

United States Department of the Interior
National Park Service

National Register of Historic Places
Registration Form

1. Name of Property

historic name Upper Bridge

other names/site number Warsaw Swinging Bridge

2. Location

street & number Old Highway A, spanning the Osage River [n/a] not for publication

city or town Warsaw [X] vicinity

state Missouri code MO county Benton code 015 zip code 65355

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 [] nationally [] statewide [x] locally. (See continuation sheet for additional comments [].)

12 August 1998
Date

Signature of certifying official/Title Claire F. Blackwell/Deputy SHPO

Missouri Department of Natural Resources
State or Federal agency and bureau

In my opinion, the property [] meets [] does not meet the National Register criteria.
(See continuation sheet for additional comments [].)

Signature of certifying official/Title

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

Signature of the Keeper

Date

[] entered in the National Register

See continuation sheet [].

[] determined eligible for the National Register

See continuation sheet [].

[] determined not eligible for the National Register.

[] removed from the National Register

[] other, explain see continuation sheet [].

5. Classification

Ownership of Property	Category of Property	umber of Resources within Property	
		contributing	noncontributing
<input type="checkbox"/> private	<input type="checkbox"/> building(s)	0	0 building
<input type="checkbox"/> public-local	<input type="checkbox"/> district	0	0 sites
<input checked="" type="checkbox"/> public-state	<input type="checkbox"/> site	1	0 structures
<input type="checkbox"/> public-Federal	<input checked="" type="checkbox"/> structure	0	0 objects
	<input type="checkbox"/> object	1	0 total

Name of related multiple property listing.

N/A _____

Number of contributing resources previously listed in the National Register.

0 _____

6. Function or Use

Historic Function
TRANSPORTATION / road-related

Current Functions
RECREATION AND CULTURE /Outdoor recreation
TRANSPORTATION / pedestrian-related

7. Description

Architectural Classification
NO STYLE

see continuation sheet [].

Materials
 foundation CONCRETE

 walls _____

 roof _____

other WOOD
STEEL

see continuation sheet [].

NARRATIVE DESCRIPTION

See continuation sheet [x]

10. Geographical Data

Acreeage of Property Less than one acre

UTM References

A. Zone	Easting	Northing	B. Zone	Easting	Northing
15	466060	4232780			
C. Zone	Easting	Northing	D. Zone	Easting	Northing

[] See continuation sheet

Verbal Boundary Description

(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification

(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title see continuation sheet
organization _____ date _____
street & number _____ telephone _____
city or town _____ state _____ zip code _____

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A USGS map (7.5 or 15 minute series) indicating the property's location.

A Sketch map for historic districts and properties having large acreage or numerous resources.

Photographs

Representative black and white photographs of the property.

Additional Items

(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name Missouri Department of Transportation
street & number P.O. Box 270 telephone 573-751-5126
city or town Jefferson City state MO zip code 65102

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 7 Page 1

Upper Bridge
Benton County, Missouri

Summary

The Upper Bridge, also known as the Swinging Bridge, is a 600-foot wire cable suspension bridge spanning the Osage River/Lake of the Ozarks in an east-west direction about 1/4 mile west of Warsaw in Benton County, Missouri. Designed by Dr. Daniel M. Eddy and built in 1904 under the direction of Joseph A. Dice (1866-1947), the Upper Bridge was the last of three wooden-decked suspension or "swinging" bridges built over the Osage at Warsaw. Throughout its history the bridge served the important function of linking Warsaw, the county seat, to the western portion of Benton County. Originally built for pedestrian, livestock, and wheeled traffic, it was condemned to vehicular use in 1979, and now carries only pedestrian traffic from an access point near Warsaw on the east to a levy hiking path or "riverwalk" on the west. The eastern access point lies adjacent to private property, while the western point is adjacent to property of the U.S. Army Corps of Engineers. Much of the bridge was rebuilt after it was destroyed by a tornado in 1924; Dice himself supervised the reconstruction and carefully followed the original plans. Routine repairs and reinforcements have been made over the years by the highway department, but the bridge's basic structural integrity has been maintained. In 1974 the City of Warsaw entered into a contract with the bridge's owner, the Missouri Department of Transportation, to provide "reasonable maintenance" for the structure.¹

Physical Description

The Upper Bridge is a wire cable suspension bridge with a substructure of concrete abutments, tower pedestals, and cable deadmen. It has a timber deck over steel stringers, steel tower columns, tower struts, and suspenders composed of parallel strand steel wires. The bridge has a length of 776.82 feet, including the suspension anchors. The bridge deck is 599.72 feet in length with a 510-foot span between towers. No original drawings or blueprints of Upper Bridge exist, as Joseph Dice was reputed to have carried all of the plans and blueprints in his head.² When the bridge opened as a toll bridge on September 23, 1904, it had a span of 558 feet between towers, and a grade of 3 feet to 100 feet. The original towers were wooden, with the west one, at the far bank from Warsaw, 45 feet in height. The height of the original east tower is not known. Suspension-cables consisted of 600 wires each; the distance between hanger wires was 6 feet. The exact sag used by Dice is unknown.³ The profile drawing of the bridge accompanying this nomination was prepared by the Kansas City Bridge Company in 1925 in response to

¹ Robert Hayden, "Joseph A. Dice, Bridge Builder. An historical study of a self-made bridge engineer, his work, and his region from 1890 through the present," a project conducted by Historical Surveys, Inc., Garrison, N.D. for the U.S. Army Corps of Engineers, Kansas City District, Harry S. Truman Dam and Reservoir Project, Missouri, 1979, p. 16; and "Change in Route Status. Old Route A (7), Benton County, at Warsaw," Contract of August 5, 1974 with the City of Warsaw. Missouri Department of Transportation.

