

# HISTORIC AMERICAN ENGINEERING RECORD

## BRIDGE I-142 (CRANDIC Rail Bridge 18.15)

HAER No. IA-100

<b>Location</b>	<p>Bridge I-142, also known as the CRANDIC Rail Bridge 18.15, is situated along the CRANDIC railroad line, spanning the Iowa River south of Middle Amana in Lenox Township, northeastern Iowa County, Iowa. This bridge is located within the designated boundaries of the Amana Colonies National Historic Landmark.</p> <p>41.783790, -91.898439 (Center of Bridge I-142, Google Earth, WGS84)</p>
<b>Date of Construction</b>	1902
<b>Architect/Engineer</b>	Chicago, Milwaukee, and St. Paul Railway
<b>Present Use</b>	The bridge supports a single railroad track as it spans the Iowa River.
<b>Present Owner</b>	Cedar Rapids and Iowa City Railway (CRANDIC)
<b>Significance</b>	<p>Bridge I-142 (CRANDIC Rail Bridge 18.15) is significant as a contributing resource to the Amana Colonies, a historic district listed on the National Register of Historic Places and a designated National Historic Landmark.</p> <p>Bridge I-142 is individually significant under Criterion A for its association with the development of the region, including the Amana Colonies, and for its association with the Chicago, Milwaukee, and St. Paul Railway, a major railroad company that expanded during this same period of development. In addition, Bridge I-142 holds engineering significance under Criterion C as a bridge that exemplifies two designs and construction methods utilized by railroad companies during this period, and for its association with the American Bridge Company, a significant bridge manufacturer in the United States.</p>
<b>Historian</b>	Libby Cavanaugh Wielenga, Historical Link, LLC; November 2023

**Project  
Information**

The Cedar Rapids and Iowa City Railway Company (CRANDIC) proposes to replace all four spans and the northern abutment of the single-track Bridge I-142 (CRANDIC Bridge 18.15) with a new multi-span, single-track bridge possessing a heavier load rating to handle modern railroad loads. This Level II HAER documentation of the existing I-142 bridge (CRANDIC Bridge 18.15) is required as mitigation per the Memorandum of Agreement among the Federal Railroad Administration, the Cedar Rapids and Iowa City Railway Company, and the Iowa State Historic Preservation Officer, executed March 2, 2023. It was prepared by Libby Cavanaugh Wielenga of Historical Link, LLC, in coordination with Wapsi Valley Archeology, Inc., Dan R. Pratt of Arch3, LLC, completed the photography.

## PHYSICAL DESCRIPTION

Bridge I-142 (CRANDIC Rail Bridge 18.15) is a four-span, open deck railroad bridge that crosses the Iowa River. The four simple spans are composed of two steel Pratt pony trusses and two steel through plate girders. The superstructure spans are supported by three concrete solid shaft piers and two concrete abutments. The two steel Pratt pony truss spans abut one another from the northeast to align with the two steel through plate girders from the southeast to complete the four-span structure. Each pony truss span measures 104' in length and has a vertical height of approximately 12'. Each plate girder span extends 50' in length. The total bridge width measures approximately 18', with a width clearance of 14'-6". The overall structure length extends 308'.<sup>1</sup>

The design of the two steel Pratt pony truss spans utilizes pin connections on the primary structural members, supported with rivet connections throughout. The truss is situated to allow rail traffic to pass through the truss without the top chords connected by cross braces. The top and bottom chords and end posts exhibit lattice bars, with the bottom chord fabricated with double lattice bars. Each vertical chord has a knee brace with gusset plate situated atop the floor beams. The counter diagonal members are present in the central bays, constructed from steel bars. Connected to the lower chord below the open timber decking are steel stringers and lower lateral bracing.

The two spans of the steel through plate girders are designed from fabricated plates and stiffeners, connected with rivets. As a through girder design, the fabricated girders are above the deck and serve as the primary structural members for these spans. The stiffener plates help the girder from bending or twisting. Knee braces with gusset plates extend from the girder interior to the frame above the floor system. The steel floor system is composed of transverse floor beams, parallel stringers, and lower lateral bracing.

