

WEB NARRATIVE 1

History of Bridges in Minnesota

Minnesota has more than 20,000 bridges. These range from small, nondescript spans over local streams, to the monumental structures that carry our trails, roads and railroads over the Mississippi River. Bridges are not only a key component of our transportation system, they also tell many overlapping stories of the state's development. They represent complex interrelationships of topography; settlement; evolving modes of transportation; advancements in engineering, materials, and construction; changes in social trends and aesthetics; and changes in local and national economics.

As Minnesota's population has grown, its transportation system evolved with it. Early trails gave way to railroads, rural roads and city streets, highways, and then the Interstate Highway System starting in the mid-twentieth century. As it evolved, the transportation system required safe and efficient means for crossing ravines, valleys, and bodies of water. Bridges were built to meet this need. As traffic and the weight of vehicles increased, early bridges were often replaced by sturdier, more durable bridges capable of carry increasingly heavier loads.

EARLY HISTORY THROUGH THE MID-NINETEENTH CENTURY

Minnesota's earliest bridges were logs placed over streams by Native Americans and later by European Americans. By the 1830s, fur traders began building primitive corduroy bridges, laying logs diagonally across a waterway or path, along the Red River Trails to carry furs and trade items back and forth.

As Minnesota was opened to settlement in the mid-1800s, more bridges began to appear. When Minnesota became a territory in 1849, one of the first acts of the territorial legislature was to authorize boards of county commissioners to maintain roads, license ferries, set toll rates, and build bridges. As a result, permanent bridges began to be constructed. However, most early bridges were constructed over smaller crossings and ferries remained the primary means for getting across larger rivers and lakes well into the late 1800s.

Most bridges constructed in the mid-1800s were small, relatively crude structures of timber and/or stone masonry. With Minnesota's abundant forests, timber was a natural choice. As communities and transportation routes became more established, more durable materials, such as stone, began to replace fire-prone lumber structures.

The first major bridge constructed in Minnesota was the original Hennepin Avenue Bridge (Father Louis Hennepin Bridge) over the Mississippi River in Minneapolis (Figure 1). This handsome, timber suspension bridge, designed by New York engineer Thomas Musgrove Griffith and opened in 1855, was the first bridge constructed over the Mississippi River. It was a rare example of a mid-nineteenth century

suspension bridge and it established a precedent for constructing monumental, iconic bridges in the state. Its Victorian styling, often described as a “fairy-like creation,” also embodied the aesthetic tastes of the period. Like most major bridges built during this period, its construction was privately financed, and users had to pay a toll to cross it.



Figure 1. Hennepin Avenue Bridge (Father Louis Hennepin Bridge), 1869
(Source: MHS Catalog PUID: MH5.9 MP4.21 p13 Catalog, Negative Number: 18933)

Rural parts of Minnesota were most often far behind the urban centers of the state in building bridges. One early exception was Blue Earth County. Given a booming population and numerous rivers within its boundaries, in the late 1860s the County embarked on an ambitious plan to build high-quality, permanent bridges. It would be decades before other counties in the state would follow this lead.

With the arrival of railroads to Minnesota in 1862, railroad companies quickly became leaders in bridge design and construction. Civil engineers employed by railroad companies set standards for bridge design and soon began experimenting with new forms, such as trusses, and new materials such as iron and later steel. Later, bridges constructed to carry roads followed engineering principles and practices pioneered by railroads.

LATE NINETEENTH AND EARLY TWENTIETH CENTURY

This period represents a golden age of bridge building in Minnesota. Rapid advancements in design and materials accompanied an exponential increase in the total number of bridges. Bridges constructed during this period ranged from simple timber beam spans, to stone masonry arch structures, to iron or steel trusses, to stately reinforced-concrete spans. Iron became a popular material in the 1870s but was replaced by steel after 1890 due to its superior strength and durability. Following on the heels of steel, steel reinforced concrete emerged as a building material for bridges around 1900, which by the second decade of the twentieth century became the most popular material for highway bridges. During this period, concrete bridges advanced from simple slab and girder spans developed in 1898, to multiple continuous span slab (1909), to rigid frame (1922) (see the accompanying Field Guide for help identifying these bridge types), to T-beam and prestressed concrete in 1937; though the Minnesota Highway Department did not start using prestressed concrete until 1957. This transition in material types allowed for the construction of increasingly larger, more durable, and higher capacity structures that were more economical in terms of construction and maintenance.

