NPS Form 10-900-b
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Anderson Co.

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United States Department of the Interior
National Park Service

003-0000-0120

National Register of Historic Places Multiple Property Documentation Form

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

Metal Truss Bridges in Kansas 1861-1939

B. Associated Historic Contexts

Development of Transportation Network in Kansas 1861-1939

C. Geographical Data

State of Kansas

☐ See continuation sheet

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards for Planning and Evaluation.

Signature of certifying official — State Historic Preservation Officer — Date: Nov 21, 1989

Kansas State Historical Society
State or Federal agency and bureau

I, hereby, certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper of the National Register — Date

E. Statement of Historic Contexts

Discuss each historic context listed in Section B.

During the 19th century and the first two decades of the 20th, roads in Kansas were considered a local matter. It was a matter of pride that such authority properly was a local issue. Because there was little perceived need for any but local roads this local authority seemed logical. Few ventured much more than ten miles to market and the average road rarely extended more than twenty miles. The rail system was available for more extensive travel.

Likewise, the purchase and erection of bridges was considered a local concern. Fords often had to suffice before bridges were built; and when bridges were erected later they were usually situated at these fords.

County commissioners had a great deal of latitude in awarding bridge contracts. Nineteenth-century bridge construction was the time of proprietary bridge designs and sales. Commissioners could specify certain patents in the specifications or simply select the lowest bidder from the plethora of companies who had salesmen in the field.

As the market economy increased in the state, so did the need for all-weather crossings of streams and rivers. The large number of small communities were competing for survival. Bridges that allowed farmers easy access to markets could make the difference between growth and stagnation.

Wooden bridges of various designs were attempted. The Howe truss gained some popularity for major stream crossings and the state even could boast a few covered bridges. The short life expectancy of the latter, however, soon made them obsolete. Where limestone was abundant, stone arch bridges were an acceptable and frequently used alternative. Metal truss bridges, on the other hand, became the most popular structure due to their life expectancy, ease of erection, and cost. They also represented a product of the growing industrial revolution in the country and a sense modernity.

There were many designs and salesmen to choose from. The metal truss bridges being nominated are representative examples of the King Post, Lattice, Bowstring, Pratt, Warren, Camelback, Parker and Pegram designs.

The King Post and Lattice designs have perhaps the oldest history of the truss types found in Kansas. The King Post traces its origin to an unknown carpenter in the Middle Ages who discovered that King Post roof trusses could be used side by side to make a bridge. As normally used, the diagonals were placed in compression while the center King Post acted under tension. This triangle design became the basis of most future trusses including the Waddell. Eight King Posts remain in Kansas, each averaging forty feet in length. Six of these are located in Phillips and Washington counties. This indicates that the design was more popular in northeast Kansas. An example bridge was selected from each county. These are estimated to have been constructed ca. 1900, which also indicates the style was used early into the twentieth century likely due to its simple design and economical construction costs. The remains of builders' plates indicate that Canton Bridge Company of Canton, Ohio was responsible for the erection of some Kansas King Post bridges.

Kansas also retains one example of a Waddell A truss. On this rare bridge, secondary verticals are added to the King Post design. As with the Kansas King Posts, the Doniphan county Wadell is a short span of only thirty-six feet in length. Ithiel Town, architect and builder, realized that if two King Post trusses in the form of a Queen Post, were stronger than the one, and could span longer distances, then ten, twenty, or thirty together could span even longer distances. These overlapping King Post trusses no longer

[X] See continuation sheet

needed the vertical King Post. He patented his idea in 1820 and was able to design bridges up to two hundred feet in length. Later designs made the use of iron straps as do the Kansas examples.

The Lattice bridges of Kansas are short spans, averaging about thirty-six feet each. Approximately ten Lattice pony truss bridges remain in Kansas. Eight of these are located in the northwest Kansas county of Norton while another is located in neighboring Phillips county. Whereas the King Post seems to have been a northeast Kansas phenomena, the Lattice seems to be the northwestern counterpart. Builders' plates and remains of builders' plates indicate that the Lattice structures were marketed by the Canton Bridge Company as were the King Posts.