The simple superstructure spans are supported by steel bearings attached at the end of each span. The bearings rest atop the substructure supports which are composed of three concrete solid shaft piers and concrete abutments. Piles extend below the piers and abutments. The bridge exhibits a continuous open deck track structure consisting of parallel steel rails, steel fasteners, and wood sleepers or ties (transverse supports under the rails). There is no skew to this bridge.

Two builder's plaques are present on the bridge, one on each of the exterior southern pony truss end posts. The builder's plaque attached to the end post of the southwestern pony truss has this label: "AMERICAN BRIDGE CO OF NEW YORK U.S.A. 1902." The bottom right corner exhibits damage, but the plaque remains legible. The second plaque, which is attached to the

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<sup>1</sup> Chicago, Milwaukee, and St. Paul Railway, *I-142 Floor Plan, Drawing no. A-995, Chicago, July 19, 1901, 1-2.*

opposite pony truss span near the eastern approach, appears to have an identical inscription but is heavily damaged and partly illegible.

Today, the vast majority of the original structural elements of the I-142 bridge remain intact. The notable change is reflected in the abutment and pier repairs that occurred in 1958. Maintenance replacement of the steel rails, fasteners, and wood sleepers or ties of the track structure have occurred over the years, but no alterations or modifications have occurred to the bridge superstructures. The four-span bridge largely remains as it was originally designed and maintains an excellent condition. The current use of the I-142 bridge retains its original historic function.

## **HISTORY**

Railroad development and expansion spread notably across Iowa in the 1860s, resulting in increased settlement patterns and economic growth over subsequent decades. By the turn of the twentieth century, the principal railroad lines through Iowa had expanded through the construction of new lines, the purchase of smaller existing lines, and the reorganization of bankrupt lines, creating a vast network of primary and feeder routes. During this period, the Chicago, Milwaukee, and St. Paul Railway – along with other principal railroad companies at the time – entered an era of infrastructure improvements. This rail line improvement period included updates and replacements to the myriad of bridges necessary to cross Iowa’s numerous waterways, including the Iowa River.<sup>2</sup>

Bridge I-142 was one such infrastructure improvement project. The original line constructed by the Chicago, Milwaukee, and St. Paul Railway Company was developed from Cedar Rapids to Ottumwa by 1884, passing through Iowa County and over the Iowa River.<sup>3</sup> This roughly north-south line intersected with an existing 1860s east-west line of the Chicago, Rock Island and Pacific Railroad just south of the Iowa River. Rail lines were constructed where rail companies could be profitable; direct access to these rail lines provided communities with an economic advantage for growth and development.<sup>4</sup>

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<sup>2</sup> Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, E-13—E-14. Popularly known as the Milwaukee Road, the line was incorporated under different names as it expanded into Iowa: Milwaukee and St. Paul Railway Company (1863); Chicago, Milwaukee, and St. Paul Railway Company (1874), Chicago, Milwaukee, St. Paul and Pacific Railroad (1927); Derleth, August. *The Milwaukee Road: Its First Hundred Years*, 265-270.

<sup>3</sup> Derleth, August. *The Milwaukee Road: Its First Hundred Years*, 133 and 293; *Cedar Rapids Evening Gazette*, July 20, 1883.

<sup>4</sup> Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, E-28.

Within south-central Iowa County, a German religious community organized as the Amana Society had settled in Lenox Township, establishing its first village by 1855. The eventual seven villages, including South Amana and Middle Amana, that were founded within a few miles of one another would be known as the Amana Colonies. Through religious communal living, the Society fostered several manufacturing and agricultural enterprises.<sup>5</sup>

Recognizing the economic benefit of direct access to the railroad to transport business products, as well as the interconnectedness of the local and regional economic development, the Society worked to gain and maintain access to the railroads. This included moving a depot for the South Amana village to align with the planned Chicago, Milwaukee, and St. Paul Railway in 1883. Adjusting to railroad access was not new to the Society; in 1861, they purchased the existing village of Homestead to gain direct access to the newly constructed Chicago, Rock Island and Pacific Railroad.<sup>6</sup>

