania, Wisconsin, Iowa, Texas, Nebraska, Minnesota, Kansas, New Jersey, Massachusetts, Connecticut, Rhode Island, Michigan, Kentucky, and West Virginia. Among them were the State Street Bridge in Columbus, Ohio of three 120-foot spans, the six 150-foot spans across the Kansas River at Topeka, Kansas, and the five-span bridge measuring a total of 550 feet that replaced the infamous 1873 collapse of a Truesdell-designed bridge in Dixon, Illinois, whose high death toll haunted iron bridge builders (*Designs*).

The Ohio Department of Transportation (ODOT) published their first statewide historic inventory of publicly owned bridges in 1983. In it, they identified 16 bowstring truss bridges that were either listed on or eligible for the National Register. An additional 7 bowstring bridges were

included in a "reserve pool" that were of a lesser level of significance. Of those 23 bridges, 4 were identified as King bowstring bridges. An Excel file currently maintained by ODOT and last updated in 2011 lists a total of 23 bowstring bridges in Ohio, both publically and privately owned. Only two were manufactured by the King company. (Ohio Department of Transportation: The Ohio Historic Bridge Inventory, Evaluation, and Preservation Plan, 1983)

Today, the *Bridgehunter.com* website identifies eighteen other extant examples of King patent bowstrings in Wyoming, Nebraska, Kansas, Iowa, Texas, Arkansas, Illinois, Indiana, Delaware, Maryland, New York, and Ohio, dating between 1868 and 1883. In Ohio, the Zenas King Bowstring Bridge is one of only two still standing. The other was moved in 1987 from Crawford County, Ohio, to the Ohio History Center in Columbus.

The Zenas King Bowstring Bridge was built as a pair of spans across Loramie Creek in 1879 (figures 1, 2) near the end of the popular era for bowstring bridges. Early on, some civil engineers objected to the difficulty of stabilizing the arch from lateral sway. The outriggers incorporated on the outside of the arches in the original fabrication of this bridge (photo 13) were an effort to limit sway but were only partially successful. Continued criticism by professionals finally resulted in bowstring designs falling from favor about 1880. Their place was taken by iron through trusses that could be more effectively braced (Simmons, "National Scale," p. 33; Delony, p. 34).

The bridge was built on a major north-south highway between Piqua to the south in Miami County and Defiance in Defiance County to the north. This important thoroughfare ran through the western portions of Shelby and Auglaize counties paralleling the Miami and Erie Canal, one of two major state-owned canal systems running between the Ohio Valley and Lake Erie.

The Great Flood of March 1913 resulted in major damage to the abutments and forced the replacement of the twin spans. Shelby County transferred ownership of both spans to Bernard Brandewie, who operated a 600-acre cattle and hog farm approximately 3 miles west of the village, now bisected by Brandewie Road, until his death in 1929. The fate of the other bowstring of the pair on the farm is unknown. The bridge was presumably an important cog in the operation of Brandewie's livestock farm (*History of Shelby County*). But when first inventoried in 1976 (figure 3), residents of the farm were no longer actively using the remaining bridge and were simply fording the small stream.

The significant components of the Zenas King Bowstring Bridge as defined in the description—the arches, verticals, lower chord, and lower chord connection features—were not impacted by its relocation in 1913 or 2020. Historically, reuse of iron bridges on new locations was a common occurrence, especially those, such as this bridge, that could be moved as a unit by animal power. Disassembly was necessary in 2020 (figures 4, 5, 6) in order to properly restore the bridge, but as noted in the description, all renovation was done in keeping with the original construction techniques and did not impact the structure's integrity of design, materials and workmanship (figures 7, 8). The bridge still clearly defines the five structural features of the King patent bowstring design, something of vital importance to Ohio's engineering heritage. The

tubular arches, verticals and diagonal bracing, lower chord eye bars, lower chord castings, and cast skewbacks of King's design are all still present and predominantly of original fabric.

The bridge meets the requirements for listing under Criterion Consideration B as a moved resource. The relocations did not adversely impact the setting, feeling, and association of the bridge. While on the farm, the bridge continued to be used as a roadway for farm vehicles and animals (figure 3). Furthermore, the relocation to Amos Lake in Tawawa Park continues its use for crossing a body of water and for the movement of people between portions of Benjamin Trail in a park setting compatible with the rural character of the earlier sites (photos 1, 15).

9. Major Bibliographical References

David A. Simmons, "Bridge Building on a National Scale: The King Iron Bridge and Manufacturing Company," *IA: The Journal of the Society for Industrial Archeology*, Vol. 15, No. 2 (1989), pp. 23-39.

David A. Simmons, "Bridges and Boilers: Americans Discover the Wrought-Iron Tubular Bowstring Bridge," *IA: The Journal of the Society for Industrial Archeology*, Vol. 19, No. 2 (1993), pp. 63-76.

David A. Simmons, "The Risk of Innovation: Ohio Bridge Patents in the 19th Century," *Proceedings of the First Historic Bridges Conference*, Ohio State University, November 1, 1985, pp. 108-132.

Victor Darnell, *A Directory of American Bridge Building Companies, 1840-1900*. Washington, DC. Society for Industrial Archeology, 1984.

Designs, King Iron Bridge & Manufacturing Company, Manufacturers of Wrought Iron Bridges (Cleveland, O., 1875).

