

United States Department of the Interior  
National Park Service

National Register of Historic Places  
Inventory—Nomination Form

For NPS use only  
received JAN 24 1983  
date entered

See instructions in *How to Complete National Register Forms*  
Type all entries—complete applicable sections

1. Name

historic Rainbow Arch (Marsh Arch) Bridges of Kansas *Thematic Resources*

and/or common N/A

2. Location

street & number See individual nomination forms N/A— not for publication

city, town N/A — vicinity of

state N/A code county *Chautauqua, Cherokee, Coffey, Geary, Linn, Lyon, Miami* code *Montgomery, and Shawnee*

3. Classification

Category	Ownership	Status	Present Use
<input type="checkbox"/> district	<input checked="" type="checkbox"/> public	<input checked="" type="checkbox"/> occupied	<input type="checkbox"/> agriculture
<input type="checkbox"/> building(s)	<input type="checkbox"/> private	<input type="checkbox"/> unoccupied	<input type="checkbox"/> commercial
<input type="checkbox"/> structure	<input type="checkbox"/> both	<input type="checkbox"/> work in progress	<input type="checkbox"/> educational
<input type="checkbox"/> site	<b>Public Acquisition</b>	<b>Accessible</b>	<input type="checkbox"/> entertainment
<input type="checkbox"/> object	<input type="checkbox"/> in process	<input type="checkbox"/> yes: restricted	<input type="checkbox"/> government
<input checked="" type="checkbox"/> thematic group	<input type="checkbox"/> being considered	<input checked="" type="checkbox"/> yes: unrestricted	<input type="checkbox"/> industrial
		<input type="checkbox"/> no	<input checked="" type="checkbox"/> transportation
			<input type="checkbox"/> other:

4. Owner of Property

name Multiple ownership--see individual nomination forms

street & number N/A

city, town N/A — vicinity of state

5. Location of Legal Description

courthouse, registry of deeds, etc. See individual nomination forms

street & number N/A

city, town N/A state

6. Representation in Existing Surveys

title Inventory of Marsh Arch Bridges has this property been determined eligible? \_\_\_ yes  no

date *Ks. Department of Transportation, 1980* \_\_\_ federal  state \_\_\_ county \_\_\_ local

depository for survey records *Kansas State Historical Society*

city, town *Topeka* state *Kansas*

## 7. Description

<b>Condition</b>		<b>Check one</b>	<b>Check one</b>
<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> deteriorated	<input type="checkbox"/> unaltered	<input checked="" type="checkbox"/> original site
<input checked="" type="checkbox"/> good	<input type="checkbox"/> ruins	<input checked="" type="checkbox"/> altered	<input type="checkbox"/> moved date _____
<input type="checkbox"/> fair	<input type="checkbox"/> unexposed		

### Describe the present and original (if known) physical appearance

A survey carried out by the Kansas Department of Transportation (KDOT) in 1980 revealed that there are at least 73 Marsh Arch bridges (also called Rainbow arch) currently standing in Kansas. The bridges were discovered through computer files and through information provided by field representatives of KDOT. All of the bridges were inspected by KDOT personnel, and all bridges included in the thematic nomination were inspected by Kansas State Historical Society staff. Photographs, dates of construction, and original plans when available, were provided for the State Historic Preservation Officer's (SHPO) review.

In a signed agreement KDOT and the SHPO consented that they would jointly select some of the bridges for National Register nomination and KDOT would be free to repair or replace the others unless extenuating circumstances developed. It was agreed that should strong local interest in an undesignated bridge develop, or any new significant information come to light, or any previously unidentified bridges be discovered, these would not be covered under the agreement and could be added to the nomination.

The bridges selected for National Register designation were chosen on the basis of their likelihood to survive. The bridges' roadbeds are generally very narrow and therefore subject to replacement. The selected bridges are located for the most part on roads that have been abandoned or are used only locally and are representative of fixed and tied, single and multiple spans. As Historic American Engineering Record officials have mentioned, a multiple span Marsh arch is no more technologically significant than a single span. The same technology is simply repeated. It was therefore not deemed necessary to nominate these bridges on the basis of length.

Of the 73 "rainbow" arches discovered, 27 (37%) were of the tied arch design while 46 (63%) were of the fixed arch design. Thirty-five were located on the state system while the remaining were located either on the county, urban or off-systems. Fifty-six of the bridges consisted of a single span while there were six double spans, eight triple spans, one four-span, one seven-span and one eight-span bridge.

Marsh's plan was to construct a bridge of reinforced concrete using arches that would expand and contract along with the floor under varying condition of temperature and moisture.

The major parts were quite simple, consisting of two abutments or piers, two arches disposed between and springing from the abutments, a floor carried by and between the arches and reaching from abutment to abutment, and the railings. The abutments consisted of footings and three interlocked walls of reinforced concrete.