² Obituary of Joseph A. Dice, printed in Hayden, "Joseph A. Dice, Bridge Builder," p. 48.

³ Hayden, p. 16-17.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 7 Page 2

Upper Bridge
Benton County, Missouri

the need to repair the bridge after the tornado of 1924. It follows closely the features and dimensions first used by Dice.

The Towers: Steel towers replaced the original wooden towers when the structure was rebuilt in 1928. The Midland Erection Company raised the east tower, but controversy flared when they tried to pour the footing for the west tower in mud rather than bedrock. Engineer Dice was contracted to pour a proper footing, raise the west tower, and finish the reconstruction. Dice modified the Company's plan by increasing the bridge's length from 540 to 600 feet.⁴ Figure 1 illustrates the position of the towers: Tower I on the east is positioned in the middle of panel I, while Tower 2 on the west is positioned within panel 85. Each panel is 6 feet. The east tower is 34 feet 10 inches in height and rests on a bluff. The west tower is 60 feet in height and rests below water near the river's west bank.

The towers' construction and composition are described in intricate detail by Robert Hayden in his 1979 report to the U.S. Army Corps of Engineers: "The basic steel member used in the tower is a C-shaped channel with a 3-inch flange on one side (unlike an I-beam with a flange on both sides), 3/8 inch thick, and 16 inches across; set up in an *H* pattern with the crossbar of that *H* being two channels set back-to-back a total of four channels per leg. The three crossbeams between the legs are each made up of two 10 foot channels separated by four spacer plates. The two rectangles formed by these three cross members are cross braced in an *X* pattern with eye bars having a turnbuckle. These bars are held in place with 2 and 1/2 inch diameter pins running through the bridge member."⁵

Anchorage: Anchorages for the bridge consist of steel pins set in concrete, around which wires of the main cable are wrapped. Joseph Dice used different anchoring systems for the two ends of the bridge, a duality that was typical of his construction. On the east side 3 1/2 inch pins have been used and are positioned one behind the other in line with the bridge itself. "As each wire was brought across," notes Robert Hayden, "it was woven in between several pins before beginning its journey back."⁶ On the west side Dice poured a large slab of concrete thirty feet across the roadway and just under the lip of an existing depression. He then set a row of steel pins the entire width of the road and perpendicular to the bridge. The wire was run and wrapped around the pins, producing a fan or splayed pattern. He "capped the pins with a drilled length of channel iron," and then covered them with concrete to hold them fast. This is the only time that Dice was known to have used this type of anchorage in his bridge building.⁷

Deck: The deck system consists of floor beams, stringers, and flooring. The flooring is treated southern pine oriented perpendicularly to the bridge span. Dice used 2 to 2 1/2 inch thick floor planks. These were

⁴Ibid., p. 17.

⁵Ibid, pp. 94-95 and 62.

⁶Ibid, p. 95.

⁷Ibid, pp. 96 and 78.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 7 Page 3

Upper Bridge
Benton County, Missouri

replaced by 2 inch by 4 inch planks set on edge when the State Highway Department rebuilt the entire floor years later. The floor beams are 8 inch I-beams placed every 6 feet, crosswise to the floor cables. Seven stringers run on top of the floor beams, parallel to the floor cables. The 8 inch floor beams are suspended from the main cables by cables of twisted wire. The beams are cross braced below by 2 inch angle irons. The angle irons are bolted to the flanges of the I-beam. Except for 20 foot sections at either end of the span, the bridge's steel stringers are bolted to each floor beam.⁸

The sway cables are attached to the floor beam and banister brace between the 44th and 45th panels. In other words, they are attached to the bridge on both sides by way of the railing brace bolted to the floor beams.

The hanger wires, some of them original, are composed of strands of twelve wires. These are looped over the main cables and under the floor beam, then highly twisted together. These wires run in a guide block, which is connected by bolts to the bottom of each floor beam, held in place by notches in the flange of each beam. The floor wires, also held in place by the guide block, number about eighteen.⁹

Site and Access Points: The Upper Bridge is located in a diverse and popular recreation area. The Osage River and Lake of the Ozarks are popular with boaters, hikers, campers, and other recreationists, drawing visitors from a vast area. There is public boat access at Lay Park northeast of the bridge, a private boat access immediately alongside the bridge (owned by Geri's Restaurant), as well as ample opportunities for swimming, fishing, hiking, and shopping. The surrounding wetlands and hills offer spectacular beauty. The east side access point to the bridge is a blacktop road that also gives access to a restaurant and an antique store. The west side access is a gravel road and path or "riverwalk" which are part of the levy system maintained by the U.S. Army Corps of Engineers. The bridge and "riverwalk" are elements in the community's ongoing Warsaw Downtown Riverfront Revitalization Project, whose aim it is to rejuvenate the downtown and bring more tourists and recreationists into the area.¹⁰

Modifications: Upper Bridge has been maintained by the City of Warsaw and the Missouri State Highway Department. That maintenance has consisted principally of painting and cable and deck repairs. The Missouri State Highway Department replaced Dice's straight hanger wires with much stronger twisted wire cable. The Highway Department also replaced Dice's 2-inch thick pine planks, the main deck or roadway, with 2 inch by 4 inch planks turned on edge, and removed the bottom rail to make space for a new wooden curb.¹¹ In 1930 the western tower, including the cross beams and eye-bars, was

⁸ Ibid, pp. 94-95 and 29.