Use of the Chicago, Milwaukee, and St. Paul Railway by the Amana Society and wider Iowa County community resulted in a cycle of market demands and railroad expansion. The railroad supported the manufacturing and agricultural enterprises of the Amana Society, opening new markets and financial opportunities for the local and regional economies beyond Iowa for both passengers and freight. Over time, the Chicago, Milwaukee, and St. Paul Railway continued to purchase smaller railway companies and expand existing lines to the west, connecting Chicago to Seattle by 1910 and becoming a key railroad company during the period.<sup>7</sup>

The era of railroad infrastructure improvement and the construction of Bridge I-142 aligned with available steel technology and popular railroad bridge design types, including the Pratt truss and through plate girder. Bridge design efficiencies increased around the turn of the twentieth century, resulting in larger and stronger bridges to accommodate the increased load capacities. Railroad companies like the Chicago, Milwaukee, and St. Paul Railway saw the advantage of paying the higher initial costs of stronger and enduring steel bridges as replacements for timber trestles in order to safeguard cargo and overall financial security for the lines. Bridge I-142 replaced the original railroad structure at this location, a timber trestle bridge.<sup>8</sup>

Due to the labor expenses of brick and stone masonry bridges, early railroads relied on native timber for their standard first-generation bridges. Costly iron and steel prices at the time resulted

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<sup>5</sup> Schroer and Mattison, *Amana Colonies*; Noe, Charles Fred. *A Brief History of The Amana Society, 1714-1900*, 21. Additional information on the Amana Colonies and its listing as a National Historic Landmark can be found in the property's National Register Nomination.

<sup>6</sup> Perkins and Wick. *History of the Amana Society or Community of True Inspiration*, 56.

<sup>7</sup> Derleth, August. *The Milwaukee Road: Its First Hundred Years*, 296.

<sup>8</sup> Amana Heritage Society, *Archival Library and Museum Photographs*. The original bridge is nonextant, replaced by Bridge I-142 in 1902.

in these materials being used primarily on large crossings. Combination iron and wood bridges were also a comparatively costly alternative. The abundance of wood and cheap labor costs resulted in railroads constructing timber trestles and stringer bridges for their original lines. Near the end of the nineteenth century, however, railroads commonly built new and replacement bridges using steel in one of the patented truss configurations or plate girder designs.<sup>9</sup>

The span types and overall design of Bridge I-142 was therefore a common design form for railroads by 1902. Truss spans, and particularly the Pratt truss in both through and pony configurations, had been used successfully by railroads for decades. Engineers capitalized on the efficiency in fabrication and assembly of truss spans, in addition to their overall lasting strength and durability.<sup>10</sup> The Pratt truss, patented in 1844 by Thomas and Caleb Pratt, derives its strength from the lower chord and diagonals in tension and the upper chords and verticals in compression. The lengths of the parallel chords and panels allowed standardization and therefore efficiency in fabrication and assembly. The technology for continuous steel spans had not yet been developed, resulting in railroad bridge engineers relying on simple spans for their crossings. Pinned connections were regularly used in 1902, but they were largely phased out by around 1910 with the capability of forming rigid connections on site.<sup>11</sup>

Along with the Pratt truss, railroad bridge engineers recognized a distinct advantage to plate girders, particularly in regard to their capacity to withstand extremely heavy loads. The web depths necessary for a railroad bridge during this period were greater than what could be achieved by rolled steel manufacturing at the time; therefore, the girders were fabricated. This design consisted of two parallel plate girders as the primary structural members with a steel floor system. The fabricated beams would span between abutments or piers parallel to the roadway to support the railway deck. The railroad decks were either solid or open, the latter revealing the floor system below.<sup>12</sup>

The use of prefabricated steel bridges manufactured off-site by steel companies and assembled at the bridge site increased during this period. Railroads had shifted from private companies designing and constructing their railroad bridges to designing engineering plans internally and then contracting the fabrication work to steel manufacturers.<sup>13</sup> Large railroad companies like the Chicago, Milwaukee, and St. Paul Railway illustrated this by creating a Bridge and Building

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<sup>9</sup> Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, E-47--49.

