

The Kansas City Southern Railroad Bridge is a single track steel structure whose most important component is a Waddell "A" truss bridge. It and the accompanying deck trusses were originally built in the 1890s over the Arkansas River in Oklahoma. They were erected in 1926 in their current location over Cross Bayou adjacent to downtown Shreveport.

The bridge consists of a 127 foot steel deck truss span, a 100 foot steel through truss span (the Waddell "A" Truss), and another 127 foot steel deck truss span. The deck trusses feature a repetitive pattern of diagonal and vertical braces. The Waddell "A" Truss is described below. The steel spans rest on concrete piers supported on foundation piling.

Patented in 1894 by bridge engineer J. A. L. Waddell, the Waddell "A" Truss bridge is regarded as an advancement in railroad bridge design (see Part 8). It is a type of short-span railroad bridge designed to effectively carry a maximum amount of weight using a minimum amount of materials in its construction. Its "A" shape truss, as seen in cross section, features a vertical eye-bar at the center and vertical and diagonal webbing. Other character-defining features of the type include strong lateral top chord bracing (the X shaped bracing seen at the top as one approaches the bridge) and the use of pin connections to join the major parts. The nature of the pin connections can be seen in the attached Historic American Engineering Record drawings of the nation's only other known surviving Waddell "A" Truss bridge. Essentially the pre-fabricated sections of the bridge are riveted together, and these major pieces are connected with pins when the bridge is erected. This method made the bridge quick and easy to erect on site (see Part 8).

Having been in use by KCS up until the late 1980s, the bridge retains its railroad trackage. To each side are deteriorated plank walks.

#### Assessment of Integrity:

A comparison of the 1926 drawings and the current structure shows that the Cross Bayou Bridge looks as it did when erected. As a well preserved example of a now rare railroad bridge type, it is an excellent candidate for the National Register.

Significant dates	1890s; 1926
Architect/Builder	Engineer: John Alexander Low Waddell

#### Statement of Significance Criterion C

The Kansas City Southern Railroad Bridge over Cross Bayou is of national significance as one of only two known remaining Waddell "A" truss bridges in the country.

The following background information on Waddell and his "A" truss bridge is excerpted from the National Register nomination on the Linn Creek Bridge in Missouri, the other remaining example of the type:

Summary: The Kansas City Southern Railroad Bridge represents the work of a master, John Alexander Low Waddell, who enjoyed an international reputation as a teacher of engineering and a practicing professional engineer. Waddell's "A" truss was developed to meet the need for a reliable, easily erected, inexpensive, short span railroad bridge and is regarded as a transitional phase in bridge design. The two, high main trusses, which were connected by top bracing and gave the bridge its characteristic "A" shape, answered the stress and vibration problems inherent in the more widely used pony truss form. Although rapid technological advances quickly made the "A" truss obsolete, Waddell's design was extensively used as a railroad bridge in both Japan, where he developed the type, and in the United States, where he perfected and patented his design.

The Engineer: John Alexander Low Waddell (1854-1938), a native of Canada, received a degree as Civil Engineer in 1875 from Rensselaer Polytechnic Institute. In the same year he worked as a draftsman for the Marine Department at Ottawa, Canada, and, in 1876 and 1877, served as an engineer with the Canadian Pacific Railroad. In 1878, Waddell returned to Rensselaer and spent two years on its faculty. Between 1880 and 1882, he worked as Chief Engineer for Raymond Campbell Bridge Builder of Council Bluffs, Iowa, and received a Masters in Engineering from McGill University of Montreal, Canada. In 1908, this same institution awarded him a doctorate in engineering.

In 1882, Waddell accepted a position as professor of civil engineering at the Imperial

University of Tokyo. For his service, the Japanese Emperor awarded him the Knight's Cross of the Order of the Rising Sun in 1885. In 1886, he returned to the United States. The following year he established a practice in Kansas City, Missouri as a bridge designer and consultant, and for the next half century, was "one of the best known bridge engineers in the United States" (Dictionary of American Biography).

According to the Dictionary of American Biography, "In his bridge work Waddell was noted for his boldness in innovation combined with a careful attention to detail. " He designed bridges in the United States, Japan, Canada, Mexico, Russia, China and New Zealand. Waddell also was a prolific writer. His 1916 two-volume Bridge Engineering became the standard work on the subject.

The "A" Truss Design: From 1882 to 1886, while serving as professor of civil engineering at the Imperial University of Tokyo, Waddell debated the design of short span railroad bridges with British engineers, who were serving as advisers for the Japanese railroad currently being developed. According to his own account in *De Pontibus* (1898), Waddell "was dissatisfied with all railroad bridges for spans between the superior limit of the plate-girder and a length of about one hundred and fifty feet, ordinary pin-connected, through, Pratt trusses being too light and vibratory, and the riveted bridges as then built being clumsy, unscientific and uneconomical."

The British engineers, who were then dominant in the engineering profession, advised the Japanese to built pony truss bridges for short spans of 120 feet or less. Waddell objected to the use of the pony truss because it had no top chord lateral bracing, so that it was less rigid and, consequently, more susceptible to stress and vibration. He also objected to the use of rivets to connect bridge components. Assemblage in the field required hand riveted connections, which were not as strong as shop riveting and were subject to vibration and susceptible to failure.

In 1893, Waddell was retained as an engineer by the Kansas City, Pittsburg and Gulf Railroad. In *De Pontibus*, Waddell recalled that "after a little persuasion the General Manager was induced to agree to build a 100-ft. 'A' truss span as an experiment; but when he saw the completed plans he ordered at once four bridges to be built therefrom...." The structure designed by Waddell was "a four panel truss bridge having eye bars in bottom chords and centre verticals, and rigid members for all the other portions of the trusses and for the entire lateral system." The resulting "A" shape was described by Waddell as "odd but not displeasing." In contrast to the pony truss railroad bridge, the two main trusses of Waddell's "A" truss design were high enough to be connected by lateral sway bracing. The "A" truss was also pinconnected, which eliminated Waddell's objection to the hand riveted connections of the British. In his own assessment of the design, Waddell noted: "The advantages of this type of bridge are great rigidity in all directions, ease and cheapness of erection, and economy of metal when it is compared with structures of other types having equal strength and rigidity."

Although the Waddell "A" truss never became a common bridge type, for its designed use it was, for a brief time, widely used in the United States, Japan and Canada. The Japanese Nippon Railways adopted the configuration as the standard bridge for spans between 65 to 116 feet, and the Kansas City, Pittsburg and Gulf Railroad adopted the design as the standard one hundred foot span for the line. The bridge was also used on the St. Louis Southwestern Railway and the Kansas City Southern. With the perfection of portable pneumatic riveting machines, the modern Pratt truss bridge supplanted Waddell's "A" truss design. By 1916, Waddell pronounced the design "antiquated," although "nearly all (the "A" truss bridges built) are still in use, notwithstanding the fact that some are frequently overloaded as much as sixty percent."

## BIBLIOGRAPHY

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Historic American Engineering Record drawings and report on Waddell "A" Truss Bridge (Linn Branch Creek Bridge), Platte County, Missouri. Copy in National Register file, Louisiana Division of Historic Preservation.

Kansas City Southern Railway Archives, contract and drawings for construction of Waddell "A" Truss Bridge over Cross Bayou. Copy in National Register file, Louisiana Division of Historic Preservation.

Eric DeLony, Chief, Historic American Engineering Record. Phone interview with National Register staff.