⁹ Ibid, p. 62.

¹⁰ Archer Engineers, "Warsaw Downtown Riverfront Revitalization". (Warsaw, Missouri, 1978), pp. 1-10.

¹¹ Hayden, pp. 17 and 96; based on personal interview with Lester Blake.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 7 Page 4

Upper Bridge
Benton County, Missouri

encased in concrete to preserve the structure against the rising water of the Lake of the Ozarks. Woven wire fencing, 3-foot height, was attached along the suspender cables in recent decades to assure greater safety for tourists and recreational users.¹² The single most expensive maintenance cost was prompted by a traffic accident in June 1975. It was reported this way by Robert N. Hunger, Missouri State Highway Commissioner: "On the night of Monday, June 8 or early morning of June 9, 1975, Floyd B. Moore drove his tractor trailer totaling 35 tons onto the bridge. The floor system failed, dropping the tractor-trailer, Moore, and approximately 150 feet of the bridge floor system to the river plus damaging another 48 feet of the floor system. A total, slightly in excess of \$41,000, was spent by the Highway Department restoring the bridge to traffic."¹³

Condition and Present Use: Construction of a concrete bridge over the Osage on Highway 7, adjacent to the swinging bridge, rerouted traffic from the old bridge to the new. The Upper Bridge was closed to vehicular traffic in 1979 and is now used exclusively for recreation and tourism. The Benton County Historical Society placed a plaque on a small limestone monument on the east side of the structure; it reads:

ORIGINALLY A TOLL BRIDGE
BUILT IN 1904 BY JOSEPH A.
DICE. IT WAS DESTROYED
IN 1924 BY A TORNADO AND
REBUILT BY DICE IN 1928
CONTAINS 720 STRAND
CABLE. IT WAS DEDICATED
TO THE CITY OF WARSAW
IN 1974 TO BE PRESERVED
AS A HISTORICAL SIGHT [sic]
AND WALKING BRIDGE.

While the piers, anchors, and abutments appear to be in sound condition, there is some rust on the cables and instability on the deck as timbers have shifted out of their original alignment. The shoreline on the east side is a mooring area for boats on private property; on the west side the U.S. Corps of Engineers has applied rock mulch/rip-rap to the shoreline to cut back on erosion. The brace cables seem to be solidly secured in concrete on either side of the bridge. Gates have been placed on each end of the bridge to block vehicle access. Diving and fishing are not allowed from the bridge. Ample parking is available to visitors at both ends.

¹² Hayden, p. 75.

¹³ Letter from Robert Hunter, Missouri State Highway Commissioner, to Gene Bibb, October 13, 1976. Printed in Hayden, pp. 67-68.

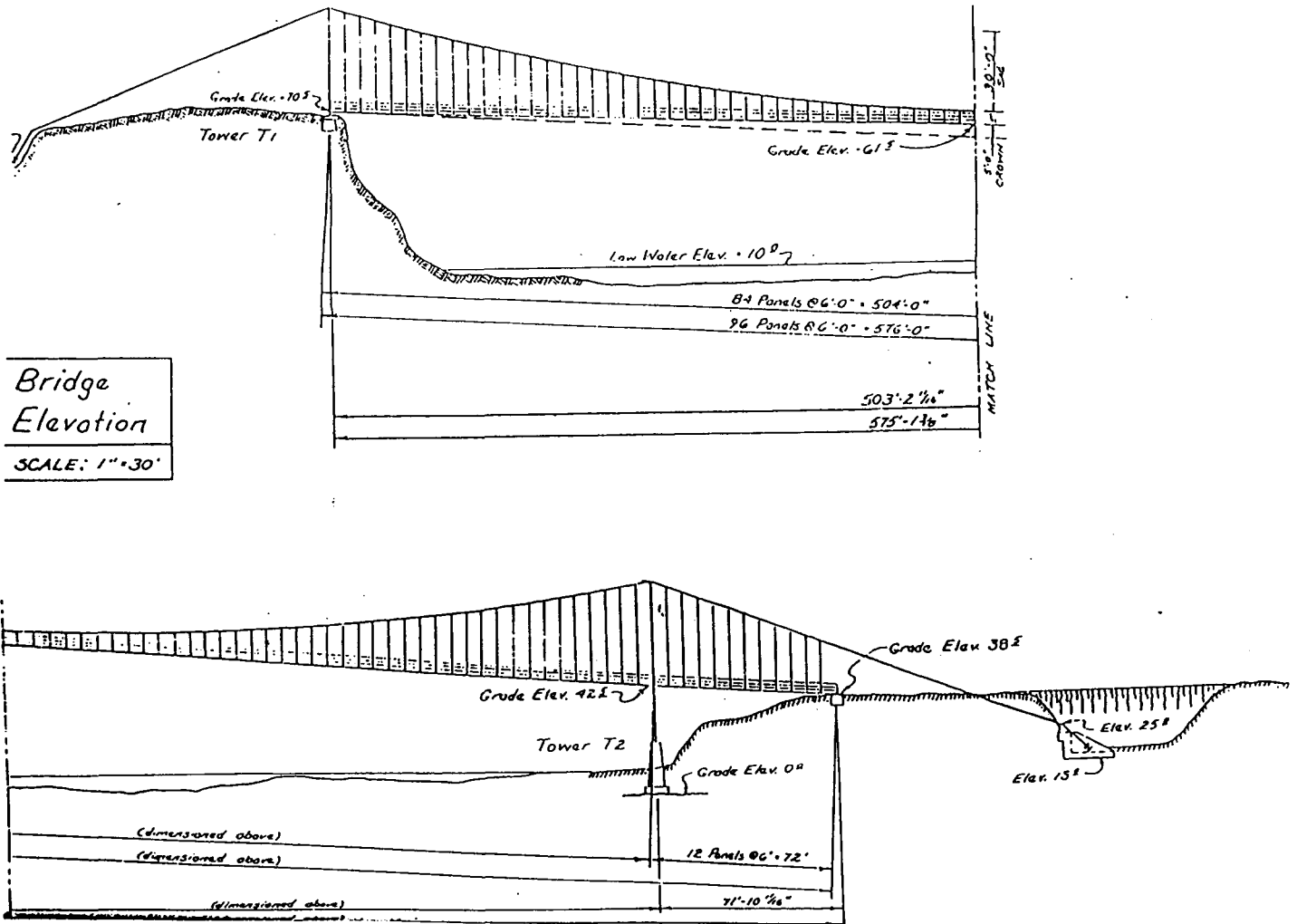
United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 7 Page 5