<sup>10</sup> Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, E-47--49.

<sup>11</sup> Roberts and Fraser, *MPDF: Highway Bridges in Iowa 1868—1945*, F-37.

<sup>12</sup> Roberts and Fraser, *MPDF: Highway Bridges in Iowa 1868—1945*, F-46—F-48; Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, F-42.

<sup>13</sup> Conard and Cunning. *The Advent and Development of Railroads in Iowa: 1855-1940*, E-47--49.

Department with an in-house engineering staff to design plans, then contracting the steel manufacturing to large fabricators such as the notable American Bridge Company.

By 1900, the American Bridge Company had absorbed some of the most prolific bridge building companies in the country. Created by J. P. Morgan and Company in 1900, the American Bridge Company was formed by consolidating smaller firms, including some of the more active companies in Iowa such as the Wrought Iron Bridge Company and the Lassig Bridge and Iron Works of Chicago. The American Bridge Company produced innovative construction techniques and steel fabrication methods to advance bridge building in the United States. It served as a subsidiary of the United States Steel Corporation.<sup>14</sup>

In 1901, C. F. Loweth oversaw the design plans of Bridge I-142, serving as the engineer and superintendent of the Chicago, Milwaukee, and St. Paul Railway's Bridge and Building Department. Loweth, along with the assistant engineer, James J. Harding, approved the final design plans of Bridge I-142 in 1901. The design detailed two "pony truss spans" and two "type C4 girder spans" for Bridge I-142 across the Iowa River. Specifications and general notes provided details for both fabrication and assembly.<sup>15</sup> The Chicago, Milwaukee, and St. Paul Railway contracted with the American Bridge Company to fabricate the structural components of Bridge I-142. The bridge was completed and placed into service in 1902.

No major alignment changes have occurred on this segment of the railroad since its original construction. No alterations or modifications have occurred to the bridge superstructures. Maintenance replacement of the steel rails, fasteners, and wood sleepers or ties of the track structure have occurred over the years. Modifications to the substructure occurred in 1958 with repairs to the concrete backwall and wings of both abutments.<sup>16</sup>

Over time the railway name has been modified; it is currently incorporated as the Chicago, Milwaukee, St. Paul, and Pacific Railroad, effective since 1927.<sup>17</sup> In 1977, the railroad filed for bankruptcy and sold portions of the line. In 1981, the Cedar Rapids and Iowa City Railway Company (CRANDIC or CIC) acquired the Amana branch, which extends 21 miles from Cedar Rapids to Amana, Iowa, and CRANDIC still maintains ownership of the line today, including Bridge I-142.<sup>18</sup>

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<sup>14</sup> Roberts and Fraser, *MPDF: Highway Bridges in Iowa 1868-1945*, E-13. Today American Bridge Company is known as American Bridge.

<sup>15</sup> Chicago, Milwaukee, and St. Paul Railway, *I-142 Floor Plan, Drawing no. A-995, Chicago, July 19, 1901, 1-2*.

<sup>16</sup> Chicago, Milwaukee, St. Paul and Pacific Railroad. *I-142 Concrete Repairs, Drawing no. 9677, Chicago, October 1957*.

<sup>17</sup> Derleth, August. *The Milwaukee Road: Its First Hundred Years*, 270.

<sup>18</sup> Iowa Department of Transportation. "Cedar Rapids and Iowa City Railway Company (CRANDIC) (CIC)."

## SOURCES

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**Appendix A Original Engineering Construction Plans**

