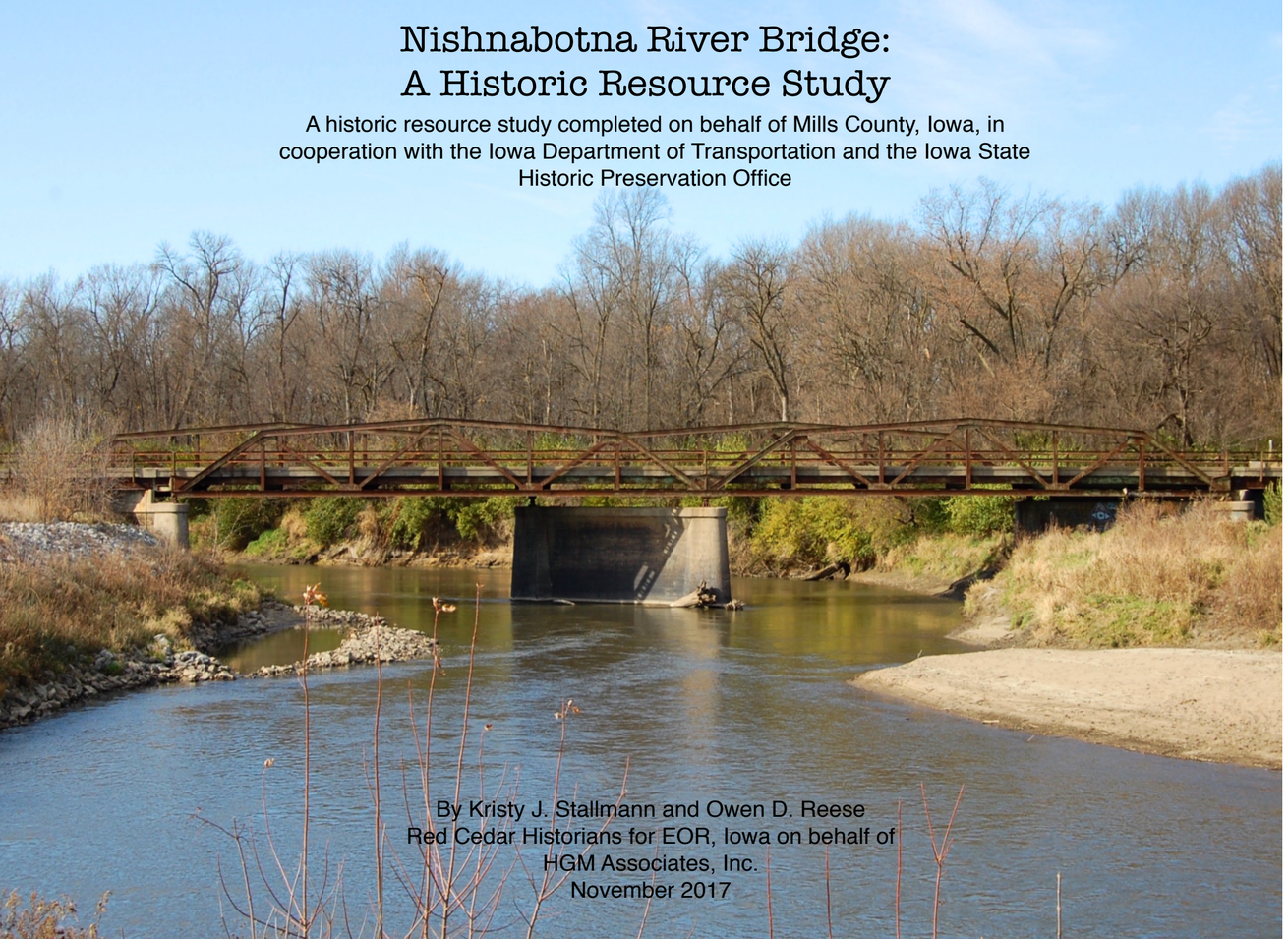
# Nishnabotna River Bridge: A Historic Resource Study

A historic resource study completed on behalf of Mills County, Iowa, in cooperation with the Iowa Department of Transportation and the Iowa State Historic Preservation Office



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HGM Associates, Inc.
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water - ecology - community

RED CEDAR HISTORIANS

## A note from the authors

The authors would like to thank Bill Martin and Justin Dunn for their contributions to this work. In addition to their work, the cooperation of Jacob Woodcock of the Iowa Department of Transporation has been extremely valuable. Without their assistance, this work would not be possible. Historic resource planning is a long, and sometimes arduous process. It is our hope that this work adds some perspective about the role of the historic resources in the process. The process of researching and documenting the Nishnabotna River Bridge has left us with an appreciation for finding beauty in common bridges and our common state heritage.