Cleave's Biographical Cyclopedia of Cuyahoga County (Cleveland, c.1879).

"Memoir of Cyrus Gildersleeve Force, Jr." in *Transactions of the American Society of Civil Engineers*, Vol. 86 (1923), pp. 1656-7.

Ohio Department of Transportation. SHE-Zenas King Bridge Rehabilitation. PID No. 106696.

History of Shelby County, Ohio by A.B. C. Hitchcock (Chicago, IL: Richmond-Arnold Pub. Co., 1913).

Eric Delony, "Surviving Cast- and Wrought-Iron Bridges in America," *IA: The Journal of the Society for Industrial Archeology*, Vol. 19, No. 2 (1993), pp. 17-47.

Bridgehunter.com

The Ohio Historic Bridge Inventory, Evaluation, and Preservation Plan (Columbus, OH: Ohio Department of Transportation, 1983).

Bowstring Bridges in Ohio-ODOT List Excel File. March 25, 2020.

Previous documentation on file (NPS):

____ preliminary determination of individual listing (36 CFR 67) has been requested
____ previously listed in the National Register

Zenas King Bowstring Bridge Sidney Shelby OH
Name of Property County and State

____previously determined eligible by the National Register
____designated a National Historic Landmark
____ recorded by Historic American Buildings Survey #_____
____recorded by Historic American Engineering Record # _____
____ recorded by Historic American Landscape Survey # _____

Primary location of additional data:

x State Historic Preservation Office
x Other State agency
____ Federal agency
x_ Local government
____ University
____ Other
Name of repository: _____

Historic Resources Survey Number (if assigned): ___SHE0000404_____

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10. Geographical Data

Acreage of Property Less than one

Use either the UTM system or latitude/longitude coordinates

Latitude/Longitude Coordinates
Datum if other than WGS84:_____
(enter coordinates to 6 decimal places)

1. Latitude: 40º20'44.9"N Longitude: 84º25'14.9"W

Or
UTM References
Datum (indicated on USGS map):

☐ NAD 1927 or ☐ NAD 1983

1. Zone: Easting: Northing:

2. Zone: Easting: Northing:

3. Zone: Easting: Northing:

4. Zone: Easting : Northing:

Verbal Boundary Description (Describe the boundaries of the property.)
The boundaries for the Zenas King Bowstring Bridge are defined by the overall footprint of the bridge, measuring approximately 72 by 12 feet and do not include the modern (2020) concrete abutments that support it.

Boundary Justification (Explain why the boundaries were selected.)
The boundaries for the Zenas King Bowstring Bridge are defined by the overall footprint of the bridge and do not include the modern (2020) concrete abutments that support it, nor any other portion of Tawawa Park. The significance of the property lies in the engineering of the structure of the bridge itself, and this aspect has remained intact through two moves. While important for the practical viability of the bridge, the concrete abutments do not add to its significance and, therefore, have not been included in the nomination.

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11. Form Prepared By

name/title: David A. Simmons
organization: Ohio Historic Bridge Association
street & number: PO Box 153
city or town: Galena state: Ohio zip code:43021
e-mail: everetsherman1877@gmail.com
telephone: 614-565-5142
date: May 16, 2021

Photographs

Photo Log

Name of Property: Zenas King Bowstring Bridge
City or Vicinity: Sidney
County: Shelby State: Ohio
Photographer: David A. Simmons
Date Photographed: August 27, 2020

Description of Photograph(s) and number, include description of view indicating direction of camera:

1 of 20.
Description: Overall view of bridge and setting from embankment. Facing northeast.

2 of 20.
Description: Overall view of bridge from southwest, camera facing north.

3 of 20.
Description: Detail view of western compression tube from southwest.

4 of 20.
Description: View of first cruciform vertical of western bowstring from southwest.

5 of 20.
Description: View of eye bar lower chord of western bowstring from northwest.

6 of 20.
Description: View of northwestern cast iron skewback connecting the tube and lower chord.

7 of 20.
Description: Eye bar connection and vertical connection near center of lower chord of western bowstring.

8 of 20.
Description: Detail view of connection of first vertical from southwest. Upper casting clamp is a replacement. Lower casting is original.

9 of 20.
Description: View of diagonal rod crossbracing between lower chord and tube near center of western bowstring from southwest.

10 of 20.
Description: View of top channel beam at center of eastern bowstring tube.

11 of 20.
Description: View of replacement flat iron scrollwork approach at southwest corner, camera facing northeast.

12 of 20.
Description: View of original flat iron scrollwork approach at northeast corner, camera facing south.

13 of 20.
Description: View of lateral sway bracing at second vertical from southwest corner.

14 of 20.
Description: View of lower crossbracing from southeast, camera facing northwest.

15 of 20.
Description: Overall view of bridge and setting from embankment looking northwest.

16 of 20.
Description: Detail of field joint in eastern tube, looking northeast.

17 of 20.
Description: Detail of new side plate of eastern tube, looking northwest.

18 of 20.
Description: Overhead detail of new upper casting clamp at first vertical from southwest corner.

19 of 20.
Description: Overhead detail of original upper casting clamp at first vertical from northwest corner.

20 of 20.
Description: Detail view of connection of first vertical from northwest showing original castings, looking northeast.