Upper Bridge
Benton County, Missouri

Figure 1. 1925 Sketch of the Upper Bridge by the Kansas City Bridge Co.



United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 6

Upper Bridge
Benton County, Missouri

Significance

Summary: The Upper Bridge, Warsaw, Benton County, is eligible for listing in the National Register of Historic Places under Criteria A and C, and is significant in the areas of TRANSPORTATION and ENGINEERING. Originally designed by Daniel Eddy and built by Joseph Dice in 1904, the bridge was rebuilt by Dice in 1928 after it was extensively damaged by a tornado. Dice was a locally renowned builder and engineer of swinging bridges. The repairs implemented during the 1928 reconstruction remained true to the original 1904 design. Due to changes in materials and dimensions, however, the period of significance begins from the time of the 1928 construction and ends in 1948, the arbitrary fifty-year limit. The Upper Bridge is a locally significant resource associated with the history of transportation and engineering in Benton County.

Transportation: During the early years of Missouri statehood, steamboats were the queens of transportation, knitting together communities along the main trunks and tributaries of the Mississippi and Missouri rivers. A major tributary of the Missouri River, the Osage, was an important freight route to interior locations, accommodating both barges and steamboats in normal as well as dry seasons. In 1855 the Missouri General Assembly appropriated funds to improve the navigability of the Osage. With these funds, they dredged the channel, removed snags and debris, and constructed wing dams between the mouth of the Osage and Osceola. These improvements facilitated the shipment of goods on the Osage as far as Warsaw and Osceola. Warsaw grew into a bustling river town, the largest town in Benton County, and a place of both commercial and strategic value. By the 1840s there were at least a half dozen ferry companies in Benton County, with three near Warsaw. Ferries, fords, dirt and plank roads, barges, and steamboats were the essence of the early transportation system.¹⁴

Warsaw was a natural crossroads. Old Military Road (1846) crossed the Mississippi at Quincy, Illinois, then crossed the Missouri River near Boonville and the Osage River at Warsaw on its route to Springfield. The "Boonville Road" carried "six-horse stages and wagons passing through Warsaw each day, loaded down as they went south."¹⁵ When the Butterfield Overland Stage came out of Tipton in 1855, Warsaw assumed the role of an outfitting center. The federal government opened the Warsaw land office the same year. During the Civil War General Fremont and his forces built a simple pontoon bridge at Warsaw, thus allowing 3,000 soldiers to traverse the river. For decades the Osage was a busy purveyor of steam and barge traffic through Warsaw, and in 1880 a branch line of the Missouri Pacific Railroad linked Warsaw to Sedalia.¹⁶

¹⁴ Kathleen Kelly White, and Kathleen White Miles, *The History of Benton County, Missouri, Vol. 3* (Warsaw, Missouri: The Printery, 1969), p. 747; and Robert Hayden, "Joseph A. Dice, Bridge Builder," p. 3.

¹⁵ White and Miles, Vol. 2, p. 20j.

¹⁶ Duane Meyer, *The Heritage of Missouri - A History* (St. Louis: State Publishing Co., 1963), pp. 238, 253, 467, and 473.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 7

Upper Bridge
Benton County, Missouri

The coming of the railroad to the region was accompanied by a decline in steamboat traffic, and once-thriving riverboat towns not on major railroad hues either stagnated or declined. Few railroads ever served the Ozark Highlands, however, as construction costs deterred the railroads from tackling the hilly terrain. The winding rivers of the region discouraged construction, too. The southern and western parts of Benton County were cut off from Warsaw and the northern part of the county by the Osage River. Complaints about deep fords, slow ferries, and limited railroad linkages led eventually to the construction of multiple bridges in the region.¹⁷