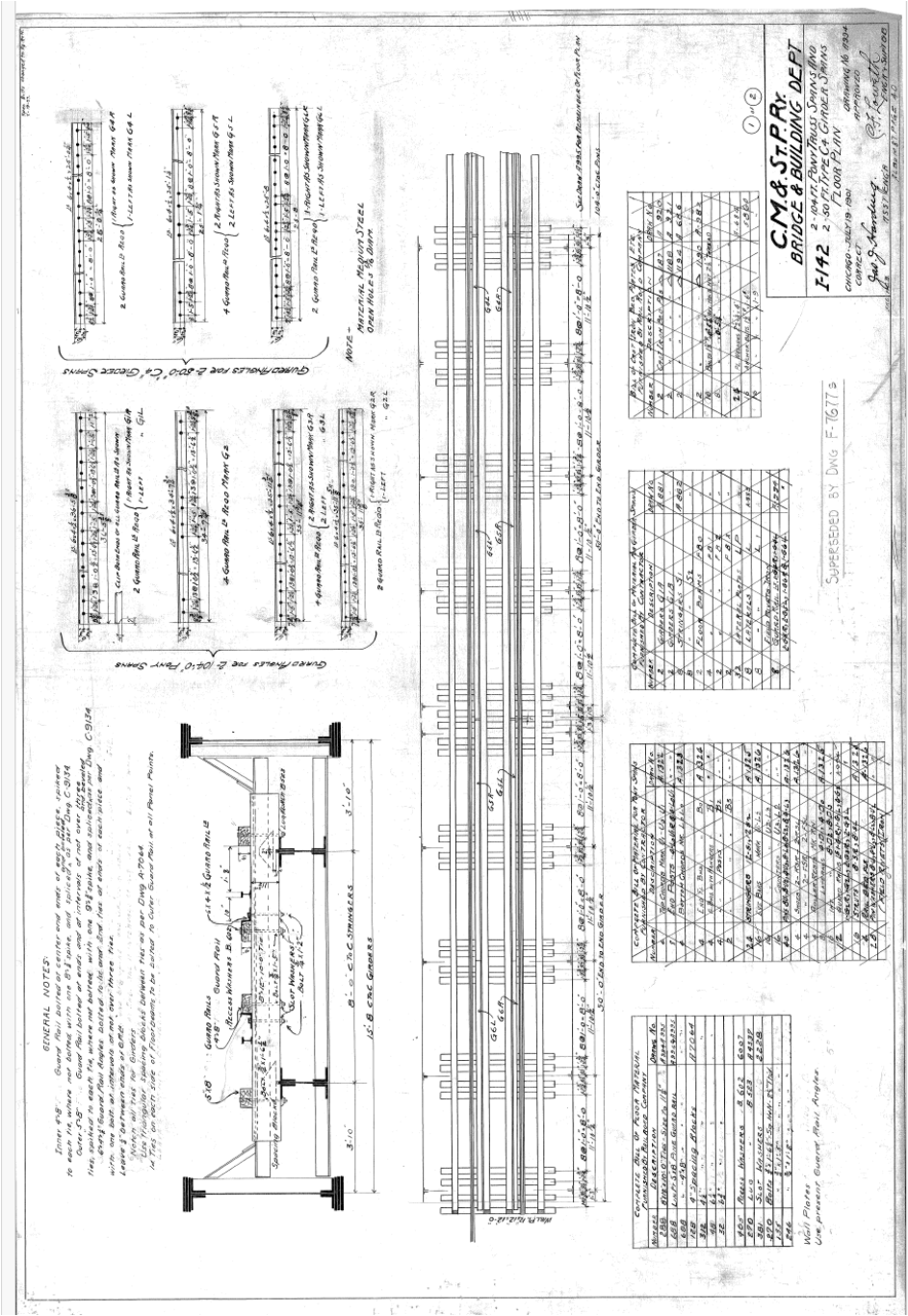


Figure 1. Copy of an original Bridge I-142 engineering construction plan. (Chicago, Milwaukee, and St. Paul Railway, Bridge and Building Department. I-142 2-104 ft Pony Truss Spans & 2-50 ft Type C4 Girder Spans, Floor Plan, Drawing no. A-995, Chicago, July 19, 1901. 1 of 2. Electronic copy provided by SW Bridge Engineers, LLC, De Forest, Wisconsin, May 2023.)

