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PLATTSMOUTH BRIDGE
Iowa Bridges Recording Project
Spanning Missouri River
at U.S. Highway 34
Pacific Junction Vicinity
Mills County
Iowa

HAER No. IA-67

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HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Department of the Interior
P.O. Box 37127
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HISTORIC AMERICAN ENGINEERING RECORD

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Location: Spanning the Missouri River on U.S. Highway 34, 3.6 miles southwest of Pacific Junction; Mills County, Iowa/ Cass County, Nebraska
UTM: 15.259130.4542720
USGS: Pacific Junction, Nebraska quadrangle
(7.5 minute series, 1993)

Date of Construction: 1929

Designers: Omaha Steel Works, Omaha, Nebraska; Modjeski & Chase, New York, consulting engineers

Builders: Omaha Steel Works, Omaha, Nebraska (superstructure); Union Bridge and Construction Company, Kansas City, Missouri (substructure)

Fabricators: Omaha Steel Works, Omaha, Nebraska; Illinois Steel Company, Chicago, Illinois; Inland Steel Company, Chicago Heights, Illinois; Carnegie Steel Company, Pittsburgh, Pennsylvania

Present Owner: Plattsmouth Bridge Company, Plattsmouth, Nebraska

Present Use: Highway toll bridge

Significance: This bridge is historically significant as a regionally important vehicular crossing of the Missouri River and is the oldest extant Missouri River highway bridge into Iowa. Moreover, it is a unique example of a privately financed and operated toll bridge over a major river. It is technologically significant as a noteworthy example of cantilevered truss construction. The Plattsmouth Bridge has been listed in the National Register of Historic Places.

Historian: Robert W. Jackson, August 1995

Project Information: This document was prepared as part of the Iowa Historic Bridges Recording Project performed during the summer of 1995 by the Historic American Engineering Record (HAER). The project was sponsored by the Iowa Department of Transportation (IDOT). Preliminary research on this bridge was performed by Clayton B. Fraser of Fraserdesign, Loveland, CO.

The Plattsmouth Bridge carries U.S. Highway 34 over the Missouri River between Plattsmouth, Nebraska and Interstate 29 in Iowa. Alternate routes for crossing the Missouri are at Bellevue and Nebraska City, Nebraska which are 12 miles up river and 25 miles down river, respectively. The bridge was built in 1929 by the Omaha Steel Works as a toll bridge for the Plattsmouth Bridge Company, and is still operated by that company as a toll bridge. It is located parallel and 250' downstream from the Chicago, Burlington & Quincy Railroad Bridge which was originally built in 1880 and rebuilt about 1903. This earlier bridge is also often referred to as "the Plattsmouth Bridge".

The highway bridge is a steel, riveted and pin-connected, cantilever through truss structure of seven spans with a total length of about 1,420' measured between abutment backwalls. The westerly three spans consist of a through truss unit approximately 804' in length. The main river span is at the Nebraska end of the structure, where an approximately 201' through truss is suspended from cantilever trusses consisting of anchor arms of about 201" with cantilever arms of about 101', to make a navigation span of about 402'. The independent suspended span is carried by means of hangers at the end of the cantilever arms. At the Iowa end, two deck truss spans of about 203' are followed by two deck truss spans of about 100'.¹

¹Data concerning the present condition of the bridge has been taken from Howard, Needles, Tammen & Bergendoff, "Missouri River Bridge: Engineering Report, Physical Condition and Rating Review," (Kansas City, MO: Howard, Needles, Tammen & Bergendoff, 1993), a report prepared for the Plattsmouth Bridge Company, Plattsmouth, Nebraska. The information in this report was verified by bridge company president Ron D. Schneider and by visual inspection by the author. Data concerning the condition of the bridge at time of completion has been taken from Plattsmouth Evening Journal, May 16, 1930.

At the time of construction, the bridge floor was about 79' at pier number 1 (the westernmost pier) and about 61' at pier number 2 above standard high water in the river. The War Department, in granting permission to build the bridge, insisted on a clear channel span of at least 400', with an unobstructed height above high water of at least 55', in order to accommodate future river traffic. Vertical clearance at the navigation channel was measured in 1993 as being about 54'.