Maps:
1. Overview of Tawawa Park
2. View of nomination boundary
3. Photo view map

List of Figures:
Figure 01: Historic view of bridge on original location. *Fort Loramie Historical Association*

Figure 02: Historic view of bridge on original location, circa 1912. *Ken Sowards Collection*

Figure 03: Ohio Historic Inventory form photo (SHE-00004-04), taken October 1976 by David A. Simmons. *Ohio Historic Preservation Office*

Figure 04: Overall condition, August 2020. *Bach Steel Photo*

Figure 05: Condition of tube side plate, August 2020. *Bach Steel Photo*

Figure 06: Condition of scrollwork approach, August 2020. *Bach Steel Photo*

Figure 07: Pad welding repairs of eye bar "eyes." *Bach Steel Photo*

Figure 08: Riveting new side plate on tube. *Bach Steel Photo*

Figure 09: Squire Whipple's patent #2064, dated April 24, 1841, was America's first iron bowstring design and incorporated shorter, panel-length castings to create the arches. *US Patent Office*

Figure 10: T. W. H. Moseley's 1857 tubular bowstring design had a triangular cross section and used simple, overlapping plates to connect adjoining plates during field assembly. Drawing by Elaine Pierce, *David A. Simmons Collection*

Figure 11: In 1859, Zenas King was still working for Moseley & Company in Cincinnati when this bridge was built over Storms Creek north of Ironton, in Lawrence County, Ohio,

for the Iron Railroad, a line established to service charcoal iron furnaces. *Ohio History Connection*

Figure 12: Zenas King used a more elaborate system to connect the four sides of his bowstring tubes during field assembly that required using threaded bolts to temporarily hold the segments in position until the tube was fully riveted. This explanatory drawing, showing the original square-headed bolts, was based on the shorter bowstring now standing at the Ohio History Center in Columbus and thus has a much-reduced cross section in comparison to the Sidney example. Drawing by Elaine Pierce, *David A. Simmons Collection*

Figure 13: The creation and marketing of King's patented iron bowstring design in the 1860s was perfectly timed to take advantage of expanding iron production stimulated by the Civil War and demands for transportation improvements across Ohio. *Cleveland Leader City Directory, 1866-67*

Figure 14: Evidence of the success of King's patent bowstrings was their choice for a prominent location in the Centennial International Exposition of 1876 in Philadelphia's Fairmount Park. Zenas King proudly stood at the end of the bridge upon its completion. *Robert M. Vogel Collection*

Figure 15: Detail photograph of an upper field connection for one of the channel beams following renovation. Photo by Dan Bennett, March 5, 2021.

Figure 16: List of Ohio Patents. Source: David A. Simmons, "The Risk of Innovation: Ohio Bridge Patents in the 19th Century," Proceedings of the First Historic Bridges Conference, November 1, 1985.

Figure 01: Historic view of bridge on original location. *Fort Loramie Historical Association*

Figure 02: Historic view of bridge on original location, circa 1912. *Ken Sowards Collection*

Figure 03: Ohio Historic Inventory form photo (SHE-00004-04), taken October 1976 by David A. Simmons. *Ohio Historic Preservation Office*