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# Introduction

This booklet stemmed from a historic bridge study that began in January 2015. Years of flood damage began to wear away the substructure of the NIshnabotna River Bridge, and Mills County recognized the bridge needed attention. They knew the bridge gained National Register of Historic Places listing status in 1998, but the historic background available in the nomination context was limited.

From the first evaluation it was clear the local context of this bridge was largely unchanged from its time of construction. The bridge stands along a remote but important farm-to-market byway through Mills County. The Nishnabotna River makes crossing the county east to west at most other locations difficult, if not nearly impossible. The bridge connects nearby Henderson to rural farms and homesteads and provides passage for farm equipment, commuter, and emergency vehicles.

While it is not a revolutionary or an undocumented style, the Nishnabotna River Bridge represents an engineering adaptation of Iowa Highway Commission standard-design bridge plans. Skewing the trusses and the piers to provide minimal drag on the river channel created a unique example of a Warren truss bridge. Channelization of the river at the time of construction attempted to provide an ideal angle for minimal drag; however, this skewing has become an issue. With a wide swing to the east, the river is putting undo stress on the structure.

The following pages document the character, location, and history of the bridge. The architectural significance of the bridge is clear. Constructed with beams from the Inland Steel Company of Chicago and erected as one of the few Warren trusses in the state, The Nishnabotna River Bridge holds an important place in the transportation history of the state.

# Part I: The Nishnabotna River Bridge

## The General:

The Nishnabotna River Bridge is located in the SW ¼ SW ¼ SW ¼ of Section 29 and SE ¼ SE ¼ SE ¼ of Section 30, Township 73 North, Range 40 West (Anderson Township), in Mills County, Iowa. The bridge spans the West Nishnabotna River at County Road M-16 (also referenced as 370th Street) approximately 4.2 miles southwest of Henderson in the northeast corner of the county. The two-lane bridge is comprised of two, off-set spans with a total length of 284 feet and a width of 20 feet.

## The Technical:

The superstructure is a six-panel, rigid-connected Warren pony truss with polygonal upper chords. The entire substructure of the bridge is skewed against the river flow. This includes skewed concrete abutments, concrete wing-walls and piers, and the floor/decking consists of a concrete deck over steel stringers. Other features of note include an upper chord and inclined end post with two channels with cover plate and lacing; a lower chord with two channels with batten plates, vertical: wide flange; and diagonal: wide flange; 1-angle lateral bracing; I-beam field-bolted to the verticals; and guardrail.