The bridge was designed to carry in addition to its own weight a traffic load of 900 pounds per lineal foot of bridge, in addition to two 15-ton trucks, having a concentrated load of 12,000 pounds on each rear wheel. In addition to the traffic load the bridge was designed to stand a wind pressure of 30 pounds per square foot on the side area of the exposed floor construction and a load of 45 pounds per square foot on the side area of each truss.

The foundation of the bridge includes two abutments and six piers, all of reinforced concrete. The Iowa abutment sits on an embankment while the Nebraska abutment rests on a rock bluff. One 24" diameter natural gas pipe line and one 9" diameter petroleum product pipe line are carried on the north side of the structure by special brackets located outside of the truss. Pipe supports for a former 24" gas main are still in place on the south side of the bridge. There are no sidewalks. The toll booth is located between the two travel lanes on the Nebraska approach.

The bridge has a reinforced concrete roadway slab approximately 20' wide curb to curb, placed over steel stringers. Minimum vertical clearance to the truss bracing is about 15'. In Iowa, the approach roadway has a direct alignment, rising at a 4.5 per cent grade through the structure. The Nebraska approach follows a severely winding alignment for about a quarter mile, as it ascends the bluff. A tight hairpin turn and reverse curve at the toll booth, located just west of the Nebraska abutment, is difficult for large vehicles to negotiate. Tractor-trailer rigs often have to pass on the "wrong" side of the toll house, moving into the opposing traffic lane, in order to negotiate the turn at the western portal of the bridge. Considerable damage has been done to the ornamental ironwork of the western portal by trucks attempting to make the turn.

The Plattsmouth Bridge features ornamental iron panels and lamp posts located at each portal, although the lamps currently have no globes and have not functioned for many years. The abutments and piers are concrete with Art Moderne detailing. In contrast to the shiny black paint that originally covered most of the bridge, the hand railing stood out with a coat of aluminum

colored paint that made it highly visible both day and night. The bridge is currently painted an overall rust color, but close inspection reveals that several colors of paint are visible on the weathered surface of the steel.

The overall design of the bridge reflects the concern of its creators with both appearance and utility. Considerable care and thought was given to the presentation of a pleasing appearance, while the technical specifications were intended to insure that the structure would accommodate increasing traffic demands throughout the bridge's projected economic life. This dual concern with aesthetics and functionality is a product of the desire of the bridge company's directors to make a profit for the company while also enhancing the image of the bridge as a symbol of the economic vitality of Plattsmouth and the South Omaha area.

Efforts in Plattsmouth to build a wagon bridge across the Missouri River first began to increase during a period of civic expansionism that gained force in the late nineteenth century. Residents of cities located along the highways of southeastern Nebraska and southwestern Iowa had long wanted a direct connection between those road systems, as had those members of the regional livestock industry who needed direct access from southwestern Iowa to the livestock market in South Omaha.²

The greatest obstacle to creation of a bridge at Plattsmouth was the matter of financing. Late nineteenth-century plans for a pontoon bridge were thwarted when City Attorney Byron Clarke gave an opinion that the city could not issue internal improvement bonds for a bridge located outside the city limits.³ Other bridge plans in subsequent years met with a similar lack of success. However, when the Plattsmouth Chamber of Commerce was reorganized January 1, 1928, the first major committee to be named was the Missouri River Bridge Committee, with local banker Henry A. Schneider as chairman.⁴

On January 21, 1928, the Plattsmouth Bridge Company was formed during a meeting held in Omaha, Nebraska of some of the men who had earlier financed and erected the King of Trails bridge over

²Robert Foster Patterson, "The History of Plattsmouth, Nebraska: 1853-1900" (unpublished Master's thesis, University of Nebraska, 1932), p. 235; "History of Plattsmouth Bridge Company," An unattributed document contained in the files of the Plattsmouth Bridge Company, Plattsmouth, Nebraska.

³Patterson, 235.