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The Bowstring truss employs a polygonal or arched top chord in compression tied to a horizontal lower chord in tension. Verticals, diagonals, and counters are all designed to act in tension to handle wind and loading stresses. External sway bracing is often added to bolster the arched top chord. Most early metal truss bridges across Kansas streams were Bowstring arches. Several different patents were represented.

The Bowstring design was one of the most popular for bridges in Kansas of the 1870s. It is presently not possible to state an exact figure as to how many there but two hundred would certainly be a conservative figure. Only nine pony trusses presently remain in the state. These bridges are divided between the known builders, King Iron Bridge Company of Cleveland, Ohio; Wrought Iron Bridge Company of Canton, Ohio; and Phoenix Bridge Company of Philadelphia. The builder of one bridge is presently unknown, but the design is similar to bridges fabricated by Missouri Valley Bridge and Iron of Leavenworth, Kansas, with the exception of the latter example. The bridges are all tubular columns. The bridges nominated were built in the early 1870s and unlike the earlier mentioned structures are distributed throughout the eastern half of the state. Five are presently being nominated.

The basic Pratt design was patented in 1844 by Thomas and Caleb Pratt. In this design diagonals were placed in tension and vertical members in compression, with the exception of the hip verticals.

One of the most popular bridge designs in Kansas from the mid 1880s till well past the turn of the century was the Pratt. Approximately two hundred sixty-two have presently been identified to exist. One might easily have seen three times that number in 1900. The bridges being nominated initially cover the time span 1883 to 1899. All, with the

exception of the Barton county bridge, represent the work of the out-of-state prolific bridge builder, Wrought Iron Bridge Company of Canton, Ohio. The exception was the work of C. R. Lane of Topeka. Lane's ironworks, headquartered in Chicago, also fabricated the structural ironwork for the Topeka State Capitol.

James Warren and Willoughbey Monzani patented the simple Warren truss without verticals in England in 1848. The Warren was not as popular as the Pratt in the nineteen century. The lack of counters, and sometimes verticals, subjected the pins at the center of the span to extensive wear. When bolts and rivets replaced the pins in later years, this problem was no longer encountered. The design was more popular for railroad bridges than for highway bridges.

The Camelback is a Pratt in which the top chord and end posts of each truss have exactly five slopes. The top chord above the center panels is always parallel to the bottom chord. The benefits from the polygonal top chord came from the fact that designers could increase the distance between the top and bottom chords and make the truss depth greatest at the center of the span where the stresses were highest. Metal could be saved on the ends where the stresses were lighter. Unfortunately this design also reduced vertical clearance at the ends and made the fabrication and installation more complicated.

The Camelback truss is quite rare in Kansas. The bridge design was being erected well into the twentieth century, however they were then subjected to heavy travel on major roadways. Most have been replaced. were While their numbers may once have reached twenty, only four through-trusses are known to remain in the state.

Bridge designers broke away from the five-slope constraints when they developed the Parker. The Parker is a Pratt with a polygonal top chord of more than five slopes. Most designers followed the long held tradition of keeping at least the top chord of one of the center panels parallel to the bottom chord.

The Pegram truss is a hybrid between the Pratt and Warren. Its polygonal top chord was difficult to fabricate and erect. Only one is presently known to exist in Kansas.

This bridge was erected in 1893 and originally used as a railroad bridge. No evidence exists to suggest that there were additional examples.

A number of the Kansas bridges being nominated were fabricated by very large and prolific out of state firms such as Wrought Iron Bridge Company and Canton Bridge Company of Canton, Ohio; Buckeye Bridge Company and Zenas King of Cleveland, Ohio; and Phoenix Bridge Company of Philadelphia, Pennsylvania. There are also examples of major local companies such as Missouri Valley Bridge and Iron of Leavenworth and Kansas City Bridge and Iron of Kansas City.