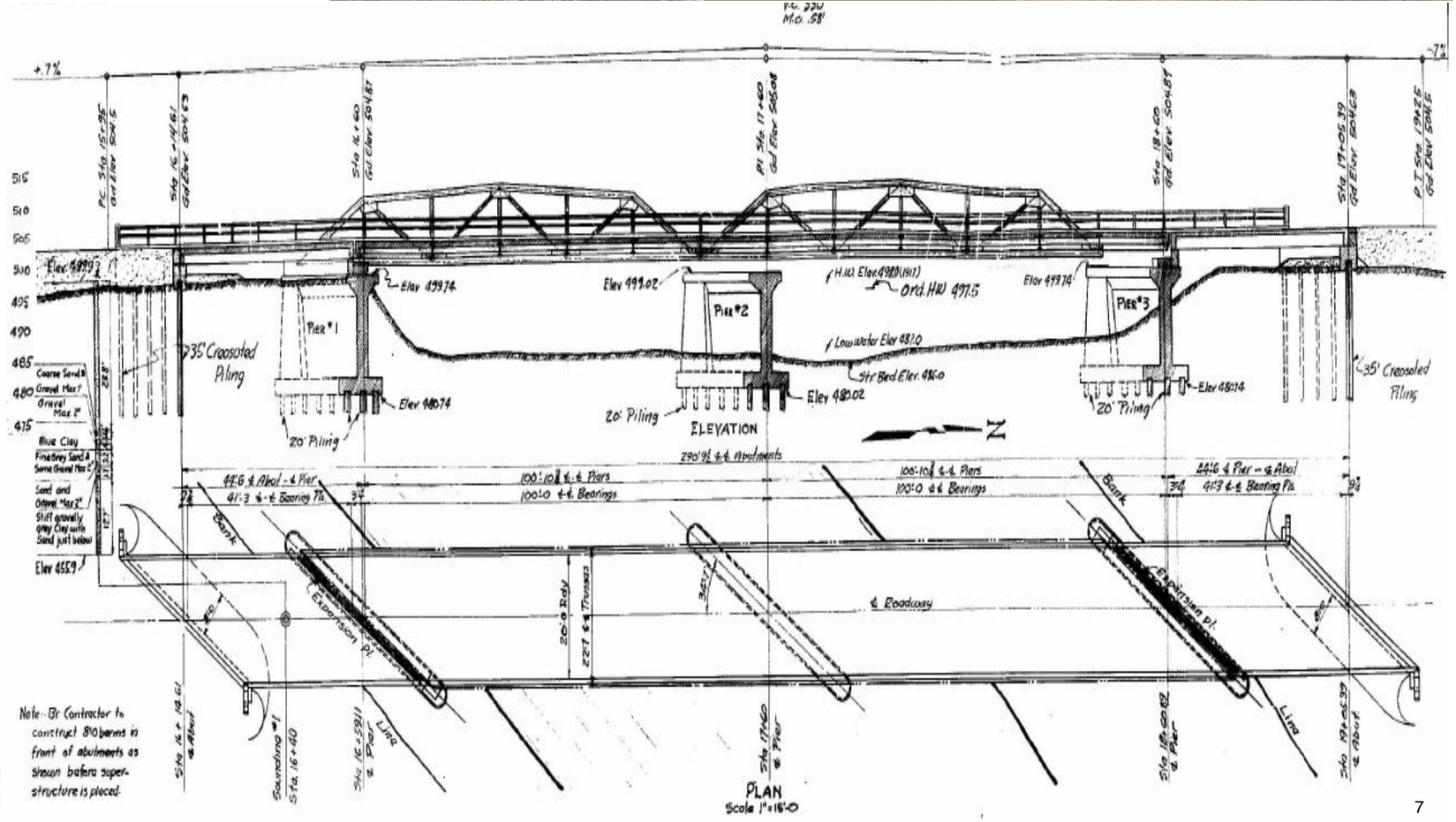
The bridge crosses the West Nishnabotna River on County Road M-16 (370th Street) in a rural, agricultural landscape characterized by a mosaic of expansive agriculture production fields; wildlife management areas; narrow river corridors; wetlands; narrow grass stream buffers and waterways; isolated farmsteads; and pastures. The bridge is in the center of the moderately wide West Nishnabotna River Valley. Forested river communities and limited agricultural ground surround the bridge. The background photograph, taken November 2016, depicts the character of the river valley. Historic maps of the area indicate the river bed was dynamic prior to stream channelization sometime in the 1920s or 1930s.