⁴Plattsmouth Evening Journal.

the Platte River, built just north of Plattsmouth in 1925. Schneider was one of those men, and was subsequently elected president of the new company at its first official meeting on February 7, 1928. The only other Plattsmouth resident among the six original incorporators was Judge James T. Begley, who was elected to the board of directors. Begley had earlier served on the executive board of a regional association organized in a failed attempt to bring about passage of state legislation to finance a bridge at Plattsmouth.⁵

The other four bridge company organizers were all from Omaha and were connected in one way or another with Omaha Steel Works. The vice president of the newly created bridge company was R.A. Leussler of Omaha, who was also at one time president of Omaha Steel Works. John W. Towle, the organizer and president of Omaha Steel Works, was elected treasurer of the bridge company, and Karl E. Vogel, chief engineer and treasurer of Omaha Steel Works became a bridge company board member. The man elected secretary was Glenn Venrick, who also served as attorney and chief financial officer of the corporation. Venrick had been Towle's attorney for several years.⁶

The articles of incorporation of the Plattsmouth Bridge Company authorized capital stock consisting of 1,000 shares of no par value common stock, and this was subscribed as follows:

⁵Unless otherwise noted, information concerning the creation of the Plattsmouth Bridge Company was obtained from "History of the Plattsmouth Bridge Company," and from Plattsmouth Evening Journal.

⁶Unless otherwise noted, information concerning Omaha Steel Works was obtained from R.L. Polk and Company, City Directory of Greater Omaha (Omaha: R.L. Polk and Company, 1911-1934); Arthur C. Wakeley, Omaha, the Gate City, and Douglas County, Nebraska: A Record of Settlement, Organization, Progress and Achievement (Chicago: S.J. Clarke, 1911), 224-225; Fredric L. Quivik and Lon Johnson, Final Report on the Determination of Eligibility to the National Register of Historic Places for Historic Bridges in South Dakota (Butte, Montana: Renewable Technologies, Inc., 1990), a report prepared for the South Dakota Department of Transportation; and Addison Erwin Sheldon, Nebraska, The Land and the People II (Chicago: Lewis Publishing Company, 1931), 48.

<u>Incorporator</u>	<u>Number of Shares</u>
H.A. Schneider	250
John W. Towle	250
R.A. Leussler	250
Glenn n. Venrick	100
James T. Begley	90
Karl E. Vogel	60

As can easily be seen, the incorporators of the company, who also constituted the first board of directors, were all closely associated with the Omaha Steel Works. This tends to support the claim of Glen Venrick's son, Charles, that Towle and Vogel decided to build the bridge as a means of providing work for the company. Schneider and Begley were asked to participate as investors simply because they were local men of influence with an interest in the creation of a bridge. Venrick's pay for setting up the corporation and devising the stock issues was ten per cent of the stock.⁷ He had earlier performed the same function for several of Towle's many corporations including the Omaha Structural Steel Works, as the company was first named.

The firm was organized in Omaha, Nebraska in 1911 by Towle, who was also president of the Western Bridge and Construction Company. Towle, a native of Nebraska, received a degree in civil engineering at Cornell University in 1894. Three years after graduation he returned to his home state where he worked in the late 1890s as the general western agent for the Canton Bridge Company, which was located in the Bee Building in Omaha. The company moved its offices and acquired new agents in 1901, but Towle retained an office in the Bee Building and was operating as an independent bridge agent at this time. One bridge built by Towle in 1906 has been identified in South Dakota; an 80' pin-connected Pratt through truss over the Big Sioux River in Mapleton Township, Minnehaha County. By 1907 Towle had organized the Western Bridge and Construction Company, which apparently remained in business until about 1934. This company was active in several states, and built a considerable number of bridges in Iowa.

The Omaha Structural Steel Works began business on a small scale in 1911, and by 1912 was listed in the Omaha Directory Company City Directory. The company prospered from the start, and a statement released early in the firm's life says:

⁷Interview with Charles Venrick conducted by Ron Schneider in 1995, as recorded in a memo in the files of the Plattsmouth Bridge Company, Plattsmouth, Nebraska.