Figure 04: Overall condition, August 2020. *Bach Steel Photo*

Figure 05: Condition of tube side plate, August 2020. *Bach Steel Photo*

Figure 06: Condition of scrollwork approach, August 2020. *Bach Steel Photo*

Figure 07: Pad welding repairs of eye bar "eyes." *Bach Steel Photo*

Figure 08: Riveting new side plate on tube. *Bach Steel Photo*

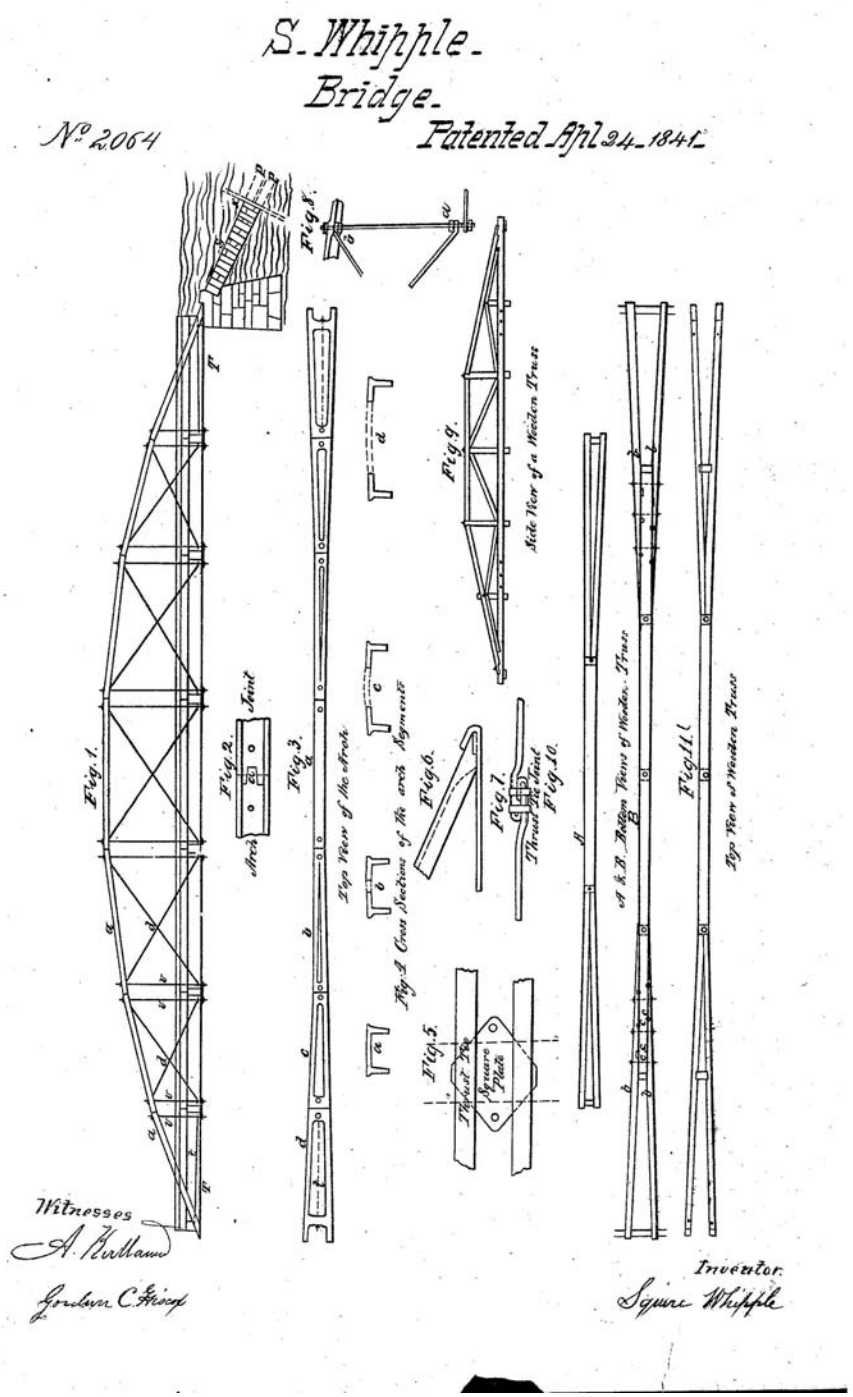
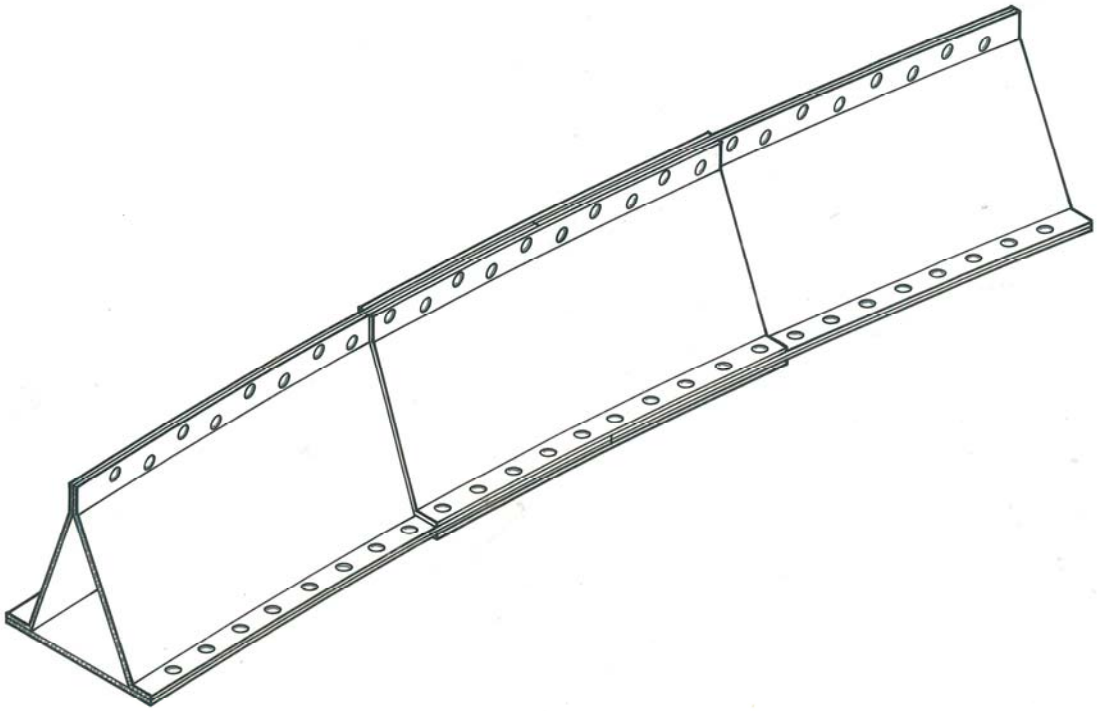


Figure 09: Squire Whipple's patent #2064, dated April 24, 1841, was America's first iron bowstring design and incorporated shorter, panel-length castings to create the arches. *US Patent Office*