This period is also characterized by a transition in aesthetics, from a time when cities and towns quickly put up the most economical crossing and gave little thought to the look and feel of a bridge, to a time of careful consideration of architectural features and what they represented of the community. The 1893 Columbian Exposition in Chicago introduced the City Beautiful Movement, or “White City,” to the United States. This movement, which utilized the Beaux Arts style to represent its ideals of well-planned, beautiful cities, was soon applied to bridges in Minnesota. This style shows up as Classical Revival designs for bridges in Minnesota through the 1930s: symmetrical, solid massing, with open railings and sometimes decorative elements that are cut in from the flat surface (relief carving) (Figure 2).



Figure 2. Classical Revival Style Bridge, West Lake of the Isles Parkway over Kenilworth Lagoon, Minneapolis

The turn of the twentieth century represents the rise and fall of small, independent bridge builders. Many small structures that did not require complicated engineering, such as stone masonry arches, timber trestles, and other short spans, were often built by local residents who may have had experience as carpenters or masons. One example is Perley N. Gillham, a local carpenter turned bridge builder who constructed a number of masonry bridges in southwest Minnesota in the early twentieth century. Some bridge builders who had formal training in bridge engineering and design also formed small bridge building firms such as the Minneapolis Bridge Co. As bridge design became more standardized, bridges could be ordered out of catalogs from distant manufacturers and shipped to the site to be assembled. This fact, combined with the formation of U.S. Steel in 1901, changed the landscape of bridge building. As a result, many of these smaller companies perished and a few large bridge building firms emerged.

As metal became the preferred material for bridge construction at the end of the 1800s, a number of large, out-of-state fabricators provided materials to Minnesota until local companies were established. These included the Wrought Iron Bridge Company of Canton, Ohio, the King Bridge Company of Cleveland, Ohio, and the Keystone Bridge Company of Pittsburgh, Pennsylvania. As Minnesota fabricators began to appear, three firms emerged as primary bridge fabricators in the state: the Gillette-Herzog Manufacturing Company of Minneapolis, the St. Paul Foundry Company, and the Minneapolis Steel and Machinery Company.

Longer and more complex bridges were designed by engineers who typically had formal training, either academic or through apprenticeship. A number of important early bridge engineers and companies were based in Minnesota, including a significant group of Norwegian-born engineers. From their talents, Minnesota became a leader in bridge design during the first half of the twentieth century. They and their firms constructed bridges that pushed the boundaries of what was considered possible for span length and form, such as the existing Mendota Bridge which carries Minnesota State Highway 55 over the Minnesota River.

Good Roads Movement

Through most of the late 1800s rural roads in Minnesota were often little more than dirt trails with bridges only at the more challenging crossings. Horses, wagons, and people still crossed most small streams and creeks by simply going through them. The move towards consistently good roads and safe bridges started in the 1880s under the banner of the Good Roads Movement. This concept was founded originally by bicyclists who were joined in the 1890s by advocates of rural mail delivery, farmers seeking access to markets, and eventually drivers of automobiles. As a result of this movement's advocacy, several states--not just cities and towns--began funding road construction and bridges in the 1890s. The movement continued its push until eventually the federal government began funding road construction in 1916. This ushered in a new era for funding.

The Good Roads Movement came to Minnesota in 1893 and quickly gained the backing of civil engineers. Due to its broad base, the movement was very successful in its efforts. In 1898, the Legislature approved a state tax for bridge construction. In 1905, the State Highway Commission was created and the State began to build roads and bridges. In 1907, the State Highway Department published its first set of

codified rules and regulations for bridge construction and began distributing them to local governments across the state. This was the dawn of standard design for highway bridges in Minnesota. In 1911, the State Highway Commission established set specifications for all public bridges costing more than \$500, leading to widespread standardization of bridge design. A decade later, in 1920, Minnesotans approved a constitutional amendment to create a system of trunk highways in the state. Known as the “Babcock Plan,” this amendment called for the creation of a system of 70 trunk highways, totaling 7,000 miles of roads, to connect all major population centers and county seats in the state. Hundreds of bridges were constructed by the State of Minnesota over the next decade as it sought to develop this system.