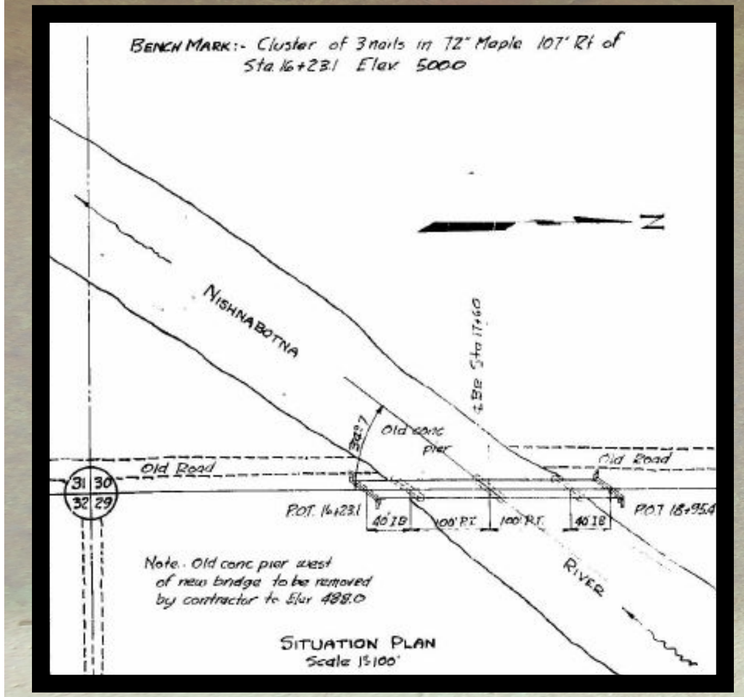
# Part II: The Warren Truss

The Warren truss was developed by British engineers Alfred H. Neville and William Nash in the late 19th century. The basic design combined diagonal members connected by two chords with no verticals. These diagonals provide both compression and tension. This bridge type, even in the early years, was commonly modified by the addition of verticals and altering diagonals. The main diagonals, end posts, and top and bottom chords are always prominent in the design. Any additions to these traditional elements are much thinner and less obvious in the design.

The Warren pony truss, like the Pratt truss, were popular with transportation engineers because tension and compression equations were easily figured with the combination of equilateral triangles to form the truss. This creates a bridge where all members equally share the weight of the bridge. In 1990, Clayton Fraser of Fraserdesign evaluated the Nishnabotna River Bridge for National Register of Historic Places eligiblity. At least one other bridge company in Iowa, including the creators of this bridge, employed polygonal-chorded Warren trusses (like the Nishnabotna River Bridge) on a limited basis in the early 1910s. Fraser found, however, that this long-span structural type never found much favor among Iowa counties.

Right: Iowa State Highway Commission Standard Design Plans for the Nishnabotna River Bridge, shown in plan and elevation.






Above: Situation plan from the Iowa Highway Commission Standard Design Plans for the Nishnabotna River Bridge. These plans depict the adjustments engineers made to accomodate the river channel and flow patterns.

# Part III: The Construction Materials:

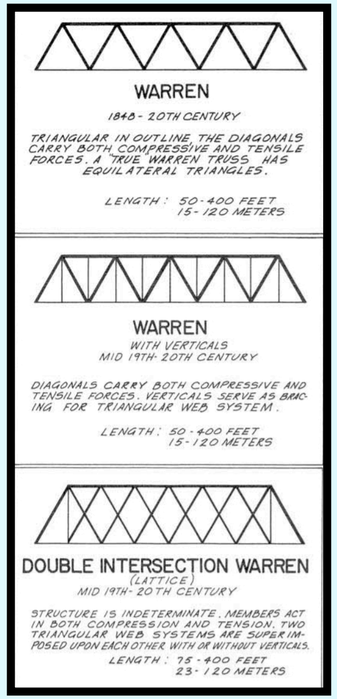
In the wake of the Panic of 1893, Chicago investors Joseph Black, Philip Block, William M. Adams, George H. Jones, Elias Colbert, Joseph E. Porter, John W. Thomas and Frank Wells, provided $20,000 to build a new steel works catering to transportation and agricultural steel needs. The newly formed steel works became known as Inland Steel. During the early years of the 20th century, Inland Steel purchased a steel plant near Lake Michigan in Chicago and invested in an iron mine near Hibbing, Minnesota. These purchases allowed Inland to become an industrial manufacturing powerhouse. By the 1920s, Inland was considered one of the most innovative fabricators in the country, creating both better materials and a safer production line for their employees.

## The Construction Team:

McCormack Construction Company of Lohrville, Iowa participated in an open bid process for the opportunity to construct the Nishnabotna River Bridge. The Iowa State Highway Commission awarded them the contract in 1928 and their workers completed the new bridge in 1929. While the bridge was constructed from standard-design engineering plans, its skewed piers were a unique alteration meant to address structural issues caused by the angle of the intersection between the river and the bridge.

# The Nishnabotna River Bridge in Context:

Relatively few Warren trusses were built in the state between 1910 and 1913 – the year that the Iowa State Highway Commission (ISHC) began issuing standard plans for bridges. Bridge architects and county engineers alike hoped these plans would cut down on production and planning costs for new bridges, as well as provide a medium to implement standardized safety regulations. ISHC's standard pony trusses ranged in span length between 35 and 100 feet and featured straight-chorded Warren configurations. Fraser noted that the sloped upper chords of the Nishnabotna River Bridge were rare, but he could not determine if the Nishnabotna River Bridge was the first or only example of this truss type constructed in Iowa. For comparison, typical Warren truss bridge designs are shown right. These are the standard styles recognized by the Historic American Engineering Record.