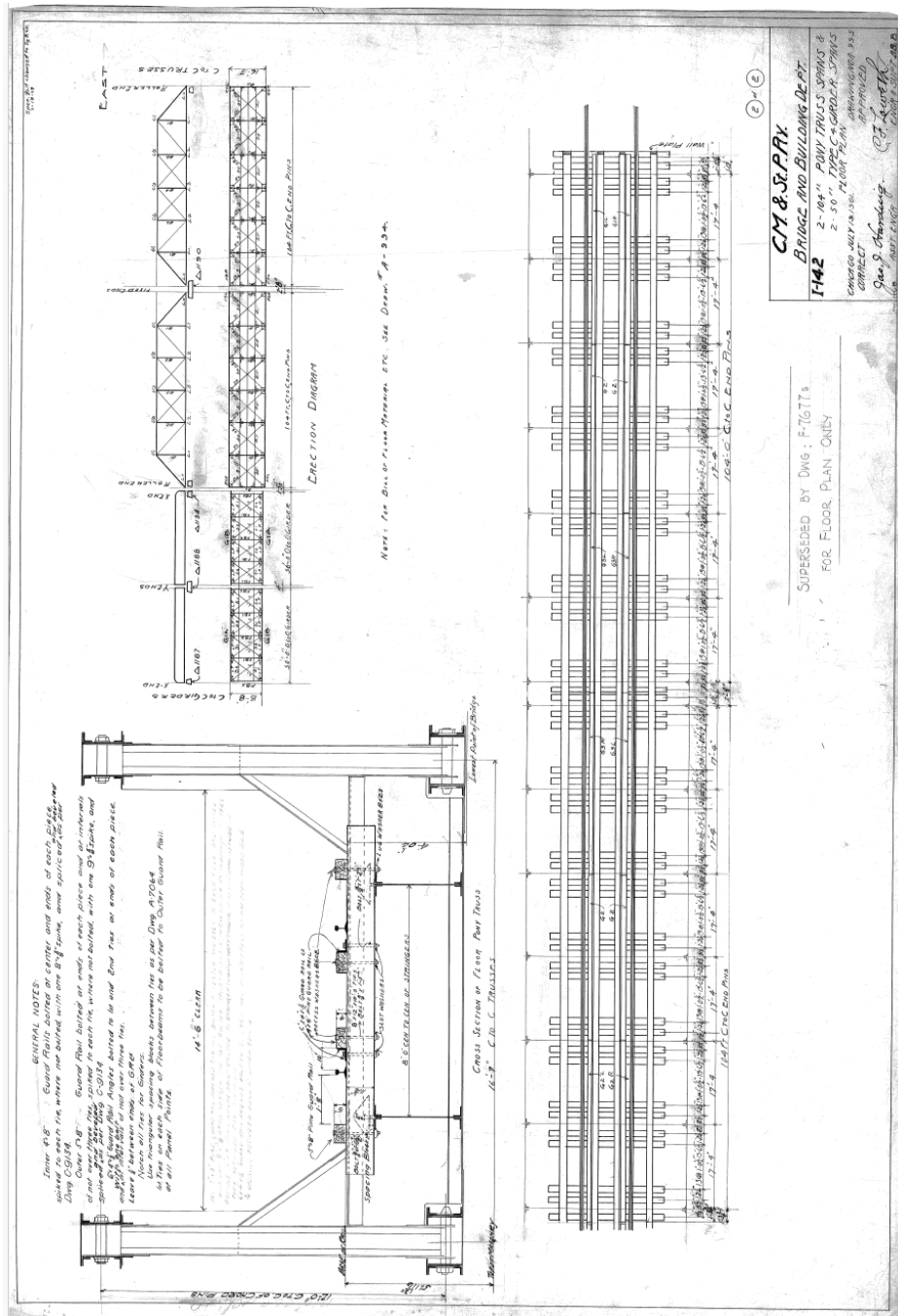


Figure 2. Copy of an original Bridge I-142 engineering construction plan. (Chicago, Milwaukee, and St. Paul Railway, Bridge and Building Department. *I-142 2-104 ft Pony Truss Spans & 2-50 ft Type C4 Girder Spans, Floor Plan, Drawing no. A-995, Chicago, July 19, 1901. 2 of 2.* Electronic copy provided by SW Bridge Engineers, LLC, De Forest, Wisconsin, May 2023.)