THE FEDERAL RELIEF ERA

The Great Depression of the 1930s and early 1940s marked a period of little investment by state and local governments. New Deal Federal Relief programs led the way during this period, providing funding and labor for many bridge projects in Minnesota. The two most prolific federal relief bridge building programs were the Works Progress (later "Projects") Administration (WPA) and the Public Works Administration (PWA). The Civilian Conservation Corps (CCC) also constructed a few simple but notable structures.

In Minnesota, bridge design and construction during the New Deal period was largely influenced by the WPA, which either built or improved approximately 1,400 bridges in the state. The WPA did not usually create new engineering methods, but it did influence the architectural treatment of bridges it funded, requiring that they incorporate Rustic, Classical Revival, or Art Deco/Moderne style elements (see Figures 2-4), which reflected popular aesthetic movements during the 1930s. The Rustic Style is a style of architecture developed by the National Park Service (NPS) in the early twentieth century. Structures constructed in this style were designed to harmonize with the natural environment, not stand out, and were built with whatever materials were available locally. This style was popular with the WPA due to its labor-intensive building methods and ability to blend with and enhance its surroundings. The strong emphasis the WPA placed on aesthetics left an important legacy in Minnesota.



Figure 3. Rustic Style Bridge. Bridge L8560, Phalen Park, St. Paul



Figure 4. Art Deco Bridge. Highway 100, Golden Valley
(Source MHS Catalog PUID: MH5.9 GV r24, Negative Number: 1475)

THE POST WAR ERA

When the United States entered World War II, bridge construction came to a halt as the nation's attention shifted to the war effort. As resources were allocated to fighting the war, steel ceased being used for bridge construction and what little bridge building took place utilized timber, stone, or unreinforced concrete.

The end of the war, however, marked the start of a new era in bridge design and construction. In the decades after the war, thousands of bridges were built in the United States, including Minnesota, as part of a larger effort to improve the nation's transportation system. Many of these bridges were built to support the growing highway system as the automobile became the primary means of personal transportation in the United States.

While many bridges were built to accommodate suburban growth and improve rural roads, an important part of the evolution of bridge design and construction during this period was the Federal Highway Act of 1956, establishing the Interstate Highway System. Conceived as a national defense measure, this 41,000-mile system was designed to link 90 percent of all cities in the United States with populations of more than 50,000. Implementation of this system required the construction of thousands of bridges, which led to many standard bridge designs across the nation.

In terms of engineering and construction, after World War II, bridge designers/builders gave way to separate firms that designed, fabricated, or erected bridges, reflecting the increasing specialization of each field. This period also introduced the widespread use of mathematical formulas to design bridges, more accurately determining loads, deflections, and stresses in structures and thereby improving the reliability of the design and increasing safety. Prestressed concrete also emerged as a popular material for bridges. It became popular since it could be designed to exact specifications, fabricated in controlled conditions at a factory, then delivered to the site where it could be quickly and efficiently installed, speeding up construction.

Two classes of bridges appeared during this period. First were the myriad of understated, "common" bridges, built according to standard plans with few aesthetic details. The second were the iconic or landmark designs that made a statement about community identity.

During the post-war austerity years, a new, Modernist aesthetic took hold in the United States, reflecting visions of a utopian future. For bridges in Minnesota, this meant that quaint Rustic style, and more formal Classical Revival and Art Deco design (see Figures 2-4), gave way as the Minnesota Highway Department began to experiment with new forms that had a "modern," clean-lined appearance. Unadorned concrete elements such as piers and wingwalls became prevalent, along with Minimalist bi-rail railings and later Jersey style railings.