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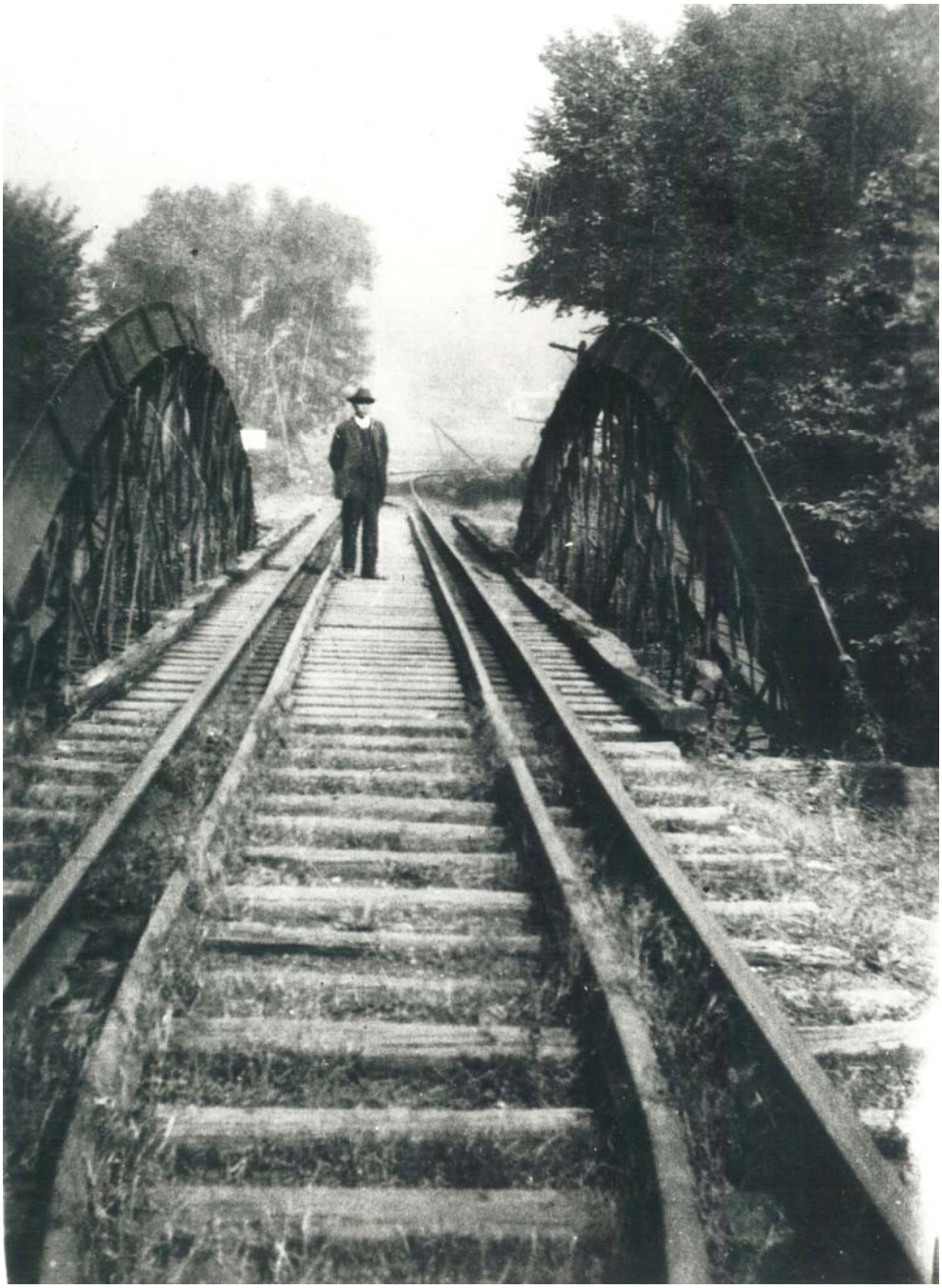