Missouri Valley Bridge Company was initially formed as a partnership between Edwin I. Farnsworth and D. W. Eaves in 1874. Edwin Farnsworth was one of the early settlers and city officials in Leavenworth. In 1867 he was appointed city engineer, a position he held until 1871, when he became an agent for Wrought Iron Bridge Company. By 1872 he was chief engineer for the competing King Iron Bridge Company which had established a shop in Topeka. Although successful, Farnsworth came to realize that it would be easier to manufacture and sell bridges in Kansas than import them from eastern firms. Returning to Leavenworth, he organized the Missouri Valley Bridge and Iron Works. By 1878, however, the business had been taken over by the banking firm of Insley and Shire, and A. J. Tullock, an engineer from Rockford, Illinois had been named manager. Farnsworth moved on to the development of Kansas City Bridge and Iron, Chicago Bridge and Iron, as well as Farnsworth and Blodgett.

A. J. Tullock purchased interest in the company in 1880 and is listed as one of the proprietors. In 1888 he purchased the whole operation and operated it until his death in 1904. The company name also changed in that year to Missouri Valley Bridge and Iron Company.

Closely associated with Missouri Valley Bridge and Iron Company was Leavenworth Bridge Company. It was founded by John B. Tearney. Tearney came from a long line of stone masons and contractors. From 1875 until 1929, Tearney built most of the bridges and culverts in Leavenworth and adjoining counties, either by direct bid or subcontract from Missouri Valley Bridge and Iron Company. He owned J.B. Tearney and Company, was a partner with Al Rohr, former contracting agent for Missouri Valley, in Rohr and Tearney, and was a silent partner in Leavenworth Bridge Company. The silence stemmed from the fact that all four companies often bid on the same contract and if one of the four received the contract they would divide it among themselves. Leavenworth Bridge was basically a bidding company. J.B. Tearney and Company did most of the actual construction. Tearney owned all of the equipment.

Generally speaking Missouri Valley Bridge and Iron built bridges that were longer than three hundred feet. Other members of the combine built the smaller structures.

In 1904, Missouri Valley Bridge and Iron Company was termed and incorporated under the laws of Kansas. The incorporators were past company employees.

In its later years the company built everything from bridges to dry docks, boats and pollution control equipment. Specialists in difficult subaqueous foundations, they erected the piers for many large structures, most notably the east foundations for the San Francisco Bay Bridge. The company ceased to exist after a fire in 1975.

Kansas City Bridge and Iron was founded between 1880 and 1882. The 1887 Kansas City Directory tells us that G. H. Wheelock was president, A. M. Blodgett was vice president, and E. I. Farnsworth was chief engineer.

We know Farnsworth as the former president of Missouri Valley Bridge and Iron. He continued to move from one position to another and alternated between being a corporate executive and serving as a civil engineer. In 1893 he associated himself with A. M. Blodgett of Chicago Bridge and Iron, in a firm called Farnsworth and Blodgett. By 1899 both men were again operating their own separate bridge companies.

The bridges included in this nomination are being nominated for their significance to the history of engineering and transportation in the state. They span the time period from the 1870s-1934. They represent the period when individual designers patented their ideas, then actually built and sold the fruits of their labor. On the other end of the scale there are examples of standardized construction which was the norm by the 1930s.

The bridges formed an important link in the Kansas transportation system. All-weather crossings became vital for the advance of the market based economy of the state to ensure that all of the state's citizens were enfranchised no matter what the weather might be, and were used as methods to promote the growth of local communities.

The metal truss bridges of Kansas are a visual reminder of our engineering and transportation heritage. They are also a tangible link to methods of construction no longer being practiced.

the panel points and throughout the structure than if the members were connected by the use of rivets. Although the riveted structure was much more rigid, the inability to insure that the individual rivets had not been damaged during insertion made risk of failure an unknown. It was extremely difficult to calculate the stress throughout the joint. The pin could be considered basically as a single rivet.