Road and bridge building were pressing concerns in nineteenth century Missouri. Many wooden bridges, some of them covered, were constructed over rivers and streams for railroad trestles and wagon passage. The state legislature encouraged the process by granting charters to individuals to build toll bridges. State government also supported the system of subscription; if a builder could raise half the cost of a bridge through subscription, the county or state would pay the remainder.¹⁸ Many early bridges were sturdy and stable, while many were cheap and "dangerously unsubstantial"¹⁹ "They were not built by professional engineers," notes Duane Meyer, "but by capable, careful frontiersmen using the timbers available at the time." Timber was cheap and plentiful.²⁰

Interest in bridging the Osage ran high, particularly among those with financial interests, like farmers, who argued that bridging the river would increase their land values and facilitate the transport of produce and supplies. Interest in bridging the Osage dates from 1855 when a Mr. Thatcher of the Keystone Bridge Company of Kansas City suggested that a four-span 660-foot bridge be built.²¹ Nobody acted on these intentions until the 1890s, however, when three Warsaw residents, i.e., Dr. Daniel M. Eddy, a medical doctor, Thomas Benton White, a newspaper publisher, and Joseph A. Dice, a self-taught bridge builder, drew up plans for bridge building on the Osage near Warsaw. Dice began his bridge building career with twenty dollars; he sold a few shares among the citizens, then strung a ball of twine across the river to mark locations and "to determine the basic inverse curve."²² The first bridge was constructed in 1895 on the south edge of Warsaw and was called Middle Bridge; it was a wooden suspension "swinging" bridge, 440 feet between towers, that spanned the river in a north-south direction. The second bridge, Hackberry, built in 1897 with a span of 520 feet, was also a wooden suspension bridge.

¹⁷ James H. Lay, and George C. Worth, *History of Benton County* (Warsaw, Missouri: Warsaw Times, 1912), p. 141; and Hayden, pp. 3-4 and 16.

¹⁸ Meyer, p. 250.

¹⁹ David D. March, *The History of Missouri, Vol. I* (New York: Lewis Historical Publishing Co., 1967), p. 605.

²⁰ Meyer, p. 250.

²¹ White and Miles, Vol. 2, p. 36j; and Hayden, p. 5.

²² Hayden, pp. 5 and 17.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 8

Upper Bridge
Benton County, Missouri

Upper Bridge, built near two fords and a ferry crossing, opened as a wooden toll bridge on September 23, 1904. Joseph A. Dice is credited with the construction of all three of these bridges. As proprietor, he was concerned that his bridges make a profit. In 1898, he bought out the Hackberry Ferry so that it would not compete with his Hackberry toll bridge.²³

Engineering: Suspension bridges have been used for centuries, even by ancient peoples, but not until the 19th century were they used for "anything heavier than horse-and-foot traffic."²⁴ At mid-century there were two "suspension-bridge experts" in the U.S., namely John Roebling and Charles Ellet. In 1841 Ellet was contracted to build a bridge over the Schuykill River, "the first wire-cable suspension bridge in America."²⁵ In the 1850s John Roebling built an 800-foot suspension span to carry trains over the gorge at Niagara Falls. Roebling and Ellet promoted the use of iron wire and stone towers over chains and wooden towers. Roebling introduced the "stiffening truss," which gave his bridges improved strength and aerodynamic stability. He erected many heavy-duty suspension bridges, but is best known for the Brooklyn Bridge.²⁶

The suspension bridge gained in popularity; it was economical, suited to wide clearances, and could be constructed of readily available materials. The concept of the suspension bridge was simple and could be copied by local builders: the roadway is hung from cables anchored over towers, without intervening support from below. Suspensions or "swingers" were particularly popular for small-scale town and county bridges in areas of rough terrain such as the southern Appalachian and Ozark Highlands. Donald C. Jackson notes that they were prevalent in the South and West.²⁷ The local or vernacular version of these bridges often lacked the technologies of the day, such as twisted wire and steel beams. Lacking some technical sophistication, the Dice "swingers" in central Missouri were built from experience with local timber and for the needs of local people.

The Upper Bridge was constructed under the direction of Joseph A. Dice, a self-educated engineer, who is reputed to have built more than thirty suspension bridges in central Missouri in the period from 1895 to 1940. He designed bridges to span substantial streams and rivers as well as small, convenient bridges for farmers on private land. Altogether, Dice claimed to have built more than forty; these were built without the aid of blueprints or engineering plans. Dice had no formal schooling beyond the fourth grade; he gained most of his bridge building knowledge from a medical doctor, Dr. Daniel M. Eddy, who held a patent on a suspension bridge and was distinguished as a member of the Paris Academy of

²³ Hayden, pp. 10, 12, 15, 16, and 34; White and Miles, Vol. 2, p. 3j.

²⁴ Joseph Gies, *Bridges and Men* (Garden City, New York: Doubleday & Co., 1963), pp. 179-180.

²⁵ *Ibid.*, p. 182.

²⁶ *Ibid.*, pp. 185-186.