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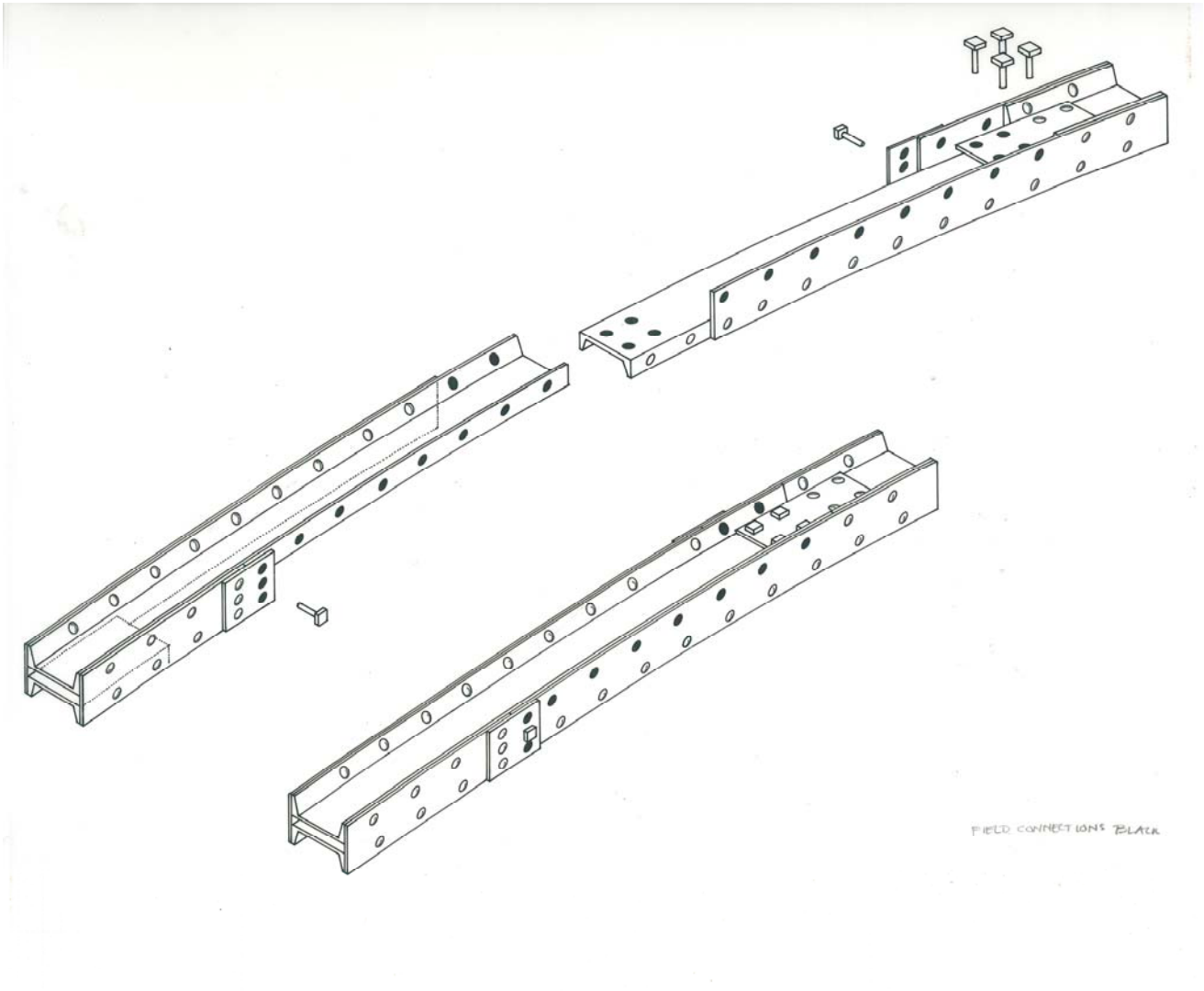

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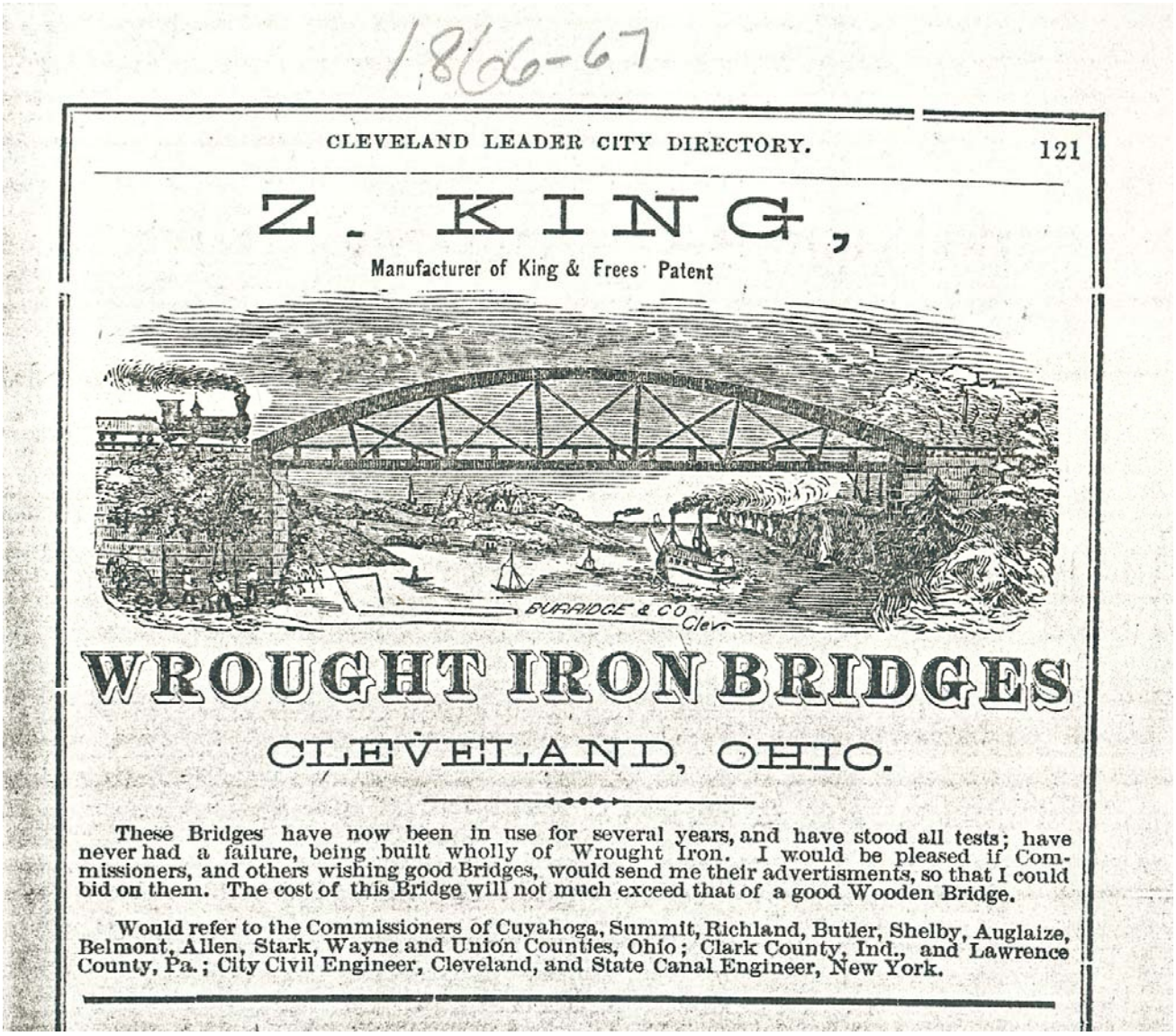

1866-67

CLEVELAND LEADER CITY DIRECTORY. 121

Z. KING,

Manufacturer of King & Frees Patent

BURRIDGE & CO Clev.