The company owns a large plant that covers about eight acres. Huge machines, each worth a small fortune, are used for handling and shaping the great masses of steel. One hundred and fifty men are employed at the plant and 250 more are kept continuously busy on work throughout the country, not including a score of engineers and office employees.⁸

The company built bridges in several states, including South Dakota and Arizona, while also constructing buildings in many locations. Towle maintained interests in several other businesses during this time, including Nebraska Bridge Supply and Lumber Company, Independent Lumber Company, Concrete Engineering Company, Allied Contractors (another bridge building company), Western Securities Company, and the Western Bridge and Construction Company.

Omaha Structural Steel Works shortened its name to Omaha Steel Works about 1920 and survived under that name at least until 1956. Relatively little is known about this firm, and it is assumed that the Plattsmouth bridge was the largest bridge project of the company.

The first order of business for the Plattsmouth Bridge Company following incorporation was securing passage of a bill by congress empowering the company to erect, maintain and operate a bridge over a navigable waterway. With the assistance of Representative John W. Morehead of the First Nebraska district, House Roll 10373 was quickly introduced in Congress, approved by both the House and Senate, and signed by the President of the United States on March 29, 1928.⁹

The bridge company next had to solve the problem of financing. The eastern investors who were asked to fund the bridge required the New York engineering firm of Ford, Bacon & Davis to conduct a traffic study and financial forecast for the proposed structure. Their report, dated June 19, 1928, indicated that the anticipated traffic would provide sufficient revenue to make the project feasible. With this assurance the financial backers gave approval for the creation of detailed construction plans. Up to this point, only rough sketches and general estimates of cost had been used.

⁸Wakeley, 225.

⁹U.S. Congress, An Act Authorizing the Plattsmouth Bridge Company, its successors and assigns, to construct, maintain, and operate a bridge across the Missouri river at or near Plattsmouth, Nebraska, Public Law 221, 70th Cong., 1st Sess., 1928.

The engineering department of Omaha Steel Works chose a cantilever type of construction for the main river span, thus utilizing a different design from that generally being used for Missouri River bridges. The plans conformed so well to War Department regulations that the approval process proceeded without delay. Application for approval of plans and location was made to the United States Engineer Office at Kansas City on July 17, 1928. On August 1 a public hearing on the application was held, and approval was granted September 9, 1928.

On November 9, 1928, at a special meeting of the stockholders, the Articles of Incorporation were amended to provide for the issuance of 1,000 shares Class A Preferred Stock of the par value of \$100 per share, and 1,750 shares Class B Preferred Stock at the par value of \$100 per share. No organized stock selling campaign was conducted, and only a small amount of preferred stock was sold locally. It is unknown why the stock was issued in this manner, but it is possible that the bridge was built under an arrangement with one of the states which stipulated that the state would take over the bridge a few years after completion. The Class B stock may have been issued as part of this scheme.

As previously stated, many of the men behind the creation of the Plattsmouth highway bridge financed and erected the steel and concrete Platte River Bridge built north of Plattsmouth in 1925. That bridge, called the King of Trails Bridge, was erected under provisions of a Nebraska bridge law that would permit the state and adjoining counties to take ownership of the bridge at any time, with the state paying half of the purchase price and the counties collecting toll revenue to cover the remaining cost of purchase. Little more than two years toll collection was sufficient to pay most of the \$120,000 cost of construction, plus interest on the investment, and to provide a reserve fund to pay for replacement of its gravel surfaced roadway with one of rock-asphalt. The state took the bridge over when it was partially paid for, and converted the bridge to a toll-free crossing. Shortly thereafter, the state converted the road between the bridge and Omaha into a all weather surface.

The Act of Congress which authorized the Plattsmouth Bridge Company to build and operate the bridge contained provisions for the transfer of ownership to either Nebraska, Iowa, or any political subdivision of such states, under terms favorable to the bridge company. Therefore, it is possible that the board of directors set up the corporation with the assumption that they

would repeat the experience of the King of Trails Bridge.¹⁰ How this arrangement was supposed to work is unclear, and additional research is required before the rationale behind the stock issuance is understood.

Following the reissue of stock, the bridge company board of directors authorized entering into a construction contract with Omaha Steel Works on November 26, 1928 and the contract was signed the next day. At the same time the board contracted with William Ranber for the necessary grading for the approach roads. Omaha Steel Works later contracted with Union Bridge and Construction Company of Kansas City, Missouri for the substructure work.