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There are several problems in the preservation, maintenance and retention of historic metal truss bridges. Due to the fact that they were erected for the purpose of providing a stream crossing, adaptive reuse for other purposes compromises their integrity. In the past when a structure was no longer able to handle the load for which it was originally intended it was moved to a crossing where this load was not as great. Many have already been downgraded as far as they can. The act of physically moving the structures at present day costs is also not a viable option for many local governments. If removal is mandated because a new bridge is needed and there are no bypass options, some financial assistance is available for relocation if the structure is National Register eligible and the replacement is employing federal funding. This assistance, however, does not cover the cost of moving, let alone the cost of placement on new abutments. If it is possible to bypass an older bridge with a new alignment, liability questions and funding requirements require the old structure to be cut off from public access. This generally means no future maintenance is done.

There are reputable engineers who feel that old metal truss bridges cannot be rehabilitated to safely carry even pedestrian traffic and recommend the erection of a totally new bridge inside the old structure, allowing the old trusswork to remain more or less as a shell. The question of how this compromises the structural integrity of the original bridge remains unanswered. If the bridge is of a design and age that makes rehabilitation an attractive option, federal requirements not in effect when the bridge was originally erected make significant changes to the original design necessary. Again the structural integrity is negatively affected.

Many local engineers are untrained in historic bridge building techniques. This makes it difficult for them to sympathetically care for the structures entrusted to them.

One of the major problems facing the proposed retention of historic bridges is the cost. This includes the added costs to reroute a new crossing, future maintenance, costs to relocate, and added design costs.

New bridges are requested for the same reasons old bridges were requested. Some of these reasons are to have a safe all-weather river crossing, allow access to fields and markets, and it is seen as progress. These needs are strong and it is difficult for the old bridge to stand in the way.

Public awareness of the value of these structures needs to be heightened. If this hurdle can be crossed the others would be more manageable.

known on a large number of the inventoried bridges in these classes. Often bridge plaques which may have contained that information have been removed, or the county's records are not complete or have been destroyed. Many times there is little to choose from in differentiating among individual bridges of these subclasses other than condition and the likelihood of preservation. Technology and individual historical significance are usually not factors.

The purpose of the KDOT survey and the subsequent evaluation was to identify a representative selection of bridges of each class or subclass and nominate to the National Register those candidates which meet the criteria of eligibility. Through this approach KDOT and KSHS hope to preserve for posterity some examples of each type of bridge.

Leonhardt, Fritz, Bridges, Cambridge, MA: MIT Press, 1984.

Plowden, David, Bridges: The Spans of North America, New York: W.W. Morton and Co., 1974.

Schirmer, Sherry, Theodore Wilson, Milestone: A History of the Kansas Highway Commission and the Department of Transportation, Topeka: K.D.O.T., 1986.

Weitzman, David, Traces of the Past: A Field Guide To Industrial Archeology, New York: Chares Scribner's Sons, 1980.

Whitney, Charles S., Bridges: Their Art, Science, and Evolution, New York: Greenwich House, 1983.

F. Associated Property Types

I. Name of Property Type Metal Truss Bridges

II. Description

The structures being nominated are metal truss bridges. The metal consists of both wrought iron and steel. Wrought iron is much more ductile than cast iron and was found to be an excellent alternative in bridge fabrication. As the quality, quantity, and cost of steel improved towards the later part of the 19th century, it began to replace wrought iron as the choice material. The use of wrought iron had virtually ended by 1910.

The nominated structures are representative of both pinned and riveted construction. Generally, until the 20th century, all panel point connections were made with the use of a pin. This became such a widespread practice that it became one of the distinctive features of United States bridge construction. The pin was selected for several reasons. It was simple in design and it was much easier for period engineers to calculate stress at

III. Significance

The oldest truss type to be found in Kansas is the Bowstring arch. It also is the type that shows the greatest variation in design. Of the myriad of patented designs Kansas has examples of many, such as the King, Miller, Phoenix, and perhaps Missouri Valley Bridge and Iron. The state was initiating its first spurt of growth during the 1870s and this coincided with the zenith of the bowstring arch bridge's popularity. They also represent the first improvement expenditures many of the fledgling counties were able to make. Most of these early bridges were built with the use of either township or county bond sales. The bond elections and controversies surrounding them are illustrative of the unsettled, although growing, political and social system.