WROUGHT IRON BRIDGES

CLEVELAND, OHIO.

These Bridges have now been in use for several years, and have stood all tests; have never had a failure, being built wholly of Wrought Iron. I would be pleased if Commissioners, and others wishing good Bridges, would send me their advertisments, so that I could bid on them. The cost of this Bridge will not much exceed that of a good Wooden Bridge.

Would refer to the Commissioners of Cuyahoga, Summit, Richland, Butler, Shelby, Auglaize, Belmont, Allen, Stark, Wayne and Union Counties, Ohio; Clark County, Ind., and Lawrence County, Pa.; City Civil Engineer, Cleveland, and State Canal Engineer, New York.

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United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Zenas King Bowstring Bridge
Name of Property Shelby County, Ohio
County and State N/A
Name of multiple listing (if applicable)

Section number Figures Page Additional Documentation

OHIO PATENTS				
PATENT FILE #	NAME	LOCATION	DATE	DESIGN
13461	Horace Hewey (III.) and Robert E. Osborn	Springfield, OH	Aug 21, 1855	Arch with suspension cable
14313	Peter Guiou	Cincinnati	Feb 16, 1856	Wooden and metallic arch
15823	Isaiah Rogers	Cincinnati	Sept 30, 1856	Cast iron arch
15873	Balaam G. Anderson	Chillicothe	Oct 14, 1856	Movable bridge for canals
16572	Thomas W. H. Moseley	Covington, KY	Feb 3, 1857	Tubular arch
20082	David H. Morrison	Dayton	Apr 27, 1858	Metal connection for wooden truss
26680	Enoch Jacobs	Cincinnati	Jan 3, 1860	Iron truss
28148	George Bovey	Chillicothe	May 8, 1860	Draw bridge improvement
32480	J. H. Junkins	Upper Sandusky	June 4, 1861	Wooden and metallic arch
33384	Peter M. Frees and Zenas King	Cincinnati & Milan	Oct 1, 1861	Tubular bowstring
34023	James S. Yerk and G. H. Heming	Tiffin	Dec 24, 1861	Cast iron truss
38966	James Ingersoll	Grafton	June 23, 1863	Turn bridge
41594	James J. Beard	Columbus	Feb 16, 1864	Cast iron arch
43202	David Hammond and W. R. Reeves	Canton	June 21, 1864	Bowstring - reissued 1867 & 1869
45051	Zenas King	Cleveland	Nov 15, 1864	Boiler plate swing bridge
52860	Martin Kremser	Cleveland	Feb 27, 1866	Iron lattice
56043	David Hammond	Canton	July 3, 1866	Bowstring - reissued 1867 & 1869
58266	Zenas King	Cleveland	Sept 25, 1866	Tubular bowstring improvement
60205	O. G. Leopold	Cincinnati	Dec 4, 1866	Plate Girder bridge
66900	Robert W. Smith	Tippecanoe	July 16, 1867	Wooden truss
70245	David H. Morrison	Dayton	Oct 29, 1867	I-beam bowstring-reissued 1871
71868	John Glass, George P. Schneider, and William B. Rezner	Cleveland	Dec 10, 1867	Oval tubular bowstring
72611	Joseph Davenport	Massillon	Dec 24, 1867	Lattice bowstring
77103	John Sanderson	Fredericksburg	Apr 21, 1868	Cast iron girder
82388	Joseph Davenport	Massillon	Sept 22, 1868	Bowstring improvement
86538	David Hammond and W. R. Reeves	Canton	Feb 2, 1869	Bowstring