There were two possibilities for the arch design. The fixed design was more popular in Kansas than the tied design. With the fixed design, the arches, springing from points within the bases of the abutments, passed through the

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front wall and arched over the stream. Hangars were suspended from the arch and were connected to the ties that supported the floor. A beam was located where the arch crossed the floor. The arches, hangars, and ties became a unified structure when the concrete was poured. The beams were separated from the floor slab by slideable wear plates. The rise and fall of the arch due to longitudinal expansion and contraction could cause the beam to move beneath the ends of the floor. The floor could also expand and contract causing it to move over the beams. The wear plates facilitated such movement. The construction of the short articulated hanger closest to the point where the arch passed through the floor allowed it to move independently also, compensating for movement of the arch. As the other hangars were further from this arch/floor crossing point, and were longer, the arch movement was more readily absorbed and articulation of these members was not necessary.

In the "tied" or "bottom chord" rainbow arch, the arches were connected to the top of the piers with use of cast steel rocker shoes. One of these shoes was engineered to allow for expansion and contraction of the structure and roadway. All this design lacked the massive abutment to absorb or resist horizontal thrust, a bottom chord or tie was added to the arch to fill this function.

The Marsh arch is actually a steel bridge with a concrete coating. Bridge plans reveal the schedule of the concrete placement after the metal framework had been erected. The footings, abutments and/or piers were the first to be concreted. These were followed by the hangars, the arch ribs, and the beams. Expansion plates were placed on the beams in preparation for receiving the floor. Finally, the intermediate ties, floor slab, wall copings and rail were poured. Once the floor centering was struck the intermediate hangars were concreted. Because the hangars had to be under full dead load when they were concreted, the floor centering was struck no less than 10 days or more than 21 after the rest of the concrete was placed. The handrail was the last portion of the bridge to be concreted.

Through the years most of the bridges have been altered in some minor way. Some have been painted, some are covered with graffiti. The decking has been replaced on most of the bridges and some overhead struts that connected one arch to the other have been removed.

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Clarification of selection process for Rainbow (Marsh) Arch Bridge thematic nomination.  
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Selecting bridges for inclusion in a thematic National Register nomination is an involved process. Not only must one consider the listing criteria provided by the National Register, but it would be foolish not to take safety and practical concerns into consideration as well. A state's road system will not accommodate itself to the hundreds of old and possibly historic bridges known to exist throughout the state. The bridges must somehow be accommodated to stricter safety codes, heavier vehicles, more traffic, and new standards for roadbeds. Sometimes a roadway will be straightened with the result that a bridge is abandoned in place. This bridge may be maintained by a municipality or a concerned citizen, or be allowed to slowly deteriorate.

More often than not, old bridges found throughout Kansas are on roads that must be brought up to state or federal standards as new projects or maintenance is carried out. Usually this means that a bridge is not wide enough or that its sufficiency rating is not adequate. The result is that the bridge must be replaced.

In the past, hundreds of bridge projects were allowed to proceed in Kansas because the significance of various types of bridges was not known, and money was not available for a statewide survey and analysis. This problem was solved when the Kansas Department of Transportation agreed to undertake a survey of all older bridges throughout the state and to pay a private contractor to do the detailed research and analysis required for the nomination of bridges of each type.

The first thematic bridge nomination submitted by the Kansas Historic Preservation Department as a result of this survey was for Rainbow (Marsh) Arches. It was stated in that nomination that the bridges included were chosen on the basis of their likelihood to survive. This was not the only criteria. Within that group the bridges had to represent the two types of Marsh Arches as well as single and multiple spans of those types. They had to have a high level of integrity.

It has seemed in the past that the National Register has been reluctant to list deteriorated structures that are threatened by imminent destruction unless listing would encourage their preservation. Listing those bridges in Kansas that do not meet modern safety codes and road requirements would not encourage their preservation but would cause a severe rift between two state agencies that are currently striving to work together on a very delicate situation. It is hoped in the future that a large percentage of each bridge class will be nominated, but in the meantime we must settle for saving at least some of the bridges rather than none.

Submitted April 6, 1983.

# 8. Significance

Period	Areas of Significance—Check and justify below			
<input type="checkbox"/> prehistoric	<input type="checkbox"/> archeology-prehistoric	<input type="checkbox"/> community planning	<input type="checkbox"/> landscape architecture	<input type="checkbox"/> religion
<input type="checkbox"/> 1400-1499	<input type="checkbox"/> archeology-historic	<input type="checkbox"/> conservation	<input type="checkbox"/> law	<input type="checkbox"/> science
<input type="checkbox"/> 1500-1599	<input type="checkbox"/> agriculture	<input type="checkbox"/> economics	<input type="checkbox"/> literature	<input type="checkbox"/> sculpture
<input type="checkbox"/> 1600-1699	<input type="checkbox"/> architecture	<input type="checkbox"/> education	<input type="checkbox"/> military	<input type="checkbox"/> social/ humanitarian
<input type="checkbox"/> 1700-1799	<input type="checkbox"/> art	<input type="checkbox"/> engineering	<input type="checkbox"/> music	<input type="checkbox"/> theater
<input checked="" type="checkbox"/> 1800-1899	<input type="checkbox"/> commerce	<input type="checkbox"/> exploration/settlement	<input type="checkbox"/> philosophy	<input checked="" type="checkbox"/> transportation
<input type="checkbox"/> 1900-	<input type="checkbox"/> communications	<input type="checkbox"/> industry	<input type="checkbox"/> politics/government	<input type="checkbox"/> other (specify)
		<input type="checkbox"/> invention		