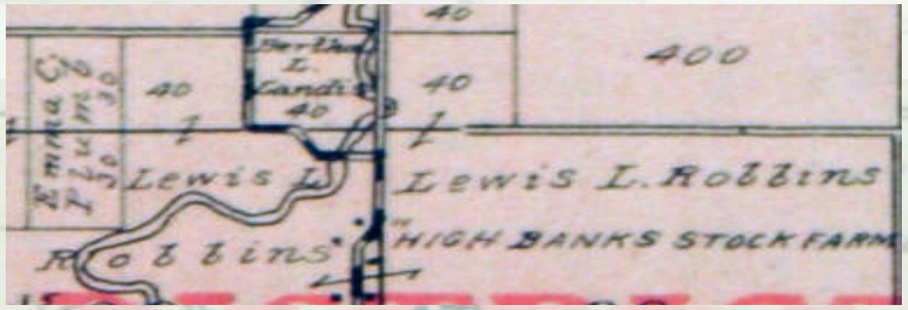

Opposite: Aerial view of the Nishnabotna River Bridge details the skewed trusses, piers and expansion joints. This photograph also depicts the meandering river channel, and local land use.

# Part IV: Historical Perspective

The landscape surrounding the Nishnabotna River Bridge is predominantly agricultural but also consists of conservation ground, lowland marshes and wooded areas.

The General Land Office survey maps of the 1850s portray uncut prairie with no farmsteads in the immediate area.

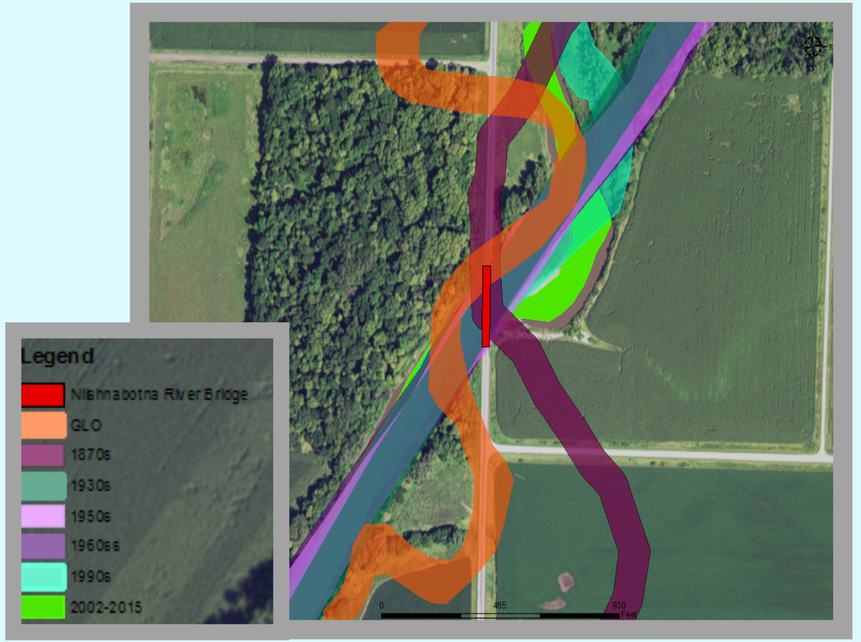
The Andreas Atlas of 1875 depicts the first farmstead in the area, owned by Lewis Robbins, south of the bridge.  It also has lowland wooded and marsh areas marked along the river channel.




The plat map of 1921 shows the land still owned by Lewis L. Robbins of the High Bank Stock Farm. Local history indicated that Lewis L. Robbins made his living raising and trading specialty agricultural animals.

The character of land use has remained largely unchanged since then and much of the land adjacent to the bridge is still in the Robbins family to this day.