Figure 5. Example of "modern" bridge with unadorned piers and bi-rail railing. Bridge 6679, Sheldon Township, Houston County

Reflecting changing social values and trends in the later decades of the twentieth century, the nation started to become increasingly aware of its heritage. Interest grew in preserving historic properties important to our past. By the 1980s, increased attention started to be placed on our historic bridges as Minnesotans recognized that many were focal points of their community. In 1988, the Minnesota Department of Transportation sponsored a statewide survey to identify historic bridges. Several iconic bridges in the state, such as the Stone Arch Bridge in Minneapolis, were also preserved and restored. Work to identify and preserve the state's significant historic bridges continues through the over 30 historic bridge rehabilitations completed in the last decade and the development of management plans to guide and prioritize preservation efforts.

SIDEBAR: BUILDING MATERIALS

The last 150 years of bridge building also overlapped with great innovation in materials, opening new possibilities for form and length.

- Wood: Pre-contact period (logs) and 1830 to the present (timber)
- Masonry (brick, stone): 1863-1945
- Iron: 1873-1890
- Steel: 1890-present
- Concrete: 1900-present

Approximate Dates of Material Types Used for Historical Bridges in Minnesota

	<i>Decade</i>															
	1830s	1840s	1850s	1860s	1870s	1880s	1890s	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s
Trusses																
Wood																
Iron																
Steel																
Arches																
Masonry																
Concrete																
Steel																
Slab, Beam, Girder & Rigid Spans																
Wood																
Steel																
Concrete																

CONCLUSION

Bridges are more than simply components of our transportation system; they are important elements engrained in our everyday lives. They provide us with safe and efficient means for crossing challenging obstacles on a daily basis and they tell many important stories about our past. Next time you look at a bridge, think about how it gets you safely from here to there, but also ask yourself: what are the stories represented in this bridge and how does it connect us to our past?

FURTHER READING

- Anderson, Rolf T. "Federal Relief Construction in Minnesota, 1933-1941." August 1994. National Register of Historic Places Multiple Property Documentation Form. On file at the Minnesota State Historic Preservation Office, Minnesota Historical Society, St. Paul, Minnesota.
- Brinckerhoff, Parsons and Engineering and Industrial Heritage. "A Context for Common Historic Bridge Types," 2005. Available at the Transportation Research Board, Washington D.C., http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25%2815%29_FR.pdf.
- Frame, Robert. "Reinforced-Concrete Highway Bridges in Minnesota." September 1989. National Register of Historic Places Multiple Property Documentation Form. On file at the Minnesota State Historic Preservation Office, Minnesota Historical Society, St. Paul, Minnesota.
- Gardner, Denis, and Eric DeLony. 2008. *Wood, Concrete, Stone, and Steel: Minnesota's Historic Bridges*. Minneapolis: University of Minnesota Press.
- Hess, Jeffery. "Minnesota Masonry-Arch Highway Bridges 1870-1945," 1989. National Register of Historic Places Multiple Property Documentation Form. Available at the State Historic Preservation Office, St. Paul, Minnesota.
- Jackson, Donald C. 1988. *Great American Bridges and Dams*. Washington, D.C.: Preservation Press.
- Mead & Hunt *Evaluation Report and Historic Context: Minnesota Bridges, 1955-1970*. July 2013. Prepared for Minnesota Department of Transportation. On file at the Minnesota State Historic Preservation Office, Minnesota Historical Society, St. Paul, Minnesota.
- Quivik, Fredric L., and Dale L. Martin. "Iron and Steel Bridges in Minnesota." July 1988. National Register of Historic Places Multiple Property Documentation Form. On file at the Minnesota State Historic Preservation Office, Minnesota Historical Society, St. Paul, Minnesota.

FOR MORE INFORMATION

Minnesota Department of Transportation Historic Bridges in Minnesota Website:
<http://www.dot.state.mn.us/historicbridges/index.html>

Federal Highway Administration Historic Bridges Website:
<http://www.environment.fhwa.dot.gov/histpres/bridges.asp>

Historic Bridge Foundation Website:
<http://historicbridgefoundation.com/>

Historic Bridges Website:
<http://www.historicbridges.org/>

Bridge Hunter Website:
<http://bridgehunter.com/>

National Bridge Inventory Database Website:
<http://nationalbridges.com/>