**Specific dates**

**Builder/Architect**

**Statement of Significance (in one paragraph)**

The Marsh arch is an attractive and well-engineered bridge such as one does not see built anymore in this day of strict utilitarianism. In the history of bridge engineering, the Marsh arch does not represent any great technological break-through but is rather one of the many ways in which reinforced concrete was used in the early 20th century, and fits into the mainstream of bridge design for that period.

Bridges were for centuries combinations of artistic expression and engineering expertise. Although the architectural and artistic aspects of bridge-building seem to have been forgotten in the last few decades, as late as the 1930's the combination of aesthetics with technology in utilitarian structures was viewed as the goal toward which engineers and architects alike should strive. As Wilbur J. Watson, a respected engineer, wrote in 1926, "It is highly desirable that utilitarian structures, such as bridges, should be pleasing to the eye as it is practicable to make them, and that there should be greater collaboration between the Architect and the Engineer, with a realization on the part of each that science without art is apt to be unattractive, and art without science inefficient." The Marsh arch bridges in Kansas are a result of this combination of engineering and architecture. They are products of an era when aesthetics were still as important as utilitarianism.

Carl Condit wrote of concrete bridges that by 1910 "the main line of evolution was moving away from massive construction, with echoes of the masonry tradition, toward the flattened parabolic curves of narrow ribs, the slender spandrel posts, and the minimal piers that scientific reinforcing was to make possible." One finds all of these characteristics present in the Marsh arch.

The earliest known Marsh arch in Kansas was built in 1917, the latest in 1934. Construction of the arches reached a peak in the late 1920's and declined after 1930. Those chosen for nomination span the period from 1923 to 1932.

THIS STATEMENT REFLECTS CURRENT KNOWLEDGE AND IS SUBJECT TO AMENDMENT.

## 9. Major Bibliographical References

Condit, Carl W. American Building  
Steinman, David B. & Sara Ruth Watson. Bridges & Their builders. NY: Dover  
Publications Inc., 1941, rpt 1957.  
Watson, Wilbur J. A Decade of Bridges, 1926-1936. Cleveland: J.H. Jansen, 1937.

## 10. Geographical Data See Individual Nomination Forms

Acreage of nominated property \_\_\_\_\_

Quadrangle name \_\_\_\_\_

Quadrangle scale \_\_\_\_\_

### UTM References

A	<input type="text"/>	<input type="text"/>	<input type="text"/>	B	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Zone	Easting	Northing		Zone	Easting	Northing
C	<input type="text"/>	<input type="text"/>	<input type="text"/>	D	<input type="text"/>	<input type="text"/>	<input type="text"/>
E	<input type="text"/>	<input type="text"/>	<input type="text"/>	F	<input type="text"/>	<input type="text"/>	<input type="text"/>
G	<input type="text"/>	<input type="text"/>	<input type="text"/>	H	<input type="text"/>	<input type="text"/>	<input type="text"/>

### Verbal boundary description and justification

### List all states and counties for properties overlapping state or county boundaries

state	N/A	code	county	code
state	N/A	code	county	code

## 11. Form Prepared By

name/title Nora Pat Small, Architectural Historian

organization Kansas State Historical Society--HPD date \_\_\_\_\_

street & number 120 West Tenth telephone 913 296-3251

city or town Topeka state Kansas 66612

## 12. State Historic Preservation Officer Certification

The evaluated significance of this property within the state is:

national  state  local

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

State Historic Preservation Officer signature *Joseph M. Gull*

title Ex. Director & State Historic Preservation Officer

date January 4, 1983

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I hereby certify that this property is included in the National Register

*Linda McClelland*  
Keeper of the National Register

date 2/10/83

Attest:

date

Chief of Registration

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Multiple Resource Area  
Thematic Group

dnr-11

Name Rainbow Arch (Marsh Arch) Bridges of Kansas Thematic Resources  
State Kansas

Nomination/Type of Review		Date/Signature
1.	Cedar Creek Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
2.	Brush Creek Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
3.	Neosho River Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
4.	Conroe Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
5.	Mine Creek Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
6.	Soden's Grove Bridge Entered in the National Register	Keeper <u>Jenna McClelland</u> 3/10/83 for Attest _____
7.	Creamery Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
8.	Pottawatomie Creek Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
9.	Dewlen-Spohnhauer Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____
10.	Blacksmith Creek Bridge Entered in the National Register	for Keeper 3/10/83 <u>Delores Byers</u> Attest _____

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Rainbow Arch (Marsh Arch) Bridges of Kansas MPS

11. Mack, John, Bridge

Added to the  
National Register

1/22/92