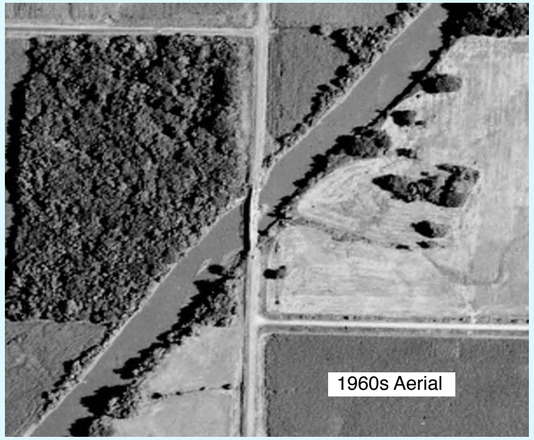




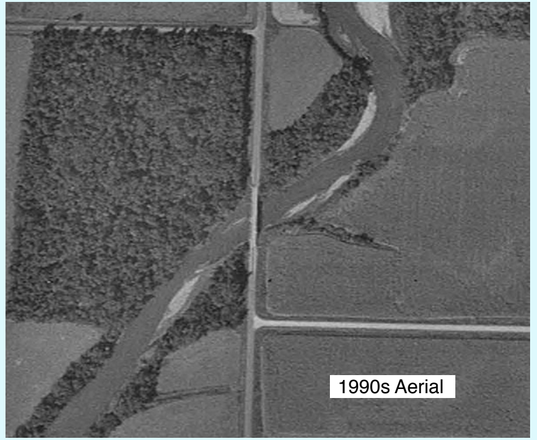

Notable changes to the landscape are confined to the meandering course changes of the river and its eventual channelization around the time of the building of the Nishnabotna River Bridge.  Following the channelization, the river began to change its course over time and return to its natural meanderings.

The 1875 Andreas map shows the route of the first road through the vicinity of the Nishnabotna River Bridge. The crossing, then southwest of the current bridge location, met the road to the north and east to meet back up with the road along the section line. The same routing is shown again on the 1904 map, with the 1910 map being the first to show a crossing in the current location. Interestingly, the 1910 map still shows the original crossing and routing of the road around to the southwest as well. This anomaly remains on maps through the 1930s, with the plat map of 1947 being the first to show the current system of roads in the area of the Nishnabotna River Bridge.

1930s Aerial


1960s Aerial




1990s Aerial

2010s Aerial

From the start, the road on which the bridge lies saw heavy traffic and was designated a secondary farm-to-market road by 1913. The 1919 Primary Road System map of the State of Iowa shows the road designated as a primary road labeled Road 4. By the mid-1920s, the need for a new bridge was apparent and the current bridge was built along with the channelization of the West Nishnabotna River. In the immediate post World War II period Mills County paved the road to facilitate its high traffic volume. Today the road is designated county road M16.

# Rehabilitation, Reuse, Relocate or Removal of Historic Bridges?

Historic bridges, like the Nishnabotna River Bridge, present unique challenges for maintenece, safety, and engineering. As historic bridges begin aging, faults in the historic materials become apparent. Whether the steel used to construct the stringers oxidizes, or the layers of concrete decking begin to crack, or the frame of the bridge itself can no longer safely support the weight of farm-to-market equipment, city and county engineers must make decisions about the cost effectiveness and safety of historic bridges versus new construction. As a mechanism for thoughtful planning of such events, the *National Historic Preservation Act of 1966* created a series of actions that must be undertaken before a historic bridge can be removed. The interested public must have a chance to comment on the project, usually through public meetings. Alternatives to removal of the bridge must be documented by trained professionals and be presented to the State Historic Preservation Office and the National Register of Historic Places officials. The officials evaulate a trained consultant's recommendations and offer an agree or disagree decision before any action can be taken to alter the future of the bridge.

Alternatives can include: rehabilition of the historic bridge attributes to allow the bridge to meet current safety codes and continue serving as traffic carrying thoroughfare; reuse of the bridge as a light-use pedestrian bridge in place; and/or relocation of the bridge to a similar setting such as a park or other private property to be used as light-use pedestrian bridge. Viability of these alternatives varies by bridge type, location of the historic bridge, and cost. Other factors may include protected animal species and protected waterways. If removal and/or replacement is chosen as the only viable option for a historic bridge, the *National Historic Preservation Act* provides guidance for preparation of mitigation strategies (such as this booklet) to ensure the legacy of a historic bridge is documented, even if the bridge cannot be preserved.



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