²⁷ Donald C. Jackson, *Great American Bridges and Dams* (New York: Wiley, 1988), p. 35.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 9

Upper Bridge
Benton County, Missouri

Inventors. A skilled, pragmatic man with a mathematical eye, Dice built a regional reputation as a builder of suspension bridges, as Robert Hayden noted, an "almost legendary reputation."²⁸ At various times Dice also served Benton County as County Engineer, County Supervisor, and County Road Commissioner.²⁹

Dice and Eddy left a legacy of bridges in central Missouri. Sometimes they worked together, sometimes alone, building a total of 11 bridges in Benton County in the period 1895 to 1928.³⁰ According to Robert Hayden, fifteen suspension bridges once spanned the Osage River.³¹ When the HAER Inventory of Missouri Historic Bridges was completed in 1990, ten suspension bridges built by Joseph Dice remained in central Missouri. Seven are known to remain today, i.e., six in Miller County and the Upper Bridge in Benton County. Midland Bridge Company and Kansas City Bridge Company were the other bridge builders in central Missouri in the early 20th century. None of their bridges are known to remain.³²

Dice and Eddy were skilled, resourceful men who built bridges that displayed a responsiveness to community needs, a boldness in flexibility, and a sensitivity to the lay of the land. These "swingers," according to Robert Hayden, are "similar in construction to other suspension 'swingers' in the United States." Their importance, he notes, stems from their simplicity of design and manner of construction.³³ Upper Bridge carries many "hallmarks" of Dice's construction, i.e., planked flooring for the road bed, high crowns, and ends that are not attached to the abutments, but merely rest on them (thus the term "swingers"). The bridge is characteristically one-lane, floor beams cut to 14 feet, as found "in every one of his bridges without exception."³⁴ Suspension bridges were well suited to the hilly terrain of the Osage Valley, where crossings high above the water were often necessary. Most of the Dice bridges were built

²⁸ Kathleen Kelly White, and Kathleen White Miles, *Water over the Dam, Miscellany About Warsaw, Benton County, Missouri* (Clinton, Missouri: Democrat Publishing Co., 1966), pp. 53-56; and Hayden, pp. 1 and 27.

²⁹ Hayden, p. 24.

³⁰ Tom Chesser, "Nomination Report on Boeckman Bridge, National Register of Historic Places," Lake of the Ozarks Council of Local Governments, Camdenton, Missouri, 1978, Section 8-Page 1; and Hayden, p. 27.

³¹ Robert Hayden, "An historical study of suspension bridges built over the Osage River and its tributaries from 1895 to 1937." A project conducted by Historical Surveys, Inc., Garrison, N.D., for the U.S. Army Corps of Engineers, Kansas City District, Harry S. Truman Dam and Reservoir Project, Missouri, 1979, p. 1.

³² U.S. Department of the Interior, National Park Service, "Historic American Building Survey-Missouri Historic Bridge Survey" Vol. I (Washington, D.C., 1990).

³³ Hayden, "An historical study of suspension bridges built over the Osage River and its tributaries from 1895 to 1937," p. 1.

³⁴ Hayden, "Joseph A. Dice, Bridge Builder," p. 30.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 10

Upper Bridge
Benton County, Missouri

in bluff areas, or where bluffs had to be connected to bottom lands. Upper Bridge is a true manifestation of Dice's sensitivity to terrain.

Carrying the blueprints in his head, Dice could not compete for state contracts on bridge construction. Moreover, the impounding of the Osage increased the demand for heavy-duty, steel truss bridges. The Dice bridges were lightweight and susceptible to dangerous rolls and vibrations, especially from heavy winds, high speed vehicles, and herds of trotting cattle. A new steel bridge on Highway 65 spanned the Osage in 1927. In 1937 the Heath suspension bridge was replaced by the Highway 35 steel bridge over the Osage three miles west of Warsaw. The Highway 7 bridge supplanted the Upper Bridge in the 1970s.³⁵

The Upper Bridge is a part of the legacy of suspension bridges or "swingers" in the Osage Valley that collectively functioned as part of an important transportation corridor. They were economically valuable to farmers and merchants; they encouraged the growth of towns and industries. At one time there were many Dice bridges, especially in Miller County, but most have been lost to neglect, flooding, or replacement by concrete and steel. The Upper Bridge is unusual in its "down home" mode of construction, built mostly of locally available materials using the skills and creativeness of local people. The towers were built with "simple shovel and pick," never by coffer dam or caisson. Traveling scaffolding transported the men and beams and facilitated the bundling of the wire into cables. For the wooden suspension bridges, Dice used local supplies of wood and concrete, purchasing only the strands of wire for cabling. "For the steel suspension bridges," notes Tom Chesser, "he ordered kits from a bridge company in Pennsylvania and just strung the cable and hung the steel "I" beams. The suspension bridge kits were less expensive than those for the steel truss bridge type since less steel was used in the suspension type bridge."³⁶

The significance of the Dice bridges is noted in the HAER Inventory of Missouri Historic Bridges:

"As a group, these spans comprise the state's most important examples of vernacular bridge construction, designed and built without the benefit of detailed structural analysis or computation. The Upper Bridge is distinguished as the longest and one of the best preserved among them. Moreover, its checkered history provides an illustration of the sometimes-uneasy relationship between engineered and empirical design in civil engineering. A well-preserved example of an esoteric structural type - the best

³⁵White and Miles, Vol 2, pp. 43-44j.

³⁶Chesser, Section 8-Page 1.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 8 Page 11

Upper Bridge
Benton County, Missouri

remaining of Dice's suspension bridges - the Upper Bridge is among Missouri's most important early vehicular spans."³⁷

Beyond this, the bridge has aesthetic and nostalgic value. From the bridge, visitors have a spectacular view of the upper stretches of the river, Kaysinger Bluff and the Truman Dam, the City of Warsaw, and the wildlife and wetland areas to the south and east. "Former residents returning to the hometown for a visit," notes Miles and White, cherish "a walk across the bridge for old times sake."³⁸ Even with repairs, the Upper Bridge retains much of the vernacular character and charm of Dice's original 1904 construction.