**Appendix B** Historic Photograph

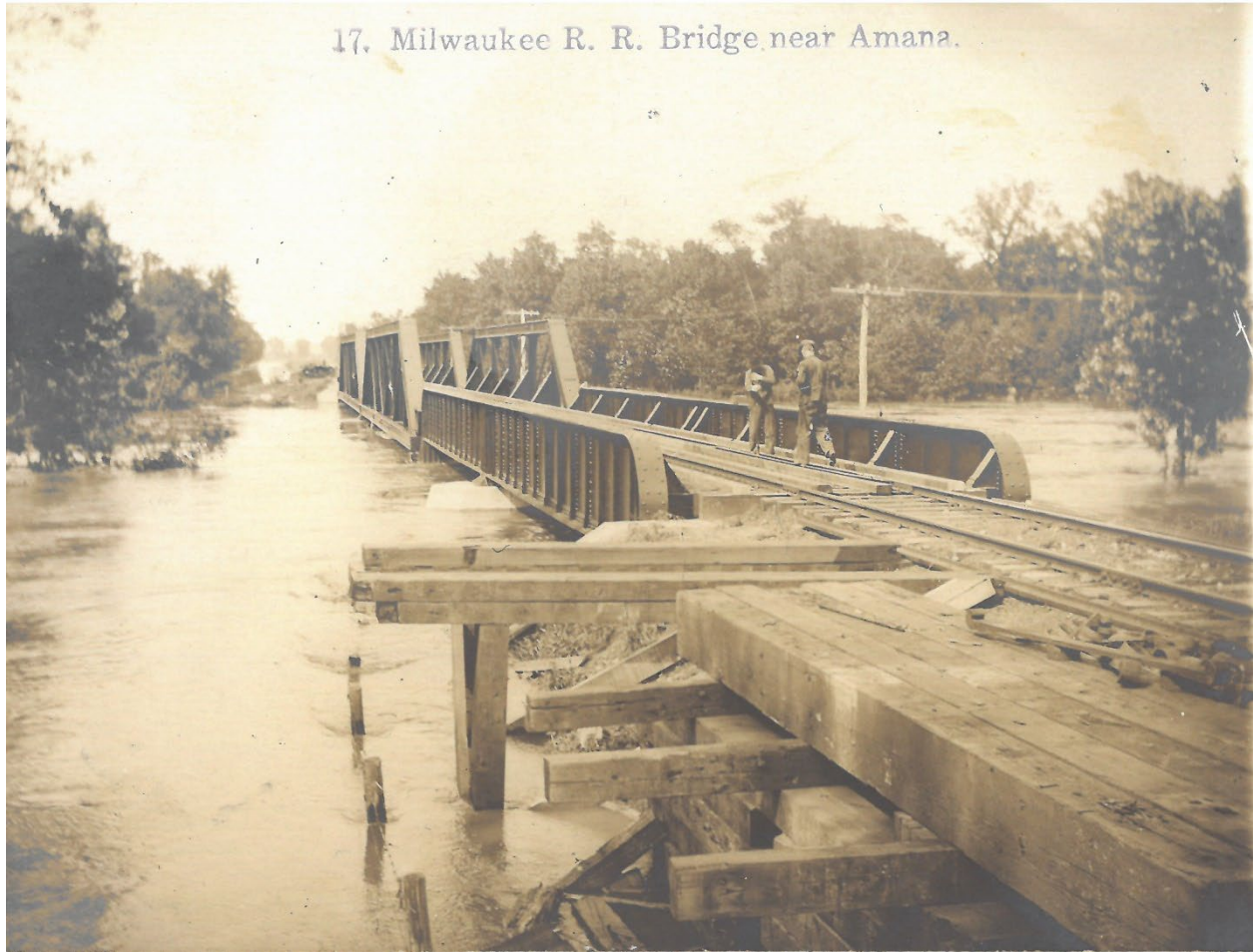


Figure 1. Image of Bridge I-142, undated. (Courtesy of the Amana Heritage Society. *Archival Library and Museum Photographs*. Amana, Iowa.)