Once called by noted bridge engineer J.A.L. Waddell "one of the best known bridge building companies of America," the Union Bridge and Construction Company had just finished work on the new combination railway and roadway bridge at Fort Madison, Iowa when contracted to perform work on the Plattsmouth bridge. The firm, which had also built the substructure of the swing bridge across the Atchafalya River in Louisiana in 1911, apparently had some expertise in erecting bridge substructures in deep, swiftly flowing rivers.¹¹

Actual construction of the bridge began December 30, 1928 with the sinking of pier number 1, which is the pier on the west river bank. The sinking of this pier required passing through about 30' of loose sandstone, limestone and granite boulders. A similar deposit of boulders was encountered by noted bridge engineer George Morison in 1880 when the west pier of the Chicago, Burlington and Quincy Railroad bridge was built about 250' north of the highway bridge. The three main river piers were sunk to limestone bedrock by the pneumatic process. Bedrock was encountered at a depth of 44', 45', and 64' below standard high water. In sinking the shaft for piers number 2 and 3 it was necessary to pass through a thick bed of shale overlying the bedrock. The density of this material made excavation slow and difficult. Progress was further retarded when the June rise in the river water level carried out the falsework leading to the mid-stream pier then partially sunk to bedrock. During the several weeks it took to rebuild both the falsework and the tramway then being used in superstructure construction the

¹⁰"Platte River Bridge Made Toll Free in 2 Years," Plattsmouth Evening Journal, 16 May 1930; Interview with Charles Venrick conducted by Ron Schneider.

¹¹J.A.L. Waddell, Bridge Engineering 2 (New York: John Wiley & Sons, 1916), 1072, 1513.

subcontractor employees remained busy laying the cement deck at the extreme east and west ends of the structure.

Two lives were lost in the construction of the piers, one from burns suffered when matches ignited in the pocket of a man working under pressure in an underwater compartment, and the other from falling formwork. To reduce the hazards associated with erection of the superstructure a boatman was stationed beneath the workers to rescue anyone who might fall into the river. Fortunately, no lives were lost during this phase of construction.

The superstructure was erected with the aid of two traveling derricks which moved along rails temporarily laid on the deck and progressing simultaneously from both ends of the bridge. Falsework was used for the anchor arms of the cantilevered portion of the superstructure, but there was no falsework underneath the main channel span. The two ends of the bridge were joined by completion of the center suspended span. This required considerable precision in both the placement of piers 1 and 2, and in the fabrication and erection of the steel.

The steel for the superstructure was fabricated during that portion of the summer when temperatures averaged 90 degrees, and it was assumed that the erection would be performed during the latter part of October with an anticipated temperature of about 50 degrees, according to trends indicated by federal weather bureau reports. This meant that there could be a temperature differential of up to 40 degrees between time of fabrication and erection, thus potentially causing a variation of 3 3/4" in the length of the upper chord of the cantilevered portion of the superstructure. When the work had progressed to the point where completion of the center span was imminent, activity was delayed for several days before the ambient temperature dropped to a point allowing final connection. At that time the traveling derricks hoisted the center sections of the floor support and dropped them into place. The holes matched perfectly and the lower chord was riveted together without difficulty. Connection of the upper chord required a even lower temperature, which was reached on the following day.

The bridge, together with approaches on both sides of the river, was completed on January 25 and opened to traffic on February 1, 1930. The bridge company reported to the Secretary of War, as required by the authorizing legislation, that the cost of constructing the bridge and its approaches, the cost of acquiring any interest in real property necessary therefor, and the financing and promotion costs amounted to \$667,266.82. After investigating the reasonableness of the alleged costs, the Secretary of War allowed a construction, financing and promotion

cost of \$639, 360.98. This investigation was done in order to establish a basis for possible future governmental acquisition of the bridge, per the stipulations of the authorizing act.