As the state grew and began to prosper, the large bridge companies of Ohio and further east saw their opportunity. Salesmen canvassed the state and marketed their company's designs.

IV. Registration Requirements

Structures eligible for listing on the National Register should have a high degree of preservation potential determined by location, structural integrity, and assessment of the likelihood of removal. These structures should be at least fifty years old and possess a high degree of structural and site integrity. Some bridges have been moved, and because it was a common and universal practice, this is not considered adversely affecting their significance If it had not been done, many existing structures would no longer exist.

[X] See continuation sheet

[ ] See continuation sheet for additional property types

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

The bridges submitted as part of this nomination are representative examples of the currently existing metal truss designs extant in Kansas. They vary from the unique to the commonplace.

The Kansas Department of Transportation (KDOT) carried out a statewide inventory of historic bridges between 1980 and 1983. The bridges to be included were identified through computer printouts developed by KDOT, from information supplied by the counties (since almost all of the historic bridges were located on secondary rather than the primary road system), and by direct observation by field personnel. All bridges were inspected by KDOT personnel, and all of the bridges included in this thematic nomination were inspected by staff of the Kansas State Historical Society (KSHS).

All the bridges included in the "Metal Truss Bridges of Kansas" thematic nomination were jointly evaluated by representatives of KDOT, KSHS, and the State Historic Preservation Officer.

Most of the bridges in each subclass are alike or quite similar in their methodology and techniques of construction. Little historical information is available on many of these small bridges. For example, the designer, builder, and date of construction are not

[X] See continuation sheet

H. Major Bibliographical References

Burr, William, and Myron Falk, The Design and Construction of Metallic Bridges, New York: John Wiley and Sons, 1916.

Cooper, James L., Iron Monuments to Distant Posterity, Greencastle: DePauw University, F.H.W.A., I.D.H., I.D.N.R. and NPS, 1987.

Darnell, Victor C., American Bridge Building Companies, Washington, D.C.: Society for Industrial Archeology Occasional Publication 4, 1984.

Delone, Eric N., letter to Richard Pankratz, April 30, 1985, located at Kansas State Historical Society, Topeka, Kansas.

Jackson, Donald C., Great American Bridges and Dams, Washington, DC: Preservation Press, 1988.

[X] See continuation sheet

Primary location of additional documentation:

- [X] State historic preservation office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Specify repository: Kansas State Historical Society

I. Form Prepared By

name/title Larry Jochims, Historian
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III. Significance

The simple Pratt designs became one of the most widely used highway bridges in the state, while the similar Warren truss never became widely used. It did, however, gain widespread use as a railroad bridge.

Variations of the Pratt, the Camelback, Parker, and Pegram truss were later adaptations and were generally used for long stream crossings. In such long spans, the designs allowed more economy of construction because the truss depth was greater where it was needed, at the center of the span, and less on the ends where it was not.

In the early years a few scattered river bridges sufficed or were all that was affordable. In a short time, however, residents saw the usefulness and experienced the benefits of the bridges over the existing fords. They also saw that the location benefited some more than others. This fueled the cry for more bridges and the rapid construction of the 1880' and 1890s.

The history of bridge construction in Kansas is one of conflict and cooperation, one of growth of the farm to market and market to market system within the state. It signifies the philosophy of and leaves us with tangible results of the great industrial revolution of the late 19th century and early 20th century. It is of value to preserve a cross section of the bridge types built in the state both for the benefit of future researchers but also to maintain that link with the past for ourselves. Although some bridges are unique in that few or no other example has been identified in the state or country some are commonplace. Even the commonplace can give us pause to reflect on the magnificence of our surroundings. It is also true that the commonplace structures are those most people came into contact with and hence are those that had the most impact on the history of the state. Due to the age of most structures, they are in danger of imminent replacement and likely destruction.