89400	Joseph Gill	Cincinnati	Apr 27, 1869	Metal tube with honeycomb
94321	John Laird	Canton	Aug 31, 1869	Bowstring
94322	John and G. F. Laird	Canton	Aug 31, 1869	Bowstring
96569	Samuel Ensign	New Franklin	Nov 9, 1869	Metal verticals for truss
97714	Robert W. Smith	Toledo	Dec 7, 1869	Wooden truss
103911	Mahlon Miller	Cleveland	June 1870	Tubular bowstring
104867	David McCurdy	Ottawa	June 28, 1870	Bowstring
104868	David McCurdy	Ottawa	June 28, 1870	Bowstring
104869	David McCurdy	Ottawa	June 17, 1870	Bridge bracing
104969	Winfield Scott Levake	Cleveland	July 5, 1870	Bowstring
107576	Isaac Wheeler	Sciotoville	Sept 10, 1870	Wooden truss
113030	Ferdinand Dieckman	Cincinnati	Mar 28, 1871	Bowstring
113916	Ferdinand Pairan	Dayton	Apr 18, 1871	Gate for drawbridges
119466	Levi Kittinger	Massillon	Oct 3, 1871	Tubular bowstring
125128	Daniel Forargue	Cleveland	Apr 2, 1872	Bowstring
127791	Reuben L. Partridge	Marysville	June 11, 1872	Wooden truss
128509	William B. Rezner	Cleveland	July 2, 1872	Skewback for tubular bowstring
128350	Michael Adler	Canton	June 25, 1872	Bridge girder
134269	John Gray	Cincinnati	Dec 24, 1872	Pier for suspension bridge
135802	David Hammond, Michael Adler, and Job Abbott	Canton	Feb 11, 1873	Tubular bowstring
140181	Daniel Bower	Troy	June 24, 1873	Wooden truss
141056	Henry Hunter and Jesse Rice	Scioto	July 22, 1873	Wooden truss
146034	James Valleley	Canton	Dec 30, 1873	Tubular bowstring
146400	John Patterson and Andrew Sprague	Toledo	Jan 13, 1874	Howe truss improvement
146916	William Laird	Canton	Jan 27, 1874	Tubular bowstring
148010	Jonathan and Zimri Wall	Wilmington	Feb 24, 1874	Lattice bowstring
150151	D. Hammond and Job Abbott	Canton	Apr 28, 1874	Iron pony truss
150152	D. Hammond and Job Abbott	Canton	Apr 28, 1874	Iron pony truss
150153	D. Hammond and Job Abbott	Canton	Apr 28, 1874	Iron pony truss
153483	D. Hammond and M. Adler	Canton	July 28, 1874	Bridge pier
154644	Andrew Burneson	Mansfield	Sept 1, 1874	Tubular bowstring
155555	R. W. Smith	Toledo	Sept 29, 1874	Bridge turn table
164349	Jonathan Wall	Wilmington	June 8, 1875	Lattice bowstring

164135	Alexander E. Brown	Cleveland	June 8, 1875	Rail compression members
164136	Alexander E. Brown	Cleveland	June 8, 1875	Rail compression members
164137	Alexander E. Brown	Cleveland	June 8, 1875	Compound rail compression member
166042	James Valleley	Canton	July 27, 1875	Bowstring
166959	William Black	Lancaster	Aug 24, 1875	Drawbridge
166960	William Black	Lancaster	Aug 24, 1875	Suspension truss
173253	M. B. Adams and F. L. Krause	Cleveland	Feb 8, 1876	Bascule bridge
174554	Samuel Mills	New Castle	Mar 7, 1876	Bridge pier
175165	John J. Reicherts	Delaware	Mar 21, 1876	Wooden stave arch
184490	Job Abbott	Canton	Nov 21, 1876	Diagonal connection for bowstring
184520	D. Hammond, Henry G. Morse, and Job Abbott	Canton	Nov 21, 1876	Metal truss
184521	D. Hammond	Canton	Nov 21, 1876	Wrought iron post
184522	D. Hammond	Canton	Nov 21, 1876	Wrought iron girder
189320	R. C. Mounsdon	Cleveland	Apr 10, 1877	Drawbridge gears
191552	Everett S. Sherman	Galena	June 5, 1877	Combination bridge
193825	M. McGrath	Cleveland	Aug 7, 1877	Drawbridge
195820	Albert Hubbard and Lewis Eddy	Cleveland	Oct 2, 1877	Timber splice
215223	Samuel Holt	Worthington	May 13, 1879	Wooden truss
219846	August Borneman	Lancaster	Sept 23, 1879	Shortspan truss
241763	Jonathan Wall	Circleville	May 17, 1881	Eccentric pin
328758	Charles and George Carr	Sugar Tree Ridge	Oct 20, 1885	Wooden truss
357638	Robert W. Smith	Toledo	Feb 15, 1887	Swing bridge
360273	August Borneman	Lancaster	Mar 29, 1887	Composite bridge pier
365970	George Coultas	Calais	July 5, 1887	Wooden bridge
381584	Reuben Sawyler	Columbus	Apr 24, 1888	Swing bridge
387139	Samuel Buchanan	Bellefontaine	July 31, 1888	Connections for wooden bridges
389951	Samuel Buchanan	Bellefontaine	Sept 25, 1888	Wooden truss
389980	Reuben Sawyler	Columbus	Sept 25, 1888	Swing bridge mechanism
438511	Stephen D. Webb and Lewis R. Haag	Middleport	Oct 14, 1890	Bent rail bridge
443714	Nathaniel W. McGiffin	Canal Lewisville	Dec 30, 1890	Wooden bridge
485689	James Hardesty	Cambridge	Nov 8, 1892	Vertical posts
531768	William Breisfoard	Jacksenburg	Jan 1, 1895	Wooden arch

539506	William N. Carr	Sugar Tree Ridge	May 21, 1895	Combination bridge connections
561375	John Coup	Cleveland	June 2, 1896	Drawbridge safety device
562805	John Coup	Cleveland	June 30, 1896	Drawbridge safety device
591832	David Fisher	Kenton	Oct 19, 1897	Wooden or combination truss
624618	William Breisfoard	Heno	May 9, 1899	Gas pipe truss bridge
633811	John Cowing	Cleveland	Sept 26, 1899	Bascule lift bridge
644405	John Cowing	Cleveland	Feb 27, 1900	Bascule lift bridge

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