Although tolls were collected beginning on February 1, the official dedication of the bridge was delayed until May 16, 1930 due to the need to improve access before the bridge could be fully operational. In general, road conditions in the area at this time were very poor. That portion of the road leading from Plattsmouth to the western portal of the bridge that was outside city limits was constructed with state and county funds, and the portion inside the city limits was financed with city and state funds. A viaduct was built over the railroad shop tracks, which extended from Third to First streets, in order to eliminate grade crossings. The cost of building this viaduct was shared by the railroad, the bridge company, and the city. The City of Plattsmouth also placed electric lights on the portion of the approach road within city limits and on the viaduct. However, only a small portion of the highway between Plattsmouth and South Omaha was paved at the time of bridge completion. The paving operations subsequently conducted on this road from 1930 to 1932 seriously interfered with trucking operations and probably reduced bridge revenue during the first few years of operation. The final two miles of this highway were not paved until 1934.

The approximately eight and one-half mile road between Glenwood, Iowa and the eastern approach to the bridge was a county dirt road at the time of bridge opening, but was quickly acquired by the state and made part of the state system. Beginning in 1930, the Iowa Highway Commission relocated, graded, shortened and straightened the road, installing concrete culverts and bridges as needed. Eventually the road was graveled. The cost of this work was included in a Mills county good roads bond issue, which was originally approved for paving of U.S. Highway 34 through the eastern part of the county and for placement of gravel on several other connecting roads. Until this work was completed, it was virtually impossible for large trucks to reach the bridge.

The relation between area road improvements and bridge operation may be seen in traffic statistics obtained from cash register recordings at the toll house for the first four years of operation, which are as follows:

<u>Year</u>	<u>Number of Trucks</u>
1930	3,694
1931	7,286
1932	17,806
1933	26,780

In the first two months of 1934, there were 5,061 truck passages, as opposed to only 2,641 passages for the same months of 1933. This represents an increase of about ninety-two percent. These figures demonstrate that as access to the bridge improved, utilization increased considerably.

The importance of good road connections to the economic viability of the bridge can be seen in the disparity between revenue projections of consulting engineers Ford, Bacon & Davis and the actual gross revenues realized during the first four years of operation, as follows:

<u>Year</u>	<u>Engineers' Estimate</u>	<u>Actually Realized</u>
1930	\$ 59,300	\$ 22,449.20*
1931	65,300	29,532.55
1932	71,300	21,563.80
1933	75,000	25,992.90

* 11 months

As can be seen, gross revenues from toll collections were less than forty percent of the revenue estimated by the engineers. Additional revenue during this period was provided by the negotiation of a twenty year contract with Missouri Valley Pipe Line Company for the rental to it of space on the bridge for one 24-inch steel pipe line, carrying natural gas. The contract began July 1, 1930 and initially paid the bridge company \$6,000 per year.

The Plattsmouth Bridge Company is now based in Plattsmouth, Nebraska and is headed by Ron D. Schneider, grandson of the original president. Sixteen stockholders, all heirs of the original six stockholders, own the common stock today. At present the bridge is in fair condition, with some repair to the deck needed. The bridge is essentially in unaltered condition and maintains a high degree of structural integrity.

APPENDIX
IMPLICATIONS FOR FURTHER RESEARCH

Several questions concerning the Plattsmouth Bridge arose during the research and writing of this report. Some of these questions, due to limitations in the scope of the Iowa Historic Bridges Recording Project, have remained unanswered. It is suggested that scholars interested in this bridge consider pursuing the following:

1. Why was the stock issued in the manner devised by the incorporators?
2. Did the Plattsmouth Bridge Company have an agreement with either Nebraska or Iowa concerning the eventual take-over of the bridge?
3. Why did the War Department find the cost figures supplied by the Plattsmouth Bridge Company to be unacceptable?
4. What is the complete history of the two firms involved in the construction of the bridge?
5. How do the pin connections function?

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This appendix is an addendum to a 15-page report previously transmitted to the Library of Congress.

APPENDIX: ADDITIONAL REFERENCES

Interested readers may consult the Historical Overview of Iowa Bridges, HAER No. IA-88: "This historical overview of bridges in Iowa was prepared as part of Iowa Historic Bridges Recording Project - I and II, conducted during the summers of 1995 and 1996 by the Historic American Engineering Record (HAER). The purpose of the overview was to provide a unified historical context for the bridges involved in the recording projects."