³⁷ U.S. Department of the Interior, "Historic American Building Survey-Missouri Historic Bridge Survey," Vol. 1.

³⁸ White and Miles, *Water over the Dam*, pp. 55-56.

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 9 Page 12

Upper Bridge
Benton County, Missouri

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United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 9 Page 13

Upper Bridge
Benton County, Missouri

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United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section 10 Page 14

Upper Bridge
Benton County, Missouri

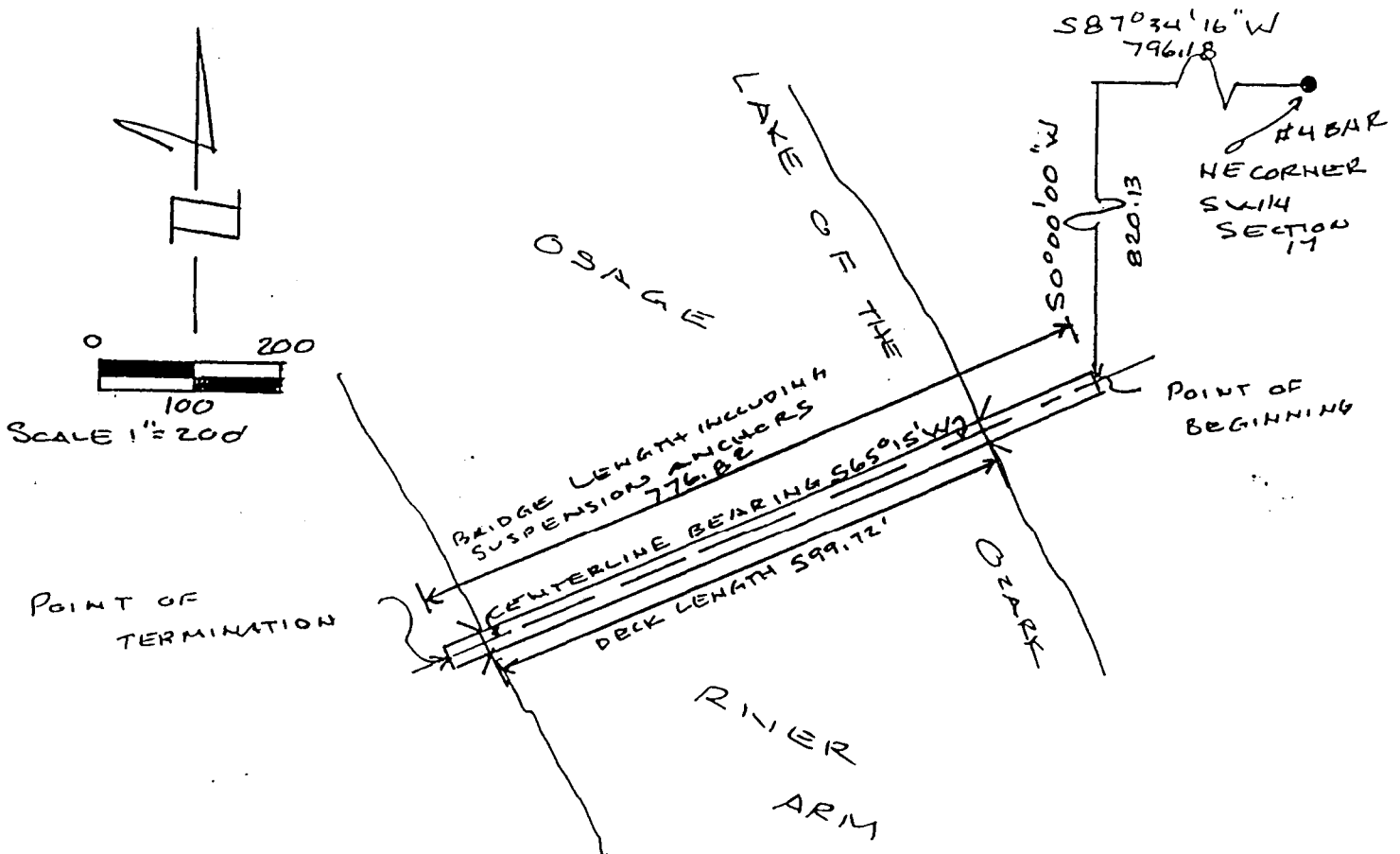
Verbal Boundary Description:

The boundary of the nominated property is based on the survey record completed October 20, 1998, by Professional Surveyors, Inc., for the City of Warsaw and is recorded on page 102 of Book M09, Benton County Recorder's Office. The survey record follows:

The bridge "envelope" is 20 feet wide and lies 10 feet on each side of the following described centerline. A strip 20 feet wide lying 10 feet on each side of the following described centerline, to wit:

Considering the North line of the SW/4 of Section 17, T40N, R22W of the 5th P.M., Benton County, Missouri to bear $S87^{\circ} 34' 16'' W$ and all other bearings used herein relative thereto:

COMMENCING at the NE corner of the SW/4 of said Section 17; THENCE along the North line of the said SW/4 $S87^{\circ} 34' 16'' W$ 796.18'; THENCE $S 0^{\circ} 00' 00'' W$ 820.13 to the POINT OF BEGINNING; THENCE along the centerline of the existing bridge $S65^{\circ} 15' 00'' W$ 776.82' to the POINT OF TERMINATION.



United States Department of the Interior
National Park Service

**National Register of Historic Places
Continuation Sheet**

Section 10.11 Page 15

Upper Bridge
Benton County, Missouri

Boundary Justification:

The boundary encompasses the entire suspension bridge along with its abutments; this area contains all of the property that is historically associated with the Upper Bridge.

Form Prepared By

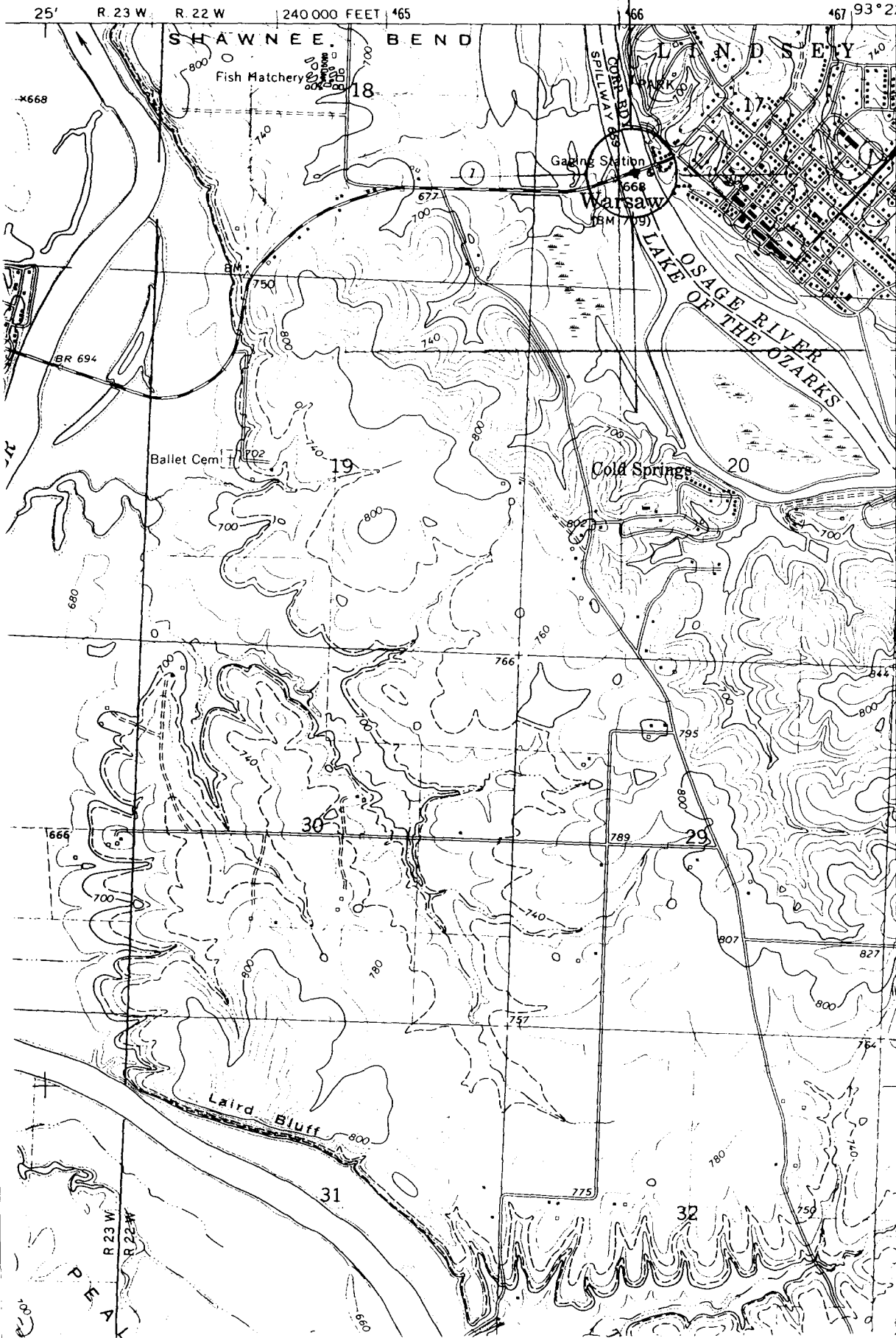
Ann M. Legreid, Professor of Geography
Central Missouri State University, Wood #8
Warrensburg, Missouri 64093
August 22, 1998
660-543-8835

Lee Gilleard, Steve Mitchell, Scott Myers
Historic Preservation Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102
August 10, 1999
573-751-5367

WARSAW WEST QUADRANGLE
MISSOURI
7.5 MINUTE SERIES (TOPOGRAPHIC)

7360 IV SE
(LINCOLN SE)

NW 1/4 FRISTOE 15' QUADRANGLE



Upper Bridge
Warsaw, Benton Co.
Missouri
UTM Reference
15/466060/
4232780





















SWINGING BRIDGE

ORIGINALLY A TOLL BRIDGE
BUILT IN 1904 BY JOSEPH A.
DICE. IT WAS DESTROYED
IN 1924 BY A TORNADO AND
REBUILT BY DICE IN 1928.
IT CONTAINS 720 STRAND
OF WIRE ROPING. IT WAS DEDICATED
TO THE CITY OF WARSAW
IN 1974 TO BE PRESERVED
AS A HISTORICAL SIGHT
AND WALKING BRIDGE.

